AMRITSAR
GROUP OF COLLEGES

**AICTE Sponsored
International Conference on**

Future Challenges in Data Science and Engineering for Global Sustainability

FCDSEGS-2021

OCTOBER 7–8, 2021

Proceedings

Editors
Dr. V.K. Banga & Dr. Amarpreet Singh

TIE UPs

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Co-Editors

Er. Tejinder Sharma & Er. Navneet Kaur Bawa

TIE UPs

Organised by

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
AGC AMRITSAR

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MESSAGE FROM
CONFERENCE CHIEF PATRON

It is my great pleasure to welcome you to the **"International Conference on Future Challenges in Data Science and Engineering for Global Sustainability"** **FCDSEGS-2021** which is going to take place in Amritsar Group of Colleges, Amritsar on October 7-8, 2021 sponsored by All India Council for Technical Education (AICTE) and being organized by the Department of Computer Science Engineering.

The foundation stone of Amritsar Group of Colleges was laid on the essence of academic pursuit and excellence. Excellence in any work can be achieved with utmost dedication, hard work, and perseverance. We, at AGC, have made this dictum our motto and our way of life in every single activity in the campus.

I extend my heartiest congratulations to the representatives and coordinators of the conference. I also take the opportunity to congratulate the Department of CSE for organizing this event. We look forward to insightful presentations, discussions, and sharing of technical ideas with colleagues from around the world. We thank you for attending the conference and we hope that you enjoy your visit to AGC.

Sr. Advocate Amit Sharma
Chairman & CEO
AGC, Amritsar

MESSAGE FROM CONFERENCE CHIEF PATRON

It is a matter of great pleasure that **"International Conference on Future Challenges in Data Science and Engineering for Global Sustainability" FCDSEGS-2021** sponsored by All India Council for Technical Education (AICTE) and being hosted by Department of CSE of Amritsar Group of Colleges, Amritsar on October 7-8, 2021.

Research and development forms the backbone of our curriculum. The staff and students engaged in various path-breaking innovative research activities all throughout the year. Here at Amritsar Group of Colleges, Amritsar we organize conferences and seminars frequently on contemporary and relevant topics in order to facilitate research in those areas which will lead to necessary metamorphosis in the academia as well. We are grateful to all authors who trusted us with their work, without them there would be no conference.

The final result would not have been possible without the dedication and hard work of many colleagues. Special thanks are due to the track chairs, workshop chairs, the members of the Technical Program Committees, the General Chair, and to all external referees for the quality and depth of the reviews, and their sense of responsibility and responsiveness under very tight deadlines. I wish the conference all the very best and urge all participants to brainstorm on the various areas of the interest. Congratulations to the Department of CSE for organizing this conference.

Ragini Sharma
Director (Finance)
AGC, Amritsar

I am pleased to learn that the Department of Computer Science and Engineering of Amritsar Group of Colleges, Amritsar has taken the initiative to organize a two days **"International Conference on Future Challenges in Data Science and Engineering for Global Sustainability" FCDSEGS-2021** sponsored by All India Council for Technical Education (AICTE) on October 7-8,2021.

The purpose of this conference is to provide an international forum for researchers to present their state-of-art research on all aspects of Future Challenges in Data Science and Engineering for Global Sustainability and to exchange ideas and explore new avenues of collaborations.

I am sure that the Professional ability sponsored up by the experience of the Management and Faculty of this Institute would guarantee that the occasion ends up being a stupendous achievement and all the conference objectives are met with to the greatest advantage of the scholarly world.

Dr. Rajneesh Arora
Managing Director
AGC, Amritsar

MESSAGE FROM CONFERENCE GENERAL CHAIR

Welcome to the "**International Conference on Future Challenges in Data Science and Engineering for Global Sustainability" FCDSEGS-2021** sponsored by All India Council For Technical Education (AICTE) on October 7-8,2021 and being organized by Department of Computer Science Engineering, Amritsar Group of Colleges, Amritsar.

This international conference received research papers on the above research issues from various countries. Papers contributed in this international conference were rigorously reviewed by expertise members of the review committee. On the basis of review reports, the program committee members have selected high quality papers to be presented in this conference.

The conferences are necessary to inculcate the culture of information exchange and feedback on developing trends in technologies. Certainly, these types of conferences not only bring all the Academicians, Industrialists and Researchers on the singular platform, but it also inculcates the research culture among the entire education fraternity of the country, thereby, contributing to the development of the nation. I congratulate, Department of CSE for initiating the conduction of such a conference in our esteemed Institution.

I wish the conference a grand success.

Dr. V.K. Banga
Principal
AGC, Amritsar

MESSAGE FROM
CONFERENCE PROGRAMME COMMITTEE CHAIR

It is a matter of great honor that Amritsar Group of Colleges, Amritsar is hosting the **"International Conference on Future Challenges in Data Science and Engineering for Global Sustainability" FCDSEGS-2021** on October 7-8, 2021 sponsored by All India Council For Technical Education (AICTE).

We at AGC have a mission to achieve academic excellence and responsive of changes in environment through an academic autonomy and prepare our budding engineers and managers for global competition and to nurture with core inner values.

The main objective of the conference is to exhibit the technical dexterity of the budding technocrats, research scholars, representatives from academia and industry. The event focuses on the ingenuity of the charismatic research scholars to be mustered under one roof with a global outlook. It aims and aspires to bring technical faculty across the countries in pace with the latest developed tools that are currently being used in context to the theme of the conference.

I wish to convey my sincere thanks to all who have contributed for the conference in whatsoever way through research papers, attendance, encouragement and valuable suggestions. I hope that the sincere efforts, zeal and vigor of the members of organizing team would be prolific enough in making this event a grand feat.

Best Wishes

Dr. Amarpreet Singh
Professor (CSE)
AGC, Amritsar

MESSAGE FROM CONFERENCE CONVENER

It is a matter of honour that Amritsar Group of Colleges, Amritsar is organizing the **"International Conference on Future Challenges in Data Science and Engineering for Global Sustainability"** **FCDSEGS-2021** on October 7-8, 2021 sponsored by All India Council for Technical Education (AICTE).

The urge to look for advancements in research and experimental techniques today is felt in almost every field of Science, Engineering and Management. This conference is a platform where scholars can share their views and ideas on the subjects related to the theme of the conference.

It would be a matter of great satisfaction, not only for the organization but the whole research community to be part of such conferences. We would like to make this conference a memorable event by offering sufficient opportunities and hope that you will enjoy the hospitality.

Dr. Sandeep Kad
Registrar
AGC, Amritsar

MESSAGE FROM CONFERENCE CONVENER

It gives me immense pleasure that Department of CSE, Amritsar Group of Colleges, Amritsar is organizing an **"International Conference on Future Challenges in Data Science and Engineering for Global Sustainability" FCDSEGS-2021** on October 7-8, 2021 sponsored by All India Council For Technical Education (AICTE).

The conference provides platform for researchers to exchange the ideas for further progress in research and development. Significant contributions by Researchers, Academicians from different countries have done a commendable job for the betterment of the society and mankind. Knowledge by sharing, undoubtedly, enhances many folds and at AGC we work with this philosophy.

I hope your experience of being a part of this conference will be wonderful. AGC is a venue where exchange of ideas finds you a global partner for collaboration by which you can explore your research experiences. Hopefully, the conference discussions, presentations and contributions play a significant role to update the knowledge in concerned field.

I wish the conference a great success.

Er. Vinod Kumar
HOD (CSE)
AGC, Amritsar

PREFACE

Organizing International conferences is necessary to provide international forum for researchers, industrialists and academicians to present and highlight their novel and innovative work to the whole world. It also inculcates the research culture among the entire education fraternity thereby, contributing to the development of the whole world. As "learning" is a key to sustainability, so participation in such conferences is much more important as it provides an individual an opportunity to exchange ideas and explore new avenues of collaborations.

Nurturing this thought in mind Department of Computer Science and Engineering , Amritsar Group of Colleges, Amritsar is organizing AICTE sponsored International Conference on Future Challenges in Data Science and Engineering for Global Sustainability (FCDGSEGS-2021) on October 7–8, 2021.

We at AGC have a mission to achieve academic excellence and responsive of changes in environment through an academic autonomy. AGC, Amritsar is putting an untiring effort to uplift education standards in the region since its establishment in 2002. AGC's well qualified and experienced faculty is serving the nation by producing quality technocrats and researchers.

In the inception phase of the conference we set our target to publish only 50-60 research papers. Getting an overwhelming response from the contributors we received 118 papers from all around the globe. Conference Review Committee scrutinized each paper very meticulously on the basis of the quality of work presented by various researchers and finalized 75 papers to be published in the conference proceedings. This conference proceeding involves full paper publications with an ISBN number. Further, organizing committee has collaborated with Scopus Indexed journals to recommend selected papers for publications.

In continuity, AGC Amritsar is going to organize International Conference on Latest development in Materials and Manufacturing ICLDMM-2022 on March 24–25, 2022 in collaboration with Elsevier.

Dr. Amarpreet Singh

Programme Committee Chair
FCDSEGS-2021

Dr. V.K. Banga

General Chair
FCDSEGS-2021

FCDSEGS-2021
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Er. Bhuvnesh Kumar	Assistant Professor-CSE, AGC Amritsar

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Bug Categorization using Topic Modeling

Dr. Sumeet Kaur Sehra[1], Dr. Sukhjit Singh Sehra[2], Dr. Jaiteg Singh[3], Dr. Sarabjot Singh[4]

[1]Guru Nanak Dev Engineering College, Ludhiana, Punjab, India
[2]Wilfrid Laurier University, Canada
[3]Chitkara University, Punjab, India
[4]Sabudh Foundation, Mohali, India
E-mail: [1]sumeetksehra@gmail.com

Abstract—**Similar bugs are those bugs which require handling of many common code files. Developers can often fix similar bugs within a shorter time period and a higher quality since they can focus on fewer code files. In the paper, an ensemble model has been proposed to detect duplicate bugs. The model combines the similarity scores obtained by a traditional information retrieval technique and cosine similarity method. The proposed ensemble model has been empirically evaluated by using datasets from two popular open-source projects, namely Thunderbird and Eclipse. The metrics used for evaluation are Mean average precision (MAP) and Recall rate. The experimental results show that proposed approach achieves better performance than individual approaches for similar bug recommendation. The future scope of current work is to include other parameters of bug reports as part of the model, which may have significant effect on the importance of bug report such as severity of bug report.**

Keywords: Bug Categorization, LDA, Topic Modeling, Clustering

I. Introduction

In software engineering (SE), the quality of code is very significant as it impacts the software defects' debugging quite expensive. Software bug reports are considered artifacts for software projects since they carry the important information required for software development and maintenance. The project manager assigns the debugging task to the concerned developers during the allocation of resources. The component field on a bug report is the indicator of which developers' team should handle it [34]. Assessment of priority and severity [25] and bug triaging [28] is performed on the basis of bug reports. Bug reports' information decides quality and reliability of these activities.

In software development, bug tracking system (BTS) is utilized in software projects. For management of software defects for a long time, BTS has a crucial role to play. The classification of bug reports in BTS is done on the basis of various parameters including priority, severity, open-close status, and affected module etc. In most of the bug repository systems, some records are common including short title, a detailed description, platform used, and release information etc. for each bug report. In addition to these, status field (e.g.fixed, assigned, new, not fixable etc.) is also present which indicates the state of the bug. This field is used by developers to make relevant comments about the status of bug.

The load of the bug triagers is heavily increased due to submission of a large number of new bug reports. In addition, the process of triaging bug reports is always manual, error prone, and time consuming [41]. Furthermore, various other issues in software engineering are also handled by BTS viz. improvement in performance, refactoring of source code, and new feature request etc. Since BTS is used for many activities, it may result into misclassification of bug reports. The research has also identified that there is a positive co-relation between the excessive reassignment of bugs and changes in bug reports' classification [17].

It is a challenging task to separate bug reports from other requests as each report has to be checked manually to find out the classification. Numerous studies have been published on manually classifying bug reports [2; 18; 38]. It has been identified from the studies that it is effort-prone and difficult to inspect the reports manually. Thus, to overcome these problems, automatic classification of bug reports is the area to be explored. Automatic categorization technique for bug reports can help in more studies in this research area and help in reducing the effort.

The core idea behind this work is to use an unsupervised technique (topic modeling) to identify the bug defect report patterns from bug repositories. In this paper, the bug repositories from Eclipse and Mozilla defect tracking dataset have been used for empirical validation. These repositories include the bug reports for 4 popular products retrieved from both Eclipse and Mozilla. The model has been developed by using Python because of it's strong string class with powerful methods.

The paper has been organized as follows. Next section describes the literature review in detail. In section III, datasets are elaborated including the bugs and components detail. Methodology is discussed in section IV. In sections V and VI, Pre-processing and topic modeling have been explained. Results are discussed in section VII and the paper is concluded in section

II. Literature Review

It has been very crucial task for software developers to identify the current and historical bug report patterns. Further, extraction from this information to focus on innovative methods and concepts also requires critical thinking. Keeping in view the volume of unstructured data, it is a tedious task to extract the desired information. Extensive research has been made on the quality of bug reports and it has been found that reports often come with incomplete and incorrect information [5].

The identification and classification of bug reports can be reviewed manually or algorithmically. A number of studies have been conducted which show that much time is spent on manually classifying bug reports [2; 18; 38]. It has also been studied the bug reports misclassification problem; i.e., reports which are labeled as bugs, but actually are non-bug issues [2]. They found that less than half of bug reports are actually related to bugs.

In large collection of documents, for identifying the trends, natural language processing can be used as an effective technique. Topic modeling, an algorithmic-based analysis approach reduces the effort as compared to manual classification [7; 8]. Further, it does not require the expertise in the subject matter also. In this method, corpus is applied as input for identification of the patterns. Then, it also augments the vocabulary by adding semantic meaning. For topic modeling, both topic analysis and clustering approaches can be applied. But, topic analysis is considered more suitable for identification of unobserved topics from the dataset [13]. With the advances in technological stack, various methods have been developed for extracting the relevant information from voluminous data.

Topic modeling is an automated process which is based on algorithmic-based analysis [8; 33]. From a corpus, this method is used to identify the patterns. Further, semantic meaning is also added to the corpus's vocabulary. Topic modeling can be applied by two methods viz. topic analysis and clustering but topic analysis is considered better choice for research trends' identification [13]. The main difference between the two methods is the assignment of a document to the topic or cluster. A document can be assigned to multiple topics in topic analysis, whereas it joins exactly one cluster in clustering.

Topic modeling can be differentiated from rule-based text mining [12]. Rule-based text mining uses searching techniques based upon regular expressions or keywords from dictionary whereas topic modeling is an unsupervised approach which can be utilized for identification and analysis of a group of words from text clusters. Topic models have emerged as a promising area in text analysis methods which have been followed by various researchers in numerous fields including social sciences, humanities and beyond [27].

From previous research, topic modeling for information retrieval has been revealed as the state-of-the-art technique. In various SE tasks, it has been applied including localization of bugs [24], defect prediction [10], change messages' classification [14], and mining software repositories [37].

Latent Dirichlet Allocation (LDA) [6] and Latent Semantic Analysis (LSA) [11] have been two prominent topic modelling methods. LSA is a text mining technique which can perform detailed and organised analysis of a large corpus. The primary concept of LSA is that similarity of word meanings and word sets is determined by the summation of all the word contexts. The given word may or may not appearing in a word context results in mutual constraints. Although it is reflected as an efficient text mining approach but it is based on the concept of adhoc principles [26].

LDA is a flexible approach which is based on the concept of generative probabilistic model. This model can be employed for discrete data collections as suggested by [6]. A probabilistic model even at the documents' level is provided by LDA. It overcomes the limitations of the generative models. Further, LDA permits easy labeling of the topic solution, and allied words are joined more efficiently into each topic [22]. For large-scale data analysis, LDA can work as an efficient technique [19]. LDA has been extensively adopted in various fields such as journalism [32], politics [16], and social network analysis [29] for text analysis. LDA has been employed as a tool to analyse the huge collections of news content [19]. Automatic recognition of emotions from music have been perfomed by employing LDA [3]. A statistical inference algorithm has been proposed by [15] based on LDA and it has been suggested that this algorithm can be helpful to gain insight into a scientific document.

Automatic binary classification has been performed to distinguish enhancement/feature re- quests from report addressing software defects [2; 30]. Bug reports are also studied for detection of duplicate bug reports [35; 36], to facilitate bug triage [28], for predicting severity [20; 25], priority [39] of bug reports, and estimating the time needed to fix a bug [1]. Automatic classification of bug reports by using LDA has been proposed by [30]. Hierarchical Dirichlet Process (HDP) which is simlar to LDA except for parameter tuning.has been proposed by [23]. Attempts are also made for automatic summarization of bug reports [31].

III. Dataset

In this paper, the dataset of Eclipse and Mozilla defect tracking dataset is used. It contains the bug reports for 4 popular products retrieved from both Eclipse and Mozilla [21]. In this dataset, all the changes and updates for a bug for complete lifetime are reported, thus providing the

information of all bug reports in a fine-grained manner. The information has been filtered to contain only genuine defects (i.e., no feature requests) and designed to cover the whole bug-triage life cycle (i.e., store all intermediate actions).dataset that provides a comprehensive information bundle on the historical evolution of the most relevant attributes from the Eclipse and Mozilla project bug reports.

The dataset consists of over 200,000 bug reports with 47,000 and 168,000 for Eclipse and Mozilla respectively. The bugs in the dataset are those which have been extracted after year 2006 onwards. Further, the included bugs have been reported until March 2011 for Eclipse and until December 2013 for Mozilla. Both Eclipse and Mozilla with bugs reported and number of components have been presented in Table I.

Fig. 1: The Structure of the Dataset Used

TABLE 1: THE DIFFERENT PRODUCTS WITH THE CORRESPONDING NUMBER OF BUGS AND COMPONENTS.

Product	No. of Bugs	No. of Components
Eclipse Platform	24775	22
Eclipse JDT	10814	6
Eclipse CDT	5640	20
Eclipse PDE	5655	5
Mozilla Core	74292	137
Mozilla Firefox	69879	47
Mozilla Thunderbird	19237	23
Mozilla Bugzilla	4616	21

Fig. 1 represents the data structure of the dataset. The dataset is a collection of XML files. Separate directory for both the Mozilla and Eclipse is maintained. In each directory, an XML file is maintained for each bug attribute including the relevant information. Further, a separate sub directory for each product containing complete relevant information is also included in the dataset. Furthermore, in each product directory, an additional XML file (i.e., reports.xml) is also present. This XML file has the information about those bugs which remain unchanged throughout the lifetime. The information includes reported bug's id, opening time and reporter of that bug.

IV. METHODOLOGY

Since the number of bug reports keep on rising in BTS, software managers find it a tedious task to manually triage the bug reports. In this project, a novel approach has been implemented for categorization of the bug reports based on the unstructured information provided in the bug report. The large number of bug reports submitted to open bug repository increase the burden of bug triagers.

Recent advances in semantic analysis using natural language processing has proposed models such as latent semantic analysis (LSA) or latent Dirichet allocation (LDA). These topic models discover topics (i.e., sets of related words) within the source code entities, which developers use as surrogates for conceptual concerns. The aim of this work is to determine the defects prevailing mostly in each bug repository. This information is often not easily available, since developers do not often manually categorize each entity. In particular, we have extracted the linguistic data from bug repository, that includes the developer comments. The comments of the developers are treated as a corpus of textual documents, which are used as a basis for topic modeling.

In the dataset used, each bug has corresponding bug report. Each bug report consists of information including the fields that are pre-defined, textual description,

Fig. 2: Flowchart
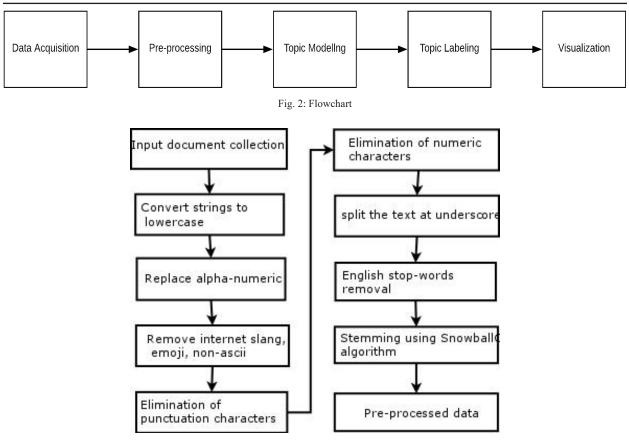
Fig. 3: Pre-processing Step

dependencies, and attachments. Some of the attributes remain unchangeable through the lifetime e.g. date of creation and the reporter. Some of them may change e.g. severity, priority, and component etc. Some attributes may be modified regularly e.g. present status, and the final state.

Bug report's textual description is represented in natural language including the bug report's title, detailed description, and comments posted. In this paper, textual content of bug reports was used to perform topic modeling. The approach used for this work follows the flowchart as depicted in Fig. 2. The data is downloaded from the repository discussed in the previous section.
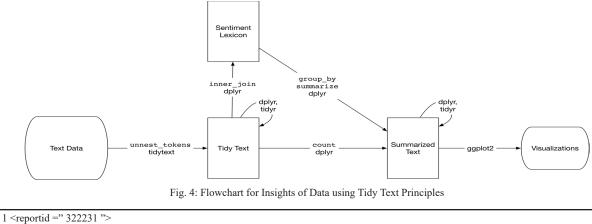
V. Pre-Processing of Dataset and Tidy Data

The structure of the XML dataset was assessed and only comments w.r.t report tag were assessed and converted into comma separated file. Pre-processing was performed to clean the dataset collected from the bug repository, particularly the comments given by the developers.

The corpus was prepared by first performing the pre-processing followed by term-filtering. Pre-processing of the obtained dataset is crucial for topic modeling. The developers does not use a well defined structure of the

sentences to share the information about the bug. Thus, it is utmost important to clean the dataset before used for model. Pre-processing steps are described in detail as shown in Fig. 3.

In pre-processing of the dataset, the sentences, characters, and words are changed into tokens. These tokens are further processed in the next steps in topic modeling. With this step of token generation, the size of dictionary is reduced and efficiency of topic modeling is improved. The following steps were followed for corpus preparation:

1. Each document (the comments by the developer at a given timestamp) was changed to lowercase.
2. All punctuation symbols including commas, hyphens, periods, commas, apostrophes, exclamation points, underscore etc. were eliminated.
3. Only textual terms were retained after filtering the numbers.
4. The internet slangs, non-ascii characters and emojis used in the documents were removed.
5. English stop-words were removed. Further, refinement was done to remove those terms that exist only once in a document.
6. The SnowballC stemmer algorithm was applied to convert inflected words to the base stem of the tokens in each document.

Fig. 4: Flowchart for Insights of Data using Tidy Text Principles

```
1 <reportid =" 322231 ">
2 <update>
3 <when>1136281841</ when>
4 <what>When uploading a objective − c ++file (.mm) bugzilla sets the MIME type as application / octet − stream</what>
5 </ update>
6 <update>
7 <when>1136420901</ when>
8 <what>When uploading a objective−c++ file (.mm)bugzilla sets the MIME type as application/octet−stream</
what>
9 </ update>
10 </ report>
```

Listing 1: Duplicate Comments in the Dataset

A. Removal of Duplicates

It has been found that a lot of comments of reports contain duplicate updates. For instance, as shown in Listing 1, there are duplicate comments submitted by the developer. The redundancy added by these duplicate messages may bias the results. Thus, the redundant information is removed using the cosine similarity. Cosine similarity is a simple but intuitive and classical approach from computational linguistics is to measure similarity based on the content overlap between documents. For this, documents are represented as bag-of-words, so each document will be a sparse vector. Cosine similarity is defined as measure of overlap as angle between vectors given by Equation 1. For calculation of cosine similarity between both the sets of documents user have to provide DTM for each them. This processed data was used to prepare the corpus for topic modeling. Further, any document that contain less or equal to two words was removed from the dataset.

$$\text{similarity}(\text{doc}_1; \text{doc}_2) = \cos(\ ) = \frac{\text{doc}_1\text{doc}_2}{\text{doc}_1\text{doc}_2} \qquad (1)$$

B. Tidying Text for Insights of Data

Using tidy data principles is a powerful way for data handling. It provides the powerful insights of the data and its behavior, because it is dependent on the linguistic terms being used.

Documents are converted into a table with one-token-per-row. Tokenization is the process of splitting text into tokens. This one-token-per-row structure is in contrast to the ways text is often stored in current analyses, perhaps as strings or in a document-term matrix. It is used to provide the insights of the dataset[1]. The following steps were performed to obtain the desired information.

For the insights of the documents, after tokennization, a common task in text mining is to look at word frequencies, and to compare frequencies across different texts as shown in Fig. 4.

Sentiment analysis provides a way to understand the attitudes and opinions expressed in texts. This work has used sentiment analysis to understand how a narrative arc changes throughout its course or what words with emotional and opinion content are important for a particular bug. This work implemented the sentiment analysis based on the lexicon bing libraries[2] from Bing Liu and collaborators. Further, n-gram combinations were also used to look closely at the combination of words used by the developers to communicate the bugs.

_____

[1]https://www.tidytextmining.com/tidytext.html,verified on November 28 2018.
[2]https://www.cs.uic.edu/~liub/FBS/sentiment-analysis. html

C. *Term Frequency-Inverse Document Frequency*

For topic modeling, TF-IDF weighting scheme was applied to reveal the relative importance of a entity with other entities in the corpus. By using this scheme, the weight increased relative to word's occurrences in the document. By this, the weight of some words appearing more frequently was balanced [40]. TF-IDF weighting schemes can be implemented in different combinations [29]. Equation (3) represents the approach followed in this paper. In this equation, where Wi;j is the weight of TF-IDF, nd is the documents' count, and df is the term frequency.

The term frequency (Equation (2)) represents the local component of a document and measures the frequency of occurrence of a term in a document; the inverse document frequency contains the global component by explaining the importance of a term in the document collection, i.e., $\log_2(n_d = df_i)$.

$$tf = \frac{\text{Number of times term appears in a document}}{\text{Total number of terms in the document}} \quad (2)$$

For driving the term-document weighted matrix, a local-component (term frequency) was multiplied with a global component (inverse document frequency). Equation (3), was used in all of the identified topic solutions.

$$W_{i:j} = tf_{i,j} \log_2(nd = df_i) \quad (3)$$

VI. Topic Modeling

Topic modeling has advantages in revealing the patterns from the unstructured data. In addition, it does not require any training data.

In LDA, the hidden topics from a large data corpus are identified which are the representation of whole corpus. Further, collection of latent topics constitute a document and the topics are associated with the keywords in the documents. Using the concept of topic modeling, word having similar meaning are connected and vice-versa. Thus, LDA generates the similar patterns from the corpus on the basis of latent topics.

LDA was applied after pre-processing was performed on the dataset as per the methodology suggested by [6]. Topic models were generated on the basis of three parameters including the hyper-parameters and , number of topics, and iterations' count required for model convergence. represents the value of the Dirichlet prior over the document's topic distribution. represents per-word-weight of Dirichlet prior over topic-word distributions. The count of words is used to find out distribution magnitude in the vocabulary.

A. *Selecting Optimal Number of Topics*

Since BTS contains bug reports in unstructured document set, identifying the optimal number of topics is a critical task. For identifying the number of topics, no standard approach is followed in topic modeling. If less number of topics are chosen it results in coarse LDA model whereas a complex model in case of large value of topics. Due to unavailability of established measure to identify the optimal topic count, heuristic parameters were applied to find the optimal range of topic solutions [4; 9]. The method used by [9] is based upon selecting the best LDA model based on density whereas metric proposed by Arun et al. [4] is computed in terms of symmetric KL-Divergence of salient distributions that are derived from these matrix factor. [15] has used the Gibbs sampling algorithm to obtain samples from the posterior distribution over z at several choices of T (number of topics).

B. *Topic Labeling*

For bug to be categorized, it is required that all the identified topic should be labeled, so that those can be identified by the bug maintainer to assign them to specific team of developers. There is no defined approach for labeling the topics, but in this paper, bi-grams have been used for labeling, which uses a naive labeling algorithm from [REF]. These naive labels are based on probabilities of P (bi grampertopic) P (bi gram).

C. *Clustering the Topics*

In addition to labeling the topics, It is also required to cluster them based on the similarity. So that similar type of bugs can be assigned to same developer team. Hierarchical clustering is used for purpose. This clustering is created based on the documents, terms, and the coherence of the topics generated. This clustering provides a clear picture of the obtained topics and their categorizations.

VII. Results

The dataset includes the bug reports for four products viz. Core, Firefox, Thunderbird, Bugzilla. In this paper, the results for only Thunderbird and Bugzilla are presented. The numbers of bugs in Thunderbird and Bugzilla reported are 19237 and 4616, respectively. The pre-processing including tokenization, stop word elimination and stemming are conducted on the natural language contents. The Porter stemming algorithm was used for English stemming processing. Fig. 5 and 6 present a clear picture of the words. their distribution and network. After the cleaning of the dataset, the prepared corpus was presented to the topic modeling algorithms viz LDA and LSA. Once the natural language contents of bug reports were extracted, the implemented topic models were used for the categorization of bug report. Thereafter, the obtained topics were further clustered to small number of the clusters to be assigned to the developer teams. For

(a) Wordcloud

(b) Most Frequent Words

(c) Sentiments of the Words

(d) Count of Words Sentiments

(e) Words Proceeded by Negation

(f) Bigram Network of Words
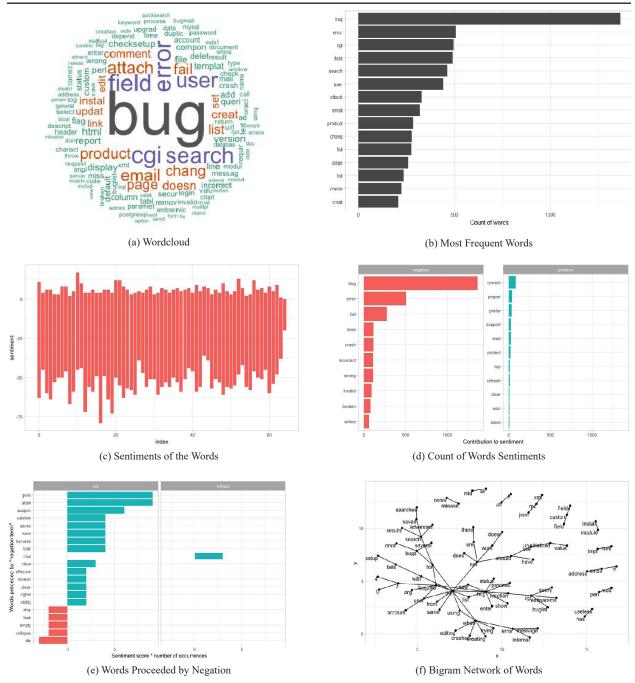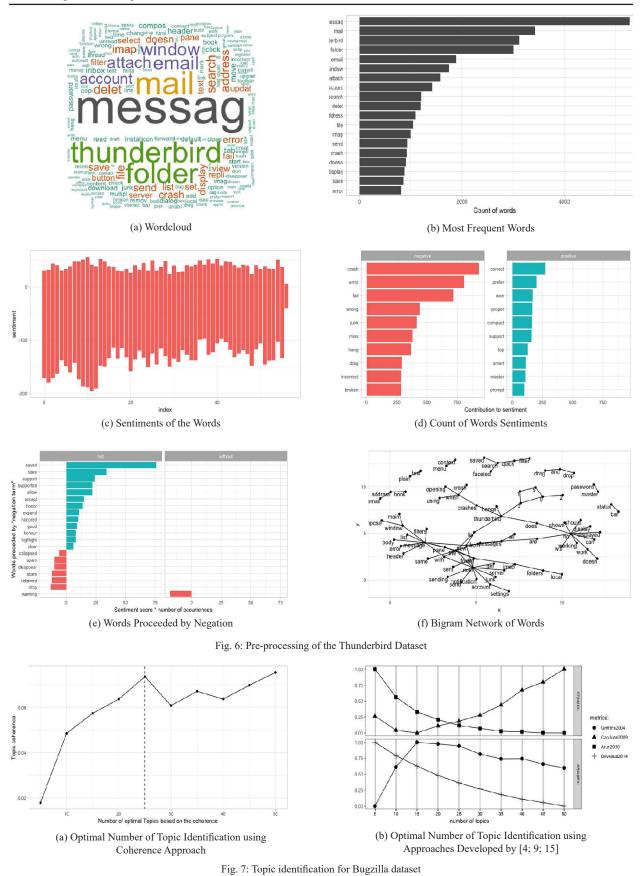
Fig. 5: Pre-processing of the Bugzilla Dataset
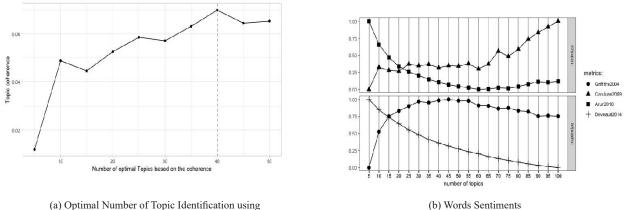
developing the model the document-term matrix was provided to LDA model. Number of iterations,s = 200, and two hyper-parameters, = 0.1, and = 0.05 were passed as parameters.

As there is no established approach to identify the optimal number of topics, this current work utilized two approaches. one of the approaches is based on probability coherence [4] and other the approach given by [9]. The identified optimal number of topics for Bugzilla and Thunderbird dataset is given in Fig. 7 and 8. From the

visual inspection,it is reveled that for bugzilla dataset, the optimal number of topics are 25. In case of Thunderbird dataset, there was no clear consequences from both the approaches. But, it was decided to select the number provided by probabilistic coherence approach which gave the number of optimal topics as 40 as this value generated a peak as shown in Fig. 8.

Table II presents the top ten topics, identified label, coherence value, prevalence value and their associated terms for both datasets. The identified labels present are

(a) Wordcloud

(b) Most Frequent Words

(c) Sentiments of the Words

(d) Count of Words Sentiments

(e) Words Proceeded by Negation

(f) Bigram Network of Words

Fig. 6: Pre-processing of the Thunderbird Dataset

(a) Optimal Number of Topic Identification using
Coherence Approach

(b) Optimal Number of Topic Identification using
Approaches Developed by [4; 9; 15]

Fig. 7: Topic identification for Bugzilla dataset

(a) Optimal Number of Topic Identification using Probabilistic Coherence approach

(b) Words Sentiments

Fig. 8: Topic identification for Thunderbird dataset

(a) Bugzilla Dataset

(b) Thunderbird Dataset
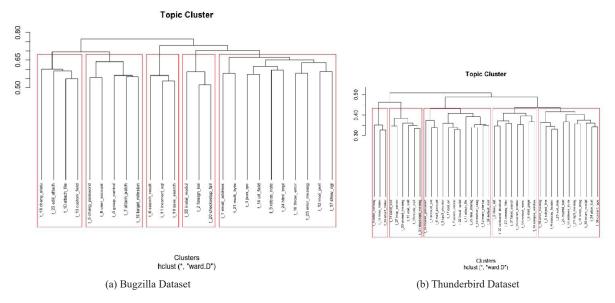
Fig. 9: Cluster Identification

categorization of the prevailing words in the bug reports. The identification of optimal clusters was done using the "gap stat" method. For the Bugzilla and Thunderbird dataset, the identified clusters were 5. The cluster identification for both the datasets is presented in Fig. 9.

The performance metrics used to identify the topics and their importance are R-square and coherence. R-squared explains the variability captured by the topics of the model, whereas, the probabilistic coherence calculates the association of words for each topic while handling the statistical independence. For every word pair in the top k terms words for a topic, It finds the difference in $P(y|x)$ and $P(y)$, in case x is more probable than y in the topic. The value for R-square for Bugzilla and Thunderbird dataset is 0.0922776 and 0.1214197, respectively. The values of the coherence for both the datasets is presented in Table 2.

VIII. CONCLUSION

The bug reports are vital for software development and improvement of the software. The information provided in the bug reports has many components, the idea and information of the bug is provided as an unstructured text format. Thus, reading all these report information manually is a tough task. The current project has been successful in applying the principles of topic modeling to bug categorizations and their assignment to developer team from the identified clusters.

The dataset of open bug repository was taken to create a reproducible project. The results of the two datasets Bugzilla and Thunderbird are presented. The limitation of this work is that since R works on in-memory databases, thus limiting the size computation that can be performed on the given dataset. Thus, in future the efforts would be given to use other big data technological stack to categorize bugs.

TABLE 2: TOP TEN TOPICS FOR BUGZILLA DATA ALONG WITH OTHER TOPIC QUALITY PARAMETERS

Topic	Topic label	Coherence	Prevalence	Top terms
BUGZILLA DATASET				
t 23	edit attach	0.037	4.885	attach, comment, add, edit, ad
t 19	save search	0.05	4.763	search, buglist, save, cgi, work
t 18	chang statu	0.064	4.555	bug, chang, statu, resolut, field
t 22	instal modul	0.102	4.513	instal, modul, requir, fail, checksetup
t 24	html tmpl	0.204	4.501	html, templat, tmpl, html tmpl, admin
t 2	foreign kei	0.046	4.363	tabl, fail, column, mysql, databas
t 6	search result	0.032	4.277	search, result, quicksearch, vote, advanc
t 16	throw error	0.039	4.197	error, line, throw, cgi, call
t 13	custom field	0.111	4.137	field, custom, cgi, custom field, enter
t 8	user account	0.044	4.092	user, account, creat, list, email
THUNDERBIRD DATASET				
t 11	attach file	0.074	3.547	attach, file, open, save, attach file
t 32	address book	0.225	3.367	address, book, address book, list, email
t 16	compos window	0.124	3.162	window, compos, open, messag, compos window
t 8	delet messag	0.073	3.142	delet, messag, inbox, folder, trash
t 10	imap folder	0.062	3.045	folder, imap, move, local, copi
t 4	messag_header	0.041	2.993	messag, pane, header, view, scroll
t 20	unread messag	0.083	2.87	messag, read, mark, junk, unread
t 38	smart folder	0.036	2.825	folder, view, save, select, search
t 7	comm central	0.02	2.747	build, remov, broken, file, string
t 37	facet search	0.056	2.702	search, result, messag, index, facet

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Indoor Tracking Using BLE:
An Experimental Approach

Ashish Garg[1], Amit Gupta[2], Monika Singh[3]

[1]Masters Student, CVUT in Prague, Czech Republic, Firmware Trainee, Crosslynx US LLC, Milpitas,USA
[2,3]Crosslynx US LLC, Milpitas, USA
Email: [1]ashishgarg.bme@gmail.com, [2]amit.gupta@crosslynxus.com, [3]eronmonika@gmail.com

Abstract— **Location-Based services play a vital role in the day today life, and one of the promising services is GPS, which is widely used for outdoor localization. Indoor Localization is in the early stage of development. Nowadays mostly used method is based on RSSI value and Bluetooth, WIFI. In this paper, we tried to apply the basic RSSI based method with Bluetooth Low Energy (BLE). And we got very promising results in the case of 2D Localization.**

Keywords: Indoor Localization, Bluetooth Low Energy (BLE), RSSI

I. Introduction

Navigation has always been an issue when we are at an unfamiliar place. But with the help of technology advancements like Global Positioning System (GPS), navigation becomes easier for us. GPS solves the problem of outdoor localization. But for indoor, there are limitations with GPS. GPS signals get blocked or reflected by the walls of the buildings due to which it becomes impossible to calculate the indoor position. In the past several years there has been tremendous development in the field of Indoor Localization. Researchers used many techniques like Trilateration, Triangularization, RSSI, etc. Indoor Positioning system is used for locating the people and objects inside multi-storey buildings, airports, alleys, parking garages, and underground locations [1]. In addition to this, we need a low-cost, reliable, and low power consumption method. RSSI-based method fulfil these requirements [2], and it is available in almost all wireless devices. RSSI stands for Received Signal Strength Indicator. It is the measurement of the power present in the received signal. If its value is negative and near to zero, it means the received signal is stronger, and if the value goes away from zero in negative, it means the signal is weak [3]. The value of RSSI value is inversely proportional to distance [3]. This paper presents the use of RSSI and RF signal-based technique, Bluetooth Low Energy (BLE), based on IEEE 802.15.1 standard for Wireless Personal Area Networks. It operates in the unlicensed Industrial,

Scientific, and Medical (ISM) band of 2.4GHz. And it is a Low power and Low-cost technique.

This paper is organized as follows: Section II gives the previous work done by the researchers, Section III gives the details of our Experimental setup, Section IV gives the Evaluation/Results we obtained, and Section V gives the Conclusion and future work can be done.

II. Related Work

In this section of the paper, we discussed the few previous work done on the Indoor Localization. Many researches have been done on the Indoor tracking, and many companies have already rolled out their indoor tracking systems in the market.

Distance estimation in RSSI based method does not give very promising results due to fluctuation of RSSI value at the same location over a period of time. So many researchers tried different methods for obtaining the correct results like in [4], the author proposed a recursive least square (RLS)-algorithm. They used Adaptive filtering, and with that, they obtained less mean distance error. The mobile node sends the signal to the fixed or reference node, which measures the signal strength. After that, RSS values are sent to the RLS-RSS Estimator for further processing. In [5], the author proposed a model that averages the RSSI at any distance and then use the Ring Localization Algorithm (iRingla) technique to minimize the errors caused by RSSI instability. iRingla is an algorithm in which rings are drawn instead of circles around the beacons. They first calculated the distance between the ibeacon and receiver using RSSI measurement, and then a matrix is constructed with the intersection points of the rings, and from that position is estimated. In [6], the author discussed smart indoor navigation system using BLE. They used the A* algorithm, estimote iBeacons with BLE, and achieved good navigation accuracy. The position of the target is estimated using Trilateration and Particle filter and then navigated using the A* algorithm. In [7], the author discussed the two algorithms to improve the proximity detection accuracy of iBeacons. They proposed Server-side Running Average (SRA) that uses the same distance formulas as (1) and Server-side Kalman Filter (SKF),

that uses a Kalman filter with SRA. Their results show that SRA and SKF perform better than the moving average approach used by iBeacons. In [8], the author discussed an improved version of the fingerprinting localization. Fingerprinting is another method of position estimation in which signal strength is recorded from different access points to create a unique set of data. After that, during tracking, the current signal strength is matched with the stored data and closet match is returned as the desired location [8], [9]. As per their [10] improved version (including weighted centroid localization (WCL) with fingerprinting), the total number of reference points is reduced, so that time consumed during the whole process is reduced. In the same way, authors of [11], proposed another system that uses a K-NN algorithm and moving average filter. RSSI data is taken from the K-NN algorithm and compared with the stored database. The error is reduced using the Moving average filter. The accuracy level of their system is higher than traditional fingerprinting and Triangulation method. In [12], the author proposed a new method based on the received number of signals indicator (RNSI). RNSI takes the location which gives the highest number of signals instead of using the Strongest RSSI based method. In the RSSI based methods, it is required to calibrate the device with the new environment, which is a very cumbersome process. Their results with RNSI-based method produced higher accuracy than the RSSI-based method even in the dynamic hospital environment.

III. EXPERIMENTAL SETUP

Measurements of the room should be known. Keep the Bluetooth receivers at fixed and known positions. The object (asset to be tracked) should be present in the room and stationary at the time of acquiring readings. Object sends the Bluetooth signal, or we can say that it throws the beacons as RSSI value. We took measurements in a closed room in which the Bluetooth receivers were set at 3 different locations of the room, and the object was kept static at a random place in the same room. The object sends the beacons, which consist of RSSI value (Received Signal Strength Indication), which is received by all three receivers. The RSSI value will differ according to the distance, So all three receivers will get different RSSI values of the same beacon.

We used the Nordic nRF51-DK device shown in Fig.1 as an object (asset to be tracked), which sends the RSSI value to the receiver and ESP32 SOLO-1 shown in Fig.2, as the receiver.
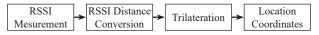
Fig. 1: Nordic nRF51-DK
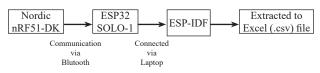
Fig. 2: ESP32 SOLO-1

Our complete flow diagram:

RSSI measurement have following steps shown in the block diagram:

We placed the ESP32 SOLO-1 at 3 different locations and Nordic nRF51-DK, as shown in the following Fig.3:

Fig. 3. Device Placement in the Office

The ESP32 SOLO-1 powered by laptop and Nordic nRF51-DK powered by 3.3V cell.

We took approx. 200 sample readings of RSSI value with each receiver, and corresponding to which we calculated the distance by using (1) [13]–[17]:

$$[\ ] = 10 \ \frac{-}{-10} \tag{1}$$

d(m): distance in meters

Tx: is the RSSI value at 1m.

N: is the environmental factor/ path loss exponent, ranges from 2-6.

Tx: -65.115.

We used n : 2, for all of our readings (Table 1 show the value of 'n' for different environment).

TABLE 1: PATH LOSS EXPONENTS FOR DIFFERENT ENVIRONMENTS (n) [18]

Environment	Path Loss Exponent, n
Free Space	2
Urban Area Cellular Radio	2.7-3.5
Shadowed Urban Cellular Radio	3-5
In building line of sight	1.6-1.8
Obstructed in building	4-6
Obstructed in factories	2-3

First, we compared the Calculated Distance with the Actual Distance using the same devices but in the line of sight.

From Fig.4 and Table 2, we can see that the calculated distance by the formula of distance gives approximately the same result as that of actual distance.

TABLE 2: COMPARISON BETWEEN ACTUAL AND CALCULATED DISTANCE

Average RSSI (dBm)	Actual Distance (m)	Calculated Distance (m)
-57.39	**1.22**	1.04
-67.09	2.44	3.20
-66.35	4.88	3.33
-74.80	7.32	7.60
-75.73	8.53	8.56
-77.50	9.75	10.37
-79.03	10.97	13.32
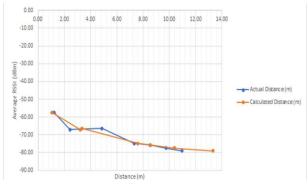
Fig. 4: Plot of Comparison between Actual and Calculated Distance

After calculating the distance in meters corresponding to the RSSI values, put these distances values in the following formulas [13]–[17]:

$$^2 = (- \ )^2 + (-)^2 \tag{2}$$

$$_2^1 = (^1 - \ )^2 + (^1 -)^2 \tag{3}$$

$$_3^2 = (^2 - \ )^2 + (^2 -)^2 \tag{4}$$

Manipulate (2),(3), and (4) as follows [13]–[17]:

$$(-2_1 \ +2_2) + (-2_1 \ +2_2) = \ ^2 - \ _1^2 - \ _2^2 + \ ^2 - \ _1^2 + \ _2^2 \tag{5}$$

$$(-2_2 \ +2_3) + (-2_2 \ +2_3) = \ ^2 - \ _2^2 - \ _3^2 + \ ^2 - \ _2^2 + \ _3^2 \tag{6}$$

Equations (5) and (6) can be written as follows in the matrix form:

$$[] = [-2_1 \ +2_2 \quad -2_1 +2_2 \\ -2_2 \ +2_3 \quad -2_2 +2_3] \ [_1^2 - \ ^2 - \ _2^2 - \ _1^2 + \ ^2 + \ _2^2 \\ _2^2 - \ _3^2 - \ _2^2 + \ ^2 + \ _3^2] \tag{7}$$

And after putting the values of the different variables, find the x and y values, and those values will be x and y coordinates.
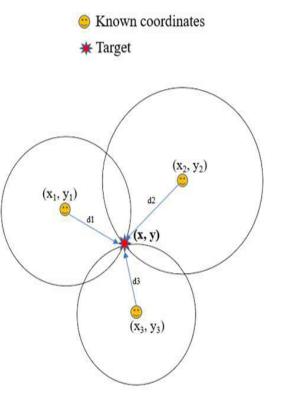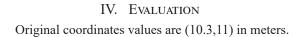
Fig. 5: Trilateration Estimation [2]

IV. Evaluation

Original coordinates values are (10.3,11) in meters.
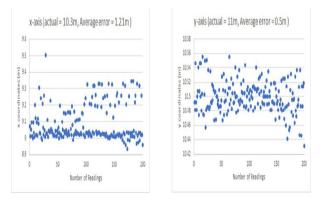
Fig. 6: Plot of 200 x-coordinates Value
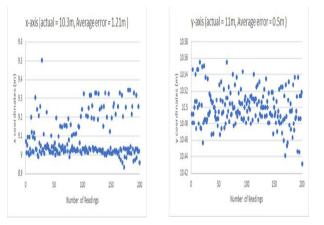
Fig. 7: Plot of 200 y-coordinates Value

Fig.6 and Fig.7 are the plot of x and y coordinates of 200 readings, respectively. But we also calculated the coordinates by taking the average of 20, 50, and 200 readings. The corresponding x-y coordinates are (9.066,10.497), (9.054,10.494) and (9.059,10.495) respectively.

V. Conclusion

It can be seen that results are approximately equal to the desired values of x and y. There are only 1.21m error in the x-axis and 0.5m error in the y-axis. And by the results, we can evident that the formulas of the Trilateration which we used were suitable for the 2D Indoor Localization. All the calculations/ analysis we did in Microsoft Excel. In our calculations, we did not use any filter. We kept the devices on the same plane, means at the same height. But in the calculation, height value is ignored. Another important factor is 'n' (path loss exponent), we used n=2, as the environment changes, the 'n' value will change, as shown in Table 1. But for the more accuracy, we can experiment with the value of 'n.' With the application of the different filters, as used by [4], [6], [7], the results can be further improved for both 2D and 3D Indoor Localization. Sometimes it is better to take the average of the RSSI value and then calculate the coordinates. The data we captured and did all the analysis is on this link Labcal.xlsx and for the Table 2 dataset_paper.xlsx. We also tried to calculate the 3D coordinates by extending the equations for the z-axis, but we got large errors.

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Website Based Classification of ECG Signal Using Hjorth Descriptor

Thaweesak Yingthawornsuk[1], Kantapat Kwansomkid[2], Anuwat Sukthong[3], Gurjeet Singh[4]

[1,2,3]*King Mongkut's University of Technology Thonburi, Bangkok, Thailand*
[4]*Amritsar College of Engineering and Technology, Amritsar, India*
Email: [1]thaweesak.yin@kmutt.ac.th, [2]kantapat.kwansomkid@mail.kmutt.ac.th
[3]anuwat.avis@gmail.com, [4]hod.ece@acetedu.in

Abstract— **Healthiness is important to our body for living our life and work for our living. Nowadays, we encounter many health problems, but the high-rate cause of death is Heart disorder. It lives among us quietly and hard to be detected without medical diagnosing devices and experienced medical staffs. But when detectable, most cases will be in the final serious period of health problem. In this paper we address such issue and have an attempt to develop the application that can help on analysis of heart disorder. As reported in the past the effective feature that is used for screening heart disorder is Hjorth Descriptor. It represents as the measurement of ECG signal's characteristics and used to classify three different types of ECG signals by machine learning, which are Normal Sinus Rhythm (NSR), Atrial Fibrillation (AF), and Congestive Heart Failure (CHF), respectively. As our classification results shown, the best model of classifier was found among several models in testing to be Extra Trees model with accuracy, recall, precision and F1 of 0.90, 0.90, 0.93 and 0.89, respectively. This can be concluded that our application can effectively classify the different categorized ECG samples and useful as the supplement of diagnosis of heart disorder and further development for improvement in future.**

Keywords— *Hjorth Descriptor, Normal Sinus Rhythm (NSR), Atrial fibrillation (AF), Congestive Heart Failure (CHF), Electrocardiography (ECG), Classification*

I. Introduction

Heart disorder is crucial that people are not aware of its affection to their healthiness. According to the World Health Organization (WHO) report in 2016, approximately 57 million people die worldwide each year, with ischemic heart disease the number one cause of death, with approximately 9.2 million deaths in Thailand in 2017. It has been reported that Thai people are likely to be sick with ischemic heart disease to 326,946 people and die from ischemic heart disease up to 20,746 people, an average of 57 deaths per day and the trend of illness is increasing continuously. Therefore, there must be an examination or surveillance of the disease to monitor all the time. The important thing in surveillance for heart disease is the heart health check using an electrocardiogram Electrocardiography (ECG) and those in high-risk groups should be examined regularly for further treatment.

ECG is an abbreviation of electrocardiogram representing the heart's electrical signal connection in each heartbeat, which is released and passed through our heart. As a result of the heart muscle that is completely contracted to send blood to the various parts of the body. The ECG popularly used to check for the heart rate whether there is an abnormally fast or slow heartbeat can be done by electrocardiogram. To obtain a result of diagnosis of ECG signal, a computer is used to process the signal and decompose it for abnormality in pattern of signal as affection from heart disorder by experienced medical professional. Currently, ECG signal analysis has received constant attention The ECG signals were analyzed with new techniques of signal processing and feature extraction to increase the efficiency and accuracy of ECG signal screening.

In this work, we therefore developed application which can analyze the ECG signals on website to screen the abnormal heart waveform from normal ECG signa by web application by using the Hjorth Descriptor as a selected feature of the ECG signal with significant characteristics that can represent the difference of dynamic change in signal pattern and using machine learning to classify the signals from different categorized ECG signal groups. This can be used as a screening tool initially and the web application is purposely designed as open source, which is a tool that is suitable and accessible by researchers or healthcare professionals to use for supplementary alternative in analysis of heart signals.

The following sections in this paper are organized as: Section II describes related works in the past. Section III presents Methodology and section IV shows implementation. Section V reveals results from study and makes discussion on the results. Finally, all works from this study concludes in section VI.

II. Related Work

ECG Signal Classification using Hjorth Descriptor [1] proposed by A. Rizal et al. was reported to identify the ECG signals based on the variance of signals and its

higher-order time derivatives. The K-Nearest Neighbor (KNN) and Multilayer Perceptron (MLP) models were used to screen ECG waveform. Different types of ECG signal samples which are normal electrocardiogram (NSR) and arrhythmia electrocardiogram (AF) were analyzed and both of which were correctly separated at a confidence level of 99.33% in accuracy.

ECG Classification with Modification of Higher-Order Hjorth Descriptors [2] by I. Wannawijit et al. is another research study that can separate ECG signal samples from three categorized groups of subjects using the original Hjorth Descriptor and two more additional parameters called Chaos and Hazard employed in the comparative classification. The Least-Squares, Maximum-Likelihood and Support Vector Machine were selected classifiers which can separate all different ECG signal samples with the efficiency up to 100% based on a combination of the original Hjorth parameters with addition of two improved Hjorth parameters.

Screening for cardiac abnormalities using Hjorth descriptors reported by [3] J. Saetang, C. Sukwisit and P. Temsang is also the continuing research study to study the principles of design and development of algorithm that can extract ECG features and classify them. The similar classifiers were employed to the Hjorth Descriptors obtained from NSR, AF and CHF ECG signal groups. Results of classification have been concluded that 99.39% of Sensitivity, 99.77% of Specificity and 90.57% of Accuracy were attained from study.

ECG detection of myocardial ischemia proposed by [4] A. Wuthipinya is a research study that presents analysis of the time domain fiber ECG signal by applying the discrete wavelet packet transform to extract the signal characteristics. and using the Decision Tree classifier to classify the patients with myocardial ischemia. The study categorized patients by efficacy shown in terms of sensitivity, specificity and accuracy of 92.3%, 100% and 96.2%, respectively.

III. Methodology

A. Structure of the Heart

The heart is a muscular organ located within the center of the thorax. (Mediastinum) located behind the sternum (Sternum) and in front of the spine (Vertebral Column) conical shape. The tip is tapered (Apex) with a direction pointing down to the left. The upper part is a wide base consisting of a large artery connecting the right and left hemispheres of the heart with a muscle as a septum (septum).
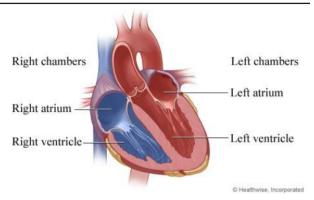
Fig. 1: Structure of the Heart's Chambers

B. Electrocardiogram (ECG)

ECG measurement is the initial diagnosis of heart disease and an additional examination based on medical history inquiries. A physical examination that includes listening to the heartbeat with a stethoscope. This is to assist physicians in the initial assessment and diagnosis of health and heart disease. An electrocardiogram is a simple and easy examination that can be performed by personnel who are physician assistants. (But the doctor interprets the results) and is a test that is available in every hospital. The benefits of an electrocardiogram help doctors know how the patient's heart is working. This is to assist doctors in assessing patient health. Help early diagnosis whether the patient has heart disease or not. The method of examination by the examinee changes to wearing hospital clothes, taking off socks, shoes, jewelry that may interfere with the examination as instructed by the staff. Lay your body's back down on the examination bed, relax, breathe normally, close your eyes, or open your eyes. Officers will place multiple cardiac electrodes on the arms, legs, chest, sometimes requiring shaving. If the hair is so much that results the patch does not stick. Before the patch is applied, the gel is applied to the skin. To help transmit the heartbeat signal from the skin to the patch better. The patch installed with a metal plate is then attached to the receiver. The examinee simply lay still, not tense, because the contraction of the muscles can affect the heartbeat and ECG signal. The staff will record the heartbeat on the visualization monitor and see it as a graph. and the results can be printed on paper used specifically for the examination record. The ECG examination generally takes about 10 – 15 minutes.

C. Hjorth Descriptor

It is a more advanced method of analyzing the properties of the processed signal in the time domain. This concept was introduced by Bo Hjorth, where this
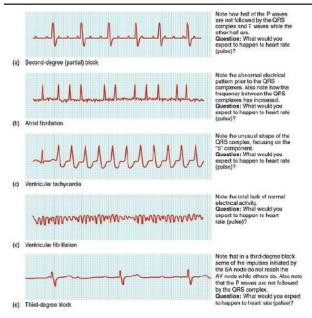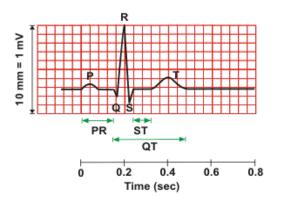
Fig. 2: Pattern of ECG in Patients with Different Heart Disorders

P wave (0.08 - 0.10 s)   QRS (0.06 - 0.10 s)
P-R interval (0.12 - 0.20 s)   Q-T$_C$ interval ($\leq$ 0.44 s)*

$$*QT_C = \frac{QT}{\sqrt{RR}}$$

Fig. 3: Electrocardiogram of a Normal Person

principle is often used in analysis of complex signals like Electroencephalography (EEG) and Electrocardiography (ECG).

D. Classification

It is the process of creating a model to organize data into a given group to show the differences between groups of data and to predict where this data should be categorized. The model used to classify data into groups as defined is based on the analysis of groups of experimental data (Training data) by bringing training data to teach the system to learn what data is in the same group. The result of learning is Classifier model. In this study several

models used, Extra Trees Classifier, Logistic Regression, Decision Tree Classifier, Random Forest Classifier, Gradient Boosting Classifier, Light Gradient Boosting Machine, Ada Boost Classifier, Quadratic Discriminant Analysis, Naive Bayes, K Neighbors Classifier, Linear Discriminant Analysis and SVM - Linear Kernel in estimating the accuracy of screening for heart disorders in each group.

E. Performance Evaluation

The values used to assess the effectiveness of the simulated screening consisted of 1) Precision as the proportion of true positives for that condition, i.e., the proportion of detections in actual patients, 2) Recall, the proportion of negative results. 3) accuracy is a value that indicates the ability of an instrument to read or display a measured value close to it. 4) ROC graph is a graph that shows the performance of a classification model based on different probabilistic criteria, ROC graph is generated by plotting FPR vs TPR where FPR is plotted on the x-axis. and TPR is plotted on the y-axis for different probabilistic threshold values ranging from 0.0 to 1.0 5) Kappa is a statistical measure coefficient between two commentators that there is consensus where the maximum possible value is 1.0 meaning all parties agree and 0.0 means neither sides agree at all by counting as a ratio of the expected probability to be when H 0 (independent) is true with the highest probability.

VI. Imprementation

A. Extraction of the Hjorth Description from the ECG Signal

First, we take the filtered signal and cut it out in the desired range and extract its characteristics with a function developed in Python to prepare the ECG signal for modeling. (Fig. 4, Fig. 5)

B. Modeling with Machine Learning

First, we take the filtered signal and cut it out in the desired range and extract its characteristics with a function developed in Python to prepare the ECG signal for modeling.

C. Web Application Operation System Design

In designing a web application to support ECG signal classification, it consists of 3 parts: (1) Client Side for display and interface (2) Server Side for model processing for waveform classification. (3) Database to collect ECG data and information related to the use of web application.

D. Technology Selection for Web Application Development (Tech Stack)

The publisher has chosen technology: (1) Client Side The developer uses React.js for the development of the
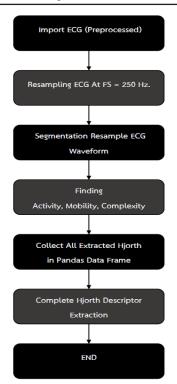
Fig. 4. Process of Extracting Hjorth Parameters from ECG Signal
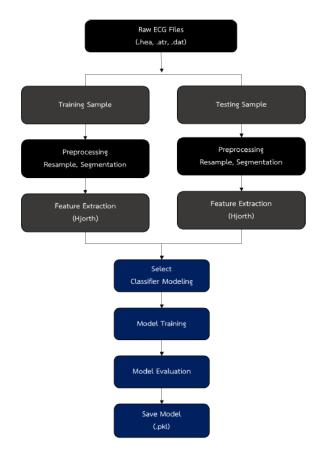
Fig. 5: Modeling with machine learning

Fig. 6: Home page of Web Application
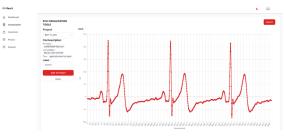
Fig. 7: Visualization Feature of Web Application

web page that interacts with the users of the website, (2) Server Side The developer uses Nest. .js for the administration of HTTP protocol communications; RESTFUL API for accessing server data; Flask.py was used by developers for EC signal processing and ECG classification with built-in models, and 3) Database The developer uses PostgreSQL as a Database for managing all databases of the website system.

Fig. 8. Demonstrating Technology for Developing Web Applications

V. RESULTS AND DISCUSSION

By using the Hjorth Descriptor as a feature of the ECG signal with three parameters: Activity, Mobility and Complexity, it is possible to be imported into a Python-developed program as well as using MATLAB as a tool that have been used in other research for extracting the Hjorth Descriptor. It is a program that requires high computer resources and fast access into the program. The use of Python programs to process requires less machine resources and can be used for free because it is an open source program under the terms of the Python Software Foundation License (PSFL) and currently has tools that support the use of such program. In cloud computing, for
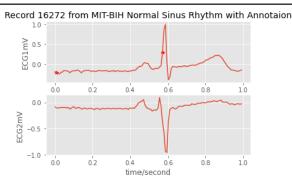
Fig. 9. Sample of a random signal at 128 Hz and specified annotation

Fig. 10. Sample of a random signal at 250 Hz and specified annotation

example, Google's Colab, Python could be a study and research alternative for extracting ECG signal attributes with Hjorth Descriptor.

The results of modeling by machine learning method of a total of 12 models showed that the most effective model for classifying ECG signals was the Extra Tress Classifier with Accuracy, Recall, Precision and F1 values. The values were 0.9000, 0.9000, 0.9278 and 0.8944, which were considered that all models are not yet used in other studies before via web based classification and the results are quite satisfactory. As it only uses the Hjorth Descriptor with only three original parameters but result came out with average accuracy higher than 85%. It can be used to classify the primary ECG signal with low efficiency and processing time. Because it relies only on basic statistical calculations.

As a result of the development of a web application for ECG classification, it is found that it can work on the website and making it easier and more convenient for users to access it via internet. The similar work is also proposed that the GUI has been developed to make it easier for users to use, such as screening for abnormalities based on Hjorth parameters reported by Jirayaporn Sae Tang in 2016. However, her work implemented in MATLAB program, which uses quite a lot of computer resources.

VI. Learning Models for Classification

All 12 models were selected, consisting of (1) Extra Trees Classifier, (2) Logistic Regression, (3) Decision Tree Classifier, (4) Random Forest Classifier, (5) Gradient Boosting Classifier, (6) Light Gradient Boosting Machine, (7) Ada Boost Classifier, (8) Quadratic Discriminant Analysis, (9) Naive Bayes, (10) K Neighbors Classifier, (11) Linear Discriminant Analysis, and (12) SVM - Linear Kernel.

Logistic Regression model with 10-fold training results were averaged for Accuracy, AUC, Recall, Precision, F1, Kappa, MCC were 0.8833, 0.9750, 0.8833, 0.8986, 0.8795, 0.8214, 0.8320, respectively. All models were trained on the same 10-fold. Three highest accurate classifiers were found to be Extra Trees Model, Logistic Regression, and Decision Tree, respectively.
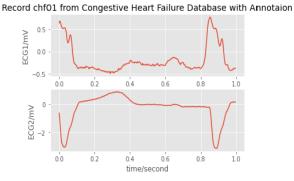
```
def calculate_activity(epoch):
    activity = np.nanvar(epoch, axis=0)
    return activity


def calculate_mobility(epoch):
    mobility = np.divide(
            np.nanstd(np.diff(epoch, axis=0)),
            np.nanstd(epoch, axis=0))
    return mobility


def calculate_complexity(epoch):
    complexity = np.divide(
        calcMobility(np.diff(epoch, axis=0)),
        calcMobility(epoch))
    return complexity
```

Fig. 11. Sample of Extraction Coding

Table 1: Result of quality assessment

Title	Average	S.D.	Quality
Web Application	4.7	0.5	Excellent
Aesthetic Aspects	4.6	0.5	Excellent
Dashboard	4.6	0.5	Excellent
Visualization	4.6	0.5	Excellent
Prediction	4.6	0.5	Excellent
Projects	4.6	0.5	Excellent
Datasets	4.7	0.5	Excellent
All of average	4.6	0.5	Excellent
Model	Accuracy	AUC	
Extra Trees Classifier	0.9000	0.9646	
Logistic Regression	0.8833	0.9750	
Decision Tree Classifier	0.8800	0.9042	

VII. Conclusion

By using the Hjorth Descriptor as a characteristic of ECG signal with 3 parameters namely Activity, Mobility and Complexity, it is imported into a program developed in Python and extracted from 3 groups of ECG waveforms. This is a sample of normal patients (NSR), a sample of patients with atrial fibrillation (AF) and a sample of patients with congestive heart failure (CHF). Characteristic values can be extracted

MODEL	Accuracy	AUC	Recall	Precision	FI	Kappa	MCC
Extra Trees Classifier	0.9000	0.9646	0.9000	0.9278	0.8944	0.8500	0.8656
Logistic Regression	0.8833	0.9750	0.8833	0.8986	0.8795	0.8214	0.8320
Decision Tree Classifier	0.8800	0.9042	0.8833	0.9186	0.8715	0.8152	0.8405
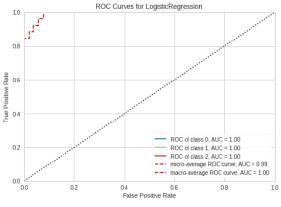
Fig. 12. ROC Plot of Logistic Regression Model
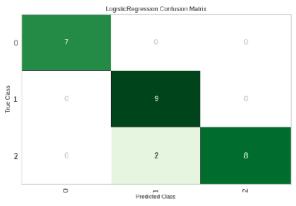
Fig. 13. Confusion Metric from Traing with Logistic Regression
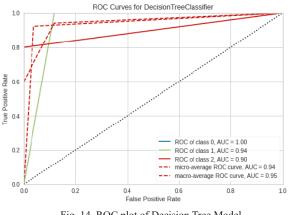
Fig. 14. ROC plot of Decision Tree Model

as follows: (1) a group of ECG signal samples with normal condition (NSR) with Activity, Mobility and Complexity values of 0.01, 0.26 and 1.86, respectively. (2) The ECG sample with arrhythmia (AF) has Activity,

Mobility and Complexity values of 2115.36, 0.3 and 1.94, respectively. 3) The congestive heart failure (CHF) ECG signal has Activity, Mobility, and Complexity values of 10368.24, 0.22, 3.26, respectively. Modeling by machine learning method with 12 models to classify three ECG signal groups was found that the model with the best correct classifying score is the Extra Trees model with Accuracy, Recall, Precision and F1 of 0.90, 0.90, 0.93 and 0.89, respectively.

In addition, the result of quality assessment made on the web application by 36 volunteers shows that the web application was found to be at the average level of satisfaction. The model for ECG classification using machine learning demonstrated the efficiency in classifying ECG signals base on only three original Hjorth descriptors which enable the high processing speeds and accuracy. In future the improvement of performance of classification will be more focused and larger database will be also acquired.

VIII. ACKNOWLEDGMENT

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Optimization of School Bus Route Planning

Karanjot Singh[1], Nupur Kapur[2], Bhaskar Dev Goel[3], Sarabjot Singh Anand[4], Sukhjit Singh Sehra[5]

[1,2,3,4]*Sabudh Foundation, Mohali, Punjab, India*

[5]*Wilfrid Laurier University, Waterloo, Canada*

Email: [1]karanjot.s@sabudh.org, [2]nupur.k@sabudh.org, [3]bhaskar.g@sabudh.org

[4]*sarabjot@sabudh.org,* [5]*ssehra@wlu.ca*

Abstract—In real-life road networks, the uncertainties resulting from accidents, bad weather, traffic jams, etc. affect people's quality of life and transportation reliability. This paper addresses the problem of school bus routing and aims to schedule an efficient fleet of school buses for rural school networks in which each student is picked up from bus stops and delivered to the school within the constraints of the bus maximum capacity, the maximum riding time allowed per student, and other factors. A single-school configuration was used, and the students were picked up at their homes. The paper uses successive routing to allocate buses to different pick-up locations based on the capacity restrictions of each bus. To achieve this a webapp has been developed that uses Openrouteservice API to provide optimized routes that take fuel savings and reduction in fees paid by students. Based on the distance travelled by each bus and its fuel consumption, each bus's mileage and CO_2 emissions are also calculated. By collecting CO_2 emissions for every bus, it will be possible to predict the CO_2 emissions for every bus in the future and plan routes that reduce global warming through incorporating CO_2 emissions in their route planning.

Keywords: Openrouteservice, , Optimization, School Bus Routing Problem

I. INTRODUCTION

The school bus routing problem involves the efficient and optimal routing of a limited number of school buses along designated routes. School bus route planning (SBRP) seeks to plan an efficient schedule for a fleet of school buses where each bus picks up students from various bus stops and delivers them to their designated schools while satisfying various constraints [1]. A typical school bus routing problem involves planning a schedule for a limited number of school buses that pick-up students from various bus stops and deliver them to their respective schools while satisfying certain constraints (capacity of bus, minimum time student spends in bus, time window to arrive at school, CO_2 emissions of each bus and other factors). Research papers have defined the problem to be one to many (going to school) and many to one (returning from school) in case of one school. Many researchers have imposed a variety of constraints in solving the school bus routing problem. These include; each bus takes exactly one route, each route begins and arrives at the school, each bus stop can be visited by one or more than one bus, the total number of students must be

satisfied and the number of students on each bus must not exceed the bus capacity [1]; number of students carried in a bus, total travel time for any student [2]; demand node on a bus, number of vehicle leaving school stop must equal the number of vehicle entering the school, arrival time window at school and number of routes should be less than or equal to the number of buses [3].

The SBRP is subdivided into five sub-problems including data preparation, bus stop selection, bus route generation, school bell time adjustment and route scheduling [6]. In this paper, we focus primarily on the assignment and generation of school bus routes. The school bus route generation problem includes the search and order of bus stops along designated routes. Various approaches had been used to solve the bus route generation problem. Research papers have used genetic algorithms, Ant colony optimization (ACO) and reinforcement learning to find better routes in terms of time and traffic.

The objective of the research is to use artificial intelligence and machine learning algorithms to make a software that provides optimized routes for school buses based on restrictions such as maximum and minimum capacity of the bus, reduced travel time for students, time window in which buses should reach to school before school starts, provide mileage and CO_2 emissions for each bus.

A. Specific Objectives:

- To select routes that are safe and avoid traffic.
- To take the size of buses into account while choosing routes.
- To calculate CO_2 emissions and mileage for each bus
- To show routes for all the buses allotted to take students from bus stops to schools

The paper is organized as follows. In section II, methodology of the proposed work is presented. Section III elaborates the results and conclusion is presented in section IV.

II. METHODOLOGY

The motivation for this study was to develop a software that focuses on picking up students from the bus stops and delivering them to schools in time without compromising on the safety of students by continuous
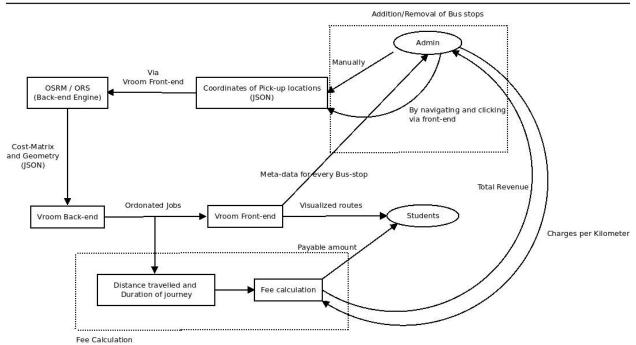
Fig. 1. Design Diagram of Software for Schools.

monitoring of routes and behavior of the drivers as well as predict CO2 emissions as the transport industry is one of the main sources of CO2 emissions which is one of the biggest contributors to global warming and climate change. Building such a system will not only focus on finding routes which reduce the time of passengers in the bus but also aim to reduce the impact of the transport industry on climate change.

To begin with the problem statement various tools were searched which could give optimized routes in less time, even for huge amounts of data. Tools like OSRM, Valhalla, Graphhopper and Openrouteservice (ORS). After research on different tools and comparison with each other, ORS was found to be the best according to our requirements due to following reasons:

- OSRM's performance, even for long routes, is good and it can update speed records in its graph with simple CSV files that can be used regularly for traffic updates, but it does not provide a profile for buses which is the requirement for this project.

- Valhalla, though it has a bus profile, is not as optimized as OSRM and is not scalable.

- Graphhopper requires a lot of RAM and they have as well closed their bus and truck profiles.

Therefore, ORS was found to be one of the most efficient and suitable tools used to find distances between locations and provided optimized roots when implemented along with VROOM. VROOM is an optimization engine that works on the top of engines like ORS.

A sample data was prepared according to the ORS and VROOM documentation to start with the webapp development. The sample data was a .csv file which consisted of four columns: area, load, longitude, and latitude. The longitude and latitude columns consisted of longitude and latitude information corresponding to the area given and the count column consisted of the number of students to be picked up from each stop. This file was then converted into json format and fed to the ORS python wrapper which returned optimized routes in json format. After understanding the working of ORS and VROOM, the design for the web app was made as presented in Figure 1.

The design of the web app enables admin to upload .csv or mark the location on the map with desired name student load for which the optimized route is needed. The admin can choose the number of routes that are required and set which location should be covered via which route. The admin can also view the optimized routes plotted on the graph and can set the charges per kilometer and based on the fee calculation API, will be able to see the total revenue generated. The students, on the other hand, can view the routes of each bus and the fee they will have to pay for the bus service.

After the points selection by admin, the number of routes desired have to be entered. Based on the number of routes entered, the admin can select which bus stop will lie on which route and click on the submit button.

The json file, containing the route information, load at each location and the coordinates of each location, is sent

to the optimization API made which uses ORS engine and VROOM to select the most optimum path for each route. Based on the distance covered by each bus to reach a particular stop and time taken to reach that stop, a fee is calculated which students of that bus stop will have to pay.

The routes obtained are then plotted on to the maps and these maps are visible to the admin as well as the students. Along with the distance, duration and fees information, mileage and CO_2 emissions of each bus is also given. In the software, buses are allocated dynamically, that is, if the buses are filled and some more locations are left to be covered, then more buses are allocated accordingly to pick-up all the students.

A. ORS (Open Route Service)

The open route service API provides global spatial services by consuming user-generated and collaboratively collected free geographic data directly from Open Street Map. It is highly customizable, performant and written in Java. Open route service is much more than a routing service: it uses a wide range of services based on OSM data which can be consumed in all different kinds of applications and scenarios. The optimization service in ORS is based on the Vroom project which solves Vehicular Routing problems and can be used to schedule multiple vehicles and jobs, respecting time windows, capacities and required skills. Currently the following services have been implemented within the framework of open route service:

- The **Directions Service** determines travel routes and navigation information according to diverse criteria. This has been realized for:
    - cars: shortest, recommended
    - several options to avoid tools, tunnels, etc.
    - multiple heavy vehicles profiles (Delivery, Forestry, Bus ...) with many customizable options
    - bicycles (regular, mountain-, road- and electric-bike)
    - pedestrian (normal and hiking)
    - wheelchair routing
- The **Pois Service** is a service that provides access to an online directory to find the location of a specific or nearest place, product, or service.
- The **Isochrones Service** calculates a polygon representing the area that is reachable within a certain time distance based on a street network around a given location.
- The **Geocode Service** provides a Geocoder/ Reverse Geocoder; the Geocoder transforms a description of a location, such as a place name, street address or postal code, into a normalized description of the location with a Point geometry.

- Polygons can be digitized on the map which will be avoided for subsequent routing.
- Upload and download of GPS Tracks in different formats.
- For the Pedestrian and Bicycle Profiles Surfacetype, Waytypes, gradient and suitability for the selected profile as well as a height profile can be shown.

In disaster situations the OSM data is continually updated and enriched with critical information. By limiting the service to active disaster regions, it is possible to recalculate the routing graph once every hour on the basis of the most current OSM data.

B. VROOM

VROOM is an open-source optimization engine written in C++ that aims at providing good solutions to various real life Vehicle Routing problems with a small computing time. VROOM works on top of several routing engines like ORS and OSRM. ORS was chosen as a routing engine because the support for this engine is widely available, and it can provide routes for buses as well as opposed to OSRM which provides routes only for cars and cycles/bikes. VROOM models a VRP with a description of resources (vehicles), single-location pickup and/or delivery tasks (jobs) and pickup-and-delivery tasks that should happen within the same route (shipments).

By using (meta-)heuristics, the solving approach offers high-quality solutions efficiently. This allows us to get solutions very quickly and/or to scale up to large problems. Testing against TSPLIB, the reference benchmark for the Traveling salesman problem, shows an average optimal gap of only +2.47% while solving most instances in a few (milli) seconds.

III. Results

The proposed webapp has been developed using Flask framework which provides the optimized routes based on the number of routes selected by the user. The following steps define the functioning of the webapp:

- Upload the .csv file which contains the longitude, latitude and load of each location given. The admin can also choose the points from the map present on the web app.
- After selecting the points, the user must enter the number of routes desired and then press enter.
- The information of each point can be viewed on the panel on the right side of the webapp. The right-side panel has the information about each location and radio buttons are present for choosing on which route the bus stop will lie.
- After choosing the points and selecting the path for each point, this data is then sent to the route

optimization API when the Submit button is clicked. The route optimization API dynamically allocates buses according to the capacity of each bus. The number of buses is increased if all the points on a particular route are not covered.

- After the routes for each bus is calculated, a fee is calculated for each stop based on the distance covered and time taken to reach that bus stop.
- The resulting routes and fees information is then plotted on the map and the admin, and the students can then view those maps and the fees information for each bus stop.
- Based on the total distance covered by each vehicle and fuel consumption of each vehicle, mileage and CO2 emissions can be calculated as well.
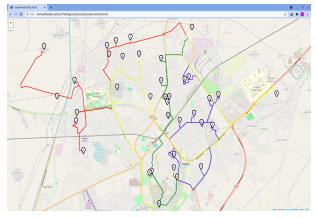
Fig. 2. Routes Obtained After Optimization
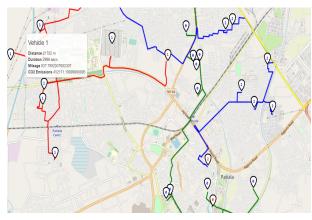
Fig. 3 Data Displayed When Hovered Over

Figures 2 and 3 represent the routes plotted on the graph that were obtained from the optimization API. When the user hovered over these routes, they were able to get the distance covered by each vehicle, time taken to cover that distance, mileage and CO2 emissions of the bus. The routes obtained from ORS optimization API provided routes with little traffic and avoided routes with construction taking place or affected by natural calamities.

IV. Conclusion

In this paper, a school bus routing problem and a set of constraints and assumptions have been considered that must be satisfied for the solution. The webapp was set up for a single school, and students were picked up from their homes. The system used successive routing to determine where buses should stop based on the capacity of each vehicle. The optimization API returns routes that are optimized based on the time it takes to get to the destination. The ORS wrapper provides routes with little traffic and avoids routes that are affected by natural disasters. Each bus's mileage and CO2 emissions were also calculated according to the distance it travels and the fuel it consumes.

For future work, the aim is to make a software that not only focuses on the optimization of routes but also provides various other features to enhance the experience of not only students but also parents, teachers, and drivers. The software will include following features:

- Image detection and guidance system for drivers to monitor them and guide them to choose better routes. The image detection model will also keep a check on the drivers to see that they don't sleep while driving.
- To make the optimization model even better, Fuzzy AHP method will be used to obtain weight matrix based on the constraints defined and to feed weight matrix to the Genetic algorithm or Ant Colony Optimization (ACO) algorithm for obtaining traffic optimized routes.
- The software will include Geofencing to send alerts to parents when the bus is near to the bus stop.
- Allocate next stop to the student if a stop is missed by directing to the next nearest bus stop based on nearest location, speed of the bus and the speed of the vehicle being used to go to the next stop.
- Automatic attendance mode which will update the attendance record for each day when a student boards the bus and will also ensure that the same number of students get down from the bus and accordingly send notification to the parents that their child has reached the school.
- CO2 emissions data would be collected when users use the webapp and the data will further be used to create prediction models that will predict the CO2 emissions for each bus.

V. Acknowledgements

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A Clustering Approach for WSN with Reduced Network Complexity and Efficient Communication Modeling

Tanvi Dogra[1], Er. Tanika Thakur[2]

[1,2]*Electronics and Communication Engineering,*
Swami Vivekanand Institute of Engineering & Technology, Banur, Punjab, India
Email: [1]tanvidogra96@gmail.com, [2]tanithakur17@gmail.com

Abstract— **Wireless Sensor Networks (WSNs) have recently been employed in practically every field due to their low cost and ease of deployment. WSN is considered a typical sensor network, which is made up of a large number of sensor nodes that continually perceive data from the sensor field. The sensor nodes faces various issues like limited battery capacity, deplete quickly, resulting in a short lifespan for WSNs, etc. To overcome these issues, a novel model based on neural networks is proposed in this paper. The suggested model randomly deploys nodes in the sensing region and forms clusters. The cluster head (CH) selection is performed based on their initial energy. To identify the best route for transferring data from the sensor node to the sink node, the suggested model utilizes neural networks. In MATLAB simulation software, the suggested model's performance is examined and compared to the conventional models. FND, HND, and LND were used to calculate the simulated results. After evaluating the data, it was discovered that the suggested approach has increased the wireless network's lifespan.**

Keywords—Wireless Communication, Network Lifetime, Sensor Network, Clustering Protocols, Optimization Approaches etc.

I. INTRODUCTION

The Wireless Sensor Network (WSN) is a collection of resource-constrained sensing devices that can detect physical phenomena in the surroundings and transfer data to a base station (sink) through various ways of communication. In WSN, data is transferred to the sink, where it is processed according to the users' requirements [1]. WSN provides efficient outcomes from unsupervised geographical places and is considered the most promising technology for researchers. Some of the most important WSN applications in real-time scenarios are industrial monitoring, border surveillance, environmental applications, healthcare monitoring, international and national highways monitoring commercial applications, etc. [2].

Nowadays IoT (Internet of Things) is the most widely utilized technology for establishing a WSN that allows sensor nodes to communicate with each other from any location[3]. This is considered a system, which contains groups of sensor nodes that can communicate through the frequency of wireless radio. The sensor nodes are considered low-powered nodes, which have a short range of transmission [4].Machine-to-machine communication uses automation as a sort of communication in the WSN-IoT in which sensor nodes can interact without interruption from humans. WSN-IoT is a sort of network that can be divided into two types: homogeneous WSN-IoT and heterogeneous WSN-IoT. All sensor nodes in a homogeneous WSN-IoT have comparable configurations, such as processing resource and communication range, whereas all sensor nodes in heterogeneous have distinct forms of processing resources, sensor types, and capabilities [5]. For maintenance purposes and quality control, sensor deployment in a transient workplace is considered beneficial because sensor nodes are powered by batteries, it is necessary to employ energy efficiency to extend the network's lifespan. Hence, WSNs must utilize energy-aware communication protocol to be more energy-efficient [6]. In WSN, clustering in WSN has been demonstrated to be effective in minimizing sensor node's energy depletion.

A. Clustering Process

Clustering in WSN contains three important components: SNs, BS, CH. A sensor node is a set of sensors in a system that is organized in such a way that they can detect the environmental variables and collect the necessary data [7]. The main function of a sensor node is to detect different activities and perform fast information processing locally and then transfers the information. However, the main drawback is the high energy usage that occurs when the sensor monitors the environment and transmits the data collected [8]. In clustered WSN, the information collected by the sensors is sent to the sink (base station) through CHs. By utilizing the sensed information, the sink decides the final estimations of the

parameters in concern [9]. Since in clustered environment, the sensor transmits the information over shorter distances, the energy usage of the network would be substantially lower than the energy usage of the sensors that transmits information directly to the sink [10]. To save energy, the sink adjusts CH and cluster membership regularly. By rotating the cluster head randomly, energy consumption is expected to be uniformly distributed [11].Clustering methods have several benefits, including the ability to repurpose bandwidth. The cluster's entire member nodes send the data they've collected to the CH node, allowing the power to be used more effectively by preventing packet overflowing, various information transfer paths and route were looping [12]. Since the clustering strategy aids in the optimal allocation of resources, it aids in modifying the activity of nodes within the cluster but not the entire system. In addition to its benefits, the clustering algorithm has several drawbacks, including the selection of Cluster heads.

Numerous concepts assist in the selection of a CH node based solely on the ID number assigned to the node or the sensor's residual power. Since entire information gathered by nodes is sent to BS, it's easy to assume that traffic around BS is heavy. As a result, the SNs surrounding the BS will automatically discharge [13]. The Base Station will remain independent if the nearby SNs run out of power, and the residual power on other SNs will be useless. Another downside to the clustering method is that when deciding the best path in the system, power is lost due to flooding and redundant packet processing due to the use of multiple paths [14].To solve these shortcomings several researchers have performed a number of techniques that are discussed in the next section of this paper.

II. Literature Survey

Several researchers have purposed many techniques to improve the routing path between sensor and base station (BS) in WSNs, out of which some are discussed here: Preeti, R. Kaur and D. Singh [15]**,** the authors of this paper tested clustering strategies such as Hierarchal clustering (HC), K-mean (KMEAN), Fuzzy C Mean (FCM), and Mean-shift, and the effects were compared using the dissimilarity factor. In addition to the other clustering techniques, Hierarchal clustering produced better performance. To find an effective formation method for Wireless Sensor Nodes, researchers compared the efficiency of different clustering methods. Effective clustering, as a result of the suggested Hierarchal clustering, would result in more efficient communication at a lower cost. Turki Ali Alghamdi [16], created a new clustering algorithm with optimized CH selection under this circumstance by taking into account four main criteria:

power, latency, distance, and protection. Furthermore, this paper presented a new hybrid method for selecting the best Cluster heads, called fire fly replaced position update in dragonfly, which combines the principles of dragon fly and firefly methodologies. Ultimately, the suggested method's efficiency was evaluated by contrasting it to that of other traditional approaches in terms of the number of alive nodes, power, latency, and damage chances. Diletta & Culmone et al. [17], researched and compared various energy-efficient clustering methods for Wireless Sensor Networks. The authors of this paper also included heterogeneous Wireless Networks, as well as methods that integrate multiple IoT systems like RFID and provide energy-harvesting capabilities. The unique REECHD "Rotating Energy-Efficient Clustering for Heterogeneous Devices" was defined. For heterogeneous Networks, this was a revolutionary clustering method. The REECHD was compared to common clustering techniques. Yanxin Yao et al. [18], suggested energy balanced clustering routing (EBCR). It could extend the WSN's lifespan in the absence of energy harvesting or increase energy consumption performance in the presence of energy harvesting without enhancing the amount of calculations. Finally, simulation findings demonstrated that the EBCR methodology outperforms the DCEM approach in terms of network power utilization and number of functioning nodes in an energy non-harvesting scenario. In comparison to the DCEM approach, simulation also indicated EBCR algorithm output under different energy harvesting scenarios, which is very adequate in terms of energy consumption output. In terms of balanced energy consumption, low computing sophistication, and high energy efficiency, the EBCR algorithm outperformed the competition. Kavyashree E.D. et al. [19],suggested a clustering solution that equally distributes energy load and decreases network overhead, resulting in improved network efficiency. The proposed scheme used watchdog LEACH in wireless communications as it offered the required stability, and the clustering method extends the lifespan of SNs. The goal of this paper was to provide an energy-efficient and secure approach for Wireless network. Parvinder Singh et al. [20],introduced a multi-purpose clustering technique to optimize energy usage, lifespan, transmission rate, and network latency. For heterogeneous and homogeneous WSNs, a fitness feature has been created. The implementation effects showed that the suggested protocol outperformed three well-known heterogeneous networks: DEEC, EDDEEC, and ATEER, in terms of increasing lifespan by 63 percent, 26 percent, and 10%, respectively. In comparison to a homogeneous LEACH method, the current approach achieved greater system reliability. Amanjot Singh Toor

et al. [21],introduced a conceptual model for mobile sensor nodes called Mobile Energy Aware Cluster Based Multi-hop (MEACBM) routing method for hierarchical heterogeneous Networks, which chooses Cluster heads based on a recently developed probability equation that picks only the SNs as Cluster Head that has the maximum amount of power among other SNs by creating a new probability formula. By contrasting MEACBM routing algorithms to other conventional cluster-based routing topologies in terms of network lifespan, reliability, latency, count of Cluster heads, and rate of dying nodes, model performance-based findings demonstrated the efficacy of MEACBM routing algorithms. JeliliOyelade *et al.*[22], discussed the characteristics of the distinct clustering methods, which make the system better biased or suited when imposed to various types of information like graph data, multimedia data, uncertain data, biological data, text data, stream data, categorical data, big data, and time-series data. The authors of this paper discussed the applicability of various clustering techniques to diverse applications areas. The authors also compared the traditional validity methods of clustering with the proposed clustering algorithm. NirojSapkota *et al.* [23],analyze the traditional data mining clustering approaches and come up with different ways to improve the accuracy of clustering. The goal of this research is to enhance the existing clustering technique. The researchers of this paper provide a novel algorithm that incorporates spectral clustering, k-means, and NFPH. The suggested approach improves the initialization mechanism for cluster centroids in standard k-means algorithms, addresses the shortcomings of k-means algorithms. The suggested system decreases the spectral clustering algorithm's clustering error. Although the accuracy level of this system was improved, but the processing time climbed to 4 seconds. Bo Zhang *et al.* [24], concentrated on the Spark framework and does extensive study on it. The proposed technique enhances the clustering processing speed by utilizing the elastic distribution datasets benefits and characteristics of parallelization, and analyses the clustering outcomes of clustering algorithms such as K-means++, - K-means, GMM, and PIC.

From the literature survey conducted, it was analyzed that several researchers have purposed many techniques to improve the routing path between sensor and base station (BS) in WSNs. In the traditional models, the scholars utilized techniques based on neural networks. In addition to this, in traditional techniques clustering was performed after cluster head (CHs) selection. At the base station, the conventional model utilized neural network-based techniques for routing between the nodes, while considering various QoS (Quality of Service) parameters. From the study, it is concluded that the traditional systems should be enhanced to improve the mechanism of CH selection, which could enhance the lifespan of WSN lifespan. Furthermore, the traditional techniques face unnecessary complexity and take time to select communication channels due to routing decisions. Hence a novel algorithm is needed, which could solve the problems and can improve the network's longevity and stability.

III. Proposed Model

To overcome the issues related to traditional models, an optimal technique is proposed in this paper to solve the routing problem in WSNs. The suggested technique can achieve a suitable path from the CH to the BS and with minimal energy usage, it could transfer data to the sensor nodes. In addition to this, two significant changes are recommended in the suggested method. The first one is to enhance the mechanism of the CH selection in the network by evaluating the energy efficiency of nodes in clusters and elect more efficient nodes for CH selection in the network. Furthermore, a neural network has been added to the system, which would minimize the decision capability by deciding only the route from CH to sink rather than all nodes in the network. The CH is considered as the simplest and quickest next hope for a node in a network with a cluster. If the CH is effectively-identified, each cluster node would exclusively transmit data to its CH. Hence, the complexity of the suggested model would be minimized by relying on a neural network to choose an optimal path between CHs and sinks.

A. Methodology

The following are the steps taken by the suggested model to get the desired outcome:

Step 1: The suggested model's first step is to initialize the network that defines several variables like area, number of nodes, and beginning energy. The suggested model uses a 100*100m^2 region with roughly 100 nodes, which are randomly distributed. Table 1 shows the values of these parameters.

Table 1: Different network parameters

Parameters	Values
Area	100*100m^2
Number of Nodes	100
Initial Energy	0.25 to 1j
Packet	2048
E_{elec}	50 nJ/bit
E_{amp}	0.0013 pJ/bit/m^4
E_{fs}	10pJ/bit/m^2

Step 2: After the network has been set up, the following step is to place nodes randomly in the sensing region such that the entire surface is occupied. The diagram of nodes deployed in the suggested approach is shown in Figure 1.
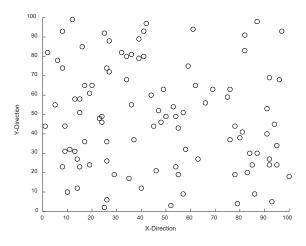
Fig. 1: Nodes deployed in the proposed network

Step 3: The next phase in the suggested approach is to construct random clusters based on their energy levels. Then the nodes with the same energy level are grouped to form a cluster.

Step 4:Then, a CH is chosen from the network. The CH selection is based on the initial energy of the nodes that varies after each round and after each iteration

Step 5: When the CHs have been established, the following step is to create the data transmission path from the sensor node to the CH and finally to the sink node. The suggested approach used a neural network to accomplish this, by only choosing one route from CH to sink node.

Step 6: The network's communication phase begins when data is sent from CH to BS node through a designated route by utilizing neural network. Equations 1 and 2 describe the energy dissipation employed in the proposed model for sending k bits over distance d.

$$E_{Tx} = E_{Tx} = kE_{etx} + ke_{amp}d^2 \tag{1}$$

$$E_{Rx} = E_{Rx} = kE_{etx} \tag{2}$$

Where E_{etx} denotes the electronic energy contained in the receiver, and E_{amp} denotes the amplifier energy.
Equation 3 shows the total energy generated by the node during the next routing operation.

$$E_{thmin} = kE_{etx} + 8kE_{etx} \tag{3}$$

Step 7: At Last, the suggested model's performance is analyzed and compared to standard models in terms of FND, HND, and LND, which are briefly defined in the next section of this paper.

IV. RESULTS AND DISCUSSION

In the MATLAB simulation software, the suggested model's performance is assessed and compared to the classic Homo-leach and C-leach models. With different initial energy of nodes, i.e. 0.25, 0.5, and 1j, the simulated results were calculated in terms of FND, HND, and LND. In this part, the collected results are briefly explained.

A. Performance Evaluation

When the initial energy of all nodes is fixed at 0.5j, the suggested scheme's performance is first assessed and compared to that of the standard Homo Leach and C-leach procedures in terms of FND (first node death), HND (half node death), and LND (last node death). Figure 2 depicts the FND, HND, and LND graphs in both traditional and proposed models.
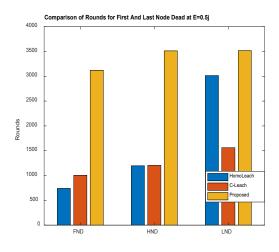
Fig. 2: Comparison graph for FND, HND and LND

Figure 2 shows a comparison graph of the standard Homo-LEACH and C-LEACH techniques and the suggested approach in terms of tehri FND, HND, and LND values and when the initial energy is set to 0.5j. The FND value in the conventional homo leach method was 740, in C-leach the FND value reached 1004, and in the suggested model FND value was 3120 with 0.5j initial energy. In the conventional Homo-leach and C-leach the HND and LND values came out to be 1196,3014 and 1204,1560, whereas in the proposed model the HND and LND values are 3512 and 3517, respectively. Hence the proposed model outperformed the conventional methods. Table 2 shows the particular value of each parameter.

TABLE 2: SPECIFIC FND, HND AND LND PARAMETERS AT E=0.5J

Parameter	Homo-Leach	C-Leach	Proposed
FND	740	1004	3120
HND	1196	1204	3512
LND	3014	1560	3517

In addition, when node's initial energy varies from 0.25 to 0.5 and subsequently to 1j, the proposed model's performance is examined in terms of FND, as illustrated in figure 3.

Figure 3 compares the FND values of the conventional Homo-LEACH and C-LEACH techniques, as well as the suggested technique, when the initial energy is varied from 0.25 to 0.5 to 1j. When the nodes initial energy is 0.25j, the first node in conventional Homo leach and c-leach dies at 456 and 452 rounds, whereas in suggested model, the first node dies after 1562 simulation rounds.
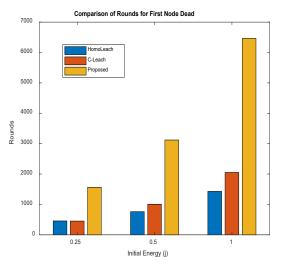
Fig. 3: Comparison Graph for FND with varying energy

When the node energy is changed to 0.5j, the first node dies in the traditional Homo leach and c-leach approaches after 761 and 1006 simulation rounds, whereas the FND value in the suggested model is 3120. When the energy in each node is 1j, the FND obtained in the traditional Homo leach and c-leach models is 1428 and 2051, whereas in suggested model the first node dies at 6463rd round. Table 3 shows the exact figures.

TABLE 3: VALUES FOR FND WITH VARYING INITIAL ENERGY

Initial energy	Homo-leach	C-leach	Proposed
0.25j	456	452	1562
0.5j	761	1006	3120
1j	1428	2051	6463

In addition, the suggested model's efficiency is tested and compared to traditional Homo leach and c-leach techniques in terms of LND with variable node energy, as illustrated in Figure 4.

In terms of their LND values, figure 4 illustrates the comparison graph of the standard Homo-LEACH and C-LEACH approaches when the initial energy is increased from 0.25j to 0.5j to 1j. When the node's initial was 0.25j, the traditional Homo leach and c-leach the first node dies at 800 and 788 simulation rounds, whereas in the
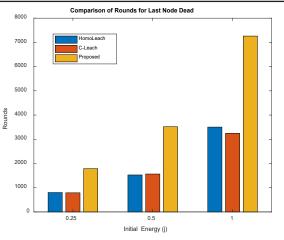
Fig. 4: Comparison graph for LND with varying node energy

suggested model, the first node dies after 1784th round. When the initial energy of the node is modified to 0.5j in the standard Homo-LEACH and C-LEACH approaches, the death of the last node happens after 1526 and 1565th rounds, whereas in the proposed technique the last node dies after 3517th simulation round. At last, the classic Homo-LEACH and C-LEACH models produced LND values of 3503 and 3246, respectively, but the suggested model achieved LND values of 7261, indicating that the suggested model efficiently extends WSNs lifespan. Table 4 illustrates the relevant values.

TABLE 4: VALUES FOR LND WITH VARYING INITIAL ENERGY

Initial energy	Homo-leach	C-leach	Proposed
0.25j	800	788	1784
0.5j	1526	1565	3517
1j	3503	3246	7261

The suggested model appears to be more effective in extending the lifespan of WSN based on the graph and tables.

V. CONCLUSION

A advanced model based on neural networks is proposed in this paper to improve the WSNs lifespan. In MATLAB simulation software, the proposed model is compared with the traditional model. In terms of FND, HND, and LND, the simulated results were analyzed with varied initial energy. After evaluating the outcomes closely, the FND, HND, and LND values were significantly higher than that of conventional Homo-Leach and C-Leach models. When node energy is only 0.25j, the suggested model's initial node dies after 1562 simulation rounds, whereas in the Traditional Homo-Leach and C-Leach models, the first node dies after 456 and 452 rounds, respectively. When node energy is increased to 0.5j and 1j, the FND value in

standard Homo-Leach and C-Leach models is 761, 1006, and 1428, 2051 rounds, but in the proposed scheme the FND value is 3120 and 6463, respectively. Furthermore, when the initial energy is increased from 0.25j to 0.5j to 1j, in the traditional homo-leach approach the last node is evaluated and it came out to be 800,1526, and 3503, whereas in the proposed scheme the last nodes are evaluated at 788, 1565, and 3246. In the suggested model, when the node energy is 0.25, 0.5j, and 1j, the last node dies after 1784 rounds, 3517, and 7261 rounds, respectively. These findings show that the suggested approach is more efficient in transmitting data from sensor nodes to sink nodes while using the least amount of energy.

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An Advanced Dispersion Compensation Approach with Hybridizing FBG and EDC to Improve Signal Quality

Irfan Bashir[1], Er. Harmandeep Kaur[2]

[1,2]*Electronics and Communication Engineering,*
Swami Vivekanand Institute of Engineering & Technology, Banur, Punjab, India
Email: [1]onlyirfandar@gmail.com, [2]hshergill@yahoo.com

Abstract— **Fiber optic communications technology is recently improving and meeting new issues that limit its ability to transport massive volumes of data over long distances. The deterioration of optical communication signals is considered a major issue because they travel through the fiber. The two main causes of deterioration are power attenuation and dispersion. The dispersion is considered an important feature of optical fibers because it distorts all signals with limited bandwidth and makes identifying the pulse at the receiver end challenging. To overcome these issues, a novel approach based on Electronic Dispersion Compensation (EDC) and Fiber Bragg Grating (FBG) is proposed in this paper. The suggested methodology creates a signal randomly and then uses an NRZ encoder to convert it to an electrical format. Before being transmitted across the optical fiber link, the signal is modified by the MZM modulator. In the Opti system, the proposed model's performance is evaluated and compared with the conventional FBG models. With altering dispersion, optical fiber length, and power, the simulated outcomes were calculated in terms of the Q-factor and eye height. The simulation results show that the suggested FBG-EDC model is successful at reducing signal dispersion.**

Keywords—Fiber Communication, Dispersion, Dispersion Compensation, Opti Systems, Modulation etc.

I. Introduction

Owing to the fast development in need for highly capable telecommunication links and the effective usage of network bandwidth, the utilization of WDM "Wavelength Division Multiplexing" has significantly increased in innovative light wave systems. WDM is a technique of transferring information from various sources over a similar optical fiber link at the same time, with each data channel transmitting over its individual wavelength [1]. The appropriate deliberation and implementation of the optical system are very significant for the broadcast supremacy of the fiber optic communication system. The key objective of communication strategies is to offer information transmission with increased dominance over a greater distance [2]. The Dispersion and loss are the two main causes that affect the Wavelength Division Multiplexing process. The fiber optic network's most distinguishing feature is that it provides a vast array of data transfer options and enormous capacity for data transfer. Because of these features, the use of Wavelength Division Multiplexing among optic fibers is highly increasing. There is thus more progress to be made in order to improve the quality of the telecommunications network based on optical fibers [3].

Fiber optic networking is a system that amplifies the data with the help of radio signal and transfer this amplified data through an optical fiber connection to allow Wi-Fi gain proper access, like simultaneous Wi-Fi and 3G from the similar antenna [4]. In other words, radio signals are transmitted using a fiber line allowing an individual antenna to catch each and every radio signals, such as telephone, Wi-Fi, and 3G, that are transmitted over a single fiber wire to a central location, where the device then changes the pointers [5]. It differs from the traditional method in that each protocol category requires an oppressed portion on the antenna spot. Radio transmission is used on fiber for 2 reasons: among cable television networks and in satellite base stations. Prior to being emitted by the atmosphere in the RoF frameworks, the Wi-Fi signals are distributed in optical form including a significant station and a rigid of BS [6]. Every BS has been configured to transmit over a radio connection with minimum one customer's mobile station that is within the radio range of the BS in question. The components for Wi-Fi, 3G, and other standards could be concentrated in a single location, which is a significant advantage over far-flung antennas linked by fiber optics that serve various systems [7]. It has a major impact on the public's device and conservation importance. The RF-over-fiber and the IF-over-fiber RoF communication techniques are normally divided into two primary groups based on the frequency range of the radio signal to be telecasted [8]. The main applications of RoF are Gain access to dead zones that provides wireless compensation between the

areas, making wireless communication difficult. FTTA (Fiber to the Antenna) is a flexible optical-to-electric (O/E) converter to the antenna at a one time and adding an optical connection to the antenna immediately [9].

A. Effects of Dispersion on Fiber Optics

Dispersion is the distortion or scattering of waves or pulses caused by variations in amplitude and light pulse mode, which causes network issues. The performance of SMF Wavelength Division Multiplexing is affected by chromatic dispersion (CD) that happens as a result of multiplexing of various colors associated with the various colors of different wavelengths [10]. Polarization, which is present even in SMF and is correlated with 2 distinct polarizations, degrades system performance further. Some changes in the propagation velocity for each polarization can be induced by fiber distortions [11].Commonly there are 3 types of dispersion i.e. Intermodal Dispersion, Intramodal Dispersion, and Polarization Dispersion

Intermodal dispersion is most prevalent in multimode fibers. The light source is dispersed and travels through many transmission ranges as it travels from a multimode fiber, which is known as the critical mode and causes intermodal dispersion. The basic mode happens when a light beam travels through a fiber that is identical to the fiber [12]. Polarization mode dispersion is a form of dispersion which may happen in a Wavelength Division Multiplexing fiber optic network. When a number of linear polarized signals arise in the fiber optic wire, polarization mode dispersion occurs, and the signals propagate similarly in the vertical plane, as seen in the diagram. Owing to imbalance in optic fiber, splicing process, and refractive index that causes polarization dispersion, the vertical planes are still not identical [13]. Intra-modal dispersion may happen in a SMF or a multimode fiber optic network. Intermodal dispersion could only happen in a multimode fiber network. The intermodal dispersion could be used to guide the dispersion of the impulses. The transmissions that contain the information are made up of several frequencies, resulting in signal scattering [14]. To compensate dispersion in Wavelength Division Multiplexing, several authors have proposed number of techniques by utilizing dispersion compensation techniques like Fiber Bragg Grating (FBG) and Dispersion Compensating Fiber (DCF). Other than this, various dispersion techniques in fiber optics are proposed that is discussed in the next section of this paper.

II. Literature Survey

Several researchers have proposed number of techniques to compensate dispersion in Wavelength Division Multiplexing, out of which some are discussed

here: N. Mahawar and A. Khunteta[15], by utilizing DCF (Dispersion Compensation Fiber) in an 8-channel WDM, the authors of this paper developed a model based on three dispersion compensation approaches i.e. per, post, and mix.NRZ (non-return-to-zero) and RZ (return-to-zero) pulses have been contrasted by utilizing a 5 Gbps transmission data rate model, in which SMF (signal mode fiber) has been explored by utilizing 120 km length. According to the finding, BER (bit error rate) and Q-factor show that utilizing RZ as a pre-compensation scheme yields optimal outcomes and by utilizing optisystem 7.0 software output power at EDA can be evaluated. Robson R. Carreira et al. [16], developed and analyzed a generalized link configuration that includes DD-MZ (Dual-Drive Mach-Zehnder Modulator) combined with DC (Directional Couplers) with arbitrary division rates besides the standard value of 3 dB, also includes RHD (Remote Heterodyne Detection) and HD (Heterodyne Detection) links as special cases. The proposed model illustrated that in comparison to link configurations, RF gain increase because laser signals and the LO were at the same end. Moreover, for frequencies between 1 and 35 GHz, a link length of up to 100 km of notch-free zones has been established. But the researchers have not published those features yet. H. M. gheni et al.[17], proposed a fiber optic system of 220km with 40 Gb/s data rate, by using two scenarios i.e. at first case fiber optic cable with a core diameter of 80 m was utilized and in second case fiber optic cable with a core diameter of 17μM was utilized, which made distance signal transmission extremely challenging. An optimal dispersion compensation FBG was employed to return the undesirable signal and to prevent chromatic dispersion. The received signal had a BER of 4.8625*10 -13. I. F. de Jauregui Ruiz et al. [18], represented the performance of the system was degraded by wavelength routing nodes to in-line optical filtering in WDM networks. The performance could be accurately predicted by utilizing the theory of digital communication of band-limited channels with linear equalization. By utilizing non-linear utilization of fibers and a commercial transponder, the researchers of this paper validated the experimental outcomes. D. Qian et al. [19], by utilizing PDM-16QAM-OFDM and PDM-8QAM-OFDM modulation, the authors of this paper demonstrated the successful transmission of WDM over 4,242 km and 10,181km. By utilizing the back-propagation approach, Q-factor up to 0.5dB can be improved by nonlinear compensation of SPM. P. Kaushik et al. [20], communication of fiber optics was considered as the most appropriate ad smartest alternative to transmitting data from gigabits to terabits. This communication was utilized for sending pictures; video, voice, and information over long distances through LANs (local

area networks) or computer systems. The author of this paper analyzed the communication system of fiber optics, which also included its major accomplishments, as well as its mechanical tendency as it moves into the next era. **S**. I. Ivanov et al. [21], in the VSP-SR system, the single-mode optical fibers performance was based on dispersion lengths outcome with increasing in transmission speed, channels number, modulation methods, nonlinear effects, chromatic and polarization mode dispersions, and changes in the power and signal-to-noise ratio. The researchers in this paper demonstrated that f proper precautions were not taken to prevent adverse effects, transmission characteristics would alter dramatically and data loss can also be caused. These adjustments would affect the length of the dispersion.T. K. Panda et al. [22],investigated the dispersion effects on optical communication and how to limit its usage by utilizing compensation techniques of dispersion. FBG was employed as a dispersion compensation technique. To achieve optimal outcomes, the authors in this paper obtained the FBG's features such as anodization function, grating length, and chirp functions were modified. In terms of BER and Q-factor, the obtained outcomes were compared. By utilizing optisystem 14 software the authors carried out the entire simulation. Ł. Śliwczyński, et al. [23], represented the suggested λ-swapping method to associate uncertainty with the asymmetric propagation to minimize the fiber chromatic dispersion values less than 2.5 ps and links up to 1000km, rendering it inconsequential in comparison to other uncertainties. In experimental findings, the distances were evaluated up to 540 km and also revealed optimal agreement among the expected and measured propagation delays of the analyzed links. Hossain et al. [24], for dispersion compensation, the researchers of this paper analyzed six distinct models. By utilizing DCF's pre, post, and symmetrical compensation, the first three models were designed, while utilizing IDCFBG, FBG, and uniform FBG the rest of the three models were designed. Each model was designed by utilizing a single channel optical system with 100 km length and 2.5 Gbps and 10 Gbps data rates, whereas these models were simulated by utilizing a package of optisystem software. The Q-factor) and BER of all models were compared. Based on the simulation findings, the post–compensation DCF model appears to be the most promising strategy.

From the literature survey conducted, it was analyzed that several researchers have proposed a number of techniques to decrease the impact of dispersion on optical communication systems. In traditional models, scholars utilized various dispersion compensation methods to analyze the system's performance. In addition to this, for short-range communications, these techniques utilized single and multi-mode optical fiber signals to produce

optimal results in compensating the dispersion. From the study, it is concluded that as the communication system grows, the traditional systems produce a lower OSNR (optical signal to noise ratio). Hence a novel technique is needed to overcome the traditional system's shortcomings and enable it to work across longer distances while compensating for dispersion.

III. PROPOSED MODEL

To overcome the issues related to the traditional models an Electronic Dispersion Compensation (EDC) based equalizer method with the current FBG system is introduced in this paper. The proposed technique would reduce the chromatic dispersion in the fiber-optic communication links with electronic receiver components. The proposed technique provided a better OSNR at higher distance communication. In addition to this, the primary goal for developing a hybrid model was to create a better dispersion technique with higher quality and lower BER. Figure 1 depicts the block diagram of the suggested EDC+FBG hybrid model.
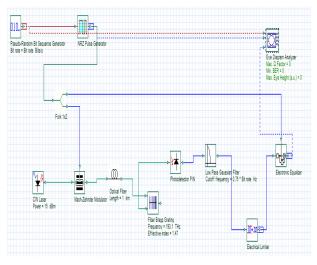
Fig. 1: Simulation Diagram of the Proposed Model

In Fig. 1, different components such as the PRBS, NRZ encoder, CW laser, MZM modulator, optical fiber, FBG, photodetector pin, LPF, electrical limiter and equalization, and eye diagram analyzer are fitted in the suggested hybrid EDC-FBG model. The PRBS generates a random signal that is transformed and modulated by the NRZ encoder and MZM modulator before being transmitted across the optical fiber. The optical signal is subsequently sent to the FBG, where it is converted back to an electrical signal by the PIN photodetector. Before reaching the eye diagram analyzer, the signal passes through the LPF to reduce unwanted noise, followed by an electrical limiter and equalizer. The methodology section provides a full description of how the suggested model works.

Parameters	Values
CW laser frequency	1550nm
CW laser power	15dBm
Fiber length	1km
Dispersion	0, 3, 17
FBG frequency	193.1 THz
Cut off frequency	0.75* Bit Rate Hz

A. Methodology

The proposed hybrid model's process is described below:

- The first stage is to initialize the system that involves defining several parameters such as CW laser power, dispersion, and GBG frequency. Table 1 contains a thorough description of all parameters as well as their values.
- The next step is to generate signals randomly after the network has been configured. In the suggested concept, a pseudo-random bit sequence generator (PRBS) is employed to create binary signals.
- Then a continuous optical wave is produced by a CW laser beam, which is used as another input source to reach the particular point of contact.
- The NRZ line encoder is used for transforming the binary signals generated by the PRBS into electrical signals.
- The electrical signal is then transmitted to the MZM modulator that produces a high-frequency optical signal by overlapping the high-frequency optical signal with the laser beam. The signal is then transferred across an optical cable with a length of 1km at the start.
- The optical signal is subsequently sent to the FBG, which decreases optical signal dispersion.
- The photodetector PIN is located at the receiving end, and it receives the optical signal and converts it to electrical form.
- The electrical signal is then sent to a Low Pass Gaussian Filter that eliminates the unwanted noise from the optical signal and reduces mistakes.
- In the suggested work, an electrical limiter is utilized to limit the amplitude of the signal in a specific range before passing it to an electrical equalization that lowers the dispersion of optical signals.
- At last, an eye diagram analyzer is utilized for evaluating the suggested hybrid model's performance and a detailed description is provided in the next section of this paper.
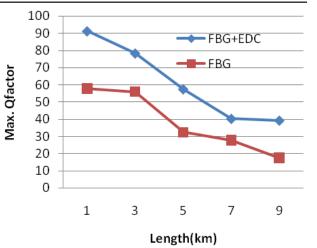
Fig. 2: Comparison Graph for Q-factor with Varying Length

IV. RESULTS AND DISCUSSION

The proposed hybrid EDC-FBC model's performance is assessed and compared to traditional models. In terms of the max Q-factor and eye height by varying the dispersion, length of optical fiber, and power of CW laser beam, the simulated results were obtained. The results obtained are briefly discussed.

A. Performance Evaluation
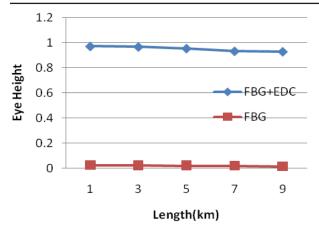
The suggested hybrid FBG-EDC performance is evaluated and compared to the conventional BG model in terms of their maximum Q-factor as the length of optical fiber is varied and is shown in figure 2.

Fig. 2 illustrates the comparison graph of the suggested hybrid FBG-EDC model and the standard FBG model in terms of Q-factor values when the length of the optical fiber is varied. The graph shows that the value of the Q-factor in the standard FBG model is low and continues to decrease as the length of optical fiber increases. When the optical fiber length is 1km, the Q-factor is 57.92, however as the length grows, the Q-factor decreases until it reaches 32.46 when the optical fiber length is 5km. When the duration is expanded to 9km, the Q-factor value drops to just 17.53. The suggested hybrid FBG-EDC model has a very high Q-factor, which was initially 91.25 when the fiber length was only 1km. The Q-factor value gradually falls as optical fiber length increases, reaching 57.55 and 39.33 at 5km and 9km, respectively.

Furthermore, the suggested hybrid FBG-EDC technique's performance is confirmed and compared to the regular FBG approach in terms of eye height while adjusting the length of optical fiber, as shown in Fig. 3.

Fig. 3 illustrates the comparison graph of the suggested hybrid FBG-EDC model and the traditional FBG model in terms of their eye height values when the length of optical fiber is changed. When the fiber length is 1km and 9km, the eye height values in the conventional
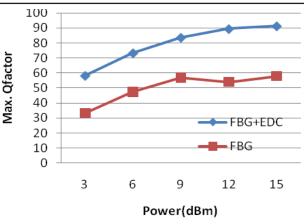
Fig. 3: Comparison Graph for Eye Height with Varying Fiber Length

Fig. 4: Comparison Graph for Q-factor when Power is Varying

FBG model are very low and virtually zero, with values of 0.0242 and 0.0165, respectively. When compared to the traditional FBG model, the value of eye heights in the suggested hybrid FBG-EDC model is good. The projected FBG-EDC eye height value was 0.9701 at 1km fiber length, 0.9532 at 5km, and 0.9282 at 9km fiber length. The suggested FBG-EDC model is more effective and efficient, as evidenced by the improved eye height value. Table 2 shows the specific value of Q-factor and eye height obtained by the traditional FBG and suggested FBG-EDC models.

This improvement in Q-factor indicates that the suggested model is more efficient in compensating dispersion in optical signals.

Moreover, when the power of the laser beam is modified, the efficiency of the proposed FBG-EDC model is evaluated and compared to the standard FBG model in terms of the eye height values, as shown in figure 5.

TABLE 2: SPECIFIC Q-FACTOR AND EYE HEIGHT VALUES IN TRADITIONAL AND PROPOSED MODEL WITH VARYING LENGTH

Length (km)	Max. Q-factor Proposed FBG-EDC	Max. Q-factor FBG	Max. Eye Height Proposed FBG-EDC	Max. Eye Height FBG
1	91.25	57.92	0.9701	0.0242
3	78.38	56.07	0.9664	0.024
5	57.55	32.46	0.9532	0.022
7	40.37	27.77	0.9319	0.0198
9	39.33	17.53	0.9282	0.0165

In addition, when the strength of the laser beam is modified, the suggested hybrid FBG-EDC model's performance is examined and compared to the traditional FBG model in terms of the Tehri Q-factor, as seen in figure 4.

Figure 4, illustrates the suggested hybrid FBG-EDC model and the traditional FBG model are compared in terms of their maximum values. When the power of the laser beam is altered, the Q-factor values vary. The graph shows that the value of Q-factor in conventional models is 33.28 when the laser beam power is just 3dBm, but as the power rises, the q-factor rises with it, reaching 56.96 at 9dBm and eventually 57.92 at 15dBm.The Q-factor then continues to rise, reaching 83.57 when the power is 9dBm and 91.25 when the power is increased to 15dBm.

Fig. 5: Comparison Graph for Eye Height with Varying Power

When the power of the laser beam is modified, Figure 5 shows a comparison graph of the suggested hybrid FBG-EDC approach and the classic FBG model in terms of eye height values. The graph shows that the classic FBG model's eye height values are very low, i.e. near to zero across the graph. When the power was 3dBm, the value of eye height was 0.0016, and it gradually increased with the increase in power, reaching 0.0066 at 9dBm power. When the power delivered by the CW laser beam is 15dBm, the eye height value increases slowly and reaches a maximum of 0.0242.The eye diagram values in the suggested FBG-EDC model are close to 1 and climb steadily with increasing power. When the power is 3dBm, the value of eye height is 0.9516, and it

continues to rise as the power is increased; at 9dBm and 15dBm of power produced by the CW laser, the values of eye height are 0.968 and 0.9701, respectively. Table 3 shows the specific Q-factor and eye height values obtained by the conventional FBG and suggested FBG-EDC models.

TABLE 3: SPECIFIC Q-FACTOR AND EYE HEIGHT VALUES IN STANDARD AND PROPOSED MODELS WITH VARIED DEGREES OF POWER

Power (dBm)	Max. Q-factor Proposed FBG-EDC	Max. Q-factor FBG	Max. Eye Height Proposed FBG-EDC	Max. Eye Height FBG
3	58.03	33.28	0.9516	0.0016
6	73.2	47.43	0.9628	0.0034
9	83.57	56.96	0.968	0.0066
12	89.39	54.17	0.9696	0.0128
15	91.25	57.92	0.9701	0.0242

As shown in the graph and tables, the suggested hybrid FBG-EDC model is more successful in compensating dispersion in optical fiber channels and effectively transfers data from one point to another.

V. CONCLUSION

A novel approach based on EDC and FBG is proposed in this paper to compensate for the dispersion in the optical signal. In the Opti system, the proposed model's performance is evaluated and compared with the conventional FBG models by altering power and fiber length. The simulated results were produced in terms of the Q-factor and eye height. At 1 km fiber length, the Q-factor value was 91.25, as the fiber length increases, the value drops until it hits 39.33 at 9km, whereas in the standard model the q-factor was just 57.92 and decreases to 17.53 at 9kms.Furthermore, when the fiber length was just 1km, the eye height value in the conventional model was around 0.0242, and gradually decreases as the fiber length increases. When the optical fiber is 9 km, the eye height value in the traditional model is 0.0165, whereas in the suggested model the eye height value is 0.9701 and 0.9282 at 1km and 9km. When the strength of the laser beam is changed in the traditional model, the Q-factor and eye height are assessed, with values of 33.38 and 0.0016 at 3dBm.At 15dBm, the q-factor rises with the increase in power, reaching 57.92 and 0.0242. At 3dBm and 15dBm, the suggested model's q-factor and eye height values were 58.03, 91.25, and 0.9516, 0.9701, respectively. In all parameters, the suggested model outperforms the traditional model..

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Wireless Android Based Surveillance System

[1]Ashok Kumar, [2*]Sunil Semwal, [3]Gurpreet Kour

[1, 2, 3]*Department of Electronics and Communication Engineering,
Model Institute of engineering and Technology, Jammu*
Email: [1]Ashok@mietjammu.in, [2]sunilsemwal.ece@mietjammu.in*
[3]gurpreetraina.ece@mietjammu.in

Abstract—**In this paper, an ultrasonic detection based mobile surveillance device, capable of detecting any intrusion within a programmable range of 4 meters has been presented .This device located at the remote areas is connected with the Android phone through Bluetooth .The Android application has been used for providing a good graphic user interface along with the easy handling of the device .The communication between the remote device and the server is provided with GSM module built in the android phone which ensures the long distance communication. The designed device is configured in two modes manual and automatic which are configured and optimized with an algorithmic approach based on an operation and synchronization between the devices and the android application.**

*Keywords: **Android, GSM module, Surveillance, Ultrasonic sensor, Bluetooth***

I. Introduction

The defense services are of utmost importance for a country's security. Therefore the use of efficient and the most effective technologies for this purpose become mandatory as these tech based devices are being exposed to most critical and harsh environments. The advent of new high-speed technology and the growing computer capacity has provided realistic opportunity for new robot controls. The Android application installed in smart phones is interfaced to the bot by using a Bluetooth module (HC-05), which is further interfaced with Arduino Uno board responsible for the bot movement control.

II. Background

Researchers have proposed a variety of Surveillance devices. After studying the related work done we found that each of the devise has many advantages as well as disadvantages. In order to design the surveillance device a model was implemented in 2014[1] using Motion Detection Method based on FPGA DE-II 70 Board. It was based on motion detection algorithm that reduced the data storage capacity for recorded video by using Block-Based MR- SAD. Its main drawback was the mismatch in distance and accuracy of the video recording. Another system [2] was designed using Atmel 89C51 based on IR tracking of the intrusion in which the direction of the wheels of the robot was controlled by the controller according to the motion of the intrusion. The above system was automatic in nature but a similar system [3] was proposed with manual controls using DTMF decoder. In this project, manual was set as dominating mode and through GSM communication the robot can be made to move in desired fixed direction. In 2013 a system[4] was presented using the combination of previous two systems[2][3] which involved the IR tracking along with the ultrasonic sensor which avoid collision during chase .It was also provided with a camera which can store the images through USB interface . These records can be used for the analysis in future. A MATLAB based system [5] was given which could detect the presence of any intrusion by the comparison of the two bit images i.e. the image with intrusion with that of vacant room. Surveillance Robot with Obstacle Sensing and Movement Control Using ARM Controller [6] addressed the surveillance system with monitoring through camera. It was provided with two modes- one in which camera was used for the surveillance through live streaming and the other in which onlyultrasonic sensor was used for object detector. P. Karthikeyan et al. [7] proposed the design of robotic system for defense and Military applications. These robots could exchange information to its nearer network. The robot comprised of motors, gear, gear box and mechanical system for locomotion. The sensed environmental data can be analyzed and perform the corresponding tasks by using powerful software which was coded in the microcontroller.It was also planned to be equipped with microphones, speakers, display devices, etc. to interact with human beings.This system has been proposed with a great guidance from the references and with an intent to improve the efficiency and the reliability of the previous designs, the details about the architecture, design and performance has been presented in the later sections.

III. System Overview

This device is mounted with an ultrasonic sensor acting as the eye of the whole system, capable of detecting obstacle in a radius of 4 meters which can be controlled by server and can be set to fixed value by the designer.

The system has two basic functional units- Android application and the Arduino Uno (controller-ATmega328). Android application is installed in the handheld Android phone and Arduino is placed on the bot, responsible for intruder detection. The sensor used for intruder detection is Ultrasonic sensor. It is placed on the bot itself and its movement is controlled using two motors -- horizontal motion control and vertical motion control motors, which are placed so as to make a U-joint for solid 360 degree angle rotation of the sensor. The Android application has two basic controls for the bot movement control- Manual Control: In this mode, the bot movement is controlled manually and the control panel is provided for the forward, backward, left, right and stop controls.

This mode is used to make the intruder detection bot reach the place from where it has to start detecting the intrusion. Ultrasonic sensor remains deactivated in this mode.

Automatic Control: This is the line/edge follower mode. In this mode intruder detection is activated and the status is checked periodically by Arduino at the output pin of the sensor. Wireless communication (Bluetooth module/ RF module/ Wi-Fi) is established between Android phone and the Arduino for the data transfer

IV. System Design

The hardware structure for the system has been briefly explained by the figure1.and it has specifications as shown in table 1

A. Hardware Implementation

After getting the initial requisite of the project and the PCB design the individual testing of all the modules was

done .The system being a mobile robot has two D.C. motors which were used to control the direction of the robot. ATmega328- an AVR microcontroller has been used as the control unit of the system .It receives two inputs, one from the Ultrasonic sensor for the distance and speed measurement of the intrusion and other from the IR sensor which forms the basis of the robot in automatic control. In case any intrusion is detected by the ultrasonic sensor, the alert will be made to the remote Android phone. This remote cell phone further informs the concerned authorities about the presence of any obstacle. The microcontroller and the cell phone communicate with each other through the Bluetooth module. In order to cover the entire periphery around
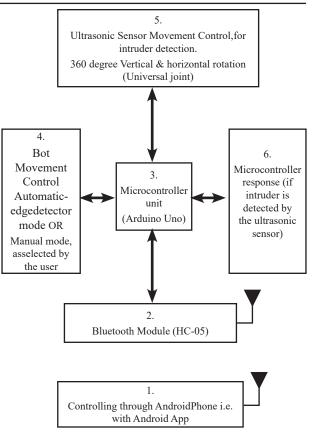
Fig. 1: Block Diagram of the System

the robot, two additional motors for the horizontal and vertical motion of the ultrasonic sensor have been used. These motors move in to-and-fro manner. As the weight that the lower motors have to bear is nearly 2 kilogram and the upper motors is nearly 200gram to 300gram. So correspondingly 200gm-cm with 300 rpm

D.C. motor has been used for the ground motion as this motor can fulfill the requirement but as the upper motors have to rotate with high torque. Hence the upper motors are of 30rpm with 1.2kg-cm torque.

The system is designed with the specification given in the table shown below. The specifications are obtained from the datasheets of these devices. Some results were analyzed about the systems before its design in order to check its performance and have a rough idea about the hardware used for example the delay in calling and messaging and the connection establishing time of the Bluetooth as it's a slow device and it takes comparatively a higher time than the radio frequency receiver transmitter and other transreceivers to data exchange which will slow down the whole system. The solution of this problem is to use the Zigbee or the LoRa (long range data transmission). These methods are low power hungry and can work for the better range than the Bluetooth. The only reason not to use these devices in the proposed system is high cost

Table 1: Specifications of the system

Parameters	Output
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (limits)	6-20V
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 kB
SRAM	2 kB
EEPROM	1 kB
Ultrasonic Sensor Range	4 m
Response Time	55 seconds
Clock Speed	16 MHz
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (limits)	6-20V
DC Current per I/O Pin	40 mA

associated with the components. Another method which can be used and has been very popular for design the project based on communication is GSM technology. It required a dedicated SIM and GSM Module this method is quite easy and can be used anywhere on globe. The anther method is internet of things (IOT).

The internet of things method use the internet technology Wi-Fi or LAN to send the data on cloud

B. Software Implementation

Software implementation includes the microcontroller code and the Android application. In this project we have used AVR- ATmega328 through the Arduino board .The programming of the Arduino has been done using the compiler and burner Arduino 1.0.5-r2 and Android application has been designed using MIT application inventor

C. Microcontroller Code

The code burnt in the microcontroller has been illustrated in the algorithm given below:

Algorithm Used:

(i) *Start*

(ii) *Read the mode received from the bluetooth*

(iii) *Repeat the following if mode = automatic*

    a. *Read input from IR sensor*

    b. *If front IR output = 1*

Then move the robot backwards

        Set previous state =1;

      If back IR output = 1

Then move the robot forwards

      Set previous state =0;

    If front IR output = 0 and back IR output=0

    Then if (previous state =1)

Then move the robot backwards

    Else Move the robot forward.

    c. *Read ultrasonic output*

    d. *If ultrasonic output =1*

    Then stop the motors

      Send bluetooth intruder detected

    e. *If mode = automatic*

      Jump to step (iii)

    Else

      Jump to step (iv)

(iv) *Repeat the following step if mode = manual*

    a. *Read input from bluetooth as bt output*

    b. *If bt output = backward*

Then move the robot backwards

If bt output = left

    Then move the robot left

    If bt output = right

    Then move the robot right

    If mode = automatic Jump to step (iii)

    else

    Jump to step (iv)

    Stop

The above stated code genuinely includes the motion of the robot as an edge detector which is performed when the system is configured in the automatic mode and during manual mode the command corresponding to the function will be sent by the cell phone. The mode in which the robot needs to be configured is decided by the remote cell phone which is commanded by the server. The cell phone and the controller are interfaced through USART for the reception and transmission through the same channel. The horizontal and vertical motors are set to rotate during the automatic mode but during the manual mode they are kept deactivated.

In manual mode, the robot is configured to place it from one location to the other so vertical motors will set to rest and no detection to the intrusion is made.

D. Android Application

The other part of the software involves the Android application that has been installed on the server cell
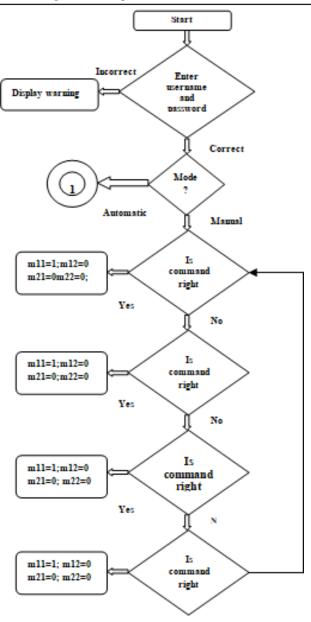
Fig. 2: Flowchart (1) of the System

Fig. 3: Flowchart (2) of the System

exit

Else

Repeat (iv) and (v)

(iv) *Read the input from the server*

Temp=received (server contact number);

Transmit (temp, microcontroller);

(v) *Read the input from the microcontroller*
Temp=received (microcontroller);

V. RESULTS AND DISCUSSIONS

This system has a better response than the previously used systems on following parameters, although these improvements are due to the use of some better components and devices on the part of performances and specifications The image illustrated below is the finally designed system which includes mechanically designed chassis and software and hardware part implemented on a printed circuit board.

This system has a better response than the previously used systems on following parameters, although these improvements are due to the use of some better components and devices on the part of performances and specifications. All of the results were carried out on i3 processor, 2.8 GHz and 4GB RAM. It was found that the code execution time for the left, right and other controls

phone. For the development of Android application, MIT app inventor has been used. It uses a graphical interface, which allows users to drag-and-drop visual objects to create an application that can run on Android devices. This application just sends the server the command that is sent by the control unit and vice versa.

Algorithm of the designed app:

(i) *Start*

(ii) *Read the username and password from the user*

(iii) *If username and password are incorrect*

Then

Show warning and error message,

Fig. 4: Wireless Android based Survelience System

was 2.36 μseconds according to measurement through the use of instruction execution time as the arduino integrated development environment designed using JAVA programming language and the response measured on the proteus simulation was sufficiently low as its value was sufficiently low to be measured in real time. And a rough estimate of the cost of the components from the market and the available and practiced knowledge about the devices a comparison of the devices is made as shown in the chart, Figure 5 as shown below.
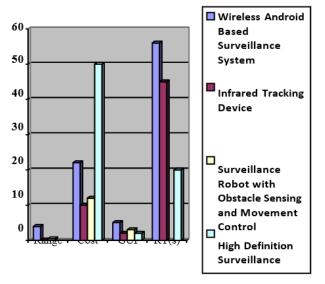
Fig. 5: Comparison of the Performance of Various Systems
[range (inm), cost (in x 100 rupee, GUI, response time (in seconds)]

VI. Conclusion

The central idea which motivated the design of project is to provide an autonomous bot for the surveillance operations, required by the defence services of a country. The designed bot since being exposed to harsh and dangerous environments, should be robust, remotely controlled (wireless tech can serve this purpose), automatic (in terms of detecting any intrusion in its vicinity), reliable, easy to configure and operate, highly responsive and fast to signal the intruder detection. The project's chassis is made up of Aluminum Frame for robust design and light weight along with its protective corrosion layer. It has Arduino Uno as control unit with ATmega328 as CPU which is fast and highly responsive. An Android Application provides a good GUI which is easy to configure and operate. An intrusion is detected by using ultrasonic sensor which is capable of detecting any intrusion in a radius of 4m and alert is signaled through call or SMS to the desired number to server by the remote cell phone connected to the device via Bluetooth Module wirelessly within a range of 10m and it takes 55 seconds to alert the operator/server about the intrusion.

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Design of Fractal Antenna using Meander and Koch Hybrid Curves on Plus-Shaped Radiating Patch for Wireless Applications

Dr. Narinder Sharma[1], Tejinder Sharma[2]

[1]*Department of Electronics and Communication Engineering , Amritsar Group of Colleges, Amritsar, India*
[2]*Computer Science and Engineering Department, Amritsar Group of Colleges, Amritsar, India*
Email: [1]dr.narinder.sharma0209@gmail.com, [2]tejindersharma@acetamritsar.org

Abstract—**This paper propounds an antenna designed by amalgamation of Meander and Koch hybrid geometries on plus shaped radiating patch with modifications in ground plane for distinct wireless applications. Space-filling property of fractal geometry has been used for designing an antenna with 50Ω transmission line feed for attaining good impedance matching along with wider bandwidth. The volumetric dimensions of proposed antenna 27 x 20 x 1.6 mm³ and has been designed on low cost FR4 glass epoxy substrate with 1.6mm thickness and dielectric constant of 4.4. Deigned antenna portrayed the impedance bandwidth (S_{11} < -10dB) at 4.4GHz (7.63 – 9.15GHz) with maximum gain 4.99dB. Different antenna performance parameters like reflection coefficient, gain and current distribution pattern has been analyzed and divulged in the acceptable range for distinct wireless standards. The juxtaposition of the performance parameters has also been made with the existing state-of-art literature for the validation of the novelty. The changes in the ground plane have also been made for attaining improved bandwidth (3050 MHz) and gain (5.11dB) which makes the proposed antenna a proficient candidate suitable for wireless applications.**

Keywords— Meander, Koch, Fractal Antenna, Multiband Characteristics

I. INTRODUCTION
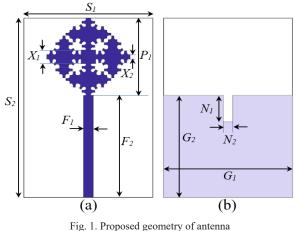
In the changing era of technology, the mode of the communication has been drastically changed and antenna is the backbone of the modern communication systems [1]. Various amendments have been made by distinguished researchers in the antenna designing for fulfilling the demand of wireless communication system [2]. Though there is plethora of literature is available related to antennas but Fractal Antenna (FA) has made its unique identity among them [3, 4]. B. Mandelbort was the first scientist who proposed fractal geometry in 1975 and his theory was based on natural fractals [5]. Fractals are complex structure which may exist naturally or can be generated by using Iterative Recursive Procedure [6]. Fractal has gained huge popularity because of its properties such as space- filling, self- similarity,

fractional dimensions and infinite complexity [7, 8]. Space filling property is helpful for reducing the size of antenna [9], whereas, self-similarity is valuable for attaining the wideband or multiband characteristics [10]. The commonly used geometries for designing of Fractal Antennas are Meander, Koch, Sierpinski Gasket/Carpet, Minkowski, Giuseppe Peano, Hilbert, etc [11, 12]. Each fractal geometry has its unique connotation in Antenna designing for particular wireless applications. For attaining the better performance parameters, many of the researchers have integrated the distinct fractal geometries in designing the antenna which is termed as Hybrid Fractal Antenna (HFA) [13]. HFA can be designed by using the distinct combinations such as Koch-Meander, Sierpinski carpet/gasket -Giuseppe Peano, Koch-Sierpinski carpet/gasket, etc. or any other combination required for particular application.

The authors are inspired from the HFA designed by Kumar et al. [14], this paper proposed a quad-band HFA for wireless applications. Keeping reference [14] under consideration, HFA has been presented in this manuscript which is designed by fusing the Meander and Koch geometries together for distinct wireless applications. The wideband characteristics of proposed antenna have been achieved by coalescing fractal geometries on plus shaped radiating patch. The structural specifications, simulated results have been exemplified in section 2 and 3, followed by conclusion.

II. ANTENNA CONFIGURATION AND DESIGN

This manuscript illuminates the design of antenna with the fusion of Meander and Koch geometries on plus shaped radiating patch, illustrated in Fig. 1. For designing an antenna, selection of the appropriate material is significant. Keeping this under consideration, an amply available low-cost glass epoxy substrate has been used with dielectric constant 4.4, mass density 19,000 kg/m3 and loss tangent 0.02. Based on these parameters and following equations (1) to (4), the dimensions S1 and

(a)

(b)

Fig. 1. Proposed geometry of antenna
(a) front view and (b) rear view

(a)   (b)   (c)

Fig. 2. Evolution Steps of Proposed Antenna
(a) 0th iteration, (b) 1st iteration and (c) 2nd iteration

S2 have been evaluated and found as 27mm and 40mm at designed frequency of 5.75GHz [15]. The optimised parameters of proposed antenna have been delineated in table 1 for better understanding.

$$S_1 = \frac{c}{2f_r \sqrt{\frac{\varepsilon_r + 1}{2}}} \quad (1)$$

Where, ε_r is relative permittivity, f_r is the resonant frequency and 'c' is the velocity of light,

The Effective Dielectric Constant (ε_{reff}) can be calculated as:

$$\varepsilon_{reff} = \left[\frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\right] \frac{1}{\sqrt{1 + 12\,h/S_1}} \quad (2)$$

The extended incremental length (ΔL) of antenna is calculated as:

$$\Delta L = h * 0.412 \left[\frac{(\varepsilon_{reff} + 0.3)\left(\frac{S_1}{h} + 0.264\right)}{(\varepsilon_{reff} - 0.258)\left(\frac{S_1}{h} + 0.8\right)}\right] \quad (3)$$
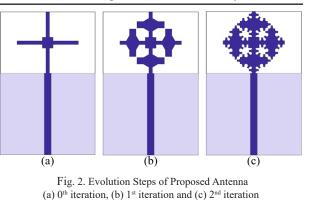
$$S_2 = \frac{1}{2f_r \sqrt{\mu_o \varepsilon_o} \sqrt{\varepsilon_r}} - 2\Delta L \quad (4)$$

TABLE 1: OPTIMIZED PARAMETRIC DIMENSIONS OF PROPOSED ANTENNA (UNIT IN MM)

S_1	S_2	F_1	F_2	X_1	X_2	P_1	G_1	G_2	N_1	N_2
27.0	40.0	2.0	23.0	3.0	1.0	17.0	27.0	23.0	6.0	2.0

After, attaining the desired shape of radiating patch, it is printed on the selected substrate with an overall dimension of $27 \times 40 \times 1.6$ mm³. This designed radiating patch is fed by using the microstrip transmission line of size 11mm × 1.6mm for obtaining 50Ω port impedance. The design evolution of different steps of proposed antenna have been shown in Fig. 2. In step-1, the ground plane is kept equal to the length and width of the substrate along with plus shaped structure which plays vital role for achieving the impedance characteristics of antenna related to reflection coefficient. Further, in step-2, Meander and Koch geometries are fused together and the length of ground plane is also reduced from full ground plane to partial ground plane for obtaining better impedance bandwidth as well as reflection coefficient. Finally, in step-3, the plus-shaped stubs along with fused hybrid geometries and variations in ground plane are consecutively attached to the inner side of the designed radiating patch as shown in Fig. 2(c), for enhancing impedance matching, bandwidth and gain. The required structures of proposed antenna have been designed and analysed by using Finite Element Method (FEM) based High Frequency Structure Simulator (HFSS).

The versatile mathematical tool, named as Iterative Function System (IFS) has been used to achieve the above-said geometries of proposed antenna by applying affine transformations *(K)* to an elementary shape *(Z)*. Affine conversion comprises of scaling, translation and rotation and represented as [16]:

$$K(x) = Zx + t = \begin{bmatrix} a & b \\ c & d \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}\begin{bmatrix} e \\ f \end{bmatrix} \quad (5)$$

Where matrix *Z* (initial geometry) is given as:

$$Z = \begin{bmatrix} \left(\frac{1}{s}\right) Cos\theta & -\left(\frac{1}{s}\right) Sin\theta \\ \left(\frac{1}{s}\right) Sin\theta & \left(\frac{1}{s}\right) Cos\theta \end{bmatrix} \quad (6)$$

Where,

'a to d' are the parameters used to regulate the scaling and rotation

'e and f' are used for the translation and shifting

's' is scaling factor

'θ' is the rotation angle
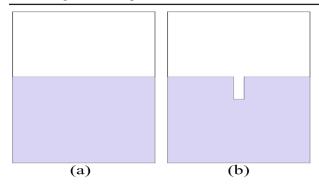
Fig. 3. Ground Plane Design Stages on 2nd Iteration of Proposed Antenna
(a) Ground – 1 and (b) Ground – 2 (Proposed)

't' represents the transformation factor

'x_1, x_2' signifies the coordinate points of x.

By applying the set of linear transformation on 'Z' and using Hutchinson operator (K), the required fractal geometry can be obtained by using the equation (4) [17]:

$$K(Z) = U_{n=1}^{N} K_N(Z) \qquad (7)$$

In the final step, the modifications in the ground plane (reported in Fig. 3) have been made for getting improved bandwidth along with enhanced gain and chosen as Fig. 2(b) for the final geometry of proposed antenna.

III. RESULT AND DISCUSSIONS

A. Parametric Analysis without Modification in Ground Plane

This section presents the parametric analysis of proposed antenna without modification in ground plane. Parametric analysis in this section is mainly based on the variation of reflection coefficient w.r.t. frequency. For understanding in the better way, reflection coefficient v/s frequency at different iterations has been expounded in Fig.4 as well in Table 2. From Fig.4, it can be anticipated that, in 0th Iteration, proposed antenna resonates on single frequency (2.8 GHz) with bandwidth 820 MHz and gain 3.39. In 1st iteration, it operates on two unique frequencies 2.7 GHz and 8.8 GHz and exhibits bandwidth 920 and 1620MHz with corresponding gain 0.57 and 2.94GHz. In 2nd Iteration, it works at four distinct resonance points 2.7, 6.5, 8.4 and 10.2 GHz and reports corresponding bandwidth 840, 610, 1520 and 830 GHz along with respective gain -2.72, 2.27, 3.35 and 4.99dB.

For improving the bandwidth and gain of the proposed antenna, the modifications in the ground plane have been made as shown in Fig.3. These modifications have been named as ground-1 projected in Fig. 3(a), and ground-2 discerned in fig. 3(b). The analysis of these variations has been made on the basis of reflection coefficient and envisaged in Fig. 5 and Table 3 for more
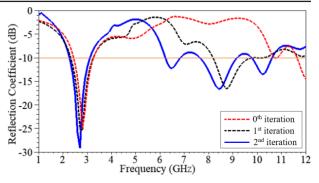
Fig. 4. Reflection Coefficient v/s Frequency
(a) 0th Iteration, (b) 1st Iteration and (c) 2nd Iteration

TABLE 2: COMPARISON OF RESULTS FOR DIFFERENT ITERATIONS OF DESIGNED ANTENNA

Antenna Design	Oper. Freq. band GHz	Reflec. Coeff. (dB)	Lower freq. F_L (GHz)	Upper freq. F_U (GHz)	Band-width MHz	Gain (dB)
0th iteration	2.8	-25.01	2.44	3.26	820	3.39
1st iterat ion	2.7	-25.15	2.32	3.24	920	0.57
	8.8	-16.34	8.18	9.80	1620	2.94
2nd iterat ion	2.7	-29.04	2.27	3.11	840	-2.72
	6.5	-12.22	6.21	6.82	610	2.27
	8.4	-16.60	7.63	9.15	1520	3.35
	10.20	-13.52	9.77	10.60	830	4.99
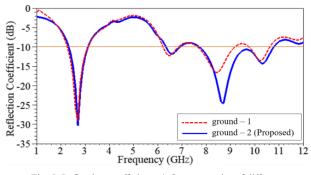
Fig. 5. Reflection coefficient v/s frequency plot of different configuration of ground plane of proposed antenna

lucidity. From fig. 5 it can be contemplated that antenna with ground-1 operates on four unique frequencies 2.7, 6.5, 8.4 and 10.2 GHz and adorns bandwidth 840, 610, 1520 and 830 MHz with corresponding gain 2.72, 2.27, 3.35 and 4.99 dB, whereas, with ground plane-2, it resonates at four distinct frequencies 2.7, 6.6, 8.7 and 10.3Ghz and elucidates wider bandwidth (3050 MHz) with maximum gain 5.11dB. Keeping aforementioned under consideration, HFA with ground -2 can be considered as final geometry of proposed antenna and it also becomes a suitable candidate for desired wireless applications

Antenna Design	Freq. band (GHz)	Reflec. Coeff. (dB)	Lower freq. F_L (GHz)	Upper freq. F_U (GHz)	B.W MHz	Gain (dB)
ground – 1	2.7	-29.04	2.27	3.11	840	2.72
	6.5	-12.22	6.21	6.82	610	2.27
	8.4	-16.60	7.63	9.15	1520	3.35
	10.20	-13.52	9.77	10.60	830	4.99
ground – 2 (Proposed)	2.7	-30.27	2.32	3.11	790	2.94
	6.6	-11.75	6.33	6.90	570	2.77
	8.7	-24.47	7.71	10.76	3050	3.69
	10.3	-14.28				5.11

Fig. 7. 3D Gain Plot of Proposed Antenna at
(a) 2.7 (b) 6.6 (c) 8.7 and (d) 10.3GHz Resonant Frequency Bands

Fig. 6. Surface Current Distribution Plot at
(a) 2.7 (b) 6.6 (c) 8.7 and (d) 10.3GHz resonant Frequency Bands

Fig. 8: 2D radiation pattern of proposed antenna at
(a) 2.7 (b) 6.6 (c) 8.7 and (d) 10.3GHz resonant frequency bands

B. Current Distribution of the Proposed Antenna (Ground–2) at Distinct Frequency Bands

The current distribution of proposed antenna at distinct frequency bands has been embellished in Fig. 6. It can be premeditated from Fig. 6(a) and (b) that the reflection coefficient and impedance bandwidth of proposed antenna at 2.7GHz and 6.6GHz have been improved due to the strong concentration of current at the plus shaped structure on the radiating patch as well as the modified ground plane. Similarly, at rest of the frequency bands, the enhancement of performance parameters has been attained due to the saturation of the maximum current on the surface of modified ground plane along with the transmission line feed as exemplified in Fig. 6(c) and (d). It has also been analyzed from Fig. 6 that, more current density at the desired frequency bands helps to store the more energy around the geometry of proposed antenna. The current is also uniformly distributed on the structure of antenna which is quite helpful in the enhancement
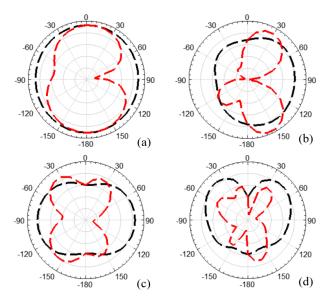
of impedance matching characteristics as well as wider bandwidth at operational frequency points.

C. Gain and Radiation Pattern of Proposed Antenna (Ground-2) at Distinct Frequency Bands

Proposed antenna also shows the positive total gain value of 2.94dB, 2.77dB, 3.69dB and 5.11dB at aforementioned frequency. The simulated 3D gain plot of proposed antenna also illustrated in Fig. 7. The radiation patterns for proposed structure of antenna in E and H – plane at distinct frequency points have been revealed in Fig. 8. The black line displays the pattern in E – plane and red line confirms the pattern in H – plane. It shows

that proposed antenna exhibits omni-directional and bi-directional radiation pattern in E and H – plane for almost all the desired frequency bands. The radiation pattern at higher frequency points gets somewhat distorted in both the planes due to higher order modes and the dispersal of short wavelength discriminated electric current on the surface of proposed geometry of antenna.

D. Comparison Among Existing and Proposed Antenna

The juxtaposition among existing state-of-art literature antennas and proposed antenna has been drawn for proving the novelty of the proposed antenna and shown in tabular form in Table 4, for better understanding. It can be observed form Table 4 that Proposed hybrid antenna is optimal, as it is compact in size in comparison to mentioned papers. Also; as we visualize the reference [18, 20 - 24, 26, 27] which operates at less resonant frequency bands as compared to the proposed antenna. Whereas, the references [24, 32] operates on four frequencies which is similar to proposed antenna, but the antenna designed in these references are almost three times in size as compared to proposed antenna. So, we can say that proposed antenna works for distinct wireless applications because of its multiband and wideband characteristics.

TABLE 4: COMPARISON OF PROPOSED ANTENNA WITH OTHER PUBLISHED WORK

Reference	Dimensions (mm × mm)	Operating frequency (GHz)	Gain (dB)
[18]	2000×2000	2.78/4.29	4.45/5.40
[19]	100×50	1.75/3.0/4.5/6.0	1.35/4.08/4.22/7.34
[20]	70×70	2.4	2.3
[21]	50.5×83.5	1.1/3.4/5.8	1.74/5.95/4.22
[22]	41×100	1.8/5.0/6.9	---
[23]	120×87	0.36/1.32/5.50	1.91/3.72/7.52
[24]	90×90	4.95/5.76	3.37/3.08
[25]	88×108	2.0/3.5/4.9/6.5	3.23/4.3/5.95/6.5
[26]	85×85	5.1	6.9 (max)
[27]	40×100	4.1	3.5 (max)
Proposed Antenna	27×40	2.7/6.6/8.7/10.3	2.94/2.77/3.69/5.11

V. CONCLUSION

A new fractal antenna has been simulated and proposed by fusing Minkowski and Koch geometry on plus shaped radiating patch with modified ground plane (named as ground -2) along with area 27 x 40 mm^2 and exhibits wideband characteristics. The proposed antenna covers four unique bands for wireless communication. Proposed antenna with modified ground plane reports enhanced bandwidth 3050 MHz as well as maximum gain 5.11dB which made it suitable for different wireless applications like S-Band, Wi-Max (3.43 GHz), C band application (4.78 GHz), point –to- point hi speed wireless (6.32 GHz), X – band applications (8.34GHz, 9.64GHz). The proposed hybrid antenna has acceptable value of required antenna performance parameters

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Prognostics and Reliability Assessment of LED using Machine Learning: A Review

Geetanjali Ralh Singh[1], Cherry Bhargava[2]

[1]ECE, IGDTUW, New Delhi

[2] ECE, SIT, Pune

Abstract—Light-emitting diodes have become increasingly popular with the advantage of a long lifetime and high efficiency than many other traditional light sources. It has a high demand in markets like general lighting devices, medical equipment, automotive lamps. Lifetime prediction becomes important to set the benchmark for the design specifications. The reliability estimation becomes challenging under different parameters and environmental conditions. To overcome these challenges, this paper investigated the various failure modes in LED devices and systems, their prognostics and remaining useful life (RUL) estimation of LEDs using various techniques including machine learning.

Keywords: LED, Prognostics, Machine Learning, RUL

I. Introduction

LED has become an emerging technology in the illumination field. Due to the versatility in the application of LEDs in the fields like communication devices, medical fields, automotive lighting and general lighting systems. There is a need for high reliability and a longer lifetime of LED systems. The main issue in solid-state lighting is the accurate prediction of reliability. The various failure modes need to be analysed for RUL estimation.

With the advancement in technology and miniaturization of the systems, failure prediction in the early stage becomes vital for a reliable system [1]. Hence prognostics and health management was invented for early prediction of failure. Prognostics is a technology that determines the RUL of the system by assessing the degradation data or deviation of the data from the expected results. For a reliable and safe design of LED lighting system in explosive atmospheres, It requires a complex safety system to avoid triggering dangerous dust, gasses or vapours. Therefore the safety of the device is important for the mechanical case strength. It is made flameproof to ensure minimum effect from heat dissipation from the LEDs, which reduces luminous efficiency of LED as the glass used is thick. The electrical and mechanical characteristics, for evaluation of failure and its effects under an explosive environment, is analysed by Fumagalli K. et. al. in paper [2]. The performance of LED systems depends on multiple degradation mechanisms. Bo Sun et. al.[3] investigated the prognostic techniques and models applied to LED systems and devices. The advantages of the various methods such as artificial neural network, Kalman filter, physics based methods etc. are utilized.

Health monitoring of electronic components is crucial to avoid complete failures of the systems. Due to which, In industrial informatics fields health assessment plays an important role [4]. This is done by utilizing the inputs from the different sensors to detect anomaly behaviour [5]. With the advances in sensor technology, large data created can be transferred directly [6][7]. Hence data-driven methods have got more attention in recent research. The predicted results can be used either as an alarm system to avoid failure or degradation of the system in advance or the maintenance of the system can be scheduled in time, which helps in cost saving as complete system failure can be avoided [8][9].

Hence reliability assessment defines how reliably a system works under the influence of different stress parameters. Reliability is a key indicator in fault detection, to avoid unnecessary rework cost especially in chips where chances of failure is more as many components integrated on the chip increases exponentially with time. Each component has a different working conditions and stress factors [10].

In this paper the reliability of LED is explored using various data-driven techniques after finding the failure modes using design of experiments approach such as accelerated life testing method. Then machine learning methods are investigated for RUL estimation in actual operating conditions. This can be used to estimate the future trend of the system that depends upon the deviation of the results from required output to take preventive measures on time.

II. Light Emitting Diode

LED is an optoelectronic device, that comprises of n-type region, p-type region and n-p junction. At the p-n junction when current flows in the circuit, the recombination occurs. Recombination is fusion of electrons and holes, which produced energy in the form of photons as shown in Fig. 1.
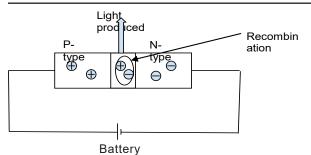
Fig 1: LED Producing Light under the Influence of Current in the Circuit

Failure at	Failure Mechanism
Package Level	1. Solder joint failure 2. Mechanical Fatigue 3. Thermal fatigue 4. Package Breakdown 5. Increase in leakage currents 6. Negative bias temperature instability 7. Di-electric breakdown
Interconnect Level	1. Electrical overstress 2. Bonding wire fracture 3. Electrostatic discharge 4. Electrical contact metallurgical interdiffusion
Semiconductor Level	1. Electromigration 2. Die cracking due to lumen degradation 3. Dopant Diffusion 4. Chip to substrate bonding defects

LEDs have shifted from simple light indicators to advance LED lighting. Several advantages like long lifetime, cost saving and high energy efficiency lead LED to large number of applications [11]. Now it is used as the best lighting option as it has provided improved color performance, advanced control of the LED lighting devices [12]. In human health applications where they are exposed to electric or natural lighting, that affects their psychology. This has taken a new direction of treating various health conditions such as depression and dementia [13]. Now LED lighting is everywhere converging smartphones, Internet of Things apps i.e. exchange of data among lighting, sensors, internet and various devices. This has created a dense network, consisting of data collection nodes in some buildings to cities. This enhanced the value of light sources [12]. This lighting has application in horticulture. In which the plants are kept under a lighting system affecting its various aspects like height, immunity flowering and stress tolerance [14]. Kim H.Y. et. al. [15] observed cracks on chip surface that propagated in the silicon lens due to the thermal stress, which reduced output light power hence the illuminance. They investigated the effects of ambient temperatures and UV wavelengths on thermal and optical performance of LED packages.

III. FAILURE MODES OF LEDS

Reliability of LEDs can be estimated after thorough understanding of causes of failures. Failures can occur at any level such as package level, interconnection level or semiconductor or die level in LEDs defined in "table 1". One of the major causes of failure is lumen degradation which occurs due to degradation of many components inside the system. Many researches have shown that failure due to lumen degradation occurs when the lumen output is reduced to initial value for a certain period of time, which is also called lifetime L70 according to IES LM-08-08 standard [11].

Huang, Jia-Sheng [16] determined accurate reliability of LASER using a sublinear model based on many hours of experimental data. It is found that the laser shows faster degradation gives accurate results due to negligible background noise. Various failures are related to the structure, materials, operating conditions, packaging of LEDs. The most usual type of failure is packaging and semiconductor level [17]. Another failure mechanism is discolouration of LEDs. The color of the output light changes with time even before the output light depreciates, this happens because of environmental conditions like temperature cycling, moisture etc. Such failures are difficult to monitor. The reliability of high power LED is affected by humidity and temperature. Out of which thermal stress is the dominant as compared to humidity stress [18]. In case of high brightness LEDs, when two LEDs of different families of HB-LED are subjected to an accelerated reliability test to find their degradation behaviour. These are undergone through high temperature and high biasing current. This proved that the lumen maintenance of devices will improve when silicon materials are used instead of epoxy plastic in packages. Qu et al. [20] applied various lifetime models in LED lamp. They used Weibull analysis for lifetime analysis using accelerated degradation testing and analysed its effects. They proposed an altered thermal transient tester system for indoor residential lighting application which shows that the lifetime is dependent on different heat sink thermal resistances. Huang J. et al. [21] described the lumen degradation by using modified brownian motion process for LED packages (white light at mid power). These LEDs were aged under step stress accelerated ageing degradation test. The results were found to be similar to when under constant stress. Hence step stressed method can be used as an alternate test that provides comparable accuracy using less time, less test capacity and smaller sample size.

IV. PROGNOSTICS AND HEALTH MONITORING OF LEDs

Prognostics is used to prevent failures to occur and to improve the reliability of the system. In recent years this has become one of the most efficient processes for predicting reliability and useful lifetime of the system. This can avoid serious failures which may occur due to malfunctioning. This may cause costly repairs, damage to the environment and users. Prognostics is defined as the process of continuously monitoring the performance parameters and finding the anomalies in the parameters values. Then predicting the future trend of the variation in parameters. Sutharsaan T. *et al*. [11] proposed prognostic approaches at design and deployment stage to improve the lifetime of LED based on PHM methods. The flowchart of PHM of LED is shown in Fig.2.
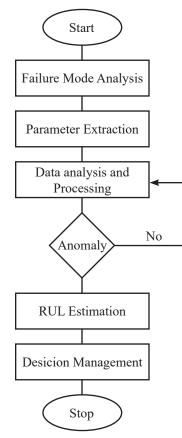
Fig. 2: Flow Chart of PHM of LED

The PHM of LED includes initially failure mode analysis, parameter extraction, data analysis and processing. If the data similar to the required data then the data is kept and utilized to estimate the RUL of the system otherwise data is refined and processed again. Finally the decision management system decides whether the LED under test can be used or needs to be replaces.

V. RUL ESTIMATION

Remaining useful life defines the useful time left before the actual failure. RUL estimation can be defined as Model-based, data- driven and hybrid methods. In the model based methods the data collected is used to estimate the parameters of the model i.e. the model is created after understanding the full fault mechanism of the system, but it becomes difficult in case of the complex system [22]. Model based methods include traditional methods (such as MIL-HBDK 217, RIAC 217 plus, PRISM etc.), failure based general models (e.g. arrhenius, eyring models etc.), physics of failure based (PoF) The data driven methods overcome the disadvantages of model based methods. It estimates the degradation of the component based on the data measured. Data driven methods are statistical methods (numerical methods), analytical methods (regression, kalman filter etc.), machine learning techniques (neural networks, fuzzy networks etc.) as shown in Fig. 3. The data driven methods have advanced to deep learning algorithms that have provided better performance.
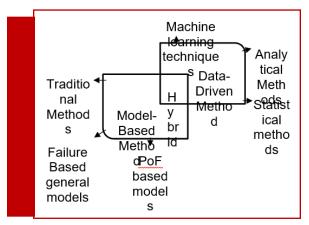
Fig. 3: Various RUL Estimation Techniques
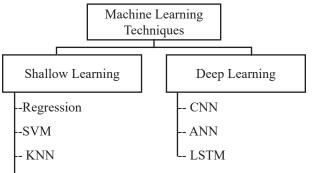
The model based fault diagnosis method provides higher accuracy and efficiency without additional tool steps. Jiang H. *et al*. [23]compared the common data driven methods, support vector machines (SVM) and neural networks for fault detection of LED lamps, they have observed requirement of higher sample data and less accuracy of back propagation neural network as compared to SVM. The data driven methods utilizes mathematical to calculate the future trend of the performance parameter and does not require in depth knowledge of the failure mechanism [24].

A. RUL Estimation using Machine Learning

Machine learning is a technique that can learn and detect the patterns based on the input data samples and utilizes these in prognostics or to estimate future data [25]. As shown in "fig. 4." machine learning can be supervised

or unsupervised depending upon the way learning takes place. In supervised learning a labeled data is provided to estimate the future behaviour.

Yuan C. C.A. *et al.*[26] applied deep learning techniques and proposed a gated network that established the relationship between thermal ageing and design parameters.This method was validated under thermal aging loading in multiple LED chip packaging and LED luminaire .

Support vector machine (SVM) model is defined as linear classifier used for learning by maximizing the interval [27]. Convolutional neural network (CNN) are used for large datasets and has the capability of best feature extraction. Lin H. *et al*. [28] utilized the features of CNN for LED chip defect detection. CNN can detect localized failures, which could not be possible with traditional methods. The proposed defect inspector based on CNN is provides high performance.

Fig. 4: Classification of Machine Learning Techniques in RUL Estimation

Artificial Neural network (ANN) is most widely used and easy to understand algorithm. Fan J. *et al*. [29] proposed a prediction method for spectral power distribution of while LED. The full spectrum is utilized. The method includes combination of spectral power distribution with ANN algorithm. The temperature of the case and driven currents in models are used to estimate parameters and proved to be a highly accurate method. Liu *et al*. [30] combined ANN with the finite element modelling analysis of a single heat transfer physics field to provide an efficient method for heat dissipation analysis of multi-chip LED light sources. Cadmus C. *et al*. [26] proposed a gated neural network and related the luminous performance and thermal ageing under multiple degradation mechanisms. The gated network is embedded with many neural network architectures like RNN (Recurrent Neural network), ANN and Long short term memory (LSTM) method. This method was validated both for LED luminaire and LED chip package. LSTM is a type of RNN. Abdelli K. *et al*. [31] proposed a LSTM RNN to detect LASER degradation modes based on the past data. And found the LSTM method to be the

most accurate of many other machine learning techniques like KNN, regression.

VI. Conclusion

RUL estimation of LED becomes an important research area because of its increasing applications. For a reliability estimation the cause of the faults need to be understood, then RUL can be estimated using various method mashed or data driven methods. This study can be used for prognostics of LED systems.

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A Rectangular Patch Antenna for C & X-band Applications

[1]Sunil Thakur, [2]Navdeep Singh

[1]*Department of Physics, D.A.V. College, Jalandhar, India*
[2]*Department of Applied Sciences, A.C.E.T, Amritsar, India*
Email: [1]sthakurphy@gmail.com, [2]arora_navdeep@rediffmail.com

Abstract—**A LU-slot enabled corner truncated antenna resonating at 9.6 GHz (X-band) is presented. The antenna shows high gain of 7.37 dBi with reflection coefficient of -24.7 dB covering the bandwidth 1.6GHz (8.9GHz-10.5GHz). The corner truncation widens the bandwidth and it shows dual band operation resonating in C-band for Wi-Fi devices, cordless telephones & weather radar systems with lower bandwidth and in X-band for land, airborne and naval radars.**
Keywords: Reflection Coefficient, VSWR, Gain, Slots

I. Introduction

Since proposal by Deschamps [1], practical development by Munson [2, 3] and Howell [4], microstrip antennas have evolved greatly. Low cost profile, Multiband Operation; small size makes them suitable for mobile, radio, remote-sensing, smart weapon systems and satellite communications [5-10].

The above applications demand high gain multiband antennas, but regular antenna designs suffer from narrow bandwidth and low gain. Various researchers have been working on configuration modifications like Planar Multi-resonator [11-12], Multilayer Configurations [13], and Stacked Multi-resonator configuration [14] can enhance the bandwidth, but these make antenna bulky. Circular rings [15], Rectangular rings [16], U-slot cut on patch of MSA [17] are few techniques increasing the bandwidth without increase in area of antenna. Also use of defective ground structure [18], circular slot on patch [18-19] enhances radiation performance of the antenna. Moreover, by choosing inset feed [20], the antenna characteristics enhance due to impedance matching between feedline and patch.

In this paper, LU- slot corner truncated antenna fed with inset feed is presented. The radiation characteristics of the antenna are obtained using FEM- based simulation software. The effect of corner truncation is studied in terms of comparison of resonance behavior of antenna with and without corner truncation.

II. Antenna Design

The proposed antenna as shown in Fig.1 is designed on RT-Duroid substrate. The dimensions of the antenna are obtained from design equations used by Thakur *et al.* [19] & Przesmycki *et al.* [21] i.e. Equations 1-7;

$$W_p = \frac{c}{2 \times f_r} \times \sqrt{\frac{2}{\epsilon_r + 1}}, \tag{1}$$

Where W_p is the width of the patch. The upper limit of the height of the substrate is

$$h \le \frac{0.3 \times c}{2 \times \pi \times f_r \times \sqrt{\epsilon_r}}. \tag{2}$$

The effective patch length is given by L_{eff} and the effective dielectric constant of the substrate is ϵ_{eff} as given below

$$L_{eff} = L_p + 2\Delta L = \frac{c}{2 \times f_r \times \sqrt{\epsilon_{eff}}}, \tag{3}$$

$$\epsilon_{eff} = \frac{\epsilon_r + 1}{2} + \frac{\epsilon_r - 1}{2}\left(1 + \frac{12h}{W_p}\right)^{-1/2}. \tag{4}$$

ΔL is the patch extension due to fringing fields given as

$$\Delta L = 0.421 \times h \left(\frac{\epsilon_{eff} + 0.3}{\epsilon_{eff} - 0.258}\right)\left(\frac{\frac{W_p}{h} + 0.264}{\frac{W_p}{h} + 0.8}\right) \tag{5}$$

$$W_s = W_g = W_p + 6h \tag{6}$$

$$L_s = L_g = L_p + 6h \tag{7}$$

Finally, length and width of ground and substrate is obtained from equations (6)-(7). The antenna so obtained has 30x30x3mm³ substrate (RT-Duroid 5880). A combination of L and U-slots is made and the antenna is fed with inset feed of 50 Ω line along its length. The patch is further corner truncated to enhance bandwidth of antenna.

III. Results And Discussion

To justify the corner truncation of patch, a comparative study is made between antenna with truncation and antenna without corner truncation. The results obtained are discussed in the following sections.
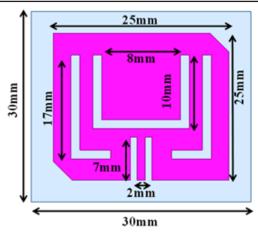
Fig.1 Proposed Geometry of Truncated Patch Antenna

Fig.3 Comparison of VSWR Value of Antenna with and Without Corner Truncation

A. Comparison of Reflection Coefficient Characteristics

The antenna without patch truncation exhibits triple resonant mode at 7.05GHz, 7.66GHz and 9.4GHz with return loss of -12.06dB, -12.43dB and -35.13dB with bandwidth of 80GHz,130GHz and 600GHz respectively. But corner truncation brings larger path for surface currents and hence the antenna shows modified performance. This antenna resonates at 7GHz and 9.6 GHz with return loss of -20.50dB and -24.732dB. The effect of corner truncation is clearly evident from the Fig.2.

Fig. 2: Comparison of Reflection Coefficient of Antenna with and Without Corner Truncation

B. Comparison of VSWR Values

The VSWR value of the antenna represents the matching of feedline with the antenna. As seen from Fig.3, corner truncation enhances this matching with VSWR values well below 2. This means truncated antenna is able to accept more power from the feedline. Again, truncated patch has edge over regular patch antenna.

C. Comparison of Gain of Antennas

To compare the gain of antennas, three dimensional radiation patterns of both the designs are plotted at resonance frequencies. As evident from Fig. 4 (a), (b) & (c) antenna without corner truncation has a gain of 4.04dBi, 7.6dBi & 6.54 dBi at its respective resonance frequencies. While gain for truncated patch antenna is 7.05dBi & 7.37dBi at respective resonance frequencies. Again truncated patch antenna is able to radiate more power in far field region.

D. Parametric Study

To explain the relation between radiation characteristics and dimensions of L & U slot on the patch, a parametric study is performed:
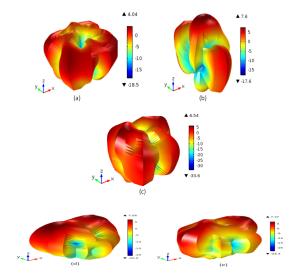
Fig. 4: Gain of the Antenna with and without Corner Truncation. Plots (a), (b) & (c) Correspond to Resonance Frequencies 7.05GHz, 7.66GHz & 9.4GHz Respectively for Antenna without Truncation. While (e) & (f) Correspond to Resonance Frequencies 7GHz & 9.6GHz, for Antenna with Corner Truncation

1. Variation with the length of L-slot

The length of L-slot is increased from 17mm to 19mm in steps of 1mm. As visible from Fig.5, with increasing slot length first resonance almost vanishes, and reflection coefficient decreases for resonance near 9GHz. These alterations have adverse effect on bandwidth which decreases.
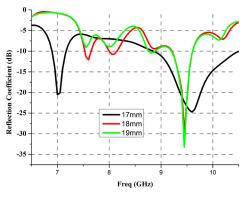
Fig. 5: Comparison of Reflection Coefficient of Antenna with Increase in Length of L-slot

2. Variation with Length of U-slot

The length of the arms of U-slot are increased from 8mm to 10mm and reflection coefficient of the antenna at various frequencies are compared. As evident from Fig.6,with the increase in arm length the antenna begins to resonate in triple band as compared to double band operation by designed antenna. Also the reflection coefficient near 9GHz decreases greatly. Thus, increasing length of U-slot, improves the reflection coefficient at higher frequency and also provides multiband operation.
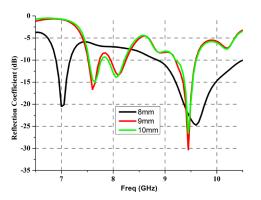
Fig. 6: Comparison of Reflection Coefficient of Antenna with Increase in Length of U-slot

3. Variation with the width of vertical slots

The width of vertical slots on the patch are increased from 2mm to3mm in steps of 0.5mm. From Fig. 7, we can deduce that the increase in width decreases the reflection coefficient at lower resonance frequency but resonance at higher frequency shifts backwards. The bandwidth is maximum for the 2mm width of vertical slots.
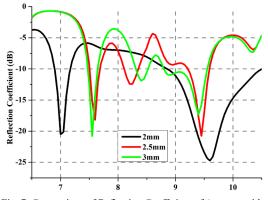
Fig. 7: Comparison of Reflection Coefficient of Antenna with the Increase in width of Vertical Slots

IV. Conclusion

A LU-slot loaded corner truncated antenna resonating at 9.6 GHz (X-band) with gain of 7.37 dBi and reflection coefficient of -24.7 dB is discussed. The antenna shows good matching with the feedline as VSWR ≤ 2 for the resonancebandwidth 1.6GHz (8.9GHz-10.5GHz). Increasing U-slot lengths improves the already existing multiband operation. The antenna finds applications in C-band for Wi-Fi devices, cordless telephones & weather radar systems with lower bandwidth and in X-band for land, airborne and naval radars.

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Implication of Knowledge Reuse in the Technological Human Resource Environments

Vikas Jain[1], Niharika Gehlot[2], O.K. Harsh[3]

[1]School of Business & Commerce, Glocal University,(Mirzapur Pole), Saharanpur, India
[2]Department of CSE, Jai Narayan Vyas University, Jodhpur (Rajasthan), India
[3]Distinguished Award Winner of University of New England, Armidale, Australia
Ex-VC, Glocal University, Saharanpur, India
Email: [1]vikas270880@gmail.com, [2]chouhan_niharika@yahoo.com, [3]oharsh@gmail.com

Abstract—In this work authors attempted to understand the importance of knowledge reuse in the Human Resource environment. For this, the role of knowledge reuse and sharing and its appropriate management is being explored. Moreover, the quality of knowledge in the fluctuating technological atmosphere has also been examined. To expedite the above activities in larger aspects we contemplate the three-dimensional model of knowledge management and present the analysis on the various issues of knowledge reusability and its submissions in the Human Resource environment. Recommendations to enhance the reusable tacit and explicit knowledge in the Human Resource setting for the growing country like India are being also explored.

Keywords: Explicit Knowledge Reuse, Human Resource Knowledge, Knowledge Reuse, Three-dimensional reuse Model, Tacit Knowledge Reuse, Quality of Knowledge

I. Introduction

Reuse of Knowledge (RK) is not merely a fresh prospective topic in HR, but it also has inevitable benefits. Many international organizations exchange knowledge for reuse or associated processes and take part in various studies. The power of reuse is crucial to discovering the rational rule that is possible in a group for the dissemination and application of knowledge. Reusing knowledge in HR departments has countless opportunities and implications for the future of any form of advanced HR. Of course, reuse reduces both time and effort [1, 2]. It is also useful to shape the dominance of knowledge and science in an institution.

Decent human resources, as well as innovation, could be implemented competently and easily through the proper reuse of certain types of knowledge. The main reason for knowledge renewal could be addressed properly to take advantage of the supply through reuse. The integration of high-quality knowledge with superior HR departments can constantly contribute to the use of new, reusable knowledge, which can be extremely useful in a comprehensive way.

Knowledge use is the especially important feature for management institutions, especially special knowledge, which, if reused correctly, can save huge amounts of time and require less effort [1-3]. Using know-how helps ensure that the reusable knowledge remains valuable to an ordinary person. It can reach huge numbers of people all over the world. Reusing explicit knowledge is easier than implicit knowledge. It should be noted that gathering tacit knowledge is difficult and time-consuming and requires extraordinary attempts.

Knowledge use can be used permanently if we employ the right expertise, where the acquired knowledge can be extended. The monitoring of explicit knowledge can also be enhanced if it is linked to coherent requirements from the institutions. Defensive or soft knowledge at the organizational level can be of great benefit if knowledge transfer between organizations is allowed. An organization must push all resources to their limits without losing management expertise in a technology environment where critical, respected, reusable resources play a dynamic role.

The HR background must be such that both tacit and explicit assets not only play a critical role, but their reusable assets are invaluable to the entire knowledge society. Tacit knowledge of the HR department, which cannot be easily corrected, is of great benefit to the HR department, which is why the HR department is dependent on manuals and standard procedures. The most important thing is to improve the personnel department's skills and ability to create both explicit and implicit knowledge with the latest skills.

Current research is linked to identifying the implications of reusing knowledge in an advanced work situation in the light of the latest trends in technology areas that have major implications for data types, perceptual mapping, linking evidence and repackaging, approaches and regulatory issues, realities of the knowledge society. The Nonaka model [4-6], the established knowledge

management or governance model, should also include reusable information and knowledge.

The reality is that growing countries are still fully committed to speeding up knowledge management and the reuse of knowledge. These countries have few prospects to grow and sustain the management structure in the form of more information or publications. Today, it's time to study these events in the human resources department to encourage the growth of related truths that may be valuable in enhancing a knowledge-reuse structure that applies to work management-oriented organizations using modern technology. This study, therefore, examines an elementary attempt to promote the reuse of knowledge carriers to a management organization.

Since the prehistoric plan of collecting, learning and shifting knowledge has come to be now outdated, hence, we want to consider converting and re-forming a unique arrangement that encourages a novel method of advancement.

II. Literature Review

A. Evaluation of Tacit and Explicit Knowledge

Organizational knowledge management includes tacit knowledge as an important part of formal work in a human resource environment. This kind of knowledge is indirectly known as both discrete and unplanned knowledge and is the fragment of an institution. Of course, it is based on our general and essential thoughts, our intellectual faculties and academic and extensive observations. Demanded knowledge comes from education because of threatening training and is observed in physical form in public. According to abundant researchers, it is difficult to speak fluently, and it is difficult to organize accordingly [8, 9]. Some researchers [5, 10] indicated that most implicit knowledge is mobile. Tacit knowledge is not easy to combine or disseminate. It is now believed to characterize knowledge that produces continuous hostile gain through the advancement of knowledge or managerial knowledge. Such knowledge has an intriguing tactical significance for an institution [11].

Required knowledge is fundamentally different from explicit knowledge. Explicit knowledge is believed to be widespread, predictable, and modest to carry typically intelligible language and likely to allocate, collect and exchange in the form of data, business, and information [5, 12]. It can also be described as discrete or powerful knowledge [13]. Iqbal, Harsh and Choudhary [32] recommended that the ADRI (Approach, Implementation, Result, and Improvement) model (about the quality of knowledge) is extremely valuable in education and training environments where knowledge management is sovereign.

One can appreciate that tacit knowledge is the highly noteworthy reason for forming new knowledge in management environments because, according to Nonaka [5, 14], "the key to knowledge creation lies in mobilizing and converting tacit knowledge." Explicit knowledge can be discovered by writing (text) or a video, which can typically be developed for a conversation with a person of varied language.

B. Tacit Knowledge

It is difficult to collect the reusable tacit knowledge of an institution. It wants reusability skills in organizations. The organization can support inspiring the reorganization of reusable tacit knowledge to fit different types of bids for the presumed tacit knowledge [20].

Usually, it is exceedingly difficult to multiply the implicit knowledge. Its quantification is also exceedingly difficult. Because of its weak strength [21]. It is an important point to understand that tacit knowledge can be a cause of practical help; therefore, it is important to recognize how it can be replaced or shared [22].

C. Reuse of Tacit Knowledge in Business

Tacit knowledge can be instantly reused and shared by leaders, enabling them to become proficient in their official conversation. It is common to quote that leaders have the cognitive services as well as the expertise and the logical knowledge. They also have "coaching and humanization capabilities" [18]. According to researchers [19], tacit knowledge is rationally justified in these situations. Such knowledge is respected and is self-destructive for the education officials.

The use of digital technology is imminent during the rapid globalization and expansion of digital knowledge. It has distorted new commercial opportunities, especially for small and medium-sized enterprises in the global [7]. Numerous businesses such as investment, transportation, marketing, education, etc. are greatly exaggerated by relentlessly diversified technologies. There is a lack of research into the internationalization of education on the role of implicit knowledge in organizations at the global level. The actual internationalization of tactical knowledge can be exaggerated by some critical questions related to knowledge posed, e.g. commercial knowledge, specialist knowledge, cross-social knowledge, etc.

Tacit knowledge cannot be recognized as explicit knowledge because tacit knowledge is buried in the individual perception. While technological expertise can help identify and reuse such knowledge. It is therefore this knowledge that must be sealed to enable recycling in the official environment.

As available in the literature, tacit and explicit knowledge is reversed (Harsh [14] and Sharma and Harsh [15]). These authors [14,15] proposed a three-dimensional model, which was based on the well-known

Nonaka model [4, 5]. These authors also pointed out that both explicit and tacit knowledge can be reusable.

The research of Harsh [14] and Sharma and Harsh [15] indicates that "the successful knowledge of an organization is considered to be improved over time, since each time we add more knowledge (it can be tacit or explicit or both) because of new ideas, new concepts or new interpretations." They further developed that due to the reusability of knowledge, it is likely to achieve qualitative knowledge due to the recurring demand for tacit and explicit knowledge. The work of March [16] indicated that an institution can nurture its beliefs that are firm to expressive and analogous to the individual's implicit knowledge of leadership.
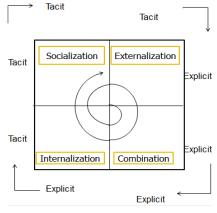
Fig. 1: Nonaka and Takeuchi Model [5]

Alani, Harsh, and Iqbal [27-31] analyzed qualitative knowledge management and reuse in an advanced human resource establishment. Several researchers have done on the development of knowledge administration, but Nonaka and Takeuchi's theory of knowledge construction [5] (model illustrated in Figure 1 in their study) is the largest comprehensive known and widely cited effort in knowledge-oriented organizational tactics [17]. According to the Nonaka model [15], the lively interaction between tacit and explicit knowledge facilitates a knowledge conversation procedure that ultimately produces knowledge. Nonaka's model [15] is the extremely recognized model of knowledge management in antiquity, which contains four different methods of knowledge transformation procedures, namely socialization - the transfer of knowledge through mixing, which has tacit consequences for tacit exchange of knowledge. Externalization - knowledge transport by the method of modification or codification from tacit knowledge to explicit. The combination is the procedure by which knowledge transfer takes place from explicit to explicit and finally Internalization - adoption of knowledge in wisdom progression [5]. Clearly, all of these advances can occur repeatedly in an advanced human resource setting during leadership training. So

there is relentless reuse of knowledge in the sophisticated organizational environment.

D.   Research Objective

Present research purposes to learn the re-use of tacit and explicit knowledge, mainly reusable tacit knowledge (by sharing or transferring) in human resource institutions and to examine whether tacit knowledge inspiration has sustainable achievable gains when controlled by the highest organizational concern. Current research will differentiate between the reusability of tacit and explicit knowledge, and it offers the opportunities of repaying to Human Resource organizations by improving the quality of existing knowledge due to the ceaseless improvement of recurring knowledge. The key resolutions in the existing studies are to realize the following indication in the advanced human resource settings:

- To appreciate precision amid the reusability of tacit and explicit knowledge in the decoration of advanced human resources.
- To understand an institution's bid for reusable knowledge, such as sophisticated knowledge management in the embellishment of tacit and explicit knowledge.
- Appreciates its quality and character for tacit and explicitly reusable facts
- Investigate the importance of ICT (information and communication technology) to produce reusable knowledge
- Finally, an argument for saving manpower because of the reusability of tacit and explicit knowledge in a sophisticated organizational environment.

III.   Method

It should be noted that despite the tremendous explanations from Nonaka and colleagues [4-6, 26] about knowledge management, it has been noted that no theory of knowledge reuse has been presented, which recommends a complementary investigation to study this model in the light of reusability of knowledge, particularly in a human resources background, is a great part of the study.

Of course, the method of knowledge management and reuse has become a vital concept due to the consequences of improving many progressive human rights organizations. In addition, the desire for growth in quality and the demand for attractive intervals has been an important part of the systematic improvement of HR organizations.

We start with Figure 2 in the long-running model of Nonaka by Harsh [1, 2, 14], where tacit and explicit knowledge conflict with the individual. Knowing this and recycling is important not only for asset management in senior HR organisations but also for policy adoption and

development. In a human resource organization, there is a relentless transfer of knowledge from manager to assistant. To resist the development of knowledge reuse (in the rapidly growing ecosystem), all HR organizations must design and manage operational tools for knowledge reuse. We want to improve the concept of reuse to improve effective management as a result of reusable knowledge and in the future we need:
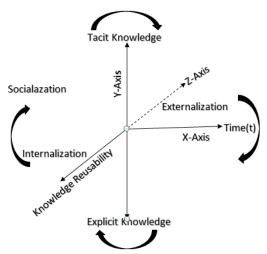
Fig. 2: Extended Nonaka and Takeuchi Model [5]

Reusable knowledge control not lonely leads organizations to increase their capability of gratifying and distributing information, while also helping to maintain frequent inspection and growth of their work, though it generates qualitative knowledge as well as producing confidence. Because we understand that tacit reusable knowledge benefits the organization by allowing its employees to increase not only its beneficial practices, while also allowing them to increase the quality and prestige of the organization by distorting this knowledge for media, meetings, and consulting.

Reusable explicit knowledge and its management of the equivalent Human Resource actions must replicate and love information at every step from organizational stage to an individual level so that such reusable knowledge can enhance (workforce), contributing to receiving leadership brilliance for managers. Inter-organizational discussion and collaboration also help improve tacit and explicit knowledge according to the sequence of the three-dimensional knowledge management model (see Figure 2).

A. Nonca Model and Recyclability Enhanced in High Human Resource Environments

Nonaka and Takeuchi [4-6] established a dialogue rebellion against explicit knowledge (and vice versa) through the repetition of socialization externalization, combination and internalization. He reveals that the combined transfer of clear and communicative

knowledge of music is stubbornly due to certain actions in an organization (see Figure 2). Such categories of happenings are 'periodic erudition action' trendy in an informative situation during where knowledge is enhanced like a spiral. Though, the attempt of Harsh [24, 25], on three-dimensional knowledge management further improves the perception of the reusability to these reemergence events which produce an improved type of reusable knowledge. Such knowledge can be intimidated in an informative atmosphere which can broaden not only renewed reusable knowledge while also regains the supremacy or quality of knowledge [Harsh 2, 14, 24].

Like this, one can comprehend that reusable knowledge delivers very effective practices for transmitting efficient methods, illustrations, judgments, presentations and is efficient in building quality systems because of the unintelligible drives of lack of knowledge. . Such are the cases of combination in addition to the socialization of tacit and explicit knowledge. It also promotes in hardening innovation and advancement and henceforth aids in building the branding of the institute. Due to the accessible assets on reusability, a common team can reuse by sharing substantial resources and can prevent duplicate belongings. It too strengthens in optimization of authentic like exchange of information and knowledge in a joint set-up. Thus, the newsletters, meetings, consultations, sessions and conventions can produce us as a gadget for reusable knowledge and therefore the great procedures.

In Fig. 2, there are exercises on the externalization of repetitive knowledge. On the other hand, if the individuals, processes, and individual organizations are involved in refining and abusing reusable knowledge, it develops a method of internalization. In this way, one can sense that individual communication and explicit knowledge, even if they are reused, subsidize the entire knowledge cycle of the three-dimensional model.
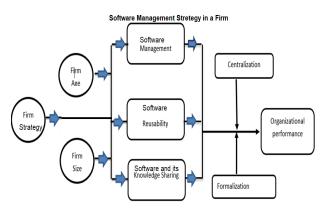
Fig. 3: A Typical Model to Boost Software Reuse Performance in an HR Environment

Fig. 3 above is a typical model to boost the performance of an HR organization which not only accounts for the reusability while also take into account other factors like

firm size, firm age, centralization and formalization of reusable knowledge.

B. Recommended Procedures for Reusable Knowledge Management in an Organization

Numerous organizations can take the shape of reusable knowledge management for human resource systems through information and communication technology tools (as well as digital media) and the latest web tools. Today, some magazines and media sponsors are also processed to provide conflicting information. The point is that if Harsh's above-mentioned three-dimensional recyclable knowledge management model [24, 25] is used for projects like "Shodh Ganga" [35], then there is a constant flow of reusable knowledge. These knowledge activities can be of great help to an HR professional in India where there is a serious dearth of HR knowledge literature.

It should be noted that the feeling of a return due to the development of reusable knowledge resources in HR organizations is extremely high, but the major advantages are:

- Used assets have expanded in the construction of reusable knowledge centers.
- Used huge manual with reusable knowledge.
- Better dissemination of official goals and functions.
- Helps clients share valuable reusable knowledge between distinct types of clients and conducts comprehensive joint processes and exercises.
- About autonomy to produce qualitatively reusable resources.
- Application optimization to generate useful facts.

Consequently, human resource organizations require to begin the growth of reusable knowledge management materials to sustain these activities. Such matter may be granted special privileges to extend the reusable knowledge system established at the authoritative level of human resources through suitable capabilities and tools. In the current three-dimensional model, the reusability of knowledge becomes an independent quantity and can be exploited whenever needed. Moreover, such knowledge becomes an asset to the organization.

Increasing reusable knowledge management requires the same concerns as the concept of information, lectures with departments, groups of workers and data diagrams. These are just some of the goal-sharing tools that you can use to create effective databases, gateways, websites, and reusable knowledge centers. The key is the need for librarians and information experts who can understand, and sort reusable knowledge. An institute gives the correct indication of this by smelling in different ways. It also includes a range of skills such as reusable data capture, reusable data control, reusable data classification, reusable data mining, reusable knowledge mapping,

reusable message association, reusable indexing and requires a reusable connection.

The current discussion suggests that the ability to communicate and reuse clear knowledge is especially important, which can be a good fit for many human resource organizations through ICT (information and communication technology). Native Americans face a shortage of small and large industry leaders and other related staff, which can be somewhat unexpected through online, and remote management systems, where reusability represents countless advantages.

Growing reusable knowledge and knowledge in management perfectly match the accountability of experts and managers, information-related activities and group data.

IV. Conclusion

The present study simulates the crucial place for reusable signals and explicit knowledge in different human resource environments, which is especially useful for a country like India where human resources need to be improved with many manuals besides machinery. The present claim also shows an increase in the quality of HR knowledge and communication and obviously reusable facts, because of its concise useful knowledge in a three-dimensional setting, due to its improvement during the knowledge cycle.

Information and communication technology is about the reuse of knowledge, and it also eliminates the great potential for the use of unnecessary knowledge. There are also benefits to reusing software applications while reusing human resources in today's research, saving us a lot of time and increasing the quality of our systems.

A. Scope of the Future

Present works can promote the innovation of reusable knowledge components that not only save time and capital but also enhance our reusable knowledge skills with custom applications. Resources invested in an industry can be optimized, based on rural reusing concepts in India, where knowledge mechanics can be introduced from potential commercial bases.

V. Acknowledgment

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[33] http://shodhganga.inflibnet.ac.in/

Discovering Diverse Phases of Mammography for Detecting Breast Cancer

Sarbjit Kaur[1], Dr. Jasmeen Gill[2]

[1,2]*RIMT University, Mandi Gobindgarh, Punjab, India*

Email: [1]*Sabby13dhillon@gmail.com,* [2]*er.jasmeengill@gmail.com*

Abstract—**With the development of technology, numerous computerized methods have come up to extract the hidden information from the images. The processed images have found its application in numerous sectors and medical science is one of them. Breast cancer is the most worrying disease that affects the majority of women universally. A mammography is a paramount tool for conducting a screening of breast cancer. Appropriately did mammography help in detecting breast cancer at initial stages and reduces the mortality rate. In cases where breast cancer is detected timely, even chemotherapy can be avoided. The limitation faced by mammography is because of low-quality images, human visual systems and controlled nature of distortions. The research paper discusses the three phases involved in the detection of breast cancer and declaring it as cancerous or non-cancerous. The three phases discussed are enhancement of mammogram image, segmentation of an image, and finally classifying it as benign or malignant. The research paper elaborates on the flowchart and algorithm elaborating on the anticipated methodology.**

Keywords— Benign, Enhancement, Malignant, Mammography, Segmentation

I. INTRODUCTION

Mammography is considered as a technique demanding examinations in medical imaging requiring fine details, high contrast, low patient motion, minimum noise levels, and appropriate viewing conditions. The mammography must be accomplished by means of dedicated mammographic imaging equipment with low energy output imaging competence like tungsten anode at low kilovoltage of 30kVp or less or rhodium or molybdenum x-ray tube anode. A mammography is a paramount tool for conducting screening but it undergoes high false-positive and false-negative rates. This limitation faced by mammography is because of low-quality images, limitations suffered by the human visual system and controlled nature of distortions [1, 2]. Mammograms have their own limitations like the uneven shape of masses, variation in size, and deceptive resemblance of the masses and other dense regions of breast tissue. Despite proposing several processing techniques for diagnosing breast masses, the rate of success has been on the lower side. The appropriate position of the patient and the compression of the breast is equally important [3]. The image classification offers doctors a second opinion which assists inaccurate diagnosis and saves physicians time and patient's money.

A mammography is a screening tool for breast cancer detection but it contains low-quality mammogram images with highly false-positive and false-negative rates. Lesion (cut, scratch) and masses are a sign of breast cancer in mammograms. Masses can be classified into three types, architectural distortion (benign category indicates the presence of post-surgical scars or soft tissue damage and is noncancerous and non - harmful for the human body and do not spread one part of the body to another part.), malignant (presence of palpable breast mass which is cancerous and harmful to the human as it spreads all over the body and cannot be cured easily), and bilateral asymmetry (high density in one of the breast as compared to the same area in other) [4, 5].

The two approaches for conducting image processing are analog image processing and digital image processing. Analog image processing is opted to handle hard copies resembling photographs and printouts. Digital image processing techniques assist in the manipulation of digital images by using computers [6]. The three general phases that all types of data have to undergo while using digital techniques are pre-processing enhancement and display, and information extraction. Different enhancement techniques like Grayscale manipulation, Green Channel Complement, different filters (Mean filter, Median filter, Laplacian filter, Gabor filter, etc.), Histogram Equalization, etc., are available to be used for enhancing an image. Different parameters are used to obtain numeric readings to justify the effectiveness of the research work. Subjective parameters are visual quality and computation time and objective parameters are Peak Signal Noise Ratio (PSNR), Mean Squared Error (MSE), Normalized Absolute Error (NAE), Normalized Correlation, Error Color and Composite Peak Signal to Noise Ratio (CPSNR). The PSNR (*Peak Signal to Noise Ratio)* block computes the peak signal-to-noise ratio, in decibels, between two images [7]. This ratio is often used as a quality measurement between the original and a compressed image. The higher the PSNR, the better the quality of the compressed, or reconstructed image. The

PSNR and MSE (*Mean Square Error)* are the two error metrics used to compare image compression quality. The MSE represents the cumulative squared error between the compressed and the original image, whereas PSNR represents a measure of the peak error. The lower the value of MSE, the lower the error

II. State of Art

There are numerous publications relevant to image classification of mammogram images, but very few papers provide a thorough explanation of breast cancer image classification methods, feature extraction and selection measures, grouping measuring parameterizations, and image classification conclusions. This section illustrates the research work conducted in the field of mammography in the past few years.

K.Akila, L.S.Jayashree, and A.Vasuki in 2015 [7] detailed the importance of contrast enhancement technique in the arena of image processing conducted on mammograms. The enhancement conducted on the basis of contrast is broadly categorized as direct and indirect contrast enhancement. Histogram Equalization is considered a prominent enhancement technique. The authors concentrated on the working principle of several indirect contrast enhancement techniques such as HE, CLAHE, RMSHE, BBHE, and MMBEBHE. The readings of numerical parameters like EME (an effective measure of enhancement) and PSNR (Peak Signal Noise Ratio) are taken to justify the research work conducted. Saeed Khodary, M Hamouda, Reda H Abo El-Ezz, Mohammed E Wahed, 2017 [8] stated that early detection of breast cancer greatly improves the prognosis and treatment for patients, the early signs of breast cancer that appear in mammograms, digital mammography is one of the best methods detection of breast cancer. Screening the breast by mammograms is useful in the detection of cancer diseases in women without any external symptom. In this paper, author's aim to early detection of breast cancer by mammography depending on the production of excellent images and competent interpretation, the author's aims to analyze the digital mammograms by computerization for helping the radiologist to detect and classify breast cancer early. The proposed technique depends on segment digital mammograms and separates the tumor regions and classifying these images based on feature extraction, the shape of a tumor, and edge-sharpness, the system decides if mammogram image is normal or abnormal, and determines whether the abnormal one is benign or malignant. The proposed system is implemented by the MATLAB program. Abdullah-Al Nahid, Yinan Kong in 2017 [9] stated that breast cancer is the biggest cause of death among women all over the world today. Advanced engineering relevant to image classification and artificial intelligence has found its application in the classification of breast images. The authors detailed the working of the Convolutional Neural Network (CNN) method for breast image classification. The author's also explained the involvement of the conventional Neural Network (NN), Logic-Based classifiers such as the Random Forest (RF) algorithm, Support Vector Machines (SVM), Bayesian methods, and a few of the semi-supervised and unsupervised methods which have been used for breast image classification. Hanna Dumky *et al.* in 2018 [10] stated that around 8023 women were diagnosed in Sweden with breast cancer. The paper elaborates that mammography examinations vary with the positioning of the patient. The study in the paper is conducted using qualitative methods. The paper identified three main categories: positioning of the patient, positioning of the detector, and compression. A fourth category, compliance, also emerged during the analysis work and was identified by the radiographers as being an important factor to be able to succeed with positioning and compression. Ahmed F. Yousef *et al.* in 2018 [11] stated that contrast-enhanced spectral mammography (CESM) enjoys high diagnostic accuracy. It works on principles having relevance with those of MRI and has a similar acceptance of contrast enhancement. The paper studied and compared CESM and MRI in the case of breast masses. The patients under study were of age range between 30 to 60 years. All multiple histologically proven lesions were detected by CESM (100%) and MRI (100%), with no significant difference in their size and number in both modalities. CESM is valuable for the diversity of local recurrence of post-treatment scarring after breast-conserving therapy and evaluation of residual tumor after treatment, with the unknown primary site of malignancy. K. Rajendra Prasad, M. Suleman Basha in 2018 [12] stated that detection of breast cancer is an emerging need that requires appropriate detection of the stages of breast cancer detection. The research paper makes use of a support vector classification method to perform mammogram classification. The paper presents the experimental results of classification performed on mammograms demonstrating the efficiency of SVM with underlying mechanisms of texture methods and it suggests the best combination of SVM and texture method to a radiologist for better medical diagnosis of breast cancer detection. K.U. Sheba, S. Gladston Raj in 2018 [13] stated the importance of detecting breast cancer at an early stage in order to reduce the death rate among women in the long term. The research paper is committed towards the growth of classification tools to distinguish among healthy, benign, and malignant breast parenchyma in digital mammograms. The system proposed in the research paper can be used as a reference reader for

performing a double reading of the mammograms and assisting radiologists in conducting clinical diagnosis in order to find out suspicious abnormalities. The regions of interest (ROI) are spontaneously noticed and segmented from mammograms by means of global thresholding via making use of Otsu's method and morphological operations. Nasrin Tavakoli, Maryam Karimi, Alireza Norouzi, Nader Karimi, Shadrokh Samavi, S. M. Reza Soroushmehr in 2019 [14] stated that the rate of mortality because of breast cancer can be minimized by initial analysis and conduct. Despite proposing several processing techniques for diagnosing breast masses, the rate of success has been on the lower side. The authors proposed a technique based on a deep learning method for classifying the breast tissues as benign (cancerous) or malignant (non-cancerous). The deep learning approach comprises CNN (Convolutional neural network) and decision mechanism. The completion of the preprocessing phase is followed by assigning a block around each pixel into a trained CNN to determine the pixel as normal or abnormal. The authors stated that employing the CNN intended for classification of the pixels of the suspicious regions enabled them to achieve enhanced results by obtaining the readings of 95 percent for AUC and 94.68 for accuracy. Natascha C. D'Amico, Enzo Grossi, Giovanni Valbusa, Francesca Rigiroli, Bernardo Colombo, Massimo Buscema, Deborah Fazzini, Marco Ali, Ala Malasevschi, Gianpaolo Cornalba, Sergio Papa in 2020 [15] performed research in which authors considered forty-five enhancing foci in 45 patients considering imaging follow-up or needle biopsy serving as a reference standard. 33 benign and 12 malignant lesions were present. There were 8 such benign lesions that had 5-year negative follow up and 15 malignant lesions were included to the dataset in order to offer reference cases to machine learning analysis. A 1.5-T scanner was used to perform the MRI examinations. 1 3-D T1 weighted unenhanced sequence was acquired followed by 4 dynamic sequences. Sensitivity, accuracy, and specificity were calculated for each classifier as point estimates and 95% confidence intervals (CIs). Sushreeta Tripathy and Tripthi Swarnkar in 2020 [16] elaborated on the critical role played by the identification of microcalcification and architectural distortion in mammogram images. The imaging offers additional information as compared to initial screening and enables enhanced focus on skeptical masses. The preprocessing of mammograms plays an important part to minimize the rateof false positive. The authors elaborate on the performance of HE (Histogram Equalization) and CLAHE (Contrast Limited Adaptive Histogram Equalization) responsible for enhancing the mammogram images. Both the techniques were inspected on mammogram pictures. The highly

contrasted pixels' percentage was recorded on mammograms. The authors proposed an innovative preprocessing technique based on statistical features like CII in order to detect artifacts in mammograms. The authors proposed that in future work the proposed preprocessing can be extended to perform further attributes extraction.

III. Proposed Workflow

The research to be conducted would involve three primary phases i.e. enhancement, segmentation, and classification of mammograms. The enhancement phase is intended to enhance the mammogram image under study by removing the noise and normalizing the mammogram image. The segmentation phase concentrates on focusing on ROI (Region of Interest) and detects any kind of microcalcification and minor of the lesions present within the mammogram image. Finally, the classification is conducted. This phase decides whether the mammogram understudy is benign (cancerous) or malignant (non-cancerous). For classification of the mammograms, supervised learning is brought into practice. Fig. 1 shows the different phases involved in analyzing mammogram images.

Fig. 2 Shows different techniques available for each of the three phases shown in Fig. 1.

The detailed workflow to be adopted for conducting the research work is proposed below in Fig. 3 as a flowchart followed by a detailed algorithm.
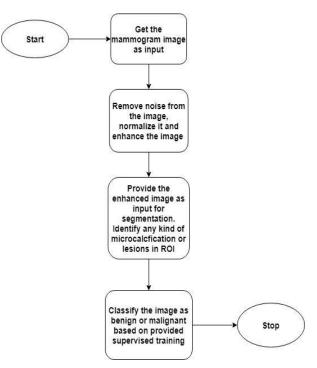
Fig. 1: Figure Shows the Different Phases Involved in Analyzing Mammogram Images
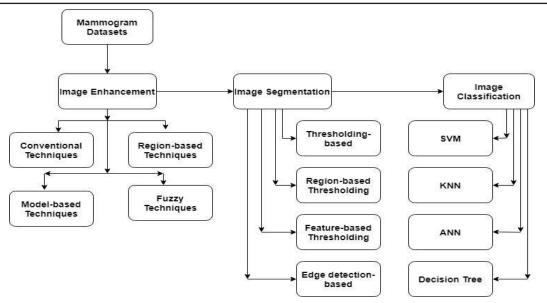
Fig. 2: Figure Shows Different Techniques Available in Different Phases of Research
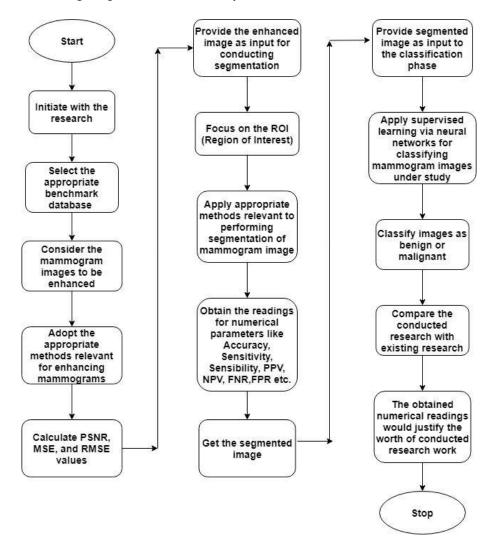
Fig. 3: Figure Depicts the Flowchart for the Detection of Breast Cancer in Three Phases

Algorithm

1. Initiate with the research
2. Select the mammogram images for the available benchmark databases like MIAS, DDSM, etc.
3. The mammogram image is enhanced using appropriate enhancement methods like CLAHE, Green Channel Complement, Morphological operations, etc.
4. The degree of enhancement achieved is measured using numerical metrics like PSNR (Peak Signal Noise Ratio), MSE (Mean Square Error), and RMSE (Root Mean Square Error)
5. The enhanced image is given as input to the segmentation phase. The ROI (Region of Interest) is extracted and undergo segmentation
6. The segmentation performed is measured in terms of achieved accuracy, specificity, sensitivity, PPV, NPV, FNR, FPR, etc.
7. The segmented image is further forwarded to the classification section
8. Classification is conducted using supervised learning via neural networks and image understudy is classified as benign (cancerous) or malignant (non-cancerous)

IV. Future Work

Detection of breast cancer is a significant social obligation as it has been a prominent cause of death among women due to cancer. Computer-aided techniques have significant importance in the detection of abnormalities which may be overlooked by even proficient radiologists. The modern digital mammography is an exciting development for conducting breast cancer screening and diagnostic applications. The research work would conduct promising initial experimental clinical tests particularly for masses with more illustrative clinical trials. The appropriate flowchart and algorithms would be constructed to accomplish each phase. The results obtained at each phase in numerical figures would be compared with the existing research and the worth of the conducted research would be compared and checked with the existing research. An appropriate simulation tool would be used for programming and calculate the figures of different performance metrics. The focus would be laid on maximizing the values of PSNR and accuracy keeping the value of MSE and RMSE as lower as possible.

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Effective Load Balancing in Cloud Computing using Improved Fruitfly Optimization Algorithm

Dhiraj Kapila[1], Dr.Vijay Dhir[2]

[1.]Ph.D Research Scholar, Research and Development, Sant Baba Bhag Singh University,
Sant Baba Bhag Singh University, Jalandhar, Punjab

[2]Director Research, Research and Development, Sant Baba Bhag Singh University,
Sant Baba Bhag Singh University, Jalandhar, Punjab

Abstract—Cloud computing is a new way of providing services over the Internet. Load balancing is an essential feature of cloud computing because it prevents nodes from being overwhelmed while others remain idle. Load balancing mechanisms that work well improve the overall efficiency of the system. As a result, a hybrid optimization algorithm is used in the current approach to use the effective load-balancing algorithm. While this hybrid solution achieves better load balancing than the conventional process, it is not without its flaws. To solve those drawbacks, the proposed approach is used here. The existing load-balancing algorithm requires more operating time for load balancing. The clustering algorithm compiles the available tasks at first. By balancing the load and reducing the virtual machine, tasks can be clustered (VM). If there are no clusters, single jobs are allocated to virtual machines, and the need for these dynamically created virtual machines grows in real time. The proposed modified K means clustering algorithm is used to cluster the available tasks. After the clustering process, the proposed load balancing approach used an optimization algorithm. The opposition fruit fly algorithm (OFFA) is used to balance the load in our suggested technique. In terms of processing and convergence time, migration cost value, and load usage, the proposed algorithm's output will be evaluated. Java can be used to build a cloud SIM simulator.

Keywords: Load Balancing, K Means Clustering, Oppositional Fruit Fly Algorithm and Virtual Machine

I. Introduction

The internet service has given vendors a new business forum, allowing them to do more profitable business than they could before. This technique allows users to access information from a variety of devices, including laptops, cell phones, and tablets [3]. As a result of this growth, the internet business attracts a lot of attention from a variety of sources, resulting in an abundance of data. Maintaining all of this data in a single location or on some other hardware unit, on the other hand, is difficult. As a result, the cloud computing paradigm has given rise to a modern infrastructure for storing and retrieving data in third-party servers that are rented to beneficiaries on a pay-per-use basis [1][6]. This is a

method for accessing storage space from anywhere on the planet. Cloud service is a strategy for gaining access to heterogeneous services that includes features such as self-service on demand, scalability, resource pooling, limited network access, rapid elasticity, and higher availability [14]. Furthermore, the company's offerings are divided into three categories: software as a service (SaaS), application as a service (PaaS), and infrastructure as a service (IaaS) [5]. With the authorization of service providers, users may access cloud services. The cloud service provider takes into account the user's request and allocates resources based on their demand and budget. [7] [10]. Protection, efficient load balancing, resource planning, scalability, QoS management, data center energy usage, data lock, and service availability are all challenges that have arisen as a result of the growth of multiple applications based on concurrent access to cloud resources [15]. Load balancing is one of the most important factors in maximizing throughput. Meanwhile, it lowers costs and response times, increases resource efficiency and performance, and thus lowers datacenter energy consumption. Load balancing will ensure service efficiency by monitoring the health of the corresponding application servers and directing traffic away from failed nodes [2] [12]. Since a large number of users may submit requests at the same time, the server may fail to respond to the users request immediately in certain cases [4]. This necessitates the creation of efficient load balancing techniques in order to sustain service quality (QoS) [13]. Allocating and optimizing resources in the data center is a critical activity for achieving efficient load balancing operations and avoiding resource overloading and imbalance [8]. Load balancing is divided into two categories: static and dynamic. Static load balancing is effective for low variations in workload and device activity because it deals with average system operations in terms of workload balancing. Dynamic load balancing, on the other hand, deals with advanced system operations and is capable of dealing with a high degree of variance in workload and system actions. In cloud computing,

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an effective task scheduling algorithm is needed for effective load balancing [11]. Genetic Algorithm (GA), Particle Swarm Optimization (PSO), and Ant Colony Optimization (ACO) are some of the algorithms used for efficient load balancing in cloud computing [9].

II. Literature Review

Cloud computing is a modern type of website that is operated and provides services over the Internet. This new topic has recently gotten a lot of attention from researchers. Project preparation is one of the factors for high productivity in a cloud setting. Since task planning is an NP-complete challenge, meta-heuristics planning approaches have been used in many cases. BahmanKeshanchi *et al.*[16] have proposed a powerful and improved genetic algorithm for optimizing task scheduling solutions. The proposed method has many benefits, including the use of evolutionary genetic algorithms and heuristic methods. A behavioral modeling methodology based on the paradigm provided by experimental techniques is used to analyze the correctness of the proposed algorithm. Linear Temporal Logic (LDL) formulas are used to derive the expected specification. They used the labeled transformation system (LDS) method to get the best results in the validation of the proposed method. Furthermore, NuSMV and PAT model validation were used to test the proposed behavioral models.

Ruilong Deng *et al.* [17] have developed a modern technique to provide an efficient technique in the fog cloud computing system that is focused on the tradeoff between power consumption and transmission delay. The blocked service delay between the optimum allocation of workload to workload allocation problem was established using fog and low power consumption. The issue was addressed by resolving the primary problem of the three sub-problems connected with the destruction of the sub-systems using the estimated method. Finally, they demonstrated that fog computing can dramatically boost cloud computing efficiency by sacrificing moderate computational resources to conserve communication bandwidth and reduce transmission delays, based on simulations and numerical results. Internet of Vehicles (IoV) has been extensively researched in recent years and is one of the core technologies of cloud computing IoV. It has received a lot of attention in recent years and is one of the most important cloud computing IoV technologies. Despite the fact that cloud computing offers high-performance computing, storage, and networking facilities, IOV still has processing times, limited mobility, and lacks location knowledge. To fix these issues, Xiuli He *et al.* [18] have combined fog computing and software defined networking (SDN). Fog computing and storage

at the network's edge with extended computing, which, in addition to providing mobility support and position awareness, reduces delays dramatically. Meanwhile, SDN provided the network with adaptive unified control and universal knowledge. They have a new SDCFN-controlled optimization based on modified particle swarm optimization in the IoV software-defined cloud/fog networking (SDCFN) system to be used effectively (PSO-CO) Proposed an algorithm that used the opposite of the mutant particles' plane.

In a heterogeneous cloud world, Qi Liu *et al.* [19] proposed an adaptive scheme to achieve time and space efficiency. A dynamic speculative execution strategy based on real-time cluster resource management was presented to reduce Map phase execution time, and a prediction model was used to predict task execution time quickly. An adaptive approach to improve space-time efficiency is obtained by combining the prediction model with a multi-objective optimization algorithm.

For cloud-hosted SIP servers, Ahmadreza Montazerolghaem *et al.* [20] proposed a virtual load balanced call admission controller (VLB-CAC). VLB-CAC specifies the best "call admission speeds" and "signaling routes" for admitted calls, as well as the best CPU and memory resource allocation for SIP servers. A new linear programming model was used to find the best solution. As input, this model needed some crucial information from SIP servers. In addition, the VLB-CAC was outfitted with an auto scaler to help it resolve resource constraints.

An energy-aware operating model for load balancing and application scaling on a cloud was developed by AshkanPaya and Dan C. Marinescu [21]. Their strategy was based on identifying an energy-efficient operation regime and attempting to optimize the number of servers operating in it. To save resources, idle and lightly loaded servers were moved to one of the sleep states. Some of the most attractive aspects of server consolidation mechanisms discussed in the literature were also utilized by the load balancing and scaling algorithms.

In a multistage routing scenario, HoumanRastegarfar *et al.* [22] performed a novel scalable analysis to research load-balancing tradeoffs between network-layer benefits and physical-layer penalties. In order to achieve performance interesting for a data center, their cross-layer simulations looked at the specifications of a wavelength-routing load balancer based on AWG and tunable wavelength converters (TWCs).

III. Proposed Method

Cloud computing is a new way of delivering services over the Internet. Load balancing is an essential part of cloud computing since it prevents certain nodes from

being overwhelmed when others are idle or have no work to do. Good load balancing algorithms can improve the overall efficiency of a system. As a result, a hybrid optimization algorithm is used in the current work to implement an effective load balancing algorithm. Even though this hybrid solution results in better load handling, it takes longer to do so. To address these issues, a load balancing algorithm that is both efficient and effective is proposed. The available tasks are first clustered using a clustering algorithm. The proposed technique uses a modified k means clustering algorithm to cluster the available tasks. Related tasks are clustered using this clustering algorithm. After the clustering method, the proposed technique uses an optimization algorithm for load balancing. The oppositional fruit fly algorithm (OFFA) is used to balance the load in our suggested technique. For successful load balancing, each cluster group is given to an optimization algorithm. Figure 1 depicts the proposed flow diagram.
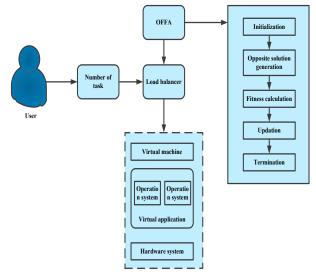
Fig. 1: The Flow Diagram of Proposed Method

In the proposed method, each submitted task contains a number of sub-tasks. Each task needs to be implemented in one VM instance type. Consider that

$PHM=\{PHM_1, PHM_2,...., PHM_x\}$ is a set of cloud physical machine. $VIM_i =\{VIM_1, VM_2,... VIM_y\}$ is a set of virtual machines (VM) types and $T= \{T_1, T_2,..., T_z\}$ is a set of task. The proposed load balancing is carried out after the related tasks are organized using a modified k means clustering algorithm. The modified k means clustering algorithm is described in detail below,

A. Modified K Means Clustering Algorithm

Clustering is a technique for categorizing a collection of data into a certain number of categories. The k-means clustering method is a common clustering method. It divides

a collection of data into a number of disjoint clusters (k). Clustering tasks increases efficiency by optimizing load and reducing the number of virtual machines used to run a single task at the same time. If tasks aren't clustered, single jobs are allocated to virtual machines, and the need for dynamically created virtual machines grows in real time. The standard k means clustering algorithm is updated by using a similarity measure in our proposed process. The method considers Minkowski Distance, probability-based measure, and Euclidian Distance as similarity measures. The steps in updated k-means clustering are shown in the diagram below.,

Step 1:Initialization

Assume $T = \{T_1, T_2,..., T_z\}$ be the set of task and Let $C = \{C_1, C_2,..., C_z\}$ be the set of centers.

Step 2: Cluster center selection

From the initialized parameters, randomly choose the cluster centers as "C" for grouping.

Step 3:Distance calculation

Using their comparing state, determine the distance between each task and cluster centers. The proposed method takes into account Minkowski Distance, probability-based calculation, and Euclidian Distance as distance measures.

Minkowski Distance: The summed up distance metric is also known as the Minkowski Distance. Take note of the fact that when n=2, the distance becomes the Euclidean distance using the equation below. The Chebyshev distance metric is a variant of the Minkowski distance metric, in which n=1 (taking a point of confinement). This gap can be used to account for both ordinal and quantitative variables.

$$\text{Distance}_{xy} = \left(\sum_{t=1}^{d} \left| X_i - Y_j \right|^{\frac{1}{n}} \right)^{n} \qquad (1)$$

Where X indicates the desired value and Y indicates the predicted value.

Probability-based Measure: For attributes of unknown objects, probability appropriations are essential. Here, an unknown entity is shown as a constant and discrete arbitrary variable, respectively, to describe uncertain data in both consistent and discrete areas. Then, in the discrete case, use the well-known KullbackLeibler (KL) dissimilarity to calculate the similarity between unknown objects using the equation below,

$$P(X \| Y) = \sum_{x \in P} X(t) \log \frac{X(t)}{Y(t)} \qquad (2)$$

The obtained probability values are then used to cluster unknown data using the K-centroid technique. In comparison to traditional clustering techniques, the K-centroid clustering algorithm is more efficient in light of KL disparity similarity.

Euclidian Distance: Euclidean distance is commonly used in clustering problems, including content clustering. The Euclidean distance is also the default distance calculation used by the K-means algorithm. The root of square contrasts between the directions of a couple of articles are determined by the Euclidean distance, as shown below,(3)

Where, t is the number of task and C is the number of cluster center.

Step 4: Assigning data point

Then, based on size, assign all of the data to the nearest center whose distance from the cluster center is the smallest of all the cluster centers.

Step 5: New cluster center

After assigning all the data, recalculate the new position of the center.

$$C_{new}(i) = \left(\frac{1}{C_i}\right)\sum_i^{c_1} T_i \qquad (6)$$

Where, T_i represents the number of task.

Step 6: Recalculate the distance between each data point and new obtained cluster centers.

Step 7: If no data point was reassigned then stop, otherwise repeat from step (3).

The suggested technique groups the available tasks based on the above method. After that, each group is fed into the next step of the process.

B. Load Balancing Using Oppositional Fruit Fly Algorithm (OFFA)

After the clustering method, the proposed technique used an optimization algorithm for load balancing. The oppositional fruit fly algorithm (OFFA) is used to balance the load in our suggested technique. For successful load balancing, each cluster group is given to an optimization algorithm. The load balancing objective feature is based on three parameters: total time, migration cost, and load utilization. The problem can be formulated by using equation (7).

$$F = \sum_{i=1}^m \min(T_i, C_i, L_{U_i}) \qquad (7)$$

Our research's objective function is defined in equation (1). The total time of the task is represented by the first term of equation (7), the migration cost is represented by the second term, and the load consumption is represented by the third term. The proposed algorithm for efficient load balancing will be used to minimize the above objective function in this paper. Below is a thorough description of the oppositional fruit fly algorithm (OFFA),

C. Oppositional Fruit Fly Algorithm (OFFA)

Fruit fly algorithm is a program that simulates fruit fly foraging behavior. The fruit fly algorithm is a new way of looking for global optimization. It all started with a study of fruit fly swarm food hunting behaviors. Fruit flies have excellent osphresis and vision, making them excellent food hunters. To begin, it detects a food source by smelling a variety of scents floating around and flies toward the appropriate location. With its delicate vision, it can discover food or go to that specific location after getting close to the food. The optima reflect food sources, and the technique of foraging is replicated in the fruit fly by iteratively searching for the optima. The oppositional approach is used to adapt the standard fruit fly algorithm. The current agent and its opposite agent are considered simultaneously in opposition based learning to get a better approximation for the current agent solution. It is assumed that an opposite agent solution has a higher chance than a random agent solution of being closer to the global optimal solution. The adaptive fruit fly optimization algorithm's step-by-step process is outlined below,

1. Initialization

The proposed OFFA's key parameters are the total evolution number and the number of tasks in each category. The number of virtual machines is represented by a fruit fly in our proposed technique. Create a random virtual machine position (VA axis, VB axis). The main goal of this paper is to assign tasks to virtual machines in the most efficient way possible based on their efficiency.

2. Opposition based learning (OBL)

The oppositional approach is used to change the standard fruit fly algorithm. The current agent and its opposite agent are considered simultaneously in opposition based learning (OBL) to get a better approximation for the current agent solution. It is assumed that an opposite agent solution has a higher chance than a random agent solution of being closer to the global optimal solution. Components of absolutely describe the opposite virtual

machine positions V_t.

$$OV_t=[OV_t^1,OV_t^2,.....OV_t^d,] \qquad (8)$$

Where $OV_t=Low_t+Up_t-V_t$ with $OV_t \in [Low_t,Up_t]$ is the position of ^{t} the virtual machine OV_l in the dth dimension of oppositional virtual machine.

Exploration is done by arbitrary path and virtual machine selection. Here, V_t is the tth location of virtual machine.

$$V_t\,(a,b)=(VA_t,VB_t)^T$$

$$VA_t=VA\_axis + Random\ Value$$

$$VB^t=VB\_axis + RandomValue \qquad (9)$$

Best position selection of suggested virtual machine,

$$BV^t = minF$$

$$best\ virtual\ machine=function(Min\ BV_l) \qquad (10)$$

Find the most excellent virtual machine.

$$[Excellent\,virtual\,machine\,Excellent\,selection]=min(F) \qquad (11)$$

Retains the best virtual machineand a, b coordinate, the fruit fly swarm will utilize visualization to flutter in that direction.

$$selected\ virtual\ machine = minF$$

$$VA\_axis = VA)Excellentindex)$$

$$VB\_axis=VB(Excellentindex \qquad (12)$$

Enter successive optimization to repeat the execution of stages 8-12, then determine if the current weight value is better than the previous weight value, and if so, perform task 7. The virtual machines are thus optimally selected using the AFFO algorithm, and the chosen task is then allocated to the cloud computing phase.

IV. Result and Discussion

This section examines the experimental effects of the proposed methods. The proposed method's algorithm is an oppositional fruit fly algorithm that is used to improve load balancing in a cloud setting. The cloud sim device was used to implement the solution in JAVA.

Experimental Results

Using the OFFA algorithm, the proposed approach is used to effectively load balance in cloud computing. First, the N number of tasks and M number of virtual machines are assigned. The suggested approaches use migration cost and load usage to manage the load. Initially, we consider work 200 to be a simple task. The load balance is different for each step of the iteration variable. The following is a brief outline of the proposed

Table 1: Load Balancing of the Proposed Method

Iteration	Load Balancing	
	VM=20, PM=20	VM=30, PM=20
1	0.448	0.446
2	0.443	0.446
3	0.440	0.442
4	0.437	0.434
5	0.433	0.438
6	0.410	0.420
7	0.359	0.389
8	0.352	0.380
9	0.347	0.370
10	0.340	0.360

method

The table 1 indicates the proposed method of load balancing iteration. Here the iteration varies from 1to 10. The iteration is 1, if the vm=20 is 0.448, vm=30 the load balancing is 0.446. If the load balancing is 0.443 for vm=20, and vm=30 the load balancing is 0.446. When the iteration is 3, vm=20 for 0.440 and 0.442 in vm=30. In 4thiteration the loads balancing are0.437 and 0.434 in virtual machine sets are 10 and 20 respectively. For 5th iteration vm=20, the load balancing is 0.433 and 0.438 for vm=30. The iteration value is 6, the vm=20, the load balancing is 0.410 and vm=30 is 0.420. In 7th iteration vm=20 is 0.359 and vm=30 is 0.389. For 8th iteration the load balancing values are 0.352 and 0.380 and the virtual machine sets are 20 and 30. In 9th iteration the vm=20 is 0.347 and vm=30 is 0.370. The vm=20 is 0.347 and vm=30 is 0.370 and the iteration is 10. The processing time of the proposed method is tabulated in table 2;

Table 2: Processing Time of the Proposed Method

	Task	Processing Time(ms)
Vm=20 Pm=20	100	21030
	200	28743
Vm=30 Pm=20	100	22430
	200	29290

The Table 2 indicates the proposed method of processing time in terms of task. In OFFA proposed method, we set the virtual machine is 20 and physical machine is 20 and the task is assigned by 101 and 200. The processing time of the proposed method is 21030ms, the task is 100 and the virtual machine is 20. When the physical machine is 20 the task is 200 and the

processing time is 28743ms. The processing time of the proposed method is 22430, vm=30 and the task is 100. If the task is 200, vm=30, the processing time is 29290. The convergence of the proposed method is tabulated in 3.

TABLE 3: CONVERGENCE TIME OF THE PROPOSED METHOD

	Task	Convergence time(ms)
Vm=20 Pm=20	100	16
	200	14
Vm=30 Pm=20	100	22
	200	24

Table 3 represents the convergencetime of the proposed method. When we analyzing the above table, we can set the value physical machine is 20 and virtual machine is 20, the task is 100 processing time obtained the value is 16ms and the task is 200 the processing time achieves the value at 14ms. In vm=30 and pm=20, the value is 22ms and 24ms for processing time in task 100 and 200.

Comparative Analysis

For comparison analysis our proposed method is compared with other existing methods. Proposed method is implemented by OFFA, whereas, existing methods namely HPSOGA, PSO, PSO and GA algorithms were used. In load balancing, the task is 200 and here also we set the physical machine and virtual machine value is 20.

TABLE 4: COMPARATIVE ANALYSIS OF LOAD BALANCING

Iteration	GA	PSO	Proposed method (OFFA)
1	0.495	0.455	0.448
2	0.477	0.451	0.443
3	0.474	0.448	0.440
4	0.462	0.440	0.437
5	0.459	0.445	0.433
6	0.444	0.428	0.410
7	0.440	0.418	0.359
8	0.412	0.417	0.352
9	0.409	0.400	0.347
10	0.408	0.395	0.340

When analyzing the above table, represents the comparative analysis of load balancing of existing method. The iteration of the proposed method is 1 the genetic algorithm value is 0.495, optimization based PSO algorithm value is 0.455, and the proposed method OFAA reaches from 0.448. If the iteration is 2, the values are 0.477, 0.451for GA, PSO respectively. Here the proposed method is achieved by0.443. The proposed value is

Minimum when comparing the existing than proposed method. 0.474 is genetic algorithm, 0.448 is for PSO and 0.432 in the iteration 3 and the proposed method value attains the 0.440. The iteration value is 4, the value of genetic, PSO 0.462, 0.44 and the proposed method is 0.437. In the proposed and existing value of iteration 5 has 0.459, 0.445, and 0.433. Here the proposed value is minimum than the existing method. If the iteration value is 6, the load balancing value attains the specific algorithm the genetic algorithm reaches the value is 0.444, the optimization algorithm has 0.428, the existing method is 0.410 and the proposed method has 0.370. 0.440 has genetic algorithm, 0.417 has PSO algorithm, and the proposed method value is 0.359 for 7th iteration. For the iteration is 8, the genetic algorithm value is 0.412, the PSO value is 0.417. Here the proposed method value reaches the 0.352. The existing value is 0.409, 0.400achieved for GA, PSO and the proposed method reaches the 0.347 for the iteration 9. In the iteration value is 10, the genetic algorithm is 0.408 and the optimization algorithm is 0.395and proposed method OFFA attains 0.340.
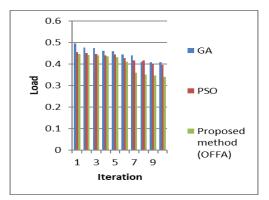
Fig. 2: Graphical Representation of Load Balancing

Comparative analysis of the proposed against the existing method based on the number of the migration is given by,

TABLE 5: COMPARATIVE ANALYSIS OF NUMBER OF MIGRATION

Iteration	Number of migration		
	GA	PSO	OFFA
1	20	20	10
2	20	20	10
3	20	20	10
4	20	20	11
5	20	20	10
6	20	20	10
7	20	20	10
8	20	20	10
9	20	20	11
10	20	20	11

From the above table, the iteration is varies from GA, PSO, algorithm achieves the same migration value. But the proposed OFFA method gets minimum migration value when compared to the existing PSO and GA. The graphical representation of the comparative analysis is given by,
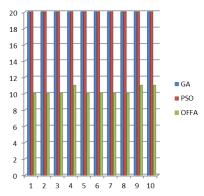
Fig. 3: Graphical Representation of Number of Migration for Different Methods

Comparative analysis of the proposed against the existing methods based on the processing time is tabulated by,

TABLE 6: COMPARATIVE ANALYSIS OF PROCESSING TIME

	OFFA	PSO	GA
100	22430	23548	24158
200	29290	31247	32325

The above table represents the processing time as compared with different existing method and proposed method. We assign the processing time physical and virtual machine is 20, the tasks are 100 and 200. The task is 100, and the processing time of the proposed method is 22430. The processing time of the existing method is 23548 and 24158 respectively. The task is 200; the processing time of the proposed method is 29290 which islow as compare to other existing method. The graphical representation of the processing time is given by,
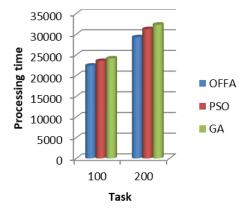
Fig. 4: Comparative Analysis of Processing Time

Comparative analysis of the proposed method against the existing method based on the convergence time is tabulated by,

TABLE 7: COMPARATIVE ANALYSIS OF CONVERGENCE TIME

Task	Convergence Time			
	PM=20, VM=20			
	OFFA	HPSOGA	PSO	GA
100	17	18	21	22
200	15	16	21	24

The above table represents thecomparative analysis of the proposed against the existing method isconvergence time. When analyzing the above table, the Physical machine and Virtual Machine value is set to 10. For Task 100, the combined time will be 17ms for the proposed method value, and the existing HPSOGA, PSO and GA value times will be 21ms, 18ms and 22ms. The time of convergence of the proposed method value reaches 15 m and the existing method task reaches 21ms, 16ms and 24ms for 200. Below is a graphical representation of comparing the convergence time for different tasks,
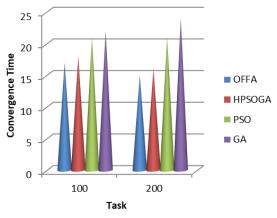
Fig. 5: Comparative Analysis of Convergence Time
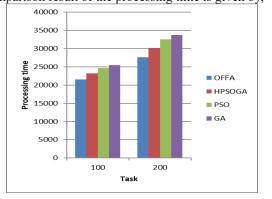
Comparative analysis of the proposed method against the existing method of processing time is tabulated by,
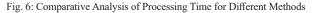
TABLE 8: COMPARATIVE ANALYSIS OF PROCESSING TIME

Task	Processing Time			
	VM=20, PM=10			
	OFFA	HPSOGA	PSO	GA
100	21564	23187	24685	25478
200	27621	30154	32548	33695

When analyzing the above table, we assign the virtual machine is 20 and the physical machine is 10. The task is 100, the proposed method is 21564 and the existing methods are 23187ms, 24685ms and 25478ms

respectively. The processing time of the proposed method is 27621ms, the existing methods of processing time is 30154ms, 32548ms and 33695ms respectively. Comparison result of the processing time is given by,

Fig. 6: Comparative Analysis of Processing Time for Different Methods

Comparative analysis of the convergence time of proposed against the existing methods are tabulated by,

TABLE 9: COMPARATIVE ANALYSIS OF CONVERGENCE TIME

Task	Convergence time		
	VM=20, PM=20		
	OFFA	PSO	GA
100	16	24	28
200	14	23	31

The above table represents the comparative analysis of the proposed against the existing method is convergence time. When analyzing the above table, the Physical machine is set to 20 and Virtual Machine value is set to 20. For Task 100, the combined time will be 16ms for the proposed method value, and the existing, PSO and GA value times will be 24ms, and 28ms. The time of convergence of the proposed method value reaches 22ms and the existing method task reaches23ms and 31ms for 200. Below is a graphical representation of comparing the convergence time for different tasks,
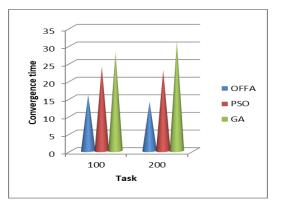
Fig. 7: Comparative Analysis of Convergence Time for Different Time

From the results section, our proposed method achieves the best result in comparison with other approaches that we clearly understand.

V. CONCLUSION

The oppositional fruit fly algorithm is used to illustrate an efficient load-balancing method in this analysis. In comparison to other approaches, the proposed load balancing solution can be used to increase planning performance. The algorithm attempts to strike a balance between migration costs, load, and processing time. How to delegate users tasks to manage the load is crucial to the load balancing process. To achieve efficient load balancing, this OFFA algorithm was used. The proposed work's experimental findings are compared to the standard PSO and GA algorithms. Our proposed load balancing strategy outperforms other methods, as shown by the results..

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Artificially Intelligent Robots

Dr. V.K. Banga

Professor, Electronics and Communication Engineering
Formerly known as Amritsar College of Engineering and Technology,
Amritsar Group of Colleges, Amritsar, India
Email: vijaykumar.banga@gmail.com

Abstract—**Robots are working in every field in today's world. This paper is about the exploration of Artificially Intelligent robots for the benefit of industry and society. Robots that are faster, more efficient, and more intelligent— can only fulfill the demand of an industry. Earlier robots were referred to as programmable machines, which can able to work for long hours and in hazardous conditions. Now it is transformed into the intelligent machine which able to perform its job as per the requirement of the situation. Autonomous robots are quite popular nowadays, which refers to robots that are capable of making their decisions as per the situation of their work. Further, we are moving to the more advanced version of robots known as Humanoid robots, which mimic the behavior of human beings and respond in the same manner with the application of Artificial Intelligence (AI). In this paper, we have presented an extensive view of Artificially Intelligent robots.**

Keywords: Robots, Artificial Intelligence, Kinematics, Autonomous Robots, Optimization, Humanoid Robots.

I. Introduction

Robots are part of every industry from entrainment to any manufacturing industry. The increasing use of robots in the industry helps to reduce the risk of humans in a hazardous environment and take care of the fatigueness due to repetitive tasks [7]. On the induction of robots in the industry, it requires flexibility to modify as per the change of process and also to incorporate intelligence to adapt to any changes required. Major parts of industrial robots are movable mechanical structures. The mechanical structure of a robot is usually a kinematic chain that functions similar to the structure of the human body [1, 8]. Robots' different parts (links) act like human bones and are called links, and actuators used to provide force to the joints act like human muscles. One link is connected to another link through joints, and movement of the links is known as DOF[4.8].

Different sensors have been used to sense the environment and accordingly provide feed back to control the process. The autonomous robot structures effectively utilize the sensors so that proper path planning can be accomplished for the assigned tasks with minimum involvement or without the involvement of the operator[14]. Path planning is a very challenging issue in the case of autonomous robots[2].

Artificial intelligence may greatly increase the efficiency of the existing use of robots in industry. But it may have an even larger impact by making more research and development to develop efficient intelligent robots. To develop more efficient robots, there is a need for more processing and data handling for developing expert-system-based system design using AI techniques. [15].

II. Autonomous Robots

As the use of robots is increasing in industry day by day. Robots are now taking their own decisions as per the situation. There is a very important role of soft computing in developing Autonomous robots which are capable of making the decision on their own by using expert systems [18, 19]. These kinds of robots, if want to move from position A to position B. One method is that you definea complete trajectory for the movement of the path from position A to B. Whereas if we are using AIand robots can take their decision as per obstacles present in their path and will reach position B from A by deciding their path, such robots are revolutionary in the field of robotics and known as Autonomous Robots [9, 22].

These robots are very useful for human society and play a very important role in supporting life.AI-based wheelchair robot navigation has been used to control joystick in the indoor environment by interacting with the surrounding environment. The data taken from sensors has been used to train the neural networks and to control the movement of the wheelchair in the indoor environment under an undefined space. The results showthat it is efficient for mobile robot navigations[23].

Mivar expert system has been used for the implementation of Autonomous Intelligent Robots. The new expert technologies can handle millions of instructions to develop Autonomous robots. Mivar decision-making system can control a group of small robots[29].

III. Humanoid Robots

In recent years, our whole focus of robotics is on Humanoid Robots. As it is very clear from the name, it's kind of robots which mimics the behavior of human being

and perform the tasks as human beings are performing. These robots are not only taking their decisions to own their own, as well as they,can also interact with us like human beings. These robots behave like human beings and can walk or run, speak,etc. [31].

These robots can work for you in your office, home, etc.,and can able to assist you in many tasks. It is very fascinated that,these machines respond you in the same manner as a human being.

In such robots,there are so many sensors, computing using machine learning, AI, soft computing incorporated to make them intelligent robots. AI social robots are using in the service delivery industry to measure consumers' trust. Trust-worthy robot function and design are formed by anthropomorphism, robot performance, and effort expectancy. Trust-worthy service task is assessed by perceived service risk, robot service fit and facilitation robots use conditions[28].The interactive model of representation and its applications in artificial intelligence (AI) and intelligent robotics are in great demand[15]. It is a very challenging issue to improve the interaction between artificial systems and their users. Researchers are making efforts to develop social robots which are not only intelligent but also emotionally sensitive. Artificial Emotional Intelligence (AEI) is focused on developing robots that are capable of expressing emotions in human-robot interaction (HRI). Such robots can interact as per the emotional state of human beings and express their emotion accordingly[30].

Researchers have advocated for the inclusion of emotion-related components in autonomous robots for better communication with humans. The framework for this beyond the standard approaches and proposes that emotion and motivation need to be integrated with all aspects of the architecture. So, Cognitive–emotional integration is prime parameters for design problems for integration of emotion and motivation[25].

IV. Role of Artificial Intelligence

There is a very crucial issue regarding monitoring, Certification, and verification of Autonomous robots and intelligent systems on the aspect of legal and technical issues [24].

In reference to Industry 4.0 to Robotics 4.0, In Intelligent robots, including motion, computing, perception, and cognition will be integrated to fulfill industry demand and to be acceptable in society[26].

In the recent year's role of robots have been become very prominent in the field of medical industry for contactless disinfection. Autonomous robots can perform their task on their own to disinfect the air and surface of the hospital, which in result reduce the risk of occupational exposure of the staff. It also improves the overall efficiency of the work and supports the medical industry[27].

To develop intelligent machines, we have to work in an uncertain and unknown environment. Machine learning plays a vital role in developing such intelligent machines. To develop artificially Intelligent robots, two major approaches like expert systems and neural networks have been widely used[3].

A. Soft Computing

Soft Computing (SC) is an evolving collection of methodologies, which aims to exploit tolerance for imprecision, uncertainty, and partial truth to achieve robustness, tractability, and low cost. SC provides an attractive opportunity to represent the ambiguity in human thinking with real-life uncertainty. Fuzzy logic (FL), neural networks (NN), and evolutionary computation (EC) is the core methodologies of soft computing. However, FL, NN, and EC should not be viewed as competing with each other, but synergistic and complementary instead[9].This problem is well addressed by neuro-fuzzy techniques because a solution is not easily found by analytical or numerical techniques. While an analytical technique is difficult, moving an arm in the presence of an obstacle can be instinctively performed. Neuro-fuzzy systems excel in using sample data to determine an input-output relationship. Neural networks bring to this solution the ability to learn while fuzzy logic is based on mimicking an expert's thinking. In addition, as hardware technology progresses, more and more value will be placed on solutions that can utilize parallel processing, like neural networks. The field of neuro-fuzzy technology has gone in many directions. The neuro-fuzzy technique replaces the traditional fuzzy logic system with a multilayer back propagation neural network. This type of system is beneficial for several reasons. While it is true that a child can move an arm around an obstacle to reach the desired goal, that ability is intuitive. Putting the instructions for performing such a task into a neat, fuzzy logic, IF/THEN rule base is not easy [12]. Thus, there is a necessity for the neural network to learn the rules. The fuzzified and defuzzifiers necessary for any fuzzy system provides an interface between an expert's control of a simulated arm and the neural network. GAs are tools on probabilistic and casualty, not necessarily they will have the same type of evolution when applied to the same problem. GAs are slower because they are tools of evolution and not for specific optimizations [11]. They are simpler, easy programming, and demand less mathematics complexity to describe the process to be optimized. ANN and fuzzy logic techniques required more information regarding the system and more mathematics as compared to GA. The great advantage observed in the GAs arethe tool of easy application and in robotics they could be thoroughly used to do several tasks, needing for that only a small description of the problem.

B. Genetic Algorithms

Characteristics of present computer methods inspired by biological evolution are classified as evolutionary computation. Evolutionary computation is the name given to a collection of algorithms based on the evolution of a population toward a solution for a specific problem. These algorithms can be used successfully in many different applications that require the optimization of a certain multi-dimensional function. The population of possible solutions evolves from one generation to the next, ultimately arriving at a satisfactory solution to the problem [10]. These algorithms differ in the way a new population is generated from the present one, and in the way, the members are represented within the algorithm. The three main elements of evolutionary computation are *Evolution Algorithms (EA)*; *Genetic Programming (GP)*; *Genetic Algorithms (GA)*. Each of these three techniques imitates the processes observed in natural evolution and provides efficient search results [6].A Fuzzy Logic Controller (FLC) is viewed as an individual. A population includes a group of FLCs. The running of the robot with the FLCs in the evaluation process. As the antecedents of an FLC are pre-defined, only the FLC consequences are encoded as chromosomes.

C. Fuzzy & Expert Systems

Fuzzy Logic FL and Expert System ES are well established as useful technologies that complement each other in a powerful hybrid system. Hybrid intelligent systems are now part of the repertoire of computer systems developers and important research mechanisms in the study of Artificial Intelligent. The integration of ES and FL has proven to be a way to develop useful real-world applications, and hybrid systems involving robust adaptations. In order to reach a goal, learning vehicles rely on interaction with their environment to extract information. ES and FL have been recently recognized to improve learning and adaptation where information is inaccurate, uncertain, and imprecise. Particularly, the use of this integration (FL and ES) is necessary to bring Intelligent Autonomous Vehicle (IAV) behavior near the human one in recognition, learning, decision-making, and action. Thus, several integrations of FL and ES-based navigation approaches have been developed. The interest in FL_ES aims to understand principles of human thinking and to build machines that can perform complex tasks requiring massively parallel computation. Essentially, this approach deals with cognitive tasks such as learning, adaptation, generalization, and optimization.

Expert System: An ES is a computer program that functions, is in a narrow domain, dealing with specialized knowledge, generally possessed by human experts. ES is able to conclude without seeing all possible information and is capable of directing the acquisition of new information efficiently.

D. Neuro-Fuzzy Techniques

From a historic perspective, neuro-fuzzy systems became the first representative of hybridization in soft computing. Neuro-fuzzy systems incorporate the knowledge representation of fuzzy logic with the learning capabilities of artificial neural networks. Both methodologies are concerned with the design of intelligent systems albeit from different directions. The power of neural networks stems from the distributed processing capability of a large number of computationally simple elements. In contrast, fuzzy logic is closely related to reasoning on a higher level. Pure fuzzy systems do not possess the capabilities of learning, adaptation, or distributed computing that characterize neural networks. On the other hand, neural networks cannot represent knowledge in a manner comprehensible to humans, a key feature of fuzzy rule-based systems. Neuro-fuzzy systems bridge the gap between both methodologies, as they synthesize the adaptation mechanisms of neural networks with the symbolic components of fuzzy inference systems, namely membership functions, fuzzy connectives, fuzzy rules, and aggregation operators [5,20].

During training, the robot is controlled either by a human or a previously designed controller. The recorded state-action pairs serve as training examples during supervised learning of neuro-fuzzy control rules. The robot successfully imitates the demonstrated behavior after iterations. The scheme follows a two-stage tuning approach; in the first phase supervised learning determines the coarse structure of input-output membership functions. The second reinforcement learning stage fine-tunes the output membership functions [7, 17, 15].

E. Swarm Intelligence

The intelligent robot is a robot whose behavior is neither random nor predictable. An intelligent swarm is a group of non-intelligent robots forming, as a group, an intelligent robot. In other words, a group of "machines" capable of forming "ordered" material patterns "unpredictably"[7]. SI systems are typically made up of a population of simple agents interacting with one another and with their environment. The group of individuals acting in such a manner is referred to as a swarm. One individual modifies the environment, which in return modifies the behavior of other individuals. Individuals within the group interact by exchanging local information such that the problem is solved more efficiently than it would be done by a single individual. Problem-solving behavior that emerges from such interactions is called swarm intelligence. The two best-known SI algorithms are Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO).

a. *Particle Swarm Optimization (PSO)* was originally inspired by the crowd behavior of birds. In terms of this bird flocking analogy, a particle swarm optimizer consists of a number of particles, or birds, that fly around and searchthe sky, for the best location. The individuals communicate either directly or indirectly with one another in search directions [21].

b. *The Ant Colony Optimization (ACO)* represents the model of the collective act of searching food behavior of ants. Path selection to a food source is based on self-organization. In the Binary Bridge experiment, two ants are taking paths of different lengths from the home to a food source. The ant that will return first to the source is the one taking the shorter path. This path will, therefore, contain the larger pheromone concentration and it will attract other ants to take the same route. As more and more ants start to follow the trail of higher pheromone concentration, a positive feedback loop is created until all the ants follow the shortest path[8].

V. Conclusion

In this paper, we have presented an extensive view about soft computing techniques like fuzzy, neural network and genetic algorithms, expert systems, Neuro-fuzzy, and swarm intelligence techniques for the development of Autonomous robots. Soft computing techniques contribute to one of the long-term goals to develop Humanoid robots, to solve the problems that are unpredictable and imprecise namely in unstructured real-world environments. Soft computing approaches are more preferable to conventional methods of problem-solving, for problems that are difficult to describe by analytical or mathematical models. Autonomous robotics is such a domain in which knowledge about the environment is inherently imprecise, unpredictable, and incomplete. Therefore, the features of fuzzy control, neural networks and evolutionary algorithms, and swarm intelligence are of particular benefit to the type of problems emerging in behavior-based robotics and multi-agent robotics for autonomous robots.

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Big Data Analytics Application for COVID-19 Spread Analysis & Prevention in India

Er. Ajay Sharma[1], Ritika Sharma[2], Mridul Mahajan[3]

[1]*Associate Professor, Deptt. of Computer Science & Engineering, Amritsar College of Engineering & Technology, Amritsar, Punjab, India*

[2,3]*BTech Student, Deptt of Computer Science & Engineering, Amritsar College of Engineering & Technology, Amritsar, Punjab, India*

Email: [1]ajaysharma@acetamritsar.org, [2]shritika356@gmail.com, [3]mahajanmridul258@gmail.com

Abstract—**The sudden outbreak of COVID-19 pandemic had caused adversities and destruction to human in the social, economic, cultural and wellbeing areas all around the world. In the thick of continuous COVID-19 spread, India has seen enormous cases. Apart from the complete lockdown across the country, India has primarily been expanding its testing rate and has tried its best to provide and strengthen the medical services in all the areas of the country to battle COVID-19. Controlling such situation and loss requires understanding the spread, which can be done by gathering and examining the connected large information and datasets. Big Data Analytics tool, majorly focused on Hadoop and Pig, plays a crucial part in building information needed to take careful steps. Nonetheless, as there is immense information available on Coronavirus from a number of sources, there is a need to jot down this large information investigation in controlling the spread of COVID-19. The collected statistics include COVID-19 confirmed cases and deaths per day, vaccination and testing details in the different states across the country. Hence, this reference paper has been prepared to perform the analysis on the foregathered statistics from different states of India. The uncovering of this paper suggests important future headings to be reviewed for more application and exploration.**

Keywords: Big Data, Big Data Analytics, Healthcare, Hadoop, Apache Pig, MapReduce, Analysis, 2019 Novel Coronavirus Disease (COVID-19)

I. Introduction

Enormous data has been generated by the Healthcare industry since decades, pertaining to patient care, observance & regulatory requirements, record care. While the biggest piece of information was stored in the form of hard copy, the fast digitization has changed this trend and latest thing is that all the data potentially medical services is available world-wide

which had helped in improving the quality of healthcare comparatively at reducible costs. This huge data has provided with better analysis or examination of severity of sickness and improved health management for the population.

On 30th January 2020, WHO (the World Health Organization) announced COVID-19 surge a general wellbeing crisis of worldwide concern and was moved up to a pandemic on 11th March 2020 [1].

Following the COVID-19 pandemic, the government and the social organisations used Big Data technology aggressively to manage and prevent the disease. The papers established so far on COVID-19 Big Data provide only a limited analysis and discussion on applications of Big Data. This research adds to the current literature by reviewing the data collection methodologies and data information collected during the times of lockdown and post vaccination details. We discuss the varied aspects in the sparse gathered data.

A. Big Data

BIG DATA is known as a multidisciplinary information processing information system. Big Data is a term that is used to describe massive and complex data which grows exponentially in size. The data these days is created in Petabytes and Zettabytes. These large datasets cannot be stored, managed or processed efficiently by traditional systems of data management. This era of technology is full of data. According to reports, about 2.5 quintillion bytes of data is generated every day which can be structured like in forms of records or unstructured like photos, videos, etc. Thus, Big data analytics tool help us to process such massive datasets and systems. This is useful at various places like information processing systems, social media but especially in healthcare services.

1. Dimensions of big data

Volume: Big Data is a term to represent plenty of data which is stored or generated per day. Data is, in reality, increasing drastically in today's world as there is a worldwide wave to the technological boom. Due to increased usage of Internet of Things, we have large datasets. Certainly, the healthcare industry is also growing and generating massive-scale data.

Velocity: It refers to the speed at which data is being generated, gathered and analysed at any instant of time. The data is expanding continuously at the speed of light. Such generation requires wise decision-making at the output.

Variety: Data sources are in fact growing from social medias to pictures, videos, files, blogs and many other sensory data. Most of the data exists in the form of unstructured data. Specifically in the healthcare including clinical data, disease outbreak etc. Hence, variety of data exists ranging from structured relational data to unstructured in the form of pictures, videos.

Veracity: This defines the quality and trust-worthiness of the data that is being foregathered. Different data sources so far vary in their data reliability. Demonstrating how accurate or misleading the collected data is; is necessary for the beneficial analysis.

Value: The worth of the extracted data. Vast amount of data doesn't mean that all data will be of equal value. The valuable information must be extracted out the database.
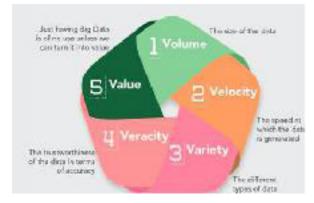
Fig. 1: Five Vs of Big Data

2. What is big data analytics?

Big Data Analytics is nothing but just a process i.e., a series of stages for extracting the key insights and the hidden trends across large and diverse datasets for making wise decisions and an edge in this competitive market. Companies whether in Business, Education or HealthCare keep track of every piece of information created during the customer interactions and daily operations. Afterwards, these datasets are analysed to study the patterns, choices and genre of customers involved. Analytics tools and wide-spread technologies, thus, provides an easier way to analyse the varied, multidimensional data or information in an efficient manner.

3. Stages in big data snalytics

- The first step is to discover the varied resources and applications from which statistics has to be gathered and brought into the Hadoop System.

- The following phase is Ingestion, which entails collecting and transferring data from the selected applications to the Hadoop Data Lake also known as Data Hub.
- The third stage is to pre-process the foregathered information for greater accuracy and better analysis.
- Final step, is to run analytics over the data.

Fig. 2: Stages/ Life Cycle of Big Data Analytics Process

B. Hadoop Tools And Techniques For Big Data

With humongous unstructured data, there must be some system in place to save it and afterwards process it. Hadoop framework and its related tools are employed by the IT sector to examine such large datasets. For real-time insights, a single tool Hadoop cannot provide entire functionality to any domain. As a result, Hadoop ecosystem is used. Major tools that are implemented in the architecture of Apache Hadoop as:

Apache Hadoop: Hadoop is an open-source technology and a free framework that manages large datasets in a cluster using commodity machines. "Hadoop can no longer be considered to be a monolithic single project, but rather an approach to data processing that radically differs from the traditional relational database models".[3]

HDFS: The storage component, Hadoop Distributed File System, is a system that holds different forms of data on several machines. It is made up of large clusters to save huge files. Entirely, the HDFS component includes the Namenode and the Datanodes. Namenode serves as the enterprise's master while Datanodes are its slaves. Internally, the data files in hdfs are split into blocks of 128 MB (default size). The commodity machines are fixed on racks and it is very affordable, that means to increase the size of data that can be stored requires only the installation of one rack. It works on "write once and read many" principle and is not suitable for multiple write operations whereas relaxes time in frequent reads.

Map Reduce: MapReduce is yet another programming process that enables to perform parallel processing on the distributed massive datasets. As a result, it gives the freedom to develop the code logic without the need to write algorithms for it. It takes care of the internal working, thus also known as the MapReduce engine. What it actually does is divide the entire analytic process into two portions: the Map function and the Reduce function.

One Map function for one block; which simply count the lines in the block. The second part is the reduce function. We run it on a single machine which then generates the result. The execution engine handles all the minor details of transferring data from mappers to reduces and finally to the output. "*The MapReduce framework operates exclusively on <key, value> pairs, that is, the framework views the input to the job as a set of <key, value> pairs and produces a set of <key, value> pairs as the output of the job, conceivably of different types*". [4]
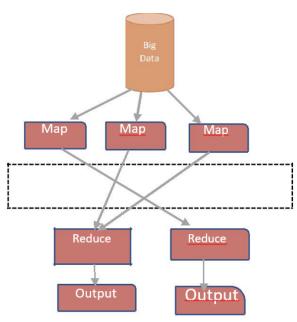
Fig. 3. MapReduce procedure

YARN: YARN is an acronym that is used for Yet Another Resource Negotiator. The purpose of initiating YARN project was to take away all the resource management and job scheduling tasks from HDFS and assign it to a new component. YARN is, thus, a middle layer between resource management layer and the processing components layer. It provides APIs for requesting and working with Hadoop cluster resources. Several execution engines work on top of YARN. The ambition of YARN is to bring all the distributed computation capabilities to one cluster.

Apache PIG: Apache pig is a scripting platform which can be used to analyse and process massive volume datasets. It is self-optimising, extensible and easily programmed. Yahoo scientists use grid tools to scan through petabytes of data. They write scripts to test a theory. It supports schema less data. Pig uses multi-query approach and good knowledge of java is not required for developing a pig script. Pig is made up of two pieces-

Pig Latin: which expresses the flow of data using various in-built operators and techniques.

Execution environment- to run the Pig Latin scripts, execution environment is required.

The architecture of Apache Pig is as follows:
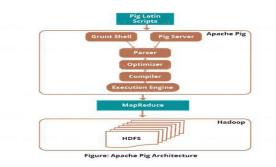
Fig. 4: Apache Pig Architecture

First of all, the script is passed through parser which check the syntax errors in the code. If there is no error, then a directed acyclic graph is created which consists of logical operators. Afterwards optimiser optimises this logical plan and sends it to the compiler. The output of compiler is fed to series of MapReduce jobs whose results is displayed on the screen.

HIVE: It is a high-level query language. MapReduce is managing these but hiding the complex inner working. It is similar to SQL in the relational databases.

Apache HBase: It is a non-relational database system that runs on top of Hadoop Distributed File System. It is built to handle sparse datasets that are common to big data and Hadoop.

Apache FLUME: "Apache Flume is a highly reliable service for accurately collecting data and moving large volumes of data from independent machines to HDFS".[5]

Data transit frequently requires a number of flume agents traversing a succession of places. Flume is frequently used for log files.

Apache Sqoop – Apache Sqoop is a service that transfer data between HDFS (Hadoop storage) and relational database servers like MySQL, Oracle RDB, SQLite, Postgres etc. [6][9]

II. Application of Big Data Analytics in COVID-19

Healthcare industry is the most crucial industry which needs to be revolutionised in order to achieve desirable and phenomenal outcomes. Earlier, traditional methods were used to store and analyse the data pertaining to any disease and alarming its severity. As such, the findings from these varied and large datasets will have an invincible effect on the improvement of medicinal services. The analytics tools that have emerged over the time has aided to the early detection of the disease and its effect on the general public. These analysis results

resulted in the following 4 R's pathway.

- Right Living
- Right Care
- Right Provider
- Right Innovation

Various authors have published their research paper reviewing the latest developments and technologies in Big Data, their profitability etc. The limiting factor to any study is the lack of data sources due to various concerns, could be of privacy or the conservation of the data/ information. Furthermore, the authors of Reference [7] reviewed numerous works on mathematical models to increase the effectiveness of detecting and predicting COVID-19. According to the results of their poll, artificial intelligence can be used to detect the number of cases, Big Data to trace the cases for improved detection accuracy. Analysing the data in real time will help use to overview the needs of beds, medical resources and healthcare specialists during such time of prevailing pandemic.

There is no shortage or conservation of data, as government organisations also require people to analyse and contribute to this area. The diverse and humongous data, which is being multiplied daily, requires the implementation of analytics techniques to study multiple areas, involving diagnosis, predicting alarming states/ risk score, improved healthcare decision-making, and the pharmaceutical industry. Figure 4 represents the potential areas of application. [8]
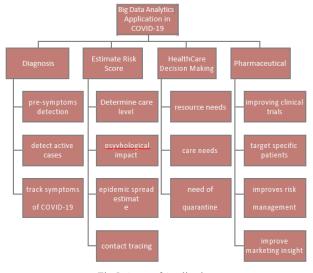
Fig.5: Areas of Application

III. Hadoop-Based Application for COVID-19

Most of the generated and available data is in printed form which needs to be digitized. The majority of the available data is unorganised, making it difficult for the healthcare industry to extract significant information about patients care and clinical research. The collection of services referred to as Hadoop ecosystem can be used to manage this vast data. It has several application including, the treatment of Cancer and Genomics, Healthcare Intelligence benefitting hospitals and insurance companies, Hospital Network for easier access by both the patients and medical officers to the services.

IV. Analysis of COVID-19 Data in India

The major part of any paper its analysis and outcomes. In this paper, we have considered the dataset of the different states of India consisting of the case details, vaccination records and its records, state-wise testing details for broad analysis. The data ranges from 30th January 2020 to 2nd August 2021.

We have used Hadoop HDFS for storing the collected dataset and Apache Pig to carry out our analytics. The main focus of the study is to analyse the life-threatening spread of COVID-19. The testing rate across the various states of India as well as the rate at which the vaccination of the population is being conducted. At the end, we will see what scope of improvement can be seen.

The gathered dataset includes three csv files and have been taken from authentic source website Kaggle.com.

Let's take a look at the first csv file:

- Dataset Name- covid_19_india
- It consists of total 17786 rows and 8 columns
- This represents the recorded cases that is being cured and prone to death for all the states of India with date and time of update
- This recorded file aid to analyse the spread of COVID-19 in several states of India along with the states where utter care should be given to the rising number of cases
- The columns are as follows:

SNo: The unique number to each record.

Date: Date of insertion of record.

Time: Time of insertion of the record.

State: State/ union territory the recorded case found.

Confirmed Indian National: confirmed Indians affected by the disease.

Confirmed Foreign National: foreign cases recorded in India.

Cured: Number of cured patients.

Deaths: deaths on a particular day.

Confirmed: confirmed cases recorded for a specific day.

The link to the dataset in the Google-drive is as follows: https://drive.google.com/file/d/1Mm9FcaHf8pU-qgTh_pA7mSWkxyFVUi28/view?usp=sharing

Figure 6 depicts the sample dataset.

Fig. 6: COVID-19 India Sample Dataset

Second csv file in the dataset contains the records of state-wise testing.

- Dataset name – Statewise_Testing_Details
- It has 15113 rows and 5 columns
- The foregathered information can help us to identify the redzone areas in the country where the positive samples encountered in given week or month are greater than the threshold value. As a result more preventive measures and required facilities can be provided in such area
- One record in the file is comprised of five characteristics as following:

Date: The date on which specific record has been recorded.

State: The state of record.

Total Samples: Total samples taken for test on that particular day in the specified state.

Negative: The number of people whose test came out to be negative.

Positive: The samples whose results came out to be positive.

The following is the link to the second csv file of the dataset in the google-drive. https://drive.google.com/file/d/1hVW6O23BQ6h8SzkKKr0Dn8G9pnVLfnN8/view?usp=sharing

The sample dataset is depicted in Figure 7.

Fig. 7: State-wise Testing Details Sample Dataset

Last, the **third csv** file in the dataset contains the records of vaccination provided so far. The number of persons who had been vaccinated, their age parameter, vaccination dose, which vaccine dose had been provided and so on. This will help to keep track of the vaccination rate in the country which in further will sparse the virus spread.

- Dataset name – covid_vaccination_statewise
- It comprises of 6690 rows and 18 columns namely, UpdatedOn – This column contains the date on which the record is updated.

State – The name of the state.

Total Doses – total number of doses per day. Total sessions – The count of sessions conducted. Total Sites: Total number of camp sites.

First Dose: The number of people who have received the first dose of vaccination.

Second Dose: The number of people being vaccinated with the second dose.

Male: Number of male vaccinated. Female – count of females. Transgender

Total Covaxin: Total number of persons that received Covaxin vaccination.

Total Covishield: Total number of persons that received CoviShield vaccination.

Total Sputnik-V: Total number of people who received Sputnik-V vaccination dose.

AEFI

18-45 Year: The range of people receiving doses.
45-60 Year: The range of people receiving doses.
60+ Years: The range of people receiving doses.

Total Individuals Vaccinated – The complete summary of all the columns containing the total number of individuals who got vaccinated on the given day.

The following is the link to the third csv file. https://drive.google.com/file/d/1cao3gL4PE6kdXxWcwtYGKQ0rXk6vQc-4/view?usp=sharing

The following Figure 8 represents the sample dataset:

Fig. 8: COVID_vaccination_statewise Dataset

A. Case Study 1

Display the overall number of cases in relation with a particular state and in the given month.

1. Analytical Model

- covid_details = load '/covid_19_india_ details.csv' using PigStorage (',') as (Sno: long, Date: chararray, State: chararray, ConfirmedIndianNational: long, Confirmed Foreign National: long, Cured: long, Deaths: long, Confirmed: long);
- covid_19_details = foreach covid_details generate Sno, ToDate(Date,'dd-MM-yyyy') as (Updated Date: datetime), State,Confirmed Indian National, Confirmed Foreign National, Cured, Deaths, Confirmed;
- by_month_state = group covid_19_details by (GetMonth (UpdatedDate), State);
- by_month_state_counts = FOREACH by_ month_state GENERATE flatten(group) as (Month, State), SUM (covid_19_details.Cured) as Cured_count, SUM (covid_19_details.Deaths) as Death_count, SUM (covid_19_details.Confirmed) as Confirmed_count;
- dump by_month_state_counts;

Result: The figure below displays the output of the CaseStudy1.


```
(1,Goa,1569499,23325,1619005)
(1,Assam,6600118,33089,6718515)
(1,Bihar,7800177,44922,7952001)
(1,Delhi,19139813,332233,19566622)
(1,Kerala,23797725,105654,26008756)
(1,Ladakh,290444,3969,298640)
(1,Odisha,10199711,58761,10312437)
(1,Punjab,5015847,169959,5263530)
(1,Sikkim,173952,4040,186334)
(1,Gujarat,7537895,134971,7880572)
(1,Haryana,8074769,92110,8233403)
(1,Manipur,865323,11322,890695)
(1,Mizoram,130882,269,133505)
(1,Tripura,1019367,12063,1032922)
(1,Nagaland,366315,2635,372584)
(1,Jharkhand,3564069,32574,3633956)
(1,Karnataka,28192578,376925,28833752)
(1,Meghalaya,414228,4445,422833)
```

Fig. 9: Output 1

The data has been grouped state-wise and month-wise to extract the sum of cured cases and death cases confirmed cases as recorded. Afterwards required opertions are performed to carry out the analysis.

It shows the month i.e 1 implies January, followed by the name of the state then the number of patients cured in the month. The last two columns represent the total number of cases which prone to death and the number of confirmed cases.

For the month of January, Goa encountered a total of 1619005 cases out of which 1569499 patients were successfully cured.

Consequence

The above result demonstrates the count which can be helpful in comparing the state-wise data as well as to estimate the rate at which the confirmed cases have been observed. As we know many websites, provide every minute information of the total number of cases state-wise. Hence, this analytic can aid to that platform.

B. Case Study 2

Give a list of states where the lockdown must be imposed because the death rate is more than 1.5% in the month of July 2021.

1. Analytical Model

- covid_details = load '/covid_19_india_ details.csv' using PigStorage (',') as (Sno: long, Date: chararray, State: chararray, ConfirmedIndianNational: long, ConfirmedForeignNational: long, Cured: long, Deaths: long, Confirmed: long);
- covid_19_details = foreach covid_details generate Sno, ToDate(Date,'dd-MM-yyyy') as (UpdatedDate:datetime), State,ConfirmedIndianNational, Confirmed ForeignNational, Cured, Deaths, Confirmed;
- filtered = filter covid_19_details by GetMonth (UpdatedDate) ==7 and GetYear(UpdatedDate) ==2021;
- by_state = group filtered by State;
- by_state_death_rate = foreach by_state GENERATE group, ((SUM (filtered. Deaths)*100.0) / SUM (filtered.Confirmed)) as Death_rate ;
- result = filter by_state_death_rate by Death_rate > 1.5;
- alarming_states = order result by Death_rate desc;
- dump alarming_states

Result: The dataset is filtered for the month of July 2021 and is grouped state-wise. Then Death_rate for each state is generated by dividing the total number of deaths with overall confirmed cases. Below is the output of the case study.

Fig. 10: Output 2

The result shows total 12 states where the death rate is more than 1.5 % with Punjab having the highest death rate of the COVID-19 patients followed by Uttarakhand.

Consequence

The study shows that lockdown must be strictly implemented in the state of Punjab, Uttarakhand, Maharashtra, Nagaland, Goa, Delhi, Himachal Pradesh, Andaman & Nicobar, Manipur. The alarming death rate must be vigilant observed and rules must be followed in its compliance.

C. Case Study 3

List the first 20 records, along with states sorted by confirmed cases, for which there were more than 20 million confirmed cases for any month.

1. Analytical Model
- covid_details = load '/covid_19_india_details. csv' using PigStorage (',') as (Sno: long, Date: chararray, State:
- chararray, ConfirmedIndianNational: long, ConfirmedForeignNational: long, Cured: long, Deaths: long, Confirmed: long);
- covid_19_details = foreach covid_details generate Sno, ToDate(Date,'dd-MM-yyyy') as (UpdatedDate:datetime), State,ConfirmedIndianNational, ConfirmedForeignNational, Cured, Deaths, Confirmed;
- by_month_state = group covid_19_details by (GetMonth(UpdatedDate),GetYear(UpdatedDate), State);
- by_month_state_counts = FOREACH by_month_ state GENERATE flatten(group) as (Month,Year, State), SUM (covid_19_details.Cured) as Cured_count, SUM(covid_19_details.Deaths) as Death_count, SUM(covid_19_details.Confirmed) as Confirmed_count;
- filtered = filter by_month_state_counts by Confirmed_count > 20000000;
- sorted = order filtered by Confirmed_count desc;
- result_list = limit sorted 20;
- dump result_list

Result: The records are grouped with respect of the state and month-year pair. Afterwards obtained choices are filtered for Confirmed_counts more than 20 million per month. The output is shown below:
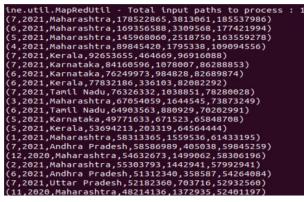
Fig. 11: Output 3

The output shows that in July 2021 around 185537986 cases were confirmed in Maharashtra. Followed by Maharashtra in the 2nd, 3rd, 4th places with a huge number of cases. Then, Kerala in July 2021 encountered 96 million+ cases which can be thought of as the beginning of third wave of the pandemic.

Consequence:

The implications of this analysis are useful in two major use case, one to find out the majorly affected areas

as well as the contaminated areas in the pandemic. Second, it depicts states have emerged with well testing system which can help to measure such huge confirmed cases and people are even aware of its severity.

D. Case Study 4

Bring out the maximum number of positive and negative samples in a day of total testing samples in Punjab and Maharashtra in June 2020.

1. Analytical Model
- testing_details = load '/Statewise_Testing. csv' using PigStorage (',') as (Date:chararray, State:chararray, TotalSamples:long, Negative: long, Positive:long);
- covid_testing = FOREACH testing_details GENERATE ToDate(Date,'yyyy-MM-dd') as (UpdatedDate:datetime), State, TotalSamples, Negative, Positive;
- covid_testing_filtered = filter covid_testing by (EqualsIgnoreCase(State,'Punjab') or EqualsIgnoreCase(State,'Maharashtra')) and GetMonth (UpdatedDate)==6 and GetYear(UpdatedDate) == 2020 and (Positive is not null) and (Negative is not null) ;
- by_state = group covid_testing_filtered by State;

- by_state_filtered = FOREACH by_state GENERATE flatten(group) as State, MAX (covid_testing_filtered.Positive) , MAX(covid_testing_filtered.Negative);
- dump by_state_filtered

Result: The records are filtered for the states of Punjab and Maharashtra significant to June 2020. The, the maximum for each group is discovered. Figure 12 displays the result after executing the above analytical model in the Pig execution engine,


```
2021-09-02 13:10:33,209 [main] WARN
temImpl - JobTracker metrics system
2021-09-02 13:10:33,224 [main] WARN
temImpl - JobTracker metrics system
2021-09-02 13:10:33,230 [main] WARN
temImpl - JobTracker metrics system
2021-09-02 13:10:33,248 [main] INFO
ine.mapReduceLayer.MapReduceLauncher
2021-09-02 13:10:33,252 [main] INFO
cation - mapred.job.tracker is depre
dress
2021-09-02 13:10:33,256 [main] INFO
cation - fs.default.name is deprecat
2021-09-02 13:10:33,257 [main] WARN
chemaTupleBackend has already been i
2021-09-02 13:10:33,278 [main] INFO
InputFormat - Total input files to p
2021-09-02 13:10:33,279 [main] INFO
ine.util.MapRedUtil - Total input pa
(Maharashtra,177945,792216)
grunt>
```

Fig. 12: Output 4

The output stated that Maharashtra encountered 177945 Positive cases and 792216 negative cases maximum in June 2020. The record for Punjab is not shown as testing details for Punjab were null hence, they were omitted in the filter command.

Consequence: It help us to identify the peak values of positive and negative samples for any given state and given month. This type of analysis is beneficial to identify the trends and graphs in cases.

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Covert Channels: A Secure and Effective Tool for Critical and Sensitive Data in Multilevel Secure Systems

Amarpreet Singh

Professor(CSE), Amritsar Group of Colleges, Amritsar, Punjab, India
Email: amarmandeep@yahoo.com

Abstract—**In an era of information warfare it is very true to say that computer networks are unpredictable. The applications and services supported by the networks are prone to numerous attacks of having an impact of different levels. This is the real scenario for not only wired but wireless networks also. In fact it is more vulnerable in ad hoc wireless networks due to its mobility and the liberty provided by optional bits of the protocols being used for the communication in this environment. The wide range of innovations and emergence of technologies can be seen during the period ranging from Wired connectivity to the era of ad hoc wireless networks. In a nut shell it frees the devices from hard connections such as wires and cables. But on the other hand wireless networks have become the fertile ground for new attacks due to its flexible parametric factors. It raises the security concerns of all types of data but especially of the critical and sensitive data of an individual and organization. This has paved way for large number of researchers to carry out their researches pivoting around the security of critical and sensitive information. This paper highlights different covert channels techniques that can be implemented effectively individually or in hybrid manner in a multilevel secure systems, thus providing security to the critical and sensitive information. This paper also provides insight to types and applications of covert channels.**

Keywords: Covert, Ad-hoc Wireless Network, Vanet, Covert Channel

I. INTRODUCTION

Data is the most valuable thing on the network that we create. Therefore it is rightly said, *"Data and Data Everywhere"*. Among the different components of any system, process or organization it has been noticed that data is the component that has found an utmost importance. For every system it is data that comes out be the driving force that leads to the success of that particular system. With the growth in network and its associated technologies most of the business and organizations have developed information centric processes.

With this growth the last decade has also seen the rise in attacks on such information centric business processes. This leads to the requirement of maintaining the multilevel security and confidentiality of sensitive and critical information. More we succeed in this aspect more is the success rate of any venture.

Numerous security measures are suggested to counter these attacks such as cryptography, steganography, watermarking and covert channels. Cryptography hides the contents of the message from an attacker, but not the existence of the message. Steganography and watermarking bring a variety of very important techniques how to hide important information in an undetectable and/or irremovable way in audio and video data. They even hide the very existence of the message in the communicating data. But the covert channel is different from them.

A covert channel is a mechanism in which a sender and a receiver set up a compromised logical link between the processes running at their ends to secretly exchange critical information without being detected by third party as shown in figure 1. A covert channel is designed to be hidden within the normal communication traffic of a legitimate logical channel, such as TCP or UDP. Secret information is amalgamated in the legitimate channel packets in such a way that only the end applications can detect and retrieve this information. Anyone else watching the network traffic is unable to detect the presence of such information in the legitimate channel packets. A covert network is so entitled in the real world scenario because it is secreted from the admittance control apparatuses of secure functioning systems since it don't deal with the genuine data transfer processes and consequently cannot be sensed or measured by the security appliances that motivate secure operating schemes [1][2].
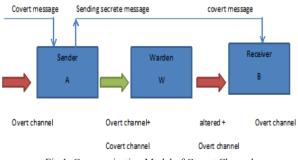
Fig.1: Communication Model of Covert Channels

Covert Channels have been defined for the first time by Lampson in 1973. A path of communication that wasn't designed for [that sort of] communication between two processes. It was authorized to communicate, but not in the way they actually are. [32]

According to Murdoch [19], a covert channel can be described as a communication in a computer system where the sender and the receiver plan to leak information over a channel which is not designed for that communication to take place, in violation of a required access control policy.

G.J. Simmons discussed one of the most common and perhaps the best vehicle for discussing the dynamics of covert communications is found in what is known as the "prisoners' problem" initially by in 1983.[31]

According to 1985 U.S. DoD publication a covert channel is "a communication channel that can be exploited by a process to transfer information in a manner that violates system security policy" [29].

The word covert is derived from the word overt which means open. Covert is opposite of overt so it means hidden or under cover. So covert channel play a dual role with regard to network communication. At a particular instant it may turn out to be a threat to an entity. But at other time it can be used as subversive means of achieving confidentiality and maintaining anonymity for another. It can be used to protect privacy or increase security of critical communication. Because a covert channel hides within a legitimate logical channel, it is a very simple yet effective mechanism for exchanging information between two end applications without alerting any firewalls or intrusion detectors on the network. For extremely sensitive applications, it may be advantageous to transmit certain data covertly. This provides an additional layer of security to that provided by the different layers of the protocol stack. Covert channels are best suited for sensitive data and their success rate is high if data burst is small. Figure 2 shows generalized scenario of covert channels.
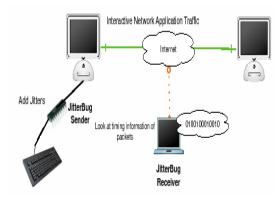
Fig. 2: Generalized Scenario of Covert Channels [33]

II.   Covert Channel: Types

A.   Covert Storage Channels

Involves the direct or indirect writing to storage location by one process and direct or indirect reading of the storage by another process. They exploit the attributes of the resources shared between the two compromised processes running at the sender and receiver end. Such attributes may be. Sectors on a disk, unused bits in a packet header or the payload. [30]

A covert storage channel transfers information through the setting of bits by one program and the reading of those bits by another. Covert storage channels occur when out-of-band data is stored in messages for the purpose of memory reuse. Examples would include using a file intended to hold only audit information to convey user passwords--using the name of a file or perhaps status bits associated with it that can be read by all users to signal the contents of the file.

B.   Covert Timing Channels

It exploits the temporal or ordering relationship in such a compromised manner that accesses to shared resources can be interpreted by the receiver.

Some common temporal based attributes used in this mechanism are packet inter-arrival times of Internet traffic, system paging rate, I/O or network usage rates, process creation rate, and time slice relinquishment.

Covert timing channels convey information by modulating some aspect of system behavior over time, so that the program receiving the information can observe system behavior and infer protected information. In some instances, knowing when data is transmitted between parties can provide a malicious user with privileged information. Also, externally monitoring the timing of operations can potentially reveal sensitive data.

Covert channels are frequently classified as either storage or timing channels. Some examples of covert timing channels are the system's paging rate, the time a certain transaction requires to execute, and the time it takes to gain access to a shared bus.

III.   Related Work

The literature survey reveals the existence of numerous publications by different researchers dealing with various aspects, issues and techniques of designing the covert channel applicable in different environments of a network. Some of them are summarized here:

The first publication on network covert channels is a paper published in 1987 [28]. It points out three covert channels to show the possibility to create a channel through a LAN. This work has been the basis for [27], where the author shows the possibility to create such channels in IEEE 802.2, 3, 4, and 5 networks with

padding and unused bits used to transmit information.

A simple covert timing channel with distribution matching is proposed in [18]. The approach processes the network traffic as fixed-length fragment and obtains the histogram of the delays, then uses the binary coding method to embed the message bits.

A relatively high bandwidth covert timing channel for 802.11 networks (Covert DCF) is proposed in [16]. It exploits the random back off in the distributed coordinated function (DCF), used to avoid collisions, to provide cover for covert timing channel. Covert DCF provides significant improvements over other covert channels at that time in the area of throughput, while maintaining high accuracy and remaining undetectable.

Communication can be done steadily in the VANET network with the establishment of Covert channels between those nodes [5]. If the covert channel is established in the VANET network, then the security is maintained between High profile vehicle and Security provider vehicle and can share secret data covertly with each other and the attacker or you can say that the other vehicles that are present in this network can't detect the covert channels.

Utilizing the unused fields of the packets for covert channel establishment has been widely investigated [21]. For example, the ACK frame's destination address field can be used as a medium for covert communication in the IEEE 802.11 protocol [23]. MANET's routing protocols can be considered as another space for covert channel establishment [17]. S.Li and A. Ephremides [17] discuss the use of various features in AODV routing algorithm for covert channel establishment. "Timing of the route request", "source sequence number filed in the route request", "lifetime field of the route reply", and "destination ID field in the route request" are some examples of these features. However, most of these covert channels are statistically detectable and cannot be considered as network steganography. In addition, the firewalls and routers are usually configured to change the unused fields to avoid hidden channels [14].

Packet retransmission and rate switching approaches are other means for covert channel establishment in wireless networks [15,25]. In [25], packet retransmission is used to create covert channel. This paper uses the "Retry bit" and "More data" fields for synchronization and the "Destination/ID" field for the covert data transmission. In [15], rate switching of the 802.11 protocol is used for covert channel creation in wireless networks. The target of the rate switching protocol is to choose a data rate that optimizes the node's performance. The proposed covert channel is established between a workstation and an access point (AP). Access point observes the sequence of data rates and decodes the hidden message accordingly. This covert channel has low bit rate with 100% accuracy

in decoding the hidden messages. In [4], the probability distribution of the different data rates in the wireless networks is used as a mean for covert channel detection. Euclidean distance is used to calculate the similarity of the probability distribution of the data rates, used by the covert sender, and the possible data rate probability distributions in a wireless network. And with the use of measured Euclidean distance, the established covert channel will be 100% detectable.

CSMA/CA is an algorithm that is used in 802.11 standard to control the medium access in wireless networks [20]. The main feature of CSMA/CA is the randomness observed in the amount of back-off times, selected by the nodes in the busy channel condition. In [13], a covert channel is created by mimicking the behavioral characteristics of 802.11 wireless networks that result in low throughput with high level of covertness. The author of [8] creates a hidden channel using QoS features in 802.11e standard. QoS Control field is added to the frame in 802.11e. The combination of three fields of QoS, CF-Poll able, and CF-Poll request is used to create the covert channel. Paper [11] creates covert communication using the time intervals between the packets at the sender. The main goal of this paper is to create a timing channel that is robust against the noise in the network. The noise on such a channel can be the extra times applied between the packets transmission, forced by CSMA/CA. LDPC coding schemes are used to produce robustness against the noise. However, the bandwidth is wasted because of the LDPC usage, and according to the paper, 0.4 bit can be encoded in each packet.

A covert channel creation method in Ad hoc networks is also presented in [10]. This paper uses AODV routing protocol to create covert channel, while OLSR routing algorithm is used between the legitimate nodes in the network. Legitimate nodes discard the corrupted packets in the network, and the covert nodes extract the hidden data from these packets. In [7], the design of a covert channel in a hybrid network (a network that contains different kinds of networks) is proposed. The combination of Wi-Fi and 3G networks is used for this purpose. One network is used to transmit the key and the other to transmit the hidden message. Covert sender uses DES cryptography algorithm to encrypt the hidden message. The used key is transmitted to the hidden receiver with the use of 3G network, but the covert sender transmits the covert data on the Wi-Fi network.

Although the aforementioned covert channel methods create covert communications, they have some drawbacks. Storage covert channels [23] are not secure. They are detectable and can be eliminated from the system. Some other covert channels are secure enough but suffer from low bit rate [7,8,15,17]. The covert channel proposed in [16] sacrifices its bit rate to achieve high security. The

methods mentioned in [27,28] are not practical because they use algorithms that are not practically so common. Some others [15, 25] only care about their long time behavior. Thus, they will be easily detected by short time monitoring of the system behavior. In this paper, a method is proposed to establish a covert channel in IEEE 802.11, which has high security along with high bit rate in comparison with the existing methods.

IV. TECHNIQUES IMPLEMENTING COVERT CHANNELS

Highlights of some techniques shown in figure 3 that how undisclosed communications can be embedded in covert channels is explained as below:
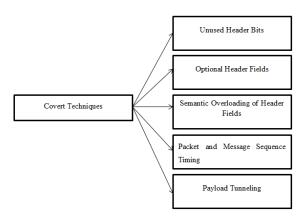
Fig. 3. Covert Channel Techniques

A. Unused Header Bits

One can exploit protocols, such as TCP/IP, it is possible to encode a covert channel using reserved or unused bits of their headers, as proven in [26]. If there is no confirmation on the receiver or the protocol specifications do not impose explicit values, hidden data can be transmitted, (e.g. in "type of service" field of the IP header). In figure 4 we can see TCP/IP header and their exploitable fields, marked as underlined.
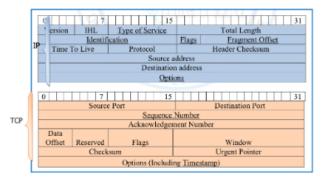
Fig. 4: TCP/IP Header Structure [28]

Another possible exploit regards padding bits. Again, if the no specific value is imposed for padding, information can be covert within those bits.

B. Optional Header Fields

Inspite of the usage of predefined header extensions regarding discretionary information transport on requisition, several protocols consent unheralded data to be carried in header extensions in order to augment the proficiency of protocols. One simple example is to covert masked data as an IP address in route record option.

C. Semantic Overloading of Header Fields

Semantic overloading is a different approach to implement covert channel.It consists of exploiting syntactic variations of the overt channel to encode covert data whilst the channel is maintained semantically identical. For example, hidden content can be encoded using TCP sequence numbers in TCP header. In order to do it, the client chooses the ISN (Initial Sequence Number), and it should be carefully chosen to prevent new incarnations sequence numbers to overlap with the ISNs previous ones. One example of a covert channel created in these circumstances is the use of each ISNs most significant byte, while enforcing the remainders to be set as zero, as proven in [4]. Higher layer protocols, mainly text based ones, like Hypertext Transfer Protocol (HTTP), offer further opportunities. By simply varying the use of upper and lower case, or the amount of spaces interleaving words, covert channel can be created.

D. Packet and Message Sequence Timing

Another technique relies on sequence timing. To establish a covert channel, in every time interval the sender adjusts its packet rate, while on the receiver's side, in order to decode the concealed data, he needs to measure the rate of the packets in each time interval. However, packet timing channels required synchronization mechanisms at both, sender and receiver sides, in order to alter the packet rate and obtain proper readings at the destination.

E. Payload Tunneling

This technique consists of using the payload tunneling one protocol into another. The major goal of this approach is to bypass firewalls responsible for restraining outgoing transmissions to a brief set of authorized application protocols, such as HTTP. Such methods can even be applied to Domain Name Server (DNS), tunneling information through the protocol. In this case, the client would request a name resolution for the host in the form of host.covertserver.com, where covertserver.com would be a modified DNS server participating in the covert channel, and host would be encoded covert data. All the covert information would be sent from the DNS server to the client in the DNS responses as text records.

V. APPLICATIONS OF COVERT CHANNELS

Few applications of covert channels with some practical implementations are shown in figure 5 and explained thereafter:
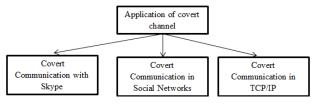
Fig. 5: Applications of Covert Channels

A. Covert Communication in Social Networks

With facebook's acceptance and usage spreading worldwide, it became a craved target for covert channels. Such exploitation was performed in [12]. In this article, the authors have successfully implemented means to use social networks as a pipe for covert communications, specifically targeting facebook. The authors created an application, named FaceCat which operates based on users facebook accounts. Firstly, the software reaches for long-term cookies stored in cache. After successfully retrieved said cookies, the software starts to operate as an authenticated facebook user.
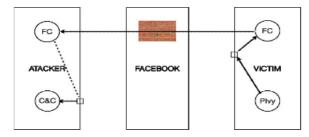
Fig. 6: FaceCat Operation Method (From [12])

By manipulating cookies, a TCP session is established between the master node wall, the "attacker", and unrelated account walls, the "victims". The master node writes its own cookie on its wall, and waits for connections. FaceCat is now able to read the cookie and, using a method, which authors called "pass-the-cookie", gain the ability to write on master's wall. Communications works using Base64 encoding as well as sequence numbers. The authors choose facebook's mobile interface as it was easier to parse and obtain the encoded messages and use Poison Ivy as a Remote Administration Tool (RAT), with the purpose of interpreting concealed data.

B. Covert Communication with Skype

Skype is currently one of the most used P2P communication systems with a number of users of around 35 million [3]. Using the IP protocol, skype communication is made in a high cryptographic manner.

Such communication aims to guarantee privacy for Skype users, but it also covers said communication from firewalls as they usually do not verify ciphered contents and therefore creates an ideal ambient for covert communication. Skype uses the UDP protocol for communications and, as many other protocols, it is susceptible to covert techniques, such as network covert storage channels through packet field manipulation. In [9], the authors successfully used Skype's 70 bit packets that do not carry speech, to conceal communications success-

Fully. Such exploit is due to Skype's method of transmitting data. Even though no dialog is being performed, like text or audio communication, skype continuously send data packets during the session time, as explained in [3].

C. Covert Communication in TCP/IP

We must start this discussion by firstly introducing some concepts regarding TCP/IP. TCP/IP is a computer networking model and a set of communication protocols widely used on the Internet. It is composed by the TCP protocol for reliable communication and IP protocol for routing functions. The protocol's header is the combination of both, TCP and IP. In [26], Craig H. Rowland successfully implemented undisclosed communications using TCP/IP packet headers, adopting three different approaches shown in figure 7
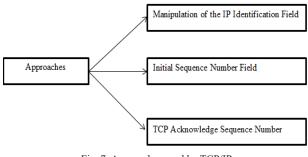
Fig. 7: Approaches used by TCP/IP

1. Manipulation of the IP identification field

TCP/IP uses the IP identification field to reassemble packet ordering at the destination node. If - by some reason - a packet was to be lost along the way, the destination router would be aware of the lack of such packet and could not reconstruct data accurately until a retransmission of the packet would be received. By using a simple method of placing the ASCII representation of the characters he wished to encode in the identification field, Rowland managed to pass the word "HELLO" hidden, being subsequently reconstructed at the destination node. This method consists of having the client host to build a packet with the correct destination host, encoded IP ID field and data regarding the source host. The remote

host, while listening on a passive socket, receives the packet and decodes the information. Although effective, this implementation is easily detectable by firewalls and there is a high probability of losing data due to the need of packet overwriting by routers (TTL for example).

2. Initial sequence number field

The second approach taken by the author consists in modifying the Initial Sequence Number Field. This field is used in the three-way handshake implemented by TCP in order to establish a reliable protocol negotiation with a remote server. It comes as an ideal field to conceal communications as it has a reserved 32 bit size. As in the previous example, the author encapsulates ASCII coding that refers to a given character in this field. They define the communication as a synchronized communication and encapsulate the ASCII code, taking in account the generation of more realistic sequence numbers through divisions.

3. The TCP Acknowledge sequence number field "Bounce"

Finally, the author refers to a third and last method entitled as The TCP Acknowledge Sequence Number Field "Bounce". In this method, the author uses basic IP spoofing (packet manipulation in order to forge the sender IP address) and bouncing technique (using IP spoofing, a packet is sent to a given server that then replies with an ACK/SYN with ISN +1). Basically, a packet is created with forged source IP address, port, destination IP address (the target system), destination port and a TCP SYN number forget with the data they wish to transmit. Then, it is sent to a bounce server that receives the packet, increments ISN by one number and replies to the forget IP address in the packet. The receiver system expects communication from the bounce server and when received, it interprets the ISN number minus one and therefore the ASCII value of the character.

VI. Conclusion and Future Scope

Thus going through the different review papers it is observed covert channel can be used as an effective tool to provide the security to critical and sensitive data in the multilevel secure systems, more effectively in Adhoc wireless systems Its effectiveness increases many folds if sensitive data is of short burst as then it becomes very difficult for the third party to detect that a secret communication is being going on between the sender and receiver. It is transferring information and data even in high security without altering the firewall or security contents. Paper also discussed its applications on skype, facebook etc.

This paper also suggests that covert channel is an emerging and hot topic for researchers. Many new algorithms can be generated and many old algorithms can be exploited to make covert channel technique more secure and effective in ad hoc wireless communication.

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Development of Interactive Musical Drum

Sirimonpak Suwannakhun[1], Thaweesak Yingthawornsuk[2], Kantapat Kwansomkid[3]

Thanaree Ploysawat [4], Nopparuj Taluypreechachan[5], Wuttipat Kitcharoen[6]

[1,2,3,4,5,6]*King Mongkut's University of Technology Thonburi, Bangkok, Thailand*

Email: [1]sirimonpak.sut@kmutt.ac.th, [2]thaweesak.yin@kmutt.ac.th, [3]kantapat.kwansomkid@mail.kmutt.ac.th

[4]thanaree.ploploy17@mail.kmutt.ac.th, [5]nopparuj.taluy@mail.kmutt.ac.th, [6]wuttipat.kitcharoen@mail.kmutt.ac.th

Abstract— This paper aims to present the development of a musical instrument simulator called "Air-Drum" which consists of station, display, and playback unit. Simulator to play drum along music was proposed for a beginner who is starting to learn how to play a drum to practice with fun and follow instruction every similar like learning from a musical instructor. Before practical use, the performance evaluation was made with three scenarios of testing, which are freestyle for playing on selected mode no.1, random hit for mode no. 2 and left-foot pedal (Pedal Hi-hat) for mode no.3. The questionnaire survey was used for collecting the user's satisfaction toward the proposed simulator. The overall mean and S.D. values obtained from survey revealed the excellent level with mean value of 4.70 and S.D. value of 0.40, respectively. It suggested that the proposed Air-Drum simulator is successful in helping users to learn playing drum with highly satisfied experience. The experts' assessment on the quality of Air-Drum showed a very good quality level toward the proposed simulator.

Keywords: Air-Drum, Arduino, Led Strip Light

I. INTRODUCTION

Nowadays, if one wants to play a musical drum, we need to have some space for installing a set of musical drums in place like studio or recording room that can seal all the sound of hitting drums not coming out to the surrounding area, which is very problematic if the sound is too loud. It can also disturb and make people around dissatisfied. Moreover, the musical drums set is very expensive to own and maintenance costs a lot to owner. Therefore, the idea of interactive air drum is proposed. We have designed and developed a drum instrument to be easier to play and our proposed drum can reduce the problem of high- pitched sound. The drum set is a percussion-musical instrument. It consists of a few drums and cymbals and uses a "drumstick" to control the tempo. The sound of a drum can add a power to a wide variety of music genres such as rock, blues, funk, disco, pop, and jazz. The use of a conventional drum set differs from the one we have designed using hardware and software applied to our proposed drums called "Air Drums", which could attract more people to play it. Adopting hardware and software to follow the current global trends, the light, color, and sound are interrelated in a very modern display, the Air Drums is one of the sounding devices for performing music. The musical drum can be added with colorful light for more interesting display. Technology has been incorporated into the musical instrument as an integral part which creates the innovation of drum instrument like our proposed Air Drums.

II. RELATED WORK

F. Ay *et al*. [1] offered a tangible and reliable real-time user-interface system to develop the air drum games for computer- based games and training programs. The user can perform the action in 6 directions using the electronic drumstick. A developed algorithm detects the direction of moving sticks by sensor. Information about how the wooden drumstick is moved and its direction is transmitted to the audio system to play the sound files of the respective drum instruments. In this way, users can get a realistic drum experience.

K. C. Fidan *et al*. [2] offered a new system that can track the movements of the drummer and produce a consistent drum sound. Camera input video sequences are processed in real-time using the local and adjustable color segmentation and tracking based on Kalman filters to predict "hits" to overcome processing delays and provide a more realistic drumming experience. It uses local and modified local search to detect the effective point of the drum. The demonstration and performance evaluation were made against the electronic drum pad's output signal.

C. T. Tolentino *et al*. [3] have taken the drummers into a free drum experience and allowed drummers to practice comfortably without the need for a complete set of drums. This helps to bring the experience of drumming to a wider audience. The prototype virtual drum kit requires users to have a laptop with a camera with easy-to-reach markers showing the drumstick tips and knee movements. The Python-based OpenCV colored paper was used to implementation in this work.

P. Eserin [4] applied standardized variable analysis (CVA) and appropriate control, 9-component LQG (linear gaussian, quadratic, linear) to boiler drum level

control in gas boiler 400. The kpph, the temperature of the used air and exhaust gases, are examined for the clean fuel flow proxy variable. Therefore, work is associated with regulating the drum level of dirty fuel boilers. CVA's ability to select a sensitive model and Akaike Information Criteria (AIC) is demonstrated in this challenging process.

Sarang *et al*. [5] invented the low-cost Microsoft Kinect sensor, making high-resolution depth and image (RGB) detection widely available. The complementary nature of the insights and images obtained by Kinect sensors opens new possibilities for solving fundamental problems in computer vision. This article offers a comprehensive review of the latest Kinect-enabled computer vision and experimental efforts on a virtual drum instrument using the Kinect sensor.

Park *et al*. [6] offered an air-drum teaching system that allows you to practice drum anytime and anywhere. The air-drum teaching system can be played only with drumsticks with vibration sensors and mobile applications. The system recognizes the user's real-time drum playing signals by means of a vibration sensor mounted on the drumstick and converts the vibration signal to the drum sound in the hand app. This application can be installed on the mobile phone and send the signal out. In addition, the air drum teaching system analyzes the user's playing style and presents score, rhythmic similarity, pitch, and strength with a basic drum pattern, which can help to improve the user's drumming skills.

P. Amnuaisuk *et al*. [7] produced a tone that corresponds to those gestures in real-time. Commonly used sensory units can be classified into two main categories: touch and non-tactile. Several sensors have been used in VMI (such as radar sensors, pressure sensors, proximity sensors, acceleration sensors, data gloves, etc.) that offered a new approach for VMI percussion machines that mimic the coin-operated drum kit, the term air tank for the project. Rather than using complex sensing units such as accelerometers or proximity sensors, which are typically expensive and require special setups, this project explored the advanced image processing techniques and developed applications.

Wishkerman *et al*. [8] used the RGB LEDs (APA102C) connected to an external Arduino microcontroller, enabling flexibility through programming, modifying, and upgrading. This study explained details about the C function that provides white and mixed color light in the LED strip, as well as the ability to produce intermittent / blinking / blinking light, the capabilities of the application presentation system with affordable open-source tools to improve and promote the cultivation of phototrophic species.

Godey *et al*. [9] made a musical system that allows the musicians and non-musicians perform mid-air gestures without touching the instrument. This "airplay" expresses the way people perceive and imagine music and their imaginations. Studying the relationship between these gestures and sounds helps to recognize gestures' structure and music experience.

Brown *et al*. [10] used Digital Musical Instruments (DMIs) to enable new ways of musical expression. The main theme of interest in this domain deals with actors' action linked to sound production. Some DMI developers choose to design these mapping strategies themselves, while others reveal this design space. To the actors, the work will explore these later scenarios by studying the user-defined mapping strategies of a group of experienced aerial musicians chosen by the rare community of DMI practitioners. The results showed that novice performers spent a little time reviewing the mapping options and have more time for practicing instruments.

III. Methodology

A. Air Drums Instruments

1. Drum Set

A percussion instrument consists of a variety of drums and many putties together using only one performer. This drum set, according to the history of the music, does not appear to join the international orchestra which is a large band but played with a jazz band and a band with a few instruments playing, including a combo, a string combo.

2. Rhythm of the Air-Drum

There are 7 main drumbeats, which the organizers can select from 5 beats: 1 Hi-Hat Open, 1 Hi-Hat Close, 1 Snare, 1 Bass Drum, and Pedal Hi-Hat 1. Tempo, with drumsticks and shoes divided for each stroke and pedaling. This will have drum sticks to create the beats of the air-drum.

3. The format of Air Drums

A drum set is in the form of a drum set that cannot see the body. Users had to imagine the drum kit themselves. On the part of the device that the user can see is a drumstick with shoes for drumming and pedaling to create the rhythm of the music. The rhythm of the air-drums is divided into three major rhythms: Snare, Bass Drum, and Hi-Hat is split into two strokes, that is, Open Hi-Hat and Close Hi-Hat, with two different strokes.

B. Hardware

The hardware equipment is divided into four types of devices having different functions such as Input

Unit, Central Processing Unit (CPU), Output Unit, and Secondary Storage, which consists of Arduino Uno R3, GY. -61 3-axis Accelerometer Module (ADXL335), Photoresistor LDR Light Sensor Module, Adapter 5V 2A, LED Strip Light and Toggle Switch.
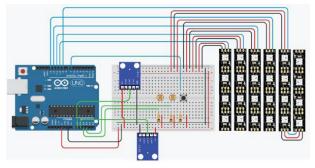
Fig. 1: Circuit diagram of Air-Drum Controller Board Connection

C. Software

An instruction set was written in coding to run on the computer. The software will work with the CPU to control the processing of the computer for calculating tasks as needed. Software used in this work can be divided into two categories: Operating System Software and Application Software, including Arduino Software, loopMIDI, Hairless, Ableton Live, and SolidWorks.
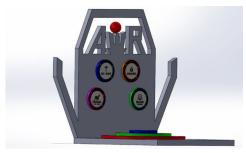
Fig. 2: Designing Air-Drum using SolidWorks

IV. Imprementation

A. Operating Process

First, we gathered all information related to development of the air-drum, then designed and tested the hardware part which is a circuit as shown in figure 1. Next, we designed, built, and tested the equipment in the air-drum with targeted audiences and finally summary and evaluation of the air-drum's performance.

B. Population and Samples

1. Population

A group of professionals who have knowledge and experience in playing music with many years of professional musician experience to assess the quality of the drum set device structure.
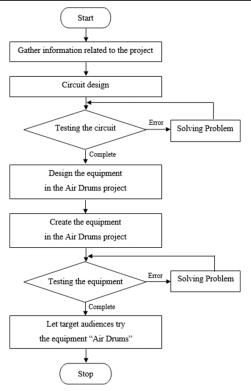
Fig. 3: Workflow of the Operation Process

Fig. 4: The Component Parts of The Air-Drum Set
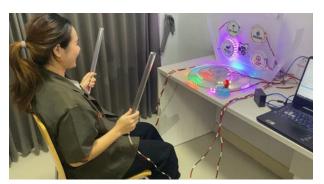
Fig. 5: The Simulator of the Air-Drum

2. Samples

The total number of 30 volunteers by using the convenience sampling method and collecting the data into primary data (Primary Data) is randomly collected from the sample group using the form of satisfaction with clear questions.

V. RESULTS AND DISCUSSION

The air-drum consists of stage, display, and playback equipment in which the design of the stage display is a suitable size for a person to play as shown in figure 5. The size of stage has been designed to have a dimension of a width of 18 inches, a depth of 23 inches, and a height of 16 inches. The main material used for the stage display is opaque acrylic equipped with the LED Strip to show the colorful lights during playing the drum simulator. The simulator was tested for at least 25 times for accurate performance evaluation. Three testing scenarios were made on freestyle for playing on selected mode no.1, random hit for mode no. 2 and left-foot pedal (Pedal Hi-hat) for mode no.3. On some topics that have not passed the test, there are only 2 topics which are the 1st-LED light showing the effect of the left drumstick and the Hi-Hat sound change showing the effect from the left-foot pedal. The test in each topic has several repeated several times in a range between 21 times and 25 times to pass the test criteria. Next result was made on the users' satisfaction toward the device. Based on the survey data collected from total 16 volunteers who have drumming experiences and another total 14 volunteers without drumming experiences, their comments showed that the Air-Drum is very user-friendly to play with and understandable on how to use the device with a very good level of quality represented by mean and S.D. values of 4.75 and 0.35, respectively. The efficiency in the use of device was found to be at good level with mean of 4.50 and S.D. of 0.70. Speed of data processing is excellent with mean and S.D>values of 4.62 and 0.52. the application was evaluated for excellence with mean and S.D. values of 5 and 0, respectively. Finally, the overall mean and S.D. values found from results of all assessments also show the excellence with 4.70 and 0.40, respectively. These numbers suggest that the proposed Air-Drum simulator was successful to make users highly satisfied.

TABLE 1: RESULT OF QUALITY ASSESSMENT

Title	Average	S.D.	Quality
Understanding how to use the equipment	4.75	0.35	Excellent
Efficiency in the use of the equipment	4.50	0.70	Good
Speed of data processing	4.62	0.52	Excellent
Design	4.66	0.46	Excellent
Application	5.00	0.00	Excellent
All of average	4.70	0.40	Excellent
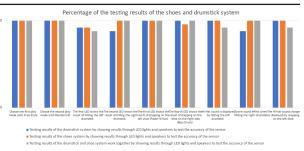
Fig. 6: Testing Results of Shoes and Drumstick System

VI. CONCLUSION

This work proposed the Air-drum for a user who wants to practice on drumming to have a new experience on simulator. The assessment of quality of device, in terms of understanding how to use device, efficiency, speed of data processing and interaction, graphical design of device and application, was made and its overall result showed to be excellent. In an overall point of views by experts the evaluated mean and S.D. values were found for excellence to use this Air-Drum simulator for beginners and the experienced users as well. Some modifications should be made for improvement of device to be more accurate for interaction made from hardware circuit and coding. More testing in different aspect of realistic musical drum instrument will be further studied to improve its performance in future.

VII. ACKNOWLEDGMENT

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Significance of Knowledge Management, Knowledge Reusability and Knowledge Sharing in Higher Educational Information System

Mohammad Shuaib Khan[1], Niharika Gehlot[2], O.K.Harsh[3]

[1]Department of C.S.E, Glocal University, (Mirzapur) Saharanpur, Saharanpur, India
[2]Department of C.S.E, Jai Narayan Vyas University, Jodhpur, India
[3]Distinguished award winner of university of new England Armidale, Australia
Ex VC Glocal University, (Mirzapur) Saharanpur, Saharanpur, India
Email: [1]Shuaibkhan.it@gmail.com, [2]chouhan_niharika@yahoo.com, [3]oharsh@gmail.com

Abstract—**Reusability and sharing of the knowledge has become one of the most important components of reprocess methods today and is considered a fundamental source of extra benefit for businesses and businesses with no income. Every institute that desires to achieve sustainable, modest additional benefits must emphasize its knowledge as much as possible and reuse and respectfully pass it on. The need to include the reuse and sharing of knowledge in the public or in the administration is not only the result of increasing competitive pressures, but also the necessity for quality development and price drop for the knowledge environment. In order to better implement the overhead actions, we will examine the three-dimensional model of knowledge management in an Information and Communication Technology environment and specifically examine the numerous topics of knowledge reuse and the provision of knowledge in an administrative environment. Proposals for the further development of reusable tacit and explicit knowledge in a management background for developing countries like India are discussed. Present research objectives to discuss key topics that should convince knowledge building to reuse knowledge in the exact arena of public administration.**

Keywords: Extra Benefit, Technology, Administrative Knowledge, Knowledge Sharing, Reusability of Knowledge, Quality Development

I. Introduction

The financial expansion of an economy is carefully associated to the provision of skills and exploration. Support for knowledge and research as a prerequisite for the presentation of inventions is still limited in our budget. High fluctuation and poor human resource management as well as insufficient analytical capacities have a negative impact on effective policy development. A low level of competence on the part of the community administration ultimately disrupts the supply of households in the capitals.

As Knowledge Management (KM) matures, the view that knowledge reuse and sharing of the knowledge with the support of IT is a much more conspicuous plan than worrying about speeding up the creation of new knowledge from an acquisition point of view.

Administrative activities take care of the requirements of knowledge management. Here we try to identify the processes of knowledge reuse and knowledge exchange in e-government and to designate them as new administrative information processes. We also discuss IT support for the reuse or sharing of knowledge in an administrative environment.

Availability and behavior are important features of the community Administrative activities known to the situation (society) while tacit knowledge [5] regulates the activities of the workforce. The information management sequence, on the other hand, is based on externalization or outsourcing tacit information in order to create explicit information objects that are available to others during the internalization process. Hence, the Information Management Regulation regulates, albeit indirectly, the excellence of efforts in a public administration organization.

The concept of past and present competency management is closely related to the business area, which is understandable and precise. In addition to the development of an information culture, there is an additional and necessary need for a knowledge dialogue in institutions.

Administrative procedures are usually taken into account by submitting an application form, which is touched on by different employees at different stages. These employees can access the current information in the procedure to get the information contained in their data set. The person responsible for applying each procedure will edit all of the material. Such procedures

are there for monitoring the implementation of laws or protocols in public organizations or large companies.

Knowledge reuse (KR) is not only a new and likely issue in the governance environment, but also has foreseeable benefits. Many places around the world share information for reuse or related processes and are involved in various studies. The gift of re-use effectively reveals the rational rule available in a group for the transfer and provision of knowledge. The re-use of knowledge in public administrations has different practices and implications for the future of each category of advanced public administrations. Some authors confirmed that reusability is responsible for diminishes interval and exertion [1, 2]. It is also useful to modify the dominant position of knowledge and learning in the company.

A. Model of Reuse Success

The theoretical model should correlate with organizational roles, tacit or explicit data type, tactical changes (e.g., increasing product flexibility and reducing sales time), policy changes (evolving and adopting reusable resources), and changes in developer insolences (propagation and reuse).

B. Tactic Variation for Reuse

Tactical changes include corporate-level judgments that govern the implementation of inventions. At the end of the developer, the high cost of learning and the blocking of knowledge in the early stages of reuse approval is possible. The form of the reuse tactic is governed by administrative deciding and determining factors: procedures, resource allocation, education and training programs.

If the strategy is changed thereafter, the organization can change quickly and effectively in the phases of the reuse. Changes in administrative regulations [34] and trade policy by management [36] are therefore profit issues.

Suitable distribution of possessions is also grave to the accomplishment of reuse procedure inventions [36]. According to author [37] we need enough number of support programs and significant resources in sequence for a reuse program to settle and accomplish reusable assets. The management controls the possibility of alteration the processes and people exaggerated by Changes. Occasionally administrative changes are iterative and sometimes necessary. However, sometimes changes are complex and unpredictable. It should be noted that due to the complexity of reuse, all parties involved must be properly informed and prepared.

Because reusable information is so compound, all reusable shareholders must have a scheduled training program [38]. It is worth remembering that training is best introduced at the beginning of the actual activity to avoid the need for data protection.

The reuse of knowledge is precisely the remarkable characteristic for management institutions, especially specific knowledge, which, when reused correctly, protects giant time and involves fewer exertion [1, 2]. The use of skills benefits reusable knowledge in order to gain additional meaning for a public being. The prevalent reusability of the explicit knowledge is more modest compared to tacit knowledge. It should be noted that the compilation of tacit knowledge is problematic and requires additional period, which requires rare exertions.

Existing studies are tied to identifying concerns about knowledge reuse in an innovative governing state in light of modern trends in scientific fields that have built a myriad of reputations for data types, perceptual mapping, linking and repackaging of evidence, tactics, and concerns about instructions on reuse and assignment of such realisms in the knowledge civilization. The Nonaka model [4-6], the well-known model for knowledge management, should have also contained the reusable evidence.

II. Literature Review

A. Appraisal of The Explicit and Tacit Knowledge

The concept of explicit as well as the tacit knowledge was mainly promoted by Polanyi [12] and further developed by Nonaka [9]. According to Nonaka & Konno [11] Explicit knowledge is knowledge that is voluntarily "formally and systematically transferred between individuals". While the tacit knowledge defined as it is knowledge that is specific to a certain thing that arises from understanding. It represents a random practical measurement, often referred to as "know-how", and contains an element of reasoning that includes views, norms, and intellectual representations. Tacit knowledge is difficult to speak fluently because it is extremely individual and often different from the specific. It should be noted that imperceptible knowledge is most valued for an organization and henceforth represents an essential basis for novelty (Lee, Egbu, Boyd, Xiao & Chinyo [8]). If we want to use this knowledge for the organization, it has to be transformed into the explicit, make it public for use and the institution can take it into account for the whole people. Skills or abilities that are transportable from one profession to extra are one instance of implicit knowledge.

Active communication in the midst of knowledge is crucial for the formation of new tacit and explicit knowledge and thereafter a prerequisite for novelty. According to Nonaka [9], such contact or interaction takes the form of a "spiral of knowledge" or the socialization, externalization, combination and internalization model (SECI) (Nonaka & Konno [8], which consists of four

practices of knowledge allocation. . Such communication between these four routes is shown in Figure 1.

Suggestion of some workers [5, 10] reveal that utmost part of tacit knowledge is transferrable. This type of knowledge is revolutionary and there are always chances in the refinement of such knowledge, for example knowledge used by executives which has its strategic consequences for any organization [11].

This one is motivating to remember that while knowledge is the key emphasis of Knowledge Management (KM), KM in training involves administrations to get knowledge, information and data instantaneously in order to maintain the order of the facts. Inappropriately, there is great confusion between KM researchers and specialists about the types or nature of knowledge gathered [38,39].

Although extreme KM researchers and specialists conclude that fruitful KM application will lead to better organizational response, there is slight experimental indication to support this and it is due to the occurrence of several things other than the manipulation of organizational performance by KM, such as: Machines, Employee Skills, and Returns [20]. In addition, KM's immediate tools are imperceptible, such as better work skills and knowledge [21]. In addition to traditional "hard" measures, management should also include "soft" measures [20] to deal with recurring administrative problems.

Joseph Schumpeter is considered to be the primary economist who recognized the importance of novelty in business [22]. Schumpeter [18] advocated an additional active vision of economic development that focused on novelty. He also presented the idea of "creative destruction," where companies with more sophisticated, higher yields or procedures can overcome the barricades that block new companies from a recognized market. Schumpeter's philosophies that are at the mercy of evolutionary economics are then appropriately referred to as coherent connections to those who established evolutionary economics, argued that it is acceptable for organizations to continue market rivalry, wanting to "move forward" or "transform" by getting into advanced movement.

Explicit knowledge is seen as extensive and can be assigned, collected and exchanged in the organization of data, transactions and information [5, 12].

B. Role of Information Technology

When information technology (IT) is set up to simplify and improve the organizational procedures for the design, allocation, storage, restoration and use of knowledge, the subsequent data-based system is referred to as a knowledge management system [32]. Most KM researchers and experts find that Knowledge Management System is the system that is purely based on IT system.

1. Enables and opposes the formation, distribution, use, storage and distribution of knowledge [32].
2. Facilitates improved conclusion construction by building accessible significant and relevant knowledge when needed [16].
3. Increases commercial value [32].

In today's world, globalization in information technology (IT) has motivated the international economy to become a knowledge-based family "based directly on the manufacturing, circulation and use of knowledge and information" [30]. At the same time, this economic movement has spawned the concept of the knowledge-based institution, which values institutions as institutions in which social and academic wealth are the main capitals of the institution [7].

The primary issue manipulating knowledge sharing is Information Communication Technology. It supports the knowledge sharing actions over the procedure of storage, mingling and accumulation worth to knowledge [13] moreover officially or casually [13]. Furthermore, this facility could diminish obstacles in sharing knowledge and it too could reduce time. Therefore, the part of ICT is to inspire speechmakers to share knowledge and too to care the procedure of knowledge sharing [17] across places, occupations and separations.

C. Knowledge Sharing

Knowledge can be described as the inclusion of experiences, morals and data identifications. In addition, knowledge can be expressed, concise, printed and accumulated to form skills and new knowledge [3]. This can also be found in many preparations, such as Brochures, films, speeches and films. Knowledge sharing arises through a process of sharing abilities, skills, actions and feelings that is determined by the donor and observer. The exchange of knowledge is also one of the actions in knowledge management [40].

D. Organization

The additional problem with manipulating knowledge sharing is organization or association. The association problem play a vital role [41] as it affects performance differently than knowledge sharing [42]. The association also publishes records and provides the basis for knowledge about the exchange of knowledge, from specialist staff to new staff. Therefore, the association problem is expected to be a novelty in the knowledge-sharing process.

E. Achievements in Administrative Environment

The motive of knowledge administration is to make the official process easier for staff to bring information to the fore. As a result, there are a variety of official approaches used by administrators in managerial organizations, such

as addresses, conversations, demonstration procedures, meetings, planning, travel, and problem solving. To make this determination, a manager needs training materials such as lecture dates, query projects, and applied interrogations. Managerial resources can tailor official content to suit managers and other staff member with different needs. One method of managerial resources is, therefore, full knowledge sharing between managers. In this way managers can restore the act of managing through informative means and thus reap experienced and hardworking managers. Evidently in this approach reuse of all types of knowledge is not only required while it is the necessity.

F. Reuse Innovation in Administrative Environment

Administrative staff at corporate want managerial innovations as new ideas and methods to advance current approaches. In addition, the informative novelty can help managers implement new methodologies in the administrative process, originality in executive process and knowledge transformations more calmly than ever before. Novelties in administration are original changes that incorporate new approaches or means by which managers achieve the goals of corporate. Although increasing the level of novelty and advancement is based on knowledge. Administrative innovations are important for managers to improve official procedure in corporate institutions and to adopt the idea of knowledge reusability. From now on, the new training of mangers can increase the value of further supervisors.

G. Reuse of Tacit Knowledge in Business

As accessible in the works, tacit and explicit knowledge are contrary (Harsh [14]. Harsh [14] recommended a three dimensional model which was originated on the popular Nonaka model [4, 5]. Work of these investigators conclude that the tacit as well as the explicit knowledge reusable correspondingly.

Exertion of Harsh [14] demonstrate that "in an organization the effective knowledge measured to be improved over the time since each prompt we add further knowledge due to various concepts". According to him, data, information and knowledge are reusable and can generate qualitative data, information and knowledge due to the recurring chance of tacit and explicit knowledge.

H. Nonaka and Takeuchi Knowledge Management Model

Harsh and Iqbal *et al.* [28, 29] scrutinized qualitative knowledge management and reuse in an innovative administrative scenery. Numerous scholars have operated
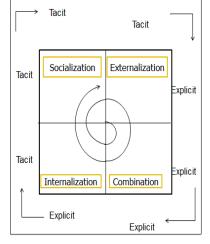
Fig. 1: Nanaka and Takeuchi Model [5]

on the progress of knowledge management, but the theory of knowledge structure by Nonaka and Takeuchi [5] (model depicted in Figure 1 in their research) is the principal all-encircling identified and commonly quoted exertion in knowledge organization campaigns. Rendering to the Nonaka model [5], the lively interplay of tacit and explicit knowledge enables a knowledge dialogue progression that eventually offers the knowledge. Nonaka's model [5, 6] is the sound-acknowledged ancient model of knowledge administration which comprises four divergent approaches of knowledge revolution, explicitly socialization - knowledge allocation by socializing, which infers that a tacit knowledge altercation occurs. Externalization - knowledge allocation through the technique of amendment or categorization of tacit knowledge to explicit knowledge. Combination is the technique with which the knowledge transmission from explicit to explicit and lastly to internalization happens - allocation of knowledge in the development of perception [5].

III. RESEARCH OBJECTIVE

This research seeks to reuse (by sharing or assigning) tacit and explicit knowledge in advanced management institutions in an information and communication environment and to determine whether tacit knowledge inspirations under the control of the organization's ultimate concern produce sustainable gains. Current research will distinguish the reusability of tacit and explicit knowledge and grant the privilege of paying back administrative organizations (in an information and technology environment) by improving the quality of existing knowledge as a result of the ceaseless refinement of repetitive knowledge. The main choices of the current investigations are to include the following evidence in the advanced administrative settings:

- To appreciate the meticulousness amongst the reusability's of tacit and explicit knowledge in the garlands of progressive secretarial circumstances.

- To realize the propositions of reusable knowledge of an establishment such as progressive knowledge management in the garlands of tacit and explicit knowledge.
- To escalate the Quality and its attractiveness for tacit and explicit reusable evidences.
- To inspect the implication of Information and Communication Technology for creating reusable knowledge.
- Implications of knowledge reuse in the developing country like India.
- Finally disagreement of saving the works as a significance of reusability of tacit & explicit knowledge in a progressive administrative atmosphere.

IV. Method

It should be noted that, despite extensive explanations by Nonaka and colleagues [4-6] on knowledge management, it has been found that they have not established a definitive theory about knowledge reuse particularly in an administrative background, which recommends additional research to upgrade the model in light of the reusability of knowledge in an administrative context can be a remarkable fragment of research.

he method of knowledge management and its reuse has of course become a living perception in a large number of advanced administrative organizations due to the consequences of improvement. In addition, the desire to improve quality and the demand to shorten the time have made an important contribution to the systematic improvement of administrative institutions.

We are going to discuss with Figure 2 of Nonaka's long-term model stretched by Harsh [1, 2 and 14], in which there is a tacit and explicit knowledge conflict. Knowledge and its reuse are important not only for managing assets in higher administrative institutions, but also for making assumptions and developing guidelines. In an administrative institutions, the transfer (continuous) of knowledge from manager to assistant and vice versa. To withstand the evolution of knowledge reuse (in a rapidly evolving environment), all governance organizations must develop operational tools for knowledge reuse and management. In the present work, authors want to strengthen the concept of reusability in order to promote effective management as a result of reusable knowledge, and henceforth propose to:

1. Stimulate the unseen tacit / implicit reusable knowledge in an administrative environment
2. Gather reusable knowledge from the managerial institute and consider all available knowledge
3. Recognize the lack of reusable knowledge, especially tacit knowledge in the office environment
4. Produce new tacit and explicit reusable knowledge

5. Brand reusable knowledge more accessible and usable during the office hours
6. Create reusable knowledge distribution systems for experiments and studies for the managers
7. Assess and replicate reusable cultural practices within the corporate or business
8. Categorize new reusable knowledge in a business environment
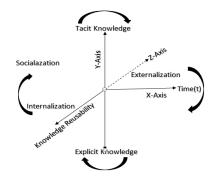
Fig. 2: Extended Nonaka and Takeuchi [5] Model.

Stretched Nonaka model and inclusion of Reusability in Higher Administrative Environment:

Nonaka and Takeuchi [4-6] set up the disobedience of implied to express information (and the other way around) all through the socialization, externalization, mix and disguise redundancies. They uncovered that public exchange of inferred to unequivocal and express to implied information is stubbornly happening attributable to one or different activities in any foundation (see Figure. 2). Such classifications of happenings are 'intermittent savviness activity' stylish in an educational circumstance during where information is improved the same a twisting. However, exertion of Harsh [25], on the three dimensional information the board extra improves the thought of the reusability to these return happenings which create restored sort of reusable information. Such information can be bullied in an edifying air which can widen not just new reusable information while additionally recuperates the predominance or greatness of information [Harsh 2, 14].

In this manner one can understand that the reusable knowledge conveys very productive strategy to move fit strategies, portrayals, decisions, introduction and is handy of making quality framework in light of the fact that the recompense deals unforced drive of information and its associated activities. Such are the occurrences of mix notwithstanding socialization of implied and explicit knowledge. It likewise helps in firming development and movement and consequently helps in building the marking of the organization. Due the accessible assets on reusability, general staff can reuse by sharing extensive assets and can dodge indistinguishable belongings. It also underpins in enhancement of verifiable like discussion

of data and information in a joint set-up. Accordingly the bulletins, gatherings, meetings, meetings and shows can convey us as a gadget for reusable information and henceforth the great practices.

Out and out the common discussion plans with different foundations occur as an outcome of discussion and discussion of musings and consequently attributable to the implied information. Along these lines in Figure 2, practices of externalization of reusable information occurs. While then again if forlorn the people, methodology and base of individual associations are tangled in cleaning and mishandling the reusable information then it builds up the system of disguise. In this manner one can understand that together solitary implicit and unequivocal information however their reuse, sponsor the entire information cycle in the three dimensional model.

The suggested procedure for reusable knowledge administration in an organization:

Various associations can get down to business a reusable information the board for the authoritative frameworks by the data and correspondence innovation instruments (just as advanced media) and most recent web utensils.

These days barely any diaries and media are in effect likewise settled to backwards data to supporters just as. Point is that if the over three dimensional reusable information the board model of Harsh [24, 25] is utilized to ventures like "Shodh Ganga" [35] (online assortment of exploration proposal) at that point there would be perpetual evolvement of reusable information attributable to its intermittent offers. These information activities can help incredibly to schooling executives in India where there is a tremendous lack of information writing.

It should be recognized that the return acknowledged inferable from development of reusable information sources in the administrative associations are abundant however boss advantages are:

- Enhanced improvement on assets consumed in generating reusable knowledge centers.
- Greater bibliographic administration of reusable tacit knowledge.
- Better dispersion of official objectives and actions.
- Supports in sharing valuable reusable knowledge amid varied types of customers and make extensive joint procedures and practices.
- Producing autonomous qualitative reusable resources.
- Making of original reusable tacit and explicit knowledge and insights.
- Optimization of applications for generating reusable facts.

In this way to continue these exercises, regulatory organizations need to start the development of reusable

information the board material. Such material might be advantaged to expand an arrangement of reusable information framed at authoritative authority stage by methods for appropriate capacity and gear. In the current three-dimensional model, information reusability is symmetrical to together implied and unequivocal information which proposes that both unsaid and express information reusabilities are self-overseeing measures and hereafter such reusable information can be made self-governing for the appropriate entries.

The development of reusable information the executives needs concerns the same to data, implication with divisions, gathering of laborers, and idea of information charts. These are not many of the fundamental focuses alluring for development of viable information bases, reusable information communities alongside doors, sites and so forth Driving truth is the necessities of curators and data masters who can handle and figure out the certain or unsaid reusable information being formed in an organization and clue it appropriately by spreading unmistakable strategies. For this a variety of abilities are likewise required like reusable information seizure, reusable information examination, reusable information arrangement, reusable information mining, reusable information planning, reusable thought planning, reusable ordering and reusable interfacing.

Present conversation proposes that reusability of inferred and unequivocal information is very fundamental which could be appropriate to incredible number of authoritative association by methods for the ICT (Information and Communication Technology) innovation. Indian little just as enormous size ventures are running activate absence of directors and other related staff which could be staggered to certain degree by methods for on the web and separation the executives frameworks where reusability shows an innumerable character.

Reusable information oversight not single ropes associations to development their capacity of fulfilling and dispensing data, while it likewise helps in maintaining the investigation and rehashed development of their works however creating the subjective information notwithstanding delivering confidence. Since we can understand that reusable implied information benefits the association to allow its faculty to easily increment not just its valuable practices while additionally license them to support the quality and height of the association by spreading this information to media, meeting and discussions.

Reusable unequivocal information and its administration of the relating managerial exercises must rehash and adore data at each stage starting from association stage to singular level stage with the goal that

such reusable information can progress (of labor forces) which commitments in getting splendor of the executives for chiefs. Conversation and shared collaboration's among associations likewise help in the upgrade of inferred just as unequivocal information according to the grouping of the three dimensional information the board model (see Figure 2). Off base such exercises happens with time, as the time propels; further and further such activities will occur.

The responsibility of information experts and chiefs in rising reusable information and its organization is to fit the data associated exercises and gathering information correctly.

V. Conclusion

Current research mimics the importance of reusable tacit and explicit knowledge in various administrative landscapes, which is very beneficial for the nation like India where there is a need to improve administrative skills through numerous manuals in addition to machines. The current argument also specifies the improvement in the excellence or quality of tacit and explicitly reusable facts as a result of the reclassification of offers in a three-dimensional environment due to their correction during the knowledge cycle.

Information and communication technology continues to use reusable knowledge and also opens up enormous possibilities for permissible applications of reusable knowledge. Recent research also has advantages in reusing the software applications while they are being reused in a management environment. This saves an enormous amount of time and increases the quality of the systems.

VI. Future Scope

Current endeavors can profit by making reusable programming information segments that spare time and capital, yet in addition improve the greatness of our reusable information while accomplishing ideal work. The assets utilized in an industry can be enhanced based on reusability ideas in rustic India where information instruments can be presented from sound business bases. A study arranged investigation too a contextual analysis on this subject can additionally abuse the new entryway for the fruitful utilizations of reusable information.

VII. Acknowledgment

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Voting Classification Method for the Diabetic Prediction

Er. Tejinder Sharma[1], Nitika Sharma[2]

[1]Associate Professor, Amritsar College of Engineering & Technology, Amritsar, India
[2]Research Scholar(M.Tech), Amritsar College of Engineering & Technology, Amritsar, India
Email: [1]tejindersharma@acetamritsar.org, [2]Nitikadvedogra123@gmail.com

Abstract—**Bioinformatics can be defined as a science of storing, fetching, arranging, interpreting and using information obtained from biological series and molecules. Prediction can be defined as a statement about future event based on the current situation. This research is based on the diabetic prediction with machine learning algorithms. The diabetic prediction has various steps. A voting-based classifier is proposed in this research work for the diabetic prediction. The performance for the diabetic prediction is optimized up to 2 percent using proposed algorithm**

Keywords: *Diabetes, Voting, Machine Learning*

I. Introduction

In the last two decades, massive growth in the volume of data being stored in databases and the amount of database applications for business and technical purposes has been noticed. The successfulness of the interactive model for storing data as well as the evolution and maturing of data extraction and handling techniques are the major reasons behind the explosion in the volume of data which is being stored in electronic manner. In the recent times, advanced techniques are being developed to meet the demand requirements. Also, some efforts have been made for the development of software for data analysis. The companies on the other hand have realized the important of valuable data hidden within these massive amounts of data that was being considered as insignificant till now. The masses of stored data comprise information of a number of factors of different organizations in the offing to be extracted and adopted for supporting the business decision-making process in more efficient manner.

Diabetes mellitus, generally known as diabetes, is a metabolic disease. This disease increases the glucose level in blood. The hormone insulin transfers glucose from the blood into human cells to be stored or used for energy. In this disease, human body either doesn't generate sufficient insulin or is not able to use the generated insulin effectively. If this disease is not treated in proper time, it can cause harm to a person's nerves, eyes, kidneys, and other organs. Diabetes Mellitus (DM) is a very common endocrine disorder. According to a report, more than

200 million people all over the word are affected by this disease. The onset of diabetes is predicted to upsurge intensely in the forthcoming years. The division of this disease can be performed into different categories:

1. Type 1 Diabetes or (T1DM)

T1DM is an autoimmune disorder. In this type of diabetes, the immune system attacks and damages cells in the pancreas, where insulin is generated. There is no clear cause of this attack. Approximate 10 percent of people are suffering with this sort of diabetes. The general symptoms of this disease may include excessive hunger, increased thirsting, unintended weight loss, frequent urination, fuzzy vision and fatigue.

2. Type 2 Diabetes or (T2DM)

In this type of diabetes, human body becomes resistant to insulin, and sugar generate in the blood of affected person. The general symptoms of type 2 diabetes may include extreme hunger, excessive thirst, frequent urination, blurry vision, fatigue and sores that heal slowly.

3. Prediabetes

This type of diabetes increases the sugar level in blood than the adequate level. But this increased sugar level is not high enough for the doctor to diagnose diabetes. In united states of America, more than a third of people are suffering from this type of disease but most of them have no knowledge about it [15]. Prediabetes can increase the chances of a person to get affected by T2DM and heart disease. Exercising more and losing extra pounds, even as little as 5% to 7% of an individual's body weight, may lower those risks.

4. Gestational Diabetes

Generally, pregnant women get affected by this disease. During pregnancy, the body can become less sensitive to insulin. Gestational diabetes does not occur in all women and generally resolves after birth of child. The condition is often detected during a regular blood sugar test or oral glucose tolerance test that is mainly performed between

the 24th and 28th weeks of gestation. In some cases, a woman with gestational diabetes may experience extreme thirst or urination.

All the steps involved in diabetes prediction have been described below:

a. Data selection: The first step of the mining process is identified as data selection. The data is obtained different sources. The acquired data includes significant risk factors such as vital signs, diagnosis and demographics. All these risk factors play an important for diabetes prediction. The major aim of using this data is to generate prediction about a person being diabetic by diagnosis on the basis of certain diagnostic measurements involved in the acquired dataset. These data include personal health data as well as results from medical tests. The detailed features in the acquired dataset generally include number of times pregnant (preg), Diastolic Blood pressure, Body mass index (BMI), age etc. [11]

b. Data pre-processing: In general, realistic databases are vulnerable to noisy, missing, and unreliable data. This occurs because of their enormous size and their possible origin from numerous, heterogeneous sources. Data quality contributes significantly in the data mining process for disease prediction and diagnosis. Low quality data may be the reason of imprecise or less predictive outcome. Therefore, various pre-processing methods are implemented for making the acquired dataset more fruitful and appropriate for diabetes prediction. Data pre-processing can be performed by applying data cleaning, data integration, data transformation, data reduction, and data discretization. The data needs to made more suitable for data mining and analysis with regard of time, price, and quality.

II. Literature Review

Deeraj Shetty, *et al.* [1] stated that data mining was one of the subfields of software engineering. It was a methodical process in which the illustrations had found in huge data sets. Assuming the data from the data set was the main objective of this data mining technique. This data was changed into a logical structure so as to use it further. The diabetes data that was collected used to learn design focusing on this part of medical conclusion. The smart therapeutic choice was produced that was emotionally supportive network useful for the physicians. The assembling of Intelligent Diabetes Disease Prediction System was the fundamental goal of this examination. The database of diabetes patient had employed in this system to provide the diabetes malady analysis. The exploitation of KNN and Beyesian algorithms was suggested in this system that had carried out in the datasets of diabetes patients. Several diabetes

features were extracted for analysis of these algorithms to predict the disease of diabetes.

Santosh Rani, *et al.* [2] studied the data related to the heath that was generated in huge amount at several stages of health system. This data was not processed easily and the analysis of this data was hard to extract because of its huge size. However, the data was processed using various approaches that based on the machine learning. The efficient data was obtained from the approach based on machine learning and this data was useful for the treatment of patients. This approach was also useful for predicting the disease's future. The contribution of past history of patients for various parameters had helped in the possibility of different health issues. In the continuous data, the data mining based on Association clustering and Time Series had utilized to build up the early warning

system. When the existing parameters were analyzed, the disease had described using system based on prediction. The patient had saved from the disease at some extent with some level of care.

Rukhsar Syed, *et al.* [3] suggested an algorithm that received benefits from the tree-based partitioning. Furthermore, this algorithm utilized the adaptive approach of SVM for the categorization. The preprocessing was carried out in sampling SMORT in this algorithm for pruning the data. The Weka tool had employed for the experiment purpose on the diabetic dataset. The comparison of the suggested algorithm had performed with RF based on tree, RT approach and J48 approach. The experimental outcomes demonstrated that the suggested algorithm achieved the more effectiveness than conventional solution to process the diabetic data and the proficient categorization was found from that data.

Bhargavi Chatragadda, *et al.* [4] focused on the implementation of data mining methodology for predicting the diabetes. To extract the knowledge, from the stored information of dataset was the major target of this data mining methodology. The patterns were also analyzed using it. People faced numerous health related issues and some people were not even conscious about the symptoms of disease. The Diabetic Mellitus was the main health issue. There were many people who were suffered from the Diabetes. This disease was occurred in the people of young generation also. The predictive analysis was employed in HUE for forecasting the diseases. The Pima Indian Database was carried out to gather the dataset. The effective technique was obtained using this framework with SVM classification that proved useful for counting the people who had faced the diabetes.

Yang Guo, *et al.* [5] analyzed that the diabetes mellitus was one of the chronic diseases and the main health challenge publicly throughout the world. The data mining techniques were employed to aid people for predicting the diabetes. The Bayes Networks had recommended for envisage the patients who suffered with developing diabetes of type-2. The Pima Indians Diabetes Data Set

was carried out to gather the information related to the patients whether they had developing Type-2 diabetes or not. In this study, Weka software was employed. The outcomes demonstrated that the recommended Bayes network was accurately and efficiently predicted the diabetes of type-2.

Purushottam, *et al.* [6] observed that the progressive research area was prediction of diabetes disease in the field of healthcare. The main reasons of diabetes disease were evaluated using number of data mining techniques but only some sets related to clinic risk factors were regarded for analysis. As a result, few efficient factors such as health condition in pre-diabetes were not taken into account during their analysis. Thus, such methods had not provided the suitable pattern and risk factors of diabetes with the exactness in their outcomes.

Ayman Alahmar, *et al.* [7] proposed the stacked ensemble methodology that was carried out with deep learning and considered as the meta-learning algorithm [7]. The short as well as long LOS had foreseen for the patients of diabetes. The capability of stacked ensemble methodology was proved in this field by its outcomes. The superior performance for prediction had achieved in the results of algorithms of stacking multiple classification learning as compared to other constituent learning algorithms. The reasonable estimation on LOS for the diabetes patients had attained that proved useful to diminish the cost of healthcare and enhanced the contentment of patient who suffered from diabetes.

Geetha Guttikonda, *et al.* [8] suggested the relevant data mining methods that were utilized for predicting the diabetes. The extraction of preferred knowledge from the stored information of dataset and the analysis of the patterns of data was the major motive of data mining. The people were suffering from many issues related to health and some were not even conscious about the symptoms of these health problems. The Diabetes Mellitus was one among such health diseases. The young ones were also faced this disease. The prediction of these diseases was done employing the HUE for predictive analysis. The behavior of these diseases was relentless. The Pima Indian database was utilized to assemble the dataset. The persons who had diabetes were calculated using

effectual technique that was achieved from the suggested framework together with SVM classification.

Wenqian Chen, *et al.* [9] suggested a hybrid prediction model for detecting the diabetes of type-2. The classification was performed using the K-means with J48 decision tree to diminish the data. The Pima Indians Diabetes Dataset was employed for the purpose of acquiring outcomes of experiments. This dataset was taken from UCI Machine Learning Repository. It was observed in the outcomes that the superior precision had obtained from the suggested model than former studies of literature. It had demonstrated that to diagnose the type-2 diabetes, the suggested model was efficient.

Zhongxian Xu, et al. [10] recommended a risk prediction model for diabetes of type-2. This model was designed on the basis of ensemble learning technique. The selection of optimal attributes was done using RF-WFS. Various performance metrics and the outcomes achieved several experiments had compared to authenticate the efficiency of this technique. This technique provided the superior predictive accurateness than other algorithms that were utilized for classification. The results were confirmed at Pima Indian diabetes dataset of UCI. The more precision and better performance for classification had acquired from the recommended model as compared to other outcomes of research that used in the literature. The diabetes was diagnosed earlier using this model.

III. Research Methodology

Data mining is a leading tool set in clinical databases. Nowadays, the use of data mining algorithms for generating clinical predictions has become quite common. Over the past few years, many researchers have theorized that medically assistive supports and prediction patterns can be acquired from the crucial data of a patient.

Following are the various phases for the diabetic prediction: -

1. Data set Input: The dataset of diabetic prediction is taken from the UCI database. The dataset has various attributes for the final prediction

2. Attribute selection: In this phase, the technique of PCA is applied which can select the most relevant attributes from the large number of attributes. The selection of relevant attributes may lead to reduction is execution time

3. Clustering: In this phase, the feature selection process will be executed. In this phase, the technique of k-clustering will can cluster similar and dissimilar type of attributes for the better classification

4. Classification: In this phase, a voting classification algorithm will be used for the diabetic prediction. This voting classifier will be combination of multiple classifier and result of each classifier will be combined to prediction final result. To apply voting classification whole data will be partitioned into training and test set.

IV. Result And Discussion

This work focusses on the diabetic prediction. The data is taken from the UCI database. The dataset has 20 attributes and data set is of multivariate type for the prediction analysis.

The two methods are implemented and compared in terms of certain parameters like accuracy, precision and recall. The first method is the combination of PCA, K-means and logistic regression. In the second method PCA, K-means and voting classification approaches are implemented for diabetic prediction. The voting classification method is combination of logistic regression, random forest and SVM classifier.
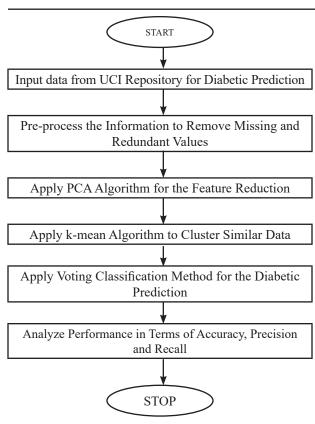
Fig. 1: Proposed Methodology

The parameters for the performance analysis are described below:-

1. Precision: Precision is the degree to which repeated measurements under static conditions generate similar outcomes.
2. Recall: Recall is the ratio of properly predicted positive observations to the all observations in original class.
3. Accuracy: It is the ratio of the accurately labeled subjects to the entire group of subjects.

Accuracy = Number of points correctly classified*100
Total Number of points

Fig. 2: Apply of Voting Classifier

Fig. 2 shows the use of diabetes dataset for PA (Prediction Analysis). To perform diabetes prediction, voting classifier combination of MLP, RF and NB was applied. The complete dataset is divided into dual subsets of training and testing for analysing predictive results

TABLE 1: PERFORMANCE ANALYSIS

Parameters	Existing Method	Proposed Method
Accuracy	97.40 per cent	98.05 per cent
Precision	97 per cent	97.12 per cent
Recall	97 per cent	98 per cent

Fig. 3: Performance Analysis

As depicted in figure 3, the efficiency of existing and new algorithm is compared with respect to certain metrics. It is analysed that percentage of all three parameters is higher in the new algorithmic approach.

V. CONCLUSION

Data-mining methods have been extensively utilized for predicting blood sugar levels. The data-mining methods do not need strong model suppositions for making prediction models for blood sugar levels. In this paper, it is concluded that diabetic prediction has various steps. The technique of PCA is applied for the feature reduction. The k-mean clustering is applied which can cluster similar and dissimilar type of data. In the last, the voting classification method is applied for the diabetic and non-diabetic prediction. It is analysed that proposed method has high accuracy, precision and recall values as compared to existing methods.

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Routing Protocols in Airborne Ad-Hoc Networks

Dr. Sachin Khurana

Department of Computer Applications, Amritsar Group of Colleges, Amritsar, India
Email: hod.mca@acetedu.in

Abstract—**With the expansion of wireless technologies, the ad-hoc networking between aircraft has become possible. This kind of networks is known as Airborne Ad hoc Networks (AANETs). These networks have emerged as one of the highly challenging areas of research due to the unique flight dynamics of the aircraft being used as nodes. The cruising speed of an aircraft (around 400-500 mph) is the major reason behind the intermittent link quality between two communicating aircraft. As a result, the routing between aircraft has emerged as a major threat for research in this field. This paper presents a study of different routing solutions provided recently by the research community for AANETs.**

I. Introduction

Wireless communication is one of the technology's major contributions today. Since its introduction in today's century, due to technological advancement, Wireless communication has improved a lot over the consecutive years. In the present time, wireless communication refers to various wireless devices and technologies like smartphones, personal digital assistants (PDAs), laptops and Bluetooth enabled devices, etc. Nowadays mobile service providers are providing higher data rates at lower prices. Hence, mobile computing is growing at a very rapid rate. Wireless communication can be accomplished by using two different techniques. The first technique is by using the existing infrastructure networks i.e. cellular Networks for carrying out voice and data traffic. But these kinds of networks are having one major issue called "hand off". At the time of hand off, the biggest challenge is to keep up the least signal level to avoid any possibility of link break so that there is a minimum delay or packet loss. The second technique is by the formation of such networks which are independent of any kind of infrastructure,known as "Ad-hoc Networks".All the users participate in forwarding data packets from source to the destination. This kind of networking has a limited range. Ad-hoc networks can be deployed at places where no pre-established infrastructure is available. They can be installed rapidly for providing any kind of communication with headquarters to carryout the relief and recovery operations smoothly.

For the establishment of the ad-hoc network, a routing protocol is needed. The protocol should be able to detect any change that may happen in the ad-hoc network. Because every node forwards the packets and hence behaves like a router, to make the required routing decisions, a routing protocol is needed. The protocol based on these algorithms selects the optimum path from the source to the destination for the regular flow of packets. In a wired network, the nodes do not move often and will be based on some defined topology. But in ad-hoc networks,there is no predefined topology as the nodes move with higher speed frequently. Due to frequent topology changes, the route determination process becomes too complex and expensive. Moreover, the limited transmission capability of every node and low band width increases the network complexity further. A mobile Ad-hoc networking working group has been formed as a part of the Internet Engineering Task Force (IETF) in the late 1980s [1]. Since then, this group is working towards the development of a routing framework for ad-hoc networks. A large number of protocols have been developed so far. These protocols are broadly classified as a table driven (or proactive) and demand-driven (or reactive) protocols.

Each kind of protocols has specific advantages and disadvantages for different kind of networks.

Swarm intelligence has been used to solve optimization problems in data networks. One such optimization problem is routing where swarm intelligence has been applied.

When the principles of ad-hoc networking have been used for providing communication between nearby vehicles and between the vehicles and existing roadside equipment, there is another kind of ad-hoc networking concept called Vehicular Ad-hoc Networks (VANETs). Here, the nodes are vehicles which move on predefined roads. VANETs are one of the key components in the Intelligent Transportation System (ITS). But today, a new kind of ad-hoc networks known as Airborne Ad-hoc Networks (AANETs) where nodes are UAVs or aircraft.

With the increasing demand for air transportation and need of in-flight broad band services, AANETs might be one be a major part of the aviation industry. After so many developments and years of research in the ad-hoc network, there is still one major challenging issue i.e. routing. This issue is the major barrier to the existence of the Airborne Ad-hoc networks in the real world. In this paper I will be discussing some of challenges and offer some useful solutions as a routing mechanism for AANET.

A. Wireless Networks

Wireless networks are flexible data communication networks which use radio frequency signals for communicating [2, 3]. Here, each node sends and receives the data in a broadcast manner. Since the transmission and reception of data are performed through the air, the nodes may not be physically connected to an already existing infrastructure.

Wireless networks can operate in two different modes based on infrastructure as shown below in Fig. 1.1.
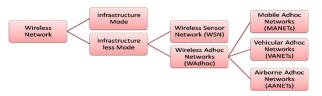
Fig. 1.1: Classification of Wireless Network

B. Airborne Adhoc Networks (AANETs)
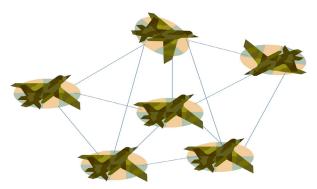
Fig. 1.2: Airborne Ad-hoc Network

AANETs are highly dynamic Ad-hoc networks with flying vehicles (i.e. Aircrafts) acting as mobile and relay nodes in air or space. These networks have different characteristics in comparison to traditional VANETs. Hence, there are different routing issues with AANETs. Due to the advancement in communication technologies in recent years, it is possible to start networking between flying nodes in space or air [4–7]. Aircraft Ad-hoc Networking is actually an ad-hoc communication between aircraft. These flying vehicles may be equipped with wireless transceivers. AANETs are also known as Flying Ad-hoc Networks (FANETs) or Aeronautical Ad-hoc Networks or simply airborne networks.

Airborne ad-hoc networks can be established between aircraft for civilian applications while for military application Unmanned Aerial Vehicles (UAVs) can be used as mobile nodes as shown in fig 1.2. UAVs can also be used for civilian's applications.

 a. Aircraft-to-Aircraft communication: Different aircraft can communicate with each other directly for different application areas like target tracking

and path planning. It is also called air-to-air communication as shown in Fig.1.3.

 b. Aircraft-to-infrastructure communication: Here, aircraft may communicate with ground stations, satellites, and warships to give information services. This technique is also known as air-to-ground communication as shown in Fig. 1.3.
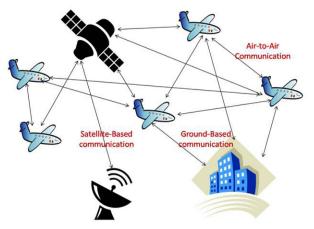
Fig. 1.3: Communication in Airborne Ad-hoc Network

C. Routing in AANETs

Routing in AANETS is very challenging since node mobility causes regular network topology updates. This requires flexible and robust routing solutions to keep up the existing routes and search for the new one when needed [8]. It is very difficult to find the shortest and reliable path between the source and the destination nodes by traversing through intermediate nodes. When any node of the network moves, the established link may break. With a constantly updating topology, even maintaining a connection is quite difficult. Besides handling these regular topology changes, AANETs routing protocols have to deal with other constraints, like limited bandwidth, low energy consumption, and higher error probabilities, which may be existing in the wireless environment. In addition to this, asymmetric links among mobile hosts and terrain conditions make routing more complicated. These networks need a responsive routing protocol which can find new valid routes as early as possible, whenever topology changes and the existing routes break. Since the implementation of the MANETs, many routing protocols in ad-hoc networks have been considered and mainly categorized by routing information update procedure used as follows:- Table-Driven(Proactive) Protocols, Demand Driven (Reactive) protocols, Hybrid Protocols[9–12]. Airborne ad-hoc networks are a subclass of VANETs and MANETs. As, it has been seen that routing in AANETs is quite different as compared to traditional VANETs and MANETs, hence existing routing protocols will not be able to deal with such dynamic movements of aircraft.

The existing routing protocols are not able to deal with rapid changes in link quality and hence, cannot be applied directly to AANETs [13]. The present research work in AANETs is based on either the modified version of the existing MANET routing approaches or few novel approaches have been presented. AANETs, the routing approaches broadly can be categorized as shown in Figure 1.4[14]:

(i) Static Routing

In this kind of routing, aircraft is loaded with a routing table before starting any task or mission. This table cannot be updated at the time of operation. That is why; this approach is termed static. Here, the connections between aircraft remain
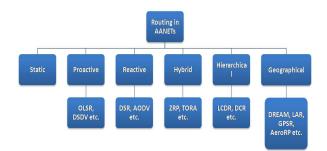
Figure 1.4: Classification of Routing Protocols In Airborne Ad-hoc Network

fixed [15, 16]. An aircraft node may communicate with other flying nodes or fixed ground stations to accumulate their information. In the event of failure of aircraft or any ground station, the routing table cannot be updated instantly. Instead, it is needed to wait until the task completion. Hence, this approach is not fault-tolerant and suitable for the highly dynamic wireless topologies.

(ii) Hierarchical Routing

In the case of AANETs, the nodes will be flying in the three-dimensional space along with different attributes like flight attitude, size, type of sensors and energy usage capabilities, etc. If a flat routing scheme is employed for large-scale VANETs and AANETs, their performance may degrade. To lower the possibility of this degradation and improving the network scalability, use of hierarchical routing also known as multi-level routing can become one of the appropriate solutions [17, 18]. In this, AANET can be divided into a number of clusters which consists of aircraft or UAVs. Every cluster will be having one representing node known as a Cluster Head (CH). This node will be responsible for inter-cluster communication. Cluster head node will be in the direct communication range of each aircraft or UAV within the cluster. An

aircraft within a cluster can communicate with other aircraft which is present in any other cluster, but only through their respective CH nodes. A cluster head is in direct connection with different ground stations, satellites, and aircraft which are present in upper or lower layers.

1. Data-Centric Routing

As the nature of communication between aircraft is wireless, so multicasting can be preferred as compared to unicast transmission between two communicating aircraft [19]. This routing is used when the data requested by many nodes is distributed using on-demand algorithms. This promising routing approach can be used in AANETs [20, 21]. Here, the data requested and gathering is done on the basis of data attributes and not using the ID of sender and receiver nodes. Any ground node or aircraft, broadcasts queries (like "getting a video fan area A if there is a change of greater than any defined percentage value") to collect specific data about any location. Routing is done on the basis of data content. Data aggregation algorithms can be applied for efficient data broadcasting.

2. Load Carry and Delivery Routing:

Here, an aircraft is loaded by receiving the data from any ground node (like getting any video image of the path to follow), then it carries these facts to any destination node (like any military team or a control station on the ground). Because of the large separation between the two nodes [22–24]. This routing scheme is the right solution for latency insensitive and delay-tolerant applications (for examples of video images and secure data traffic). This routing solution can enhance the throughput withmore security. However, if the gap between the source and the destination is abit more, the transmission delay may also rise exponentially. This problem can be handled by developing multi-aircraft systems so that the distance between UAVs and transmission delay, both get decreases.

(iii) Proactive Routing

This kind of routing solutions maintains the updated routing information for each node of the network even if it is not required. This requires the forwarding of link information periodically so that every receiving node can compute routes to other nodes of a network. The routes can be computed using any standard algorithm like Dijkstra's. Link information can be disseminated using flooding of link information about any particular node with its neighboring nodes. In large networks, this flooding process can consume more bandwidth. Hence, this approach is not suitable for highly mobile and large networks [25]. Here, few proactive protocols which have been used before in various AANET implementations, are presented as follows:

1. Optimized Link State Routing (OLSR)
2. Destination-Sequenced Distance Vector(DSDV)

(iv) Reactive Routing

Routing scheme is known as an on-demand routing means a route between two nodes is created only when they communicate. This is primarily designed to overcome the problem of larger overhead in proactive routing. Here, the route request message is flooded into the network by the source node while the route reply message to reply by receiving node. As soon as, a Route Reply message is received by the Route Request message sender node, the communication begins. Hence, each node maintains only the currently used routes. This way reactive routing is more bandwidth-efficient.vOn the other side, the route finding process may take a long time therefore, more latency can be one of the major disadvantages.

1. Dynamic Source Routing (DSR)
2. Ad-hoc On-Demand Distance Vector (AODV)

(v) Hybrid Routing

It is a combination of both reactive and proactive routing methods. The shortcomings, like large delay and due to the route discovery process in reactive routing and large overhead in proactive routing, can be overcome by hybrid routing solutions. It is suitable for larger networks. The network is subdivided into smaller zones where intra-zone nodes communicate through a proactive approach while inter-zone communication is accomplished using a reactive approach [26].

1. Zone Routing Protocol (ZRP)
2. Temporarily Ordered Routing Algorithm (TORA)

(vi) Geographic (or Position) Based Routing

This kind of routing scheme needs information about the location of the communicating nodes in the network. Generally, the Global Positioning System (GPS) help the calculation of the physical location of the individual nodes [27]. The various geographic forwarding decisions are breakdown into three types: - Most Forward with Radius (MFR), Nearest with Forwarding Progress (NFP) and Compass [28]. Here MFR forwards the data packets to the node which makes the most for ward progress with respect to the source and the destination nodes. NFP sends the data packets to that node which is nearest to the source while is near to the destination node. It reduces the possibility of packet collisions as compared to MFR because of the shorter hop decision. Compass forwarding selects a node which is nearest to an imaginary line used as a reference between the source and the destination nodes and makes further progress. Few popular geographic routing protocols are discussed as follows:

1. DREAM (Temporarily Ordered Routing Algorithm)
2. Location-Aided Routing (LAR)
3. Greedy Perimeter Stateless Routing (GPSR)
4. AeroRP

(vii) Cross Layer Routing

Sometimes, the layered network architectures are not applicable to wireless communications [29]. This cross-layer routing approach can be suitable to improve the performance in a wireless environment. It can be defined as a routing technique based on the violation of the existing layered network architectures. There are many methods for designing cross-layer architecture [30]. The subsequent layers can be termed as a super layer. Another cross-layer approach is to provide interactions between non-adjacent layers. Based on cross-layer design approach, the FANET architecture is provided in [31]. Here, the interaction between the first three layers of the OSI model is facilitated. A novel MAC layer protocol, Intelligent Medium Access Control Protocol (IMAC-UAV) is used in this study. At the network layer, directional Optimized Link State Routing (DOLSR) Protocol is implemented in thissystem. The FANET performance can be upgraded by using this cross-layer design. Another algorithm was proposed by the Huba and Shenoy named as a meshed-tree algorithm which is established on the directional antennas [32]. Here, the integration of the clustering and scheduling for the MAC layer and the routing approach for network layeris provided. The scheduling is based on the TDMA technique. Thisapproach has remarkably boosted the packet delivery ratio and end-to-end latency.

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A Review of Data Clustering Techniques and Enhancement of Data Clustering using Hybrid Clustering Model of K- Means and PSO Clustering

Er. Vinod Sharma[1], Er. Sudesh Sharma[2]

E-mail : [1]vinod.daviet@gmail.com, [2]ersudesh.er@gmail.com

Abstract—**Clustering is the classification of patterns (observations, data items, or features) into groups (clusters). Cluster analysis is the organization of a collection of patterns (usually represented as a vector of measurements, or a point in a multidimensional space) into clusters based on similarity The patterns within a valid cluster are more similar to each other than they are to a pattern belonging to a different cluster. Clustering is useful in several exploratory pattern-analysis, grouping, decision- making, and machine-learning situations, including data mining, document retrieval, image segmentation, and pattern classification. In This paper we will presents an overview of pattern clustering methods, with a goal of providing useful information and references to fundamental concepts accessible to the broad community of clustering researchers.**

Keywords: Data Clustering, Hierarchical Clustering, K-Means Clustering Algorithm, Hybrid PSO Algorithm
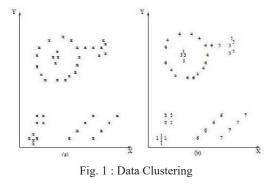
I. Introduction
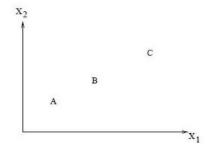
Data clustering is the process which divides a dataset into some groups or classes. It lets the data objects of the same group have high similarity, and the data objects of different groups have large differences. The similarity is often using the distance between the objects. The data clustering usually has two classes, namely the supervised clustering and the unsupervised clustering. Under the supervised clustering, learning algorithm has an external guidance signal, which offers the class marks for its data vectors. For the unsupervised clustering, there is not an external directive signal, and the algorithm groups the data vectors based on distance from each other.
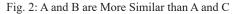
II. Components of a Data Clustering Process

Data clustering activity involves the following steps.
1. Pattern representation (optionally including feature extraction and/or selection),
2. Definition of a pattern proximity measure appropriate to the data domain,
3. Clustering or grouping,

Fig. 1 : Data Clustering

Fig. 2: A and B are More Similar than A and C
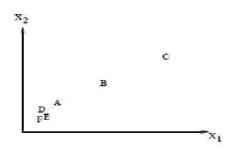
Fig. 3: After a Change B and C ae More Similar than A and B

4. Data abstraction (if needed),
5. Assessment of output (if needed).

Pattern representation refers to the number of classes, the number of available patterns, and the number, type,

and scale of the features available to the clustering algorithm.

Feature selection is the process of identifying the most effective subset of the original features to use in clustering.

Feature extraction is the use of one or more transformations of the input features to produce new salient features.

Pattern proximity is usually measured by a distance function defined on pairs of patterns.

III. Data Clustering Techniques

Different Approaches are being used for the purpose of identifying data sets belonging to their respective clusters.

A. Hierarchical Clustering

A hierarchical data Clustering algorithm yields a *dendrogram* representing the nested grouping of patterns and similarity levels at which groupings change. The operation of a hierarchical clustering algorithm is illustrated using the two-dimensional data set in Figure 4 .This figure depicts seven patterns labeled A, B, C, D, E, F, and G in three clusters.
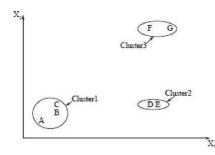
Fig. 4 : Points Falling in Three Clusters

B. Hard Data Clustering vs. Fuzzy Data Clustering

A hard clustering algorithm allocates each pattern to a single cluster during its operation and in its output. A fuzzy clustering method assigns degrees of membership in several clusters to each input pattern. A fuzzy clustering can be converted to a hard clustering by assigning each pattern to the cluster with the largest measure of membership.

1. Hard Data Clustering vs. Fuzzy Data Clustering

1. Select an initial fuzzy partition of the *N* objects into *K* clusters by selecting the *N * K* membership matrix U. An element Uij of this matrix represents the grade of membership of object **xi** in cluster **cj**. Typically, uijE (0,1).
2. Using U, find the value of a fuzzy criterion function, e.g., a weighted squared error criterion function, associated with the corresponding

partition. Reassign patterns to clusters to reduce this criterion function value and recompute U.
3. Repeat step 2 until entries in U do not change significantly.
4. K-Means Clustering Algorithm
5. Choose *k cluster* centers to coincide with *k*
6. randomly-chosen patterns or *k* randomly defined points inside the hyper volume containing the pattern set.
7. Assign each pattern to the closest cluster center.
8. Recompute the cluster centers using the current cluster memberships.
9. If a convergence criterion is not met, go to step 2. Typical convergence criteria are: no (or minimal) reassignment of patterns to new cluster centers, orminimal decrease in squared error.

Several Versions of K – Means are available and some of them try to find good initial partition so that it is able to find minimum global value.

D. K-Means Clustering Algorithm

PSO algorithm originated from the study of social behaviors of bird flock. Researchers found that birds always changed direction, dispersed and clustered all of a sudden. Their behaviors were unpredictable, but even then the whole always kept the consistency and each of them preserved the optimum distance as well from each other. Through studying behaviors of the similar biotic population, found that there is a social information sharing mechanism in the biotic-population. A Particle Swarm Algorithm maintains a population of a certain number of particles, and every particle stands for a potential solution of the problems. The particles are flying in an n-dimensional space and their position adjustment depending on the experience of themselves and their neighbors.

The clustering process terminates when one of the following conditions is satisfied:
1. The number of iterations exceeds a predefined maximum.
2. When change in the cluster centroids is negligible.
3. When there is no cluster membership change.

Algorithm

1. Initialize each particle to contain Nc randomly selected cluster centroids.
2. For t = 1 to t_{max} do
   a. For each particle i do
   b. For each data vector Z_p
      i. Calculate the Euclidean distance $d(Z_p, M_{ij})$ to all cluster centroids C_{ij}
      ii. Assign Z_p to Cluster C_{ij} .
      iii. Calculate the fitness using equation (3)
   c. Update the global best and loc.

E. Hybrid Model for K-Means and PSO Clustering

The convergence rate of K-Means algorithm is faster than the PSO algorithm, but the former usually is not accurate clustering. In order to improve the capability of the PSO algorithm, using the result of the K-means algorithm as an initialized particle, so that it can improve the convergence rate of the PSO algorithm. The process of this mixed clustering

Hybrid PSO algorithm (KPSO) can be described as following:

1. Execute K-means algorithm, and assign the K cluster centric vectors from the K-means algorithm to a particle of the particle swarm, then initialize the other particles of the particle swarm randomly according to the norm of data vectors
2. Execute the PSO algorithm as presented above

IV. CONCLUSION

In this paper, a method based on combination of theparticle swarm optimization (PSO) and the k-mean algorithm. The combined method has the advantage of both PSO and k-means methods while does not inherent their drawbacks. As the PSO algorithm successfully searches all space during the initial stages of a global search we used PSO algorithm at earlier stage of PSO- KM. As long as the particles in swarm being close to the global optimum, the algorithm switches to k-means as it can converge faster than PSO algorithm. It was detected the proper stage for switching from PSO to k-means using the fitness function. The result of experiment on five datasets including real and synthetic data showed the hybrid algorithm outperforms K-means and PSO clustering.

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Mobility Dependant Machine Learning Approach for Effective Routing in FANETS

Amandeep Singh Mehandiratta[1], Er. Tanika Thakur[2]

[1,2]*Electronics and Communication Engineering,*
Swami Vivekanand Institute of Engineering & Technology
Banur, Punjab, India
Email: [1]amankhalsa3328@gmail.com, [2]tanithakur17@gmail.com

Abstract—**Unmanned Aerial Vehicles (UAVs) also called as drones were only employed by the military, but nowadays they are utilized by civilians for commercial purposes such as health care, agriculture, traffic management, etc. Flying ad-hoc networks (FANETs) are created when several UAV nodes are deployed in a network. Due to the UAV node's high mobility, the FANETS configuration varies frequently those results in a huge number of average hops and insufficient connectivity. To overcome these issues, a novel scheme based on a neuro-fuzzy decision-making system is proposed in this system. The proposed system takes four factors i.e. Mobility, latency, stability, and bandwidth efficiency as inputs to which are processed by the ANFIS model to train itself. The proposed models provide an optimal route for transferring data from the source to the destination. The result of the ANFIS model is the optimum route for transporting data from source to destination. In terms of average hop count and link connectivity, the suggested ANFIS model's performance is evaluated and compared to the classic FUZZY model in MATLAB software. The findings show that the suggested ANFIS model improves the link connectivity and reduces average hop count to a huge extent.**

Keywords: *UAV, FANETs, Multi-hopping, Adhoc Networks, Routing Protocols, etc*

I. Introduction

Recently Ad hoc networks are considered an important aspect since they expand the number and types of applications that can be used with our modern technical infrastructure [1]. Due to technical advancements, UAVs (Unmanned aerial vehicles) provide a wide range of options. Due to the high mobility and nodes' versatility, forming an ad hoc network with UAVs has considerable benefits over other networks [2]. A FANET (Flying Ad Hoc Network) is considered a form of network that is a subtype of VANET (Vehicular Ad Hoc Networks) or MANETs (Mobile Ad Hoc Networks) [3]. Flying Ad-hoc Networks (FANETs) is a set of UAVs (Unmanned Aerial Vehicles) that interact without the use of any access point, but at least one of them must be linked to a ground/base station or satellite [4]. Unmanned Aerial Vehicles like autopilot, operate without the assistance

of humans. Because of the low cost and small size of wireless communication systems, Flying Ad-hoc Networks have received a lot of interest from industry and academia in recent years. Flying Ad-hoc Networks are implemented in a variety of applications, including defence and commercial applications, as well as wildfire management and crisis management [5]. Fig1. illustrates a block diagram for FANETs.
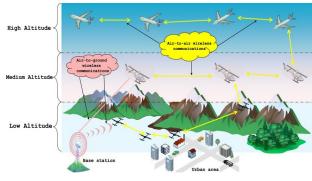
Fig. 1: Communication Architecture of FANETs

The FANETs communication architecture defines how data is exchanged between the UVS or between BS (base station) and a UAV. In the architecture of FANETs, UAVs provide ad hoc network's real-time communication, which can eliminate the infrastructure needs and alleviates the constraint of the communication range [6]. The communication architecture of FANETs plays an important role in several cases where range constraints and real-time communication are critical and infrastructure provision is challenging [7]. The UAVs in the FANETs regularly join and detach from the network. So the ad hoc network is the optimum solution among the UAVs in the majority of circumstances. In addition to this, the decentralized communication architecture is considered better for robust and quick communication amongst UAVs [8]. For multi-UAV systems, numerous distinct communication architectures such Unmanned Aerial Vehicles Ad Hoc Network, Multi-Groups Unmanned Aerial Vehicles Ad Hoc Network, and Multi-Layers Unmanned Aerial Vehicles Ad Hoc Networks are considered.

The Unmanned Aerial Vehicles ad hoc network is the simplest architecture to maintain the communication between the sub-UAVs and ground station/satellite, backbone UAV act as gateway node [9].The Multi-Groups Unmanned Aerial Vehicles Ad Hoc Network framework is developed by integrating a centralized network and ad-hoc network. For intra-group interactions, base stations are not required. It plays an important role where a large number of Unmanned Aerial Vehicles is involved in the network and every UAV has different features and flights [10]. The multi-layers Unmanned Aerial Vehicles network is a layered structure and consists of heterogeneous UAVs where every group performs a different task. For many Unmanned Aerial Vehicles tasks, this network framework is best. Also, this architecture doesn't have a single point of failure [11].

Several routing techniques like dynamic source routing, pre-computing routing, flooding, etc. are used in wireless ad hoc communication networks. FANET's are considered as a highly dynamic structure and features, like variations in node connections and speed, makes developing a routing scheme, which considers loop avoidance, self-adaptation, and an effective routing approach extremely difficult [12].To overcome these constraints several researchers have performed number of techniques, which are mentioned in the next section of this paper.

II. Related Work

Several researchers have proposed many techniques to make communication efficient for FANETs, out of which some are discussed here; Qin Yang *et al*. [13], suggested a multi-objective routing scheme for flying ad hoc networks, so that the features of the flying ad hoc networks, the network impact relies on the mobility of the unmanned aerial vehicles nodes and the energy state of every node must be involved in the analysis of the routing route, and the overall reliability and security of the network should also be accomplished. The proposed scheme was compared to the traditional fuzzy scheme and Q-value-based AODV in the simulation results. The test findings demonstrated that the suggested methodology would keep the hop count and energy consumption down and can increase the network lifespan. Chenguang He *et al*. [14], used a fuzzy logic reinforcement learning-based routing algorithm for flying ad hoc networks to solve the issue of a high average number of hops and weak link communication. The proposed flying ad-hoc routing algorithm outperformed the ant colony algorithm optimization (ACO) in terms of both average hop count and connection success rate. The condition is more suitable because it will help satisfy the network's requirements. Jorge Souza *et al*. [15], suggested a Flying ad-hoc network's adaptive routing algorithm that relies on fuzzy logic. The FANET adaptive protocol was tested using Network Simulator version 2 (NS-2) and evaluated using quality of experience (QoE) metrics and quality of service (QoS). Farhan Aadil *et al*. [16], aimed to resolve issues of low storage capacity and higher mobility, resulting in shorter flight times and inefficient routing, the authors of this paper proposed a novel scheme by using effective clustering. The suggested model performed better than common AI methods including the Grey Wolf Optimization-based clustering methodology and the Ant Colony Optimization-based clustering method. The proposed algorithm's efficiency was measured in terms of power consumption, cluster building period, cluster number and cluster lifespan. Jianmin Liu *et al*. [17], to meet the needs of FANETs, a Multi-objective optimization Routing protocol was developed by the author of this paper. In the routing decision process, the proposed approach choose the more accurate next hop by re-checking the neighbour relationships instead of using pre-estimated neighbour relationships. According to simulation results, the proposed system can provide minimum power consumption, less delay and higher packet arrival ratio than existing high-performing Q-learning based routing methods.

Hassen RedwanHussen *et al*. [18], introduced and developed a predictive and scalable multicast routing scheme for FANETs. The MATLAB-based assessment performed in standardized and randomized deployment scenarios showed that as the communication range raised, the chance of discovering one-hop expected forwarders to hit multicast destinations are also increasing. The efficiency of proposed routing algorithm was compared with two currently used MANETs routing protocols (Dynamic Source Routing and Geographic Routing Protocol). Finally, the author discussed two possibilities for integrating a scalable and predictive geographic multicast routing mechanism into a FANETs in the Internet of Things platform. S. Choi *et al*. [19], used multichip network connectivity to develop a geo-location-based routing mechanism for flying ad-hoc networks. This protocol performed well in a complex multichip network topology and demonstrated its robustness and flexibility. Due to the high velocity of unmanned aerial vehicles, a network topology consisting of unmanned aerial vehicles is highly dynamic. In this situation, this protocol utilized neighbour's geo-location information to locate the route to the desired location. B. Zheng *et al*. [20], presented a novel multi-channel load awareness-based Medium Access Control protocol for Flying ad-hoc networks to address the drawbacks of IEEE 802.11 Time division multiple access (TDMA) and distributed coordination feature (DCF) protocols. The findings of the experiment explained that this protocol can distinguish services for different priorities in flying ad-hoc networks based on

actual channel state, ensuring effective Quality of Service for transmissions of data, and the network bandwidth resource was efficiently used. Shaojie Wen *et al*. [21], suggested an adaptive delay-constrained routing to solve the end-to-end time limited routing issues for FANETs in a local way. The author of this paper demonstrated that the proposed routing algorithm is convergent and tested its efficiency. According to the simulation findings, the proposed routing strategy effectively boosted the network efficiency in terms of end-to-end, error rate, and delay throughput. M. F. Khan *et al*. [22], defined an ideal path in 5G network by considering Unmanned Air Vehicles with greater residual energy and reliability in order to maximize lifespan of network. The suggested algorithm used an AI technique known as reinforcement learning, and the impact of various learning rates were verified.

III. Proposed Work

From the literature survey conducted, it was analyzed that to make communication efficient for FANETs, several researchers have proposed a number of techniques. In traditional models, most of the experts focused on fuzzy logic reinforcement learning and routing algorithms. `These techniques used fuzzy logic for two-level selection of the next hop in the system. The conventional techniques generated their matrix that aided in determining the optimum path to the destination and updated the training system's information matrix. From the study, it is concluded that mobility is the most significant component for FANETs.

Therefore, network's effectiveness would be enhanced, but in traditional models, mobility was not involved in any stage of the protocol. Other than this, the conventional models also faced delays in making a judgment because they utilized independent algorithms such as learning and fuzzy. Hence a novel algorithm is needed to overcome the limitation of traditional models and provide the optimal communication channel for FANETs. For this, a novel technique is proposed in this paper that is based on neuro-fuzzy system. The traditional fuzzy and reinforcement learning models utilized two distinct levels to determine the route in the network, which can affect the time duration for the decision-making module.

A. Adaptive Neuro-Fuzzy Inference System

The Adaptive Neuro-Fuzzy Inference System (ANFIS) is considered a modified decision-making method. The Neuro-fuzzy is implemented in the proposed system because it is considered as a training mechanism, which produces a neural estimation technique that studies the presence of a fuzzy inference system. Neuro-fuzzy reasoning generates comprehensible and usable information by developing rule sets that are completely

consistent with statistical data. Neuro-fuzzy reasoning generates comprehensible and usable information by developing rule sets that are completely consistent with statistical data. In the proposed neuro-fuzzy system, four inputs i.e. mobility, stable rating, delay, and bandwidth efficiency are taken into consideration. To provide an efficient outcome, the ANFIS system processes the four membership functions with their three membership variables.

B. Basic Concepts

The proposed scheme utilizes the decision factor Mobility, which is considered along with delay, Stability rating, and Bandwidth efficiency factor. These decision factors can be evaluated by using the equation in 1, 2, and 3 respectively.

Delay: It is the parameter that estimates the total time taken for the data to travel from its origin to its destination and back. Equation 1 can be used for computing delay.

$$DMc(x) = \begin{cases} \frac{d(x,c)}{R} & , d(x,c) < R \\ 1 & , d(x,c) \geq R \end{cases} \quad (1)$$

where $d(x, c)$ denotes the distance between the source x and destination nodes c.

Stability Rating: It can be evaluated by using equation 2 and relates to how steady the system is for transmitting data successfully.

$$SR(s,x) = \frac{|v(x)| - min_{y \in Ns}|v(y)|}{max_{y \in Ns}|v(y)|} \quad (2)$$

Where $v(x)$ denotes the entire speed of the unnamed aerial vehicle (UAV), and Ns denotes the group neighbouring nodes of the current UAV.

Bandwidth Efficiency: it can be described as the effective and efficient utilization of all available transmission frequencies, and can be evaluated by using the formula in equation 3.

$$BEF = \begin{cases} 1 & , Cnt(y) = 1 \\ \frac{1}{cnt(y)} & , otherwise, \end{cases} \quad (3)$$

Where the total number of nodes used in communication and node queue is represented by $Cnt(y)$. Finally, the algorithm will be tested in a variety of circumstances, including altering the number of nodes in the network for computing the average number of hops and UAV link connection. The next section will provide a detailed description of how the proposed model works.

IV. Methodology

As mentioned above, to provide an optimal outcome the ANFIZ method firstly initializes the network's parameters like total area taken the number of UAV nodes, their speed, and location. The particular values of these parameters are represented in Table 1.

Parameter	Values
Number of UAV Nodes	10
Area	5000 x 5000
Speed of UAV nodes	[0 60]
Location of UAV Nodes	Random

In the proposed model, the next step is to deploy UAV nodes in the given area. As illustrated in figure 2(a) the 10 UAV nodes are randomly deployed in the three layers and their speed varies from 0 to 60 kmph. After the network has been set up and nodes have been deployed, the next step in the proposed model is to choose the source and destination zones for data transmission. The diagram in which the source and destination nodes are selected is shown in Fig 2(b).

(a)

(b)
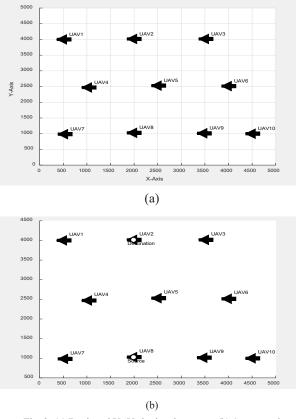
Fig. 2: (a) Deployed UAVs in the given area, (b) Source and destination regions

The ANFIS must be started and trained before moving on to the route selection phase. To do so, four critical evaluation criteria must be defined, including mobility, delay, stability, and bandwidth efficiency, as well as their fuzzy membership functions that would be used as inputs to ANFIS. Fig 3.depicts the four membership functions variables with their three membership variables of the low, medium, and high.
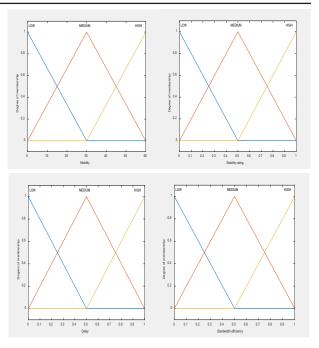
Fig. 3: Four Membership Functions Along with their Membership Variables

According to Fig. 3, the mobility of the four membership functions mobility, stability, delay, and bandwidth efficiency varies from 0-60, whereas the remaining three parameters vary within limits of 0-1. Following the specification of the inputs, a dataset of conditions or records is created. The suggested ANFIS model uses this dataset to train itself to make optimal node selection decisions. The next step is to discover a path from source to destination after the model has been trained. To build an efficient path for data transmission, the current source node evaluates the nodes in the network. Finally, the suggested model's performance is evaluated and compared to the standard model in terms of the average number of hops and link connectivity, and the results are briefly presented in the next section.

V. RESULTS AND DISCUSSION

In MATLAB simulation software, the proposed ANFIS model's performance is analysed and compared with the traditional fuzzy models. Two performance matrices, the average number of hops and link connectivity, are used to determine the simulated outcomes. The proposed ANFIS model's performance of the suggested ANFIS model is assessed and compared to that of the traditional FUZZY model in terms of the average number of hops per node with respect to the number of nodes. Fig. 4 and Fig. 5, displays comparison graphs of the traditional and new models.
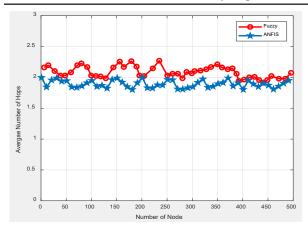
Fig. 4: Comparison Graph of the Proposed ANFIS and Traditional FUZZY Model
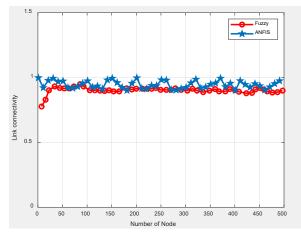
Fig. 5: Comparison Graph for Link Connectivity

According to Fig. 4 and Fig. 5, the suggested ANFIS model and the classic FUZZY models are compared in terms of the average number of hops and link connectivity. The red-colored line depicts the traditional FUZZY model's performance, while the blue-colored line depicts the suggested ANFIS technique's performance. Fig 4, illustrates that in the traditional FUZZY model if the average number of hops is greater than 2 then it would fluctuate continuously as the number of nodes increases. In the suggested ANFIS model, if the average number of nodes goes to a maximum of two with the increase in the number of nodes. Hence the number of hops would be reduced in the suggested ANFIS model. According to fig5, the suggested ANFIS model's link connection improves over time, reaching a maximum value of 1. The link connection in the traditional FUZZY model is poor and stays below 1 throughout the network with the increase in the number of nodes. This validates the proposed ANFIS model's efficacy. From the graph, the suggested ANFIS model is more efficient and effective in selecting the appropriate route for conveying information between the source and destinations.

VI. CONCLUSION

A novel strategy based on the neuro-fuzzy system is proposed in this paper to determine an optimal route for transmitting the data from the source to the destination. In the MATLAB simulation software, the suggested ANFIS model's performance is investigated and compared to the classic FUZZY model. To determine the simulated results, two dependent factors i.e. average number of hops and link connectivity were utilized. In the conventional FUZZY model, the average number of hop counts is greater than 2, and this number changes as the number of nodes increases, whereas in the suggested ANFIS model, the hop count drops to a great extent and the value reaches a maximum of 2. Furthermore, the link connectivity in the traditional models is poor and remains below 1 as the number of nodes increases, whereas the link connectivity in the suggested ANFIS model has enhanced and reaches a maximum of one. According to the findings, the average number of hops decreases, and link connectivity increases as the number of nodes increases. This demonstrates that for transferring data from source to destination, the suggested ANFIS model is more efficient and effective in choosing the appropriate path.

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A Novel Optimization Method for Solving Multi-objective Power Dispatch Including Different Industrial Constraints

Namarta Chopra

Department of Electrical Engineering, Amritsar Group of Colleges, Amritsar, Punjab, India,

Abstract—This paper solves the problem of economic - environmental dispatch in case of thermal power plants while satisfying various equality and inequality constraints. The load on the power plant is assigned in such a way that the overall operating fuel cost and pollutants' emissions can be minimized simultaneously. The conflicting nature of this bi-objective problem is handled using the proposed hybrid particle swarm optimization (PSO) with simplex search method (SSM). As PSO is used for global search inspired from the social behavior of swarms, whereas SSM is used here for further refining the global optimum solution by local search.Physical constraints like valve point loading effect, ramp rate limits and prohibited operating zones are included in the basic environmental economic dispatch problem to increase the practical aspect in the problem. The effectiveness of the proposed algorithm is tested by considering the ten and fifteen unit generator systems and the results obtained are compared with some of the existing methods discussed in the literature. It is evident from the results obtained that the suggested approach gives more satisfying results for both economic and environmental aspect of the problem, hence proving the superiority of combining the global and local search optimization methods.

Keywords: Environmental-Economic Dispatch (EED), Constraints, Valve Point Loading Effect (VLE), Ramp Rate Limits (RRL), Prohibited Operating Zones (POZ), Particle Swarm Optimization (PSO), Simplex Search Method (SSM)

I. Introduction

Effective economic operation of electrical generation system has always been considered of great significance in the electrical power industry. Recently, with the increase in day by day demand and public awareness about the environmental pollution, the design and running strategiesof power plants are reformed, which reduce the atmospheric emissions like nitrogen oxides, sulphur dioxide, and carbon dioxide. These gaseous emissions causes adverse effect on the health of human beings [1]. Thus, an optimum operating strategy is required, which can ensure minimum pollution level along with minimum cost. Hence, the economic load dispatch in power systems is not only concern with the minimization of fuel cost but also relates to the minimization of pollutants' emissions from these plants[2-6].

To upgrade the quality of results for the problem of EED together, researchers work a lot on the problem which includes, classical methods such as linear programming method, Newton's method, lambda iteration method and gradient method were used for the matter of fuel cost dispatch [3]. Modern optimization methods such as evolutionary programming (EP), ant colony optimization (ACO) [6], gravitational search algorithms (GSA)[7], particle swarm optimization (PSO) [8]–[10], [10]–[13], cuckoo search algorithm (CSA) [14], differential evolution (DE) [15], [16], bacterial forging algorithm(BFA), artificial bee colony (ABC)[17], [18], genetic algorithms (GA), flower pollination algorithm (FPA) [19], bat algorithm (BA) [20], [21], hurricane optimization (HO) [22] etc. are applied nowadays to improve the results more effectively.The direct search methods are also used alongwith the modern optimization techniques, which convert the simple optimization problem into the hybrid optimization [28].

For ongoing work, a novel hybrid method is proposed which includes the application of PSO in conjunction with simplex search method (SSM) over the problem of combined EED. The PPF is applied effectively to work outthe mentioned multiobjective optimization problem while satisfying all the constraints in scalar optimization framework.This paper solves the constrainedEED problem using PSO_SSM in conjunction with the various price penalty factor methodsto study the proportional weight for fuel cost to emissions to get the best solution. The various practical cases of EED problem i.e. operation of power plants by considering the valve point loading effect, ramp rate limits (RRL) and prohibited operating zones (POZ) are examined.

II. Problem Formulation

A. Economic Objective

The total cost of fuel for generating units is represented aspiecewise quadratic or quadratic function with the supposition that the incremental cost curves of the units are monotonically growingas piecewise-linear functions.

[18], [23-32]. For this the quadratic fuel cost equation can be given as,

$$F_C = \sum_{i=1}^{n} (a_i\,P_i^2 + b_i\,P_i + c_i + |d_i sin\{e_i(P_i^{min} - P_i)\}|) \quad (1)$$

where F_C represents final fuel cost, P_i represents the power generated by i^{th} generator, a_i, b_i, c_i, d_i and e_i are the respective fuel cost coefficients and n is the total number of power units.

B. Pollutants'Emission Objective

This objective includes the minimization of total gaseous pollutants' emissions. Mathematically, like fuel cost equation, it is also represented by quadratic function as,

$$E_T = \sum_{i=1}^{n} \left(\alpha_i P_i^2 + \beta_i\,P_i + \gamma_i + \eta_i e^{(\delta_i P_i)} \right) \quad (2)$$

where, E_T is total emissions, $\alpha_i, \beta_i, \gamma_i, \eta_i, \delta_i$ represents the emission coefficients of ith generator.

C. Constraint Handling

The multi-objectives to be minimized are forced to various power balance and generator limit constraints.

$$\sum_{i=1}^{n} P_i = P_D + P_L \quad (3)$$

where, P_D represents power demand and P_L is the transmission loss of the generating station.

The losses in transmission line can be expressed by Kron's loss formula as,

$$P_L = \sum_{i=1}^{n}\sum_{j=1}^{n} P_i B_{ij} P_j + \sum_{i=1}^{n} B_{0i} P_i + B_{00} \quad (4)$$

where, P_i, P_j are the powers generated by generating units i and j and B_{ij}, B_{0i}, B_{00} represents the loss coefficients.

The inequality constraint imposed on the outputs of the generator units can be given as,

$$P_i^{min} \leq P_i \leq P_i^{max} \quad (5)$$

where, P_i^{min} represents the minimum wattage of real power assigned at unit i and P_i^{max} represents the maximum wattage of real power assigned at unit i.

The unit ramp limits constraints[1] are given as:

   i.   With the increase in generation,

   ii. $P_i - P_i^o \leq UR_i$

   iii.   With the decrease in generation,

$$P_i^o - P_i \leq DR_i$$

Hence, the generator ramp rate limit inequality constraint on the outputs of the generator units is given as,

$$max(P_i^{min}, P_i^o - DR_i) \leq P_i \leq min(P_i^{max}, P_i^o + UR_i) \quad (6)$$

where, UR_i represents up ramp limit of ith unit in MW/h, DR_i represents the down ramp limit of ith unit in MW/h, P_i^o represents the previous output power of ith unit in MW.

Also, the units having prohibited operating zones, extra constraints within the unit operating ranges are,

$$P_i = \begin{cases} P_i^{min} \leq P_i \leq P_{i,1}^L \\ P_{i,j-1}^U \leq P_i \leq P_{i,j}^L \; ; (j = 2, \dots, N_{zi}) \\ P_{i,Nzi}^U \leq P_i \leq P_i^{max} \end{cases} \quad (7)$$

where, N_{zi} is the total prohibited operating zones of ith generator, $P_{i,j}^L P_{i,j}^L$ and $P_{i,j}^U P_{i,j}^U$ are the lower and upper bound of jth prohibited operating zones of ith generator.

D. Optimization Problem

In the problem of EED, the best result must be such that, both fuel cost as well as emissions be minimized simultaneously. This minimization must be subjected to the equality constraint mentioned in Eq. (3) and inequality constraints mentioned in Eqs. (5, 6, 7) as per the cases applied as,

$$F_{Tj} = F_C + h_j E_T \quad ; (j = 1, \dots, 4) \quad (8)$$

Eq. (8) represents the solution for final EED with valve point loading effect, whereas for EED cases without valve effect, coefficients d_i, e_i, η_i and δ_i are zero. h represents the PPF for the above equation and can be calculated by taking the ratio between the minimum or maximum total fuel cost and minimum or maximum pollutants' emissions of the concerned generators for Min-Min, Min-Max, Max-Min and Max-Max penalty factors as,

$$h_1 = \frac{\sum_{i=1}^{n}(a_i\,(P_i^{min})^2 + b_i\,P_i^{min} + c_i)}{\sum_{i=1}^{n}(\alpha_i\,(P_i^{max})^2 + \beta_i\,P_i^{max} + \gamma_i + \eta_i e^{(\delta_i P_i^{max})})} \quad (9)$$

$$h_2 = \frac{\sum_{i=1}^{n}(a_i\,(P_i^{min})^2 + b_i\,P_i^{min} + c_i)}{\sum_{i=1}^{n}(\alpha_i\,(P_i^{min})^2 + \beta_i\,P_i^{min} + \gamma_i + \eta_i e^{(\delta_i P_i^{min})})} \quad (10)$$

$$h_3 = \frac{\sum_{i=1}^{n}\left(a_i\,(P_i^{max})^2 + b_i\,P_i^{max} + c_i + |d_i sin\{e_i(P_i^{min} - P_i^{max})\}|\right)}{\sum_{i=1}^{n}(\alpha_i\,(P_i^{max})^2 + \beta_i\,P_i^{max} + \gamma_i + \eta_i e^{(\delta_i P_i^{max})})} \quad (11)$$

$$h_4 = \frac{\sum_{i=1}^{n}\left(a_i\,(P_i^{max})^2 + b_i\,P_i^{max} + c_i + |d_i sin\{e_i(P_i^{min} - P_i^{max})\}|\right)}{\sum_{i=1}^{n}(\alpha_i\,(P_i^{min})^2 + \beta_i\,P_i^{min} + \gamma_i + \eta_i e^{(\delta_i P_i^{min})})} \quad (12)$$

Now, the optimization problem is finally minimizing Eq. (8) by observing various results of PPF as mentioned in Eqs. (9-12). The value of PPF which gives the minimum value for Eq. (8) will become the optimal solution for the EED problem, i.e,

$$F_{Tj} = min\{F_{T1}, F_{T2}, F_{T3}, F_{T4}\} \quad (13)$$

III. Particle Swarm Optimization with Simplex Operator

A. Particleswarm Optimization (PSO)

In 1995, a nature inspired stochastic optimization approachwas given by Kennedy and Eberhart based on the population searchand was motivated from the generalnature of bird flocking [33]–[36]. During their movement, each swarmmodify its position as per its own observationand alongwith the observation of other swarms in the whole group.

Aset of random particles is required to start this optimization technique. The particle is modifiedby the two values,pbest and gbest in its each iteration. After gettingtheseoptimum values, velocity as well as position of each particle is modified as,

$$v_{pi}(k+1) = wv_{pi}(k) + c_1 r_1(k) \left(pbest_{pi}(k) - P_{pi}(k) \right) + c_2 r_2(k) \left(gbest_i(k) - P_{pi}(k) \right) \quad (14)$$

$$P_{pi}(k+1) = P_{pi}(k) + v_{pi}(k+1)$$
$$; (i = 1,2,\dots,n; \; p = 1,2,\dots,N_P) \quad (15)$$

$$w = w^{max} - \left(\frac{w^{max} - w^{min}}{iter^{max}} \right) iter \quad (16)$$

where,$N_P N_P$ is the total swarm particles, n represents the total members in one particle,$v_{pi}(k) v_{pi}(k)$ represents the velocity of p^{th}particles during k^{th} movement, $w$represents inertia weight, $P_{pi} P_{pi}$is the position of pth particle during k^{th}movement which is actually the solution obtained in terms of power for individual unit with different penalty factors. Eq. (17) will decide the non-inferior solution.

$$F_{Tp} = min\{F_{Tp1}, F_{Tp2}, F_{Tp3}, F_{Tp4}\} \quad (17)$$

$pbest_{pi}(k)$ is the optimum value of the particle at every iteration, $gbest_i(k)$ is the optimumvalue from all the best particle solutions, $c_1 = c_2 = 2$ are acceleration constants. $r_1(k)$ and $r_2(k)$ are the random numbers between (1,0), itc represents the iteration counter and itc^{max} is the the maximum iterations count. The updated velocity of the particle must satisfied their maximum and minimum inequality constraints as given in Eq. (18)

$$-0.5P_{pi}^{min} \leq V_{pi} \leq +0.5P_{pi}^{max} \quad (18)$$

The inequality constraints for the updated position with different cases must satisfied as,

For valve point loading and simple EED case,

$$P_{pi}(k) = \begin{cases} P_i^{min} & ; P_{pi}(k) \leq P_i^{min} \\ P_i^{max} & ; P_{pi}(k) \geq P_i^{max} \\ P_{pi\,(k)} & ; P_i^{min} \leq P_{pi}(k) \leq P_i^{max} \end{cases} \quad (19)$$

For ramp rate limits case, the maximum and minimum limits are adjusted as given in Eq. (6)

$$P_{pi}(k) = \begin{cases} max(P_i^{min}, P_i^o - DR_i) & ; P_{pi}(k) \leq max(P_i^{min}, P_i^o - DR_i) \\ min(P_i^{max}, P_i^o + UR_i) & ; P_{pi}(k) \geq min(P_i^{max}, P_i^o + UR_i) \\ P_{pi\,(k)} & ; max(P_i^{min}, P_i^o - DR_i) \leq P_{pi}(k) \leq min(P_i^{max}, P_i^o + UR_i) \end{cases} \quad (20)$$

For POZ case, the constraints are given as in Eq. (7). The functioning in POZ areas is not permitted for the better conduct of the power plant. So the generation in the POZ area is adjusted as

$$P_{pi}(k) = \begin{cases} P_{i,j}^L - r\frac{(P_{i,j}^U - P_{i,j}^L)}{P_{i,j}^U}; & P_{i,j}^L \leq P_{pi}(k) \leq \frac{P_{i,j}^L + P_{i,j}^U}{2} \\ P_{i,j}^U + r\frac{(P_{i,j}^U - P_{i,j}^L)}{P_{i,j}^U}; & \frac{P_{i,j}^L + P_{i,j}^U}{2} < P_{pi}(k) \leq P_{i,j}^U \end{cases} \quad (21)$$

$$; (j = 1,2,\dots,N_{Zi}); (j = 1,2,\dots,N_{Zi})$$

where, $N_{Zi}$is the total prohibited operating zones for i^{th} generator and r is any arbitraryuniform random number from 0 to 1.

For the balancing of equality power constraint, any one generator is selected as dependent generator[1], Eq. (3) can be re-consider as,

$$P_{pd} + \sum_{\substack{i=1 \\ i \neq d}}^{n} P_{pi} = \left[\sum_{\substack{i=1 \\ i \neq d}}^{n} \sum_{\substack{j=1 \\ j \neq d}}^{n} P_{pi} B_{ij} P_{pj} + \sum_{\substack{j=1 \\ j \neq d}}^{n} P_{pj}(B_{jd} + B_{dj}) P_{pd} \right.$$
$$\left. + B_{dd} P_{pd}^2 + \sum_{\substack{i=1 \\ i \neq d}}^{n} B_{io} P_{pi} + B_{do} P_{pd} + B_{oo} \right] + P_D \quad (22)$$

This equation can be simplified as,

$$X P_{pd}^2 + Y P_{pd} + Z = 0 \quad (23)$$

where, $X = B_{dd}$

$$Y = \sum_{\substack{j=1 \\ j \neq d}}^{n} P_{pj}(B_{jd} + B_{dj}) + B_{do} - 1$$

$$Z = P_D + B_{oo} + \sum_{\substack{i=1 \\ i \neq d}}^{n} \sum_{\substack{j=1 \\ j \neq d}}^{n} P_{pi} B_{ij} P_{pj} + \sum_{\substack{i=1 \\ i \neq d}}^{n} B_{io} P_{pi} - \sum_{\substack{i=1 \\ i \neq d}}^{n} P_{pi}$$

The solution for Eq. (23) can be given as,

$$P_{pd} = \frac{-Y \pm \sqrt{Y^2 - 4XZ}}{2X}, where \; Y^2 - 4XZ \geq 0 \quad (24)$$

The positive solution of dependent generator, which lie within the limits is to be considered only for verifying the equality constraints.

B. Simplex Search Method (SSM)

This technique was originally suggested by Spendley in 1962 and after that improved by Nelder and Mead forgetting thelocal minima from a set of several variables. The total points in initial simplex are much less in comparison to evolutionary optimization method [9], [26], [37]. For n generators system, only $n+1$ points are considered in initial simplex, which means that $n+1$best results of objective function are taken as initial simplex from PSO.

This technique improves the inferior point by variousoperational calculations as reflection, contraction and expansion.

Firstly, worst point (x_h), best point (x_l) and next to worst point (x_g) based on the objective function value are determined from the initial variables of simplex. The new point obtained then replaces the $x_h$of the initial simplex and the next iteration continues using new simplex formed.

$$Centroid, x_{cj} = \frac{1}{n}\sum_{j=1, j\neq h}^{n+1} x_j \quad ; (j = 1,2,\dots,n) \quad (25)$$

$$Reflected\ point, x_{rj} = 2x_{cj} - x_{hj} \quad (26)$$

$$x_{new,j} = \begin{cases} (1+\sigma)x_{cj} - \sigma x_{hj} & ;if\ F_T(x_{rj}) < F_T(x_{lj}) \\ (1-\mu)x_{cj} + \mu x_{hj} & ;if\ F_T(x_{rj}) \geq F_T(x_{hj}) \\ (1+\mu)x_{cj} - \mu x_{hj} & ;if\ F_T(x_{gj}) < F_T(x_{rj}) < F_T(x_{hj}) \end{cases} \quad (27)$$

The objective function is evaluated at this new value and the procedure is again repeated until some stopping condition is fulfilled. The iterations will terminate when the simplex converged enough according to the Eq. (28).

$$\left[\sum_{j=1}^{n+1} \frac{\left(F_T(x_j) - F_T(x_{cj})\right)^2}{n+1}\right]^{1/2} \leq \epsilon \quad (28)$$

where, ϵ is the termination parameter. The recommended values for the parameters are $\sigma \approx 2.0$, $\mu \approx 0.5$ and $\epsilon \approx 0.001$.

Final EED is then calculated corresponding to the new point, $x_{new,j}$ we get from the SSM as

$$F_C = \sum_{j=1}^{n}(a_j x_{new,j}^2 + b_j x_{new,j} + c_j + |d_j sin\{e_j(P_j^{min} - x_{new,j})\}|)$$

$$E_T = \sum_{j=1}^{n}\left(\alpha_j x_{new,j}^2 + \beta_j P_j + \gamma_j + \eta_j e^{(\delta_j P_j)}\right)$$

$$F_{Ti} = F_C + h_i E_T \quad (29)$$

$$(as\ i = 1,\dots,4)\ for\ different\ PPF$$

The value of PPF which gives the minimum value for the above equation will become the optimal solution for the EED problem, i.e.

$$F_T = min\{F_{T1}, F_{T2}, F_{T3}, F_{T4}\} \quad (30)$$

C. Proposed Algorithm for EED Problems

In the proposed method particle swarm optimization is considered as a base level search andthe simplex search method is then used to further improve the solutions.

TABLE 1: CASES UNDER CONSIDERATION FOR VALIDATION OF PROPOSED ALGORITHM

Case	Number of Generators	VLE	RRL	POZ	Transmission Losses
1	10	ü	û	û	ü
2	15	û	ü	ü	ü
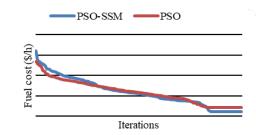
Fig. 1: Convergence of Fuel Cost with PSO and PSO_SSM for Case 1
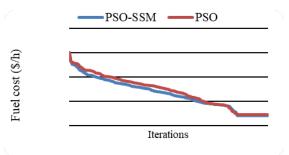
Fig. 2: Convergence of Fuel Cost with PSO and PSO_SSM for RRL with POZ (Case 2)

IV. RESULTS AND DISCUSSION

The suggestedPSO_SSM is implemented on the various cases of EED problem to lessen the system operating fuel cost and pollutants' emission level. The code for different cases are formulated in MATLAB 7.11.0.635 version using core i3 with 3GB RAM. Parameters undertaken are: Number of particles in one swarm =10, total members in one particle= generators taken in each case,$c_1 = c_2 = 2$, $w^{min} = 0.4$, $w^{max} = 0.9$, $\sigma = 2.0$, $\mu = 0.5$ and $\epsilon = 0.001$.Various cases to be considered for the validation of proposed algorithm are shown in Table 1.

Case 1: In this case, the EED problem including the valve point loading effect is implemented [18]. The results obtained at 2000 MW for EED with different PPF using PSO_SSM are 180518.59 \$/h with min-max, 179962.53 \$/h with min-min, 161433.01 \$/h with max-max and 181153.79 \$/h with max-min. It shows that the best solution is obtained using max-max price penalty factor as decision making technique. EED solutions with PSO_SSM and max-max PPF for different power demands are given in Table 2. The comparison analysis with valve point loading at 2000 MW for fuel cost and emissions with other methods is shown in Table 3 and convergence characteristics are shown in Fig. 1.

Case 2: This cases solve the EED problem considering ramp limits with prohibited operating zones [33], [38].

TABLE 2: EED Solutions With Valve Point Loading Using PSO_SSM for Different Power Demands (Case-1)

Unit Power Output [MW]	Power Demand [MW]						
	1700	1800	1900	2000	2100	2200	2300
P1	24.999	25	32.341	54.797	55	55	55
P2	59.999	60	60	62.396	75.888	80	80
P3	79.999	80	80	81.939	95.431	111.097	120
P4	79.999	80	80	81.939	95.431	111.097	130
P5	109.999	110	110	111.939	125.431	141.097	160
P6	179.999	180	180	181.939	195.431	211.097	240
P7	249.999	250	253.485	275.941	289.433	300	300
P8	299.999	300	300	310.651	324.143	339.808	340
P9	275.489	383.704	432.849	455.305	468.798	484.463	518.084
P10	399.999	400.338	449.483	470	470	470	470
Total P	1760.49	1869.043	1978.157	2086.849	2194.98	2303.66	2413.08
P_L	60.476	69.033	78.148	86.859	94.997	103.671	113.093
FC×10^5[$/h]	0.957	1.012	1.071	1.132	1.201	1.274	1.355
E_T×10^3[Kg/h]	3.101	3.397	3.778	4.106	4.449	4.862	5.328
EED×10^5[$/h]	1.321	1.391	1.497	1.614	1.770	1.962	2.195

TABLE 3: Comparison of EED Solutions with VPL using PSO_SSM with Other Methods at 2000 MW(case-1)

Unit Power Output [MW]	PSO-SSM	ABC_PSO [18]	NSGA-II [15]	SPEA-2 [15]	DE [15]
P1	54.79	55	51.95	52.98	54.95
P2	62.39	80	67.26	72.81	74.58
P3	81.94	81.14	73.68	78.11	79.43
P4	81.94	84.22	91.35	83.61	80.69
P5	111.94	138.34	134.05	137.24	136.85
P6	181.94	167.51	174.95	172.92	172.64
P7	275.94	296.83	289.44	287.20	283.82
P8	310.65	311.58	314.05	326.40	316.34
P9	455.31	420.34	455.69	448.88	448.59
P10	470	449.16	431.81	423.90	436.43
P_L	86.86	84.17	NA	NA	NA
FC [$/h]	113207.65	113420	113540	113520	113480
Emissions [Kg/h]	4106.10	4120.10	4130.20	4109.10	4124.90
Time (s)	5.36	NA	6.02	7.53	NA

TABLE 4: EED Solutions of RRL with POZ using PSO_SSM for Different Power Demands (Case-2)

Unit Power Output (MW)	Power Demand [MW]					
	2580	2610	2630	2650	2680	2700
P1	455.006	455.010	455.014	455.016	455.018	455.022
P2	184.926	184.987	184.975	184.907	184.993	184.995
P3	130.006	130.010	130.014	130.016	130.018	130.022
P4	130.006	130.010	130.014	130.016	130.018	130.022
P5	179.975	179.971	179.974	180.004	180.012	179.998
P6	429.966	429.964	430.013	429.985	430.001	429.977
P7	430.006	430.010	430.014	430.016	430.018	430.022
P8	160.006	160.010	160.014	160.016	160.018	160.022
P9	95.795	108.310	116.732	125.190	137.923	146.460
P10	106.164	118.680	127.102	135.559	148.292	156.829
P11	80.006	80.010	80.014	80.016	80.018	80.022
P12	29.981	29.994	29.795	29.899	29.979	29.883
P13	85.006	85.010	85.014	85.016	85.018	85.022
P14	55.006	55.010	55.014	55.016	55.018	55.022
P15	55.006	55.010	55.014	55.016	55.018	55.022
Total Power	2606.77	2631.84	2648.51	2665.44	2691.09	2708.01
P_L	27.34	22.83	19.94	17.04	12.86	10.21
F_C×10^4 [$/h]	3.231	3.259	3.277	3.296	3.325	3.344
E_T×10^3 [Kg/h]	8.086	8.127	8.160	8.197	8.262	8.311
EED×10^4 [$/h]	4.354	4.395	4.423	4.454	4.502	4.536

EED Problem Considering Ramp Rate Limits with POZ: The results obtained at 2630 MW for EED with different PPF using PSO_SSM are 44230.11 $/h with min-max, 111201.89 $/h with min-min, 61136.77 $/h with max-max and 219205.74 $/h with max-min. It shows that the best solution is obtained using min-max price penalty factor as decision making technique. Results with min-max PPF at different power demands are given in Table 4.

The solutions obtained at 2630 MW are compared with PSO [38] and GA [38] for ramp rate limits with POZ in Table 5 and convergence characteristics are shown

TABLE 5: COMPARISON OF EED SOLUTIONS HAVING RRL WITH AND WITH POZ USING PSO_SSM WITH OTHER METHODS FOR LOAD 2630 MW (CASE-2)

Unit Power Output [MW]	PSO_SSM with POZ	PSO [38]	GA [38]
P1	455.014	439.12	415.31
P2	184.975	407.97	359.72
P3	130.014	119.63	104.42
P4	130.014	129.99	74.98
P5	179.974	151.07	380.28
P6	430.013	459.99	426.79
P7	430.014	425.56	341.32
P8	160.014	98.56	124.79
P9	116.732	113.49	133.14
P10	127.102	101.11	89.26
P11	80.014	33.91	60.06
P12	29.795	79.96	50
P13	85.014	25	38.77
P14	55.014	41.41	41.94
P15	55.014	35.61	22.64
Total Power	2648.505	2662.41	2668.44
P_L	19.948	32.42	38.28
Fuel cost [$/h]	32778.613	32858	33113
Emissions [Kg/h]	8160.653	-	-
EED [$/h]	44230.119	-	-
Time [sec.]	6.665	26.59	49.31

in Fig. 2. This comparison shows that lower values are achieved for fuel cost, losses and computation time which prove the success of the proposed method.

Hence it yields that the proposed PSO_SSMgives the better overall solutions as compared to classical PSO without SSM. Moreover, the effectiveness of the suggested approach is also achieved in different cases like valve point loading effect, ramp rate limits with prohibited operating zones.

V. CONCLUSION

This papereffectivelydemonstrates the hybrid PSO and SSM approach with PPF as decision making on constrained EEDproblem. Discontinuity is included in these cases due to the inclusion ofVPL effect, POZ andRRL.For valve point loading case, the efficacy of the suggested approach is evaluated on ten generator system and for the case of ramp rate limits alongwith POZ it is applied on fifteen generator system. The results obtained demonstrate the success of the proposed method.The comparison is done with other existing methods available in the literature. Proposed method is also successful in handling the non-linearity of the multi-model system alongwith the merits of low fuel cost, pollutants' emission and power loss.Hence,

it is concluded that the suggested method is flexible and simple and can be applied on various constrained problems related to economic-emission dispatch.

VI. ACKNOWLEDGMENT

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Conceptual Framework of Artificial Intelligence and Its Utilization

Ms.Pooja Puri[1], Rubaldeep Kaur[2]

[1]*Associate Professor, Department of Mgt. Studies, AGC, Amritsar, Punjab, India*
[2]*Student (MBA 3rd Sem.), Department of Mgt. Studies, AGC, Amritsar, Punjab, India*

Abstract—**It is continuously seen that man-made thinking has been advanced as another flexible. Due to the tall volume of data that being created by contraptions, sensors and web-based media clients, the machine can figure out how to recognize the illustration and makes a sensibly not too bad estimate. This article will explore the utilization of AI and also explain deep learning, machinelearning.**
Keywords: AI, Deep Learning, Machine Learning

I. Introduction

In the present-day advancement and the universe of mechanical self-sufficiency, imperative energy is driving another time of these automatons that known as counterfeit insights. This unused period is attracting wide thought of specialists and designers. They are excited to move them to another period that is more clever and more psychological, which we call Super Manufactured Insights. Consistently organizations are challenging the permanent volume of data. Not in any manner like some time as of late, taking care of this volume of data is past excellent information administration to a level that we know it as vast information that are getting around at the speed of the internet. Since our step by step tasks inside an association or endeavours are developing the Web of things making do with this data either coordinated or unstructured additionally is creating at a similar speed, subsequently taking care of this data for removing the legitimate information for the right data growing appropriately. With the solicitation of control to make a decision with the least risk dependent on information of data from information accumulated in huge information store, we require ongoing planning of the data coming to us from Omni-bearing perspective. Toward continuous planning of data with an establishment around the huge data might be a term that portrays the extensive volume of data — both coordinated and unstructured — that engages trade on an everyday reason. Anthony Liew Walden (2007), jardinsp (2018)

II. Objective of the Study

1. To know about AI, Machine learning and deep learning
2. This article will explore the utilization of AI and various kinds of Artificial intelligence

III. Review of Literature

Ambit, J. L. and Knob lock, C. A.(2001)found that this paper gives a wide survey of recent developments inside the field of artificial knowledge (AI) and its applications. The work is targeted at new contestants to the artificial insight field. It additionally helps the experienced-researchers about some to remember the issue they have known. Davenport *et al.*, (2020) found that of all the disruptive technologies, artificial intelligence is the latest technological disruptor and holds immense marketing transformation potential. However, a systematic literature review can highlight the importance of artificial intelligence in marketing and chart future research directions. The present study aims to offer a comprehensive review of AI in marketing using bibliometrics, conceptual and intellectual network analysis of extant literature published between 1982 and 2020. Data clustering using the Lou-vain algorithm helped identify research sub-themes and future research directions to expand AI in marketing. Burrell, J. (2016) mentioned that the article considers the issue of opacity as a problem for socially consequential mechanisms of classification and ranking. The analysis in this article gets inside the algorithms themselves. Recognizing the distinct forms of opacity that may be coming into play in a given application is a key to determining which of a variety of technical and non-technical solutions could help to prevent harm. Horng S. *et al.* (2017) mentioned that using artificial intelligence and machine learning techniques in different medical fields, especially emergency medicine, is rapidly growing. In this paper, studies conducted in the recent years on using artificial intelligence in emergency medicine have been collected and assessed. These studies belonged to prediction and detection of disease;

prediction of need for admission, discharge and also mortality; and machine learning based triage systems. Bengio (2009) found that this monograph provides an overview of general deep learning methodology and its applications to a variety of signal and information processing tasks. The application areas are chosen with the following three criteria in mind: expertise or knowledge of the authors; the application areas that have already been transformed by the successful use of deep learning technology, such as speech recognition and computer vision. Blum, A.(1997) mentioned that supervised machine learning is the search for algorithms that reason from externally supplied instances to produce general hypotheses, which then make predictions about future instances. The goal of supervised learning is to build a concise model of the distribution of class labels in terms of predictor features. The resulting classifier is then used to assign class labels to testing instances where the values of the predictor features are known, but the value of the class label is unknown. Krizhevsky, A (2012) found that deep learning allows computational models that are composed of multiple processing layers to learn representations of data with multiple levels of abstraction. These methods have dramatically improved the state-of-the-art in speech recognition, visual object recognition, object detection and many other domains such as drug discovery and genomics. The research was carried out by a team of scientists at the National Science Foundation in California.

IV. Introduction to Machine Learning

Machine learning is a type of artificial intelligence (AI) software that allows structures to assess and improve from experience without having to be explicitly coded. Machine learning is concerned with the creation of computer programmes that can gain access to data and interpret it for themselves. Without any operator involvement or support, the computer can learn and make appropriate adjustments on its own. Machine learning is a vital component of the rapidly expanding discipline of data science. Algorithms learn categorization or prediction by uncovering essential concepts in data mining projects using statistical methodologies. These insights can subsequently be used to affect key growth metrics and drive choices across applications and enterprises. As the market for data scientists grows, so will the demand for data scientists. You must assist in the identification of the most pressing business issues and, as a result, locate data that can address them (Wuest, T.; Weimer, D.; Irgens, C.; Thoben, K.)When employing traditional machine learning methods, however, the text is interpreted as a list of keywords. Semantic analysis methods, on the other hand, mimic people's capacity to comprehend text (Wang, K.; Wang, Y.).

V. How MachineLearning Works

As a rule, gadget contemplating calculations are utilized to make an expectation or arrangement. In view of a couple enter information, which might be named or unlabeled, your arrangement of rules will deliver a gauge around an example with inside the information. A trademark serves to evaluate the forecast of the model. On the off chance that there are respected models, a trademark could make a differentiation to assess the precision of the model. When the model better fits the information focuses in the preparation set, change the loads to lessen the distinction between known models and model assessments. The calculation rehashes this assessment and advancement measure, and naturally refreshes the loads (Zohuri, B., and McDaniel, P. J.).

VI. Introduction to Deep Learning

Deep learning is a subset of machine learning , which is basically a neural organization with at least three layers. These neural organizations attempt to impersonate the conduct of the human mind, despite the fact that they are a long way from its capacities, so it can "learn" a ton. Albeit a solitary layer neural organization can in any case make harsh expectations, other secret layers can help upgrade and improve precision. Deep learning drives various man-made thinking (AI) applications and organizations that improve robotization, performing shrewd and real endeavors without human intervention. Deep learning development lies behind conventional things and organizations (like modernized teammates, voice-engaged TV regulators, and Mastercard deception acknowledgment) similarly as emerging progressions (such as self-driving vehicles).Deep learning is a man-made reasoning capacity that can mirror the human cerebrum to deal with information for object acknowledgment, discourse acknowledgment, language interpretation, and dynamic. Deep learning AI can depend on unstructured or tokenized information for learning without human mediation. Deep learning is a sort of Machine learning that can be utilized to uncover misrepresentation.

VII. Deep Learning Applications

Deep learning applications in reality are essential for our every day lives, yet by and large, they have been all around coordinated into items and administrations, so clients don't comprehend the perplexing information preparing behind the scenes. Incorporate the accompanying:

A. Monetary Administrations

Monetary organizations consistently utilize prescient examination to oversee algorithmic stock exchanging, evaluate business chances in credit endorsements,

identify misrepresentation, and oversee client speculation and credit portfolios.

B. Client Assistance

Numerous organizations incorporate profound learning innovation into their client care measures. Chatbots utilized in different applications, administrations and client support entryways are a straightforward type of man-made reasoning. Customary talk bots utilize normal language and surprisingly visual acknowledgment that is basic in call habitats menu. Notwithstanding, more complex arrangements from chatbotsendeavor to utilize preparing to decide if there are various responses to equivocal inquiries. At that point, in view of the appropriate responses got, the chatbot will attempt to address these inquiries straightforwardly, or forward the discussion to a human client. Menial helpers, for example, Apple's Siri, Amazon Alexa, or Google Assistant add voice acknowledgment to the idea of chatbots, making another kind of customized client experience.

C. Medical Care

Since the digitization of clinic records and pictures, the clinical business has profited enormously from a wide scope of learning openings. Picture acknowledgment applications can help clinical imaging experts and radiologists by dissecting and deciphering more pictures in less time.

VIII. Introduction to Artificial intelligence

Artificial intelligence assumes a major part in bookkeeping and money. Computerized reasoning is suggesting to programming innovation that makes PC program to think and learn. This computerized reasoning framework plays out some task better than an individual in certain segments. Here the presentation of assignment implies man-made brainpower apparatuses save time, work at fast and give precise reports. In any case, AI can't supplant human completely. Artificial intelligence additionally affects the bookkeeping and account area. They have some great just as terrible effects. As the machine utilizes id, not new learning many money and bookkeeping organizations relies upon AI apparatuses nowadays. Firms need to foster a legitimate comprehension of how AI can take care of money and bookkeeping issues. With the assistance of AI, tools company is shielded from any mistake that happens in reports. This will diminish the responsibility or the bookkeeper and save time. In this manner, there is affirming in the market that AI-fueled individuals may lose positions. The bookkeeping and money worker feel shaky about their work that they may lose the employment. As the bookkeeper obligation is to

record every one of the monetary exchanges. Blunders can happen in monetary exchanges or some other review mix-ups can occur which can be effortlessly settled by AI apparatuses. So nowadays the bookkeeper isn't confronting such sort of issues. This is helpful for bookkeepers and financers to play out their duties viably. To perform AI exercises, there ought to be the appropriate nature of information in any case it's difficult to play out any exercises. Prior to embracing the AI framework the organization should comprehend the security cycle to forestall any false exercises. Consequently, there are some awful effects just as the great effect of the AI framework (Susto, G.A.; Schirru, A.; Pampuri, S.; Beghi, A.; De Nicolao, G.)

A. Examples of Artificial intelligence

- Disease planning and expectation instruments
- Manufacturing and robots
- Optimised, customized medical care therapy proposals
- Conversational bots for promoting and client assistance
- Robo-counsels for stock exchanging
- Spam channels on email
- Social media checking instruments for risky substance or bogus news
- Song or TV show proposals

B. How is AI Used?

Artificial intelligence is generally divided into two categories:

Narrow AI:

This kind of computerized reasoning (in some cases called "powerless AI") works in a restricted reach and is a reenactment of human insight. Limited computerized reasoning is typically centered around managing job competently. Albeit these machines have all the earmarks of being keen, their tasks are considerably more limited than even the most fundamental human insight (Li L, Ota K, Dong M, 2018)

Thin AI encompasses us, maybe the best computerized reasoning execution to date. As indicated by the 2016 distribution of the Obama Administration, "Getting ready for the Future of Artificial Intelligence," close AI has made numerous advances in the previous decade, zeroing in on explicit undertakings that "bring immense social advantages and advance financial strength (JardineP, 2018)

A couple of instances of Narrow AI include:
- Google search
- Image acknowledgment programming
- Siri, Alexa and other individual aides
- Self-driving vehicles

C. What is the Purpose of Artificial Intelligence?

The reason for artificial intelligence is to help human capacities and settle on complex choices with expansive effect. From a specialized perspective, this is the appropriate response. From a philosophical perspective, artificial intelligence reasoning can help individuals carry on with significant lives without superfluous challenges. Labor and help deal with a perplexing organization of interconnected individuals, organizations, states, and nations, working such that advantages all humankind(McCarthy, J.; Minsky, M.L.; Rochester, N.; Shannon). In the course of recent years, we have invented every single diverse instrument and advancements to improve on human work and help us settle on better choices, and together we have accomplished the objectives of artificial intelligence today. artificial intelligence is likewise our most recent innovation. This development will create inventive devices and administrations that will change our lifestyle dramatically and ideally kill struggle, disparity and human affliction (Ritue, Jyoti June 2018).

Regardless, the entirety of this is an out of reach future, we actually have far to go before such a result. Today, organizations principally utilise artificial intelligence to improve measure effectiveness, computerize asset serious errands and anticipate business dependent on solid information. Maybe than instinctively: As with all recently presented advances, innovative work costs should be financed by organizations and government offices before they can be given to normal individuals (Zsifkovits, H.; Woschank).

D. Applications of Artificial Intelligence

Administration : The AI system can assist you with performing and every day the board undertakings while limiting human blunder and improving productivity. NLP records of clinical notes help structure patient data, so clinicians can peruse the data all the more without any problem.

Telemedicine: In non-crisis circumstances, patients can speak with the emergency clinic's AI framework to investigate their side effects, input fundamental signs, and assess clinical requirements. By giving just extreme cases, this lessens the weight on wellbeing experts.

Better Proposal: This is typically the main model refered to when posing inquiries about AI business applications. This is on the grounds that AI has accomplished exceptional outcomes in such manner. You might be keen on what made the main concern increment fundamentally.

Filtering Spam and Phone Surveys: Due to the enormous number of audit locales like Amazon, the natural eye can't examine for unsafe substance. With the force of NLP,

computerized reasoning can output and channel these remarks for dubious exercises, subsequently improving the shopping experience (Anthony Liew Walden June 2007)

Optimizing Search: All of the e-exchange depends upon clients endeavoring to discover what they need, and being equipped for find it. AI has been upgrading look for results basically dependent on loads of boundaries to ensure that clients find the exact item that they're looking for.

Building Work Culture: AI is utilized to investigate representative information and disperse it to the correct group, allocate projects dependent on their capacities, gather criticism from the working environment, and even foresee whether they will leave your organization.

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Diabetes Prediction using Gradient Boosting Ensemble Learning with Cross-Validation

Kajal

Department of Computer Engineering & Technology, Guru Nanak Dev University, Amritsar, Punjab, India
Email: kajal.kaler96@gmail.com

Abstract- **More than 30 million individuals in India are experiencing Diabetes numerous others are in danger. It is considered a persistent and deadliest disease, which is caused due to the expansion of sugar or glucose in large amounts which is combined into the blood. It results in deadly diseases for example cardiac and respiratory illness. It influences various organs of the human body which hence, hurts many parts of the body's system, especially the blood veins and nerves. Various challenges and difficulties happen if this deadly disease doesn't get analyzed on time, it remains unfamiliar and untreated. To accomplish the objective, this research work usually explores different risk factors connected to this disease by using machine learning methods. Machine learning techniques give effective outcomes to extract knowledge by building predicting models from diagnostic medical datasets gathered from Pima Indian dataset. We utilized Ensemble machine learning algorithms, particularly Gradient Boosting classifier and Adaboost classifier using cross-validation at k=12 folds to predict diabetic Mellitus. The best algorithm considered in this experiment is Gradient Boosting Classifier using cross -validation i.e. 76.95% accuracy.**

Keywords: Diabetes, Ensemble Learning, Gradient boosting, Adaboost, Cross Validation

I. Introduction

Diabetes also called Diabetes Mellitus is one of the terrible diseases nowadays. Diabetes is a general term used for asymmetrical disorders that affect the body's ability to use the energy source present in food. It is labeled as a non-communicable disease (NCD) in which the blood sugar (glucose) is exposed to the human body. This raises blood sugar to a higher level, called hyperglycemia. The human body part, the pancreas, and discharge a hormone known as insulin which permits the use of sugar (glucose) from the carbohydrates in our body. Victim diabetes secretes insulin in small amounts which effectively stops the use of insulin. Diabetes can be labeled into four groups that are Type1, Type 2, Type 3, and Type 4. Type1 diabetes is a chronic disease in which vital cells that produce insulin to absorb glucose are demolished which are needed to generate energy in the blood. The Type 2 body fights to soak insulin either it cannot originate insulin. Usually, it happens in aged people. Prediabetes is the condition of type 3 diabetes in which the level of blood sugar is very but not high as in type 2 diabetes. At last, type 4 is gestational diabetes commonly occurs in pregnant women.

II. Literature Review

Pradeep Kandhasamy et al. [1] predict Diabetes Disease by comparing various machine learning algorithms such as J48 Decision Tree, K-Nearest Neighbors, and Random Forest, Support Vector Machines. These approaches have been taken from the UCI machine learning data repository. In this work, Random Forest is considered the best technique with 100% accuracy. P. Suresh Kumar et al. [2] identified a best predicting algorithm in this research work. This study is based on Random Forest (RF), SVM, k-NN, CART, and LDA algorithms for predicting Diabetes disease, and the Dataset is taken from Diabetes Dataset. By comparing all these algorithms, thus it is concluded that the RF algorithm predicts diabetes more efficiently. Vaishali R et al. [3] have proposed a work in which they use Naïve Bayes, J48 for Diabetes Prediction. The proposed work attained attributes from PIMA Indian Dataset. MOE NSGA II fuzzy has achieved the highest accuracy of 83.04% as compared to other algorithms. Dipti Sisodia et al. [4] identified diabetes prediction by using Artificial Neural Network learning. Artificial Neural Network is related to neural networks and gives the best method that resolves problems and predictions. The dataset was taken from the Medical database (PIDD). It had achieved 76.30% accuracy. Sidong Wei et al. [5] predict Diabetes using the most popular techniques eg, DNN, SVM to process Diabetes. They analyze the accuracy of these algorithms on the PIMA Indian Dataset. They compare the accuracy of each classifier. The best technique has 77.86% accuracy by using 10-fold cross-validation. Muhammad Azeem Sarwar et al. [6] applied NB, KNN, SVM, LR, DT, and RF for diabetes prediction. All these algorithms are applied on PIMA Indian Dataset. Data was divided into two portions including training data and testing data. The performed outcome represents that KNN and SVM algorithm is predicting the information more effectively

TABLE 1: COMPARISON OF MACHINE LEARNING TECHNIQUES FOR DIABETES DISEASE PREDICTION

References	Year	Dataset	Technique used	Accuracy Achieved
J. Pradeep Kandhasamy *et al.* [1]	2015	UCI data repository	J48 Decision Tree, K-Nearest Neighbors, and Random Forest, Support Vector Machines	100%
Vaishali R *et al.* [3]	2017	PIMA Indian Dataset	Naïve Bayes, J48, MLP, MOE NSGA II fuzzy	83.04%
Deepti Sisodia *et al.* [4]	2018	Medical database (PIDD)	Naive Bayes, SVM, Decision tree	76.30%
Sidong Wei *et al.* [7]	2018	PIMA Indian Dataset	DNN,SVM	77.86%
Muhammad Azeem Sarwar *et al.* [5]	2018	PIMA Indian diabetes dataset	DT,LR,RF,NB,KNN, SVM	77%
Ayman Mir *et al.* [6]	2018	PIMA Indians Diabetes Database	Naive Bayes, Support Vector Machine, Random Forest	79.13%
Priyanka Sonar *et al.* [8]	2019	Global dataset with 768 instances and 9 features	Decision tree, ANN, Naïve bayes, SVM	82%
Amani Yahyaoui *et al.* [11]	2019	PIMA Indian Diabetes Database	SVM, CNN, RF	83.67%
Amelec Viloria *et al.* [12]	2020	Pima Indian Dataset	SVM	95.2%
Biswajit Giri *et al.* [14]	2020	PIMA Indian diabetes database	LB,SVM,NB, RF,K-NN	72.63%
Subhash Chandra Gupta *et al.* [15]	2020	PIMA Indian Diabetes database	K-NN	87.01%

and perfectly. Ayman Mir et al. [7] described Diabetes Disease Prediction by using Naive Bayes, Support Vector Machine, and Random Forest on WEKA tool. In this research work, PIMA Indians Diabetes Database is used. It is observed that the Support Vector Machine performed best in the prediction of Diabetes disease with the highest value of 79.13%. Priyanka Sonar et al. [8] have discussed the result analysis of Machine Learning Techniques such as Decision Tree, SVM, Naïve Bayes, ANN for Diabetes Disease Prediction. In this paper, the Global dataset is used with 768 examples and 9 features. And at last, 82% accuracy has been achieved. Neha Prerna Tigga et al. [9] have introduced a Random Based Forest classification method to predict diabetes. The dataset has been taken from Pima Indian diabetes dataset. In this paper, six machine learning classification techniques were applied, and their outcomes were matched with various statistical measures.

III. MATERIALS

A. Data Description

The proposed classification Algorithms were evaluated on PIMA Indian dataset which is accessible on the online and can be downloaded from Kaggle Library [17]. The dataset is split into training and testing parts with the ratio of 70% and 30%, respectively. The dataset includes 8 attributes out of 786 instances. The 500 instances were of non diabetic category and 268 were diabetic. In the present work, the dataset was separated into preparing and testing parts. Additionally, the preparation dataset was partitioned into 10% cross validation set to assess the performance of the model. These were randomly chosen and repeated 10 times to ensure there is no bias in the framework. The accuracy was determined as the average accuracy acquired from this analysis.

B. Data Preprocessing

Data Preprocessing is a Data Mining method that involves converting raw data into a clear format. Real-world data is usually not complete, uncertain, and shortage in few behaviors and are probably many errors that would occur. Data Preprocessing is a proven way to solve such problems. Data Preprocessing is a stage in Data Mining that gives methods that can assist us with understand and build knowledge discovery of information simultaneously. The current work includes the first step of data cleaning. Data Cleaning attempts to fill in missing values, smooth out noise while identifies outsiders, and exact unpredictability in the information. There is no existence of null and duplicate values in the dataset.

IV. PROPOSED METHODOLOGY

The proposed methodology includes the usage of Jupyter notebook was utilized for execution and Python programming language was utilized for coding. Ensemble learning classification techniques such as Gradient Boosting and Adaboost and Cross validation is applied on the model. The following Fig. 1 represents the research work in flowchart.
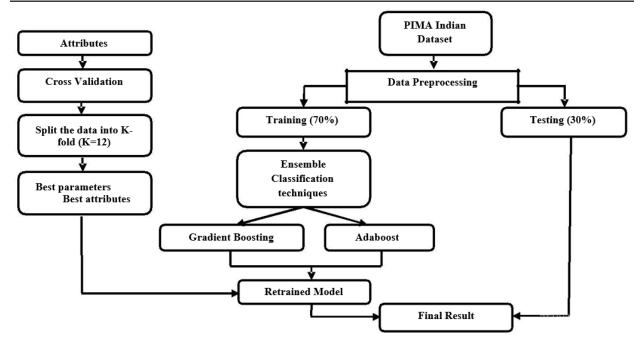
Fig. 1: Flowchart of Proposed Methodology

A. Gradient Boosting Machine

The gradient Boosting Machine merges all the predictions from various decision trees and provides the last prediction. It can be used in overfitting training set rapidly and hence, enhance the performance of the classifier. It trains several model in a gentle manner. It recognizes the weaknesses of weak learner (Decision trees). The purpose of Gradient Boosting is to reduce the loss function of the model with the help of weak learner.

B. Adaboost

Adaboost is an Ensemble technique in Machine learning. In Adaboost algorithm, the weak learners are changed into strong learners. It is mostly preferred for classification issues instead of regression problems. The most general Machine learning algorithm used with Adaboost technique is Decision Trees. It is used to decrease bias in the model.

C. Cross-Validation Method

The method which helps in evaluating the ability of Machine Learning models by training and testing on the subset of input data is called Cross-Validation. Cross-Validation is common method as it is easy to learn, apply and provide outcomes. It is used in some cases where is need to protect the model from overfitting. The main purpose of using cross-validation technique is to getting the accurate patterns and not having too much noise in the data .

D. Performance Evaluation Metrics

Performance Evaluation Metrics is the presentation of the expected outcomes of any binary testing that is regularly used to represent the performance of the classification model on a set of test data for which the genuine values are known. We have given little definitions for every metric are as per the following:

1. Accuracy: It is the total of accurate predictions made as a proportion of each prediction made.
2. Precision: The precision metric shows the proportion of your suitable outcomes.
3. Recall: Recall provides us the true positive rate, which is the ratio of accurate positives to every positive.
4. F- measure: Merging of precision and recall.
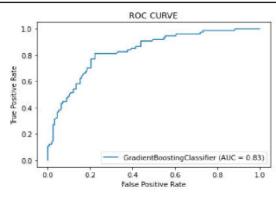
V. Results
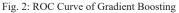
The following results have been evaluated using particular parameters such as Accuracy, Precision, Recall and F1 score.

Table 2: Comparison Table of Algorithms

Ensemble Learning Classifier	Accuracy
Gradient Boosting Classifier	76.19%
Gradient Boosting using Cross-Validation (K=12)	76.95%
Adaboost Classifier	74.45%
Adaboost using Cross- Validation (K=12)	76%

The Table 3 is the comparison of Gradient Boosting and Adaboost classifier using cross-validation on the basis of Accuracy. When the cross-validation at K=12 is applied on classifiers, the Gradient Boosting algorithm achieved better accuracy instead of Adaboost classifier.

Fig. 2: ROC Curve of Gradient Boosting

Fig. 3: ROC Curve of Adaboost Classifier Classifier

Fig. 4: Precision Recall Curve of Gradient Boosting
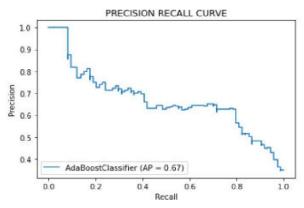
Fig. 5: Precision Recall Curve of Adaboost Classifier Classifier

Fig. 6: Comparison Graph of Gradient Boosting Classifier
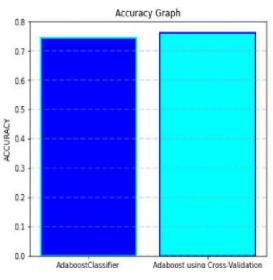
Fig. 7: Comparison Graph of Adaboost Classifier

VI. Conclusion

One of the worldwide medical problems is to recognize the danger of diabetes in its early stage. The accuracy of the presented model can be unlike and relies on the quality of the dataset used, the tools utilized by different researchers. Machine learning is used to analyze diabetes disease that helps the health professionals as well as patients. The given research work is done on PIMA Indian dataset. The Ensemble machine learning algorithms like Gradient Boosting and Adaboost classifiers have been used and Cross-Validation method is applied on it. The obtained results show that Gradient Boosting Classifier is predicting the Diabetes information more efficiently using cross-validation.

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Rice Leaf Diseases Classification using CNN with Transfer Learning

Shivani Sharma[1], Prof. Navneet Bawa[2]

[1,2]Computer Engineering Department, PTU Regional Centre
Amritsar College of Engineering & Technology, Amritsar, Punjab, India
Email: [1]shivanis35@yahoo.com, [2]navneet.cse@acetedu.in

Abstract—Rice is one of India's primary crops, which is damage at different phases of its production by numerous diseases. For farmers, the correct identification of these diseases with limited information is extremely challenging. Recent Deep Learning advances indicate Automatic Image Recognition systems employing models from the Convolutional Neural Network (CNN) may be extremely useful. As the image data set is not easy to access for rice leaf diseases, we will generate our own smaller data set, so that we will implement Transfer Learning in order to build our profound learning model. Based on VGG-16, the propose CNN architecture we will going to train and test using rice and internet dataset datasets.

Keywords: CNN, Transfer Learning, Rice Leaf Diseases

I. Introduction

In India and throughout the globe, rice is the primary source of nutrition. In different phases of its cultivation, it is affected by a number of diseases. Early identification and remediation of these diseases are thus helpful in ensuring large quantities and highest quality, but this is extremely difficult because of the enormous amount of land among farmers and the wide range of diseases, and since more than one disease is seen in a single plant. In distant regions, expertise of agricultural experts is not accessible and it is time to proceed. The Automated Systems are thus necessary. In order to support the suffering of the farmers and increase the precision of plant disease diagnosis, research has been undertaken utilizing several machine learning algorithms, including Support Vector Machine,[1]–[3].

However, the precision of these systems depends heavily on selection of features. Recent investigations into convolutional neural networks have brought major breakthroughs to the identification of the picture via the elimination of the requirement for preprocessing and the integrated function selection. A further issue is that big dataset sets for such situations are extremely hard to acquire. If the dataset set is somewhat small, a model that is pre-trained on a big dataset should be used better. This is known as Transfer Learning and may be used to build a model that can be used as a fixed feature extractor that removes the last fully connected layer or by refining the last few layers that works more specifically with the dataset involved.

Mobile phones are now available for everyone, which means that we come up with an automated method where farmers can upload the sick leaf picture and put it back on our servers, where the neural network can detect the disease, classify the disease, and return the cure to the farmer. We suggest in this project that the architecture for the automated system's disease categorization section. Inspired by work on convolutional neural networks in [4]–[5] and [6], we will built a deep learning method using our data set on rice disease during the last several months. We are going to use the pre-trained VGG-16 model and have improve the fully connected layers using the transfer learning so we can fit our own dataset and have finally made an error analysis, trying to understand the causes of this failure.

II. Literature Survey

While a lot of research was conducted with traditional gradations, the outcomes depend heavily on the selection of features and the image preparation. Consequently, CNN has attracted many researchers that want to benefit from the high accuracy of categorization

A. Biftasama Bari (2021)

Work has taken on the "Technology for identifying rice leaf disease using a deep learning-based fast R-CNN framework." Rice leaf infections are a major risk to rice production, which impact many farmers worldwide. Rice leaf disease is common in many areas of rice production. In order to promote good rice plant growth and provide enough provision and food production for the fast-growing population, chemotherapy of rice leaf disease is essential. As a consequence computer disease detection methods may overcome the limitations usually time consuming, inaccurate and expensive in conventional leaf disease detection methods. Techniques for the diagnosis of computer-aided rice leaf infections are becoming more common [7].

The proposed deep-learn method has demonstrated success with the automated identification of three exclusive rice-leaf diseases with 98.09 %, 98.85 % and 99.17 percent accuracy: rice flash, downy mildew and hispa.

Moreover, a nourishing rice leaf 99.25% of the time was properly recognised in the algorithm. The results indicate that the Fast R-CNN model offers a powerful rice leaf disease detection system, which can identify the most common rice diseases in real time with accuracy.

B. Ankur Das (2020)

Agriculture continues to be one of the most varied economic sectors, with a major role to play in the country's global socio-economic structure, regardless of the fact of agriculture's economic impact is constantly decreasing with the country's economy expanding.

Different diseases damage food supplies and create substantial agricultural losses, endangering the farmers' livelihoods and the nutrition and safety of the population at large. The main objectives of researchers are thus the identification of plant diseases and the fast recovery from them.

Author have developed a deep, automated learning system Prediction of rice leaf disease. This project seeks to improve agricultural output by predicting leaf conditions early and preventing disease transmission in the surrounding regions. The plant's damaged leaves are first wiped from the remaining leaves. The convolutional neural network is a contemporary collection of deep learning models. [8].

C. S.M., Maji, et.al (2021)

In this paper, author replaced the conventional convolution with a detachable convolution that lowers the number of parameters and the cost of the calculation. The dataset was developed using an open set of 14 plant species and 38 categorical disease classes and healthy leaves. The models were applied. Different factors like as batch size, dropout and various epoch numbers were included for the evaluation of model performance. The models used obtained an accurate disease rates of 98.42 per cent, 99.11 per cent, 97.0% and 99.56 per cent, which were higher than conventional, handmade methods, using Inception V3, InceptionResNetV2, MobileNetV2 and EfficientNetB0. The model used produced higher accuracy performance and needed less training time compared to previous deep-learning models. In addition, the MobileNetV2 architecture has an optimized parameter for mobile devices. The accuracy of diseases has shown that the deep CNN model is promising and may have a major effect on efficient identification of diseases and a possibility for disease detection in farm systems in real time [9].

D. Research Gaps and Motivation

A thorough examination of these publications found the following shortcomings:

Inadequate sample size or imbalanced datasets. Due to the under-representation of a certain category of rice disease, there are insufficient samples for the model to learn from; combining these samples with those from other mismatched categories leads in imbalanced datasets that may skew classification findings.

The standardized datasets are not adequately available. The majority of study has examined manually collected images. Because the sample sizes vary from research because of varying illumination, color or quality of the background. It is wrong to directly compare the results of such study without taking into consideration these factors.

Poor picture quality and color similarity make it difficult for models to correctly recognize features, preventing them from learning the required points for effective categorization.

III. Problem Formulation

A. Problem Statement

The most devastating illness in lowland rice-producing areas was bacterial blight (BLB) caused by Xanthomonas oryzaev. oryzae (Xoo). Orizzae (Xoo) is also known as an antibacterial chemicals generator which may be used as biocontrolling agents. Standard methods for leaf disease identification are human vision. In many cases, it takes time and is expensive to get expert advice. There are many drawbacks to human vision methods. The precision and precision of methods to human vision depend on a suitable vision for the person or expert.

A machine-based learning system enables diseases to be identified and reliable assessments can be made and the right treatments may be selected. One of the advantages of using machine-based learning technology is that it does more tasks frequently than human experts. A new machine-based classification method is thus required to combat the limitations of the current systems. Very few recent progresses has been made in the detection and classification of plant leaf disease using a machinery-learning method and less in paddy leaf disease.

B. Objectives

- To study various rice leaf diseases
- To explore classifications for detecting rice disease
- To study and test different rice leaf diseases on the basis of various images

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To Review and Study of Dual Axis Solar Tracker

Ajaypal Singh[1], Bimal Kumar[2], Chetan Verma[3]

[1,2,3]Department of Electrical Engineering, ACET Amritsar, Amritsar, Punjab
Email: [1]ajaypals18@gmail.com, [2]bimal.eee@acetedu.in, [3]chetan.verma@acetedu.in

Abstract—**The goal of this thesis was to develop a laboratory prototype of a solar tracking system, which is able to enhance the performance of the photovoltaic modules in a solar energy system. The operating principle of the device is to keep the photovoltaic modules constantly aligned with the sunbeams, which maximizes the exposure of solar panel to the Sun's radiation. As a result, more output power can be produced by the solar panel. The work of the project included hardware design and implementation, to gather with software programming for the microcontroller unit of the solar tracker. The system utilised a microcontroller to control motion of two DC motors, which rotate solar panel in two axes. The amount of rotation was determined by the microcontroller, based on inputs retrieved from four photo sensors located next to solar panel. At the end of the project, a functional solar tracking system was designed and implemented. It was able to keep the solar panel aligned.**

I. Introduction

The world researchers are always finding sources of energy that are clean, renewable, pollution free and have no effect on global warming. Solar energy is among the sources of energy that contains all the above qualities. Moreover, solar energy is abundantly available almost worldwide, so far the efficiency of generating electric energy from solar radiation is low, because solar beam used to change direction with respect to time a day and also based on the season. Thus, increasing the efficiency of generating electric energy from the solar radiation becomes very important issue.

The photovoltaic panels are usually mounted on the roof of the house or at a near open area to face the sun. The custom is to fix these solar modules position angle to the country latitude angle. If possible, seasonally some people try to adjust the module's direction manually towards the sun. To produce the maximum amount of energy, a solar panel must be perpendicular to the light source. Because the sun moves both throughout the day as well as throughout the year, a solar panel must be able to follow the sun's movement to produce the maximum possible power. The solution is to use a tracking system that maintains the panel's orthogonal position with the light source.

Solar tracking is a system that is mechanized to track the position of the sun to increase power output by between 30% and 60% than systems that are stationary. It is a more cost effective solution than the purchase of solar panels.

There are many tracking system designs available including passive and active systems with one or two axes of freedom. Dual axis trackers are among the most efficient, though this comes with increased complexity. Dual trackers track sun light from both axes. They are the best option for places where the position of the sun keeps changing during the year at different seasons. Single axis trackers are a better option for places around the equator where there is no significant change in the apparent position of the sun.

The level to which the efficiency is improved will depend on the efficiency of the tracking system and the weather. Very efficient trackers will offer more efficiency because they are able to track the sun with more precision. There will be bigger increase in efficiency in cases where the weather is sunny and thus favourable for the tracking system.

These systems are cheaper than active systems, but are not commercially popular and also, these have viscous dampers that prevent excessive motion in response to gusts of wind.

Active (Electrical) Solar Tracking System

These systems make use of motors and gear trains for direction of the tracker as commanded by the controller responding to the solar direction. The position of the sun is monitored throughout the day. When the tracker is subjected to darkness, it either sleeps or stops depending on the design. This is done using sensors that are sensitive to light such as LDRs. Their voltage output is put into a microcontroller that then drives actuators to adjust the position of the solar panel. There are three main types of active tracker systems: auxiliary bifacial solar cell system, electro-optical system, and microprocessor/computer system.

A. Photovoltaic Systems

They supply electric power using the sun; their efficiency is directly related to the amount of solar energy acquired by the system. The more solar energy acquired, the more electric power supplied. So it is necessary to follow the sun to increase the efficiency.

B. Automatic Photovoltaic Tracking System

Automatic Photovoltaic system is designed using trackers which have two types:□

1. Single axis tracker

Single axis trackers have one degree of freedom that acts as an axis of rotation. The axis of rotation of single axis trackers is typically aligned along a true north meridian. It is possible to align them in any cardinal direction with advanced tracking algorithms. A single axis tracker tracks the sun east to west. There are several common implementations of single axis trackers. These include HSAT (horizontal single axis trackers), VSAT (vertical single axis trackers), TSAT (tilted single axis trackers) and PSAT (polar aligned single axis trackers). The orientation of the module with respect to the tracker axis is important when modelling performance Figure 1 shows single axis
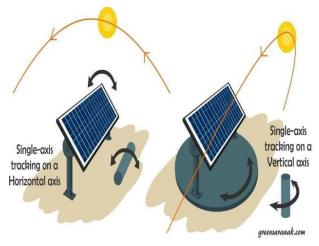
Fig. 1: Single Axis Tracker

2. Dual axis tracker

Dual axis trackers have two degrees of freedom that act as axes of rotation. These axes are typically normal to one another. The axis that is fixed with respect to the ground can be considered a primary axis. The axis that is referenced to the primary axis can be considered a secondary axis. They are classified by the orientation of their primary axes with respect to the ground. Two-axis tracker tracks the daily east to west movement of the sun and the daily declination movement of the sun. Two common implementations are TTDAT (tip-tilt dual

Fig. 2: Dual Axis Tracker

axis trackers) and AADAT (azimuth-altitude dual axis trackers) Figure 2 shows Dual axis tracker.

C. Review on Solar Tracking Systems

In this section, a review of a lot of previous studies done on Single and Dual axis trackers is presented such as:

1. Single axis trackers

Agarwal and Pal [5] designed a computer based one axis solar tracking system. LDR is used as photo sensor to sense the incident solar radiation. A computer based stepper motor is used in the tracking system to provide motion to the photovoltaic panel. The results show that, in cloudy weather, the system cannot track the actual position of the actual position of the sun, because of the absence of shading effect. Al-Haddad and Hassan [6] designed a one axis solar tracking system. The control part of the system is made using electronic circuit that have the op-amp LM324 as the main component. While for the mechanical part, the moving base of the reflector of the satellite receiver antenna is used. Measurements have been made for comparison between fixed and tracking system. The results have shown that, the tracking system is effective in the sense of relatively high output power increase and low cost. Abdallah and Badran designed a

single axis sun-tracking system for enhancing solar still productivity. A computerized sun tracking device is used for rotating the solar still with the movement of the sun. In this study, the programming method of control works efficiently in all weather conditions regardless of the presence of clouds. The calculated values of the surface positions as a function of time are fed to the PLC program to control the actuator of the sun position tracker, 24 V AC electrical motor. A comparison between fixed and sun tracked solar stills shows that the use of sun tracking increased the productivity for around 22%, due to the increase of overall efficiency by 2%. It can be concluded that, the sun tracking is more effective than fixed system and it is capable of enhancing the productivity.

2. Dual axis trackers

Roth, et al.designed a two axis sun tracking system. The tracker gives the possibility for automatic measuring of direct solar radiation with a pyrheliometer. In the active operation mode, the tracker uses the signal of a sun detecting linear sensor to control the pointing. Two stepper motors move the instrument platform, keeping the sun's beam at the centre of the sensor. Duarte, et al. Designed a two axis sun tracking system. This work studies the solution of two axis solar tracking system based on solar maps, which can predict the exact apparent position of the sun, by the latitude's location, thereby avoiding the need to use sensors or guidance systems. To accomplish this, it is used a low-power microcontroller, suitably programmed, to control two electric motors to ensure that the panels supporting structure is always oriented towards the sun.

II. Methodology

The entire set up is divided into 3 parts the light detecting unit, monitoring unit and the movement controlling unit.
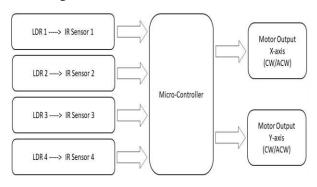
Fig. 3: Block Diagram

A. Light Detecting Unit

It consists of four light detecting resistors each forming a pair of two. It measures the light intensity and converts it into analog voltage and gives the input to the controller. One pair of LDR trace the location of sun in east- west direction and the other pair senses in the north-south direction. Resistance is inversely proportional to intensity of light and hence it decreases with increase in light intensity

B. Monitoring Unit

Arduino is the main monitoring unit of the entire apparatus as showed in fig.1...LDR is connected to the first four pins of Arduino i.e. A0- A4.Arduino takes the input from the LDR and based on that it gives instructions to dc motor to rotate either in horizontal or vertical directions.

C. Movement Controlling Unit

The movement controlling unit comprises of two dc motors. The Arduino gives an output of 5 v which is used to drive the servo motor which can be driven by an input of about 4.5 volts. One of the motor controls the horizontal rotation while the other controls the vertical rotation. Only one motor functions at a time so as to reduce the power consumption

III. The Expermient

- LDRs are used as the main light sensors. Two DC motors are fixed to the structure that holds the solar panel. The program for Arduino is uploaded to the microcontroller. The working of the project is as follows
- LDRs sense the amount of sunlight falling on them. Four LDRs are divided into top, bottom, left and right
- For east – west tracking, the analog values from two top LDRs and two bottom LDRs are compared and if the top set of LDRs receive more light, the vertical servo will move in that direction
- If the bottom LDRs receive more light, the DC motor moves in that direction
- For angular deflection of the solar panel, the analog values from two left LDRs and two right LDRs are compared. If the left set of LDRs receive more light than the right set, the horizontal servo will move in that direction
- If the right set of LDRs receive more light, the DC motor moves in that direction

Dual axis tracker follows the sun much better as compared to single axis tracker. It consists of two motors, one for X-axis rotation and other for Y-axis rotation. The microcontroller is programmed to controls the motors such that all LDRs receive maximum amount of light which ensures that solar panel is also receiving maximum sunlight for maximum power generation.
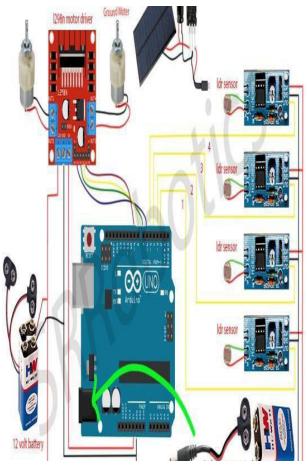
Fig. 4: Dual Axis Solar Tracking System

Fig. 5: Model

IV. Result

In this Dual Axis Solar Tracker, when source light falls on the panel, the panel adjusts its position according to maximum intensity of light falling perpendicular to it.

The objective of the project is completed. This was achieved through using light sensors that are able to detect the amount of sunlight that reaches the solar panel. The values obtained by the LDRs are compared and if there is any significant difference, there is actuation of the panel using a servo motor to the point where it is almost perpendicular to the rays of the sun.

The input stage is designed with a voltage divider circuit so that it gives desired range of illumination for bright illumination conditions or when there is dim lighting. The potentiometer was adjusted to cater for such changes. The LDRs were found to be most suitable for this project because their resistance varies with light. They are readily available and are cost effective. Temperature sensors for instance would be costly.

The control stage has a microcontroller that receives voltages from the LDRs and determines the action to be performed. The microcontroller is programmed to ensure it sends a signal to the DC motor that moves in accordance with the generated error.

The final stage was the driving circuitry that consisted mainly of the servo motor. The servomotor had enough torque to drive the panel. DC motors are noise free and are affordable, making them the best choice for the project.

V. Conclusion

Despite being perceived as a less exciting infrastructural component of the solar industry, solar tracking has seen a number of technological and mechanical breakthroughs that promise increased growth due to lower costs and increased weather resistance. In any environmental condition the automatic solar tracking system is a way much better implementation than the fixed panel. Automatic solar tracking system offers a prototype for implementing a large array type solar tracker.

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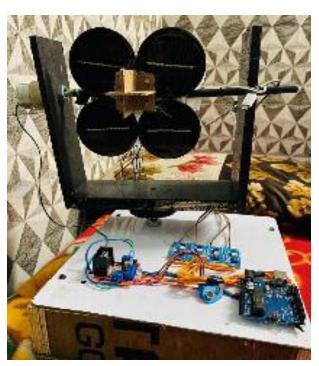
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A Review: Various Learning Techniques in Machine Learning

Er. Shivani Sharma

Deparment of Computer Science and Engineering, Amritsar Group of Colleges, Amritsar, India
Email: er.sharma04@gmail.com

Abstract—**Machine learning is the science of getting computers to act without being explicitly programmed. In the past decade, machine learning has given us self-driving cars, practical speech recognition, effective web search, and a vastly improved understanding of the human genome. Machine learning is so pervasive today that you probably use it dozens of times a day without knowing it. Machine learning, especially its subfield of Deep Learning, had many amazing advances in the recent years. This research paper contains various Learning techniques which are used in today's World.**
Keywords: Component, Formatting, Style, Styling, Insert

I. INTRODUCTION

Machine learning is used to teach machines how to handle the data more efficiently. Sometimes after viewing the data, we cannot interpret the pattern or extract information from the data. In that case, we apply machine learning [1]. With the abundance of datasets available, the demand for machine learning is in rise. Many industries from medicine to military apply machine learning to extract relevant information. The purpose of machine learning is to learn from the data. Many studies have been done on how to make machines learn by themselves [2] [3]. Many mathematicians and programmers apply several approaches to find the solution of this problem.

II. LEARNING TECHNIQUES

There are many techniques that are described as types of learning. In this section, we will take a closer look at some of the more common methods. This includes multi-task, active, online, transfer, and ensemble learning..

A. Multi-Task Learning

Multi-task learning is a type of supervised learning that involves fitting a model on one dataset that addresses multiple related problems. It involves devising a model that can be trained on multiple related tasks in such away that the performance of the model is improved by training across the tasks as compared to being trained on any single task.

Multi-task learning is a way to improve generalization by pooling the examples (which can be seen as soft constraints imposed on the parameters) arising out of several tasks.

For example, it is common for a multi-task learning problem to involve the same input patterns that may be used for multiple different outputs or supervised learning problems. In this setup, each output may be predicted by a different part of the model, allowing the core of the model to generalize across each task for the same inputs [29] In the same way that additional training examples put more pressure on the parameters of the model towards values that generalize well, when part of a model is shared across tasks, that part of the model is more constrained towards good values

Multitask learning has a simple goal of helping other learners to perform better. When multitask learning algorithms are applied on a task, it remembers the procedure how it solved the problem or how it reaches to the particular conclusion. The algorithm then uses these steps to find the solution of other similar problem or task. This helping of one algorithm to another can also be termed as inductive transfer mechanism. If the learners share their experience with each other, the learners can learn concurrently rather than individually and can be much faster [19].

B. Active Learning
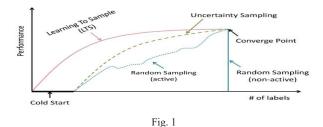
Active learning is a technique where the model is able to query a human user operator during the learning process in order to resolve ambiguity during the learning process.

Active learning: The learner adaptively or interactively collects training examples, typically by querying an oracle to request labels for new points.[28]

Active Learning Literature Survey, 2009.

"Active learning is a useful approach when there is not much data available and new data is expensive to collect or label."

The active learning process allows the sampling of the domain to be directed in a way that minimizes the number of samples and maximizes the effectiveness of the model. [29] Active learning is often used in applications where labels are expensive to obtain, for example computational

biology applications. The Following figure show the flow of Active Learning.

Fig. 1

Algorithm for End-to-end active learning loop

1.   # encode items in S with context-sensitive encoder
2.   # and encode items in E with context-free encoder
3.   S = {(x, y)}, S u 0 = {(x, ·)}, S k 0 = ∅,

   E = {(ˆx, yˆ)}
4.   for t = 1 . . . T do
5.   # select next instance
6.   i ← SELECT(S u t−1 , Sk t−1 , ht−1)
7.   # read labeled instance and update controller
8.   (xi , yi) ← READ(S, i)
9.   ht ← UPDATE(ht−1, xi , yi)
10. # update known / unknown set
11. S k t ← S k t−1 ∪ {(xi , yi)}
12. S u t ← S u t−1 \ {(xi , ·)}
13.   # perform fast prediction (save loss for training)
14. L S t ← FAST-PRED(S, Su t , Sk t , ht)
15. end for
16. # perform slow prediction (save loss for training)
17. L E T ← SLOW-PRED(E, Su T , Sk T , hT)

This algorithm is used in Machine learning while working with active learning. It is used in many applications.

Active learning is often used in applications where labels are expensive to obtain, for example computational biology applications.

C.   Online Learning

Online learning involves using the data available and updating the model directly before a prediction is required or after the last observation was made.

Online learning is appropriate for those problems where observations are provided over time and where the probability distribution of observations is expected to also change over time. Therefore, the model is expected to change just as frequently in order to capture and harness those changes.

Traditionally machine learning is performed offline, which means we have a batch of data, and we optimize an equation However, if we have streaming data, we need to perform online learning, so we can update our estimates as each new data point arrives rather than waiting until "the end" (which may never occur).

This approach is also used by algorithms where there may be more observations than can reasonably fit into memory, therefore, learning is performed incrementally over observations, such as a stream of data.

Let us try to formalize the problem. Even in this simple setting there will be a few surprises.

Let y = (y1, . . . , yn) ∈ {−1, 1} be as sequence of (signed) bits. A deterministic prediction strategy can be written as

A = (ŷ1, . . . , ŷn), with ŷt = ŷt(y1, . . . , yt−1) ∈ {−1, 1}.

If we employ the deterministic strategy ŷ on (y1, . . , yn), we make

$1/n \sum t = \{ŷt \neq yt\}$

average number of mistakes. You should be able to convence yourself that for any such deterministic strategy there exists a sequence on which this strategy makes mistakes all the time, thus incurring an average loss of 1. This upsetting issue, however, is fixed by considering randomized strategies, as we show next.

A randomized algorithm will be denoted by A = (q1, . . . , qn), with qt = qt(y1, . . . , yt−1) ∈ [−1, 1]. Each value qt is to be understood as parametrizing the mean of a distribution on

{−1, 1}. For any sequence y1, . . . , yn, we now consider the expected value of the loss

`A; y1, . . . , yn) = E[1 n n $\sum$ t=1 1{ŷt ≠ yt}] ,

where the expectation is over the randomization of the algorithm. The value `(A; y1, . . . , yn) tells us how many mistakes, on average, the randomized algorithm A is expected to make on the given sequence.

An algorithm that guesses randomly will incur the average loss of 1/2 for any sequence, and so there is no longer a single "bad" sequence .Above is the formulae of online Learning which will be used in various field

D.   Transfer Learning

Transfer learning is a type of learning where a model is first trained on one task, then some or all of the model is used as the starting point for a related task.

In transfer learning, the learner must perform two or more different tasks, but we assume that many of the factors that explain the variations in P1 are relevant to the variations that need to be captured for learning P2.

It is a useful approach on problems where there is a task related to the main task of interest and the related task has a large amount of data. It is different from multi-task learning as the tasks are learned sequentially in transfer learning, whereas multi-task learning seeks good

performance on all considered tasks by a single model at the same time in parallel. It pretrain a deep convolutional net with 8 layers of weights on a set of tasks (a subset of the 1000 ImageNet object categories) and then initialize a same-size network with the first k layers of the first net. All the layers of the second network (with the upper layers initialized randomly) are then jointly trained to perform a different set of tasks (another subset of the 1000 ImageNet object categories), with fewer training examples than for the first set of tasks.

E. Ensemble Learning

The objective of ensemble learning is to achieve better performance with the ensemble of models as compared to any individual model. This involves both deciding how to create models used in the ensemble and how to best combine the predictions from the ensemble members [29]

Ensemble Learning When various individual learners are combined to form only one learner then that particular type of learning is called ensemble learning. The individual learner may be Naïve Bayes, decision tree, neural network, etc. Ensemble learning is a hot topic since 1990s. It has been observed that, a collection of learners is almost always better at doing a particular job rather than individual learners [20]. Two popular Ensemble learning techniques are given below [21]

A single algorithm may not make the perfect prediction for a given dataset. Machine learning algorithms have their limitations and producing a model with high accuracy is challenging. If we build and combine multiple models, the overall accuracy could get boosted. The combination can be implemented by aggregating the output from each model with two objectives: reducing the model error and maintaining its generalization. The way to implement such aggregation can be achieved using some techniques. Some textbooks refer to such architecture as meta-algorithms.

Boosting: Boosting is a technique in ensemble learning which is used to decrease bias and variance. Boosting creates a collection of weak learners and convert them to one strong learner. A weak learner is a classifier which is barely correlated with true classification. On the other hand, a strong learner is a type of classifier which is strongly correlated with true classification [21]. Bagging: Bagging or bootstrap aggregating is applied where the accuracy and stability of a machine learning algorithm needs to be increased. It is applicable in classification and regression. Bagging also decreases variance and helps in handling overfitting [23].
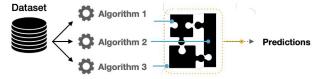
Fig. 2: Diversifying the Model Predictions using Multiple Algorithms

F. Ensemble Techniques

1. Bagging

The idea of bagging is based on making the training data available to an iterative process of learning. Each model learns the error produced by the previous model using a slightly different subset of the training dataset. Bagging reduces variance and minimizes overfitting. One example of such a technique is the Random Forest algorithm.

Bootstrapping: Bagging is based on a bootstrapping sampling technique. Bootstrapping creates multiple sets of the original training data with replacement. Replacement enables the duplication of sample instances in a set. Each subset has the same equal size and can be used to train models in parallel.

Random Forest: Uses subset of training samples as well as subset of features to build multiple split trees. Multiple decision trees are built to fit each training set. The distribution of samples/features is typically implemented in a random mode.

Extra-Trees Ensemble: is another ensemble technique where the predictions are combined from many decision trees. Similar to Random Forest, it combines a large number of decision trees. However, the Extra-trees use the whole sample while choosing the splits randomly

III. Conlusion

This paper surveys various machine learning Techniques. Today each and every Human Being is using machine learning like getting a recommended product in online shopping to updating photos in social networking sites. This paper gives an introduction to most of the popular Learning Techniques which are very useful for various algorithms of Machine Learning.

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KUK: Towards an AI Assisted Tool for Bird Call Detection and Analysis in the Wild

Nupur Kapur[1], Pulkit Komal[2], Apoorav Mittal[3], Rushil Sharma[4]

[1,2,3,4]Sabudh Foundation, Mohali, India

Email: [1]nupur.k@sabudh.org, [2]pulkit@sabudh.org, [3]apoorav.k@sabudh.org, [4]rushil.s@sabudh.org

Abstract—This work is motivated towards the detection and analysis of bird call from natural environment audio recordings. We focus on designing an end to end system that will accept a audio recording and scan the stream for bird call detection with a binary classification system. After detecting the regions where bird call is predominant a multi-class classifier identifies the bird species from that region. We incorporate this in an web application which will help interested analysts to study different audio recordings which may contain bird call. We also use the same system to study bird call pattern over a specific period of time which will give us some insight on the effect of environmental changes on bird species related ecosystem.

I. Introduction

Birds are a significant element in our biosphere. The ecology of a forest, jungle or to some extent human habitats depends on the birds. Due to the continuous urban expansion over past few decades in India (not to mention other developing counties as well) massive deforestation is taking place. One evident consequence of this is an irreversible destruction of bird habitat. This leads to extinction of different species over a not too long period of time. This project is a part of bigger work that analyse this pattern around different places in Northern India and seek possible remedies of the problem through IoT and advanced AI based tools in the back-end.

The audio data that contain bird call can be recorded in different environments, one of them can be an enclosure for birds where we will get higher bird call presence in a certain interval. Also in this situation the ambient sound (non-bird call audios) will be much less. The second environment can be either a forest, jungle or similar natural environments or even human habitats like city, towns, villages etc. The audios that comes from the second environment may contain different non-bird audio regions, they are :

1. Geophonic sounds like wind, leaves
2. Anthropogenic sounds like human voice
3. Other animal sounds that are present in same environment
4. Occasional sounds that are non-biological in nature, like machine/ vehicle sounds 1
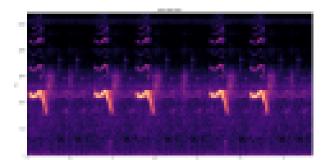
In our present work we have taken our data mostly from the second category. Most of these data came from open access public data sets and on top of that we have used our own recording to enrich the collection. The detail description of data set is in Sec.5.1. Selecting the second category for our data gives us the ability to use the prediction model for analysis and detection of bird call in the wild. Now as the audio also have a lot of other sounds as mentioned before a natural strategy would be to identify regions of audio that mostly contain bird call data. For this we have designed our classification model based on supervised and unsupervised methods, this is discussed in Sec. 4. After identification of the bird call in a certain region in the audio we use a deep learning based Multi-class classifier to identify the species of the bird. The detail architecture of the model and performance evaluation is discussed in Sec.4.1.2 and Sec.5.2 respectively.
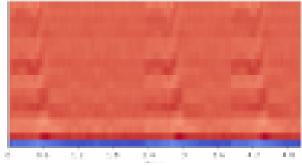
With these models in the back end we have also developed a web application to store, load, analyse and annotate bird call and related audio files. This application can directly connect with Amazon S3 server for data transfer and storage. The front end can be used to load audios and view their spectral information along with automatically labelled regions for bird call. Specific features for this tool is discussed in Sec.6. The prediction models are also used in a specific application that loads certain recorded audios along with the timestamp value and detect the frequency of bird call over time in a day. With multiple recordings over days we are also trying to find a "behavioural pattern" of bird call in a certain geographic location throughout the day. This pattern can be useful to study the changes in call pattern over a longer duration in time (say years) and possibly associate that with seasonal, climate or abrupt environmental changes. This in future may guide us to possible remedies of bird habitation related problems. We are aiming to design a system that can be integrated with a cloud based IoT network of simple sound recorders distributed over a larger geographic area and also act as an automated analytic interface for several ecosystem and biosphere related scenarios.

II. RELATED WORK

Bird species can be identified using bird calls and the reason for this classification is that human labor required to classify birds based on bird calls is humungous so machine learning came for the rescue.Substantial of work has been done using machine learning which includes using CNN such as Resnet and inception model [1] as a model architecture on Xeno - canto database. Their conclusion states that the Inception model gave better accuracy as compared to ResNet18 and ResNet34 and the reason could be the hyperparameters. In [2] a dynamic kernel-based support vector machines(SVM's) and deep neural networks which are famous for sorting different length patterns extracted from speech and audio signals. The model used for classification was GMM and SVM and after comparing both the classifiers it was concluded that GUMIK- based SVM worked better than GMM classifiers with their respective accuracies of 93.44% and 98.4%. Another interesting work [3] conducted different experi ments to improve bird call classification such as fusion or f CNN-based models using the public dataset (CLO-43DS). The three TFRs such as Mel-spectrogram, harmonic-component-based spectrogram, and percussive-component-based spectrogram were used to extract features of each bird recording. Dif ferent CNN base models were trained using different spectrograms and class-based late fusion was used to ameliorate the classification process which served the purpose and attained an accuracy of 93.31%. In paper[4], authors uses a 3D CRNN(3D+CNN+RNN) for bird sound detection which is a combination of CNN and RNN on 2 datasets i.e BirdVox and Poland, and for feature extraction they used Mel-Spectrogram. After using this architecture F1 score of 87.13% and an AUC score of 88.70% were attained.Also in [5], used recordings from the PELZ BIOPHON commercial edition CD carriers. VAD[Voice activity detection] module is used for detecting bird call recordings.HFCC [human factor cepstral coefficients] and MFCC [mel - frequency cepstral coefficients] are used for feature extrac tion.One HMM model is trained for each bird species which in return gives the likelihood factor and the one with maximum likelihood is selected. These coefficients are transferred into a one-dimensional sequence of a code value. Using clustering the accuracy obtained was 81.2% and for the family, classi fication accuracy went up to 90.45%. Paper [6] also uses CNN as it has proven out to be the best for audio classification. Using different methods for mapping audios in spectrograms such as DGT, MEL, CO, and GA bandpass filters. Different approaches were used for different datasets such as CAT, BIRDZ, ESC-50. The methods used were compared and concluded that Fusion global(composed of 63 networks) using MEL gives better results as compared to Alexnet, Googlenet, Inception, ResNet, etc. Comparison of sound classification ensemble was done with state-of-art which also concluded that

(a) MFCC for the call of an Asian Koel

(b) Mel Spectrogram for the call of an Asian Koel

Fig. 1: Feature Extraction-Sample Image

Fusion global, when used with DGT feature extractor, gives out the accuracy of 96.82% on the BIRDZ dataset, 90.51% on the CAT dataset, and 88.65% on ESC-50. Paper [7] used Cornell dataset and interval- IID model and Bayes risk-minimizing classifier. Features of the dataset are extracted using MFCC. Using the concept of codebooks k-means++ clustering is used and later these codebooks are used for classification using Bayes risk minimizer. It was concluded that the nearest-neighbor classifier using Kullback-Leibler and Hellinger distance for comparing features is equally competitive as the state-of-art method.

III. FEATURE EXTRACTION

Feature extraction is an essential part of analysing and finding relations between different things. The models cannot understand the audio data directly so it is converted into an understandable format using feature extraction. During our model training we used MFCC (Mel-Frequency Cepstral Coefficients) and Mel Spectrogram to extract features from the audio files.

A. Mel-Frequency Cepstral Coefficients

This feature is one of the most important method to extract a feature of an audio signal and is used majorly whenever working on audio signals. In MFCC, we apply M triangular filters on a set of frequencies to select a

few of them. The filter is applied to the audio. For each position, the values are summed up. If there are M filters, we will have M values for one position, and for T such positions we will get (T X M) shape array.

B. Mel Spectrogram

Mel Spectrograms are spectrograms that visualize sounds on the Mel scale. The Mel Scale is a loga rithmic transformation of a signal's frequency. The core idea of this transformation is that sounds of equal distance on the Mel Scale are perceived to be of equal distance to humans.

IV. PROPOSED MODEL

In this paper, we propose to make a robust bird call detection and classification model which is composed of two models, a binary classifier, to identify the regions where bird call is present in the audio files and a multi-class classifier that identifies the bird species present in the regions of the audios identified as bird call. The aim is to make this model robust to ambient noise recordings as well so that it can accurately identify the bird call and classify it even in noisy surroundings such as urban areas.

To predict the presence of bird call in an audio, both supervised and unsupervised models were used to evaluate which model performed better.

A. Supervised Learning

1. Binary Classifier for Bird Call Detection

For binary classifier, the audios were chunked into 5 second audios and were manually annotated as 0 and 1, 0 being no bird call and 1 being bird call. The manually annotated data was then converted to MFCC arrays of shape (214, 40) and the final dataset consisted of 70 bird calls and 70 no bird calls. A 4 layered CNN model was trained on those arrays. This experiment was carried out on Cornell bird call data which was available on Kaggle. The model performed well on the Cornell dataset audios but failed to perform well on ambient sound recordings. It classified audios with no bird call but with noise in the background as bird call as well. The results obtained from this model were the motivation to build a system that is robust to ambient sound recordings as well.

For the next experiment, active learning was used where initially 30 audios were taken and split into two sets of 15 audios each. From each set, 5 audios were picked initially. Each audio file was one minute long. The audios were then split into 2 second chunks and 125 frames of 2 seconds long were obtained which amounted to 250 audios in total. These audios were ambient sound recordings, collected from Audiomoth. The model was then trained on the MFCCs of 200 audios and 50 audios were kept as test data. The predictions were obtained for the test data. For the next iteration, again 5 audios were picked from the

first set and chunked into 135 frames. For these audios, model was used to predict the labels for them instead of manual annotation. These audios and their labels were then combined with the actual training set and now the model was trained on 335 audios. We carried out this experiment for 2 iterations and the results were much better in comparison to the results obtained from the first experiment but when the model was tested on some more audios, it didn't perform as expected as the number of false positives was quite high.

The next objective was to attain the labels for the audios and for that unsupervised learning methods were used, explained in next section, which clustered the Melspectrograms of the 200 audios and gave labels for each audio. The 4-layered CNN model was trained on these audios and for the next iteration of active learning, unsupervised model was again used to predict the labels for the next set of audios taken.
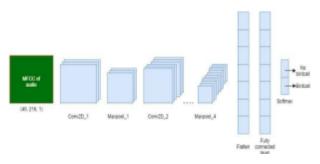
Fig. 2: Model Architecture For Binary Classifier

2. Multi-class Classifier for Bird identification

For multi-class classifier, a 4-layered CNN model was trained on 10000 audios which consisted of 25 species. The dataset in this case was the Cornell Bird cal dataset. MFCC was chosen to be the feature extraction method for this experiment.

To test various CNN models, a dynamic CNN model was created which could take in as many number of layers wanted and other parameters like kernel size, filters, learning rate could also be changed without re-writing the whole model. After the creation of this model, three experiments were conducted, experiment 1 on 8 species and experiment 2 on 26 species and experiment 3 on 4 species using Transfer learning. Experiment 1 and 2 used the data extracted from xeno-canto.org which is the largest repository for bird calls and experiment 3 was trained on 4 species from the Cornell dataset.

- In experiment 1, 5 layer CNN was trained on melspectrograms of 4800 5 second audios which consisted of 8 species. The learning rate was set to be 0.001 in this case.
- In experiment 2, 7 layer CNN was trained on melspectrograms of 26509 5 second audios which consisted of 26 species. The learning rate was set to be 0.001 in this case.

- In experiment 3, transfer learning was implemented. Transfer learning is a technique whereby a neural network model is first trained on a problem similar to the problem that is being solved. Transfer learning is the improvement of learning in a new task through the transfer of knowledge from a related task that has already been learned. The model trained in the above experiment was used as pre-trained model for the new model to be trained on the Cornell dataset. In this model, 7-layered CNN was formed and learning rate was set at 0.001.
- To attenuate the noise in the audios and make our models even better, various de-noising methods were tried and tested. Following are the de-noising methods which were taken into account:
- Discrete Wavelet Transform: Discrete Wavelet Transform is a denoising technique which is used to remove the noise from a given audio signal by using different wavelets. For denoising audio the wavelet used is the biorthogonal 6.8 and the mode used is periodic. After denoising the Signal to-Noise Ratio (SNR) is also calculated for the signal to detect how much noise is removed from the signal.
- Spectral Subtraction Spectral Subtraction is another denoising technique in which de-noising is done by subtracting the magnitudes of the signal and the noise part. This method uses only the magnitude of both the audio signal and the noisy part and subtract them and in the end add the phase (which is kept constant) to it. The Signal-to-Noise Ratio (SNR) is also calculated for the signal to detect how much noise is removed from the signal.

After testing both the methods of de-noising it was found that using Spectral Subtraction, the SNR of audios increased significantly but same was not the case for Discrete Wavelet Transform. After denoising of audios, a CNN model of 6 layers was built which was trained on 600 audios from the Cornell dataset and the results improved significantly.

The results of all the experiments discussed above are in the next section.
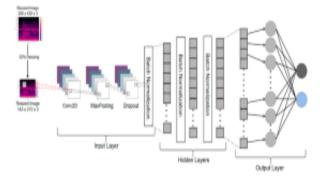
Fig. 3: Model Architecture

B. Unsupervised Learning

Unsupervised learning is a technique which is used to find patterns within data. To understand our data better, 100 audios were taken and melspectrograms for each of them were extracted. After saving the melspectrogram images, pre-trained model of VGG16 was used for feature extraction in which last two layers, that is, the output layer of the model was removed to obtain array of features. PCA was used after this for dimensionality reduction. The resultant array of images was then fed to KMeans algorithm, which gave three clusters. One cluster had all the bird calls, the second cluster had all the insect noise and the third cluster has ambient noise recordings.

Similarly, other unsupervised learning algorithms like Agglomerative clustering, Birch, DBSCAN, and Spectral Bi-clustering were used to see which algorithm performed better. Almost all the algo rithms performed equally but in Kmeans, the number of bird call audios in the ambient noise cluster were less in comparison to others.

V. Experiment Result

Various experiments were conducted using different layered CNNs and hyperparameter tuning to reach the best model for both binary and multi-class classifier. Different datasets were used to study how our models performed across various datasets and to understand how difference in background conditions in audios could affect the training and performance of the models.

A. Dataset

The data was gathered from different sources and some of it was manually annotated. The purpose was to test our models across different audios with different background conditions for better evaluation of the models formed. We used three datasets: Cornell Dataset, Xeno-canto dataset and audio recordings obtained from the Audiomoth device.

Cornell Dataset: This dataset was collected from a competition on Kaggle that was held pre viously. The dataset consisted of 264 classes with 100 audios each. For our purposes, we used 25 classes from this dataset which consisted around 2500 audios. The audios were later chunked into 5 second audios before feature extraction and model training.

Xeno-canto Dataset: Xeno-canto is a huge repository for finding open source bird call recordings. This dataset was formed for 29 bird species belonging to Indian origin. 50 audios for each of the bird species were extracted from this website.

Audiomoth Recordings: A device called Audiomoth was deployed onto the roof of the house and the audio recordings consisted of recordings of one full day.

Next day, after storing previous day's recordings, the Audiomoth was again set for recordings. We obtained 3000 audio recordings of 55 seconds each which summed up to 39000 audio recordings after chunking into 5 second frames.

B. Result

1. Binary classifier

For the first experiment, which consisted of 70 bird calls and 70 no birdcalls, the model classified noise in the test dataset to be birdcall because the no birdcall data earlier didn't have any noise. For the second experiment involving active learning, and for the third experiment all the results are summarized in Table.1.1
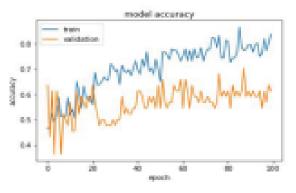
Fig. 4. Train and Validation Accuracy for iteration 1
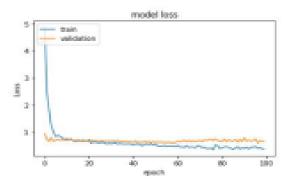
Fig. 5. Train and Validation Loss for iteration 1
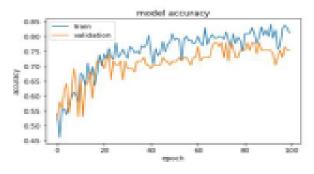
Fig. 6: Train and Validation Accuracy for Iteration 2
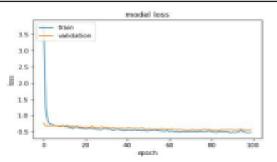
Fig. 7: Train and Validation Loss for Iteration 1

Experiments	Name	Train accuracy	Test accuracy
1	Trained on Cornell Dataset	0.96	0.85
2(a)	Active Learning 1st iteration	0.85	0.79
2(b)	Active Learning 2nd iteration	0.81	0.827
3	Trained on labels obtained from unsupervised model	0.90	0.85

Fig. 8 Table 1.1: Experiments for Binary Classifier

2. Multi-class classifier

- Results of all the multi-class classifier experiments are written below in the Table 1.2.
- Transfer learning improved the results of classifier significantly.
- The results after de-noising subsequently improved the model performance
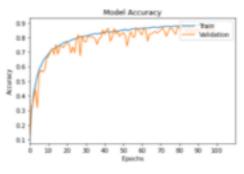
Fig. 9: Model Trained on 26 Species
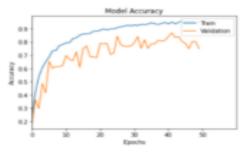
Fig. 10. Model trained on 8 species
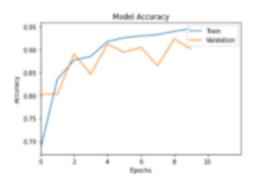
Fig. 10. Using transfer learning

Experiments	Name	Train Accuracy	Test Accuracy
1	Multi Classifier on Cornell data with 25 species	0.74	0.66
2	Multi classifier on xeno canto data with 8 species	0.95	0.84
3	Multi classifier on xeno canto data with 26 species	0.91	0.82
4	Multi classifier using Transfer learning with 7 species	0.95	0.90
5	Multi classifier using denoised audios	Before denoising 0.90 After denoising: 0.69	Before denoising: 0.90 After denoising: 0.82

Fig. 12 Table 1.2: Experiments for Multi Classifier

VI. Tool Features

A. User Authentication

The user will have to login to the web app using the credentials provided. Only users provided with credentials will be able to login to the web app. Users who want to access the web app will have to request for credentials.

B. Dashboard

When the user logs into the web app, the dashboard is presented to the user. The dashboard has four main functions:

Upload: This feature allows the user to upload a single file to an aws storage. Which gets saved under the directory "root".

Multiple Upload: This feature allows the user to upload multiple audio files to an aws storage with a specific directory name. If no directory name is provided the files will get stored under "temp" directory.

Test prediction model: This feature allows the user to upload a wav or mp3 file which then gets processed with one of the models mentioned above. This will redirect to the model results 6.3.

Directories: This feature allows the user to access the files uploaded as well as the directories the user has

created. The user can open the directories and evaluate the audio files uploaded, similar to the test prediction model feature however in this the user doesn't have to upload the file.

C. Model Results

The model results are shown to the user after an audio file is evaluated using the Test prediction model function or is evaluated directly from aws using the Dashboard. The model results provides the user with two sections:

1. Visualizations

In the visualizations section the user can listen to the evaluated audio using the play audio button on the top and also download the visualization plots using the "DOWNLOAD IMAGES" button below the plots. The user will be shown four plots representing:

1. The spectrogram of the uploaded audio file. A spectrogram is a visual representation of the spectrum of frequencies of a signal as it varies with time
2. The Mel Spectrogram of the uploaded audio. The mel spectrogram are spectrograms that visu alize sounds on the Mel scale
3. The waveform of the uploaded audio. The waveform is a visual representation of the amplitude over a certain amount of time
4. The color map of the bird and no bird call regions of the audio waveform. In this the coral region is the region where the bird call is detected, whereas the blue region is the region where there is no bird call detected

2. Annotation Tool

The audio file uploaded by the user gets converted into smaller chunks of audio and is then processed by a machine learning model which predicts what the audio chunk is. The annotation tool has four columns representing:

Result: This column gives the prediction output from the model used.

Timestamp: This column provides the timestamp where the prediction is in the audio file. 9

Audio: This column gives the user a play button so the user can listen to audio chunk to verify the model results.

Class: This columns give the user the option to change the class after listening to the audio file

The user then can save the changes made by submitting the data which will be stored in an aws storage. This data will be used for further model training. The user can also download the data, it will stored under "annotated-files" directory which is available on the Dashboard

VII. Conclusion

The evaluation shows that even with a limited amount of data the model shows a promising output both for the binary and multiclass classifier. With more data from different relevant locations under different recording condition should certainly be challenging but with necessary measure this will also yield a robust system.

VIII. Acknowledgement

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Documentary Review "Role of Technical Doctrines in Space Science" Research | Artificial Intelligence | Remote Sensing

Akash Chowrasia[1], Er. Sakshi Mahajan[2]

[1]B.Tech Scholar, Department of Computer Science & Engineering

Amritsar College of Engineering & Technology, Amritsar, Punjab, India

[2]Assistant Professor, Department of Computer Science & Engineering

Amritsar College of Engineering & Technology, Amritsar, Punjab, India

Email: [1]chowrasia.akash08@gmail.com, [2]sakshimahajan@acetamritsar.org

Abstract—In the current era, space science is on the way to become more & more powerful. We are now looking forward to searching and relocate Human population on a different planet, continuously resolving the bigger mysteries of the universe just because of successful space missions we are launching continuously. These all are becoming possible just because of enormous computerisation & encouragement towards it throughout the world. Every country is coming in front to invest & explore space. If we just talk about NASA. "It's budget for the financial year (FY) 2020 is $22.6 billion. It represents 0.48% of the $4.7 trillion the United States plans to spend in the fiscal year. Since its inception, the United States has spent nearly US$650 billion (in nominal dollars) on NASA. When adjusted for inflation via the GDP deflator index the cumulative figure is closer to $1.19 trillion, an average of $19 billion per year over its entire history". The entire paper will briefly enlighten the past, future & present of space science with respect to the Role of Artificial Intelligence. The ultimate motive of this paper is to give a brief & motivating reader towards space science, A wide scope of Artificial Intelligence, Remote sensing and Research.

Keywords: Research, Artificial Intelligence, Robotics, Remote Sensing, Space Mission, Rovers

I. Think About World Without Space Science

Imagine a world without Astronomy & space exploration. What if we never explore the moon? What if we never looked up towards the sky? Without space science we never have got the knowledge of the universe. We might still believe in the myth about the sun, moon & stars. We never develop such a system which keeps analysing & notifying us about the flood, navigation, security & many more. We could never have imagined about the life of earth, and the life of the sun. Nowadays we are having great systems & future views for safety of human kind. Human made machines are now in the way to meet some other developed civilisations like voyager missions, these all became possible just because of Space science. Think if there is no technology & computers evolved, does space science exist? Never. Because every rower, lander, satellites, oriters, Analysis models. Everything directly operated just because of computer efficiency & advanced technologies like Big Data Analytics, Artificial Intelligence, Remote sensing & many more. We can say, **Space science is never possible without computers & technologies**.

II. Space Science

Space science encompasses all of the scientific disciplines that involve space exploration and study natural phenomena and physical bodies occurring in outer **space**, such as **space** medicine and astrobiology.

Space science makes us look outwards from our planet, to the stars and beyond. It's a subject that strives to answer the ultimate questions: How did our Earth and our Solar System form and evolve? What is our place in the Universe? Where are we going? Where did life come from, and are we alone?

How did the universe begin and evolve? We seek to explain the earliest moments of the universe, how stars and galaxies formed, and how matter and energy are entwined on the grandest scales.
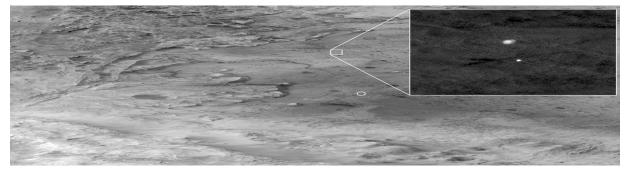
How did we get here? We investigate how the chemical elements necessary for life have been built up and dispersed throughout the cosmos, evidence about how the Sun affects Earth, similarities between Earth and other planets, and how comets and asteroids in our solar system affect Earth.

Where are we going? Our ultimate place in the cosmos is wrapped up in the fate of the universe. Humanity has taken its first steps off our home world, and we will contribute to making it safe to travel throughout the solar system.

Img. 1: Earth from International Space Station

Img. 2: Image Captured by the Mars Reconnaissance Orbiter Shows Perseverance Descending under its Parachute Moments before Landing

Are we alone? Beyond astrophysics and cosmology, there lies the central human question: Are we on Earth because of an improbable accident of nature? Or is life, perhaps even intelligent life, scattered throughout the cosmos?

III. Artificial Intelligence

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving. Artificial intelligence is based on the principle that human intelligence can be defined in a way that a machine can easily mimic it and execute tasks, from the most simple to those that are even more complex. The goals of artificial intelligence include mimicking human cognitive activity. Researchers and developers in the field are making surprisingly rapid strides in mimicking activities such as learning, reasoning, and perception, to the extent that these can be concretely defined. Some believe that innovators may soon be able to develop systems that exceed the capacity of humans to learn or reason out any subject. But others remain skeptical because all cognitive activity is laced with value judgments that are subject to human experience. Robots are machines that have inbuilt artificial intelligence. They are used in all kinds of situations, especially where they can alleviate strenuous tasks or complete missions that are too dangerous for a human to undertake. The term 'artificial intelligence (AI)' comprises all techniques that enable computers to mimic intelligence, for example, computers that analyse data or the systems embedded in an autonomous vehicle. Usually, artificially intelligent systems are taught by humans — a process that involves writing an awful lot of complex computer code. But artificial intelligence can also be achieved through machine learning (ML), which teaches machines to learn for themselves. ML is a way of 'training' a relatively simple algorithm to become more complex. Huge amounts of data are fed into the algorithm, which adjusts and improves itself over time. In ML, machines process information in a similar way to humans by developing artificial neural networks. This type of artificial intelligence has taken major leaps forward since the dawn of the internet. Deep learning (DL) is a specialised technique within ML, whereby the machine utilises multi-layered artificial neural networks to train itself on complex tasks like image recognition. This can happen via supervised learning (e.g. feed the system Moon and Earth pictures until it can successfully identify both types) or unsupervised learning, where the network finds structure by itself. Good examples of deep learning are online translation services, image libraries and navigation systems for self-driving cars or spacecraft.

A. Categorization of Artificial Intelligence

1. Reactive machines

These are the oldest forms of AI systems that have extremely limited capability. They emulate the human mind's ability to respond to different kinds of stimuli. These machines do not have memory-based functionality.

This means such machines cannot use previously gained experiences to inform their present actions, i.e., these machines do not have the ability to "learn." These machines could only be used for automatically responding to a limited set or combination of inputs. They cannot be used to rely on memory to improve their operations based on the same. A popular example of a reactive AI machine is IBM's Deep Blue, a machine that beat chess Grandmaster Garry Kasparov in 1997.

2. Limited memory

Limited memory machines are machines that, in addition to having the capabilities of purely reactive machines, are also capable of learning from historical data to make decisions. Nearly all existing applications that we know of come under this category of AI. All present-day AI systems, such as those using deep learning, are trained by large volumes of training data that they store in their memory to form a reference model for solving future problems. For instance, an image recognition AI is trained using thousands of pictures and their labels to teach it to name objects it scans. When an image is scanned by such an AI, it uses the training images as references to understand the contents of the image presented to it, and based on its "learning experience" it labels new images with increasing accuracy. Almost all present-day AI applications, from chatbots and virtual assistants to self-driving vehicles are all driven by limited memory AI.

3. Theory of mind

While the previous two types of AI have been and are found in abundance, the next two types of AI exist, for now, either as a concept or a work in progress. Theory of mind AI is the next level of AI systems that researchers are currently engaged in innovating. A theory of mind level AI will be able to better understand the entities it is interacting with by discerning their needs, emotions, beliefs, and thought processes. While artificial emotional intelligence is already a budding industry and an area of interest for leading AI researchers, achieving Theory of mind level of AI will require development in other branches of AI as well. This is because to truly understand human needs, AI machines will have to perceive humans as individuals whose minds can be shaped by multiple factors, essentially "understanding" humans.

4. Self-aware

This is the final stage of AI development which currently exists only hypothetically. Self-aware AI, which, self explanatorily, is an AI that has evolved to be so akin to the human brain that it has developed self-awareness. Creating this type of Ai, which is decades, if not centuries away from materializing, is and will always be the ultimate objective of all AI research. This type of AI will not only be able to understand and evoke emotions in those it interacts with, but also have emotions, needs, beliefs, and potentially desires of its own. And this is the type of AI that doomsayers of the technology are wary of. Although the development of self-awareness can potentially boost our progress as a civilization by leaps and bounds, it can also potentially lead to catastrophe. This is because once self-aware, the AI would be capable of having ideas like self-preservation which may directly or indirectly spell the end for humanity, as such an entity could easily outmaneuver the intellect of any human being and plot elaborate schemes to take over humanity. The alternate system of classification that is more generally used in tech parlance is the classification of the technology into Artificial Narrow Intelligence (ANI), Artificial General Intelligence (AGI), and Artificial Superintelligence (ASI).

5. Artificial Narrow Intelligence (ANI)
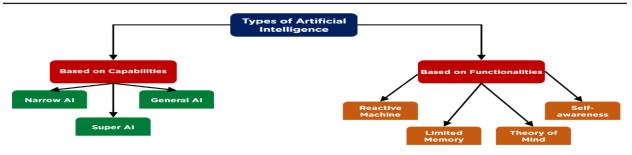
This type of artificial intelligence represents all the existing AI, including even the most complicated and capable AI that has ever been created to date. Artificial narrow intelligence refers to AI systems that can only perform a specific task autonomously using human-like capabilities. These machines can do nothing more than what they are programmed to do, and thus have a very limited or narrow range of competencies. According to the aforementioned system of classification, these systems correspond to all the reactive and limited memory AI. Even the most complex AI that uses machine learning and deep learning to teach itself falls under ANI.

6. Artificial General Intelligence (AGI)

Artificial General Intelligence is the ability of an AI agent to learn, perceive, understand, and function completely like a human being. These systems will be able to independently build multiple competencies and form connections and generalizations across domains, massively cutting down on time needed for training. This will make AI systems just as capable as humans by replicating our multi-functional capabilities.

7. Artificial Super Intelligence (ASI)

The development of Artificial Superintelligence will probably mark the pinnacle of AI research, as AGI will become by far the most capable forms of intelligence on earth. ASI, in addition to replicating the multi-faceted intelligence of human beings, will be exceedingly better at everything they do because of overwhelmingly greater memory, faster data processing and analysis, and decision-making capabilities. The development of AGI and ASI will lead to a scenario most popularly referred to as the singularity. And while the potential of having such powerful machines at our disposal seems appealing,

Img. 3: Types of Artificial Intelligence

these machines may also threaten our existence or at the very least, our way of life. At this point, it is hard to picture the state of our world when more advanced types of AI come into being. However, it is clear that there is a long way to go as the current state of AI development compared to where it is projected to go is still in its rudimentary stage. For those holding a negative outlook for the future of AI, this means that now is a little too soon to be worrying about the singularity, and there's still time to ensure AI safety. And for those who are optimistic about the future of AI, the fact that we've merely scratched the surface of AI development makes the future even more exciting
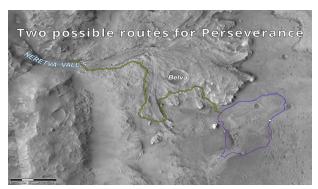
IV. ARTIFICIAL INTELLIGENCE IN SPACE SCIENCE

The most successful AI implementations based on DL are rarely used in the space industry today, as the (statistical) models developed within the neural network are not human readable and have been impossible to replicate thus far. AI, and in particular ML, still has some way to go before it is used extensively for space applications, but we are already beginning to see it implemented into new technologies. One area in which the applications of AI are being thoroughly investigated is in satellite operations, in particular to support the operation of large satellite constellations, which includes relative positioning, communication, end-of-life management and so on. ML systems are also commonly used in space applications to approximate complex representations of the real world. For instance, when analysing massive amounts of Earth observation data or telemetry data from spacecraft, ML plays an important role. Potential applications of AI are also being thoroughly investigated in satellite operations, in particular to support the operation of large satellite constellations, including relative positioning, communication and end-of-life management. In addition, it is becoming more common to find ML systems analysing the huge amount of data that comes from each space mission. The data from some Mars rovers is being transmitted using AI, and these rovers have even been taught how to navigate by themselves. Its development has come a long way over the last couple of decades, but the complicated models

and structures necessary for ML will need to be improved before it can be extensively useful. AI also currently lacks the reliability and adaptability required in new software; these qualities will need to be improved before it takes over the space industry.

A. Mission Design and Planning

Planning a mission to Mars is not an easy task, but artificial intelligence can make it easier. New space missions traditionally rely on knowledge gathered by previous studies. However, this information can often be limited or not fully accessible. This means the technical information flow is constrained by who can access and share it among other mission design engineers. But what if all the information from practically all previous space missions were available to anyone with authority in just a few clicks. One day there may be a smarter system – similar to Wikipedia, but with artificial intelligence that can answer complex queries with reliable and relevant information – to help with early design and planning of new space missions.
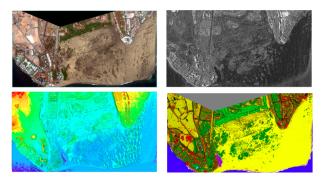
Img. 4.1: Possible Path Design for Perseverance Rover

Researchers are working on the idea of a design engineering assistant to reduce the time required for initial mission design which otherwise takes many human work hours. "Daphne" is another example of an intelligent assistant for designing Earth observation satellite systems. Daphne is used by systems engineers in satellite design teams. It makes their job easier by providing access to relevant information including feedback as well as answers to specific queries.

B. Satellite Data Processing
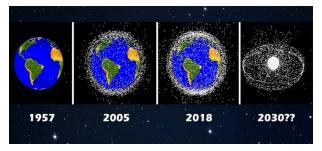
Earth observation satellites generate tremendous amounts of data. This is received by ground stations in chunks over a large period of time, and has to be pieced together before it can be analysed. While there have been some crowdsourcing projects to do basic satellite imagery analysis on a very small scale, artificial intelligence can come to our rescue for detailed satellite data analysis. For the sheer volume of data received, AI has been very effective in processing it smartly. It's been used to estimate heat storage in urban areas and to combine meteorological data with satellite imagery for wind speed estimation. AI has also helped with solar radiation estimation using geostationary satellite data, among many other applications. AI for data processing can also be used for the satellites themselves. In recent research, scientists tested various AI techniques for a remote satellite health monitoring system. This is capable of analysing data received from satellites to detect any problems, predict satellite health performance and present a visualisation for informed decision making.

Img. 4.2: Image Processing Using Remote Sensing Analysis

C. Space Debris

One of the biggest space challenges of the 21st century is how to tackle space debris. According to ESA, there are nearly 34,000 objects bigger than 10cm which pose serious threats to existing infrastructure. There are some innovative approaches to deal with the menace, such as designing satellites to re-enter Earth's atmosphere if they are deployed within the low Earth orbit region making them disintegrate completely in a controlled way.

Img. 4.3: Space Debris wide Prediction Over Time

Another approach is to avoid any possible collisions in space, preventing the creation of any debris. In a recent study, researchers developed a method to design collision avoidance manoeuvres using machine-learning (ML) techniques. Another novel approach is to use the enormous computing power available on Earth to train ML models, transmit those models to the spacecraft already in orbit or on their way, and use them on board for various decisions. One way to ensure safety of space flights has recently been proposed using already trained networks on board the spacecraft. This allows more flexibility in satellite design while keeping the danger of in orbit collision at a minimum.

D. Navigation Systems

On Earth, we are used to tools such as Google Maps which use GPS or other navigation systems. But there is no such a system for other extraterrestrial bodies, for now.
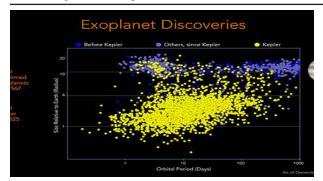
Img. 4.4: Navigation System

We do not have any navigation satellites around the Moon or Mars but we could use the millions of images we have from observation satellites such as the Lunar Reconnaissance Orbiter (LRO). In 2018, a team of researchers from NASA in collaboration with Intel developed an intelligent navigation system using AI to explore the planets. They trained the model on the millions of photographs available from various missions and created a virtual Moon map.

E. Discovery of ExoPlanets and Alien Life

Artificial intelligence also proves resourceful in classifying heavenly bodies, especially exoplanets. A couple of years ago, a research team developed an artificial neural networks algorithm, to classify planets, based on whether they resemble present-day Earth, early Earth, Mars, Venus or Saturn's largest moon, Titan. These five bodies are most potentially habitable objects in our solar system and are therefore associated with a certain probability of life. In regards to life in outer space, Researchers at NASA's Frontier Development Lab (FDL) employed generative adversarial networks, or GANs, to create 3.5 million possible permutations of alien life based on signals from Kepler and the European Space Agency's Gaia telescope.

Img. 4.5.0: Exoplanets Population

Besides, NASA has teamed up with Google to train its artificial intelligence algorithms to sift through the data from the Kepler mission to look for signals from an exoplanet crossing in front of its parent star. With the help of Google's trained model, NASA managed to discover two obscure planets — Kepler-90i and Kepler-80g. In 2019, astronomers from the University of Texas at Austin, teamed with Google, to use AI for uncovering two more hidden planets in the Kepler space telescope archive (Kepler's extended mission, called K2). They used an AI algorithm that sifts through Kepler's data to ferret out signals that were missed by traditional planet-hunting methods. This helped them discover the planets K2-293b and K2-294b.
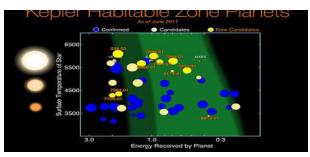
Img.4.5.1: Predicted Drawing of (Gliese 486 b)

Researchers from Germany's Max Planck Institute for Astronomy said the planet — Gliese 486 b — is not itself a promising candidate as a refuge for life as it is hot and dry, with possible rivers of lava flowing across its surface. But its proximity to Earth and its physical traits make it ideally suited for a study of its atmosphere by the next generation of space-borne and ground-based telescopes. NASA is due to launch the James Webb Space Telescope later this year. Scientists could extract data to be able to decipher the atmospheres of other exoplanets — planets beyond our solar system — including ones that may harbor life. Under the Artificial Intelligence Data Analysis (AIDA) project, which is funded under the European Horizons 2020 framework, an intelligent system is being developed that can read and process data from space. The key object of this project is to enable the discovery of new celestial objects, using data from NASA.

F. Discovery of Kepler Exoplanets

NASA's Kepler Telescope was designed to determine the frequency of Earth-sized planets orbiting Sun-like stars, but these planets were on the very edge of the mission's detection sensitivity. Accurately determining the occurrence rate of these planets required automatic and accurate assessing the likelihood that individual candidates are indeed planets, even at a low signal to noise ratio.

Img. 4.6: Kepler Habitable Zone Planets

To overcome this limitation, researchers from Google and other scientists used a Convolutional Neural Network named AstroNet K2 to predict whether a given signal from Kepler's space telescope is a transiting exoplanet or a false positive caused by the astrophysical or instrumental phenomenon. By training this neural network model up to 98(approx) percent, they successfully identified two new exoplanets namely Kepler 80g and Kepler 90i orbiting Kepler 80 star system and Kepler 90 star system respectively.

G. First Image of Black Hole
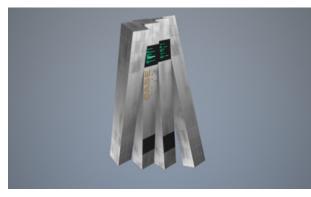
We got our first black-hole image using CHIRP (Continuous High-Resolution Image Reconstruction using Patch Priors) Algorithm. CHIRP is a Bayesian algorithm used to perform deconvolution on images created in radio astronomy. The development of CHIRP involved a large team of researchers from MIT's Computer Science and Artificial Intelligence. The CHIRP used the image data from the Event Horizon Telescopes which was too large and this is where image processing had to be done. Scientists used Numpy, pandas, and other Python libraries Now that we have the first-ever image of a black hole, scientists and researchers are working towards getting more accurate images of a black hole. To do so, they come up with more complex algorithms that are going to use more Machine Learning and Artificial intelligence

Img. 4.7: Black Hole of 55 million LY away M87 Galaxy

Keep in mind many objects are still unknown to us in deep space, so applying Machine Learning and Deep Learning will help us in classifying the type of object and these researches in the future may lead to identify more and more new objects and hence help scientists and explorers in space exploration.

H. AI-Based Assistants and Robots

Img. 4.8: CASE from 'Interstellar'
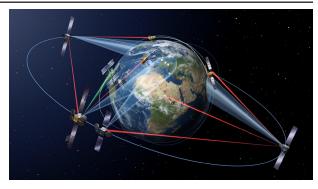
Do the names TARS and CASE ring any bells? Yes, I am talking about the robots from the very famous movie 'Interstellar' (and in case you haven't watched it, I highly recommend you do). If you remember the role of TARS and CASE in the movie, imagine how useful they would be in assisting the astronauts in real life. Scientists are developing AI-based assistants to aid astronauts in their mission to the Moon, Mars, and beyond. These assistants are designed to understand and predict the requirements of the crew and comprehend astronauts' emotions and their mental health and take necessary actions in the case of an emergency. Now how do they do that? The answer to this is sentiment analysis. Sentiment Analysis (also known as opinion mining or emotion AI) is a sub-field of NLP (Natural Language Processing) that tries to identify and extract opinions within a given text across blogs, reviews, social media, forums, news, etc. Robots, on the other hand, can come in more handy when it comes to physical assistants like helping in piloting spacecraft, docking spacecraft, and handling extreme conditions that are not safe to humans. Most of it may sound hypothetical, but it will prove to be a lot of help to astronauts.

I. Earth Observation

Satellite imagery in conjunction with AI can be used to monitor a number of different places, from urban to hazardous areas. This can help improve urban planning, finding the best places for development. It can also help discover new routes, allowing us to get around more quickly and efficiently.

Satellites can also observe areas of interest, such as deforestation. Data collected by this technology can help researchers monitor and look after them. As well as this,

Img. 4.9: Satellites

satellites can be deployed to monitor hazardous environments, such as nuclear sites, without the need for people having to enter. Data collected by space technology and processed by AI machines is fed back to the industries that require it, allowing them to proceed accordingly. Other environmental satellites can assist environmental monitoring by detecting changes in the Earth's vegetation, atmospheric trace gas content, sea state, ocean color, and ice fields. By monitoring vegetation changes over time, droughts can be monitored by comparing the current vegetation state to its long term average. For example, the 2002 oil spill off the northwest coast of Spain was watched carefully by the European ENVISAT, which, though not a weather satellite, flies an instrument (ASAR) which can see changes in the sea surface. Anthropogenic emissions can be monitored by evaluating data of tropospheric NO_2 and SO_2

V. Conclusion of the Paper

Humans evolve themselves continuously. There was a time we only used to look over the sky and imagine the universe. After the evolution of the computer era now, we are continuously jumping into it. From **October 1957** to now we launched an enormous number of successful missions which I can never cover into one single paper. Today man made objects are travelling in the deep universe with a hope of searching for some other civilization. With the unity and continuous evolution of the computer era & technology we are not so far to even get ownership of much more knowledge about the unimaginable Universe.

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Clustering: An Optimization Tool In Wireless Sensor Networks

Priya Tuli[1], Dr. Amarpreet Singh[2]

1,2Deptt. of CSE, Amritsar Group of Colleges, Amritsar, Punjab, India
Email: 1priyatuli77@yahoo.com, 2amarpreetsingh@acetamritsar.org

Abstract—**Wireless Sensor Networks (WSNs) consists of thousands of sensor nodes that are used to collect information in their surroundings and then send it to the base station for further processing. Being a highly flexible network, Wireless Sensor Networks faces some challenges. Reliability, scalability, resource management and deployment size are a few of them. Many algorithms have been presented by the researchers to optimize WSNs and hence, increase their lifespan. Clustering algorithms have become very popular and gained a lot of interest from the research community. This paper discusses WSNs and their applications, architectural challenges followed by clustering algorithms. Probabilistic and non-probabilistic clustering algorithms are discussed in this paper. A literature survey is also conducted to understand the concept of clustering in WSNs. For the future perspective, the scope of advancements in clustering techniques is still there. These techniques can be combined with some other popular clustering algorithms to obtain better results.**

Keywords: Wireless communication, Clustering protocols, Cluster Head selection, routing protocols, Networking, etc.

I. Introduction

Wireless Sensor Network (WSN) has been a hot topic for researchers in the recent years because it offers variety of applications. Presence of the ad-hoc wireless links, flexibility, and ease of deployment, this appears to be the best sustainable technology for environmental sensing, whether it is for small or large-scale monitoring [1]. Wireless sensor networks (WSNs) are made up of large number of small electronic gadgets (called sensors or motes) with mechanical parts that can perform communication, signal processing, and remote sensing [2].

A. Architecture
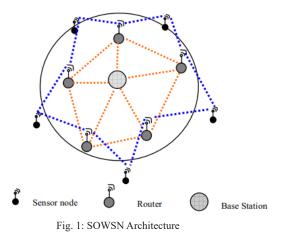
An architecture comprises of a Self-Organizing Wireless Sensor Network (SOWSN) with a Star-Mesh Topology.SN (Sensor Node) and BS (Base Station) are the two wireless nodes that make up the system. The SN is in-charge of collecting the data generated by malicious targets. This involves : a) collecting the data about potentially malicious activities, such as target nature and relative location; b) real-time event generation for identified targets, with event transmission to an event

analysis center via BS; and c) transmitting produced events to the BS. The operations done for efficient sensing are controlled by the BS. The relative position of the event source is computed by the BS. After this, BS sents it to the Analysis Center along with the timestamp and the source position. Each sensor node in the network contains a fixed amount of energy in the initial round. BS serves as a gateway between SN's and the Analysis Center. An example of a SOWSN architecture is shown in Figure 1.

B. Applications

There are two types of WSN applications: tracking and monitoring. Construction monitoring, seismic monitoring, industrial and process automation, inventory position monitoring, energy monitoring, health and fitness monitoring and outdoor/ indoor environmental monitoring are all examples of monitoring applications.

Fig. 1: SOWSN Architecture

Humans, products, animals and automobiles can all be tracked using tracking applications. There are many types of applications. This paper discusses some of the applications that have been implemented and verified in the real world [3].

Military Applications: WSNs are used in targeting systems, investigation, frontline surveillance, communications, computing, control and military intelligence [4].

Area Monitoring Applications: In this case, SNs are distributed over a region where activities are to be

monitored. When the sensors detect an activity (such as pressure and temperature), the information is transmitted to the BS, which immediately performs the necessary action [4].

Transportation Applications: WSN's collect real-time traffic data in order to support transportation systems and make drivers aware of potential traffic jams [4].

Medical And Health-Related Applications: Drug administration and management, investigatins and diagnostics are some of the medical advantages of sensor networks.

Environmental Applications: The term "Environmental Sensor Networks (ESNs)" was introduced to integrate various advantages of wireless sensor networks to the environment and earth science researches. This includes forests, volcanoes, atmosphere, glaciers, seas, oceans etc. Moreover several biosensors have been designed for environmental and agricultural sustainability applications. Air pollution monitoring and control, landslide detection, greenhouse gas (GH) management and control, forest fire detection are all important issues [4].

Agricultural Applications: It has been stated that the usage of wireless sensor networks benefits the farmers in a variety of ways, including the maintenance of wiring in a challenging environment and irrigation automation which helps in more efficient water consumption and reducing waste [4].

The WSN's operations need a constant power supply, which is difficult to achieve. Ensuring effective energy usage is one technique to solve this issue. In addition to energy usage, when it comes to sensor limitations, there are various other factors that has to be considered. These are outlined in the next sections.

C. Design Challenges of WSNs

Power Consumption: In WSN's, power conservation is an important topic. Therefore, designing power-aware techniques and procedures for sensor networks is necessary [5].

Production Cost: The prices of SNs should be low in order to make wireless sensor networks feasible [5].

Hardware Design: The hardware of a wireless sensor network should be energy-efficient. Therefore in WSN's, the communication unit, power control and microcontroller should be designed to utilize minimal power [5].

Computational Power and Storage Capacity: All SNs store data separately and sometimes many SNs contain the same data and send it to the sink. This waste SN's power and storage capability. Therefore an appropriate techniques are required to reduce duplication in the Sensor network [5].

Security: In WSN, security is a key problem. Therefore, determining whether or not the data is authenticated is a challenge. Security of the data transmitted is also very essential. [5].

Working Environment: SNs can be employed to serve in a dangerous environment. These SNs could be used at the floor of the sea, in a house or in a huge building or for a automobile traffic management, etc [5].

Wireless sensor networks offers a low-cost solutions for defense, healthcare, smart grid and commercial purposes. SNs can also be used to evaluate environmental conditions such as sunlight, humidity, pressure, etc. The construction of this kind of a network would need an optimized utilization of SN's power and management techniques. Clustering can be utilized to address such issues

D. Clustering

Clustering is a form of topology management strategy that groups SNs in order to increase system efficiency by managing energy and distributing tasks among all SNs. Every cluster has a number of members and one or more cluster head to control them as well as to merge, analyze, transmit and organize the information of the members. Moreover, every network has one or more base stations that can act as gateways or data processing units. Base station collects the data from the cluster heads either directly or indirectly through middleman nodes- which are the nodes that connect the cluster head to the base station.

Cluster Head (CH) Selection: After cluster creation, the next stage is to choose heads for each cluster. CHs are responsible for collecting and transmitting the information from cluster members to the BS. Each CH's burden level is proportional to the cluster's size. CHs are chosen at a random or are pre-assigned by the network's architecture. In the random selection approach, CH is chosen at a random, depending on the probability that the node was never selected as CH during its whole lifespan in WSN [6].

The clustering techniques are classified into two categories: Probabilistic (Random or Weighted) Clustering Algorithms and Non Probabilistic Clustering Algorithms. These two types are discussed below in details.

1. Probabilistic (Random or Weighted) Clustering Algorithms

In the category of Probabilistic selection Clustering Algorithm, a prior probability is assigned to each sensor node and is utilized to identify the initial CH or other type random selection method. The initial probabilities allocated to every SN are sometimes used as the major

criterion for deciding whether or not they should be selected as CHs. Other secondary factors such as remaining energy, average network energy and initial energy, etc, may be considered during CH selection process. Beyond the significant energy efficiency, clustering methods in this category usually offers better operation as well as a lesser amount of exchanged messages. Low-Energy Adaptive Clustering Hierarchy (LEACH) [7], Low-Energy Adaptive Clustering Hierarchy-Centralized (LEACH-C) algorithm [8], Hybrid Energy- Efficient Distributed (HEED) clustering approach [9] abd Distributed Energy-Efficient Clustering (DEEC) Algorithm [10] are very popular probabilistic (random or weighted) clustering algorithms which are used in WSNs. LEACH protocol in perspective of choosing a proper Super Cluster Head (SCH) among all the CH's by applying appropriate fuzzy descriptors[11].

2. *Non Probabilistic Clustering Algorithms*

More specific criteria for CH selection and cluster creation are generally studied in non- probabilistic clustering techniques. They are mostly dependent on the location, position, connectivity, proximity and degree of SNs, etc. They are also dependent on the data gathered from nearby SNs. This type of method typically needs extra message exchanges and resulting in slightly higher time complexity than random or probabilistic or random clustering methods. Heterogeneous Sensor Routing (HSR) Protocol [12], Distributed Clustering Algorithm with Load Balancing (DCLB) [13] and Fault Tolerant Energy Efficient Distributed Clustering (FEED) algorithm [14] are popular non probabilistic clustering algorithms.

II. RELATED WORK

In the past few years, many researchers presented various techniques and protocols to improve the performance of WSNs. In this paper, some of the recent developments in WSNs are discussed. Preeti Kaur, R., & Singh, D.,[15], Clustering approaches like Hierarchal clustering (HC), K-Mean (K-MEAN), Fuzzy C Means (FCM) and Mean shift were simulated in this research and the outcomes were compared based on the dissimilarity component. In comparison to the other clustering methods, hierarchal clustering produced better results. With the suggested Hierarchal clustering method, better clustering resulted in more effective transmission at a lower cost. X. Liu, *et al*.,[16], utilized the Differential Evolution (DE) Algorithm to develop a method for routing, clustering and CH selection in the study. Then, by lowering the calculation amount and balancing the network's power usage, the authors enhanced the method's efficiency. They continued to optimize the network by modifying the communication method and after that, they completed the entire model.

Asha Rawat, & Dr. Mukesh Kalla., [17], provided an energy-efficient clustering technique that chooses the best CHs. The distance between the BS, SNs and the residual energy of nodes impacts the CH selection. The remaining energy of every SN was compared to the total number of SNs. The findings suggested that the recommended technique enhances the lifespan of WSNs. Masood Ahmad, *et al*., [18], recommend WSN clustering based upon the memetic algorithm (Mema) to reduce the likelihood of early convergence using local exploration strategies. A memetic algorithm can be used to dynamically balance the load among the clusters in WSN-IoT, resulting in optimal clusters. Jianfeng Yang, *et al*.[19], Using general masked data and the expectation-maximization (EM) technique to fix the issues of MLE "Maximum Likelihood Estimation", this research developed a unique additive reliability model for a cluster-based WSN system. To analyze system reliability, the probability characteristics of the system were evaluated based on the topology of the wireless sensor network system. Lastly, utilizing a simulated dataset, the suggested model was shown to be effective in evaluating WSN system reliability. A. Rodríguez, *et al*., [20], introduced a robust clustering routing mechanism for wireless sensor networks. To calculate the number of CHs and to pick the best CHs, the technique employs the "Locust Search (LS-II)" approach. In comparison to other common clustering routing algorithms, simulation results show that the presented method allows for the minimization of power usage while also prolonging the lifespan of the system. Q. Wei, *et al*., [21], Cluster-Based Energy Optimization with Mobile Sink (CEOMS) was proposed in this research. According to the energy density function, this method first creates the energy density function of network SNs and then allocates SNs with greater residual power. However, the mobile sink's directivity motion performance function was designed to increase the likelihood of remote SNs being assigned as CHs. Safa'a S. Saleh, *et al*., [22], The goal of an improved energy-efficient head election protocol was to improve LEACH by finding a CH that consumes the least amount of energy. The findings demonstrated that this research can improve LEACH while also extending the lifespan and efficiency of the sensor network. M. S. Ram, *et al*., [23], for efficient CH selection, presented the K-Genetic Algorithm (K-GA). In comparison to existing strategies, the simulation outcomes showed that the suggested K-GA helps in selecting the best CH and T-FA discovers the ideal pathways, extending the network's lifespan by lowering end-to-end delay. Aruna Pathak, *et al*., [24], presented a proficient bee colony-clustering protocol (PBC-CP) based on the ABC "Artificial Bee Colony" method. This algorithm selects the most energy-efficient route for sending information from CH to BS, thus reducing the

WSN's power usage. Simulation trials demonstrated the efficacy of the suggested strategy. Jun Wang, *et al.*, [25], A cluster-head rotating election routing algorithm was presented in this study. The modeling findings revealed that by controlling the system's adjustment parameters, the network lifespan can be effectively increased. The testing results of this algorithm indicated significant performance gains as compared to DDEEC, EEC, LEACH, and I-LEACH.J. Pradeep, *et al.*, [26], proposed the approach called "Novel Distributed Entropy Energy-Efficient Clustering Algorithm" (DEEEC) for HWSNs and was developed by Chaotic Firefly Algorithm CH (CFACH) Selection. When compared to the present standard clustering procedures utilized in HWSNs, the simulation outcomes of the proposed DEEEC Method offered good outcomes in terms of energy and increased longevity. Wang, *et al.*, [27], presented an improved routing protocol for WSNs in order to attain a global optimization in power consumption for all CHs, reducing the impacts of hot spots in some SNs near the sink node and preventing the hot head nodes from becoming overloaded with data transmission. The modeling outcomes demonstrated that this algorithm is more reliable than the traditional LEACH and EEUC algorithms in reducing the overall power usage of a sensor network with more balanced communication loads and extending the system's lifespan. R. Wang, *et al.*, [28], presented an improved SEP methodology for cluster division that considers the impact of distribution density, signal strength and residual energy on WSN's energy usage. K. Kawaljeet, *et al.*, [29] suggested that the kmedoids clustering algorithm was applied for homogeneous clustering and then CH selection was performed by using collaboration of two techniques i.e. Euclidean distance and maximum residual energy The strategy can efficiently conserve energy and increase the usage time of sensor networks, as demonstrated by the experimental findings. S. E. KHEDIRI, *et al.*, [30], Distance Energy Evaluated is a novel centralized energy-efficient clustering method for homogeneous wireless sensor networks that was presented in the paper. Simulated findings suggested that DEE offered a longer lifespan in HWSN than current key clustering algorithms.

III. Conclusion

Wireless sensor networks provides a number of applications. WSN can be used in military applications, agricultural fields, transportation, etc. So, there is a need for algorithms that can effectively manage wireless sensor networks. In this paper, we have discussed clustering algorithms to manage WSNs. Probabilistic selection clustering algorithm and non-probabilistic selection clustering algorithm are presented in this paper. When these two are compared with each other, it is observed

that the non-probabilistic algorithm has higher time-complexities as compared to the probabilistic selection clustering algorithm. HEED, LEACH, LEACH-C are some of the well-known probabilistic selection clustering algorithms. HSR, DCLB, and FEEB are non-probabilistic selection clustering algorithms. Along with these, some more algorithms are also discussed in the literature. From this survey, it is concluded that these clustering algorithms can enhance the performance of WSNs and increase the energy efficiency and lifespan of wireless sensor networks. These algorithms can be modified to further decrease the point-to-point delay and to optimize the energy resources.

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Machine Learning: A Review of Learning Types

Sanjeev Kumar

Computer Science & Engineering, Amritsar Group of Colleges, Amritsar, India
Email: Sarangal.sanjeev@gmail.com

Abstract—**In this paper, various machine learning techniques are discussed. These algorithms are used for many applications which include data classification, prediction, or pattern recognition. The primary goal of machine learning is to automate human assistance by training an algorithm on relevant data. This paper should also serve as a collection of various machine learning terminology for easy reference.**

I. Introduction

Machine learning is the study of computer algorithms that provides systems the ability to automatically learn and improve from experience. It is generally seen as a sub-field of artificial intelligence. Machine learning algorithms allow the systems to make decisions autonomously without any external support. Such decisions are made by finding valuable underlying patterns within complex data. Based on the learning approach, the type of data they input and output, and the type of problem that they solve, there are few primary categories of machine learning algorithms supervised, unsupervised and reinforcement learning. There are a few hybrid approaches and other common methods that offer natural extrapolation of machine learning problem forms. In the following sections, all the methods are briefly described. Recommended literature for further reading is also listed. This paper should also serve as a collection of various machine learning terminology for easy reference.

II. Primary Approaches

A. Supervised Learning

Supervised learning is applied when the data is in the form of input variables and output target values. The algorithm learns the mapping function from the input to the output. The availability of large scale labeled data samples makes it an expensive approach for tasks where data is scarce. Supervised learning1 Supervised learning is fairly common in classification problems because the goal is often to get the computer to learn a classification system that we have created. Digit recognition, once again, is a common example of classification learning. More generally, classification learning is appropriate for any problem where deducing a classification is useful and the classification is easy to determine. In some cases, it might not even be necessary to give predetermined classifications to every instance of a problem if the agent can work out the classifications for itself. This would be an example of unsupervised learning in a classification context. This model

is not needed as long as the inputs are available, but if some of the input values are missing, it is not possible to infer anything about the outputs. These approaches can be broadly divided into two main categories

1. Classification

The output variable is one of some known number of categories. For example, "cat" or "dog", "positive" or "negative".

2. Regression

The output variable is a real or a continuous value. For example,"price","geographical location".
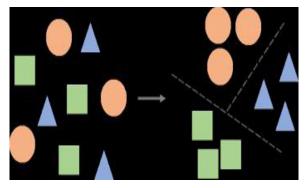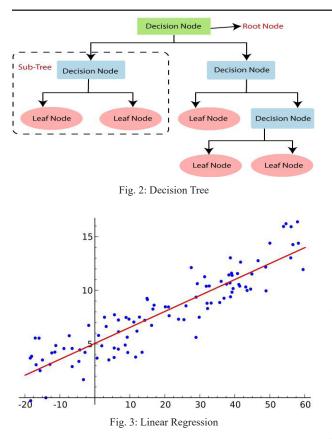
Fig. 1: Overview of Supervised Learning. Input Examples are Categorized into a Known Set of Classes

B. Supervised Learning Algorithms

1. Decision trees

Decision tree represents a classifier expressed as a recursive partition of the instance space. The decision tree consists of nodes that form so called root tree, which means that it is a distributed tree with a basic node called root with no incoming edges.

All of the other nodes have exactly one incoming edge. The node that has outgoing edges is called internal node or a test node. The rest of the nodes are called leaves. In a decision tree, each test node splits the instance space into two or more sub-spaces according to a certain discrete function of the input values. In the simplest case, each test considers a single attribute, such that the instance space is portioned according to the attribute's value. In case of numeric attributes, the condition refers to a range. Each leaf is assigned to one class that represents

Fig. 2: Decision Tree

Fig. 3: Linear Regression

Fig. 4: Visual Representation of the Logistic Function

$$y = \beta 0 + \beta 1\ x1 + \beta 2\ x +.. + e$$

Linear regression also belongs to the category of supervised learning algorithms. It means we train the model on a set of labeled data (training data) and then use the model to predict labels on unlabeled data (testing data).

3. Logistic regression

Like the naive Bayes, logistic regression works by extracting some set of weighted features from the input, taking logs and combining them linearly, which means that each feature is multiplied by a weight and then added up. The most important difference between naive Bayes and logistic regression is that the logistic regression is a discriminative classifier while the naive Bayes is a generative classifier. Logistic regression [14] is a type of regression that predicts the probability of occurrence of an event by fitting data to a logistic function. Just as many form of regression analysis, logistic regression makes use of several predictor variables that may be numerical or categorical. The logistic regression hypothesis is defined as:

$$h\ (\quad) = (\qquad)$$

Where the function is sigmoid function defined as:

$$(\quad) = 1\ 1+ \qquad -$$

The sigmoid function has special properties that result the values in range [0,1], as visualized on Fig.5:

The cost function for logistic regression is given as:

$$J(\theta) = -\frac{1}{m}\sum_{i=1}^{m}[y^{(i)}\log(h_\theta(x^{(i)})) + (1-y^{(i)})\log(1-h_\theta(x^{(i)}))]$$

To find the minimum of this cost function, in machine learning we will use a builtin function called fmin_bfgs2 , which finds the best parameters for the logistic regression cost function given a fixed dataset (of and values). The parametars are the initial values of the parameters that need to be optimized and a function that when given the training set and a particular , computes the logistic

the most appropriate target value. The leaf may hold a probability vector that indicates the probability of the target attribute having a certain value. The instances are classified by navigating them from the root of the tree down the leaf, according to the outcome of the tests along the path. On Figure 3 describes a simple use of the decision tree. Each node is labeled with the attribute it tests, and its branches are labeled with its corresponding values. Given this classifier, the analyst can predict the response of some potential customer and understanding the behavioral characteristics of the entire potential customers' population.

2. Linear regression

The goal of the linear regression , as a part of the family of regression algorithms, is to find relationships and dependencies between variables. It represents a modeling relationship between a continuous scalar dependent variable y (also label or target in machine learning terminology) and one or more (a D-dimensional vector) explanatory variables (also independent variables, input variables, features, observed data, observations, attributes, dimensions, data point, etc.) denoted using a linear function. In regression analysis the goal is to predict a continuous target variable, whereas another area called classification is predicting a label from a finite set. The model for a multiple regression which involves linear combination of input variables takes the form:

regression cost and gradient with respect to for the dataset with and values. The final value will be used to plot the decision boundary of the training data.

C. Unsupervised Learning

Unsupervised learning is applied when the data is available only in the form of an input and there is no corresponding output variable. Such algorithms model the underlying patterns in the data in order to learn more about its characteristics. One of the main types of unsupervised algorithms is clustering. In this technique, inherent groups in the data are discovered and the n used to predict output form seen inputs. Unsupervised learning4 4 seems much harder: the goal is to have the computer learn how to do something that we don't tell it how to do! There are actually two approaches to unsupervised learning. The first approach is to teach the agent not by giving explicit categorizations, but by using some sort of reward system to indicate success. Note that this type of training will gen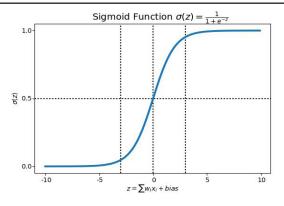erally fit into the decision problem framework because the goal is not to produce a classification but to make decisions that maximize rewards.
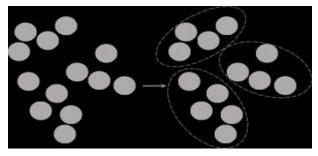
Fig. 5: Overview of Unsupervised Learning. Input Samples are Grouped into Clusters Based on the Underlying Patterns

1. K-Means clustering

K-means is one of the simplest unsupervised learning algorithms that solves the well-known clustering problem. The procedure follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed a priori. The main idea is to define k centres, one for each cluster. These centroids should be placed in a smart way because of different location causes different result. So, the better choice is to place them as much as possible far away from each other. The next step is to take each point belonging to a given data set and associate it to the nearest centroid. When no point is pending, the first step is completed and an early groupage is done. At this point we need to re-calculate k new centroids as barycenters of the clusters resulting from the previous step. After we have these k new centroids, a new binding has to be done between the same data set points and the nearest new centroid. A loop has been generated. As a result of this loop we may notice that the k centroids change their location step by step until no more changes are done. In other words centroids do not move any more.

Finally, this algorithm aims at minimizing an *objective function*, in this case a squared error function. The objective function

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| x_i^{(j)} - c_j \right\|^2$$

where

$$\left\| x_i^{(j)} - c_j \right\|^2$$
$$\left\| x_i^{(j)} - c_j \right\|^2$$

is a chosen distance measure between a data point xi and the cluster centre cj, is an indicator of the distance of the *n* data points from their respective cluster centres.

The algorithm is composed of the following steps:

- *Let X = {x1,x2,x3,………,xn} be the set of data points and V = {v1,v2,……,vc} be the set of centers*
- *Randomly select 'c' cluster centers*
- *Calculate the distance between each data point and cluster centers*
- *Assign the data point to the cluster center whose distance from the cluster center is minimum of all the cluster centers*
- *Recalculate the new cluster center using*
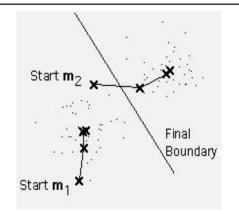
$$v_i = (1/c_i) \sum_{j=1}^{c_i} x_i$$

where, 'ci' represents the number of data points in ith cluster.

- *Recalculate the distance between each data point and new obtained cluster centers*
- *If no data point was reassigned then stop, otherwise repeat from Step 3)*

Although it can be proved that the procedure will always terminate, the k-means algorithm does not necessarily find the most optimal configuration, corresponding to the global objective function minimum. The algorithm is also significantly sensitive to the initial randomly selected cluster centres. The k-means algorithm can be run multiple times to reduce this effect.
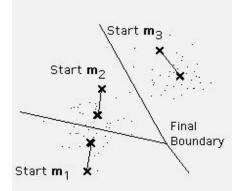
K-means is a simple algorithm that has been adapted to many problem domains. As we are going to see, it is a good candidate for extension to work with fuzzy feature vectors.

The k-means procedure can be viewed as a greedy algorithm for partitioning the n samples into k clusters so as to minimize the sum of the squared distances to the cluster centers. It does have some weaknesses:

- The way to initialize the means was not specified. One popular way to start is to randomly choose k of the samples
- It can happen that the set of samples closest to mi is empty, so that mi cannot be updated. This is a problem which needs to be handled during the implementation, but is generally ignored
- The results depend on the value of k and there is no optimal way to describe a best "k"

This last problem is particularly troublesome, since we often have no way of knowing how many clusters exist. In the example shown above, the same algorithm applied to the same data produces the following 3-means clustering. Is it better or worse than the 2-means clustering?

Unfortunately there is no general theoretical solution to find the optimal number of clusters for any given data set. A simple approach is to compare the results of multiple runs with different k classes and choose the best one according to a given criterion, but we need to be careful because increasing k results in smaller error function values by definition, but also increases the risk of overfitting.
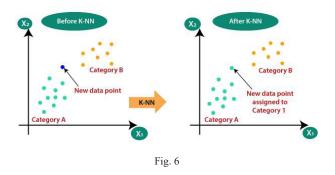
2. K-Nearest neighbor(KNN) algorithm

K-Nearest Neighbour is one of the simplest Machine Learning algorithms based on Supervised Learning technique.

- K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories
- K-NN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data appears then it can be easily classified into a well suite category by using K- NN algorithm
- K-NN algorithm can be used for Regression as well as for Classification but mostly it is used for the Classification problems
- K-NN is a non-parametric algorithm, which means it does not make any assumption on underlying data. performs an action on the dataset
- KNN algorithm at the training phase just stores the dataset and when it gets new data, then it classifies that data into a category that is much similar to the new data

Why do we need a K-NN Algorithm?

Suppose there are two categories, i.e., Category A and Category B, and we have a new data point x1, so this data point will lie in which of these categories. To solve this type of problem, we need a K-NN algorithm. With the help of K-NN, we can easily identify the category or class of a particular dataset. Consider the below diagram:

Fig. 6

How does K-NN work?
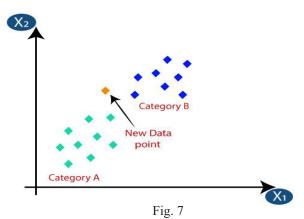
The K-NN working can be explained on the basis of the below algorithm:
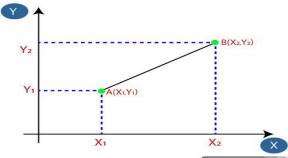
- Step 1: Select the number K of the neighbors
- Step 2: Calculate the Euclidean distance of K number of neighbors
- Step 3: Take the K nearest neighbors as per the calculated Euclidean distance
- Step 4: Among these k neighbors, count the number of the data points in each category

- Step 5: Assign the new data points to that category for which the number of the neighbor is maximum
- Step 6: Our model is ready

Suppose we have a new data point and we need to put it in the required category. Consider the below image:

Fig. 7
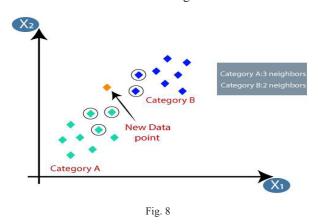
- Firstly, we will choose the number of neighbors, so we will choose the k=5.
- Next, we will calculate the **Euclidean distance** between the data points. The Euclidean distance is the distance between two points, which we have already studied in geometry. It can be calculated as

Euclidean Distance between A_1 and $B_2 = \sqrt{(X_2-X_1)^2+(Y_2-Y_1)^2}$

- By calculating the Euclidean distance we got the nearest neighbors, as three nearest neighbors in category A and two nearest neighbors in category B. Consider the below image:

Fig. 8

- As we can see the 3 nearest neighbors are from category A, hence this new data point must belong to category A.
- How to select the value of K in the K-NN Algorithm? Below are some points to remember while selecting the value of K in the K-NN algorithm:
- There is no particular way to determine the best value for "K", so we need to try some values to find the best out of them. The most preferred value for K is 5.
- A very low value for K such as K=1 or K=2, can be noisy and lead to the effects of outliers in the model.
- Large values for K are good, but it may find some difficulties.

Advantages of KNN Algorithm:

- It is simple to implement.
- It is robust to the noisy training data
- It can be more effective if the training data is large.

Disadvantages of KNN Algorithm:

- Always needs to determine the value of K which may be complex some time.
- The computation cost is high because of calculating the distance between the data points for all the training samples.

D. Reinforcement Learning

Reinforcement learning is applied when the task at hand is to make a sequence of decisions towards a final reward. During the learning process, an artificial agent gets either rewards or penalties for the actions it performs. Its goal is to maximize the total reward. Examples include learning agents to play computer games or performing robotics tasks with end goal.
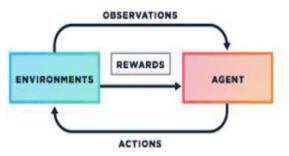
Fig. 9: Overview of Reinforcement Learning

E. Semi-supervised Learning

As the name suggests, this is an intermediate between supervised and unsupervised learning techniques. These algorithms are trained using a combination of labeled and unlabeled data. In a common setting, there is a small amount of labeled data and a very large amount of unlabeled data. A basic procedure involved is that first similar data is

clustered using an unsupervised learning algorithm and then existing labeled data is used to label the rest of the unlabeled data.
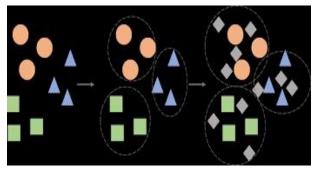
Fig. 10: Overview of Semi-supervised Learning

F. Self-supervised Learning

Self-supervised learning is a form of unsupervised learning where the training data is autonomously (or automatically) labeled. The data is not required to be manually labelled but is labeled by finding and exploiting the relations (or correlations) between different input features. This is done in anunsupervised manner by forcing the network to learn semantic representation about the data. Knowledge is then transferred to the model for the main task. It is sometimes referred to as pretext learning.

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Signal Jamming Surveillance Robot Car

Akansha Khanna[1], Sahil Sarmotia[2], Simranjit Kaur[3], Shivam Kumar[4], Atul Mahajan[5]

[1,2,3,4,5]*Amritsar College of Engineering and Technology, Amritsar, India*

Email: [1]akhanna265@gmail.com, [2]sarmotiasahil@gmail.com, [3]simran9662@gmail.com

[4]shivamgupta352000@gmail.com, [5]atul.ece@acetedu.in

Abstract—This paper accomplishes a project based on a signal-jamming surveillance robot car. In today world due to the increase in essentialities , the robotics sector has evolved even more. One area that begins to bloom in robotic systems is monitoring and guarding vehicles at a distance using mobiles or laptops. This project can be used for examination purposes where the project has camera surveillance for proper monitoring of students with a signal jammer that would avoid any kind of cheating from electronic devices.

Keywords*: *Robot Vehicle, Camera Surveillance, Mobile Jammer

I. Introduction

Technology in recent times has developed at a rapid pace. In the present era of automation , we can save workforce and energy with resourceful work. We have made and assembled a smart robot with camera surveillance and a mobile jammer to be used for examination purposes. This project is controlled from a distance using a Bluetooth app interface. Its figure is given below:-
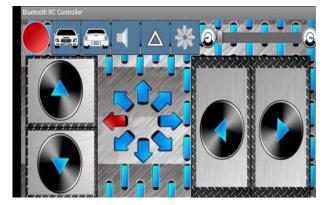
Fig. 1: Bluetooth App Interface

The live video from the camera can be monitored using device like such as laptops, pcs, and android. The mobile jammer is used to jam the signals. The frequency range we want to block can be done using the antenna.

II. Project Description

This paper will present the study and the compilation of a vehicle that will have sensing elements, a mobile jammer circuit for signal jamming, and camera surveillance for proper monitoring of students during examinations.

In this project, we are using two motors attached to four wheels of the car for free movement of the car. Necessary connections are made and the code for the robot as well as camera surveillance are uploaded to Arduino. A network jamming circuit is also being used that blocks the desired range of frequency. The model is designed to replace human efforts in the examination hall where a single observer can solely handle a large number of students appearing for the examination

In addition to the Arduino which is the main driving element of the circuit, there are other components required. Firstly to make the robot car, the perquisites are the HC-05 Bluetooth module(full duplex), L298N dual motor driver, and the dc geared motors.

Secondly, the signal jammer circuit is there which required some of the basic electrical components like resistor, capacitor, and inductor of some specific values, 555 timers, transistor, and antenna.

Lastly, the surveillance camera circuit would require a separate Arduino and a camera module.

The network is extensively used in today's time is the 4-G which operates on a high frequency of 1900Mhz and 850 Mhz. Thus our antenna is set to block this frequency range. Some people might doubt that the signal jammer will block the Bluetooth signals also but this might not be the case because Bluetooth operates at a frequency of 2.45 GHz.

Fig. 2: The Robotic Vehicle of the Project

Fig. 3: HC-05 Bluetooth Module

To achieve this objective, the following materials were used in its manufacture:

HC-05 Bluetooth Module Arduino UNO

L298N motor driver Geared 5V DC motor Timer 555 circuit Led

Resistor (3.9k,6.8k, 5.6k, 10k, 220, 4.7k)Ohm Capacitor (3.3 pf,47pf,2pf)

Inductors Transistor(bf495) Antenna

Power supply

OV7670 Camera Module

A. HC-05 Bluetooth Module

This module is basically serial port protocol used for setting up a wireless connection that is compliant with short range wireless connection to exchange the information as per required and with support for both UART and USB interfaces. Generally, the HC-05 Bluetooth Module, comes with the BC417 IC along with flash memory. Such Modules come as surface mount boards and several manufacturers use these boards to build a more competent system by adding some required pins and components.

B. Geared Motor

The geared DC motors can be considered as a advanced variation of the brush DC motors and it can be considered as source that contributes a bigger part in saving the energy. Rotation Per Minute (RPM) is the unit of measurement for the speed of motor.The motor speed is varied with the help of the torque generated.. This motor provides more rigidity as compared to the brush dc motors .The gear head of the motor will increase the torque The DC motors work in a specified range of the voltage and thus produces rpm according to that. For Example, if the motor working within the voltage limits of of 5-10V, it will generate minimum RPM at the input of 5V and the maximum at the 10V. Angular Momentum is the working principle of motor. The gears having a smaller radius cover more RPM than the ones with a larger radius. However, the larger gear will produced more torque to smaller gear and vice versa. The gear ratio for the motor can be defined as
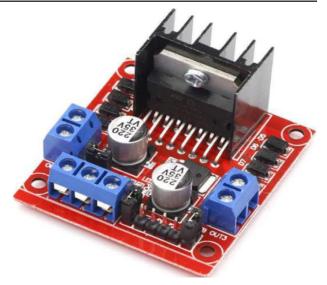
Fig. 4: It Represents L298N Motor Driver

Fig. 5: Gear DC Motor 12V 236 RPM

the ratio of the angular momentum of input gear to the output gear. When number of gears are connected, the law of conservation of energy is followed in the system . The direction of the two adjacent gears in the motor can never be same they always rotate in a direction opposite to one another. In any type of the DC motor the variation RPM and torque are in the inverse proportion . Hence the gear which will have the more torque in the system will have a lesse rpm. In the geared DC motor, pulse width modulation technique is used for the controlling purposes.

C. L298N motor driver

The 298N is adual h-bridge Motor Driver Module used for providing the required drive current to the motors of the robotic car. L298N Motor Driver IC operating voltage is upto 35v dc and the power consumption of 30w. The module accepts the standard TTL and IC can be used to drive different inductive loads such as relays and the stepper motors.

D. The OV7670

The OV7670 is a inexpensive full-frame 0.3 megapixel FIFO camera module with extensive range of formats.

It works on 3.3 v which can operate to 30 frames per second. The OV7670 module consists of :

- An array of image sensor
- A timing generator circuit in order to maintain synergy between different signals.
- Signal Processor for analog signals
- Analog to digital Converters
- JPEG decoder
- A digital signal processing unit
- Image enhancement process

The OV7670 is clocked at a frequency of 400khz by an oscillator of 24mhz. it supported the motion detection features.It also offers the vga resolution and it is very small in size which makes it more compact and easy to use for the various applications.

Arduino is available on an open-source electronics platform. It has easy-to-use software and hardware and is used to make plenty of projects on an electronics platform. Microcontroller Atmega of 328p operates at voltage 5V. Input Voltage is recommended to be 7-12V. There are 14 digital I/O Pins present on the Arduino board some of which are the pwm pins. It provides high reliability and stability with a minimal user interface.

E. Microcontroller

A microcontroller is a small computer contained in a single, integrated computer chip. Microcontrollers are an excellent way to program and control electronic devices. Microcontroller boards have a microcontroller chip and other useful connectors and components that allow a user to interface the external devices with them. It is based on the Microchip ATmega328P microcontroller and developed by Arduino.

III. Algorithm And Software

In this part , the software used for the interfacing of different components will be explained.

Programming for the Arduino functioning is written in Arduino IDE 1.8. The software we used for controlling the Robotic car through an Android device is Bluetooth RC Controller. The software interface is very simple to understand.

5 keys are being used in the app for forwarding, Reverse, Left, Right, and Stop. The corresponding data associated with each key is as follows:

- Forward arrow key – 1
- Reverse arrow key – 2
- Left arrow key – 3
- Right arrow key– 4
- Stop key – 5

First, in the Android App, there are five keys as forwarding, Reverse, Left, Right and Stop. When a key is pressed, the corresponding data concerning our Arduino
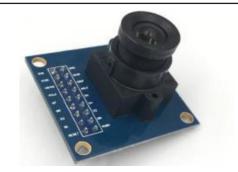
Fig. 6: 640×480 VGA CMOS Camera Image Sensor Module

Fig. 7: Microcontroller Arduino UNO

programming is transmitted to Bluetooth Module from the phone over Bluetooth Communication and it simply performs switch case operation where each case is associated with appropriate instructions to the Motor driver Input pins.

There is also an important component that is connected to this Robotic Car is a Camera i.e. OV7670 for capturing the images of the external environment. We can see the images on our PC/Laptop during the working of this Project. The Arduino will command the camera module to take the image, then it will obtain the image and send it to a Computer/Laptop

Via Arduino's USB port.

IV. Conclusions

This project was designed to present the design and manufacturing of a remote-controlled robotic platform that will send data and images in one or several central control stations. This process could solve many needs especially in the field of remote monitoring and telemetry in places that are difficult to approach by the humans. The field on which we mainly focused is the examination

field where it acts as a surveillance robot that also has an inbuilt mobile signal jammer which c an be considered as additional security feature . The present system can easily be modulated and its use can be extended easily for new functions with new sensors to be able to provide more information to the user as per requirement. This project could be a basis for further research in the field of robotically moving ground vehicles and their construction based on the logic of expandability. The code tracks were designed in driven modular construction so that one can use them as separate parts to a different project. It could also be automated according to the needs of a particular individual.

V. Acknowledgments

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Role of IoT in Intelligent Healthcare Systems

Supreet Kaur[1], Dr. Sandeep Sharma[2]

[1,2]*Department of Computer Engineering & Technology, Guru Nanak Dev University, Amritsar, India*
Email: [1]supreetcet.rsh@gndu.ac.in, [2]sandeep.cse@gndu.ac.in

Abstract—**The healthcare and technology industries have been deeply interwoven for a long time and with the new expansion in areas like the Internet of Things arises new opportunities. Wearable bio-sensors allow easily accessible, personalized, and always available information about the owner allowing revolutionary improvements for individual health. Although there are numerous upsides of these technologies, closer collaboration is needed between hardware/ software developers and medical personnel to have truly reliable, safe, adaptive, and efficient healthcare e-devices/systems. This paper focuses on the IoT-based healthcare systems targeting different diseases and tries to understand the issues and challenges observed while implementing these systems. This survey paper gives insight into the working of IoT in improving patient care (diagnosis/prediction/maintenance) which could lessen the overall burden of medical staff especially in situations like pandemics. A fully capable IoT-based healthcare center can effectively handle the influx of patients with ease in minimal time and also can be a great aid in monitoring the patients in the critical stage by alarming them about any danger even in absence of medical staff**

Keywords: Cancer Patient; Disease Prediction; Healthcare; IoT; Machine Learning
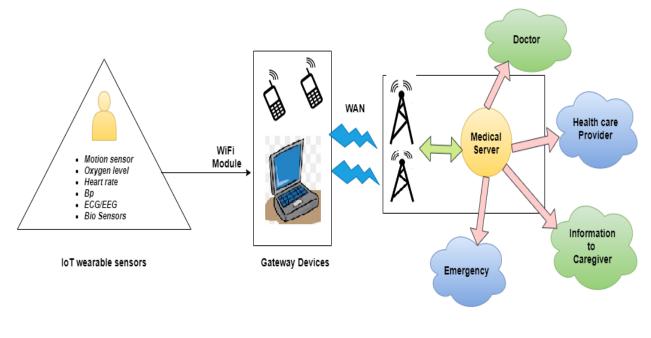
I. Introduction

The synergy between healthcare and technology has taken a big leap across the world in recent years. IoT and Big data analytics have gained popularity in healthcare for their great potential for smarter living as through IoT anything that can be connected to the internet provides the facility to exchange information and data. For example, Google has recently implemented the concept of IoT to launch self-driven cars which interact with road conditions as well as transportation systems that enable them to drive and navigate around the city and highways driverless with ensured safe and secure driving. The extensive use of sensors in IoT that are interconnected with each other and functions to achieve a common goal gives this technology a more beneficial stand. When the sensors that are low cost and provide similar functionality to traditional autonomous medical devices are integrated into the hardware components and then synchronized

with a backend processing software results in a multi-sensor (IoT) based healthcare system. what makes IoT healthcare systems different is the idea that expects them to offer information share in advanced connectivity of every possible device, machine, a system which makes it an efficient personalized system which goes beyond machine to machine communications. The humongous complex data generated by the sensors are nothing but big data on which various analytic tools can be used to extract hidden meaningful patterns. Machine learning and Deep learning are both powerful data analysis tools that can generate decisions without human intervention with a great success rate. For example, Watson provides artificial intelligence geared healthcare solutions which can give accurate diagnoses based on symptoms/ data input by comparing it with all possible billions of combinations already fitted in it in a matter of a minute. Taking the present scenario into consideration COVID-19 has very well alarmed and exhausted the medical strength of each targeted country taking its toll on medical personnel. IoT can be implemented on various levels in healthcare which can tremendously increase the medical power of one nation despite the possible low manpower. Sensing-based surveillance systems can acquire various data from wards, diagnostic equipment, wearable or planted sensor, patient's smartphones which can be mined using artificial intelligence for efficient monitoring and tracking of patients without much involvement of medical staff around. However, this may lead to more energy consumption problems along with privacy-preserving issues as patients' data are involved which further risks the security aspect of a possible hacker attack on this data. The present absolute infrastructure of medical facilities is not adequate for the workability of IoT technologies and up-gradation will incur a cost. IoT-based Intelligent healthcare systems are something that will soon become an everyday occurrence in each country with more advent of technology and is believed to tremendously improve the quality of living of people in coming years.

II. IoT Healthcare Applications

IoT is a growing technology that has a long-term impact on health monitoring, administration as well as clinical service to patient's physiological information. Patients are connected with various sensors that send

Fig. 1: IoT Health Monitoring Application

the associated data to health monitoring units using various gateways and wireless transmission. Sometimes a cloud service is used and all the data is then sent to the main server which helps in the management of data stored with security which is one of the challenges in IoT healthcare systems. In a typical scenario, IoT and cloud start handshake for real-time processing of sending and receiving the big data generated by sensors which are further analyzed and information is stored for easy access of medical personnel. Figure1 gives an overall framework idea about working of IoT-based healthcare applications as follows;

The author focused on generating effective decision-making using k-means clustering regarding cardiovascular risk based on the analysis from data collected from various IoT sources along with the patient's physiological parameters like age, gender, systolic/ diastolic Bp, cholesterol, smoking habits, and diabetes for which Framingham score. The proposed system efficiently predicts high and low-risk patients when applied to cardiovascular diseases and the author pinpointed its inability to run analysis on data generated from automated machines at present that could be worked in the future[1]. IoT and cloud-based system is proposed which collects data not only from IoT devices but also from UCI repository and medical records which are securely stored over Amazon cloud database. Then FRNC (fuzzy rule neural classifier) is implemented using java programming and used to make decisions on the severity prediction of

the diabetes disease and it was claimed by the author that the predictions were effective and coincides with the expert advice which was collected from physicians against those medical records. moreover in comparison with other techniques on account of accuracy the proposed system though achieved the highest accuracy but it was at par with DT and K-nn classifiers[2]. In this research, the big data technology is used to propose the AI and IoT geared disease prediction model by implementing Boltzmann belief network DEEP learning. With the help of wearable sensors, the conditions of humans are used and GARIC with regression rules gives the best accuracy in colorectal prediction. The authors used a regularization genome-wide association study to predict colorectal cancer and were able to gain a 96% precision rate which was the highest in comparison to SVM & semiconductor nanostructed[3]. The system generates warnings by SMS, emails after once they get a confirmed diagnosis from the doctor along with the treatment.

The authors proposed a framework for a smart integrated IoT healthcare system for cancer care. In the layered architecture, they have taken 4 layers namely cancer care, hospital layer, data layer, and lastly service layer. All the smart IoT devices at the cancer center are connected and the generated data is then sent to the health center/ rehabilitation or homecare centers (layer 2) from which it is stored at data center (computational and visualization service). Finally, there comes the service layer which incorporates various services like drug

interaction, RT dose target determination, other symptom monitoring, etc. Operational and security challenges faced in the design were mainly patient confidentiality and privacy, data theft, interoperability of heterogeneous smart devices, reliability of the network used in cancer care[4]. The heart disease dataset was taken from the UCI repository along with medical data past logs from the hospital and medical-related IoT sensors. The authors stored all these data onto the Amazon cloud database upon which machine learning-based prediction is carried out to categorize the patient as normal or as abnormal as the final test report result. In machine learning computation various classifiers are used such as J48, SVM, LR, and MLP, and among all these J48 has the highest accuracy of 91.48 along with the best F-score, precision, recall, and Kappa whereas MLP showed the worst performance[5]. This paper worked to overcome the shortcoming in existing IoT healthcare systems of their ability against physical attacks by proposing a physical unclonable function-based authentication scheme along with a decision-making scheme based on fault tolerance. The basic idea behind PUF is that just like fingerprints in human beings, each device on the network will have a unique fingerprint that cannot be cloned, and if someone tries to have authenticated access to this, PUF will be destroyed. Whereas for fault tolerance aspect achievement a machine learning technique SVM is used to learn the usual behavior of the patient from the IoT sensors data and on each data entry an anomaly is being avoided and if detected any, it shows that either the data is missing/incomplete or this is not the usual behavior model. In such cases, the ML algorithm takes emergency decisions to check the patient as well as the sensors which reported such data, and on testing, this proposed approach showed efficiency while providing security features[6] The authors focused on developing a disease diagnosis system that records patient's data from wearable sensors and consequently the signals generated are transmitted to a cloud server where a novel hybrid decision-making approach is implemented. This neuro-fuzzy technique then performs the diagnosis for diabetes disease and a warning is raised to the concerned person as well as the physician/ hospital if the risk factor is high. Although the authors claimed the proposed system to be more efficient and effective than the existing ones yet inclusion of the traditional security aspect in the proposed model becomes a major setback against the hackers and a new cryptography mechanism is suggested to enhance the security of IoT based healthcare systems[7]

III. Challenges in IoT Healthcare

Security is the major challenge while dealing with IoT healthcare systems because hackers can easily access the data generated by the sensors. Moreover, the data

stored include patient's personal information which also draws attention towards preserving the privacy rights of the patient. Various encryption techniques are available to ensure that only the intended person can have access to the data which ensures security and privacy issues are resolved however they tend to affect the fast processing ability. Not only do they increase the processing time but also complex the system with more need for storage for all the extra work. Energy consumption is another challenge that is nowadays effectively tackled by green energy by which solar panels are extensively used to cope up with the power consumption of the growing system. Yet power leakage remains a hampering aspect. It is also noticed that some IoT wearable sensors make it uncomfortable for the patient's body also, the data transferred from sensors to the control room and finally to the monitoring center tends to get noisy which reduces the data quality. Still, there are some sensors whose data involves a supervised manner such as ECG but if machine learning applied can helps to improve this issue. Monitoring a large number of users in IoT requires humongous storage which even if overcome by cloud services tends to increase complexity along with the need for more security against possible thefts/ attacks. One another challenge observed is the faulty devices that could generate missing or false data which could create an emergency situation that could only be superficial. In such a scenario it is very important to locate and repair the faulty IoT device to avoid the futuristic occurrence to enhance the reliability of the system. Despite all the technological advancement, these systems must also include a panel of experts that could double check all the evaluations and decisions made by the model to ensure the proper and correct workability of the system as often a life is at stake here.

IV. Conclusion

IoT efficiently monitors the patient from remote areas and helps doctors to provide emergency services especially when the patient is in a critical situation. The main aim of this paper was to analyze the numerous research activities involved in IoT-based healthcare systems. Most studies were effective for patient monitoring as well as providing data to the monitoring center which also emphasized combating some challenges faced in IoT. It can be summarized that the power consumption issue has been tackled by the green energy wave to a very extent if not fully. The inclusion of cloud technology does combat storage issues but also adds to the complexity of the system and a similar pattern was observed while the encryption process to ensure security. Artificial intelligence can easily handle those data generated by the sensors which need the supervision of a doctor/ medical personnel for understanding if included in IoT systems. Moreover these techniques are effective in detecting any

anomaly which further ehngaces the security aspect of IoT-based healthcare systems in addition to making them intelligent. Authentication, fault tolerance, cryptography mechanism needs to include but the choice of them should be as such that the computational aspect of the overall system doesn't get affected negatively as they tend to slow down the processing time. Intelligent IoT healthcare systems can be seen as blessing in the medical sector with all the added benefits that they come with even when they are still under evolving phase.

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Diabetic Retinopathy Detection Using Machine Learning Methods

Monika Diwan[1], Prof. Navneet Bawa[2]

[1]Computer Engineering Department, PTU Regional Centre
[2]Amritsar College of Engineering & Technology, Amritsar, Punjab, India
Email: [1]Monadiwan814@gmail.com, [2]navneet.cse@acetedu.in

Abstract—**An image is known as scalar in case if a single measurement is done at every location that exists in the image. Due to the development of high-speed, more accurate and less invasive devices, the medical imaging has been going through a revolution over the decade. Adequate software is also needed to be developed to handle such high level of imaging. In the existing method of diabetes retinopathy detection the image is pre-processing, the feature of the pre-processed image is extracted with the textural feature analysis. The technique of optical disk segmentation is applied for the segmentation of diabetes portion. The existing method is extended in this research work using KNN classification. The implementation of proposed is carried out in MATLAB tool. The analysis of achieved outcomes is carried out in terms of different performance metrics.**

Keywords: Diabetic Retinopathy, GLCM, KNN

I. Introduction

For generating an image, the measurements of 2-dimensional and 3-dimensional spaces are collected which are also known as pixels. In medical images, various kinds of pixels are found since these images are generated from various sources like the X-ray images, MRI scans or ultrasounds. If one similar kind of measurement is identified for each of the location in images, the image is known to be scalar. The medical imaging has been through a revolution over the decade since it has provided high-speed, accurate and less invasive devices development in several applications [1]. For handling high level of imaging, there is a need to provide adequate software.

Therefore, based on the partial differential equations and curvature driven flows new algorithms are designed for signal and image processing technologies. Mathematical models are used for designing the biomedical computing. Depending on the newly deployed models in which the data extracted from images is used, a fundamental approach is designed in which the scientific progress of various fields is possible. Diabetic retinopathy (DR) is the disease due to which the retina of a human eye

is affected. The disease can spread all over the eye and cause permanent blindness if not treated accordingly [2]. In the developing countries, there is lack of trained ophthalmologists and the awareness of this kind of disease is also less. However, providing initial care to the patients is possible by introducing automated tools and treating the disease before it arrives to the stage in which it cannot be cured. Several solutions are provided to prevent DR since there is a need to perform early diagnosis and the diabetic patients are to be monitored continuously [3]. For diagnosing DR, it is important to evaluate the retinal images. However, to define the severity of DR, grading the images manually required huge amount of time and resources. This issue can be highlighted in cases where the tiny blood vessels available in the retina are damaged. From the tiny blood vessel, blood with keep flowing and from the fluid available in retina, the features will be generated [4]. The most important factors required for studying this issue are the features included due to the leakage of fluid and blood from the blood vessels. The normal, NPDR (non proliferative DR) and PDR (proliferative DR) are the three categorizations of DR based on their severity. An early stage of DR is non proliferative which is categorized based on the presence of micro aneurysms. In the retina, oxygen enters and then new blood vessels are generated which result in clouding the vision due to the spreading of disease. Thus, the retina of diabetic patients needs to be screened regularly. The automatic or computer-based analysis helps in providing a clear view of the retina of diabetic patients [5]. The diabetic retinopathy is quantified and the features are identified on the fundus images. However, even with the analysis of specific features of retina, researchers have not been able to propose a reliable or robust technique. To detect the severity of DR and automatically grade it, a three-stage algorithm is designed and then applied on the ophthalmic fundus images. In the preprocessing stage, few issues such as non-clarity, image blurring or image size, are rectified [6]. Initially, the image is resized and then the issues like image restoration and color space conversion are considered in this process. In the

final stage, the image is improved. In the color space conversion, the color fundus image provided as input is converted into HSI format. In HSI format, the color model space is decoupled from color images. The initial step here is to perform histogram equalization. Following this, in the preprocessing module the contrast enhancement is applied and the pixel intensities are scaled. Several morphological operations operate in the candidate extraction process for identifying the micro-aneurysms and exudates features. Further, the invert image method is applied to invert the image [7]. The holes are then filled in the next step. After identifying the exudates and micro-aneurysms from color image, extracting the features from fundus images is possible. Several classifiers are applied in this process from which the input is given using the outputs of calculated features. Support vector machine is basically a binary classification model [8]. This classifier studies the problem related to multi-class pattern recognition. There are mainly two ways in which this binary classification model can be used to resolve multi-class issue. The computation of the value of KNN classifier is done on the basis of the Euclidean distance occurring amid a test sample and the specific training patterns. Naïve Bayes Classifier is founded on the concept of the Bayes' theorem [9]. This classification model assumes that the predictors do not depend on each other. The incidence of a particular attribute within a class does not relate to the accessibility of another feature according to the assumption made by this classification model.

II. Literature Review

Ashish Issac, *et al.* (2018) suggested a fresh algorithm to detect the pathologies in computerized way. These were the analytical features of diabetic retinopathy disease [10]. The main aim of this work was to make use of these features tactically in a system for grading the risk level of this malady. This work made use of a normalization technique for highlighting the bright lesions. The detection of these lesions was carried out by implementing anisotropic diffusion and intensity threshold. The accurate detection of red lesions was carried out from a shade-approved green channel picture. The elimination of FPs (false positives) by geometrical attributes decreased the complexity of detection system and increased its efficiency.

Narjes Karami, *et al.* (2017) developed a novel technique based on DL (dictionary learning) for automatically detecting diabetic retinopathy [11]. This work made use of digital fundus images for disease detection. The developed technique was based on the optimal atomic demonstration of fundus images as per the learned dictionaries using K-SVD approach. On the other hand, the robustness of learned dictionaries by K-SVD was required to distinguish the regular and diabetic categories. It implied that the test image was related to

the class with minimal amount of optimal definite atoms. This work made use of thirty color fundus images for testing the performance of developed technique. This technique achieved accuracy rate of 70% for normal images and 90% for diabetes images.

Shailesh Kumar, *et al.* (2018) presented an enhanced DR detection approach by accurately extracting region and number of micro aneurysms from color fundus images [12]. It was highly important to detect micro aneurysms early. This was the first step in DR detection. With the time, a lot of techniques were recommended for detecting and diagnosing DR. At first, different pre-processing methods were applied. This work made use of PCA, CLAHE, morphological operation and standard filters for detecting. The linear SVM classifier classified the diabetic retinopathy disease. The recommended approach achieved sensitivity of 96% and specificity of 92% in DR diagnosis.

Enrique V. Carrera, *et al.* (2017) presented computerized diagnosis of DR disease. The main aim here was to assist doctors in the timely detection of DR disease [13]. The digital processing had been applied on the images of retina in this work. This work was focused on the automated classification of non-proliferative DR at some image of retina. The first phase of image processing involved the isolation of blood vessels, MA and hard exudates for feature extraction. An SVM classifier could use these features for discovering the retinopathy grade of all retinal images. The tested outcomes demonstrated that the recommended approach achieved sensitivity and prediction efficiency of 95% and 94% respectively. The evaluation of this approach was carried out in terms of its powerfulness with respect to variations in different metrics.

Nikita Kashyap, *et al.* (2017) presented an image extraction approach for finding and extracting the query image from database containing the images of retina [14]. The color histogram feature was extracted to generate an extraction method. Afterward, the feature vector of required magnitude had been discovered by inserting the number of bins in histogram. The computation of Euclidean distance was carried out between the query and database image to validate the similarity. The color histogram extraction framework performed better in HSV color space than RGB color space. The recommended framework reduced the work of experts of analyzing all fundus images instead of diabetes image. In this work, the designing of a ideal DR image management framework was done for improving the efficiency of DR diagnosis.

Harini R, et.al (2016) recommended a new technique for detecting diabetic retinopathy disease. The recommended technique made use of Fuzzy C-Means (FCM) clustering and morphological image processing for detection purpose. There were the various steps

included in image pre-processing [15]. The recommended technique performed the segmentation of blood vessels by applying morphological operations. The retinal images for this task were obtained from hospitals and other openly existing databases. This work made use of SVM classifier for classifying retinal images into normal and diabetic. This classifier with selected attributes achieved accuracy, sensitivity and specificity of 96.67%, 100%, and 95.83% respectively.

III. Research Methodology

Following are the various phases of implementation strategy

A. Data Input and pre-processing

In the phase of datainput and pre-processing, images are taken as input which can be further processed for the diabetic retinopathy detection. The input image can converted to the LAB format in which G phase will be extracted. The G phase will be improved and again inserted to the RGB image. The pre-processing will high light the portion of the image which are not so visible. The RGB images can be converted to gray scale for further processing

B. Feature Extraction

The feature extraction is thesecond phase of the implementation strategy. In the phase of feature extraction technique of textual feature detection and color feature detection will be applied. The feature extraction can leads to segmentation and classification

C. Segmentation

The segmentation is the techniquewhich can segment the diabetic and non diabetic portion from the image. The technique of circular hog transformation can be applied which segment the blood vessel and non blood vessel can portion from the image. In this part extra information from the image can removed for the further processing

D. Classification

The classification is the last phase ofthe diabetic retinopathy detection. In the phase of classification image can be taken as input which be processed and technique of neural networks can be applied for the classification of diabetic and non diabetic portion from the image/

IV. Result and Discussion

This research work is based on the diabetic retinopathy detection. The dataset is collected from the different internet sources. The results of the proposed technique is analyzed in terms of accuracy, precision and recall

Figure 2 shows the performance analysis of recommended and earlier algorithm in terms of accuracy
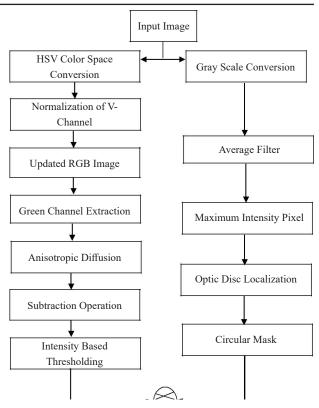
Fig. 1: Proposed Flowchart

Table 1: Accuracy Comparison

Images	Existing Technique	Proposed Technique
1	0.9512	0.9605
2	0.9786	0.9991
3	0.9851	0.9944
4	0.9173	0.9266
5	0.9342	0.9503
6	0.9269	0.9662
7	0.8156	0.8486
8	0.8325	0.8486
9	0.8495	0.8588
10	0.9003	0.9344
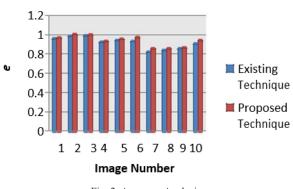
Fig. 2: Accuracy Analysis

TABLE 2: SENSITIVITY COMPARISON

Images	Existing Technique	Proposed Technique
1	0.9492	0.9594
2	0.7966	0.8068
3	0.9831	0.9933
4	0.9153	0.9545
5	0.9322	0.9424
6	0.6949	0.7151
7	0.8136	0.8438
8	0.8305	0.8907
9	0.8475	0.8577
10	0.8983	0.9851

Fig. 3: Sensitivity Analysis

TABLE 3: SPECIFICITY COMPARISON

Images	Existing Technique	Proposed Technique
1	0.9602	0.9815
2	0.8076	0.8761
3	0.9941	0.9978
4	0.9263	0.9727
5	0.9432	0.9721
6	0.7059	0.7892
7	0.8246	0.8656
8	0.8415	0.8935
9	0.8585	0.8705
10	0.9093	0.9213

Fig. 4: Specificity Analysis

using different types of retinal pictures. As per the achieved outcomes, the recommended algorithm shows more accuracy than the earlier algorithm.
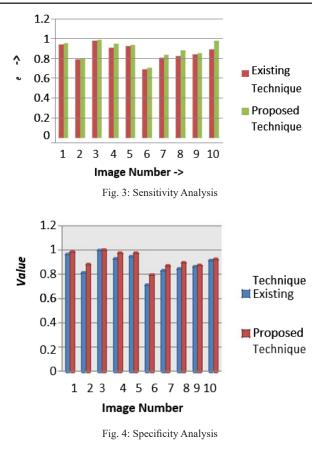
Fig. 3 shows the performance analysis of recommended and earlier algorithm in terms of sensitivity using different types of retinal pictures. As per the achieved outcomes, the recommended algorithm shows more sensitivity than the earlier algorithm.

Fig. 4 shows the performance analysis of recommended and earlier algorithm in terms of specificity using different types of retinal pictures. As per the achieved outcomes, the recommended algorithm shows more specificity than the earlier algorithm.

V. CONCLUSION

Diabetic Retinopathy (DR) is an eye disease. Diabetes mellitus is the main reason of this disease. The complications of DM (Diabetes Mellitus) cause harm to the eye retina in this disease. In United States of America, this disease is considered as the main cause of vision loss. Some signs of this disease are indistinct vision, obscurity in seeing colors, floaters, and even total blindness. It is imperative for diabetic people to check their vision at least once in a year to prevent diabetic retinopathy. There are mainly three stages included in the detection of DR

disease. These stages are called pre-processing, feature extraction and classification. This work implements KNN classifier for classifying diabetic regions from the retinal images. The new approach shows better performance than earlier approach in terms of different performance metrics for DR detection.

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Ultra-Wideband Metamaterial Inspired Antenna with Band Notched Characteristics

Navdeep Singh[1], Kapil Jairath[2]

[1]Associate Professor, Department of Applied Sciences, Amritsar College of Engineering & Technology, Amritsar, Punjab, India

[2]Research Scholar, Department of applied sciences, IKG PTU, Kapurthala, Punjab, India

Email: [1]arora_navdeep@rediffmail.com, [2]jairathkapil@yahoo.com

Abstract—An ultra-wideband antenna with band notched properties inspired by metamaterial is presented here. The suggested antenna with small size of 20 X 16 X 1.6 mm3 and a broad frequency range of 3.4 to 10.8 GHz. A single rectangular shaped split ring resonator (RSRR) metamaterial slot embedded on the radiating patch and S-shaped slot etched on the microstrip feed line were used to generate the notched bands. WiMAX band frequencies (3.51-3.7 GHz), C-band applications frequencies (3.7-4.2 GHz), WLAN band frequencies (5.15-5.62 GHz), X-band satellite communication system frequencies (7-8 GHz), and uplink X-band (8.89-10.38 GHz) frequencies have all been successfully rejected. Adjusting dimensions of the metamaterial inspired slot and S-shaped slot can change frequency of specific rejected band. At frequency 7.73 GHz, the proposed prototype has a high gain of 14.3 dB, and simulated radiation pattern of the recommended antenna is seen at various frequencies.

Keywords: Metamaterial, RSRR, Radiation Pattern, Band Notching, Gain

I. Introduction

UWB communication systems are becoming increasingly attractive to academic and industrial researchers due to high data rate transmission, low power operation etc. Since the allocation of ultra-wide band frequency of range from 3.1 to 10.6 GHz by the Federal Communication Commission (FCC), its demand in communication system has been increased at large extent [1]. A planar antenna is an excellent contender for UWB communication applications. However, there are numerous challenges that must be overcome when designing a UWB system, as there are several other existing technologies that can interfere with the UWB system, such as the WiMAX frequency band (3.3-3.6 GHz), C-band downlink (3.8-4.2 GHz), WLAN frequency band (5.15-5.825 GHz), downlink of satellite communication system (7.25-7.75 GHz), and ITU X-band satellite communication (8.025-8.4 As a result, it is critical to design antennas with band notched

properties in order to avoid the previously mentioned intervention.

Various strategies have been used in recent years to generate a single rejected frequency band [2-5]. Recently, there have been reports of UWB antennas with multiple band notches [6–13]. In various designs, two frequencies bands are rejected by etching slots on the radiating patch as well as on the ground plane [6], CPW-fed having three rejected frequency band [7], by use of EBG structure [8], open rectangular parasitic elements [9], and with the help of U-shaped split ring embedded on patch [10]. Furthermore, on radiating patch, employing a quarter wavelength open ended slot and half wavelength slots leads in tri-frequency rejection [11], incorporating the band stop elements [12], and using slots of uneven widths [13]. Due to its high quality factor, the split ring resonator (SRR) can be utilised to create a filter with a band stop at a given frequency. SRR can also be used as a slot type structure to get rid of undesirable frequencies [4–16].

The present article proposes a compact ultra-wideband (UWB) antenna with band notch features. By utilising a SRR structure having metamaterial properties and an S-shaped slot on microstrip feed line, existing frequencies of WiMAX band, C-band, WLAN band, down-link satellite communication system, ITU band & X-band application are abolished. Controlling the rejected bands requires tweaking the dimensions of the RSRR slot & S-shaped slot. The suggested antenna is constructed from cost effective FR4-Epoxy substrate & employs a single rectangular split-ring resonator (RSRR) as well as an S-shaped slot for frequency rejection, thereby minimising system complication.

II. Design of Antenna

The schematic detail of proposed antenna with frequency rejection characteristics is illustrated in Fig. 1.

(a) Top View

(b) Bottom View

(c) S-shaped Slot in Microstrip Feed Line
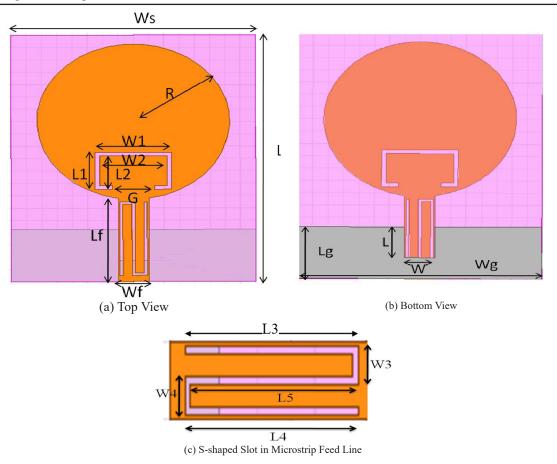
Fig. 1: Geometry of Suggested Antenna

Ansoft HFSS 15 is used to simulate the outcomes of the suggested antenna. The suggested antenna is made of a 20×16 mm2 layer of FR4-Epoxy dielectric substrate tangent loss tanδ=0.02 and a relative permittivity of 4.4. To achieve 50Ω impedance, the antenna height is 1.6mm and the feed line diameter is 2mm. Table 1 depicts the detail geometry of the proposed antenna.

One of the most important aspects of band notched antenna design [17-19] is determining the position and proportions of the injected SRR metamaterial. At the band's notch frequency, the length of the slot is usually half the guided wavelength [17]. Fig. 2 and 3 depict the primary antenna's reflection coefficient curve and VSWR due to a single rectangular SRR slot on the radiator and an S-shaped slot in the feed line. By integrating a single rectangular split ring resonator (RSRR) slit on upper plane & an S-shaped slit on the microstrip feed line, frequencies rejection for WiMAX, C-band, WLAN & X-band satellite communication has been effectively realised, as shown in Fig. 3.

III. Parametric Study of Proposed Antenna

High frequency simulation software (HFSS) is used to assess the proposed antenna's performance. The parametric investigation is being carried out to see how variations in the dimensions of the SRR metamaterial slot and the S-shaped slot affect the results. Antenna optimization is performed using these parametric analyses. The length of the SRR metamaterial slot was optimised as shown in Fig. 4.

Table 1. Detail dimensions of Proposed Antenna (mm)

Parameters	Ls	Ws	Lf
Unit	20	16	7
Parameters	Wf	R	L1
Unit	2	6.3	3
Parameters	W1	L2	W2
Unit	5	2.4	4.4
Parameters	L3	L4	L5
Unit	6	6	6
Parameters	W3	W4	G
Unit	0.6	0.6	2.8
Parameters	Lg	Wg	L
Unit	0.6	0.6	4.2
Parameters	W		
Unit	16		

Fig. 2: Reflection Co-efficient Curve for Conventional and Proposed Antenna

Fig. 3: VSWR Variation Curve for Primary and Proposed Antennaparametric Study of Proposed Antenna

Fig. 4: VSWR Curve for Different Dimensions of L1

Fig. 4 shows that as the value of L1 of the single rectangular shaped split-ring resonator (RSRR) slot is increased from 2.8 m to 3.2 mm, the frequency of the rejected band shifts from 8.1 GHz to 6.4 GHz.

The fluctuation in VSWR with different dimensions of the length of the S-shaped slot in the feed line is
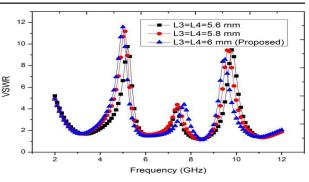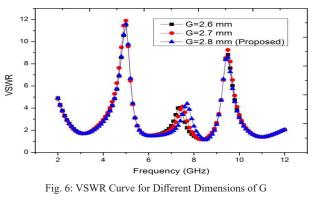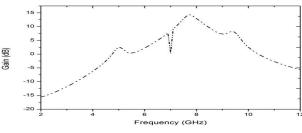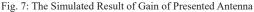
Fig. 5: VSWR Curve for Different Dimensions of S-shaped Slot

Fig. 6: VSWR Curve for Different Dimensions of G

Fig. 7: The Simulated Result of Gain of Presented Antenna

illustrated in Fig. 5. With increment in the length of the DMS slot (L3 & L4) as illustrated in figure 5, the rejected frequency of the band shrinks. Due to the defective microstrip structure (DMS), the feed line's effective inductance & capacitance rise. Increases in slot length result in an increase in effective inductance, resulting in a smaller rejected band. Fig.6 illustrates the fluctuation in gap G VSWR effects for a single rectangular SRR metamaterial slot on patch. As illustrated in Fig.4, a single rectangular SRR is capable of generating strong band rejection characteristics. When the length of the metamaterial-inspired rectangular SRR is increased, the effective inductance drops proportionately, which leads to frequency of high resonance.

Fig. 7 illustrates the simulated gain of the proposed band rejected antenna over the UWB frequency range (3-12 GHz). The obtained result indicates a 14.3 dB gain with a low value at rejected bands.

Fig. 8 illustrates the proposed antenna's predicted radiation patterns. As seen in Figure 8, the proposed UWB antenna radiates in a bidirectional pattern in E-Plane and an omnidirectional pattern in H-Plane.

Fig. 9 illustrates the simulated surface current distribution at different frequencies. As illustrated in Figure 9, current is primarily spread across the rectangular shaped split-ring resonator (RSRR) metamaterial slot & the S-shaped rejected band slot.

(a) At 3.1 GHz

(b) 6.1 GHz

(c) 8.5 GHz
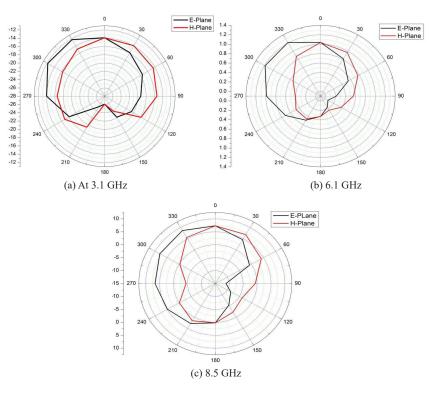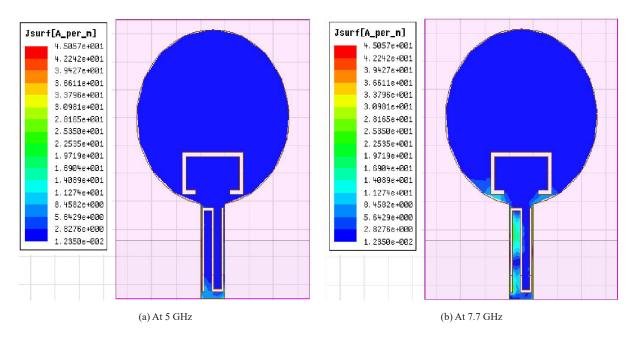
Fig 8: Simulated Result of Radiation Pattern at Different Frequencies

(a) At 5 GHz

(b) At 7.7 GHz

(c) 9.5 GHz
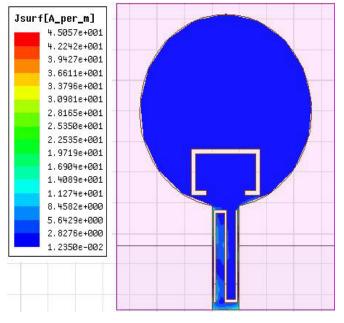
Fig. 9: Surface Current Distribution Different Frequencies

IV. CONCLUSION

This paper describes a miniaturised ultra-wide band antenna having band stop characteristics by using metamaterial inspired split-ring resonator (RSRR) slot & S-shaped slot. They do not require additional space because they are introduced on the patch and on the feeding line of the rudimentary antenna. The notch frequencies are simply adjustable by making variation in the dimensions of the inserted slots. The device achieves a broad bandwidth of 3.4 to 10.8 GHz while providing a high gain of 14.3 dB at 7.73 GHz. Over UWB frequency, the suggested structure produces bi-directional radiation patterns in the E-Plane and omni-directional radiation patterns in the H-Plane.

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A Study on E-commerce with Indian Perspective

Amarpreet Singh[1], Mandeep Kaur[2]
[1]Professor, AGC, Amritsar, Punjab, India
[2]Assistant Professor, GNCEW, Kapurthala, Punjab, India
Email: [1]amarmandeep@yahoo.com, [2]mandeepamar@yahoo.com

Abstract—Electronic commerce (e-commerce) as part of the information technology revolution became widely used in the world trade in general and Indian economy in particular. With advancements in technology, there have been changes in the methodology for business transactions. India, being a rapid adaptor of technology is apace with the current scenario of electronic data exchanges and has taken to e-commerce.This paper is a conceptual research and is focused on the concept of e- commerce. This paper discusses e-commerce with an Indian perspective. Further key drivers and the challenges faced by e commerce in Indi are also discussed.

Keywords: E-commerce, Electronic Data Interchange, E-Tailing, Mobile Users, Online Retailers, Market, Growth

I. Introduction

E-commerce stands for electronic commerce and pertains to trading in goods and services through the electronic medium. Electronic commerce draws on technologies such as Mobile Commerce, Electronic Funds Transfer, Supply Chain Management, Internet Marketing, Online Transaction Processing, Electronic Data Interchange (EDI), Inventory Management Systems and Automated Data Collection Systems. Modern electronic commerce typically uses the World Wide Web at least at one point in the transaction's life-cycle, although it may encompass a wider range of technologies such as e-mail, mobile devices, social media, and telephones as well.

E -Commerce or E-Business is the largest application of computers and information technology in keeping and managing business and financial records. It helps in transaction of any amount of money from any part of the world to other. Application of e commerce are billing to customers, tracing payments received and payments to be made and tracing supplies needed and items produced, stored, shipped, and sold, etc.

Electronic commerce is generally considered to be the sales aspect of e-business. It also consists of the exchange of data to facilitate the financing and payment aspects of business transactions. This is an effective and efficient way of communicating within an organization and one of the most effective and useful ways of conducting business. It is a Market Entry Strategy where the company may or may not have a physical presence.

E-commerce can be divided into subsections as given:

1. Buying or selling on websites and/or online marketplaces
2. The gathering and use of demographic data through web contacts and social media
3. Electronic data interchange, the business-to-business exchange of data
4. E-tailing or "virtual storefronts" on websites with online catalogs, sometimes gathered into a "virtual mall"
5. E-mail and fax and their use as media for reaching prospective and established customers (for example, with newsletters)
6. Business-to-business buying and selling
7. The security of business transactions

II. Regulations by Government

Federal Trade Commission (FTC) is regulatory body in US that regulates e-business activities.. These activities include the use of commercial e-mails, online advertising and consumer privacy.. The Federal Trade Commission Act regulates all forms of advertising, including online advertising, and states that advertising must be truthful and non-deceptive Using its authority under Section 5 of the FTC Act, which prohibits unfair or deceptive practices, the FTC has brought a number of cases to enforce the promises in corporate privacy statements, including promises about the security of consumers' personal information. As result, any corporate privacy policy related to e-commerce activity may be subject to enforcement by the FTC.

The Ryan Haight Online Pharmacy Consumer Protection Act of 2008, which came into law in 2008, amends the Controlled Substances Act to address online pharmacies.

Internationally there is the International Consumer Protection and Enforcement Network (ICPEN), which was formed in 1991 from an informal network of government customer fair trade organizations. The purpose was stated as being to find ways of co-operating on tackling consumer problems connected with cross-border transactions in both goods and services, and to help ensure exchanges of information among the participants

for mutual benefit and understanding. From this came Econsumer.gov, an ICPEN initiative since April 2001. It is a portal to report complaints about online and related transactions with foreign companies.

There is also *Asia Pacific Economic Cooperation (APEC)* was established in 1989 with the vision of achieving stability, security and prosperity for the region through free and open trade and investment. APEC has an Electronic Commerce Steering Group as well as working on common privacy regulations throughout the APEC region.

In Australia, Trade is covered under Australian Treasury Guidelines for electronic commerce, and the Australian Competition and Consumer Commission regulates and offers advice on how to deal with businesses online and offers specific advice on what happens if things go wrong.

Also Australian government e-commerce websites provides information on e-commerce in Australia.

In the United Kingdom, The FSA (Financial Services Authority) is the competent authority for most aspects of the Payment Services Directive (PSD). The UK implemented the PSD through the Payment Services Regulations 2009 (PSRs), which came into effect on 1 November 2009. The PSR affects firms providing payment services and their customers. These firms include banks, non-bank credit card issuers and non-bank merchant acquirers, e-money issuers, etc. The PSRs created a new class of regulated firms known as payment institutions (PIs), who are subject to prudential requirements. Article 87 of the PSD requires the European Commission to report on the implementation and impact of the PSD by 1 November 2012.

India is showing tremendous growth in the Ecommerce. The low cost of the PC and the growing use of the Internet is one of reasons for that. There is a growing awareness among the business community in India about the opportunities offered by e-commerce.

India has an internet user base of about 560 million. The penetration of e- commerce is low compared to markets like the the United Kingdom, China and United States and but is growing at a much faster rate with a large number of new entrants. The industry consensus is that growth is at an inflection point.

Unique to India (and potentially to other developing countries), Cash on delivery is a preferred payment method. India has a vibrant cash economy as a result of which 80% of Indian e-commerce tends to be Cash on Delivery. Similarly, direct imports constitute a large component of online sales. Demand for international consumer products (including long –tail items) is growing much faster than in-country supply from authorized distributors and e-commerce offerings.

India's e-commerce market was worth about $2.5 billion in 2009, it went up to $6.3 billion in 2011 and to $14 billion in 2012. About 75% of this is travel related (airline tickets, railway tickets, hotel bookings, online mobile recharge etc.). Online Retailing comprises about 12.5% ($300 Million as of 2009). India has close to 10 million online shoppers and is growing at an estimated 30% CAGR vis-à-vis a global growth rate of 8–10%. Electronics and Apparel are the biggest categories in terms of sales. The Indian E-commerce market is expected to grow to US$ 111.40 billion by 2025 .

Key drivers in Indian e-commerce are:

1. Increasing broadband internet and 5G penetration.

2. Rising standards of living and a burgeoning, upwardly mobile middle class with high disposable incomes

3. Availability of much wider product range (including long tail and Direct Imports) compared to what is available at brick and mortar retailers

4. Busy lifestyles, urban traffic congestion and lack of time for offline shopping

5. Lower prices compared to brick and mortar retail driven by disintermediation and reduced inventory and real estate costs

6. Increased usage of online classified sites, with more consumer buying and selling second-hand goods

7. Evolution of the online marketplace model with sites like amazon, Flipkart, snapdeal myntra, shopclues etc. The evolution of ecommerce has come a full circle with marketplace models taking center stage again.

As per "India Goes Digital", a report by Avendus Capital, a leading Indian Investment Bank specializing in digital media and technology sector, the Indian e-commerce market was of Rs 28,500 Crore ($6.3 billion) for the year 2011. Online travel constitutes a sizable portion (87%) of this market today. Online travel market in India grew at a rate of 22% over the next few years and reached Rs 54,800 Crore ($12.2 billion) in size by 2015. Similarly Indian e-tailing industry was at Rs 3,600 Crore (US$800 mn) in 2011 and grew to Rs 53,000 Crore ($11.8 billion) in 2015.Overall e-commerce market reached to Rs 1,07,800 crores (US$ 24 billion) by the year 2015 with both online travel and e-tailing contributing equally. The Indian E-commerce market is expected to grow to US$ 111.40 billion by 2025

E-commerce business in India has seen exponential growth over the last decade. This growth is due to many contributory factors, including rapid adoption of technology by Indian consumers, large increases in the number of internet users, new enabling technologies, innovative business models and alternative payment options offered by E-commerce companies. Moreover,

the high growth in E-commerce continues unabated, with the sector expecting to witness a steep increase in revenues in the coming years.

III. E- Commerce in India: Challenges

The growth of ecommerce volumes in India is attracting the attention of players around the globe. India, the second most populous country in the world, is home to 1.2 billion people.

To put that number into perspective, consider this: the combined populations of Germany, UK, France, Italy, Netherlands, Belgium, and Greece equal one-fourth the population of India alone! Despite lower per-capita purchasing power, this still makes India one of the most attractive emerging markets for ecommerce. But India is far from being a bed of roses. Here are few challenges that ecommerce businesses face in India.

A. Indian Customers Return Much of the Merchandise they Purchase Online

Ecommerce in India has many first time buyers. This means that they have not yet made up their mind about what to expect from ecommerce websites. As a result, buyers sometimes fall prey to hard sell. But by the time the product is delivered, they demonstrate remorse and return the goods. Though consumer remorse is a global problem, it is all the more prevalent in a country like India, where much of the growth comes from new buyers.

Returns are expensive for ecommerce players, as reverse logistics presents unique challenges. This becomes all the more complex in cross-border ecommerce.

B. Cash on Delivery is the Preferred Payment Mode

Low credit card penetration and low trust in online transactions has led to cash on delivery being the preferred payment option in India. Unlike electronic payments, manual cash collection is laborious, risky, and expensive.

C. Trust Issues

Indian customers are still reluctant to purchase the products online. They are often reluctant to disclose their credit card and bank details online due to fear of online fraud. To address this issue the companies should be open for all payment gateways like ewallets, COD, prepaid cards etc. And there is also a "Touch and feel factor" that Indian customers are more comfortable in buying physically than online especially for products like apparel, jewelry etc. Thus trust is one of the issues that need to be addressed.

D. Privacy

Privacy is a major issue that need to be addressed. Customers are much concerned about sharing their information because of the fear of cyber-crime. There can be server risk, data transfer risk, financial fraud, reputation damage, Destruction of critical infrastructure etc.

E. Payment Gateways have a High Failure Rate

As if the preference for cash on delivery was not bad enough, Indian payment gateways have an unusually high failure rate by global standards. Ecommerce companies using Indian payment gateways are losing out on business, as several customers do not reattempt payment after a transaction fails.

F. Internet Penetration is Low

Internet penetration in India is still a small fraction of what you would find in several western countries. On top of that, the quality of connectivity is poor in several regions. But both these problems are fast disappearing. The day is not far when connectivity issues would not feature in a list of challenges to ecommerce in India.

G. Indian Customer Go after Offers and Discounts

Indian customers are very much interested in offers and discounts. This leads to tagging of higher retail prices by companies to tackle the discounts..

H. Tax Structure

Tax rate system in India is another major factor in growth of e-commerce in India as compared to developed countries like USA and UK. In those countries tax rate is uniform for all the sectors whereas in India it varies from sector to sector. This creates accounting problem for Indian online businesses. Also there are no special provisions for taxation e-commerce companies in India. There is lot of ambiguity in applicability of withholding provisions. GST when implemented is expected to impact the e-commerce positively through simple interstate-goods, uniform tax structure, merchant compliance and easier tax refund, by eliminating the incident of double taxation etc.

I. Postal Addresses are Not Standardized

If you place an online order in India, you will quite likely get a call from the logistics company to ask you about your exact location. Clearly your address is not enough. This is because there is little standardization in the way postal addresses are written. Last mile issues add to ecommerce logistics problems.

J. Logistics is a Problem in Thousands of Indian Towns

The logistics challenge in India is not just about the lack of standardization in postal addresses. Given the large size of the country, there are thousands of towns that are not easily accessible. Metropolitan cities and

other major urban centers have a fairly robust logistics infrastructure. But since the real charm of the Indian market lies in its large population, absence of seamless access to a significant proportion of prospective customers is a dampener. The problem with logistics is compounded by the fact that cash on delivery is the preferred payment option in India. International logistics providers, private Indian companies, and the government-owned postal services are making a valiant effort to solve the logistics problem. If someone could convert the sheer size of the problem into an opportunity, we might soon hear of a great success story coming out of the Indian logistics industry.

K. Overfunded Competitors are Driving Up Cost of Customer Acquisition

The vibrancy in the Indian startup ecosystem over the past couple of years has channeled a lot of investment into the ecommerce sector. The long-term prospects for ecommerce companies are so exciting that some investors are willing to spend irrationally high amounts of money to acquire market share today. Naturally the Indian consumer is spoiled for choice. However, this trend has reversed as investors are getting worried about slipping further down a slippery slope, and I expect more rational behavior in 2014.

IV. E- Commerce in India: Future

In India which is seventh- largest by geographical area, second most populous country, and the most populous democracy the future is e-commerce is tremendous. E-commerce has reduced the gap between the manufacturer and consumer. In India there is vast scope of e-commerce because internet penetration in India is 36.5% as on 30th June 2016 (As per internetworldstats. com) and is increasing at a faster rate. According to statista the retail e-commerce sale compound annual growth rate from 2016-2020 in selected countries shows that Indonesia will rank first in terms of e-retail development with a growth rate of 18.82% in projected period. India is ranked second with an retail e-commerce CAGR of 16.98%, followed by Mexico and china with the CAGR of 16.57% and14.28% respectively. Changing lifestyle, rising internet penetration, increasing disposable income are the major factors that will lead to growth of e-commerce in India. Ecommerce market is largely driven by innovation and continuous technology led solution and these are expected to continue in future. Some of the innovations that are likely to positively change the future of e-commerce in India include:

A. Innovation in Payment

Use of plastic money and increasing use of digital wallet together with newly introduced Unified payment interface (UPI) shall foster innovation in payment and can also make cash on delivery seamless by cashless fulfillment at the time of delivery.

B. Delivery Model

Keeping in mind the "traffic" situation in India's metros leading to late delivery. E-commerce and logistic service providers are exploring new methods of delivery such as Drone delivery ,taking delivery form nearby kirana stores e.g. Amazon kiranaNow in Bangalore, crowd-sourced delivery model e.g. Flipkart has tied up with dabbawalas in Mumbai for last mile delivery, etc.

C. Artificial Intelligence and the use of Drones

Managing the supply chain logistic to provide on-time delivery especially during festive season is a challenge for e-commerce companies today. Solution for it is drone delivery such as amazon prime.Air is working on drone based delivery of its products. Also artificial intelligence (AI) is also transforming the e-commerce industry that could enable the users to discover what they are looking for with the click of mouse seamlessly.

D. App Only Approach

Expert suggest that the future of e-commerce lies in mobile. Around 279.5 million people in India accessed internet through mobile devices in 2015 and this is expected to increase to 524.5 million in 2021 (As per statistic digital market outlook). The mobile applications in India are helping e-tailers to reach more customers located in even rural and remote areas. Customers can get alert, updates, view product catalogues, place order and pay by simple mobile application.

E. Digital Advertisement

Digital advertisement is flexible and can be used for any kind of devices and goods. The ability to customize the ads for target audience, increasing engagement and loyalty and tow way interactive opportunity make digital advertisement more effective.

F. Search Engine Optimization (SEO)

SEO are the set of rules that the website owners could follow to increase its search engine ranking for web promotion. With thousands of products that are there in the digital catalogues could be made visible with the help of SEO technology. Search engine bots prefer websites that are updated, error free, with content etc. Therefore, e-tailers should increase the critical aspect of their online store to make it more search engine preferred and thereby derive more motivated buyers to the website.

V. Conclusion

E-commerce and electronic applications in automation has brought in tremendous growth in India. Even e-commerce is connecting rural India for the business hence develop village economy. The future does look very bright for ecommerce in India. Though this paper focuses on ecommerce challenges in India, an intrinsically one-sided topic, it is important to note that ecommerce giants are increasingly attracted to India. Cross-border ecommerce to India is growing, and many large international players are also making a significant investment in setting up shop in India. As a concluding note E-commerce is a future of shopping in India and is continuously changing the way people buy and sell products and services today. Future of e-commerce in India would be bright if some of the concerns related to weak cyber law and basic rights such as privacy, intellectual property, prevention of fraud, consumer protection etc. all are taken care of.

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Knowledge-Graph for Recommender Systems

Karanjot Singh Saggu[1], Puneet Singh Bhooi[2], Gurmukh Singh[3]

[1,2,3]Tatras Data, Delhi, India

Email: *[1]kjkr7373@gmail.com, [2]sbucks2ps@gmail.com, [3]gurmukh.singh511@gmail.com*

Abstract—**Recommender systems have seen a lot of upgrades over the years in terms of algorithmic and computational capabilities. With the bloom of Deep Learning, recommender systemshave shown improvement over the traditional state-of-art models like SVD [1], SVD++ [7] etc., but still, as far as quality of recommendations is concerned, the recommendations generated by these recommender systems are decent but there is further scope of improvement. Knowledge Graph and their integration with recommender systems have proved to be a better option in some domains which have ample data available in the form of user demographics and/or item meta-data. In this paper, we look at the specifics of Knowledge Graphs and how they can be used to improve the recommendation process.**
In the works that follow we propose different versions of recommender systems that use Knowledge Graph to model connections between different users and the items to generate recommendations.

Keywords: Recommender Systems; Knowledge Graphs; Neural Networks; Data Mining; Deep Learning

I. Introduction

With the tremendous amount of information floating around the internet in the form of news, movies, etc. the task of providing recommendations to users is also evolving and growing in importance every day. This large amount of data can be used to model user behaviors and interactions comparable to how Facebook uses network analysis for connecting similar/ related users. Similar ideology can also be transferred to the recommendation domain where we can leverage huge amounts of data to simulate collaborative and content-based recommender systems by decomposing the meta information into Knowledge Graphs.

A traditional recommender engine like SVD [1] works by creating user and item vector representations and using these vectors to model the interaction between users and items via inner-products, neural networks, etc. But there are some limitations to such a model, the first being that traditional models are solely dependent on the rating like explicit/implicit targets. Also, traditional models suffer from sparsity problems. The sparsity problem is expected for such a model as explicit/implicit targets are very hard to calculate and their quantities are also limited, reason being we can't expect all the users to watch the majority,

if not all, of the movies and provide ratings to them.

To tackle these issues recent research [6] suggests the use of Knowledge Graph with Neural Networks/ Traditional models can tackle the shortcomings of the traditional approaches. KGCN [6] is one such model that uses a Neural Network with Knowledge Graph to assign an importance score to relations (actor, director, producer, etc.) and serve recommendations accordingly. These types of models are a step above the traditional models in terms of quality of recommendation generated but they suffer from an issue of the amount of depth that they can traverse the knowledge while assigning ranks to the recommendation.

Our approach is slightly different from all the aforementioned approaches. The approach, broadly, uses Knowledge Graph with a ranking algorithm inspired by the famous PageRank [5] algorithm. In another model, we create a vector representation of the nodes of the graph and try to utilize the word2vec [4] backend to get the most common nodes to the input node. These models have the advantage that they can traverse large depths of the graph and that the ranking algorithm used has a global scope over the graph that makes connections robust because of multiple iterations over the nodes of the graph.

At this point in time, we have just presented our results based on the evaluation metrics fetch using MovieLens-100k [1]. The results present both qualitative and quantitative metrics showing that our approach's performance in terms of quality is much better than state-of-the-art algorithms that do not rely on Knowledge Graphs.

II. Problem Formulation

We formulate the use of a knowledge graph for the purpose of providing recommendations to the user. We will be following the following nomenclature during the paper for reference to important keywords and aliases.

The knowledge graph $\mathcal{G}$ at hand has the following pair of triples as a single row: {head, relation, tail}. The head can be either a movie or a user, the relation can be linked from head to tail, for example, actor, director, rating, etc. Like the head, the tail can also be a movie or a user. An example of the above triple representation can be {"Star Trek: First Contact", producer, "Hornstein, Marty"}.

All the entries of the head and tail combined will be referred to as *entities* and all the related items will be referred to as *relations*.

III. DEVISED SOLUTIONS

In this section, we present our approaches that rely on knowledge graphs used with either PageRank-based ranking algorithms or with machine learning models.

A. Personalized PageRank

The PageRank algorithm (equation 1) was originally designed for the task of connecting the content on the internet via any kind of linking available but can also be used for searching tasks.

The PageRank algorithm is operated by constructing a graph and models the relevancy of a random surfer landing on that node in the form of a probability distribution matrix that is column stochastic in nature. For the purpose of calculating the probability distribution, the algorithm goes over the whole graph in several iterations to stabilize the effect of the neighboring nodes as well as the effect of the random surfer directly landing on a particular node. The variation of PageRank that we are interested in is personalized PageRank (Figure 2 & 3) which works similarly to the original PageRank with the addition that we can limit the nodes from which the random surfer can start/ randomly teleport to during the graph traversal.

$$r = G \cdot r; \ G = \beta M + (1 - \beta) \left[\frac{1}{|s|} \right]_{N*N} \tag{1}$$

A brief description of how the personalized PageRank works is discussed below in the form of diagrams

1/6	1/6	1/6	1/6	1/6	1/6

Fig. 1: PageRank: The probability of each node being selected as the landing spot after teleportation has a Uniform distribution.

0	0	1/2	1/4	1/4	0

Fig. 2: Personalized PageRank: The probability of some nodes being selected as the landing spot after teleportation is non-zero while the rest have a zero probability of being selected as a landing spot after the teleportation.

0	0	0	1	0	0

Fig. 3: Hyper Personalized PageRank: Only one node can act as the landing spot after teleportation.

The above figures explain the working of personalized PageRank.

Personalized PageRank can be used with knowledge graphs to produce node *proximity* ranking w.r.t a *personalization* node. The output ranking list contains ranks for different *entities* e.g., producers, actors, genre, movies, etc. We can then extract the movie names from these rankings in order to serve recommendations. Not only that we can also assign weights to each of the relations present in the knowledge graph to bias the PageRank toward traversing highly weighted nodes, but this approach is a little tricky to implement because these weights are difficult to generalize for each user and movie combination.

B. Random Walks and Biased Random Walks

While Personalized PageRank performs one long random walk with multiple teleportations, the result of each sub-random walk is independent after each teleportation. Results from one sub-random walk are not required in the next sub-random walk. This makes random walk an embarrassingly parallelizable problem. The page ranks achieved by several random walks act as a good approximation of page ranks achieved after running a Personalized PageRank on the same graph. Further, these random walks can be biased by dynamically changing the probability of traversal of the outgoing edges from the current node. This causes the random surfer to either jump to a neighboring node of the previous node or to a node far away from the previous node. This biasing is however memory consuming since a stack of nodes traversed is to be stored. A biased random walk can act as a Depth-first traversal or Breadth-first traversal of the graph which can be used to extract global features and local features, respectively.

Looking at the mathematical aspect the matrix formed by random walks is also a column stochastic to accommodate a small probability for traversing the unreachable/ dangling nodes.

Let,

x_t^i be the probability that a surfer is at node i at time t, and

x_{t+1}^i be the probability that a surfer is at node i at time t+1,

Random walks suggest a stable state variable P as the probability of the traversal by the surfer where P is the eigenvalue of x_t^i and x_{t+1}^i such that it satisfies the below-mentioned equation after many steps.

$$A x_{t+1}^i = x_t^i P \tag{2}$$

C. Personalized PageRank with Neural Network-based models

The intuition behind these models was to incorporate the best of both knowledge graphs with PageRank and neural network-based models in order to serve good predictions. The first model is a combination model that merges the node relevancy metrics from Neural Matrix

Factorization [8] and PageRank using a simple weighted multiplication of the output of both models.
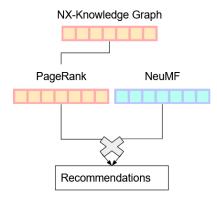
Fig. 4. PageRank+NMF Model: prediction from PageRank and NMF are combined using a weighted sum to get the final ranking of nodes

The NeuMF [8] model is a state-of-the-art model that combines General Matrix Factorization and Multilayer perceptron-based approach to serve prediction. The weighted sum can be tuned as per the best hyperparameter, but it is recommended to bias the weight more toward the PageRank than towards the NeuMF. Another factor to keep in mind with these types of models is to properly scale the outputs of the model to common scales to remove the problem of biased scales.

The second model that comes in this category is the Node2Vec with our custom MetaMF model. The underlying concept is similar to the PageRank+NeuMF model but the difference arises in the underlying model structure and graph aspect.
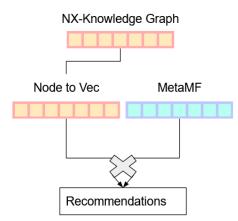
Fig. 5: Node2vec+MetaMF Model: prediction from Node2Vec and MetaMF are combined using a weighted sum to get the final ranking of nodes

The node2vec being used here essentially decomposes the nodes of the graph as vectors. The transition probabilities for traversal between nodes are calculated by creating a vector representation for each of the nodes present in the knowledge graph. In the backend, node2vec uses gensim's Word2Vec model and as a result

of this closely related nodes can be calculated using just distance metrics like Cosine Similarity, etc. The MetaMF, on the other hand, tries to handle the problem of uneven data (e.g., for each movie the number of genres can be different, say Titanic has genres Drama, Romance whereas Hunger Games had Action, Adventure, Mystery. The model uses boolean masks with embeddings in order to skip the genres that are not present and inputs a boolean list of genres along with the rest of the metadata (not knowledge graph). The model creates an embedding for each of the categorical columns in the meta-data space along the uneven columns (a genre in this case) to predict the likelihood of the user enjoying a movie. The model structure is given below.
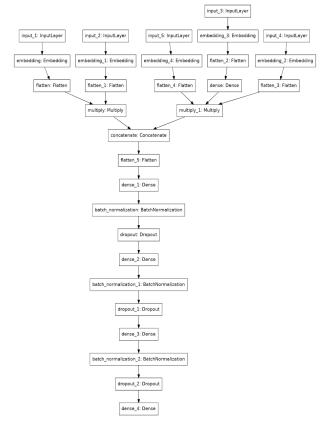
Fig. 6: MetaMF model: multi-input model that can work with meta-data (tabular) to predict the likelihood of the user liking a movie

IV. Experiments

In this section, we evaluate our model on a movie-based dataset and compare its performance with some of the previous state-of-art models.

A. Dataset

For the purpose of research, we utilized the well-known GroupLens based dataset MovieLens-100k dataset.

MovieLens-100k: This dataset is one of the most famous datasets for movie recommender systems. The

MovieLens-100k dataset is an open-sourced dataset developed during the 1990s as a research project at the University of Minnesota. The dataset has meta-data associated with the users, but nothing related to movies except the title. In order to enrich the dataset for Knowledge Graphs, another dataset called IMDB (IMDB) data was used to link the movie to their meta-data. The resulting dataset contains user demographic information as well as movie meta-data in the form of actor, director, cast, crew, production company, etc. A brief summary of the data is visualized below.

Table 1. Description of MovieLens-100K dataset

Property	Description
# Users	943 unique users
# Movies	1682 movie names with 1664 unique ids
# Movie-ratings	100,000 rating scale (1-5)
Size knowledge graph	170,046 unique triples

B. Baselines

To see how our model stacks up against the previous research we chose some of the best models that have been used for the purpose of the recommender system. We have chosen the following model to compare with our approaches.

- SVD: is the classic model that uses matrix factorization in the backend to learn user and item embeddings matrices. The algorithm was popularized by Simon Funk during the Netflix 2006 challenge.
- KGCN: The NeuMF model is a great model that uses knowledge graphs to give scores to the relation for a particular user. The model works by creating a receptive field for each item and combining it with a user vector to serve prediction in the form of ratings.
- NeuMF: This model takes the matrix factorization algorithm to the deep learning sphere. The model contains two sub models, one of the models performing general matrix factorization and the other Multilayer-layer Perceptron-based model for learning implicit user-item interaction using dense layers only.
- SVD++: This is an extension of the SVD model in terms of performance. The SVD++ can work using explicitly as well as implicit targets. The SVD++ model is slower than the Funk SVD model but performs better in all aspects.

C. Experimental Setup

This section presents the evaluation metrics and hyperparameter/config setting for the evaluation of models.

1. Evaluation metrics

The metrics chosen are a custom Average Reciprocal Hit Rank [9] (equation 5, 6, 7, 8), precision@k (k=10) (equation 3), recall@k (k=10) (equation 4) for the evaluation purposes. The vanilla ARHR was modified somewhat to provide a better understanding of how the model works for ranking bad and good-rated movies separately. In an ideal situation, we want the low-rated movie of a user to be in the last place in the overall ranking list and the highly rated movies to be in the top-ranking spots. The vanilla ARHR was not able to capture this, so we have proposed the following new version of the metric along with other metrics shown diagrammatically.

$$precision@k = \frac{1}{|U|} \sum_{u \in U} \frac{|L(u) \cap T(u)|}{|L(u)|} \tag{3}$$

$$recall@k = \frac{1}{|U|} \sum_{u \in U} \frac{|L(u) \cap T(u)|}{|T(u)|} \tag{4}$$

$$ARHR' = \frac{1}{|U|} \sum_{u \in U} \sum_{i \in T(u)} (Z(u,i) + R(u,i)) * w(u,i) \tag{5}$$

$$Z(u,i) = \frac{1}{rank(i,L(u))} * g(u,i) \tag{6}$$

$$R(u,i) = \frac{rank(i,L(u))}{|L(u)|} * (1 - g(u,i)) \tag{7}$$

$$g(u,i) = \begin{cases} 1 \ if \ \hat{r}_{ui} > \hat{r}_u \\ 0 \ if \ \hat{r}_{ui} \le \hat{r}_u \end{cases} \tag{8}$$
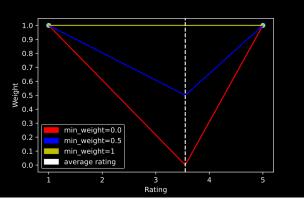
Fig. 7: Weighting the Contribution of Reciprocal Rank in ARHR'

2. Hyperparameters and other configurations

For the purpose of performing experiments, certain guidelines were made in order to maintain consistency in results among all the models tested. The evaluation metrics were chosen with care by removing all aspects of potential bias in their work. The models were optimized for ARHR metrics implicitly because ARHR cannot be used as a loss function directly.

As far as dataset split is concerned, a simple 80:20 split provided by default by GroupLens research was used for the purpose of model evaluation for all the models. The

TABLE 2. PERFORMANCE SUMMARY OF MODELS

Model Name	Precision@K	Recall@K	ARHR	ARHR positive	ARHR Negative
Funk SVD	0.0506	0.0364	0.2158	0.0158	0.2000
SVD++	0.0652	0.0450	0.2191	0.0182	0.2009
KGCN	0.0721	0.0505	0.1860	0.0191	0.2051
NeuMF	0.0948	0.0654	0.2022	0.0255	0.1767
Personalized Page Rank	**0.3013**	0.2070	0.1205	0.0590	0.0615
Node2Vec + NMF	0.1111	0.1081	0.0953	0.0344	**0.0609**
Random Walks	0.2511	**0.2520**	0.1396	**0.0648**	0.0629
PageRank-NeuMF	0.1534	0.1496	0.1204	0.0505	0.0699

data split was checked nonetheless for potential bias but to our analysis, the data split was evenly balanced among the movies, users, and genres which is a good thing.

Most of the models are using almost the vanilla settings, this is especially true for the matrix factorization-based models. For the deep learning-based solution L1-L2 regularization was used to reduce overfitting. For the experiments with KGCN, the hyperparameters are batch-size-32, K-8, aggregator type-sum, H-3, epoch 25 were giving the best results. For the matrix factorization models surprise was used and each model was trained with the default setting. For the NeuMF based model, the only important hyperparameters are learning rate - 1e-3 and the number of neurons in each layer was set to 64. As far as node2vec is concerned the hyperparameters are as follows: dimension-10, walk length-20, num of walks-10 provides a fair comparison in terms of time complexity and quality of results.

D. Results

The results of the evaluation of the model are as follows (note: Higher ARHR' does not mean good ARHR positive is the metric to look at if only concerned with actually highly rated movie rankings). Table2 shows a summary of all the models with their statistics.

- Personalized PageRank and Random Walks have the highest precision and recall because these models can correctly predict which movie will be liked by the user in general
- Overall ARHR is very high for matrix factorization-based models but keep in mind this result is only there because these models are pretty good at finding the ranking for the movie that a user will like but suffer very badly when it comes to ranking movies that a user will like
- The ARHR for Knowledge Graph-based model along with the custom Neural Network model is lower as compared to baseline models but again

these models are pretty good at finding movies that the user will like but very bad at ranking those movies which the user will not like which is obvious in ARHR breakdown as shown by ARHR positive and negative in Table 2

V. CONCLUSION AND FUTURE WORK

The motive of this purpose was to show ways to use knowledge graphs in recommender systems. We were able to see that with a proper knowledge graph at hand we can provide pretty good recommendations to the user. Lack of a proper knowledge graph will lead to not-so-good results. The Knowledge Graph-based techniques are not perfect in the sense that they are not able to properly rank the movies that the user will not like but this problem is of little importance as far as it does a decent job on movies that the user will like.

To improve on this research, we propose some future work. (1) This research shows the results on a single dataset domain of movies. The same model can be implemented on let's say some book recommendation dataset to see if the performance is consistent cross-domains as well. (2) Another scope for future work is improving the modeling process but doing custom weighting while creating a knowledge graph which was not done in this paper.

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Study of Solar-Wind Hybrid Power Generation System

Bimal Kumar[1], Ajaypal Singh[2], Chetan Verma[3]

[1,2,3]*Department of Electrical Engineering, ACET, Amritsar, Punjab, India*
Email: [1]Bimal.eee@acetedu.in, [2]ajaypal.eee@acetedu.in, [3]chetan.verma@acetedu.in

Abstract—**We are living in 21st century. Our day to day life is solely dependent on electricity. As the fossil reserves are replenishing so our main focus is the use of renewable sources of energy. No doubt the output of these resources is less than fossil equivalent yet renewable sources are preferred as these have no or very less impact on environment. Among such sources comes sun, wind or the solar wind hybrid generation. This hybrid clean source is becoming popular because limitations of one source is fulfilled by another.**

I. Introduction

The Hybrid power generation is widely preferred in remote areas which are not connected to power grid or lack reliable power supply or due to rise of petroleum prices. The components of Hybrid power are more than one non-conventional energy sources which work simultaneously to improve the efficiency or reliability of supply.

However, there are some cons too. Like the high price of solar panels is one drawback. Another difficulty is that the wind turbine can't work at low wind speeds.

Solar hybrid power systems are hybrid power systems that combine solar power from a photovoltaic system with another power generating energy source. This would create more output from the wind turbine during the winter, whereas during the summer, the solar panels would produce their peak output. Hybrid energy systems often yield greater economic and environmental returns than wind, solar, geothermal or tri-generation stand-alone systems by themselves.

II. Solar Energy

Solar energy is that energy which we get from the sun in form of radiation. It does not cause any kind of pollution, it is inexhaustible. It is available free of cost. Investment is involved in setting up a solar power plant and also it is quite easy to maintain. The efficiency of the system is also quite good. Long life span and less emission of pollutants are its major advantages.

III. Wind Energy

When air flows then it is having some kinetic energy with it which is known as wind energy. This kinetic energy is converted into mechanical energy by the wind turbine, which is used to rotate the shaft of the generator and then electricity is produced. The cost of generation of electricity is quite less. The initial investment of the system varies depending on the type of turbine used. The best part about producing electricity with the help of wind energy is that wind is available for almost 24 hours in day, so there will not be any discontinuous production of electricity. The output varies with the speed of the wind.

IV. Hybrid System

We have become even more interested in usage of renewable energy sources as an alternative method of producing electricity. Hybrid systems are basically an integration of solar panels and wind turbine, the output of this combination is used to charge batteries, this stored energy can then be transmitted to local power stations. In this system wind turbine can be used to produce electricity when wind is available and solar energy panels are used when solar radiations are available. Power can be generated by both the sections at the same time also. The usage of batteries is to provide uninterrupted power supply. This system requires high initial investment. But the reliability, long-life span and less maintenance make up for that disadvantage. The power output of the wind turbine is AC which is converted to DC with the help of a rectifier. The voltage can be stepped up or stepped down with the help of a 'SEPIC' converter which uses MOSFET switching. The microcontroller is used in the system to control the switching between the converters with the help of a driver circuit. A CUK converter is used to control the power supply of solar panels.

V. Components Used

A. Solar Panels

Solar panel / PV panel are used to convert the renewable power coming from the sun into electrical energy. The principle of working solar panel is with semiconductors. A solar cell is used to convert solar energy into electric energy, it is also known as photovoltaic cell. It is a p- n

junction diode which consist of two different layers of a semiconductor material called as n and p region, n region is heavily doped and is thin while p region is lightly doped and is thick. The radiation falling on the surface of p-n junction diode can pass through the n side. Most of the depletion region is contained in the region which is lightly doped. The extent to which the n region can be penetrated is decided by the wavelength of the falling radiation. Electron–hole pairs are generated in the n and p region, due to the difference in potential the electrons move to the n region and holes towards the p region. The current starts flowing when an external load is connected to the terminals of the n and p regions. To make a solar panel multiple solar cells are connected in series and parallel combinations, they are connected in such a way that the output obtained is additive in nature.

B. Wind Turbine

Wind is a renewable source of energy. Wind turbine having large blades which are joined to rotor of generator leading to produce electrical energy as moves by flow of wind. Wind power is also renewable, never energy source and easily available within atmosphere. A wind turbine is used to convert the kinetic energy of the wind into electric. The generator connected to the shaft of the blades converts the mechanical energy to electric energy. The wind turbine is of two types depending upon the rotating axis of the blades, first is vertical axis wind turbine and horizontal axis wind turbine. The output of the turbine depends on the speed of the wind. The power generated by the turbine is fluctuating. In order to obtain continuous supply of power first the electricity is stored in a battery unit and then it is transferred to the load.

C. Batteries

The batteries are used in order to store the electricity that is produced from wind and solar energy. The capacity of battery may vary depending on the size of wind turbine or solar power plant. Battery should be having low maintenance and charge leakage should also be low. Considering all these parameters free discharge type is the best option available. Multiple batteries can be connected in series and parallel to increase or decrease the capacity of the battery, depending upon the output from the hybrid systems. The electrical energy produced by the system is need to be either utilized completely or stored. Complete utilization of all the energy produced by the system for all the time is not possible. So, it should be store rather than useless wasting it. Electrical batteries are the most relevant, low cost, maximum efficient storage of electrical energy in the form of chemical reaction. Hence, batteries are preferred.

D. Inverter

Most of the electrical appliances require AC voltage, so first the DC output of the batteries will be converted into AC voltage with the help of an inverter and then it will be transferred to the loads. The inverter must be having over voltage protection, reverse polarity and short circuit protection. Inverter is an electronic system, converters direct current into alternating current, i.e. DC into AC. The stored electrical energy in the batteries is DC in nature. And it cannot be utilized for various kinds of load. So, for delivering AC supply to the load inverter system is required. Inverter is either analog or digital kind. Digital inverter is microcontroller based which increase the build-up cost of the system also, is uses MOSFET technology providing more efficiency. But, considering the financial aspect and resolution the proposed project designs and build the inverter analog in nature.

VI. Advantages

The advantages of the proposed system are as follows: -

- Drawbacks of traditional stand-alone system are overcome by this hybrid system
- Least maintenance required
- Non-conventional sources like wind, sun are used so no waste problem
- Easy installation of whole setup
- Clean energy causing no pollution or environmental impact
- Installation cost gets covered within little period of time
- If some fault comes, there is no need to change the entire system. Only replacing certain faulty part will work out
- More efficiency and reliability than stand-alone system

VII. Drawbacks

No system is 100% perfect. There are some drawbacks always:

- First time installation cost is high
- As there is no micro-computer, the circuit designing is complex

VIII. Applications

Following are some application of hybrid power:

- In Yachts
- For domestic purposes
- Powering the communication equipment like BTS.
- In remote areas where AC transmission is unavailable or temporary down.
- Traffic lights
- Street lights
- In irrigation system

IX. Experimental Setup

Fig. 1: Solar Wind Hybrid Model

This is the model of solar-wind hybrid system, the power developed by the system is transferred to the load as shown in the figure. The output voltage and current of solar panel, wind turbine, batteries and load are measured very precisely and then the final results are calculated. Amount of power produced and consumed are measured.

Solar Wind hybrid power specifications are given below.

PV Array Power = 20Watts

Wind turbine/generator = 3W

System Voltage = 48V

Battery=12V

Inverter Rating (VA) 25

Output AC Waveform Sine-wave

Output AC Voltage = 230 V/AC

Output Ac Frequency, Hertz = 50 Hz.

X. Future Scope

As the awareness of non-renewable sources and pollution causes by them, the clean energy production with renewable sources is widely preferred and day by day implementation of such sources going on, so, research and resources are also increasing for such plants and projects. As the first time installation cost is higher due to design and manufacturing perspective. The system can be monitories using graphical user interference on computer. So, the whole information will be available to user and/or stored regarding further applications and development.

XI. Conclusion

Developing hybrid systems is one of the most convenient and effective solution for producing electricity as compared to non- renewable energy resources. Itis not only less costly but also it does not cause any harm to the environment. Another thing is that it can be used to generate electricity in hilly areas, where it is quite difficult to transmit electricity by conventional methods. Depending on the requirement its setup can be decided. All the people in this world should be motivated to use non- conventional resources to produce electricity in order to make them self- reliable to some extent. Long life span and less maintenance are some of its plus points. It just requires some high initial investment.

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Factors Influencing the Use of Information and Communication Technology (ICT) in Teaching and Learning Process

Pooja Puri

Associate Professor, Deptt. of Management Studies, Amritsar Group of College, Amritsar, India
Email: poojapuri2530@gmail.com

Abstract—**Information and communication technology (ICT) which incorporates radio, TV and more up to date advanced innovation like PCs and the internet, are possibly useful assets for expanding education options, formal and non-formal, to one and all. Examination concentrates in the previous year's show that Information and Communication Technology is a successful method for flaunting educational opportunities, yet most educators neither utilize this innovation as an educational conveyance framework nor coordinate innovation into their educational plan. Studies uncover various components impacting instructors' choices to utilize ICT in the homeroom. The accomplishment of the execution of ICT in educating and learning process isn't subject to the accessibility or nonappearance of one individual factor, still up in the air through a powerful interaction including a bunch of interrelated components. It is proposed that continuous expert improvement should be given to educators to demonstrate the new instructional methods and apparatuses for learning fully intent on upgrading the educating learning measure. In any case, it is significant for instructor mentors and strategy creators to comprehend the components influencing adequacy and cost-viability of various ways to deal with ICT use in educator preparing so preparing techniques can be properly investigated to roll out such improvements suitable to all. The motivation behind this examination was to explore factors influencing the utilization of ICT in instructing and learning - measure. Information was gathered through singular meetings, perception technique; at last, record investigation was utilized. Therefore, the examination reasoned that both home and institutions climate factors work together to influence the utilization of ICT in teaching and learning process in Amritsar District.**

Keywords: ICT, Learning, Teaching, Technology

I. Introduction

Innovation includes the age of information and procedures to foster frameworks that tackle issues and expand human abilities. As such, innovation can change or adjust how individuals access, accumulate, investigate, present, communicate, and recreate data (See, 1994). The effect of innovation is perhaps the most basic issues in instruction (Webber, 2003). The utilization of data and correspondence innovation (ICT) establishes an amazing learning climate and it changes the teaching and learning process wherein students manage information in an active, self-coordinated and productive way (Volman and Van Eck, 2001). ICT isn't simply viewed as an apparatus, which can be added to or utilized as a substitution of existing instructing techniques. ICT is viewed as a significant instrument to help better approaches for educating and learning. It ought to be utilized to foster understudy's abilities for participation, correspondence, critical thinking and long lasting learning (Plomp et al., 1996; Voogt, 2003).

Incorporating innovation into curricular with the plan of emphatically impacting instructing and learning has been in a condition of advancement in the course of recent years (Dias and Atkinson, 2001; Dockstader, 1999). Driven principally by hardware and programming advancement, openness to PCs in educational settings, and mainstream educational innovation patterns, innovation reconciliation has covered the continuum from guidance on programming abilities, self-coordinated drill and practice, intuitive learning programming, online preparing, testing, educational delivery expansion, and Internet-based availability to data, correspondence, and publication (Dias and Atkinson, 2001).

As per Flanagan and Jacobsen (2003), innovation coordination is intended to be cross curricular as opposed to turn into a different course or subject in itself. Innovation ought to be utilized as an instrument to help the educational goals like abilities for looking and surveying data, collaboration, correspondence and critical thinking which are significant for the arrangement of students for the information society (Drent and Meelissen 2007). Indeed, inventive utilization of ICT can work with understudy focused learning (Drent, 2005). Henceforth, every educator should utilize learning advancements to upgrade their student learning in each subject since it can draw in the reasoning, dynamic, critical thinking and thinking practices of students (Grabe and Grabe, 2001).

These are intellectual practices that students need to learn in aninformation age. (World Almanac, 2002), there has been less achievement recognizing, which computer abilities ought to be instructed in school and how PCs can be utilized for educating and learning process (Dooling, 2000). Along these lines, current consideration has gone to what exactly is really occurring in the education institutions with PC innovation. Despite the fact that ICT might work with autonomous independent learning, the capability of ICT may not be streamlined in case there is no change in the learning and teaching process worldview (Bangkok, 2004). Truth be told, educators assume a significant part in the instructing/ learning change in outlook. They should comprehend the likely job of innovation in training. Likewise, they should become successful specialists to have the option to utilize innovation in the study hall. The multiplication of innovations has confounded the educating learning cycle and tracking down the most ideal methods of coordinating innovation into study hall rehearses is one of the difficulties the 21st century educators face. Adequately incorporating ICT into learning frameworks is significantly more muddled than giving PCs and tying down an association with the Internet.

In fact, the combination of ICT is related with a shift from instructivist to constructivist methods of reasoning of educating and learning process (Barker, 1999). Thus, innovation coordination sets aside time; time to find out with regards to the advancement, time to be enough ready to utilize it. In this regard, higher authorities assume a significant part and apply various techniques, for example, change specialist, deep rooted student, head ally, and asset supplier to carry out ICT in education institutions (Han, 2002). Accordingly, they ought to have the option to distinguish and explain a dream, give a fitting model, offer individualized help, give scholarly incitement, cultivate acknowledgment of gathering objectives, and accomplish elite assumptions (Leithwood, 1994). They ought to have information, abilities and uplifting perspectives toward the execution ICT in education institutions. Along these lines, they can make changes in their institutions by zeroing in on activity and by changing their instructors over to be pioneers who will ultimately become influencers. Subsequently, instructors can assume a part as a pioneer when they are focused on a reason and are self-managing (Bennis and Nanus, 1985).

II. Purpose of the Study

The purpose of the study is to establish factors in the home and institutions environments affecting the use of ICT in teaching and learning process.

III. Scope of the Study

The study covers management students from different colleges of Amritsar district. Sample sizes of 100 students were taken to know about the different factors that affects the ICT during the teaching learning process.

IV. Factors Affecting Teachers use of ICT

A. Level of and Accessibility to the ICT Infrastructure

Utilizing modern equipment and programming resources is a vital component to dispersion of innovation (Gulbahar, 2005). In recent years, most of the education institutions are furnished with various types of innovative framework and electronic assets accessible. For example one Australian intitution has announced that his institution has given individual note pad PCs and their own web spaces, email access and work area for all staff, and students from Year 5 onwards. Video conferencing is accessible and institution has set up its own intranet, putting every one of its assets on-line. These are available through radio associations from school and home. In this school the utilization of radio is viewed as an advancement that has totally changed the idea of instructing and learning process (Richardson, 2000). Likewise, Richardson (2000) revealed that numerous educators coordinated innovation into their instructing and learning measure in this school. This mindfulness seemed when they saw the capability of on-line exercises and the chance of making shared, net-based educating materials. Along these lines, equipment, programming and organization framework should be accessible to coordinate ICT in instruction. Suitable resourcing and adaptable, forward looking arranging, connected near what instructors really need and need at some random stage, will be fundamental. Besides, Albirini (2006) did an examination analyzing the elements identifying with the educators' perspectives toward information and communication innovations.

Instructors' qualities (for example person's instructive level, age, sex, instructive experience, insight with the PC for instructive purposes and monetary position) can impact the reception of an advancement (Rogers, 1995, Schiller, 2003). The report by the National Center for Education Statistics (2000) demonstrated that educators with less long periods of involvement were bound to utilize PCs in their classes than instructors with more long periods of involvement. All the more explicitly, instructors with three years or less showing experience announced utilizing PCs 48% of the time; educators with 4-9 years, 45% of the time; those with 10-19 years, 47% of the time, while educators with 20 years or all the more allegedly utilized PCs just 33% of the time. This might be expected, to a limited extent, to the way that new instructors have been presented to PCs during their preparation and thusly, have more experience utilizing

this apparatus. Then, at that point, one of the components that decide the degree to which instructors use PCs in their classes might be the number of years they have been educating.

B. Parent and Community Support

One manner by which schools can move to understudy focused utilization of ICT is through joins with the more extensive local area. Such connections empower the advancement of a more credible and contextualized way to deal with learning upheld by ICT apparatuses (Demetriadis et al., 2003). In this way, human obligations, jobs and needs inside the local area should be revamped. For instance, evaluation approaches ought to be upgraded to permit all intrigued local area individuals to assume a proper part. In this regard, Granger and his associates (2002) concentrated on four schools to recognize factors contributing in fruitful execution of ICT by instructors. In light of their discoveries, they reasoned that effective execution required PCs as well as commitment and community with the last two being firmly interlinked. Likewise, they added that the schools worked constantly with inquiries of value, advantage, language, and community support. Each meant to foster a way of thinking of teaching method educated by the interesting attributes of their particular networks. Moreover, Kingston et al. (2002) did an examination on imaginative work on utilizing ICT in schools. They showed how a school utilized the acquaintance of PCs with develop a 'associated learning local area' in a space of absence of social and monetary setting. Kingston and her associates arranged the fundamental components of the model created by the school.

They are as follows:

- The establishment of an "open access" institute where discussion about education between parents and teachers and students was encouraged
- The provision of laptops at institute and home: for educational and personal purposes; to develop learners' ICT skill and competence; and to support the adoption of new teaching approaches which motivate students and parents and which give students a sense of success
- The arranging of e-Mentors in industry for students with little family history of formal employment
- Access to skill development in ICT for parents through adult education courses on site
- A network of support for students and parents learning about ICT together
- The provision of a crèche to support parental access to learning
- The celebration of the learning of adults and children through assemblies

C. Manipulative School and Teacher Factors

Educators need to know precisely how ICT is utilized as an instructing and learning tool. Numerous specialists have called attention to that aninstitute's ICT vision is fundamental to viable ICT mix (Anderson and Dexter, 2000). Bennett (1996, p. 60) focused on the significance of a "distinct mission that portrays innovation's place in teaching". In accordance with this thought, Ertmer (1999) stated, "A dream gives us a place to begin, an objective to go after, just as a guidepost along the route". Additionally, Means and Olson (1997) suggest that instructors and schools should foster a dream before they make considerable interests in hardware and software. All in all, user of innovation should have a principal faith in the worth of development or the advancement is ill-fated to disappointment. Instructors should have freedoms to contemplate, notice, reflect, and examine their work on, including their utilization of ICT, to foster a sound teaching method that joins innovation (Kearsley and Lynch, 1992).

Henceforth, the vision should not be made by a solitary individual or through a hierarchical interaction. It is urgent to include the people who have a stake in the results, including educators, guardians, scholars, and the community, and permit them to aid the formation of the vision by contributing their insight, abilities, and inspirational perspectives. In this way, an exact vision of ICT mix in institutes that is shared by all individuals from the institute local area promoteapractical utilization of ICT in the classroom. When the vision has been effectively made and acknowledged, the subsequent stage is to express an ICT combination plan, explaining how the instructors are relied upon to incorporate innovation in their teaching (Strudler and Wetzel, 1999). In fact, an ICT end-all strategy that is figured by a institute's vision and its sociocultural setting guarantees effective mix of ICT (Bangkok, 2004). Gulbahar (2005) directed an examination to delineate how innovation planning measure was done in a private K-12 school in Turkey.

Discoveries of this examination demonstrated that instructive establishments should foster an innovation plan to utilize innovation in a compelling and effective way for educating, learning and authoritative purposes. Additionally, a few issues that ought to be considered include staff and student advancement for ICT-related abilities, educational program and evaluation, ICT offices,resources and support groups (both specialized, authoritative and instructive). In this manner, an ICT joining plan gives a point by point outline of the means and techniques expected to decipher the school ICT vision into the real world. Creating ICT reconciliation plans is no question a complex and tedious assignment, yet they are generally certainly worth the time needed to assemble them.

D. Level and Quality of Training for Teachers

Proficient advancement of instructors sits at the core of any effective innovation and training program. Baylor and Ritchie (2002) did a quantitative report that took a glance at the variables working with instructor expertise, educator spirit, and saw understudy learning in innovation utilizing classrooms. They tracked down that proficient improvement impacts how well ICT is embraced in the study hall. Likewise, they added that instructors' preparation programs regularly center more around fundamental proficiency abilities and less on the coordinated utilization of ICT in educating. Regardless of the various designs to utilize innovation in schools, notwithstanding, instructors have gotten little preparing around here in their educator training programs (Varsidas and McIsaac, 2001). As indicated by Schaffer and Richardson (2004), when innovation is brought into educator training programs, the accentuation is frequently on instructing about innovation as opposed to educating with innovation. Subsequently, lacking planning to utilize innovation is one reason that instructors don't systematically utilize PCs in their classes. Instructors should be offered freedoms to work on utilizing innovation during their educator preparing programs with the goal that they can see manners by which innovation can be utilized to increase their classroom events (Rosenthal, 1999).

1. Does level of accessibility and cost of ICT equipment affect the use of ICT in teaching and learning process?

Response	Frequency	Percentage
Agree	50	50%
Disagree	20	20%
Strongly Agree	10	10%
Strongly Disagree	20	20%
Total	100	100%

Research question I says, Does level of accessibility and cost of ICT equipment effects the use of ICT in teaching and learning process and 50% respondents agree, 20% respondents disagree, 10% respondents strongly agree while 20% respondents strongly disagreed to this statement.

2. Does ICT training for teachers effects the use of ICT in teaching and learning process?

Response	Frequency	Percentage
Agree	70	70%
Disagree	3	3%
Strongly Agree	12	12%
Strongly Disagree	15	15%
Total	100	100%

Research question II, Does ICT training for teachers effects the use of ICT in teaching and learning process and 70% agreed that Teachers training is the problem, 3% disagreed, 12% respondents strongly agreed to this statement while 15% of the population say that it like of parent and community support are the problems.

3. Does teachers' and students' attitude towards computer usage affects the use of ICT in teaching and learning process?

Response	Frequency	Percentage
Agree	45	45%
Disagree	20	20%
Strongly Agree	10	10%
Strongly Disagree	25	25%
Total	100	100%

Research question III, Does teachers' and students' attitude towards computer usage effects the use of ICT in teaching and learning process, 45% agreed that teachers' and students' attitude towards computer usage effects the use of ICT in teaching and learning process, 20% said that it is like of found that incapacitates the teaching and learning of the subject., 10% disagreed, 25% respondents strongly disagreed to this statement.

4. Does like of parent and community support effects the use of ICT in teaching and learning process?

Response	Frequency	Percentage
Agree	25	25%
Disagree	30	30%
Strongly Agree	25	25%
Strongly Disagree	20	20%
Total	100	100%

Research question IV, Does like of parent and community support effects the use of ICT in teaching and learning process and 25% respondents agreed to this statement while 30% respondents disagree about parents and community supports that effects the use of ICT in teaching and learning process. 25% respondents are against this statement and 20% respondents strongly disagree about this statement and they said it is cost of ICT equipment that effects the use of ICT in teaching and learning process.

5. To what extent does the use of ICT effects teaching and learning process in Amritsar City?

Response	Frequency	Percentage
Agree	15	15%
Disagree	10	10%
Strongly Agree	70	70%
Strongly Disagree	5	5%
Total	100	100%

Research question V, to what extent does the use of ICT effects teaching and learning process in Amritsar district. 70% respondents strongly agreed that the use of ICT has a strong and very high effect to teaching and learning process while 5% respondents strongly disagreed with them, for them, teaching and learning process can still be effective without the use of ICT.

V. Summary & Conclusion

From the data collected, and the information generated through the interview and questioners distributed the following summary holds; Level of accessibility and cost of ICT equipment, like of ICT training to teachers, Teachers and Students attitude towards computer usage and like of parents and community support effects the use of in teaching and learning process in Amritsar district among other factors.

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Amplifying Signal Approach for Long Distance in Optical Communication System

Nadeem ul Amin[1], Er. Harmandeep Kaur[2]

[1,2]Electronics and Communication Engineering
Swami Vivekanand Institute of Engineering & Technology, Banur, Punjab, India
Email: [1]bhatnadeem37@gmail.com, [2]hshergill@yahoo.com

Abstract— The optical wireless communication (OWC) and free-space optics (FSO) are rapidly growing since they have an unconstrained spectrum, cheap installation time, acceptable price, high throughput, and insusceptibility to electromagnetic radiation. But these systems cannot transfer data over greater distances due to reduction in signal strengths. For two FSO and OWC connection systems, this paper provided a novel scheme in which amplification is done in two stages. Furthermore, the proposed scheme employs the Bessel filter to remove undesired noise from the signal. The NRZ encoder converts the pseudo-random signals generated by the transmitter into electrical signals. Before being passed through the FSO and OWC channels, the signals are amplified by an optical amplifier. Then, the Bessel filter eliminates any extra noise from the signals before passing them through another optical amplifier to boost their intensity. The optical receiver collects these signals, converts them to electrical signals, and then sends them to the BER analyzer. In Optisystem software, the performance of the suggested system's performance is examined and compared to that of the standard system's performance. The Q-factor, minimum BER, and eye height are used to calculate the simulated results. The findings show that the suggested method is more convenient and effective at sending data over longer distances..

Keywords—Fiber Communication, NRZ Encoding, Optical Wireless Communication, Opti Systems, Free Space Optics Etc.

I. Introduction

Recently there has been a growing demand for faster transmission rates in comparison to global telecommunication systems. Traditional telecommunications systems, such as radio transmission, microwave and coaxial cables, provide restricted bandwidth, and suffer from high distortion, and therefore are unable to satisfy current and future bandwidth demands [1]. Optical fiber is likely to experience lower error rate and a broad bandwidth. As a result, it has the ability to meet both current and future requirements for combined image, sound, and information transmission [2]. In telecommunication services, optical fiber is termed as a most effective and appropriate transmission medium, but recently there has been a significant demand for services

that has a high capacity system [3]. Optical fiber with minimal delays allows massive transmission bandwidth. FSO (free space optics) are considered as an extremely appealing answer to the issues because it combines the optical fibers link's channel capacity with the licensing-free wireless telecommunication technologies [4].

Free Space optical communication is an emerging wireless technology which treats atmosphere as channel for the communication. The FSO communication system is one of the prominent wireless communication systems, to establish optical communication. FSO communication entails the propagation of an IR or visible ray modulated via the atmosphere [5]. The FSO communication system has transmitters just like all other communication systems to transmit data, which could be laser source depending upon the necessity or could be LED (Light-Emitting Diode). The receiver and transmission channel in FSO system helps to decode the sent data [6]. The LoS (Line-of-Sight) in FSO offers communication that operates in both visible and infrared spectrum. The essential idea of the FSO system is nearly identical to the optical fiber transmission because the data signals travels through a directed channels in optical fiber transmission, but in FSO the data travels through an unguided channel. In FSO communication system at both ends, optical transceivers are utilized for 2-way communication [7]. FSO is a system that has multiple advantages like a license-free spectrum, low power consumption, speedy deployment, and high data rate [8].

The FSO communication technique does not involve any fiber or waveguide equipment. Since radio disruption and electromagnetic fields have no effect on Free Space Optics, it is very effective than WCS In the domain of disaster management, optical communication systems are often used to create temporary links [9]. Disturbances in the atmosphere can cause problems in the Free Space Optics communication process. Furthermore, due to negligible interception, the FSO allows transmission that is secure by utilizing point-to-point laser signals in combination with lower errors over optical fiber transmission.

The FSO integration with radio systems generates optimal results because it combines the high data rates of optical communications and during deployment it gives more flexibility, eliminates large upfront costs, and reduces the time of deployment [10].The main advantage of a FSO infrastructure is that it has a large data transfer speed, which increases protection and efficiency. As a result, Free Space Optics is very efficient and reliable method of transmitting information from an individual transmitter to a single receiver. Although FSO offers gigabytes of speed and is simple to set up, it has certain downsides, including signal deterioration because of fading, pointing inaccuracy, attenuation, and atmospheric turbulence. To increase the stability and efficiency of the FSO system for communicating and transferring data over large various researchers have provided number of techniques that is mentioned in the next section of this paper.

II. Literature Survey

Several researchers have developed a number of strategies to enhance the accuracy and effectiveness of the FSO system, out of which some are discussed here: Nirali Shah *et al.* [11],by utilizing gamma channel and free space optics K channel, the researchers of this paper examined the strategies of alternative relay selection. In free space optical communication, the researchers also compared the DE and PSO algorithms performance. As a result, this would give a detail study of the free space optical communication's performance in various channels by using various algorithms for various relay selection techniques. Marzieh Najafi *et al.* [12],evaluate the usage of IRSs (intelligent reflecting surfaces) to loosen for the requirements of line-of-sight in the FSO system. The analytical outcomes revealed the angle between IRS plane and beam direction, developing sway for the Iris has a bigger or smaller effect on the end-to-end FSO channel quality than developing sway for the receiver and transmitter. The simulation outcomes revealed that proposed. Moreover, the results of our simulations confirmed the proposed models accuracy and provide guidance for system design. S. N. Pottoo *et al.* [13], due to unauthorized bandwidth, short deployment cost, decent price, high speed, and insusceptibility to electronic radiation, the emerging technology in FSO and OWC offered many advantages over traditional radio networks. Two OWC networks, one with Free Space Optic network and the other with Optical Wireless Communication networks, were studied and the results were obtained. As output indicators, the consistency parameter and BER were used to evaluate both schemes. For network requirements, the numerical model for obtained optical power and pointing error was used. Florence Rashidi *et al* [14],conducted a study on the use of RoF in Wavelength Division Multiplexing communication system. The architecture of the Wavelength Division Multiplexing communication system, as well as its characteristics and modules such as transmitters, receivers, and optical amplifiers, were addressed in this study. The authors of this paper also illustrated many characteristics of individual modules. This study can be beneficial to other investigators in the Wavelength Division Multiplexing field to gain a perspective on ROF. K.H. Shakthi Murugan *et al.* [15], for various optical filters, the OWC networks were evaluated and contrasted to their previous version. In terms of both optical range and light separation, the findings showed the highest Q-factor as compared to the prior design. In terms of optical length, receiver and transmitter aperture diameters, the suggested framework was obtained the highest Q-factor with various optical filters. In contrast to other optical filters, the highest Q-factor could be obtained utilizing a Gaussian optical filter. Optical contact was used to capture all of the results obtained. Suman Malik *et al.* [16],studied the potential of an OWC network in this paper, reporting the feasible Bit Error Rate and total bandwidth utilizing various modulation techniques such as pulse position modulation (PPM), quadrature phase shift keying (QPSK), and on-off keying (OOK). To evaluate the output of the Free Space Optic method, a closed-form graphical representation for overall BER and total available bandwidth for different modulation schemes, such as pulse position modulation, quadrature phase shift keying, and on-off keying, is provided. This research presented evaluation findings for Bit Error Rate and channel power for various modulation schemes using the Gamma-Gamma and Lognormal distribution channel models. K. Prabu *et al.* [17],suggested a technique for calculating optical signal noise generated by Single Phase Modulation induction in a device intended to communicate optical signals in an Ultra-dense Mixed-Wavelength Division Multiplexing method. The simulator methodology revealed that the threshold of tolerated power levels increases up to 21 dBm for the 10 Gbit/s NRZ-OOK network, 15 dBm for the 40 Gbit/s 4-POLSK channel and 18 dBm for the 40 Gbit/s 2-POLSK channel. Z. Rahman *et al.* [18], analyzed SNR, ergodic level, and power consumption efficiency of Optic Wireless Communication systems under foggy conditions. The developed model was analyzed by computing limits on the typical Signal to Noise Ratio, ergodic rate, and power usage using parameter values, and contrasting the Receiver Beam Selection scheme to a single-aperture system, they demonstrated that the Receiver Beam Selection scheme outperforms the single-aperture system. Rizwan Khalid *et al.* [19],proposed the non-linearity known as FWM "Four Wave Mixing" as well as its response in this paper. By using WDM with a connection length of 150 kilometers produces

authors discovered a higher performance parameter. Furthermore, the study found that placing line amplifiers 80-100 kilometers apart was successful in mitigating communication flaws. J. Sung *et al*. [20], for effectively and reliably supporting various users, a beam-width flexible Optic Wireless Communication device capable of sending accumulated radio waves was suggested. The propagation of four 400-MHz Orthogonal Frequency Division Multiplexing signals across 1.7-m Optic Wireless Communication with a net speed of 4.13 Gb/s was illustrated.

From the literature survey conducted, it is analyzed that, various researchers have proposed number of techniques to increase the stability and efficiency of the FSO system for communicating and transferring data over large distances. In the traditional models, experts utilized wireless optical communication systems for two channels i.e. FSO and OWC system. In addition to this, the performance of the FSO and OWC systems was evaluated in terms of Q-factor and BER. Furthermore, due to high attenuation and excessive losses, the performance of the traditional system for FSO and OWC systems degrades with the increasing range. Moreover, the traditional models do not have any optimal method for extracting noise from the signals. Aside from this, changing atmospheric conditions also impacted the received signals by lowering the quality factors of the signal at the receiver. Hence a novel system is needed, which is capable of long-distance communication and at the same time, it could also provide resistance.

III. Proposed Model

To overcome the issues related to the traditional models a novel system is proposed in this paper that modifies the conventional system by developing the concept of two-level amplification. To increase the communication distance, an amplifier is introduced so the signal's powers do not get degraded. The proposed two-level amplification module will have a pre-amplification and post-amplification phase before and after the channel. In addition to this, a filtration technique is also introduced into the proposed model to enhance the system's performance and overcome the impacts of the environmental conditions, and boosting signals noise. The transmitter, channels (FSO and OWC), Bessel filter, amplifier, receiver, and BER analyzer are considered essential components of the suggested model. Figure 1 represents the block diagram of the proposed Optical communication systems with FSO and OWC channels.

Fig. 1 shows the block diagram of the suggested optical communication model, which employs two channels, one FSO and the other OWC. The proposed model also includes a transmitter module that includes PRBS, NRZ encoder, CW laser, and MZM modules.

The PRBS module generates a random signal, which is then transformed to an NRZ type electrical signal by the NRZ line encoder. The NRZ line encoder's output is then used as an input to the MZM module that overlaps the NRZ signal with the high-frequency optical signal to generate an optical signal as an output. The optical amplifier amplifies the signal, and data is then transferred across two channels, FSO and OWC. Furthermore, the Bessel filter is used to separate the signal strength from the noise. An optical receiver with an avalanche photodiode (APD), a low pass filter (LPF), and a BER analyzer is fitted at the receiving end. An APD is utilized for converting the received optical signal to electrical output. The LPF then blocks the output signal to remove the high-frequency noise. Then, the filtered output is sent into a BER analyzer that displays the signal's BER and Q-factor. The methodology section is a full description of how the suggested model works.

A. Methodology

Step 1: The first stage is to set up the model that includes defining several characteristics like optical power, data rate, wavelength, and range. Aside from that, there are a number of other parameters defined in Table 1.

Step 2: After the model has been initialized, the next step is to utilize the transmitter for emitting signals randomly. The PRBS module generates the signals, which are then transformed into electrical signals by using the NRZ line modulator.

Step 3: To produce a high-frequency optical signal as the output, the electrical NRZ signals are then overlapped with the high-frequency optical signals

Step 4: The generated optical signals are then sent to the first amplifier, which enhances the signal strength before sending it to the two channels, FSO and OWC.
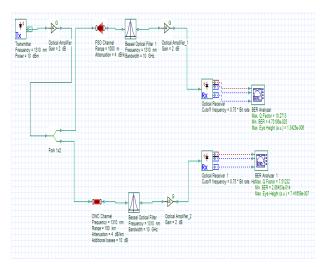

Fig. 1: Proposed Optical Communication System with FSO and OWC Channels

Step 5: When signal intensity is increased, some noise is introduced into the signal that impairs its performance. To remove the unnecessary noise from the signal, the suggested model will use a Bessel filter.

Step 6: The optical filter then amplifies the filtered signals to increase signal strength and allow them to travel longer distances.

Step 7: An optical receiver with an avalanche photodiode (AVD) and low pass filter (LPF) modules is fitted at the receiving end. By using the AVD module, the received optical signal is transformed back to an electrical signal.

Step 8: Before transferring the output signal to the BER analyzer, the electrical output signal is passed through an LPF, which blocks noise signals.

Step 9: Finally, the performance of the proposed model is analyzed and compared with the traditional model in terms of the Q-factor, BER, and eye height and are discussed briefly in the next section of this paper.

TABLE 1: SIMULATION PARAMETERS

Parameters	Value
Launched optical power	10dBm
Data rate	1.5Gbps
Transmitter optics efficiency	1
Receiver optics efficiency	1
Transmitter gain	0 dB
Receiver gain	0dB
Transmitter pointing loss factor	0μrad
Receiver pointing loss factor	0μrad
Beam divergence	2-5 mrad
Atmospheric attenuation	0.32-4 dB/km
Additional loss	5-10 dB
Wavelength	1310nm
Range	100 -1000 m (Channel A)
	10-100 km (Channel B)

IV. RESULTS AND DISCUSSION

In the Optisystem simulation software with two channels, FSO and OWC, the suggested model's performance is assessed and compared to the conventional model. The Q-factor, BER ratio, and eye height were used in the proposed model to generate the simulated outcomes. This section contains a full discussion of the acquired results.

A. Performance Evaluation

Phase 1: Performance analysis for FSO channel

In Fig. 2, the proposed FSO link system's performance is evaluated and compared to that of the classic FSO model in terms of their Q-factor.
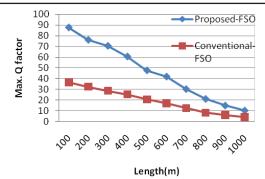
Fig. 2: Comparison Graph for Q-factor
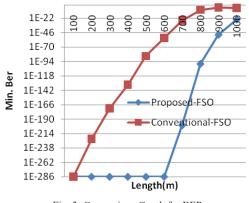
Fig. 3: Comparison Graph for BER

According to figure 2, the suggested FSO model and the traditional FSO system are compared in terms of the Q-factor value. The graph shows that the value of the Q-factor in the conventional FSO system starts quite low, approximately 36.78 at 100m distance, and then continues to decrease as the distance increases. In a typical FSO system, the Q-factor drops to just 4.12 after traveling to roughly 1000m.In the suggested FSO model, the value of the Q-factor is initially high, at 87.52, before progressively decreasing to 10.27 after traveling 1000 meters. This demonstrates that the suggested FSO model is more dependable and effective.

Furthermore, the proposed FSO link system's performance is evaluated and compared to the conventional FSO system in terms of tehri BER value and is illustrated in Figure 3.

The suggested FSO system and the standard FSO system are compared in terms of their BER values in Figure 3. From the graph, the resulting graph shows that the BER value in the conventional model starts at the beginning and continues to rise as the distance increases. At 100m, the BER value is 1.00E-286, which increasing to 1.00E-85 after half the distance i.e.500m is covered. The traditional FSO system has the greatest BER value at 1000m, with a value of 1.00E-05, demonstrating the model's inconsistency. BER is zero in the proposed

Fig. 4: Comparison Graph for Eye Height
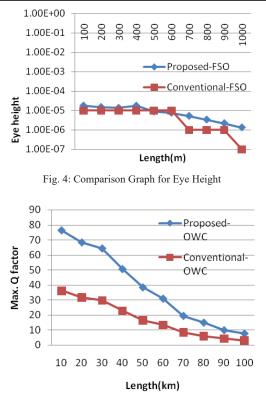
Fig. 5: Comparison Graph for Q-factor in Proposed OWC Model

Fig. 6: Comparison Graph for min. BER

Fig. 7: Comparison Graph for Eye Height

FSO connection system until the optical signal covers a distance of 700 meters. Following that, the BER value gradually increases, but not dramatically. At 1000m, the value of BER was calculated to be 4.73E-25.

Finally, in figure 4, the proposed FSO link system's performance is evaluated and compared to that of the traditional FSO model in terms of eye height.
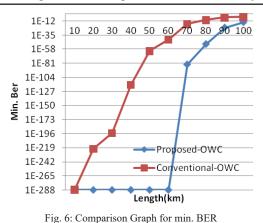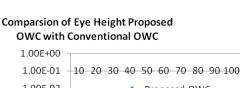
The suggested FSO system and the standard FSO system are compared in terms of their eye height values in Figure 4. From the graph, the value of eye height in the conventional FSO model is low and comes out to be just 1.00E-05 at 100m distance, which further undergoes adjustments and comes out to be 1.00E-06 when the optical signal covers 700m distance. After 1000 meters, the eye height value in the conventional FSO model was 1.00E-07. While the value of eye height in the proposed FSO system starts at 1.83E-05 and then changes as the distance increases, the value of eye height in the suggested FSO model comes out to be 9.01E-06 and 1.34E-06 when the optical signal reaches 500m and 1000m, respectively.

Phase 2: Performance analysis for OWC channel

The proposed OWC system's performance is assessed and compared to that of traditional OWC systems in terms of their Q-factor and is illustrated in figure 5.

The suggested OWC system and the standard OWC system are compared in terms of their Q-factor value in Fig. 5. From the graph, the value of the Q-factor is quite low from the beginning, i.e. only 36.26 at the range of 10km. The Q-factor decreases as the distance increases reaching 16.46 when the optical signal has reached half the distance, or 50 km. At 100 km, the Q-factor drops, even more, reaching just 3.02E+00. When it comes to the suggested OWC system, the Q-factor is highest at 76.26 in the beginning, and then drops to 38.29 after 50 km. The Q-factor number drops as the distance traveled increases, reaching 7.51 after 100 km. The proposed OWC model becomes increasingly effective and efficient as the Q-factor value rises.
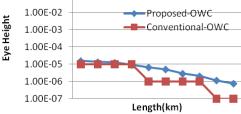
In addition, the suggested OWC system's performance is validated and compared to that of the standard OWC system in terms of the BER ratio attained, as shown in figure 6.

Fig. 6 shows a comparison graph of the suggested OWC and traditional OWC systems in terms of their minimum BER values. From the graph, the BER value achieved by the old OWC model was 1.00E-288 at 10km, which then increased with increasing distances until it reached 1.00E-61 after 50km. After 100 km, the conventional OWC model's BER value was 1.00E-05. Even after traveling 60 km, the bit error rate in the suggested OWC system is 0%. The BER in the suggested OWC system is 2.28E-83, 4.63E-50, 4.66E-23, and 2.86E-14 at 70, 80, 90, and 100 km, respectively.

At last, in figure 7, the performance of the proposed OWC link system is evaluated and compared to that of the standard OWC system in terms of eye height.

In terms of eye height, Figure 7 depicts a comparison graph of the suggested OWC and conventional OWC systems. From the graph, when the optical signal travels 10 km, the value of eye height reached in a standard OWC system is 1.00E-05. The eye height value falls as the length increases, reaching 1.00E-06 at 50 km and 1.00E-07 at 100 km. This is not the case with the planned OWC system, whose eye height value was 1.53E-05 after a 10-kilometer journey. The value of eye height then gradually declines with increasing distance, reaching 6.51E-06 at 50kms and 7.41E-07 at 100kms.

According to the graphs and tables, the suggested FSO and OWC link systems are more effective and efficient in transmitting the information.

V. Conclusion

To improve the FSO communication system's performance, a technique is devised that involves two steps of amplification and the Bessel filter is utilized for removing noise from optical signals with FSO and OWC channels. In the Optisystem software, the suggested FSO and OWC system's performance is assessed and compared to that of the conventional FSO and OWC system. The Q-factor, BER value, and eye height value were utilized for generating simulated outcomes. When the suggested systems have values of 87.52 and 76.26 respectively, is compared to the traditional links system, which has values of 36.78 and 36.26 respectively, it is clear that the proposed systems have a higher value of Q-factor. The BER value is also examined in both links and it is shown to be zero in both the suggested link systems until 600m and 60km, respectively. However, in FSO the BER values rise to 4.72E-25 after travelling 1000m and 1.00E-05 at 100kms. Then, in terms of eye height, the proposed system is compared with the traditional system. When optical signals travel up to 10m and 10km, the eye height value in suggested systems is 1.83E-05 and 1.53E-05, respectively. With increasing distance, the eye height falls, reaches up to 1.34E-06 and 7.41E-07 at 100m and 10km, respectively. The eye height energy of both systems decreases with the increase in height and distance. According to the findings, the suggested FSO and OWC process is more effective and efficient in delivering data over longer distances.

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A Survey Article on Machine Learning Techniques to Detect Routing Attacks in Vehicular Adhoc Networks (VANETS)

Dr. Jayant Vats[1], Er. Shivani Sharma[2]

[1,2]Assistant Professor, Dept. Computer Applications, Amritsar Group of Colleges, Amritsar, India
Email: [1]jayantvasu@gmail.com, [2]er.sharma04@gmail.com

Abstract—**Road traffic accidents and their sequences increase dramatically worldwide and thus raising a demand for solutions to providing safety and control of vehicles on road when driving. This is one of the top priorities for modern countries focusing on enhancing citizens' quality of life by developing an Intelligent Transport System (ITS). Vehicular Ad hoc Networks (VANETs) are recognized to be effective in realizing such a concept. VANET is potential in improving road safety and in providing travelers comfort. However, such technology is still exposed tomuch vulnerability led to numerous of security threats that must be solved before VANET technology is practically and safely adopted. Machine Learning is an approach where the system automatically learns and improves itself based on previously processed data. These algorithms provide efficient supervised and unsupervised learning of these collected data, which effectively implements VANET's objective. We highlighted the safety, communication, and traffic-related issues in VANET systems.**

I. Introduction

Rising cars on streets brings to many kind of issues arises such as for example traffic impediment, situations on streets, air pollution that triggers substantial harm to humanity to overcome all these kind of issues the investigation gifts people who have the brand new engineering named VANET (vehicular ad-hoc network) [1]. Vehicular Adhoc Communities is known as distinctive type of lightweight Adhoc techniques (MANETs) [5]. VANETs reveals people the whole data regarding streets that is how to travel on streets with security, which rate must be used, which street is better, also detects the problem happens as a result of atmosphere problems such as for example flood,slipping, viewing due compared to that your show lowers between and the whole data isn't reached to the user[7,8]. VANET employs vehicles as lightweight nodes in MANET (mobile ad-hoc network) to generate a lightweight program, VANET converts every participating vehicle directly into a quick heart or node allowing vehicles estimated 100 to 300 meters of

each other for joining and subsequently make a program with large variety just like the vehicle fallout from the show variety and drop right out of the program another vehicle which enters the road may take part in linking cars to a different so that lightweight net connection is created. The very first techniques which could incorporate that engineering are authorities and fireplace brigade for joining with each other of security purpose by introduction the engineering of VANETS [6]. The cars frequently shift an structured design rather than going randomly the in the offing program of VANET is on the basis of the relationship among people through their mobile phones that is sensible devices by giving the update information about regional traffic therefore that they can manage their street to travel [9]. Making the info in regards to the traffic get a grip on with the support on GPS and NAVIGATION the driver gets the sum total information about the traffic ahead but at once frame an individual can also accessibility the info from their own cellular phone which supports to regulate the traffic and decreases how many accident. The small items throughout the streets may prevent many situations the machine such as for example Road Side Unit (RSU) which straight connected to an individual to update the traffic data and consequently On OBU which reveals the info on the vehicle screen that the car in primary and one place or at the trunk trips with simply just how much rate and the length maintained from your vehicle [2].It reveals the whole information about all of the cars that vacation in the exact same street or regional street VANET is dependent on immediate technologies such as for example lightweight information or wireless connections. The main element need of VANETs is always to total the people decision in route and construct theirdrive secure and comfortable [8].VANET has its own unique characteristics when compared with other types of Ad hoc networks, the unique characteristics of VANET include [5] [6]:

- Predictable mobility: nodes in VANET move in a haphazard manner because vehicles are constrained by road layout and by the follow the traffic lights, road signs
- No power constraints: the power in VANET is not consider as a challenge
- Rapid changes in network topology: which due to the high speeds of the vehicles, especially at the highway
- Large-scale network: which depends on the dense urban areas such as big cities, the downtown, and highways
- High computational ability: which refers to the number of nodes needs to exchange the information between them and RSU at the same time?

II. Literature Review

In this section, we briefly review the attacks in VANET. After that, we explore machine learning techniques used on VANET system especially for detecting routing attacks.

A. Vulnerabilities in VANET

In VANET, the routing protocols are classified into five categories: Topology based routing protocol, Position based routing protocol, Cluster based routing protocol, Geocast routing protocol and Broadcast routing protocol. Vehicular multi-hop ad hoc networks (VANETs) enable the exchange of information between vehicles without any fixed infrastructure. The varying conditions in VANETs introduce high requirements on the routing protocols being used. Thus, we developed a reasonable freeway mobility model and evaluated the performance of AODV, DSR, FSR and TORA in typical freeway traffic scenarios on the basis network simulations. The outcomes show that AODV performs best in all the simulated traffic situations, accompanied by FSR and DSR, while TORA is inapplicable for VANETs.

B. Topology Based Routing Protocols

These routing protocols use links information that exists in the network to execute packet forwarding. They're further split into Proactive and Reactive.

1. Proactive Routing Protocols

The proactive routing implies that the routing information, like next forwarding hop is maintained in the background aside from communication requests. The advantage of proactive routing protocol is that there's no route discovery since the destination route is stored in the background; nevertheless the disadvantage of the protocol is that it provides low latency for real-time application. A table is constructed and maintained within a node. To ensure that, each entry in the table indicates the next hop node towards a particular destination. In addition it contributes to the maintenance of unused data paths that cause the decrease in the available bandwidth. The various kinds of proactive routing protocols are: LSR, FSR

C. Fisheye State Routing

It is similar to link state routing protocol (LSR). Each node maintains a topology table on the basis of the latest information received from neighborhood nodes. It uses different exchange period for different entries in routing table to reduce how big is control messages in large networks. The disadvantage in FSR routing is how big is the routing tabling increases with upsurge in network size. Route discovery may fail if the destination node lies out of scope of source node. Because of high mobility in VANET, route to remote destination become less accurate.

D. Optimized link State Routing Protocol

It is an optimization of a natural link state protocol for mobile adhoc networks. Each node in the network selects some neighbor nodes called as multipoint relays (MPR) which retransmits its packets. The neighbor nodes that aren't in its MPR set can only read and process the packet. This procedure reduces the amount of retransmissions in a broadcast procedure.

E. Destination Sequence Distance Vector Routing

DSDV protocol it can be an earliest ad hoc routing protocol, it implements the length vector strategy and uses a shortest path algorithm to implement. DSDV protocol guarantees the loop free routs, excludes extra traffic due to frequent updates. DSDV increases the overhead in the large network; due to unnecessary updating broadcast even when there is no change in the network topology.

1. Reactive/Ad-Hoc Based Routing [15]

Reactive routing opens the route only when it's essential for an ode to keep in touch with each other. It maintains only the routes that are now in use; as a result it reduces the burden in the network. Reactive routing consists of route discovery phase in which the query packets are flooded in to the network for the trail search and this phase completes when route is found. The various forms of reactive routing protocols are AODV, PGB, DSR and TORA

2. Ad-Hoc on Demand Distance Vector (AODV)

AODV is a source initiated routing protocol and uses HELLO messages to spot its neighbors. Source node

broadcasts a route request to its neighbors which fill forward to the destination. Then the destination unicast a route reply packet to the sender. Every node maintains broadcast-id which increments for new RREQ. Whenever a RREQ arrives at a node, it checks the broadcast id if it is less than or corresponding to previous message then it will discard the packet.

3. *Dynamic Source Routing (DSR)*

It uses source routing rather than based on intermediate node routing table. So routing overhead is always dependent on the path length. The limitation of the protocol is that the route maintenance process does not locally repair a broken link. The performance of the protocol briskly decreases with increasing mobility.

4. *TORA*

TORA is a reactive, highly adaptive, efficient and scalable distributed routing algorithm based on the concept of link reversal. TORA is proposed for highly dynamic mobile, multi-hop wireless networks. The main feature of TORA is that the control messages are localized to a very small set of nodes near the occurrence of a topological change. The protocol has three basic functions: Route creation, Route maintenance and Route erasing.

1. *Position Based Routing Protocols*

Position based routing consists of class of routing algorithm. They share the property of using geographic positioning information to be able to select the following forwarding hops. The packet is send without any map knowledge to the main one hop neighbor, which will be closest to destination. Position based routing is beneficial since no global route from source node to destination node need to be created and maintained. Position based routing is broadly divided in two types: Position based greedy V2V protocols, Delay Tolerant Protocols

2. *Broadcast Routing Protocols*

Broadcasting routing enables packets to flood into the network to all available nodes inside the broadcast domain. Broadcasting routing is widely in VANETs, it mainly used in the route discovery process, some protocols (like AODV) allow nodes to rebroadcast the received packets. This routing scheme allows packets to deliver via many nodes which may achieve a reliable packet transmission, however it could consume the network bandwidth by sending replicated packets, so each node need to identify which packet is replica (it has received it before) to discard.

3. *Geocast Routing Protocols*

Geo cast routing is actually a spot based multicast routing. Its objective is to provide the packet from source node to all or any other nodes in just a specified geographical region (Zone of Relevance ZOR). Geo cast is considered as a multicast service in just a specific geographic region. It normally defines a forwarding zone where it directs the flooding of packets in order to reduce message overhead and network congestion due to simply flooding packets everywhere.

4. *Cluster Based Routing Protocols*

Cluster based routing is preferred in clusters. A group of nodes identifies themselves to be always a part of cluster and a node is designated as cluster head will broadcast the packet to cluster. Good scalability can be provided for large networks but network delays and overhead are incurred when forming clusters in highly mobile VANET. In cluster based routing virtual network infrastructure must be created through the clustering of nodes in order to supply scalability.

III. Usage of Machine Learning for VANET

In VANET a large amount of data should be processed fast from each node. And to handle the huge amount of data and process them with minim time, several machine learning techniques have been applied to cope up this issue in VANET environment.

Machine learning has not been studied extensively in misbehavior detection in VANET. However, in [16], they proposed a new effective misbehavior detection model based on machine learning techniques for VANET applications. The proposed model consists of four phases: data acquisition, data sharing, analysis, and decision making. Authors evaluated the proposed model by simulating real-world traffic dataset namely NGSIM. NGSIM contains both attacker and normal traffic data. They used Artificial Neural Network (ANN) techniques to train the dataset. the experiment result shows very high accuracy with an average of 99%, in addition to the effectiveness of the proposed model in comparison with the existing baseline model.

Another effort used machine learning to secure Software Defined Vehicular Networks (SDVN) in [17]. The proposed mechanism detects four categories of attacks: DoS attack, probing attack, user to root attack, and remote to local attack. Authors used multi-class support vector machine (SVM) to dynamically detect different attacks. The proposed mechanism was conducted with simulation. They used MATLAB with multi-class SVM toolbox as the simulation tool and KDD CUP 1999 intrusion detection dataset which is general intrusion
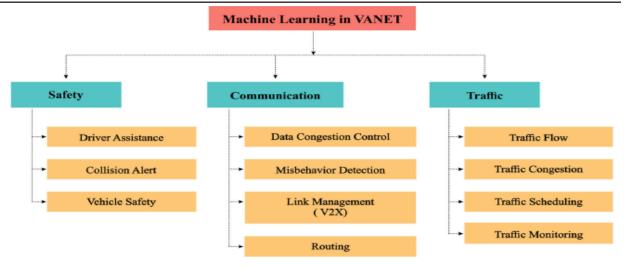
Fig. 1: Machine Learning in Vanets

dataset not real/synthetic from VANET environment. However, the results demonstrate that the effectiveness of the proposed mechanism to classify the types of attacks, as well as good performance regarding high precision, recall, and accuracy.

Authors in [18] focused on context changes which are rife in VANETs. They proposed a context-aware security framework for VANETs based on SVM algorithm. The objective of the proposed framework is to automatically differentiate between malicious nodes from abnormal nodes due to contextual reasons. like movement speed, temperature, and transmission range. The proposed framework has three functional modules, start with behavior data collection, then context sensing and processing, finally the misbehavior detection. In the experiment, they generated a dataset to train SVM classifier by using simulation tools and GloMoSim 2.03 as the experimental platform. the results demonstrate that the proposed framework achieves a good performance in accuracy, recall values, and an acceptable value of communication overhead. in addition, and it is more flexible to context changes which are suitable for VANETs environments compared with other existing security solutions for VANETs.

Authors in [19] designed a framework for differentiating between legitimate and malicious nodes in VANET. They used a machine learning approach to classify multiple misbehaviors node in VANET using behavioral features of each node. These features are speed deviation, distance, received signal strength (RSS), the number of packets generated, delivered, dropped, collided. They used two types of classification to measure the accuracies, the first one is Binary and the second one is Multi-Class. In Binary classification, all types of misbehaviors considered as single misbehavior class whereas, Multi-class classification can categorize misbehaviors into misbehaving classes. In addition, authors extracted the features of packets by performing experiments in NCTUns-5.0 simulator with various simulation scenario and calculated by nearby observer nodes. Also, they used WEKA to classify the misbehavior, with different classifier namely: Random Forest (RF), J-48, Naive Bayes, Ada Boost1, and IBK. Experiment result shows that RF and J-48 classifiers perform better compared to other classifiers. The RF and J-48 classifier gives better classification due to the boosting and bagging properties.

IV. MACHINE LEARNING MODELS AND TECHNIQUES IN VANET

In VANET, the primary goal is to provide each mobile node's safety and reduce the rate of accidents and data delivery latency. The instability of the network structure leads to routing issues. The data-rich environment in the VANET system leads to data congestion on RSUs. Many traditional prediction-based protocols have been devised for routing, traffic management, safety, and various specific purposes. However, none of them integrated a machine learning (ML) approach for further data analytics, which motivates the integration of machine learning models with conventional models to improvise the performance [15, 16]. Various techniques of machine learning such as Support Vector Machine (SVM), k-nearest neighbors (kNN), k-means clustering, Naive Bayes (NB), Convolutional Neural Network (CNN), and Artificial Neural Network (ANN) unfold such problems by analyzing the data flow in the VANET system [17]. Also, safety is one of the primary objectives of the intelligent transportation system. For safety provisioning, the essential aspect is to detect the objects and obstacles

on the road. The k-NN and CNN methods provide better performance for obstacle detection using visual data [18]. Data transmission in 5G-VANET requires Gbps links for which MillimetreWave bands are most suitable [19]. An appropriate beam selection using machine algorithms can be devised for data transmission by considering surrounding environmental features [20].

A. Attack Detection

Attack detection refers to abnormal activity detection in the VANET communication system. This misbehavior could be the flaw in the vehicular nodes, which leads to the dropping of data packets, false requests for resources, DDOS attack, etc. Misbehavior in communication can result in reduced PDR, low throughput, End-to-End Delay (EED), etc. The various progressive works on misbehavior detection in VANET system are discussed as follows. Using k-means clustering and classification algorithms, data obtained from vehicular node helps to predict the behavior of the surrounding nodes. Therefore, each node can decide as in which manner to interact with other nodes [29]. In VANET, the SQL injection attack is crucial as every vehicular node is connected to surrounding nodes, disturbing the entire network. For these, Long Short-Term Memory (LSTM) based SQL injection attack detection method is proposed [22]. Instability of the vehicular network increases network overhead when message copies are transmitted using the DTN algorithm. Machine learning can be applied to discriminate malicious intermediate node to increase data delivery [31]. The performance of networks and corresponding applications are severely affected due to misbehavior information in VANET. To detect this misbehavior data, Ghaleb *et al*. [23] used the feed forward and the back propagation ANN classification algorithm. The model consists of four phases: 1. data acquisition 2. Data sharing 3. Feature deriving 4. Model construction since the traffic flow of VANET yields temporal features, spatial and spatiotemporal features, Nie *et al*. [21] developed a method that uses CNN to extract some of the most significant features. The model then estimates the network traffic using the extracted features. A threshold-based approach tests the detection of the anomaly.. Shams *et al*. [86] proposed Trust-Aware Support Vector Machine (SVM) based Intrusion Detection System(TSIDS). The proposed approach uses the modified promiscuous mode with SVM to construct a precise trust value table (TVT) for intrusion detection and its prevention in VANET. In this method, in the packet forwarding route, every vehicular mobile node is allowed to examine the next hop to detect any malicious or defective hop that affects the packet routing system's performance. The examples of a

malicious or defective system are the intentional dropping of a packet, not receiving the packet, and delaying the packet forwarding. These malicious acts affect the EED and PDR. This work emphasizes the improvement of the performance of the system and compares its performance with the system without any defense mechanisms. ML-based Intrusion Detection System (IDS) with SVM is one of the approaches for curbing malicious attacks. Sharma *et al*. [22] proposed a Multi-cluster head IDS approach to detect malicious nodes. As per this approach, firstly, a cluster of the vehicle is formed, and a cluster head is assigned. Then the optimized SVM algorithm is deployed on cluster head to detect malicious nodes from the respective cluster. After removing malicious nodes from the cluster, other cluster heads are selected using Hybrid Fuzzy Multi-Criteria Decision Making (HF-MCDM) technique.

B. Routing

Routing refers to finding the optimal path for transmitting data from source to destination. Routing should be such that it requires less computing, and data reaches the target in the desired time limit. Various approaches to determine the efficient path for communication in the VANET system are discussed here.

SVM based routing algorithm for efficient communication, which is called Greedy Peer-to-Peer Network. Application Machine Learning Routing (GMLR). Features used for training the model are the distance between nodes, moving direction of nodes, and acceleration of nodes. It was observed that the packet delivery rate of the proposed routing algorithm was always higher than conventional routing methods. Routing algorithms used in VANET do not consider their previous experiences of network statuses such as congestion, misbehavior, and so forth. To resolve this, Laing *et al*. [18] developed a deep learning-based technique for efficient routing. Initially, routers calculate all possible paths from one node to the other. These paths are recorded as a 3D path matrix depending on the values like hop number, distance, and priority. These collected data are trained using deep CNN for making routing judgment, and packets are forwarded accordingly.

For efficient routing, the selection of appropriate neighboring vehicular nodes with the stable link is essential. Roscher *et al*. [21] applied Machine Learning algorithms like Multilayer Perceptron (MLP), k-NN, Decision Tree, and RF classifiers for estimation of the neighboring node. For these, they used a large dataset of message exchange samples obtained from simulated traffic in the detailed Luxembourg SUMO Traffic Scenario. Vehicle distance, linkage, received power, and heading difference is considered for identifying the channel's status.

V. Conclusion

In this paper, we provide insights into how Machine Learning techniques can be incorporated for efficient working of VANET. The survey is inspected based on different perspectives like safety, communication, and traffic. We have discussed in detail regarding the convergence of Machine Learning in VANET. Machine learning convergence with VANET is analyzed based on year-wise improvements and advancements in vehicular networks. We have explored various applications of the vehicular network such as Driver Assistance, Collision Alert, Misbehavior Detection, Routing, Traffic Monitoring, and Data Control of different perspectives, where Machine Learning concepts can be exploited. It turns out that neural network-related approaches are widely used in traffic management applications.

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Cyber Security in the Aspect of Data Privacy and User Data Control

Er. Parambir Singh[1], Aanchal Mittal[2]

[1]Assistant Professor, Department of Computer Science & Engineering
Amritsar College of Engineering & Technology, Amritsar, Punjab
[2]Tech. Scholar, Department of Computer Science Engineering
Amritsar College of Engineering & Technology, Amritsar, Punjab
Email: [1]parambirsingh@acetamritsar.org, [2]aanchalmittal98@gmail.com

Abstract—**In the information era, enormous amounts of data have become available which may include personal information, this data becomes vulnerable when passed on to the network. CYBER SECURITY is the concept that comes into the picture when we talk about the security of information or we can say it is required when data needs to be protected by the hacker's mind.**

Keywords: Cyber Security, Ethical Hacker

I. Introduction to Cyber Security

As the data around the world is increasing day by day, there are more chances of hacking. It is not only because of data but also because the increase in technological aspects is providing hackers with many ways through which they can easily attack data on the network. So here Cyber Security comes into the picture. Cyber security is generally the practice of defending computers, servers, mobile devices, electronic systems, networks, and data from malicious attacks. Cyber security focuses on protecting computer systems from unauthorized access or being otherwise damaged or made inaccessible. But the fact is that implementing effective cyber security measures is particularly challenging today as there are more devices than people, and attackers are becoming more innovative in terms of hacking one's data.

There must be effective data security and effective data security should adopt a set of controls, applications, and techniques that identify the importance of various datasets.

Cyber Security aims to reduce the risk of attacks and protect against the unauthorized exploitation of systems, networks, and technologies. The global cyber threat continues to evolve at a rapid pace, with a rising number of data breaches each year.

The data can be sensitive information, whether that be intellectual property, financial data, personal information, or any type of data for which unauthorized access could have negative consequences. So the data whether a piece of personal information or information related to any

Fig. 1

Fig. 2

organization must be protected and this protection is cyber security. There are many ways by which data can be protected.

II. Importance of Cyber Security

It protects personal, financial, intellectual, or any other type of data. With an increasing number of users, devices, and programs in the modern enterprise, combined with the increasing deluge of data much of which is sensitive should be protected so that no loss occurs hence cyber security plays the important role in protecting such information. It is important because it protects all categories of data from theft and damage. This includes sensitive data, personally identifiable information (PII), protected health information (PHI), personal information, intellectual property, data, and governmental and industry information systems. A normal consumer, who

is connected to the internet if not vigilant enough, can be trapped easily. Because it is just a matter of minutes to hack an internet-connected device and that is why Cybersecurity matters.
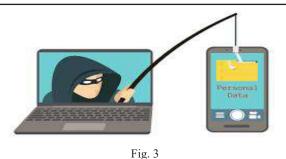
III. How Data is Being Attacked?

The attackers or you can say hackers are always active on the web. They are always on a path of targeting someone to make a profit out of it. Suppose a person is sending mail to his/her friend and has attached a keylogger with it and now when his friend opens it and click on the link the keylogger becomes active on the device and now all the activities are recorded as an exact pattern of keystrokes can be achieved and believe that it is just a 5% of what a hacker can do. A cyber attack can be launched from anywhere by any individual or group using one or more various attack strategies. People who carry out cyberattacks are generally regarded as cybercriminals. Often referred to as bad actors, threat hackers, they include individuals who act alone, drawing on their computer skills to design and execute malicious attacks. They can also belong to a criminal syndicate, working with other threat actors to find weaknesses or problems in the computer system that can be exploited for criminal gain. This is the reason that if you talk about any financial transaction your one of the perspectives at that time is that your information should remain secure. Today at present the banks keep this point on the peak that the data of the client must be secured so that no fraud can occur but the fact is that still a phishing attack is done where hackers just take your bank details via making a fake website which exactly looks like an original website.

Government-sponsored groups of computer experts also launch cyber attacks. They're identified as nation-state attackers, and they have been accused of attacking the information technology (IT) infrastructure of other governments, as well as non-government entities, such as businesses, nonprofits, and utilities.

Other financially motivated attacks are designed to disable the computer systems themselves, with cybercriminals locking computers so that their owners and authorized users cannot access the applications or data they need; attackers then demand that the targeted organizations pay them ransoms to unlock the computer systems.

Bad actors also launch attacks specifically to sow chaos, confusion, discontent, frustration, or mistrust. They could be taking such action as a way to get revenge for acts taken against them. They could be aiming to publicly embarrass the attacked entities or to damage the organization's reputation. These attacks are often directed at government entities but can also hit commercial entities or nonprofit organizations.

Sometimes hackers also do it for a thrill because they want to just make fun out of it and do not want any benefit

Fig. 3

from data but just to irritate the person they are just doing such kinds of attacks.

In an untargeted attack, where the bad actors are trying to break into as many devices or systems as possible, they generally look for vulnerabilities that will enable them to gain access without being detected or blocked. They might use, for example, a phishing attack where they email large numbers of people with socially engineered messages crafted to entice recipients to click a link that will download malicious code.

IV. Different Attacks on User Data

A. Malware

The importance of Cyber Security awareness increases because even emails from suspicious sites are not safe. Downloads or emails from some insecure sites carry ransomware, worms, spyware, and viruses that may compromise your security. There occur suspicious things when any malware enters the device like automatic deleting of files, which may lead a person to panic whose information is deleted.

B. SQL Injection

Seeing the technological advancement used for hacking in this kind, you will exactly understand why Cybersecurity is so important. Here, the hacker will put malicious code into an SQL-using server. This is generally done with an unsafe website search box. If this works successfully, the hacker gains access to target confidential information. Over here the hacker makes the database fool via inserting those conditions which will always remain true.

C. Phishing Attack

This is the most commonly used technique to attack the general public online. In this method, fake text messages and emails are sent to get access to the private information of a particular user. With more and more people getting into this kind of trap, the importance of Cyber Security in modern days increases. It is the most basic approach where hackers will take your information via using fake websites and it is one of the most dangerous attacks.

D. DOS Attack

These attacks are generally considered a nuisance but they enlighten us about what is the need for Cybersecurity. To exhaust the bandwidth, the hackers here drown a network with numerous requests.

E. Man-In-Middle Attack

To steal data, the attacker in this kind of attack places himself secretly in a two-party communication. The attacker here can even possibly alter the communication. MITM attacks are less common these days as most email and chat systems use end-to-end encryption which prevents third parties from tampering with the data that is transmitted across the network, regardless of whether the network is secure or not.
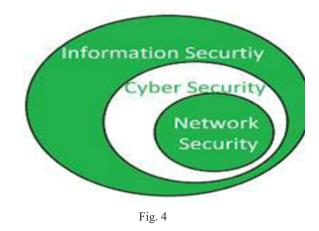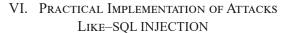
F. Drive-by Attack

A 'drive-by-download' attack is where an unsuspecting victim visits a website which in turn infects their device with malware. The website in question could be directly controlled by the attacker or one that has been compromised. These days exploit kits are available which allow novice hackers to easily set up malicious websites or distribute malicious content through other means.

V. Information Security is Part of Cyber Security

Cybersecurity is meant to protect against attacks in cyberspace such as data, storage sources, devices, etc. In contrast, information security is intended to protect data from any form of threat regardless of being analog or digital. Cybersecurity usually deals with cybercrimes, cyber frauds, and law enforcement.

Information security primarily refers to protecting the confidentiality, integrity, and availability of data, no matter its form. Information security can just as easily be about protecting a filing cabinet of important documents as it is about protecting your organization's database. One can say that cyber security is the subset of Information security.

Fig. 4

VI. Practical Implementation of Attacks Like–SQL INJECTION

SQL injection is a web security vulnerability that allows an attacker to interfere with the queries that an application makes to its database. It generally allows an attacker to view data that they are not normally able to retrieve. This might include data belonging to other users, or any other data that the application itself can access. In many cases, an attacker can modify or delete this data, causing persistent changes to the application's content or behavior.

Fig. 5

A successful SQL injection attack can result in unauthorized access to sensitive data, such as passwords, credit card details, or personal user information. Many high-profile data breaches in recent years have been the result of SQL injection attacks, leading to reputational damage and regulatory fines. In some cases, an attacker can obtain a persistent backdoor into an organization's systems, leading to a long-term compromise that can go unnoticed for an extended period. For this, in the password field, one has to write command such that it always remains true. For this, I tried to choose the SQL command which always remains true and doesn't tell which web page you are doing with.

For this one can also design or implement his/her query in SQL which would always remain true.

This condition would always remain true and it doesn't matter how much worse the situation is. It tries to make the password field true which pretends that the actual password has been added.

Steps To Implement Sql Injection

STEP 1: Visit the web page on which you want to have SQL INJECTION.

STEP 2: Open the admin login page for entering in ADMIN mode.

STEP 3: Once the login mode opens now in username type admin

STEP 4: In the password field type the command as:

VII. SQL Query Different Steps For Security

1. Always keep your data secured with a strong password so that it is difficult to crack the password by a hacker
2. Keep your device firewall ON always so that

malicious activities can be stopped to enter your device

3. One can secure their device using anti-virus
4. One must update the device from time to time
5. One must work on a virtual private network to have a more secure end

VIII. Conclusion

The data is all around needed to be secured either personal or organizational, it must be secured in all terms like having strong passwords, VPN, Firewall, etc. This ensures that yes your data is secured. In terms of any organization, they must have protection against internal threats like privilege abuse, external threats like phishing attacks, and software threats like the disruption of any hardware component. Hence one can conclude that having data does not mean that it needs not to be secured, it is a serious term for any individual because a small mistake in securing data can lead to the loss of huge amounts.

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Soft Computing Technique based Fault Detection and Diagnosis in Three Phase Induction Motor

G. Jegadeeswari[1], B. Kirubadurai[2], Dr. T. Sasilatha[3]

[2]*Assistant Professor, Dept of Aeronautical Engineering*
Vel Tech Dr. Rangarajan Dr. Sagunthala R&D Institute of Science & Technology
Chennai, India
[1,3]*Professor, Dept of Electrical and Electronics Engineering, AMET Deemed to be University*
Chennai, 603112, India
Email: [1]jegadeeswari.dharan@gmail.com, [2]bkirubadurai@gmail.com, [3]Sasilatha08@gmail.com

Abstract—Because of their reliability, low price, roughness and simplicity of control, induction engines have now been widely adopted. Especially in industrial applications, the induction motor is considered a fault tolerant machine. The main focus of this work is to show the importance of induction engine failure detection and diagnosis. Fault detection and diagnosis of an induction engine against feasible problems such as under voltage, overvoltage, overload overcurrent, and over temperature are very useful in the current scenario and to protect the engine against terrible damage. The paper proposed a number of SVPWM schemes to improve the Voltage Source Inverter's output (VSI) and Neural Network Predictive Controller (NNPC) is used to detect and assess the fault and its frequency. The objective of this paper is to study the effects of induction motor fault. The model of a three phase induction motor developed in MATLAB Simulink software.

Keywords— PWM techniques; VSI; Sensor; fault; NNPC; diagnosis; MATLAB/Simulink.

I. Introduction

The induction engine now plays an essential role in industrial applications. It offers reduced expense and simpler maintenance compared to the DC machine. But induction engine speed management is more complicated, which makes it non-linear. Speed variation for this type of machine may thus be performed by using the net frequency of supply. The frequency of an electronic supply till current electronics was established is not efficient and straightforward.

On the contrary, electricity consumption is either DC or AC in the case of electric traction. The three-stage DC/AC inverter is the only interface available due to the flexible voltage and frequency fluctuations. As mentioned above, the three-phase DC/AC convertor used in traction supplies power in AC or DC.

For AC, the correcting units are connected directly to the three phase DC/AC converter by an up/down transformer and AC / DC. The issue with the induction motor is to develop a control unit that ensures a broad
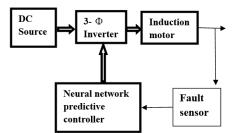

Fig. 1: Overall Block diagram of Proposed Technique

range of speed points for a 3-stage system and motor movement.

The present task is to regulate the engine speed through a change in its benchmark and diagnosis of engine problems. To regulate a motor speed, the prediction controller is constructed. The NNP controller stabilizes the controlled system effectively and precisely accomplishes its tracking objectives.

II. Methodology

Figure 1 illustrates the block schedule of the planned work on the predictive control device for the neural network to identify and diagnose the problem. The schematic of the block contains a DC power source paired with an IGBT 3-phase inverter fed to a motor. An NNP controller is used to activate the pulse of the inverter switch. For the speed of the induction engine a constant (V\F) ratio is maintained by adjustment of the inverter trigger pulse.

In this instance, the inverter is an IGBT inverter in three phases that may lower the output voltage and increase it, as necessary. The use of the inverter assigns the functioning of the induction machine even in low load scenarios.

Neural network prediction controllers are employed in the intelligent controller as illustrated by figure 1, which includes the benefit of the management of any sort of self-tuning capability, information and self-learning, imitating human decision making, self-organizing, etc.

III. Space Vector Modulation

The SVPWM method has three instantaneous reference voltages, the d-axis voltages and the q-axis voltages. The unreal period of switching from the immediate values of the reference phase voltages can be set as

$$V_\alpha + jV_\beta = \frac{2}{3}\left(V_a + e^{\frac{j2\pi}{3}}V_b + e^{\frac{-j2\pi}{3}}V_c\right) \tag{1}$$

Realization of Space Vector PWM

- Step 1. Determine V_d, V_q, V_{ref}, and angle (α)
- Step 2. Determine time duration T_1, T_2, T_0
- Step 3. Determine the switching time of each transistor (S_1 to S_6)

With one zero vector and two active, Vref can be initiated. Vref may be situated with V0, V1 and V2 for sector 1 (0 to α-3). Vref can be viewed according to the duration:

$$V_{ref} * T_c = V_1 \frac{T_1}{T_c} + V_2 \frac{T_2}{T_c} + V_0 \frac{T_0}{T_c} \tag{2}$$

$$V_{ref} = V_1 T_1 + V_2 T_2 + V_0 T_0 \tag{3}$$

The total cycle is given by:

$$T_c = T_1 + T_2 + T_0 \tag{4}$$

The magnitude and angle of location of Vref, V1, V2 and V0 may be explained:

$$V_{ref} = V_{ref} r^{j\theta} \tag{5}$$

$$V_1 = \frac{2}{3}V_{DC} \tag{6}$$

$$V_2 = \frac{2}{3}V_{DC}e^{\frac{j2\pi}{3}} \tag{7}$$

$$V_o = 0 \tag{8}$$

$$T_c = \binom{\cos\theta}{\sin\theta} T_1 \left(\frac{2}{3}\right) V_{DC} \binom{1}{0} + T_2 \left(\frac{2}{3}\right) V_{DC} \binom{\cos\left(\frac{\pi}{3}\right)}{\cos\left(\frac{\pi}{3}\right)} \tag{9}$$

This division into real and imaginary components simplifies the computation for each duration:
Real part:

$$T_c V_{ref} \cos\theta = T_1 \left(\frac{2}{3}\right) V_{DC} + T_2 \left(\frac{1}{3}\right) V_{DC} \tag{10}$$

Imaginary part:

$$T_c V_{ref} \sin\theta = T_2 \left(\frac{1}{\sqrt{3}}\right) V_{DC} \tag{11}$$

T1 and T2 are then given by:

$$T_1 = T_c \frac{\sqrt{3}V_{ref}}{V_{DC}} \sin\left(\frac{\pi}{3} - \theta\right) \tag{12}$$

$$= T_c.a.\sin\left(\frac{\pi}{3} - \theta\right) \tag{13}$$

$$T_2 = T_c \frac{\sqrt{3}V_{ref}}{V_{DC}} \sin(\theta) \tag{14}$$

$$= a.\sin(\theta) \quad 0 < \theta < \frac{\pi}{3} \tag{15}$$

IV. Fault Detection Methods

This section contains numerous types of defective detection methods offered for identification of rotor defects of a three-phase cage induction engine. Current motor analyses, acoustic noise measurement techniques, artificial intelligence and network based techniques, noise and vibration monitors, electric magnet field monitoring techniques using search coils, or coils wounded in the form of motor shafts (axial flux detection), temperature measurement techniques, infection control techniques, etc. are the most frequently used methods of detection.

Mathematical models are used for almost all of the following ways to detect mistakes and analysis of the three-phase induction motor. The mathematical model of a squirrel cage induction engine with a rotor defect is particularly challenging due to its enormous number of differential equations. This research attempts to determine the effect of a partly and fully-rotor-breaching bar failure utilizing a three-phase Squirrel Cage Induction motor using the Neural Network Method.

V. Controller Design

A. Neural Network Predictive Controller

In order to predict future results for a non-linear model, the controller leverages a neural network. The controlled inputs are derived using the NNP controls that increase system performance over a given time horizon. The initial part of the predictive management is the assessment of the neural network system model. The second phase is the use of the system model to forecast future performance using the prediction controller for the particular system. The NNP controller uses the previous input and output to forecast future system values. The Neural Network System model is given in Fig. 2(a).
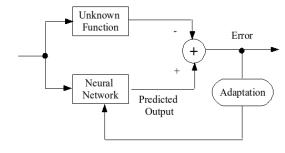

Fig. 2(a): Structure of NNP Controller

The NNP control technique is to calculate the future response of the system and to remove the costs utility based on an error between the predicted system reaction

Fig. 2(b): Neural Network Predictive Control
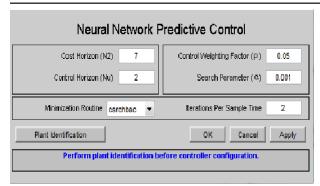

Fig. 2 (c): Plant Identification for Neural Network Predictive Controller
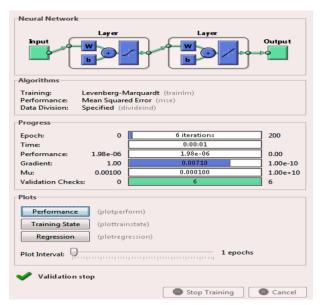
Fig. 2(d) Plant Identification
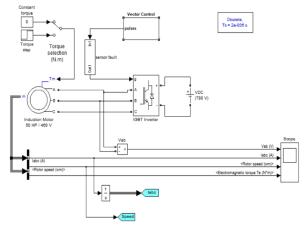
Fig. 3(a): Overall Circuit Diagrams of the Proposed Systems
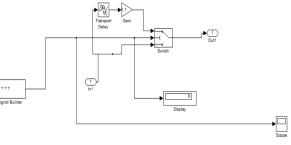
Fig. 3(b): Sensor Fault

and the reference path. The pricing utility for optimum control of the non-linear system which might differ from instance to example.

For training with a vast amount of data neural network is utilized. The network is much easier than any other system to train. The rest of the parameters are determined by the system needs. Most importantly, the network training and engine speed management. The various needs for the system model are shown in Figure 2(d).

VI. RESULTS AND DISCUSSION

In the following figures, the results of Matlab/ Simulation are displayed. For the suggested MATLAB/ SIMULINK version, simulation is carried out.

Figure 3(a) shows the Simulink model of proposed system. Figure 3(b) shows the Simulink model of sensor fault block. Figure 3(d) shows the output waveform after fault detection and diagnosis. Figure 3(c) shows SVPWM with Neural Network Predictive Controller. For simulation results achieved under varied operating circumstances the reference value speed is chosen 500 rpm.

VII. CONCLUSION

In this article, fault detection and the triphase induction engine is diagnosed by utilizing a predictive neural network controller. With a broad view, neural network predictive controller enhances the overall drive
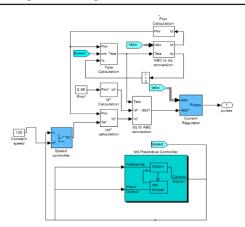
Fig: 3(c): SVPWM with Neural Network Predictive Controller
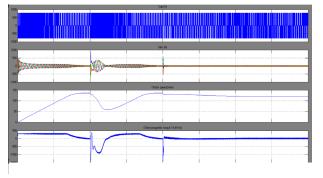
Fig. 3(d): Output Waveform after Fault Detection and Diagnosis

performance under diverse operating situations. The controllers were explicitly constructed to genuinely fulfill the diagnostic error performance in the rotor and were developed to achieve appropriate reference to the rotor speed throughout a broad range of reference speed variations. The results of a simulation study were confirmed.

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Situational Awareness for Internet of Vehicles (IoV) in IoT Environment

Naveen Joshi[1], Dr. Harpreet Kaur[2]

[1]Assistant Professor, Doaba College, Jalandhar, Research Scholar, Sant Baba Bhag Singh University
[2]Associate Professor, CSE, Sant Baba Bhag Singh University, Jalandhar, Punjab, India
Email: naveenjoshi84@gmail.com

Abstract—Due to the development of smart cities, security of smart cities is essential topic in term of making a secure smart city. The aim of this article is to provide NSSA based approach for IoT based smart city. Moreover this article also describes the concept of IoT and IoT based smart cities. Various applications of smart cities also explained with the help of example. Impact of NSSA on network security of IoT based smart cities also discusses. Some challenges associated with cyber security of smart cities also explained to some extent. Furthermore various aspects of security of gadgets used in smart city also explained. Some challenges associated with the implementation of IoT based smart cities also discussed in this paper.

Keywords: Internet of Things (IoT), Internet of Vehicles, SA(Situation Awareness), NSSA (Network Security Situation Awareness), Smart City

I. Introduction

As per the report submitted by UN that by 2050 population of world is likely to double and reach nearly 6.7 billion. As population increases various problems comes to cities. So IoT play a important role in prevention from traffic problem, environment problem, urban crime etc. Smart cities are created to improve the sustainability and quality of life of people living and working in the city. Nowadays many smart systems are implemented in smart cities, so the securities of these smart systems have become a major challenge that requires effective counter measures. IoT act as a backbone for smart cities. IoT based smart cities includes various elements like communication protocol, communication technologies, sensors, computations and semantics.[1] The main feature of IoT based smart city is to include a high level of integration of information technology with information resources. This research paper is divided into six sections. First section is the introductory section which gives some detail about the popularity about IoT based smart cities. Second section focused on IoT for Smart cities. Various aspects of IoT (Internet of Things) will discussed in this section. Third Section gives us the detail of security issues related to the implementation of smart cities. Fourth section told us the brief overview of Network Security Situational Awareness (NSSA). Basic architecture of situational awareness is discussed under this section. Fifth Section gives us the information regarding some challenges, which comes during the implementation phase of smart city. Sixth section concludes the paper.

II. IoT for Smart Cities

The term IoT refers to the extensive growth of number of digital devices. These digital devices can interact with each other with the help of network/internet and can be remotely monitored and controlled. The IoT for smart cities is to install sensors like RFID, IR, and Scanners etc. The IoT things have the ability to communicate with other things of smart city without human intervention. The logic of IoT is to provide the internet with more productivity [2]. Following are the actual IoT applications for smart cities.

Fig. 1: IoT Applications for Smart Cities

A. Road Traffic

For sake of security of people of smart cities, municipal corporations of smart cities implement smart traffic solutions. Smart traffic solutions fetch data from GPS enabled smart phones of drivers and determine the

location and speed of vehicle. In IoT based smart cities traffic management system several components such as RFID Readers, wireless sensors etc are installed to observe the movement of vehicles. GIS based tools are used to monitor the real time traffic.

B. Smart Parking

IoT enabled parking system continuously monitors and check the availability of parking space. The smart parking system helps the user to know the availability of parking space real time. It allows the end user to check the availability of parking space and book the parking space according to the availability of parking space.

C. Smart Street Lighting

This system allows to remotely controlling street lights while keeping track of electricity consumption. The smart street lighting system provides surety to reduce energy by dimming and brightening the light remotely depending upon the weather conditions at that time.

D. Waste Management

In IoT based waste management system, a full day monitoring system is designed for monitoring waste. A smart and organized system is designed for selective clearing. The Infrared sensor is used for measuring the level of waste in the dustbin. IR sensor and moisture sensor is used for separating wet and dry waste.

E. Public Safety

The IoT for public safety market is segmented on the basis of components (platform, solution, and services), applications, vertical markets, and regions. The platform segment of IoT for public safety market includes device management, application management, and network management. The IoT platforms enable central monitoring and control of each activity that takes place in organizations across the verticals.

III. SECURITY ISSUES FOR INTERNET OF VEHICLES

Smart cities are the future of city life but harnessing the power of three Ds i.e digital technologies, data, and design thinking to boost the efficiency and effectiveness of city services. However, this new wave of digital transformation also brings new cyber risks that could fundamentally impact the existence of smart cities. Cyber threats have been on the rise for years, but the last few years have seen an explosion in cyber attacks that target both data and physical assets [6]. IoT can act as a backbone for various applications and services in various domains. There are so many issues related to smart cities especially when we talk about IoT enabled smart cities. The main issue is of security and privacy of data [3]. IoT security is a growing concern in today's scenario. The

personal information collected at various sensors can aid criminals in stealing the identity of particular person.
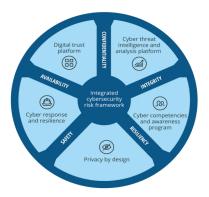
Fig. 2: Smart City Network Risk Frame Work [6]

Above figure shows us an integrated cyber risk framework which can provide smart cities with to incorporate into their smart city planning, design, and transformation stages. It also consist of industry standards, legal, and regulatory requirements which are useful to determine how cyber risk may affect all the ecosystem participants, including users, government, services, infrastructure, and processes, as well as assess each system's and asset's influence on each other.

Security issues for smart cities broadly categorized into following points [4].

A. Confidentiality

In confidentiality no unauthorized user can access the data to be used by two sensors. If unauthorized user can able to access the contents of a message the confidentiality get compromised.

B. Authenticity

Only the authentic user can access the data, users have to show their authenticity by producing some identities. This concept authenticate that the origin of message is correctly identified.

C. Integrity

Integrity means the content of the message to be transacted are not modified even if the content of the message access by some unauthorized access.

D. Availability

Availability means the network is always available for authorized users to access the data as per their requirement.

IV. NSSA

Network security situational awareness is a new technique to solve security issues of computer network. It helps the user to analyze the actual security situation of their networks [5]. Dependency on the cyber space has increasingly increased the need of situational awareness. The network that operates on cyber world has vulnerabilities. Due to these vulnerabilities there is always a risk of security for organizations. The term situational awareness is important in various operations of cyber security. Situational Awareness is defined as: "*Within a volume of time and space, the perception of an enterprise's security posture and its threat environment; the comprehension/meaning of both taken together (risk); and the projection of their status into the near future.*" [CNSSI 4009]. The NSSA model defined by Mica Ensley works on perception, comprehension, projection and resolution to the OODA loop of "observe, orient, decide, and act." These models are good for understanding the concept of situational awareness but their practical implementation to cyber security is not always evident.

Perception perceives the critical factors in the environment that are important to a particular decision-maker. It consists of identification and valuation of the status, attributes and dynamics of the relevant factors over time and space based on the data collected from different sources in the environment.[7]

Comprehension comprehends what the factors from layer 1 mean. Comprehension consists of integration and correlation of disjointed elements that need to be used in the context of the decision-makers role to make a sound decision. [7]

Projection projects the understanding of the situation into the future to predict the impact of those elements in the context of the decision-maker's view future decision. Projection involves management of the knowledge of the status and dynamics of the factors and comprehension of the elements characterizing the situation (both layer 1 and layer 2) to predict what will happen in the environment within a period of time. [7].

Situational Awareness work in following domains of network security:

Fig. 3 : Various Domains of Situational Awareness

V. Challenges

The main challenges of implementing IoT in smart cities are computational attacks, listening attacks, broadcasting attacks etc. Dealing with cyber attacks is another big problem in implementing IoT based smart cities. It is not an easy job to monitor the security attacks because sensor devices are not resource limited. Many security challenges act as an obstacle in the implementation of IoT devices in smart cities; solutions for these constrained devices are needed. Avoiding the concept of redundancy is a major key to continuously provide smart services despite the existence of attacks and failures. Therefore, the infrastructure must operate and recover efficiently from security attacks. Moreover it must adapt to novel attacks that were unknown during deployment [8]. IoT based smart objects interact with other components such that proxies, mobile devices, and data collectors, data sharing and other activities in the context of the available service. Moreover such components contribute to address various societal challenges and provide new advanced services for users but their limited processing capabilities make them vulnerable to security and privacy threats [9].

VI. Conclusion

In conclusion, the fundamental aspects of security of smart city especially cyber security is controlling access and monitoring the environment, and respond according to incidents or situations when they occur. In the IoT based smart city, security can be delivered by using Situational Awareness and respond to the threat level detected rather than by designing a model with the expectation of threat being able to withstand any and all attacks. Situational Awareness in Cyber Security is not any single product; it is a philosophy that has to be realized by the intelligent use of the products and processes that encompass the information systems network. On future research we have to create a situational awareness based model using semantic web for the secure implementation of IoT devices in smart city.

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A Study on Biometrics

Er. Sahil Luthra[1], Muskaan Sachdeva[2]

[1]*Assistant Professor Student, Department of Computer Applications, Amritsar Group of Colleges*
PTU, Kapurthala, Punjab, India
[2]*Department of Computer Applications, Amritsar Group of Colleges, PTU, Kapurthala, Punjab, India*

Abstract—**Biometrics is the utilization of biological characteristics (face, iris, and fingerprint) or behavioral traits (signature, voice) for identity verification of an individual. Biometric authentication is gaining popularity as more trustable alternative to password based security systems as it is comparatively hard to be forgotten, stolen, or guessed. On the other hand, biometric data which can uniquely identify a person (e.g. fingerprints, iris patterns) can be used to track individuals, linking many separate databases (where the person has been, what he has purchased etc.), which raises privacy concerns.**

Keywords: Working, Security, Database Collection, Future Work

I. Introduction

Biometrics is a technology that uses the unique patterns of physical or behavioral traits of users for authentication or identification. With biometric scanners on smartphones and other devices becoming more prevalent, as well as a growing number of services calling for high security and good customer experience, traditional methods of authentication (e.g., passwords and PINs) are increasingly being replaced by biometric technology.

While the earliest accounts of biometrics can be dated as far back as 500BC in Babylonian empire, the first record of a biometric identification system was in 1800s, Paris, France. Alphonse Bertillon developed a method of specific body measurements for the classification and comparison of criminals. While this system was far from perfect, it got the ball rolling on using unique biological characteristics to authenticate identity. Fingerprinting followed suite in the 1880s, not only as a means of identifying criminals but also as a form of signature on contracts. It was recognized that a fingerprint was symbolic of a person's identity and one could be held accountable by it. Through there are debates on who exactly instigated fingerprinting for identification, Edward Henry is denoted for the development of a fingerprinting standard called the Henry Classification System. This was the first system for identification based on the unique architectures of fingerprints. This system was quickly adopted by law enforcement replacing Bertillon's methods becoming the standard for criminal identification. This began a century's worth of research on what other unique physiological characteristics could be used for identification.

Fig 1: Biometrics

The term biometrics refers to the emerging field of technology devoted to the identification of individuals using biological traits or behaviors. In practice, this means capturing an image of a unique feature of an individual such as a fingerprint, hand, eye or face, and comparing it with a template captured previously. For ease of explanation this has been over-simplified, but in essence this is how biometric technology works.

II. How Biometrics Works?

Authentication by biometric verification is becoming increasingly common in corporate and public security systems, consumer electronics and point-of-sale applications. In addition to security, the driving force behind biometric verification has been convenience, as there are no passwords to remember or security tokens to carry.

There's no denying that biometrics seems complicated, but in reality, all biometrics systems use the same three steps:

Enrollment: The first time a biometric system is used, it records basic information about you. This could be your name or an identification number. It will then capture an image or record a specific trait.

Storage: Instead of storing the complete image or recording, the trait that was recorded is analyzed and translated into a line of code or a graph.

Comparison: The next time you encounter the system, it compares the trait you present to the information it has
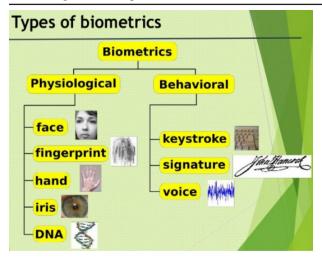
Fig. 2: Types of Biometrics

Fig. 3: Face Recognition

identity by matching images to those images that been stored in database.

There are four main methods being used for facial recognition:

- Eigenfaces: a tool developed by MIT that extracts characteristics through the use of two-dimensional grayscale imagery.
- Feature Analysis (also known as Local Feature Analysis (LFA)): is the most widely used technique because of its ability to accommodate for facial changes and aspect. LFA uses an algorithm to create a face print (84 bytes in size) for comparison.
- Neural network: a method that extracts features from the face and create a template of contrasting elements that is then matched to a template in database.
- Automated Face Processing (AFP): a technique that looks for distances and ratios between certain facial features, and is more ideal for poorly lit areas.

B. Fingerprint Recognition

Fingerprint Recognition includes taking a fingerprint image of a person and records its features like arches, whorls, and loops along with the outlines of edges, minutiae, and furrows.

There are three methods for scanning finger prints:
1. Optical scanners,
2. Thermal scanners and
3. Capacitance (solid state) scanners.

Currently, there are two accepted methods for extracting the fingerprint data
1. Minutia-based and
2. Correlation-based

"Minutia-based is the more microscopic of the two. This method locates the ridge characteristics (branches and endings) and assigns them a XY-coordinate that is then stored in a file.

The correlation-based method looks at the entire pattern of ridges and valleys in the fingerprint. The location of the whorls, loops and arches and the direction that they flow in are extracted and stored. Neither method actually keeps the captured image; only the data is kept, therefore making it impossible to recreate the fingerprints."

stored on file. The system will then either accept or reject who you claim to be.

There are also three main components to all biometric systems:
1. A sensor that detects the characteristic used for identification
2. A computer that reads and then stores this information
3. Software that analyzes the characteristic, converts it into a graph or a line of code, and begins the actual comparisons

III. Types of Biometrics

Biometrics isn't a one-size-fits-all type of technology. There are many ways biometrics is used to identify if a person is really who they say they are. A biometric identifier typically falls into two categories: physical identifiers and behavioral identifiers.

A. Face Recognition

A face recognition system is one type of biometric computer application that can identify or verify a person from a digital image by comparing and analyzing patterns. These biometric systems are used in security systems. Present facial recognition systems work with face prints and these systems can recognize 80 nodal points on a human face. Nodal points are nothing but endpoints used to measure variables on a person's face, which includes the length and width of the nose, cheekbone shape, and eye socket depth. A facial recognition system will use biometrics to map the face and compare it with a database to find a match.

The first step in the face recognition is to obtain an image of an individual and store it in a database for later use. Usually, several pictures (or video images) at different angles are taken. Individuals may also be asked to make different facial expressions for the data base. Next, the images are analyzed and extracted to create a template. The last step is to verify the individual's

Fig. 4: Fingerprint Recognition
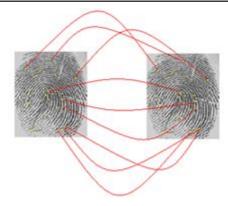

Fig. 5: Hand Geometry

Once the scanning is complete, the analysis is done by a comparison of several features of the fingerprint know as minutia. Investigators are systems look at where the ridge lines end or where one ridge splits into two (bifurcation). The scanning system uses complicated algorithms to recognize and analyze the minutia. If two prints have three ridge endings, two bifurcations, and form the same shape with the same dimensions, then it is likely the same person's fingerprints.

These systems use a digital camera and light. Once a user places their finger on the flat surface, the software aligns the print against several pegs to ensure a correct reading. There are over 30 specific points (called minutiae) in a fingerprint that a scanner will obtain for identification.

C. Hand Geometry

Hand geometry is concerned with measuring the physical characteristics of the user's hand and fingers and it is believed to be sufficiently unique for use as a means of biometric authentication. The technology records various dimensions of the human hand, it is relatively easy to use, and offers a good balance of performance characteristics. Reader configurations vary among a softball-shaped device which the subject grabs in his hand and a flat plate which the subject places his/her hand, a bar which the subject grabs as if opening a door, and a flat plate which the subject places his/her hand on.

Hand geometry readers are developed in a wide range of scenarios, including time and attendance recording where they have proved extremely popular. The methodology may be suitable where there is a large user base or there are users who access the system infrequently. Accuracy can be very high if desired.

Hand geometry readers are relatively large and expensive but the ease of integration into other systems and processes, small template size (only 9 bytes for pure hand geometry template) and ease of use makes it a good choice for many projects.

Fig.6: Iris Recognition

D. Iris Recognition

Iris-recognition is a biometric technology which deals with the recognition based on the human Iris. Iris-recognition technology is considered to be the most accurate biometric technology available today. The Iris is an inner organ of the body which is observable, or it is the area of the eye wherein the colored or pigmented circle, which is generally blue or brown, rings the dark purple area of the eye. No two irises are alike, not even in one individual or in identical twins. The iris consists of over 400 distinguished characteristics. Compared to the 40 or 50 points of distinct fingerprint characteristics, the iris has more than 250 distinct features. Therefore, iris scanning is much more accurate than fingerprints or even DNA analysis of the distinguishing features. With video technology, a camera scans the iris pattern, which consists of corona, pits, filaments, crypts, striations, and radial furrows (page). The system software then digitizes the unique information of the iris and stores it for authentication at a later time. Iris scanning is easy, accurate, and convenient. One significant downfall of Iris recognition is the initial startup costs as they are extremely high.

In identifying one's Iris, there are two types of methods that are used by Iris identification systems, passive and active. The active Iris system method requires that a user be anywhere from six to 14 inches away from the camera. It also requires the user to move back and forth so that the camera can adjust and focus in on the user's iris. The passive system allows the user to be anywhere from one to three feet away from the camera(s) that locate and focus in on the iris.
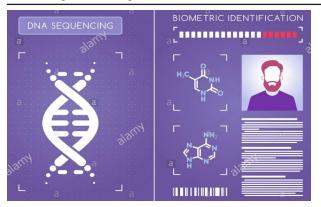
Fig.7: DNA Scanning

This technology's main uses are for authentication, identification, and verification of an individual.

E. DNA Scanning

DNA scanning is the identification of someone using the analysis of specific segments from their DNA. This can be anything from a hair follicle to a drop of blood. DNA scanning is an up-and-coming type of biometrics and is used primarily in law enforcement to identify suspects.

DNA is an increasingly useful biometric, and is encountered most often in forensics and healthcare.

For forensics, current DNA identification technologies measure short tandem repeat sequences (STRs) in the nuclear or mitochondrial DNA. The chosen STR sequences (typically 13 or more) are not linked to any known genetic characteristic, but vary from person to person in accordance with well-known population statistics. For this reason, measuring the lengths of these STRs provides a highly accurate and easily stored attribute that can be compared to others for potential identification, lead generation, exclusion, or family matching of an individual or individuals.

Determining the lengths of the STRs in a DNA sample involves some fairly advanced chemistry and associated processes. Before the advent of rapid DNA identification technology, this work was confined to certified laboratories with trained technicians and six different specialized laboratory instruments. Results usually came back after several days. Recent rapid DNA identification technologies have reduced this process down to one portable desktop instrument with automated processing taking about 90 minutes. A feature of DNA identification, unique among the biometrics, is the ability to infer familial relationships via DNA testing. Through comparison of STRs, DNA technologies can confirm or deny blood relationships – an extremely valuable tool in scenarios such as missing person and disaster victim identification, lost-child and counter-human-trafficking applications, paternity and

Fig. 8: Signature Recognition

maternity testing, and determinations of eligibility for immigration benefits.

It's also the only biometric process that can link a person to relatives, providing specific information about a person. Another major perk: the results of a DNA test can be available in as little as 90 minutes.

F. Signature Recognition

Signature recognition is one type of biometric method used to analyze and measure the physical activity of signing like the pressure applied, stroke order and speed. Some biometrics are used to compare visual images of signatures. Signature recognition can be operated in two different ways, such as static and dynamic.

In this case, more emphasis is given on the behavioral patterns in which the signature is signed than the way a signature looks in terms of graphics.

The behavioral patterns include the changes in the timing of writing, pauses, pressure, direction of strokes, and speed during the course of signing. It could be easy to duplicate the graphical appearance of the signature but it is not easy to imitate the signature with the same behavior the person shows while signing.

This technology consists of a pen and a specialized writing tablet, both connected to a computer for template comparison and verification. A high quality tablet can capture the behavioral traits such as speed, pressure, and timing while signing.

During enrollment phase, the candidate must sign on the writing tablet multiple times for data acquisition. The signature recognition algorithms then extracts the unique features such as timing, pressure, speed, direction of strokes, important points on the path of signature, and the size of signature. The algorithm assigns different values of weights to those points. At the time of identification, the candidate enters the live sample of the signature, which is compared with the signatures in the database. It is used in document verification and authorization. The Chase Manhattan Bank, Chicago is known as the first bank to adopt Signature Recognition technology.

G. Voice Recognition

Voice recognition technology is used to produce speech patterns by combining behavioral and

Fig. 9: Voice Recognition

physiological factors that can be captured by processing speech technology. The most important properties used for speech authentication are nasal tone, fundamental frequency, inflection, cadence. Voice recognition can be separated into different categories based on the kind of authentication domain, such as a fixed text method, in the text-dependent method, the text-independent method, and conversational technique.

Voice recognition biometric modality is a combination of both physiological and behavioral modalities. Voice recognition is nothing but sound recognition.

IV. How Biometrics Data is Collected?

In addition to biographic data, many ID systems collect fingerprints, iris scans, facial images, and/or other biometry to use for **biometric recognition**—automatic recognition of individuals based on their biological or behavioral characteristics. This process involves comparing a template generated from a live biometric sample (e.g., a fingerprint or selfie) to previously stored biometric(s) to determine the probability that they are a match.

Biometric recognition encompasses both **biometric identification**—the process of searching against a biometric enrollment database to find and return the biometric reference identifier(s) attributable to a single individual (i.e. 1:n)—and **biometric verification**—the process of confirming a biometric claim through biometric comparison. These processes can be used to perform two distinct tasks in foundational ID systems:

Deduplication of identity records: To ensure that each person in a database is unique, ID systems can use biometric identification perform a duplicate biometric enrollment check. This involves comparing a template generated from a captured biometric against all or a subset of templates stored in biometric database to detect a duplicate registration, after which the new template is added to the database. This process involves automation as well as manual checks to adjudicate matches.

Authentication of individuals: Some authentication protocols require biometric verification of the user. This involves a one-to-one comparison of a template generated from a captured biometric against a single stored template (e.g., one stored on an ID card or mobile phone, or in a database).

Biometric recognition has rapidly proliferated in modern ID systems in part because it is currently the most accurate and efficient technology available for deduplicating large populations to ensure statistical uniqueness---particularly in countries without existing authoritative sources of identity information---and because it can provide a relatively high level of assurance during authentication. As such, biometrics can be a key ingredient in ensuring the trustworthiness of ID systems.

A. What is Biometric Authentication?

Simply defined, *biometric authentication is the use of unique characteristics of a person's body or behaviour to verify identity.* It can be used to control access to technology, buildings or services. The types of characteristics that can be used for identification can be broadly categorized into physical characteristics including fingerprints, eye scans and face recognition, and behavioural characteristics including voice recognition, keystroke patterns and engagement patterns. Fingerprint authentication is the most popular method, although facial and voice recognition is becoming more common in certain sectors such as crime prevention and travel.

Biometric technology offers a very high level of detection and security. This is because a fingerprint, iris scan or voice cannot easily be duplicated or falsified. Using a biometric means of authentication is less time consuming, dependable (you can't forget your finger), user-friendly and requires almost no training. Biometrics can be used to automate processes such as recording employee hours, which are prone to falsification and error.

B. Can you Fake it?

You may well ask, however, if it is possible to use the fingerprint of someone who is deceased, create a false face or imitate someone's voice. The simple answer is no because biometric scanners have liveness detection built into them. Liveness detection is any technique used to detect a spoof attempt by determining whether the source of a biometric sample is a live human being or a fake representation. This is accomplished through algorithms that analyse data collected from biometric sensors to determine whether the source is live or reproduced.

C. Capturing Biometric Fingerprint Data

When storing, processing and using biometric data for authentication, the first stage is the capture of a person's fingerprint. Once a piece of biometric data is captured

it cannot be amended. Unlike a password, you can't forget your fingerprint or voice. Once this data has been captured, it is then analysed and converted into a biometric template. This is a binary mathematical representation of the original fingerprint based on an analysis of the minutiae – usually endings and bifurcations of ridges. This template cannot be backwards engineered into a picture of a fingerprint.

Storing Biometric Data: A hardware-based recognition system is where the data is stored on a specific piece of hardware and works with the device to recognise the data, without storing the data on the device itself. This offers a fast response during user authentication as the biometric templates are stored locally and the recognition system does not require any external response.

A Portable Token System: A Portable Token System uses a fob or a smart card to store biometric data. This means that your fingerprint, once captured, is stored within the token. The benefits of storing biometric data on a portable token are that it doesn't need to be transferred over a network for verification purposes, and so this reduces the risks that can come with network-related vulnerabilities. When using this method, the user will need to present their card or fob and then their biometric data as a two-step authentication process.

Biometric data can also be stored on an end user's device. This is most common on smartphones that use touch ID fingerprint sensors, such as Apple's iPhone. On-device storage can be used to store biometric data through a chip that holds the data separately to the device's network. Many of the new biometric bank cards which have been trialled in the last few years work using this system. When storing the data on the authentication device itself, the organisation implementing the biometric verification process doesn't have control over it.

A Biometric Server: A Biometric Server is another way to store data, although it is more susceptible to cyber-attack. As data is held on an external server it allows for multi-location verification. To reduce the risk of data being breached, it must be encrypted when being transferred over the network. The issue with encryption is deciding where encryption keys will be stored and who will be trusted with access. With the recent implementation of GDPR, there are increased responsibilities of managing and storing data with the potential for penalties should the data become compromised. One major flaw with this method is that should a hack take place, all of the user's biometric data could be leaked at once. This happened to Equifax, British Airways and Uber.

Distributed Data Storage: Distributed Data Storage is a further method which stores the biometric templates on a server and a device. By storing the data this way, it makes it harder for a cybercriminal to access the data, as they would need to get into both points. This method

offers security and privacy without sacrificing usability or scalability. However, it is really only suitable for companies looking to maintain complete control over the data and willing to accept the risks and liabilities associated with storing end-users' biometric data themselves.

V. Real-world Examples of Biometrics

Aside from the obvious example of being on our smartphones, biometrics is being used in a variety of different fields.

For instance, law enforcement is using fingerprints, palm prints, and DNA to identify criminals. The law enforcement industry also utilizes live facial recognition in a crowd in real-time, or after an event in cities before or after an attack to catch a suspect. Cities like New York, Chicago, and Moscow are using CCTV cameras with facial recognition databases to help police solve crimes.

Facial recognition and fingerprint data are also being used at airports and border control in the form of electronic passports. In addition to being able to verify authentication, using biometric scanners in airports and at border control speeds up the process, allowing for more identifications than ever before. Some cities with airports using facial recognition include Chicago, Amsterdam, Tampa, Minneapolis-St. Paul, Dubai, and New York City.

VI. Conclusion

The advances in accuracy and usability and decreasing cost have made the biometric technology a secure, affordable and cost effective way of identifying individuals. Biometric parameters such as fingerprint scanning, iris scanning, retinal scanning, hand geometry, signature verification, voice verification and others are all well established with their own particular characteristics. The limiting factors of speed and band width are now a thing of the past and their practical performance might in many instances be better than expected. Today, it is an efficient and effective method of replacing passwords, tokens and smart cards.

It is important to recognize that although biometric authentication has served extensively in high security applications in defense industry, it is still fledgling technology in commercial world, both in terms of its technical sophistication and current extent of deployment. There are no established standards for biometric system architecture, for template formation, or even for biometric reader testing. It is also not clear as which technology or technologies will dominate the customer market. In the absence of standards and direction, the rapid and wide spread deployment of biometric authentication system could easily facilitate the problematic proliferation of authentication and tracking of the people.

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3D Multi-Object Detection Techniques: A Review

Karanjot Singh Saggu

Tatras Data, Delhi, India
Email: kjkr7373@gmail.com

Abstract—Computer-vision is certainly one of the most growing areas in the technical world. The paper presents a comprehensive study on the field of object detection by providing different research work done by many researchers. The paper also acts as a simple dictionary for many pieces of research done in the field of 3D-Object Detection. For the ease of the user, the paper is divided into clearly labelled sections aided along with the use of pictures and tabular data. The paper focuses primarily on the use cases of object detection such as Autonomous Driving Cars, Medical Field, Military Applications, and Crowd Control and Detection. After presenting these topics the paper sheds light on the research gaps and problems with the existing research and provides a few ways to improve on these problems in the result and discussion section. Furthermore, the Result and Discussion section also expand a little on the newer approaches that are being used in the current Object Detection Market.

Keywords: Object detection; Computer-vision; Artificial Intelligence; Machine Learning; Deep Learning

I. Introduction

Computer vision no doubt is the future itself. Due to the plenty of scope and future possibilities, this field is quite new and open for the research. The paper highlights different applications of the 3D object detection field. The future of object detection is very bright and a lot of research work is required in order to reach a stage where object detection can be efficiently incorporated into all possible areas where applicable without the need for human intervention (Auto-ML).

II. Applications of 3D Object Detection

Object Detection has become one of the most significant breakthroughs in the 21st century. More and more aspects of life have started to accommodate object detection techniques one way or the other.

The application areas of object detection are increasing day by day as a result of new research, automation and development of industries via IoT based technologies. It is not possible to cover all the application areas in this paper but

Some of the most interesting fields where 3D-Object Detection is really useful and is being extensively used are discussed in this paper.

Fig. 1 [2]

A. Autonomous Driving Cars

The field of autonomous cars still remains a topic of research for even the top companies known for their autonomous power. Various companies like Tesla, BMW, and Baidu, Lyft, etc. are able to build autonomous driving cars with the use of 3D object detection technology. Lyft has used a large data set to train their detectors, a public dataset was also made available by Lyft on Kaggle which included 85GB of data focused on training models for autonomous driving cars. The dataset is rich in features, as it includes 55,000 human labelled images having various annotated objects like people, poles, bicycles, cars, animals etc. The above is the visual representation of what autonomous cars are able to achieve in the context of object detection. It can be seen that instead of 2D bounding boxes, we are able to see the 3D boxes which provide various benefits like real time distance measurement and angle knowledge etc. A very promising research paper was made public by the University of Toronto [1] in which the researchers made use of the monocular image to achieve 2D and 3D object detection

They demonstrated their research via the KITTI dataset which is considered as a baseline for performance in the field of autonomous driving. They used a fairly easy-to-understand but interesting approach. To summarise, they assumed a ground plane for each of the monocular images to observe what objects lie close to the assumed plane. According to the research, the plane is made orthogonal to the plane of the image and at some calibrated length from the top of the camera. After this, the monocular image is passed via various segmentation algorithms, shape priors, and location priors, and the resulting candidates are passed via a min-max suppression algorithm. The final candidate is passed through a Convolution Neural Network to get

the score of the predictions. Their research has proved to be indeed better than all the approaches using monocular images algorithms present at that time.

B. Medical Field

3D object detection has a large number of applications in the field of medical science and treatment. Some examples of the applications of 3D object detection in the medical field are detection of cancer tissues in the medical image of the patient, scanning of the x-ray samples to detect the presence of any kind of tumor, etc. in the brain image analysis, detection of eye deficiencies and other related problems via retinal image analysis and much more.

Very prominent and interesting research work has been done in this field:

- Abramoff *et al*. [3] has given a very comprehensiveapproach of using CNN techniques specifically to detect, eye fundus images containing diabetic retinopathy where research was able to produce sensitivity of 96.8% with 6/874 false negatives and hence having negative prediction power of 99.0% accuracy and an AUC of 0.980 was achieved.

- Laukampet *et al*. [4] were one of the first researcherswho enlightened the way to detect glaucoma by focusing more on attention-based CNN. Magnetic resonance was used for image meningioma and their deep learning model was able to correctly detect 55 out of 56 cases.

- German Gonzalez [5] and his team of researchersproposed research that used Convolutional Neural Networks to detect chronic obstructive pulmonary diseases (COPD) via CT images of smokers.

- Islam *et al*. [6] proposed a paper demonstrating the useof a double Convolutional Neural Network (ResNet and Inception v4) to detect Alzheimer's disease using MRI image data.

A wide variety of public datasets are available for the detection of various kinds of medical issues. Some of the datasets are discussed below:

- ILD dataset [7]: This dataset contains imagesregarding lung diseases collected from 128 patients over a span of 38 months. The dataset contains various attributes like age, sex, smoking history, etc. of the patients.

- INbreast dataset [8]: This dataset consists ofmammographic images containing a total of 410 images related to 115 cases out of which, 90 cases belong to women and the rest from mastectomy patients. This dataset is useful for the detection of various diseases in the breast area.

- OASIS-3 dataset [9]: This dataset contains datarelated to the brain having rich data of more than 1000 patients and collected over a span of 30 years. Data contains 609 cognitively normal patients and 489 patients of some stages of cognitive decline having an age range of 42-95 years.

Although the data is available for medical analysis, most of the datasets suffer from the problem of data-unbalancing meaning the number of examples of one class is very low as compared to other classes.

C. Military Applications

The use of 3D object detection in military applications has seen an increase in past years. Major applications of object detection in military applications include remote control flying object detection, landmark detection, remote sensing, etc. The object detection used here uses very high-resolution images due to the necessity of extremely accurate calculation, a lack of which may lead to serious misdetection and loss of property or even life.

To solve this problem data fusion technique was proposed by the researchers which included using very high-resolution images with very complex and efficient Object Detecting Networks like RetinaNet, YOLO (You Only Look Once), SqueezeNet, etc. with the hope of achieving accurate prediction which later found out to be difficult to generalize for different situations. Consequently, various other projects were proposed, for example building better detectors and collecting data to a massive scale which are still considered as problems to this date. Some of the prominent researches done in the military field are:

- Zhang *et al*. [10] proposed a research paper on how tobuild a weakly supervised coupled Convolutional Neural Network for aircraft detection.

- Han *et al*. [11] in one of his research papers proposeda framework that specifically detects optical remote sensing images and on the same hand, it was weakly supervised.

- Li *et al*. [12] gave exceptional research on theimplementation of a deep neural network combined with Hough transform and multi-stage RPN to detect the landmark.

- Ma *et al*. [13] introduced a multi-model decisionfeature network in one of her research papers which uses the multi-region information along with contextual information in order to detect objects in remote sensor images.

- Li *et al*. [14] to detect vehicles from multipleorientations from an image or video he customized a rotatable network for detection along with this he also created a customized R3-Net by the combination of rotatable RPN.
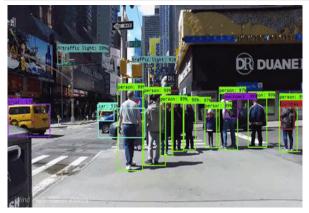
Fig. 2 [20]

- Tang *et al*. [15] introduced an improved version of faster RNN which with the help of negative example mining helped to reduce false vehicle detection.
- Xiaoliang Qian [16] presented a deep neural networkthat aimed to improve bounding box regression and multi-level feature detection that was used to detect numerous landmarks along with objects in remote sensing images.

Various datasets are available for evaluating and training the pipeline. Some of the more popular and noticeable datasets include:

- NWPU-VHR [17]: - The dataset contains a richcollection of images of various landmarks like airplanes, ships, roads, basketball courts, etc. that are publically available to use.
- DOTA [18]: - The dataset is similar to NWPU-VHR dataset and contains similar landmarks like swimming pools, soccer ball fields, helicopters, and other landmark images.
- DLR 3K MUNICH [19]: - This dataset contains ahuge collection of 3000 high-resolution images collected in Munich to detect vehicles and other landmarks from an aerial point of view.

D. Crowd Control and Detection:

Crowd control and other road-related detections belong to the most common field where 3D object detection is used on a wider scale. This field has various possible applications such as automatic issuance of traffic penalty tickets to a high-speed driving card by detecting the number plate of the car, Crowd monitoring during a national emergency or any other road problem, detection of refugees during the time of riots, or in case of disastrous havocs.

3D and 2D object detection have a great role in assessing the issues of crowd control which are not possible only via human supervision.

A large amount of research has been done to provide new methods and improve the existing ones such as in [21] [22]. Some of the prominent research is discussed below:-

- Jones [23] proposed the implementation of crowddetection by using spatiotemporal information of the crowd and explained it in scanning window pedestrian detectors.
- Leibe [24] with the help of top-down segmentation thatproduces a combination of local and global features was used in a pedestrian detection system of images that are crowded.
- Lin [25] also proposed a crowd detection systemthrough the use of computer vision and wavelets in order to achieve the result.
- Xiang and Gong [26] successfully implemented acrowd detection system that detected the crowd for any abnormal behavior via the use of distributed learning.

Some of the prominent datasets available in this field are:

- MS-COCO [27]: - This is the most widely used publicdataset of all the discussed earlier. MS-COCO has very large and properly annotated data with proper labels. The data has been collected over various years and this is one of the best datasets available for any type of computer vision task.
- Open Images [28]: - This dataset was made public byKaggle which is considered a data science learning platform. The dataset has a rich collection of images having more than 1 million images having more than 600 classes with annotated bounding boxes and other features.
- CrowdHuman [29]: - The CrowdHuman dataset is anopen dataset. It contains high-resolution images of crowds with proper annotations provided. It contains around 25000 images divided into train, test, and validation sets containing a total of 470,000 human instances thus a very detailed dataset.

E. Face Detection and Recognition

Face detection is one of the generally seen practical implementations of object detection and hence is very commonly used. Various practical applications can be seen as simple as using an app filter for a face which uses the applications of 3D object detection to recognize the facial landmarks and align the filter according to the face. In some countries, face detection has become the de facto application in the field of education where students are monitored on a daily basis about their mood and behavior so as to provide the necessary attention to the student. Also, face detection is being used in the field of forensics

Fig. 3 [30]

where the face of a person is made to run through a database so as to get the necessary information about that person.

Another very common application that is frequently used these days is the use of the face unlock feature which is also powered by 3D and 2D object detection.

The following approach is followed while implementing a face-detector:

- Using a pre-trained CNN and fine-tuning the layers so as to achieve face detection.
- Using algorithms such as Random Forest, Support Vector Machine, and other machine learning
- algorithms to get a working face detector in the case when the data is of small image size.

TABLE 1: COMPARATIVE ANALYSIS OF OBJECT DETECTION TECHNIQUES

Year	Author	Technique	Dataset Used	Metrics	Advantages
2017	Redmon et al. [37]	Convolution Neural Network (YOLO Technique)	MSCOCO, Image-Net PASCAL VOC 2007	Mean Average Precision (mAP) of 78.6 at 40 fps on PASCAL VOC 2007	The technique (YOLOv2) is more robust, accurate, and powerful. A combination of two datasets was used and the YOLOv2 performed on par with the other state-of-the-art detectors like SSD512 etc. but is 2-10x faster.
2019	Leung et al. [38]	Faster Recurrent Convolutional Neural Network (Faster RCNN)	PASCAL VOC 2007	Mean Average Precision (mAP) of 0.7324 on VGG16 and of 0.8214 on Res Net.	The research presented a novel method to achieve very accurate results using a simple configuration on VGG16 and ResNet-101.
2016	Zhang et al. [39]	2x Convolutional Neural Networks	SYDNEY AIRPORT, TOKYO AIRPORT, BERLIN AIRPORT	An accuracy of 89.13%, 98.46%, and 96.77% was obtained on SYDNEY, TOKYO and BERLIN AIRPORT.	A novel approach to object Detection. It was able to achieve better accuracy in comparison to the likes of SPMK and UFL.
2016-2017	Xiaozhi et al. [10]	Convolutional Neural Network	KITTI dataset	The average accuracy of 92% and an average recall of 90% on KITTI dataset.	The technique is faster and produces higher performance on the KITTI dataset achieving a state-of-the-art average accuracy.
2018	Islam et al [6]	2x Convolutional Neural Networks	OASIS dataset [9]	f1-score of 0.40 for the class having only support example count of 2 and 0.99 f1 scores for a class having 73 support examples on the OASIS dataset.	The technique used a combination of Inceptionv4 and ResNet with a modified loss function on OASIS (416 images only) to produce fairly good results considering the very small amount of data available.
2008	MichelJon es [23]	Ada-Boost algorithm	Custom dataset of 25 videos: total 78,858 frames, PETS dataset	The detection rate of 93% and FPR of 10-6 on the datasets used.	Dated before the widely accepted use of Neural Network, this research used a fairly simple and less hardware-intensive pipeline consisting of the AdaBoost method to build an object detector.

- Using the combination of the above two techniques where first a pre-trained CNN is used to fetch the embedding of the images which are later passed through a simple machine learning algorithm that finally outputs the corresponding label of the embedding.

Some of the prominent researches done in the field of face detection using object detection are by:

- Fares Jalled *et al.* [31] Presented a detailed approachon how to implement and use face-detection and recognition using the Haar Cascade algorithm via the use of Matlab and Open-Cv in Python through the images collected via Unmanned Aerial Vehicle (UAV).
- Wang J *et al.* [32] proposed an attention mechanism tohighlight underlying face target features.
- Wang, x *et al.* [33] proposed the use of a faster RNNto implement a Generative Adversarial Network for generating the occluded objects.

Some of the datasets that have been used for face-detection and face-recognition are <u>WIDERFACE</u> [34], <u>PASCAL-VOC</u> [35], <u>Face Detection, and Benchmark (FDDB)</u> [36].

III. Results and Discussions

From Table 1 it can be inferred that Recurrent Neural Network with ResNet (mAP of 0.8214) is a better approach than VGG-16 based Recurrent Neural Network (mAP of 0.8214) on PASCAL VOC 2007 primarily because of the newer and denser architecture of ResNet. Now better-performing models with cross-platform integration (mobile, desktop, and embedded systems) are being used for object detection: the most popular being YOLOv3-v5 which is based on the DarkNet model.

Some gaps are also present in a few of the researches present in Table 1. The research presented by Islam *et al* [6] using 2x Convolutional Neural Network can be improved by collecting more data for one of the classes which have only 2 support examples present when the model was trained. Training on more data can significantly improve the model performance and hence make it more prone to overfitting. Another research that can be improved is KITTI dataset performance by Xiaozhi *et al.* [10] by using the patch refinement technique which has proved to be significantly better than traditional convolutional neural networks. Another technique that can be used in this context includes PointRCNN which has a tested mAP of 85.94 on the KITTI dataset.

Similarly, if we take a look at the model structure of the newer object detection algorithm: the models that are both efficient and scalable are now being used e.g. EfficientNet Family [40], ResNet-50, ResNet 101-200D instead of older models like VGG-16, VGG-19, ResNet-18, etc. These newer models are much more memory efficient and significantly outperform most of the mentioned older models in terms of the overall value of usage. Furthermore, object detection models such as SqueezeNet are really efficient in that they can be loaded from a mobile device or embedded systems to perform object detection.

IV. Conclusion

Deep Learning has seen a significant increase in use cases and performance over the years. The application of deep learning and object detection is increasing every day from basic applications to complex ones. The majority of the problems like health monitoring, business management, object detection, weather predictions, etc. that are not efficient to solve via traditional programming are now being better solved via the aid of Deep Learning. Deep Learning has many beneficial implementations, one of them being Object Detection.

Object detection has seen a boom during the last few years due to the availability of excessive data along with powerful yet cheap GPU (Graphical Processing Unit) and faster RAM (Random Access Memory). Real-time video detection technology has also improved and now can be rendered at much higher FPS (Frames- Per-Second) than before which is crucial for applications such as CCTV detection, road monitoring, and other live video detection applications. Furthermore, various companies like Tesla, Amazon, etc. Has been extremely successful in formulating the idea of detecting an object into real-life implementation and is able to provide the public with its products like Autonomous Cars, Drone Delivery, etc.

The future of object detection is very bright and researchers still haven't breached the future applications of object detection. A lot of work can be done so that object detection can be implemented and improved without the intervention of humans (Auto-ML).

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Review: A Paper on Cryptography

Sahil Luthra

Assistant Professor, Department of Computer Applications
Amritsar Group of Colleges, Amritsar, India
Email: sluthra423@gmail.com

Abstract—**Cryptography is the science of information security. The word is derived from the Greek kryptos, meaning concealed. Cryptography includes techniques such as microdots, merging words with images, and other ways to hide in order in storage or transit. Modern cryptography intersect the disciplines of mathematics, computer science, and electrical engineering. Applications of cryptography include ATM cards, computer passwords. Cryptology prior to the modern age was almost one and the same with Encryption, the translation of information from a understandable state to apparent nonsense.**

Keywords- *Security, Cryptography, Encryption*

Fig. 1: Cryptography

I. Introduction

Nowadays, cryptography plays a major role in protecting the information of technology applications. Information security is an important issue, for some applications. Have the top priority such as ecommerce, e-banking, e-mail, medical databases, and so many more, all of them require the exchange of private information. Cryptography is the transformation of readable and understandable data into a form which cannot be understood in order to secure data. Cryptography refers exactly to the methodology of concealing the content of messages, the word cryptography comes from the Greek word "Kryptos", that means hidden, and "graphikos" which means writing .

For example, let us consider a person named Sam a sender who wants to send a data message which has a length of characters to a receiver called Bob. Alice uses an unsecure communication channel. Which could be a telephone line , computer network, or any other channel. If the message contains secret data, they could be intercepted and read by hackers. Also they may change or modify the message during its transmission in such a way that Bob would not be able to discover the change. In thissurvey a various ways of encryption is viewed and have been compared ,a lot of examples havebeen provided .

Network security originally focused on algorithmic aspects such as encryption and hashing techniques. While these concepts rarely change, these skills alone a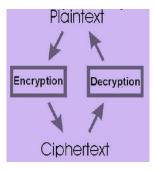re insufficient to protect computer networks. As crackers hacked away at networks and systems, courses arose that emphasized the latest attacks.Currently, many educators believe that to train people to secure networks, they must also learn to think like a cracker. The following background information in security helps in making correct decisions: Attack Recognition, Encryption techniques, Network Security Architecture, Protocol analysis, Access control list and vulnerability.

Cryptography means "Hidden Secrets" is concerned with encryption. Cryptography, the investigation of systems for secure correspondence. It is helpful for examining those conventions, that are identified with different viewpoints in data security, for example, verification, classification of information, non-denial and information uprightness.

II. Literary Survey:

A. Network Security Model

Figure demonstrates the model of system security. A message is to be exchanged starting with one gathering then onto the next over some kind of Internet administration. An outsider might be in charge of appropriating the mystery data to the sender and beneficiary while keeping it from any rival. While building up a safe system, the accompanying should be considered.

Confidentiality: It means that the non-authenticated party does not examine the data .

Integrity: It is a certification that the information which is gotten by the collectorhas not been change or Modified after the send by the sender.

All the techniques for providing security have two components

- A security-related change on the data to be sent. Message ought to be scrambled by key with the goal that it is confused by the adversary.
- An encryption enter utilized as a part of conjunction with the change to scramble the message before transmission and unscramble it on gathering.
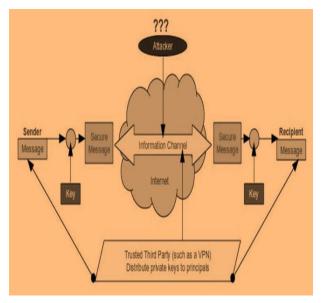

Fig. 2: Network Security Model

Security perspectives become an integral factor when it is fundamental or alluring to shield the data transmission from a rival who may display a danger to classification, realness, etc.

III. Cryptography Mechanism

Cryptography is a strategy for putting away and transmitting information in a specific frame so that those for whom it is expected can read and process it. The term is regularly connected with scrambling plaintext message (customary content, in some cases alluded to as cleartext) into ciphertext (a procedure called encryption), then back once more (known as decoding). There are, as a rule, three sorts of cryptographic plans commonly used to achieve these objectives: mystery key (or symmetric) cryptography, open key (or hilter kilter) cryptography, and hash works, each of which is portrayed underneath.

Key: A key is a numeric or alpha numeric manuscript or may be a unique figure.

Plain Text The first message that the individual wishes to speak with the other is characterized as Plain Text. For instance, a man named Alice wishes to send "Hi Friend how are you" message to the individual Bob. Here "Hi Friend how are you" is a plain instant message.

Cipher Text The message that can't be comprehended by any one or an aimless message is the thing that we call as Cipher content. Assume, "Ajd672#@91ukl8*^5%" is a Cipher Text created for "Hi Friend how are you". Cipher Text is otherwise called scrambled or encoded data since it contains a type of the first plaintext that is indistinguishable by a human or PC without the correct figure to unscramble it. Decoding, the backwards of encryption, is the way toward transforming ciphertext into meaningful plaintext. Ciphertext is not to be mistaken for code content in light of the fact that the last is an aftereffect of a code, not a figure.

Encryption A procedure of changing over plain content into figure content is called as Encryption. This procedure requires two things-an encryption calculation and a key. Calculation implies the system that has been utilized as a part of encryption. Encryption of information happens at the sender side.

Decryption A turn around procedure of encryption is called as Decryption. In this procedure Cipher content is changed over into Plain content. Decoding process requires two things-an unscrambling calculation and a key. Calculation implies the method that has been utilized as a part of Decryption. By and large the both calculations are same.

IV. Context of Cryptography:

Cryptology, the study of cryptosystems, can be subdivided into two branches –

- Cryptography
- Cryptanalysis
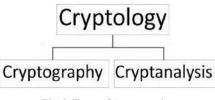
Fig. 3: Types of Cryptography

A. What is Cryptography?

Cryptography is the art and science of making a cryptosystem that is able of providing information safety.

Cryptography deal with the actual secure of digital information. It refers to the design of device based on arithmetical algorithms that provide basic information security services. You can think of cryptography as the organizations of a large toolkit contain different techniques in safety application.

B. What is Cryptanalysis?

The art and science of contravention the cipher text is recognized as cryptanalysis.

Cryptanalysis is the sister bough of cryptography and they together co-exist. The cryptographic procedure consequences in the cipher text for broadcast or storage. It involve the learn of cryptographic mechanism with the meaning to break them. Cryptanalysis is also used during the design of the fresh cryptographic technique to test their security strength.

V. Security Services of Cryptography

The primary purpose of using cryptography is to give the following four basic information security services. Let us now see the likely goals intended to be satisfied by cryptography.

1. Confidentiality

Confidentiality is the basic security service provided by cryptography. It is a safety service that keeps the in order from an unauthorized person. It is from time to time referred to as privacy or secrecy. Confidentiality can be achieve through many means starting from physical secure to the use of arithmetical algorithms for information encryption.

2. Data Integrity

It is safety service that deals with identify any alteration to the data. The information may get modified by an illegal entity intentionally or accidently. Integrity service confirm that whether data is whole or not since it was last created, transmitted, or stored by an authorized user. Data integrity cannot prevent the change of data, but provides a means for detect whether data has been manipulate in an illegal manner.

3. Authentication

Authentication provides the recognition of the originator. It confirm to the receiver that the data established has been sent only by an recognized and established sender.

Authentication service has two variants

- Message authentication identifies the creator of the message with no any regard router or scheme that has sent the message.
- Entity authentication is pledge that data has been received from a specific entity, say a exacting website.
- Apart from the originator, authentication may also provide declaration about other parameter related to data such as the date and time of formation/ transmission.

4. Non-repudiation

It is a security repair that ensures that an entity cannot refuse the possession of a previous commitment or an action. It is an guarantee that the original creator of the data cannot denythe formation or transmission of the said data to a recipientor third party.

Non-repudiation is a property that is most attractive in situations where there are probability of a argument over the exchange of data. For example, once an arrange is placed electronically, a purchaser cannot deny the purchase order, if non-repudiation repair was enable in this transaction.

VI. Cryptography Primitives

Cryptography primitives are not anything but the gear and technique in Cryptography that can be selectively used to give a set of desired safety services −

- Encryption
- Hash functions
- Message Authentication codes (MAC)
- Digital Signatures

The following table shows the primitives that can attain a particular safety repair on their possess.

Primitives / Services	Encryption	Hash Function	MAC	Digital Signature
Confidentiality	Yes	No	No	No
Integrity	No	Sometimes	Yes	Yes
Authentication	No	No	Yes	Yes
Non Reputation	No	No	Sometimes	Yes

Fig. 4: Cryptography Primitives

A cryptosystem is an execution of cryptographic technique and their associated transportation to provide in sequence security services. A cryptosystem is also referred to as a cipher scheme.

Let us discuss a simple model of a cryptosystem that provides privacy to the information being transmit. This essential model is depict in the picture below:
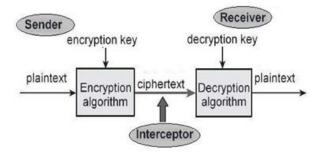

Fig. 5: Cryptosystem Model

The design shows a sender who needs to transfer some responsive data to a recipient in such a means that any party intercept on the communication channel cannot extract the data.

VII. Components of a Cryptosystem

The various mechanism of a basic cryptosystem are as follow

Plaintext: It is the data to be protected during communication.

Encryption Algorithm: It is a arithmetical process that create a cipher text for any given plaintext and encryption key. It is a cryptographic algorithm that take plaintext and an encryption key as input and produce a cipher text.

Cipher Text: It is the twisted version of the plaintext produced by the encryption algorithm using a precise the encryption key. The cipher text is not guarded. It flows on public channel. It can be intercepted or compromise by anyone who has access to the communication channel.

Decryption Algorithm: It is a numerical process, that produces a unique plaintext for any given cipher text and decryption key. It is a cryptographic algorithm that takes a cipher text and a decryption key as input, and outputs a plaintext. The decryption algorithm basically reverses the encryption algorithm and is thus closely connected to it.

Encryption Key: It is a cost that is recognized to the sender. The sender inputs the encryption key into the encryption algorithm along with the plaintext in arrange to calculate the cipher text.

Decryption Key: It is a worth that is known to the receiver. The decryption key is connected to the encryption key, but is not for all time identical to it. The receiver inputs the decryption key into the decryption algorithm all along with the cipher text in order to compute the plaintext.

Interceptor: An interceptor (an attacker) is an illegal entity who attempts to determine the plaintext. Can see the cipher text and may know the decryption algorithm.

VIII. Types of Cryptosystems

Basically, there are two type of cryptosystems base on the way in which encryption-decryption is carried out in the system –

- Symmetric Key Encryption
- Asymmetric Key Encryption

A. Symmetric Key Encryption

If there should be an occurrence of Symmetric Encryption, same cryptography keys are utilized for encryption of plaintext and unscrambling of figure content. Symmetric key encryption is speedier and less difficult yet their principle downside is that both the clients need to move their keys security
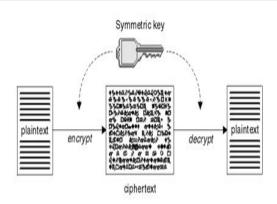

Fig. 6: Symmetric Key Encryption

There is only one key used both for encryption and decryption of data.

1. Types of symmetric-key algorithms

Symmetric-key encryption can use either stream ciphers or block ciphers.

- Stream ciphers encrypt the digits (typically bytes) of a message one at a time.

Square figures take various bits and encode them as a solitary unit, cushioning the plaintext with the goal that it is a different of the piece measure. Squares of 64 bits were regularly utilized. The Advanced Encryption Standard (AES) calculation endorsed by NIST in December 2001, and the GCM piece figure method of operation utilize 128-piece squares.

B. Asymmetric Key Encryption

Asymmetric encryption uses two keys and also known as Public Key Cryptography, because user uses two keys: public key, which is known to public and a private key which is only known to user.
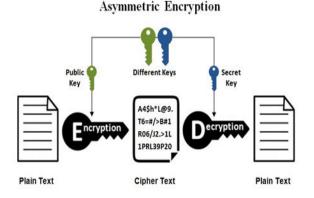

Fig. 7: Asymmetric Encryption

Asymmetric key Encryption, the diverse keys that are used for encryption and decryption of facts that is Public key and Private key.

Public key encryption in which message data is encrypted with a recipient's public key. The Message can't be unscrambled by any individual who does not have the coordinating private key, who is dared to be proprietor of that key and the individual related with the general population key. This is an endeavor to guarantee privacy.

Digital Signature in which a message is signed with sender private key and can be verified by anyone who has access to the private key, and therefore is likely to ensure the security of the Network.

IX. Advanced Encryption Algorithm

AES is an iterated symmetric piece figure, which is portrayed as: working of AES is finished by rehashing a comparable sketched out strides different circumstances. AES can be a mystery key encryption calculation. AES works on foreordained bytes

Effective Implementation of AES With the quick movement of computerized information trade in electronic route, in information stockpiling and transmission, data security is turning out to be a great deal more vital. An answer is available for cryptography which assumes a key part in data security framework against different assaults. A few calculations is utilized as a part of this security system uses toscramble information into confused content which can be just being decoded or unscrambled by gathering those has the related key. Two sorts of cryptographic strategies are being utilized: symmetric and hilter kilter. In this paper we have utilized symmetric cryptographic procedure AES (Advance encryption standard) having 200 piece obstruct and additionally key size. What's more, the same routine 128 piece ordinary. Utilizing 5*5 Matrix AES calculation is executed for 200 piece. On executing, the proposed work is contrasted and 256 piece, 192 bits and 128 bits AES systems on two focuses.

Open key encryption in which message is scrambled with a beneficiary's open key. The Message can't be unscrambled by any individual who does not have the coordinating private key, who is dared to be proprietor of that key and the individual related with general society key. This is an endeavor to guarantee classification.

X. Comparison of Various Encryption Algorithms

In the following Table, Comparative study of various encryption algorithms on the basis of their ability to secure and protect data against attacks and speed of encryption and decryption.

XI. Conclusion

With the touchy development in the Internet, system and information security have turned into an security reason. Encode message with firmly secure key which is known justby sending and beneficiary end, is a huge

SYMMETRIC ENCRYPTION:	KEY SIZES	In Steps Of
DES	40 – 56 bits	8 bits
Triple-DES (two key)	64 – 112 bits	8 bits
Triple-DES (three key)	120 – 168 bits	8 bits
PUBLIC KEY ENCRYPTION:		
Diffie-Hellman	512 – 2048 bits	64 bits
RSA *	512 – 2048 bits	64 bits
DIGITAL SIGNATURES:		
DSA	512 – 2048 bits	64 bits
RSA *	512 – 2048 bits	64 bits

Fig. 8: Comparison of Encryption

angle to procure powerful security in cloud. The safe trade of key amongst sender and collector is an imperative errand. The key administration keeps up classification of mystery data from unapproved clients. It can likewise check the respectability of the traded message to confirm the genuineness. Arrange security covers the utilization of cryptographic calculations in system conventions and system applications. This paper quickly presents the idea of PC security, concentrates on the dangers of PC system security later on, work should be possible on key circulation and administration and also ideal cryptography calculationfor information security over mists.

unavoidable sympathy toward any association whose interior private system is associated with the Internet. The security for the information has turned out to be exceptionally vital. Client's information security is a focal question over cloud.

The paper displayed different plans which are utilized as a part of cryptography for Network

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Information Extraction from Unstructured Text Using Python and spaCy

Neha

CSE Department, Amritsar Group of Colleges, Amritsar, India
Email: nehachadha@acetamritsar.org

Abstract—**Natural Language Processing (NLP) is one of the most interesting sub-fields of data science, and data scientists are increasingly expected to be able to whip up solutions that involve the exploitation of unstructured text data.**

Keywords: NLP, POS ,NER, PIP

I. Introduction

NLP is a subfield of artificial intelligence and is concerned with interactions between computers and human languages. NLP is the process of analyzing, understanding, and deriving meaning from human languages for computers.

NLP helps you extract insights from unstructured text and have several use cases, such as:

- Automatic summarization
- Named entity recognition
- Question answering systems
- Sentiment analysis

spaCy is a free, open-source library for NLP in Python. It's written in Cython and is designed to build information extraction or natural language understanding systems. It's built for production use and provides a concise and user-friendly API.

II. NLP and SPACY

A. Sentence Detection

a. How to install spaCy

spaCy can be installed using pip, a Python package manager. You can use a virtual environment to avoid depending on system-wide packages.

Shell

```
$ python3 -m venv env
```

Activate this virtual environment and install spaCy:

Shell

```
$ source ./env/bin/activate $ pip install spacy
```

b. How to Download Models and Data

spaCy has different types of models. The default model for the English language is en_core_web_sm.

Activate the virtual environment created in the previous step and download models and data for the English language:

```
$ python -m spacy download en_core_web_sm
```

Verify if the download was successful or not by loading it:

```
>>> import spacy>>> nlp = spacy.load('en_core_web_sm')
```

```
>>> nlp = spacy.load('en_core_web_sm')
```

If the nlp object is created, then it means that spaCy was installed and that models and data were successfully downloaded.

Sentence Detection is the process of locating the start and end of sentences in a given text. This allows you to you divide a text into linguistically meaningful units. You'll use these units when you're processing your text to perform tasks such as part of speech tagging and entity extraction[10].

In spaCy, the sent property is used to extract sentences.

Here's how you would extract the total number of sentences and the sentences for a given input text:

```
>>>text = ( ' Natural Language Processing.')
```

```
>>>doc = nlp(text)
```

```
>>>sentences = list(doc.sents)
```

```
>>>len(sentences)
```

```
>>>for sentence in sentences:
```

```
>>>print (sentence)
```

In the above example, spaCy is correctly able to identify sentences in the English language, using a full stop(.) as the sentence delimiter. You can also customize the sentence detection to detect sentences on custom delimiters.

B. Tokenization in spaCy

It allows you to identify the basic units in your text. These basic units are called tokens. Tokenization is useful because it breaks a text into meaningful units. These units are used for further analysis, like part of speech tagging.

In spaCy, you can print tokens by iterating on the Doc object:

>>>for token in about_doc:

>>>print (token, token.idx)

Some of the commonly required attributes are accessed: text_with_ws prints token text with trailing space (if present).

is_alpha detects if the token consists of alphabetic characters or not.

is_punct detects if the token is a punctuation symbol or not. **is_space** detects if the token is a space or not.

shape_ prints out the shape of the word.

is_stop detects if the token is a stop word or not.

You can also customize the tokenization process to detect tokens on custom characters. This is often used for hyphenated words, which are words joined with hyphen.

In order for you to customize, you can pass various parameters to the Tokenizer class:

nlp.vocab is a storage container for special cases and is used to handle cases like contractions and emoticons. **prefix_search** is the function that is used to handle preceding punctuation, such as opening parentheses. **infix_finditer** is the function that is used to handle non-whitespace separators, such as hyphens.

suffix_search is the function that is used to handle succeeding punctuation, such as closing parentheses. **token_match** is an optional Boolean function that is used to match strings that should never be split. It overrides the previous rules and is useful for entities like URLs or numbers.

III. Unstructured Text And Statistical Analysis

Lemmatization is the process of reducing inflected forms of a word while still ensuring that the reduced form belongs to the language. This reduced form or root word is called a lemma [7].

For example, organizes, organized and organizing are all forms of organize. Here, organize is the lemma. The inflection of a word allows you to express different grammatical categories like tense (organized vs organize), number (trains vs train), and so on. Lemmatization is necessary because it helps you reduce the inflected forms of a word so that they can be analyzed as a single item. It can also help you normalize the text.

spaCy has the attribute lemma_ on the Token class. This attribute has the lemmatized form of a token:

>>> help_text = ('Natural Language Processing.')

>>> help_doc = nlp(help_text)

>>>for token in help_doc:

>>>print (token, token.lemma_)

In this example, organizing reduces to its lemma form organize. If you do not lemmatize the text, then organize and organizing will be counted as different tokens, even though they both have a similar meaning. Lemmatization helps you avoid duplicate words that have similar meanings.

A. Word Frequency

You can now convert a given text into tokens and perform statistical analysis over it. This analysis can give you various insights about word patterns, such as common words or unique words in the text:

>>> from collections import Counter

>>> complete_text =
('Natural Language Processing.')

>>> complete_doc = nlp(complete_text)

>>> words = [token.text for token in complete_doc if not token.is_stop and not token.is_punct]

>>> common_words = word_freq.most_common(5)

>>> print (common_words)

>>> word_freq = Counter(words)

>>> unique_words = [word for (word, freq) in word_freq.items() if freq == 1]

>>> print (unique_words)

This way, you can take any unstructured text and perform statistical analysis to know what it's about.

B. POS Tagging

Part of speech or POS is a grammatical role that explains how a particular word is used in a sentence. There are eight parts of speech:

Noun

Pronoun

Adjective

Verb

Adverb

Preposition

Conjunction

Part of speech tagging is the process of assigning a POS tag to each token depending on its usage in the sentence. POS tags are useful for assigning a syntactic category like noun or verb to each word[5].

In spaCy, POS tags are available as an attribute on the Token object:

>>> for token in about_doc

>>>print(token,token.tag_,token.pos_,spacy. explain(token.t ag_)

Here, two attributes of the Token class are accessed:
tag_ lists the fine-grained part of speech.
pos_ lists the coarse-grained part of speech.

spacy.explain gives descriptive details about a particular POS tag. spaCy provides a complete tag list along with an explanation for each tag.

Using POS tags, you can extract a particular category of words:

```
>>>   nouns = []
>>>   adjectives = []
>>>   for token in about_doc:
...      if token.pos_  == 'NOUN':
...      nouns.append(token)
...      if token.pos_  == 'ADJ':
...      adjectives.append(token)
...
>>>   nouns
[developer, company]
adjectives
[interested]
```

Use this to derive insights, remove the most common nouns, or see which adjectives are used for a particular noun.

C. Visualization: Using displaCy

spaCy comes with a built-in visualizer called displaCy. You can use it to visualize a dependency parse or named entities in a browser or a Jupyter notebook.

You can use displaCy to find POS tags for tokens:

```
>>>   from spacy import displacy
>>>   about_interest_text =
         ('He is interested in learning'
...      ' Natural Language Processing.')
>>> about_interest_doc = nlp(about_interest_text)

>>>   displacy.serve(about_interest_doc,  style='dep')
```
The above code will spin a simple web server.

D. Preprocessing Function

You can create a preprocessing function that takes text as input and applies the following operations:

• Lowercases the text
• Lemmatizes each token
• Removes punctuation symbols
• Removes stop words

IV. RULE BASED USING SPACY

Rule-based matching is one of the steps in extracting information from unstructured text. It's used to identify and extract tokens and phrases according to patterns (such as lowercase) and grammatical features (such as part of speech)[1].

Rule-based matching can use regular expressions to extract entities (such as phone numbers) from an unstructured text.

It's different from extracting text using regular expressions only in the sense that regular expressions don't consider the lexical and grammatical attributes of the text.

With rule-based matching, you can extract a first name and a last name, which are always proper nouns:

```
>>>   from spacy.matcher import Matcher
>>>   matcher = Matcher(nlp.vocab)
>>>   def extract_full_name(nlp_doc):
...      pattern =
         [{'POS': 'PROPN'}, {'POS': 'PROPN'}]
...      matcher.add('FULL_NAME', None, pattern)
...      matches = matcher(nlp_doc)
...      for match_id, start, end in matches:
...      span = nlp_doc[start:end]
...      return span.text
...
>>> extract_full_name(about_doc)
```

In this above example, pattern is a list of objects that defines the combination of tokens to be matched. Both POS tags in it are PROPN (proper noun). So, the pattern consists of two objects in which the POS tags for both tokens should be PROPN. This pattern is then added to Matcher using FULL_NAME and the the match_id. Finally, matches are obtained with their starting and end indexes.

V. DEPENDENCY PARSING USING SPACY

Dependency parsing is the process of extracting the dependency parse of a sentence to represent its grammatical structure. It defines the dependency relationship between headwords and their dependents. The head of a sentence has no dependency and is called the root of the sentence. The verb is usually the head of the sentence. All other words are linked to the headword.

The dependencies can be mapped in a directed graph representation:

• Words are the nodes.
• The grammatical relationships are the edges.
• Dependency parsing helps you know what role a word plays in the text and how different words relate to each other. It's also used in shallow parsing and named entity recognition.

you can use dependency parsing to see the relationships between words:

```
>>>
>>>   text = ' Natural Processing'
```

```
>>>   doc = nlp(text)
>>>   for token in doc:
>>>print (token.text, token.tag_, token.head.text,
token.dep_)
```

A. Navigating the Tree and Subtree

The dependency parse tree has all the properties of a tree. This tree contains information about sentence structure and grammar and can be traversed in different ways to extract relationships.

B. Shallow Parsing

Shallow parsing, or chunking, is the process of extracting phrases from unstructured text. Chunking groups adjacent tokens into phrases on the basis of their POS tags. There are some standard well-known chunks such as noun phrases, verb phrases, and prepositional phrases.

C. Noun Phrase Detection

A noun phrase is a phrase that has a noun as its head. It could also include other kinds of words, such as adjectives, ordinals, determiners. Noun phrases are useful for explaining the context of the sentence. They help you infer what is being talked about in the sentence.

D. Verb Phrase Detection

A verb phrase is a syntactic unit composed of at least one verb. This verb can be followed by other chunks, such as noun phrases. Verb phrases are useful for understanding the actions that nouns are involved in. spaCy has no built-in functionality to extract verb phrases, so you'll need a library called textacy.

You can use pip to install textacy:
$ pip install textacy

E. Named Entity Recognition

NER is the process of locating named entities in unstructured text and then classifying them into pre-defined categories, such as person names, organizations, locations, monetary values, percentages, time expressions, and so on.

You can use NER to know more about the meaning of your text. For example, you could use it to populate tags for a set of documents in order to improve the keyword search. You could also use it to categorize customer support tickets into relevant categories.

VI. CONCLUSION

spaCy is a powerful and advanced library that is gaining huge popularity for NLP applications due to its speed, ease of use, accuracy, and extensibility. The spaCy provides an approach to customize and extend built-in functionalities and perform basic statistical analysis on a text, create a pipeline to process unstructured text, parse a sentence and extract meaningful insights from it.

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Vehicular Ad-Hoc Networks– A Review

Inderpreet Kaur[1], Sandeep Kad[2]

[1]Research Scholar, IKG PTU Regional Centre, ACET Amritsar College of Engineering and Technology
Amritsar, India
[2]Department of CSE, ACET Amritsar College of Engineering and Technology
Amritsar, India
Email: [1]issarinderpreet@gmail.com, [2]sandeepkad@acetamritsar.org

Abstract—**VANET is a vehicular ad hoc network, comprising of interconnected nodes that form a temporary platform enabling vehicles to interact. In VANET, vehicles are interconnected with wireless links where the moving vehicles on the road form a network that is capable of communicating with one another. In contrast to MANETs, the node positions in VANETs keep on changing very rapidly thus it becomes a big challenge to route the information to itsdestination.VANET is primarily used both for comfort and safety applications. In this paper, different aspects of VANETs are discussed.**

Keywords: Vehicular ad-hoc Network (VANET), Routing Protocols, Vehicle2vehicle, Roadside and Inter-Infrastructure Communication

Fig. 1: VANET System [3]

I. Introduction

Tele-communication solutions have revolutionized the automotive sector over the last decade by allowing interaction across heterogeneous devices anywhere at any time. This simplicity of connection allows critical data to be communicated to all the vehicles while moving on the road. Among all these improvements, the paradigm of Vehicular Ad-hoc Networks (VANET) rose to prominence, opening up new avenues for the deployment of security applications [1]. The idea behind VANETs is straightforward, where the implementation of wireless communications can be used for a variety of purposes, including crash avoidance, blind spot warning, vehicle routing plan, entertainment applications etc.In VANETs, the difficulties arise due to the presence of large number of vehicles on road. The challenge becomes even more difficult due to specialized and heterogeneous components as well as dynamic transportation. [2].

VANET is extremely similar to MANET, with a few variations. The inter-vehicle connection allows data to be transferred back and forth, improving vehicular traffic, detecting driving conditions, reducing crashes, detecting emergencies thereby, improving overall system effectiveness. By the use of numerous hops, VAN*Et al*so transmits data to distant vehicles [3]. Fig. 1 depicts basic VANET architecture.
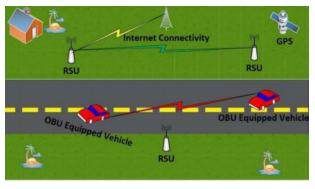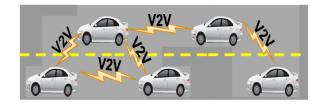

Fig. 2: Vehicle to Vehicle Communication [4]

A. Communication Types of VANET

There are three different modes of communication in VANETs:

1. Vehicle to Vehicle
2. Infrastructure to Infrastructure
3. Vehicle to Infrastructure

1. *Vehicle to Vehicle (V2V)*: V2V communication is also known as Inter vehicle communication. In this type of communication, vehicles transmit the data to each other in the wireless network. The data transmission may include the location of the vehicle, condition of the road, information related to traffic, directions, speed of the vehicle etc. Dedicated Short Range Communication (DSRC) is used in Vehicle- to- Vehicle communication which provides communication range of about 300 m. Fig. 2 depicts Vehicle to Vehicle communication.

2. *Inter-Infrastructure Communication (I2I)*: Inter-Infrastructure communicating equipment comprises of
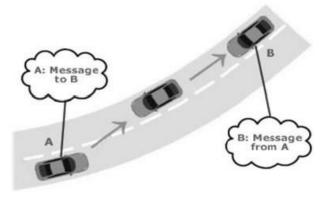
Fig. 3: Inter- Infrastructure Communication [4]

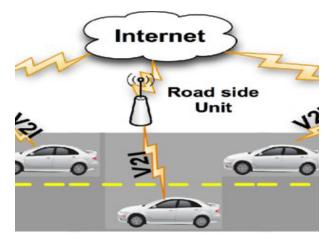Fig. :5 Architecture of VANET [6]

Fig. 4: Vehicle to roadside communication [5]

road side units (RSU) that interact with each other and share information through multi-hop transmission as well.

3. Vehicle to roadside communication (V2R): In V2R communication vehicles and roadside infrastructure communicate and share the required information. This is also known as hybrid communication. V2R communication is shown in Fig. 4.

B. The System Architecture of VANET [6]

The fundamental layout of a VANET on road is shown in fig 5, where vehicles interact with each other as well as with roadside infrastructure, commonly referred to as Road Side Units (RSU). VANET nodes have an an On-Board Unit (OBU) that interoperates with oneanother in the system. Every On-Board Unit is composed of an Incident Navigation System, a Global Navigation Satellite System, and a wireless narrow transmitter. Other transmission protocols, including GSM, may be supported through extra connectors. Whenever the OBU is turned active, it works with the RSU and obtains a port number that is required for connectivity. OBU also
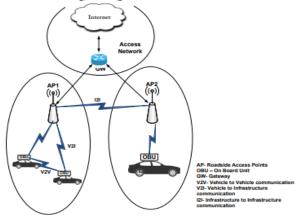
has a processing component that is used in most of the applications of VANETs in the surrounding. In wireless ad-hoc communications, RSUs are comparable to network devices.

C. Advantages of VANETs [7]

VANETs

- Encourages variability and more efficient resource use
- Provides validation for safe driving
- Helps in reducing the traffic congestion and movement of traffic freely
- Provides high scalability

D. Mobility Management in VANET

Node mobility characterizing VANETs results in rapid topological changes. In addition, there has been no stable architecture on which unit may depend for transmission of data in an ad-hoc context. A conventional vehicular networks method, like MIPv6, is used in such cases because a direct link between both the cluster and the architecture is necessary. Due to dynamic topology of the nodes, numerous short passes occur, causing access control to be disrupted.Whenever a unit in a system shifts from one component (node) to the next, the procedure is known as handover. In VANETs, handover management is a critical component. In delay-sensitive Intelligence TransportationSystems (ITS), quick handover is critical, particularly whenever the transmission distance is limited in the wireless system.Vehicular networks must also ensure that services are available at all times, regardless of the location of the VANET component or the access technique employed [8].

E. Routing Protocols in VANET

The implementation of routing protocols in VANET is increasingly difficult due to the high mobility architecture attribute. The VANET routing protocols are divided
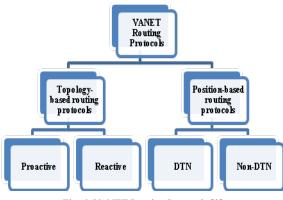
Fig. 6: VANET Routing Protocols [9]

mainly into two categories: (i) position-based routing protocols and (ii) topology-based routing protocols [9].

1. Topology-based Routing Protocols

In topology- based routing protocols, every node in a connection uses the forwarding table to gather paths knowledge of other nodes, and each table entry includes information about every next node in the connection irrespective of whether the path is really used or not. The proactive approach primarily relies on congestion control associated with the table-driven approach. The topology-based routing protocols are further subdivided into different protocols such as proactive and reactive routing protocols.

2. Position-based Routing Protocols

Position-based routing protocols also known as geographic routing protocols that work on location-based mechanisms and are used in different applications such as GPS. Thesetypes of protocols are used for path selection. The linkage paths and shortest paths are mentioned in the routing tables of the network.

F. Applications of Vanets

VANET is a considered as an important technology that enhances the safety and efficiency of Modern Technology Systems (MTS). The different applications of VANET are oriented on various aspects such as commercial, productive, convenience, and safety [12].

1. Safety-oriented [13]

These types of applications are used to monitor the traffic of the road, provide collision warnings, hazards of road notifications.

2. Commercial

Commercial applications lead to advertisements, access to comfort applications like multimedia etc. to the motorist while on move.
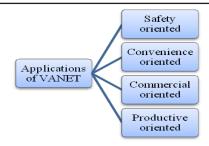

Fig. 7: VANET applications [10]

3. Convenience

Convenience applications mostly engage with road traffic, also improves vehicle performance by increasing motorist satisfaction.

- Electronic Toll Collection
- Availability of parking
- Route Diversions

4. Productive

Productive applications are those applications that provide environmental benefits, fuel-saving etc.

G. Characteristics of Vanet

The different characteristics [11,14] of VANET are discussed as below:

1. High Mobility

The nodes in VANET move at a rapid rate, leading to meshes in the connection. As a result, calculating the vehicle's location information delivery becomes difficult.

2. Time Critical

The data in VANET needs to be sent to the appropriate node within specific timespan which otherwise may not be of any use.

3. Frequent information exchange

Due to high mobility and huge traffic, information to be shared is frequently generated and needs to be shared in timely manner.

4. Inter-action With On-board Sensors

The VANET provides the interaction between the vehicles with the help of sensing devices. The sensors generate the inter-linkage between the vehicles.

This paper is organized into four different sections. The first section provides introduction comprising of basic architecture, routing protocols, applications and characteristicsof VANET. The basic routing protocols are also discussed. In section II, a literature survey based on existing work is carried.Section III addresses the gaps in few areas where improvement is feasible. Section IV comprises of the conclusion the paper.

TABLE 1: VARIOUS EXISTING FRAMEWORKS OF VANET

Reference No.	Proposed Work	Simulator	Pros/Conspiracy
[15]	Clustering framework with multiple hops	NS-2	• Easily transmits the clusters of data • In some cases fail to detect malicious node
[16]	A hybrid framework for intrusion identification	NS2	• Not highly accurate • High detection accuracy for intrusion attack
[17]	Cloud-based Broadcast as a service cross-layer learning approach	MATLAB	• Data dissemination issues • Low communication cost
[18]	Artificial Intelligence-based UAV-Assisted Vehicular Adhoc Network	NS2	• High packet delivery ratio • End to end delay is more in cluster transmission
[19]	Routing Protocol for VANET	NS2	• High efficiency • Security challenges
[20]	Clustering-based framework	NS2	• Provided high security • Low rate of transmission

II. RELATED WORK

A vehicular ad-hoc network falls in the category the mobile ad-hoc network comprising of several vehicularnodes that operates without using much of the pre-existing infrastructure. Temurnikar, *et al*. [15] proposed a clustering framework for the generation of Vehicular Ad-hoc networks. In this work, the number of co-related clusters arecombined for cluster member's selection. The base station node is selected on the basis of its proximity, maximum speed of the other nodes and its ability to extend the lifetime of the network. The performance of the system was measured with throughput, packet end-to-end delay, the overheads of network, loss of packets, and PDR (packet delivery ratio). Bangui *et al*. [16] in their approach suggested a composite Ml algorithm to improve the performance of IDSs. To identify established security breaches, the proposed methodology primarily employs the benefits of Random Forest. The approach was tested on the CICIDS2017 dataset, which is a modern IDS database. Accordingly it was observed that the suggested composite method can predict the intrusions attack. Mchergui *et al*., [17] proposed a broadcast as a service streaming method, which uses cloud computing to efficiently transfer information to vehicular networks. As the vehicles have minimum space and communication bandwidth, all data related to congestion and the transmission mechanism is collected and analyzed. As a result, a cloud-based aided VANET framework organizes many channels of interaction across VANETsand the cloud. The originating vehicle forwards the data to the server using adjacent RSU, which acts as an intermediary. The proposed framework reduces the packet delay and breakage of linkage. Fatemidokht, H., *et al*. [18] proposed a UAV (Unmanned Aerial Vehicles) based VANET. The ad hoc functioning of UAVs and related interaction with vehicles were investigated to aid in the tracking and identification of malicious vehicular nodes. VANET routing protocol was a proposedcomprising

two unique modes of data routing: (i) transmitting data packets among vehicles employing UAVs via VRU, and (ii) forwarding wireless signals across UAVs via VRU. NS2 was used to deploy the proposed scheme. The comparative analysis of the proposed system with the existing system provided 16% of improved PDR and 7% of less delay in packet transmission. Qin, H., *et al*. [19] presented a unique routing system that takes into account the impact of both traffic volume and stops signs on road segment. The method gathers existing traffic data using one-way transmissions before selecting the next forwarding segment using a generalized demandingselection technique. The simulation results demonstrated that even under the presence of stop signs, the routing algorithm can enhance the efficient transmission rate while maintaining the same end-to-end delay. Sugumar, R., *et al*. [20] proposed a cluster-based Vehicular AdhocNetwork for integrity authentication. The trustworthiness level of each network node was determined after which the vehicles were aggregated. The trustworthiness level was made up of both explicit and implicit reliance. The communicationwas then authenticated mostly by the transmitter, scrambled using a decryption key provided by a centralized intermediary, and are unencrypted by the recipients. The authentication was used as the technique for verifying both the sender's and recipient's identities.

III. GAPS OF RELATED WORK

The main issue that occurs in VANET is security. The aggregated data transmitted by multiple vehicles is also a challenging aspect [16].Timely delivery of information in VANETs is of utmost importance. In some networks, authentication errors also occur that generate security challenges because VANETs are frequently used in security applications as well. For ensuring that VANET nodes are genuine, a safe and inexpensive identification technique is required.A single weakness in a surveillance system might deceive the entire infrastructure jeopardizing

the safe operation. Except for node authorization, the transmission of data requires a link layer and edge-to-edge security to ensure that the information authenticity is preserved along its journey.Security threats like DoS (Denial of service) and Sybil attacks [18, 19], software attacks like falsification and modification threats, and surveillance assaults like eavesdropping are all security-related assaults. Also, there is a need to strike the right balance between privacy and security [20].

IV. Conclusion and Future Scope

VANET, being an important constituent of the Intelligent Transport System is utilizing Information and Communication Technologies to provide a smart environment for drivers and passengers. More and more vehicles fitted with smart devices like navigation systems and sensors etc. are assisting the drivers in making decisions while they are on the wheels. The efficient information disseminating mechanisms are contributing to saving human lives, time, and fuel, and at the same time provide comfort to drivers and entertain passengers during long journeys. Due to some inherent characteristics of VANET, like rapid topology changes and high mobility of vehicles, the network connection breaks quite often which makes the information dissemination task tedious. Further, if the desired information is not delivered well in time, the information loses it importance. In the future, we intend to propose a fuzzy-neurobased system for secure and timely delivery of information in VANETs.

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Review Paper for Comparison of Different Wireless Power Transfer Systems for Electric Vehicles

Abhay Khonje[1], B.P. Patil[2]

[1]*Research Scholar, Department of Electronics and Telecommunication,*
Pimpri Chinchwad College of Engineering, Pune
[2]*Principal, Army Institute of Technology, Pune*
Email: [1]abhaykhonje@gmail.com, [2]bp_patil@rediffmail.com

Abstract—**Electric vehicles (EVs) are gaining significant attention in a large domain of transportation in recent times. EVs are considered as one of the prominent alternatives to fuel-based vehicles because of their effectiveness in reducing the dependency of transportation domain on fossil fuels and thus effective contributing to the reduction of greenhouse gas emissions. However, there are some specific constraints which restrict the deployment of electric vehicles such as its ineffectiveness when deployed for short driving ranges and long charging times. In order to overcome these restrictions, the adoption of wireless power transfer (WPT) method has been proposed by various researchers. The significant advantages of WPT systems are that it does not require any manual connection between the charging station and electric vehicle. Additionally, WPT systems enhance the adaptability of electric vehicles for long range driving applications, while simultaneously reducing the size of the batteries and increasing the feasibility of charging the vehicles. This review presents an inclusive analysis of WPT technologies and its types and optimization techniques.**

Keywords: Comparison of WPT, Electric Vehicles, Vehicle Charging, Wireless Power Transfer

I. Introduction

A. Background of the Study

The commercialization of electric vehicles has expanded prominently as a result of recent advancements in battery technologies, power electronic converters for effective battery charging and discharging systems, battery management systems and electric motors [1].

However, there are certain challenges concerning the effective applications of electric vehicles such as cost of batteries, battery lifetime, efficient charging systems, slow charging mechanism, restricted energy density, weight, and reliability, which needs to be resolved. Among these challenges, one of the significant issues restricting the growth of electric vehicles is constituted by the scarcity of feasible infrastructures facilities such as battery charging stations [2].

Ernst & Young conducted a survey for analysing the feasibility of charging stations in public places. The survey stated that one of the prominent problems faced by the public was related to lack of availability of charging stations [3]. Hence, the main constraints for increasing the feasibility of electric vehicles in public application are related to non-availability and safety issues concerning charging systems and their ease of access to the public.

Due to the emergence of wireless power transfer (WPT), it has been convenient for the users to charge their EVs without requiring any physical connection [4]-[6]. This study discusses various aspects related to wireless power transfer mechanisms in electric vehicles.

Electric vehicles (EVs) are regarded as an optimistic substitute for traditional fuel based vehicles, because of their effectiveness in reducing vehicular pollution and noise. The batteries and internal combustion engine (ICE) in EVs enact a prominent role in reducing vehicular emission thereby contributing towards a pollution free ecosystem. The battery is one of the significant components in electric vehicles, whose performance is evaluated with respect to OCV (Open circuit voltage), SOC (State of charge), battery resistance and power capacity.

B. Wireless Power Transfer

The significant advantages of WPT systems are that it does not require any manual connection between the charging station and electric vehicle also WPT systems are not affected by the changes in environmental conditions [7]. The primary coil of the inductor will be placed in the on ground (stationary base) whereas the secondary (receiver) coil will be positioned in the electric vehicle [8]-[10].The basic block illustrating a WPT system is presented in figure 1.
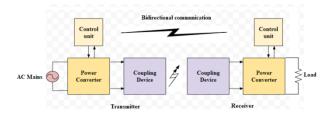

Fig.1: Illustration of Basic WPT System

A general WPT system includes two main blocks: transmitter and receiver block. From the existing literary works, it was inferred that the WPT methodology can be categorized mainly into stationary wireless charging and dynamic wireless charging [11],[12]. In dynamic wireless charging techniques EVs can be charged when the vehicle is in moving condition i.e. it is possible to run the electric vehicle without stopping for charging [13]. The important issue in wireless power transferring mechanisms is that the efficiency of power transfer in WPT systems is less in comparison with traditional conductive charging systems.

II. STUDY OF VARIOUS WIRELESS POWER TRANSFER SYSTEMS

In modern years concept of wireless power transfer has gained wide acceptance among the users since it possesses potential advantages compared to traditional charging methods [14].

A basic illustration for a closed loop wireless electric vehicle charging is illustrated in figure 2
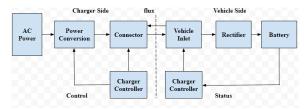

Fig. 2: A Closed Loop WPT System for EV Charging [15]

This section discusses different WPT charging techniques:

A. Inductive Wireless Power Transfer

The primary coil of the system which is used as a charging paddle is inductively coupled and is placed into the middle of the secondary coil to enable charging the electric vehicles by avoiding any physical connection[16]. The permissible charging range will be in between 6.6 kW to 50 kW. The equivalent circuit of an IPT system is illustrated in figure 3.
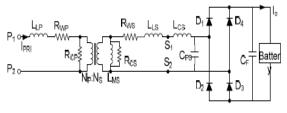

Fig.3: Equivalent Circuit of an Inductive Interface [17]

B. Capacitive Wireless Power Transfer

The CPT technique based WPT is considered as an alternative to the contactless power transfer mechanisms [18]-[20]. The schematic of a WPT interface which is

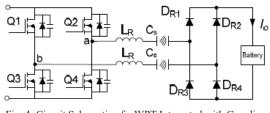developed around the coupling capacitors is illustrated in figure 4.

Fig. 4: Circuit Schematic of a WPT Integrated with Coupling Capacitors [18]

One of the prominent advantages of using a CPT system is its effectiveness in minimizing the size and cost of the charging system at lower power levels [21].

C. Low Frequency Permanent Magnet Coupling Power Transfer

A low frequency permanent magnet coupling power transfer (PMPT) system is integrated with synchronous permanent magnet (SPM) electric motors and magnetic gears and consists of two important modules: a transmitter and corresponding receiver [22]. The system uses a rotating magnet for improving the power transfer mechanism in PMPT systems as shown in figure 5.
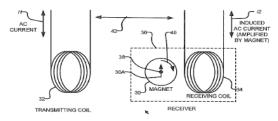

Fig.5: Rotating Magnets for Increasing IPT Between Two Coils [22]

1. Transmitter

Transmitter unit consists of a rotating cylindrical PM rotor (permanent magnet rotor) which is energized using an external or by using static windings which are placed along with the circumference of the rotor [23].

2. Receiver

The receiving magnet or the receiver consists of a similar rotor as that of the transmitter which is placed in parallel to the user-side at rotor during charging operation. The rotors in the electric vehicles tend to rotate with the speed similar to the speed of the user-side rotor. This effect is also regarded as a magnetic gear effect which is caused due to the effect of magnetic coupling between the two rotors. An electro dynamically coupled WPT was presented in [24].

D. Resonant Inductive Power Transfer (RIPT)

Wireless power transfer using resonant inductive circuits is one of the most widely used WPT technologies

in recent years [25] -[27]. This technology employs a combination of least two resonant tanks which resonate at the same frequency [28].

A simplified representation of a resonant type inductive charger is presented in figure 6
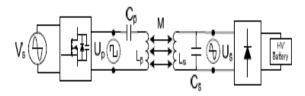

Fig.6: Schematic Representation of a Resonant Inductive Charger [28].

Experimental results show that the system with three-coil based architecture showed an increase in the maximum efficiency by 83% in comparison with a two-coil system.

E. On-Line Power Transfer (OLPT)

The operating principle of the OLPT is the same as that of the resonant IPT circuits.

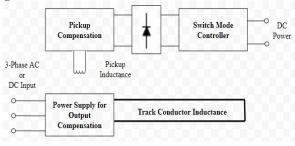An illustration of an on-line WPT is presented in figure 7.

Fig.7: Schematic of an On-Line WPT [29], [30]

Considering the short range of electric vehicles and the implementation cost, the adaptability of these systems are not practicable in cost-effective applications.

F. Comparative Study of Wireless Power Transfer Techniques

Based on the existing literary works, this section provides a comparative analysis for wireless charger techniques as tabulated in table 1.

TABLE 1. COMPARATIVE ANALYSIS OF DIFFERENT WPT SYSTEMS
WHERE → H= HIGH, M= MODERATE, L= LOW

Technology	Performance			Cost	Size	System Complexity	Feasible Range of Power
	Efficiency	Electromagnetic Interference	Frequency				
Inductive Power Transfer(IPT)	M	M	10 - 50 kHz	M	M	M	M or H
Capacitive Power Transfer(CPT)	L	M	100 -500 kHz	L	L	M	L
Permanent magnet Coupling Power Transfer (PMPT)	L	H	100 -500 kHz	H	H	H	M or L
Resonant Inductive Power Transfer (RIPT)	M	L	1 - 20 MHz	M	M	M	M or L
On-Line Inductive Power Transfer (OLPT)	M	M	10 - 50 kHz	H	M	M	H

III. CONCLUSION

This research provides a comprehensive review of the WPT techniques for charging EVs. The significant advantages of WPT systems are that it does not require any physical connection between the charging station and electric vehicle in contrast to conventional conductive charging methods. Various WPT techniques such as inductive power transfer, capacitive power transfer etc for charging electric vehicles have been analysed and it was observed from the existing literary works that the inductive WPT is the most appropriate technique for charging electric vehicles. It was inferred from the analytical study that in inductive WPT the compensation is required for reducing the equivalent reactance as measured from the source side of the transmitter and user side of the receiver to improve the overall efficiency, for maximizing the power transfer and for reducing the sizing of the power ratio. The study also briefs about various compensation technologies proposed in various literary works. The prominent challenge in WPT

a system which restricts the effectiveness of the WPT systems is related to the distance of power transfer. Hence, the study reviews different optimization techniques incorporating ANN algorithms. Different ANN algorithms such as back propagation, genetic algorithm and particle swarm optimization algorithms were reviewed, and the prominent observations are tabulated. The prominent observations concerning the effectiveness of the ANN algorithms are: These algorithms are most suitable for maximising the power transfer using impedance matching and for enhancing the power transfer using impedance matching. As a part of further research, this study intends to investigate the WPT technology using advanced sensor techniques, communication modules, and control strategies.

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Wormhole Detection and Isolation Scheme Based on Threshold Mechanism in Mobile Ad Hoc Network

Kunal[1], Sumit Chopra[2]

[1]Research Scholar, CSE Dept., KC Group of Institution, Punjab Technical University, Nawanshahr, India
[2]Assistant Professor,CSE Dept., KC Group of Institution, Punajb Technical University, Nawanshahr, India
Email: [1]sumit.chopra@kcinstitutes.com,[2]kunaljarewal1993@gmail.com

Abstract—The mobile nodes further transmit message to their neighbouring nodes after receiving any message. The message is sent by the intermediary nodes and act as a router in the condition when a node wishes to forward information to a movable node but it is out of coverage area of sender node. Due to the random movement of nodes, the fixed paths cannot be obtained for message forwarding.The wormhole intrusions are the kind of system layer intrusion. When the system passage is forwarded via the channel for increasing the network delay, then it is identified as worm hole. While the source nodule delivers the control memo for the trail organization towards the target, then the control memos go through via the channel. The respond memos go through the channel as well and source scrutinized that direct route occurs via the channel. The wormhole is the active type of attack which affects network performance. In this research work, technique is proposed for the detection and isolation of wormhole attack. The proposed technique is implemented in network simulation version 2. The performance of proposed technique is analyzed in terms of certain parameters and it give high performance as compared to existing technique for isolation of wormhole attack in MANET.

Keywords: MANET, Wormhole, Threshold Delay

I. Introduction

MANETs includes various movable sensor nodes. These sensor nodes interact with each other through the movement of data packets in multi-hops without having any centralized control. These networks involve numerous mobile hosts. These hosts use wireless links for communication purpose [1]. These nodes move randomly in any direction as these are infrastructure less network with no central control. Due to these attributes, all nodes in the network behave as router where data packets are transmitted by host. MANET provides optimum solutions in many cases for example wired or wireless network in which the issue of damage and congestion occurs abruptly. The security of route is the major issue of MANET. In past few years, various types of local link fixing techniques were proposed to minimize the issue of link failure. For instance, the interconnection of all devices coming from

the same place such as business meeting at a place for the composition of Ad-Hoc network in presence of network services. The mobile nodes further transmit message to their neighbouring nodes after receiving any message [2]. The message is sent by the intermediary nodes and act as a router in the condition when a node wishes to forward information to a movable node but it is out of coverage area of sender node. Due to the random movement of nodes, the fixed paths cannot be obtained for message forwarding. The wireless network faces many issues due to its infrastructure-less configuration. An infrastructure is required for efficient functioning of these networks. The nodes within this network can behave both as router and host as it has the ability using which traffic can be routed from source to destination. Topology change, unreliable communication and inadequate energy of nodes are some factors which cause issue in the design of these networks. Therefore, the more attention should be given to the issues of MANET such as limited bandwidth and node mobility. The MANET faces various routing issues during the routing process due to some factors such as the nodes present in network are movable type. The nodes are distributed randomly. The movement of intermediated nodes in the path causes path failure. Therefore, an effective mobility management is required during routing process. The bandwidth limitation is the one more design issue present in MANETs. Thus, it is required to design a routing protocol for eliminating the issue of limited bandwidth to reduce network overhead. Collision and congestion are two major issues of wireless sensor network. The immediate mobility of nodes inside the system is the main cause of collision between data and control packets during communication in mobile ad hoc network. The issue of hidden terminal and exposed terminal also occurs in MANET [4]. The packet collision at the end point of receiving node is called hidden terminal issue. This issue occurs due to the concurrent transferring of nodes towards those which do not exist in straight coverage area of correspondent but occur in

the receiver transferring area. Therefore, this is a main problem as it causes intrusion among nodes due to link variation. These issues destroy overall transmission. The situation in which nodes do not know each other and transfer packets at the same time due to which they come in the way of each other and cause collision and terminals damage. Thus the issues of hidden and exposed terminal should be minimized during the designing of protocols.

MANETs are extensively utilized in various areas for example financial, military and private sectors. This network allows users to send and exchange information without considering distance and hence avoids geographic locations [5]. Following are the various applications of MANETs.

II. EASE OF USE

A. Military Sector

In recent times, military technologies regularly include several types of processing tools. MANET networking allows military to get benefit from regular network machinery in order to maintain an information sharing network among military. The vital performance of MANET comes from this region.

B. Commercial Sector

These networks give effective results during disaster. Because of this reason, these networks are broadly used for rescue operations or urgent situations. The communication among nodes is essential during the security processing order to provide appropriate support. The communication device generates information system automatically using which rescue operations are implemented by the rescuers easily.

C. Sensor Networks

This network involves large numbers of small sensors for identifying large numbers of resources within a region. These sensors have limited potential and depend on each other for information transmission. The computing capability of single sensor is limited due to which more failure and information loss occur [11]. Thus, this can be used as a key to future homeland security.

D. Personal Area Networking

In order to simplify, communication among various movable devices, very small range MANET is utilized such as PDA, laptop, mobile phone etc. Wireless links are replaced by repetitive wired flex. In MANET, access can be provided to certain systems or internet with the help of some techniques such as WLAN, GPRS, as well as UMTS. PAN is considered a promising functional area of mobile ad hoc networks for the future determined computing scenario.

E. Emergency Services

This network is extensively used in such situation when entire communication structure is distorted or not working properly. These situations include Tsunamis, storms, volcanic activity etc. The lessening of disaster effects and rapid re-formation of infrastructure is very necessary [6]. With the help of this arrangement, a network can be established within few hours as this network does not need wired link.

III. LITERATURE REVIEW

Elbasher Elmahdi, *et.al* (2018) presented a new approach to provide trustworthy and safe data transferring in the occurrence of attacker nodes [7]. In this study, a routing protocol named AOMDV was modified for splitting message into numerous routes. This approach implemented a homomorphic encryption technique. The simulation outcomes depicted that proposed approach performed well in terms of higher packet delivery ratio and network throughput. Therefore, this approach was extremely advantageous for urgent functions of MANETs. Moreover, higher achievement rate and packet delivery assurance towards destination had been provided by the presence of numerous dynamic routes in each network cluster. As future work, end-to-end delay can be decreased by expanding this study for applying this approach within urgent situations.

Oussama Sbai, *et.al* (2018) presented a study relevant to single and numerous black hole intrusions in AODV and OLSR protocols [8]. In this simulation, the network density based on the quantity of nodes within the network was taken into account with the mobility scheme and nodes' velocity. For physical layer, a routing protocol named IEEE 802.11ac was selected to perform simulation. This routing protocol was able to manage more genuine and universal circumstances. Routing overhead, average end to end delay, throughput and packet delivery ratio were the factors on which performance of proposed approach was evaluated. In terms of these parameters, the proposed approach showed better performance in comparison with existing techniques.

Guoquan Li, *et.al* (2018) proposed a research study to detect the impact of black hole intrusion within the network during the occurrence of AODV protocol [9]. Different performance parameters like packet loss, end-to-end delay and throughput were considered to estimate this effect. Overall nodes, the black hole nodes as well as the velocity of mobile nodes were modified to analyze the performance of network. The properties of black hole intrusions were provided through the tested outcomes. These properties reflected the behaviors of black hole intrusion and its effect on the network performance.

Amar Taggu, *et.al* **(2018)** proposed an easy and effective intrusion detection scheme for the detection of black hole attack occurring in the application layer of MANETs [10]. The proposed algorithm utilized mobile agents (MA) and modified version of Trace route to detect manifold black holes in DSR protocol. In the proposed approach, the utilization of mobile agents eliminated the need of improvements in routing algorithms. The simulation outcomes depicted that the single and multiple black hole nodes could be identified fruitfully athwart changeable mobility of sensor nodes.

Sayan Majumder, *et.al* **(2018)** projected a novel scheme named as Absolute Deviation (AD) for the impediment of wormhole intrusion [11]. The discovery of wormhole intrusion could be executed in extremely small amount of time because of the exploitation of absolute deviation covariance and correlation. The projected algorithm did not need any additional circumstances for its implementation. The wormhole malevolent generated a false channel from source to target. The frequency level of this connection was extremely elevated. In this study, it was supposed that the remoteness amid source and target was extremely small and the time period utilized for the transmission of message would be extremely fewer. Though, the large duration of time was utilized for the following of authentic route. Therefore, the time period utilized for the prevention of wormhole malevolent from coming to the network was computed significantly in this study. The tested outcomes demonstrated that absolute deviation approach provided superior outcomes than AODV. In addition, the Absolute Deviation Correlation Coefficient was used for the identification of the wormholes through determining the packet plunge prototype.

Nikhil G. Wakode, (2017) presented a new scheme with the help of cooperative bait detection approach (CBDA). The novel scheme was presented in conjunction with attacker node detection algorithm for the prevention of black hole intrusion. This intrusion caused a lot of damage to the network [12]. Due to the proposed approach, end-to-end delay, normalized routing overhead and packet delivery ratio were reduced significantly. On the other hand, the existence of attacker nodes within the network increased packet drop ratio. Nevertheless, overall performance parameters were enhanced due to the reduction in packet drop ratio and growth in normalized routing, end-to-end delay and packet delivery ratio. The tested results demonstrated that safe information sharing was executed by network simulator.

PratikGite, *et.al* **(2017)** stated that the expanding technique of Mobile Ad-hoc Network was utilized extensively in the wireless links. The proposed technique was dependent on some parameters such as mobility, wireless connectedness and self-configuration. The movement of the nodes and the shortage of the energy were the major issues of multi-hop Ad-Hoc network which occurred due to the link failure in the system. These losses could not be identified through the standard congestion system. Thus, in the system, the routing protocols were identified as the necessary part because of their benefits and drawbacks. Routing protocol was extremely important because it discovered and maintained all paths. A new routing protocol was presented in this study. With the help of this protocol, preference was provided to the available paths in accordance with their route robustness [13]. A link prediction approach was proposed based on the signal power. In this study, the proposed approach was applied on the AODV routing protocol. The tested outcomes indicated that performance of the proposed technique was better than the earlier approach. The proposed approach enhanced the performance of network in terms of some parameters.

Kavitha T, *et.al* **(2017)** stated that link failure inside mobile ad hoc network occurred to the nodes' movement. Till now, various approaches had been proposed for the speedy re-routing of data packets. In these techniques, hop count was utilized as the main factor but these techniques did not provide good results for end to end delay. Thus, in this study, an immediate Route Migration protocol was proposed for the creation of shortest path. This protocol considered route distance and hop count. A partial topology aware technique was applied to obtain shortest route immediately [14]. A technique was presented in this study for redirecting packets towards the target easily during link failure at every node. The experienced outcomes revealed that projected technique showed highest throughput, less end to end delay, and instant path transfer.

Roshani Verma, *et.al* **(2017)** stated that the main objective of this study was the recognition and removal of wormhole intrusion for the duration of the broadcasting and transmission procedures. The projected approach improved the safety of ad hoc arrangements. These types of intrusions were prohibited from entering the system [15].The packet delivery proportion was improved and the control overhead was diminished by the improvement of routing protocols in the systems. The table accesses at target node were enhanced in order to recognize the wormhole attack

affected nodules at elevated speed. The new technique provided assistance in the exploitation of competent techniques by which the DoS intrusions and hybrid intrusions could also be prohibited from entering the systems and thereby enhanced the network safety.

IV. RESEARCH METHODOLOGY

This research work is based on the detection and isolation of wormhole attack in mobile ad hoc network. The routing and security are the major issues of mobile ad hoc network. The routing protocols are broadly classified into reactive and proactive. In the reactive routing protocols path from source to destination is established when required. The source node flood route request packets in the network and nodes which are adjacent to destination will reply back with the route reply packets. The source node receives many replies and path from source to destination is established based on hop count and sequence number. The path which has least hop count and maximum sequence number will be considered as best path for the data transmission. In the established path malicious nodes exists which increase delay in the network. The methodology is proposed for the detection of malicious nodes from the network. The proposed methodology has various phases which are explained below in detail:-

Step 1: Path Establishment: In the first phase, the path will be established from source to destination based on the hop count and sequence number. The path which have least hop count and maximum sequence number will be considered as the best path for the data transmission from source to destination

Step 2: Define Maximum and Minimum Bandwidth: The network, the data rate is defined according to network configuration. The mobile ad hoc network configuration is not so high, due to which bandwidth consumption is also low. The bandwidth consumption will decide the delay in the network.

Step 3: Malicious Node Detection: When the malicious node trigger wormhole attack in the network than delay start increasing at steady rate. The delay at every hop gets counted and if the over delay in the path get improved than threshold value then it possibility of malicious node. The hop at the delay is maximum that hop node is considered as the malicious node which will be marked as red color.

Step 4: Isolation of Malicious Node: The last phase is isolation phase in which malicious node get isolated from the network. In the isolation phase, the technique of multi hop routing will be implemented in the network. The path in which malicious node exists can be further selected for the data transmission
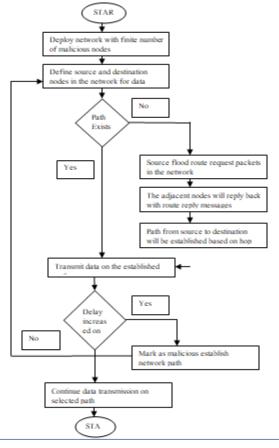

Fig.1: Proposed Methodology

V. RESULT AND DISCUSSION

Network Simulator is an occasion relied simulator. The network simulator is a kind of distinct occasion packet level simulator. It covers huge amount of dissimilar types of protocols used in different kinds of applications and packets. In the network simulator, scripting language is utilized. It comprises "NAM" files using which animatronics proceeds. In this investigative study, the AODV routing protocol is utilized for the route formation from source to target. The AODV protocol is the reactive kind of routing protocol which attains data when it is mandatory for the establishment of path from source to target. The AODV protocol is relied on distinct source and a particular target method is utilized for the formation of a route which comprises slightest remoteness and highest consistency.

The performance Matrix of the work is described below:

Throughput: How many packets are effectively transmitted to the target in analyzed by the throughput

$$Throughput = \frac{No\ of\ packets\ Received}{Total\ number\ of\ packet\ send} * time$$

TABLE 1: SIMULATION PARAMETERS

Simulation Parameters	Values
Channel- Type	Wireless channel
Propagation model	Two ray ground propagation
Mobility Model	Random way point
Antenna type	Oml-directional
Number of nodes	100
Speed (s)	150 m/ second
Traffic Type	CBR
Mac Type	IEEE 802.11 (b/g)
Routing protocol	AODV
Area of stimulation	800*800
Time of stimulation	100 seconds

a. Power: The power utilization is the parameter which scrutinize the power utilization in the network

Power Consumption = Number of packets send * per unit power

b. Packet Loss : The packet loss is the total amount of packets which are misplaced during information broadcasting in the network

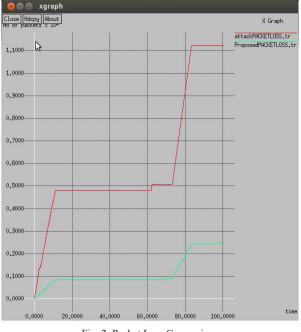Packet loss= No of packets send - No of packets received

Fig. 2: Packet Loss Comparison

As shown in figure 2, the packet loss of the proposed technique and existing technique is compared for the performance analysis. It is analyzed that packet loss of proposed technique is low as compared to existing technique
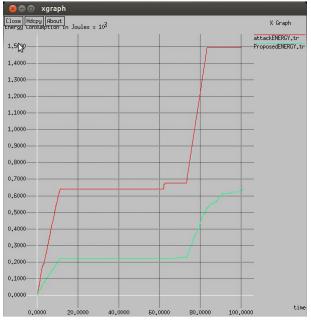

Fig.3: Energy Comparison

As shown in figure 3, the energy of the proposed technique and existing technique is compared for the performance analysis. It is analyzed that energy of proposed technique is low as compared to existing technique.
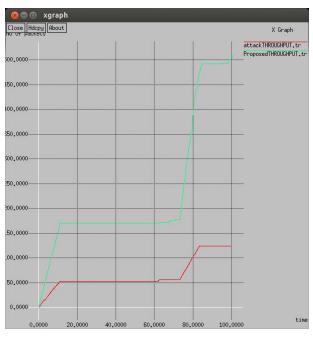

Fig.4: Throughput Comparison

As shown in figure 3, the throughput of proposed technique is compared with the existing technique. It is analyzed that throughput of proposed technique is high as compared to existing technique.

VI. Conclusion

The wireless ad hoc network is the decentralized kind of network in which movable nodes can connect or depart from the network according to their requirement. This kind of network does not comprise any kind of middle manager or central controller. The network security, routing and quality of service are the major constraints of this arrangement because of the self arranging character of this network. An active kind of attack named wormhole intrusion may be the reason of the entering of attacker nodes in the system and because of this delay increases. In the presented research, two phase verification scheme is utilized. For the recognition of attacker mobile nodes, this scheme shows fewer precision and large implementation times. The projected and accessible approaches are applied in NS2 and the reproduction outcomes depict development in throughput, reduction in delay and packet loss.

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Hypothetical Overview of Commercial Off the Shelf (COTS): Component Based System

Kanwaljit Singh Walia[1], Sahil Luthra[2]

1,2Deptt. of Computer Application, Amritsar Group of Colleges, Amritsar, India
Email: 1Waliakanwal@hotmail.com, 2Sluthra423@gmail.com

Abstract— **The business of software market is directly promotional to interaction speed among consumer and developer. Consumer entails high-quality result in petite period of time with precise outcome. Developer entails high-quality outcome in pertinent period of time with accurate conclusion. The success of system depends upon the effective selection of components that fulfil consumer requirements. Commercial Of The Shelf (COTS) is a third party support supplied by a vendor, that has specific functionality as part of a system – a piece of pre-built software that is integrated into the system and must be delivered with the system to provide operational functionality or to sustain maintenance efforts. This paper presents how the complexity of the system is reduced by sharing the source code of the system with the third party.**

Keywords—COTS, CBSD, Component, System, Metrics

I. INTRODUCTION

Nature of COTS suggests that the model of component based software development (CBSD) should be different from the development model [1]. The complexity of the system is reduced by sharing the source code of the system with the third party. The source code of the components are generated and collected from the third party. These properties generate the property of Black-Box in COTS components. This reduces the cost and the time of the system development. COTS deliver a reliable system in shorter time frame and demand for larger and more complex software solutions, which often cannot be effectively implemented in a timely manner by a single software development organization. Reusability of COTS components increases degree of standard compliance among COTS components that enables reduction of component integration time and development cost.

II. COMMERCIAL OF THE SHELF (COTS) LIFE CYCLE

In the initial phases of the life cycle as in fig- 1, the designer and the integrator collects the information as per the user requirement for the requirement analysis. After the appropriate collection of information, the designer request for the components to perform the processing on the information to bring the results as per the requirements to bring the results to achieve the goals. If the components are not as per the information, new components can be requested again and the old one are send back to the stock or get destroyed. Until proper components are not generated for the first phase, the cycle cannot move to the second phase. The multi-directional model represents shows that the requirements of the user can change at any moment of time. With this the information changes as well as the component lying in the requirement phase also get changed.

A lot of components are generated to fulfill the requirements of the users. It is difficult to develop a design on the basis of component warehouse. The second phase is the process to select the astute and idol components with proper analysis, and to develop a system design from the selected components. The design of the system easily represents how the system is modularized into subsystems. Every electronic product is simulated before it is launched, similarly every system is architected before implemented. At last generate an architecture representing the multi dimensional representation of the system. Appropriate architecture is developed for an easy communication among components according to user requirements

After the design and the architecture of the components, the designer and the integrator has to confirm that whether the components that are used for the designing and architecture is appropriate for particular term or not. This can be done by component implementation by collecting the information of COTS components and grouping these components into different sets for further evaluation. If any mistake but nor error occurs, the other process can come into action, that is, customization. Customization is a process modify the components to get better performance

After making all the changes, the next level of the lifecyle is the system integration. Integration is performed at the subsystems and the whole system. System integration is the process to merge the components according to system architecture.

The last step is the system testing in COTS life cycle. Testing occurs when a COTS component is chosen, and needs to be repeated for each new version or release. The developer go through the testing to confirm whether the component is reliable to the system with the current requirements of the user and the updated requirements.
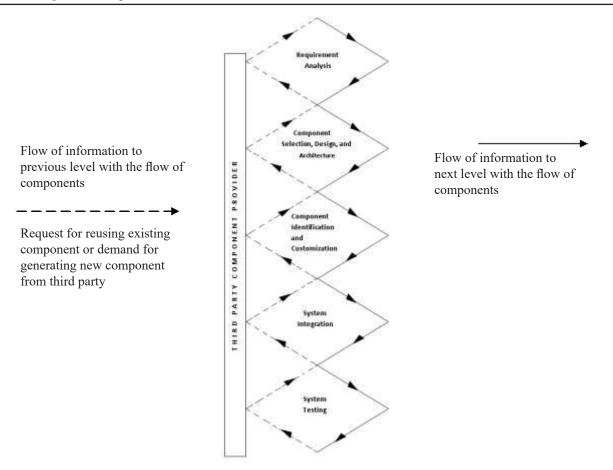
Flow of information to previous level with the flow of components

Request for reusing existing component or demand for generating new component from third party

Flow of information to next level with the flow of components

Fig:1 Bow-Arrow, COTS Component Based System Development life Cycle Model

III. COMMERCIAL OF THE SHELF (COTS) LIFE CYCLE

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IV. Hypothesis

In the component based development level the complexity of the system is reduced by selecting and integrating the components at individual level. At each level, sub-system is generated and various processes make their best to fulfill the stakeholders' requirements. As per the release history of the software, an evolution is the process of component selection and integration. The database represents the warehouse of old, updated and new components. After each evolution, the database gets updated and the contents or components are inserted or modified. With proper understandability of properties of the component, the component is selected. The system can be maintained [2]:

- By keeping the proper track of the system properties, such as performance tracking or compatibility tracking.
- By modifying the components of the system within limited range.
- By the ability of the components to adapt to different platform.
- By the ability of the components to adapt the property reusability, high-quality,

A. Hypothesis-I: Selection of Components

Classification Approach: Filtration is a global technique that is applicable on every system whether it is human, scientific, computer, or business system. While checking the components from database, searching and filtration of components fulfill goals and requirements of the stakeholder. To select more specific components those are goal-oriented, proper evaluation and analysis criterion being performed. Classification act as a mode of comparing the properties of the components for better selection of the components. The various classification techniques are; simple keyword search, faceted classification, signature matching [6] and behavior matching [3]. Some of the other classification approaches are taxonomies and ontologies for software component matching [4], and approach to define and apply the measure of distance between required and offered functionalities [6].

Dominion Approach: Realm Off the shelf option (OTSO) [7] is a dominion approach which decomposes the requirements into a domain criterion. It facilitates a systematic, repeatable and requirement-driven

component identification and selection process. Another method is COTS-based integration system development model (CISD) [8], the major operations performed in this method is requirement analysis, product identification, and product prioritization.

Iterative Approach: The system is updated by refining the components until the most appropriate components are selected and ready to interconnect to generate an effective system. Some of the approaches are Procurement Oriented Requirement Engineering PORE [10,11] and COTS-based Requirement Engineering CRE [9] (COTS-Commercial Off The Shelf: COTS components motivates in the reduction of overall system development and cost)

B. Hypothesis-II: Component Integration

Qualification: The performance and reliability of the component relies on its interfaces. The qualification of the components depends on the properties of the components. In other words, qualification of the component is the development process used to create and maintain the prototype of the component [12].

Adaptation: The frequent changes in the stakeholder's requirements bring the shuffle in the grid of integrated-components. Stand alone components brings serious conflicts. To bring the grid in normal mode, revision is required in the integration of the components. It is necessary to create adaptation to reduce the conflict among the selected components [4]. Adapters are one of the software tools that can manage the components [13].

Composition of Components: The assembling of the integrated components is done in top-down or bottom-up composition. Each level of composition represents the scope of the system and the stakeholder contentment.

Verification and Validation: Verification and validation are the major task for the component based system process. After selection and integration of various filtered components, the testing is performed at each level to check the performance of the system. The Black Box testing is performed to check the behavior (correct/incorrect) of the system) , some of the other maintenance techniques for verification and validation are [10]. To maintain the system proper evolution is performed to fulfill the stakeholders' requirements. The process keeps on going until the requirements of the stakeholder are fulfilled.

C. Hypothesis-III: Components Co-evolution

Internal Co-evolution: With every evolution, the number of components decreases and the corresponding number of interaction increases. The huge gap between the ratio of interaction and components increase the dependency among the components and make a bad effect on system in form of co-evolution [14].Co-evolution is: if

component C1 is interact with component C2, the change made to C1 must require the corresponding changes to C2. Internal co-evolution, if there are 'n' modules within a component C1 and there are 'm' interactions;

If, m>n : Internal co-evolution inactive

If, m<n : Internal co-evolution

External Co-evolution: External co-evolution of a component depends upon interaction of external components with the inner modules

- Afferent coupling: Number of external components that depend upon internal modules of a component.
- Efferent coupling: Number of external components that the internal modules depend upon.

Co-evolution Frequency: The number of co-evolutions happened to a component in a particular period of time.

Component Coupling: In component based system, two components act as coupled if and only if one component may depend on the other. The component coupling is the summation of afferent and efferent coupling. Component coupling highlights the exertion and independence from responsibility

Coupling Density or Interface Density: Every component performs set of operations in form of interactions, either incoming or outgoing. It cannot exceed the operations as per the limits. The density of the component is calculated as per the limits of the component.

V. Acknowldegement

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Electronic Coloring Board Kit

Thaweesak Yingthawornsuk[1], Sirimonpak Suwannakhun[2], Kantapat Kwansomkid[3],
Nalinthip Punvongrod[4] Ariya Saelee[5], Nattapong Yeesan[6]

[1,2,3,4,5,6]*King Mongkut's University of Technology Thonburi, Bangkok, Thailand*
Email: [1]*thaweesak.yin@kmutt.ac.th*, [2]*sirimonpak.sut@kmutt.ac.th*, [3]*kantapat.kwansomkid@mail.kmutt.ac.th*
[4]*nalinthip.pun@mail.kmutt.ac.th*, [5]*ariya.lee@mail.kmutt.ac.th*, [6]*nattapong.40@mail.kmutt.ac.th*

Abstract— **Electronic Coloring Board Kit supporting the development of creativity was created for studying, designing, and improving the Electronic Coloring Board Kit and website "Picpixel", also surveying the satisfaction of users. Electronic Coloring Board Kit includes website "Picpixel" which displays on the coloring board when the sensor detected the color of the object placed by user. The users can get the exact color from object that user needs in drawing. It will find the color codes and send them to the database. After that, the website "Picpixel" will convey the data to display on the website. Based on the test result made on the performance of the Electronic Coloring Board Kit, the average accuracy of color can be found at 88.75%. This result shows that the proposed kit is effective to use as a creatively drawing tool. As the result of users' satisfactory score shown, the overall average scores are 4.05 and 4.19 found from the usage of Electronic Coloring Board Kit and the website usage pattern, respectively. Both scores reveal a high satisfactory level of user toward the proposed kit.**

Keywords: Electronic Coloring Board Kit, Color Sensor, Website

I. Introduction

Many people think that coloring books and crayons are for children only. It has recently been discovered that coloring books are also suitable for adults. Because adulthood is the age that is responsible for many things. Must deal with the expectations of those things around them. Therefore, you will inevitably face daily pressures, stress, and anxiety. Many people try to relax by finding hobbies such as playing music, reading, playing sports, exercising, drawing, or any other activities to strengthen both the body and mind. From research at home and abroad, it was found that coloring in a coloring book is another option that works well. It helps alleviate anxiety a lot. Because focusing on the lines and coloring is a great way to make concentration and to practice using our imagination and creativity without worrying about whether someone will like it or not.

Because existing coloring books may not be attractive enough. In addition, the preparation of colors is difficult to carry and store, and if you want new images, you need to buy more. For us to have new images to create in our imagination when technology is rapidly evolving, the organizers have designed and developed a set of electronic coloring boards that can add images so that we can fill in our imaginations are endless.

The electronic coloring board kit includes software in the form of a website called "Picpixel" that allows you to draw, paint, upload, and save images into the website. The kit has three pieces of equipment, including a display board, a pen for coloring, and a color sensor. The display board has a function as a paper for drawing. The main function of the work is to display drawing as result. The screen is a touchable screen. The color sensor can copy the color of any object placed on it. The resulting color value will automatically show up on the website.

II. Related Work

J. Ren *et al.* [1] used an art education software for children in the Chinese market mainly composed of drawing software. Paint software, puzzle software and dressing software. There are more than 20 kinds of drawing software and 100 other kinds of art education software for children, but most of the software is developed by foreign countries, Hong Kong, or Chinese Taipei, which has limited distribution and use in mainland China. To meet the needs of preschoolers in drawing they brought Chinese culture as a painting medium and developed children's educational art software "Happy baby drawing board" which is good for spreading and using in kindergarten.

Li Chengmao *et al*. [2] developed art learning using the English interface and English speech hints. Three of which were developed by Hong Kong and Taiwan uses traditional Chinese character representations. To meet the needs of preschoolers in drawing, they brought Chinese culture as a drawing medium and use it, which has been effective in its spread and used in kindergarten.

D. Xu [3] invented the computer drawing board as an interesting color practice platform in the smart art teaching module. Especially for foreigners who have difficulty of understanding the basics of artistic literacy. The process of traditional teaching systems takes a long time and traditional educational facilities required too much capacity to accommodate students. A module for

teaching visual arts using color in a network environment has been developed together with related hardware system updates Increased suitability of students has been demonstrated for the learning outcomes of application and transmission.

P. Lapides *et al*. [4] presented a simple and inexpensive system for interacting and exploring three-dimensional (3D) data. The device uses a traditional drawing-board mechanical structure that can be moved up and down. Easily while the height of the surface is tracked using conventional sensors. Users interact with a tablet or tablet PC placed on a surface while simultaneously changing height. The result is a direct mapping of virtual and physical space. It enables detailed design and development of 3D Tractus hardware and software, as well as an initial assessment of 3D drawing and sketching applications using the new desktop interface.

Zhi-song Qin *et al*. [5] developed the TCS230D color sensor, a programmable light-conversion frequency sensor manufactured in IN TAOS Corp. in America. It is characterized as a high-end solution. Programmable color channel output and the output signal are digital, which makes it easy to connect to a universal MCU. This article mainly focuses on the process of using high-quality color identification algorithms and the algorithm's application. It is possible to create new functional color identification devices or systems using the TCS230D chip.

M. Seelye *et al*. [6] outlines the calibration techniques for RGB sensors and compares them with high-end spectrophotometers. Automation for plant leaf color measurement as an indicator of plant fertility status It was developed for saplings growing in a modified micro-propagation system. Sensors mounted on a pan-and-tilt system at the end of the robotic arm use a custom-built robotic arm to monitor plant growth and growing environment in a controlled environment. Optimized rapid growth with minimal human input using a modified micro-propagation system.

T.-K. Woodstock *et al*. [7] developed an RGB color sensor to accurately detect and track passengers in bright areas by detecting discoloration from the background color distribution generated by passengers. Investigation of the momentary dependence of the discoloration caused by the slightest movement of the occupant. This makes it possible to avoid omission/misplacement detections associated with other types of sensors, which feature surface spectral absorption properties that alter the perception of the spectral power dissipation emitted by the light.

Y. Takenaka *et al*. [8] presented a neuron filter algorithm to address the two constraints of the graph coloring problem through a separate board-level routing (s-BLRP) problem in the system. FPGA-based logic simulators for rapid prototyping of large digital systems.

Multiple FPGAs provides a powerful logic simulation system, where the signals or meshes between the FPGA-embedded design partitions are interconnected through beams in simulations in randomly generated comparison site instances, indicating that the algorithm filter, the neurons with thinner applications.

S. Srinivasan [9] designed a color graphics board that uses a graphics processor to connect to a personal computer bus. A highlight of this design is the adoption of a new color mapping style. This feature enables simultaneous display of more than 256 colors on the screen of 8-bit pixel data and provides smooth transitions from one color space to the next on the display screen. A software utility developed to enable interaction from a PC keyboard is described.

T. Nishimoto et al. [10] have taken the advantage of verbal input. They proposed some principles of human-computer interaction. It contains the basic principles and organization of interfaces necessary for a comfortable input system. In applying these principles discuss the desired interface layout using speech, mouse, and keyboard, and design a multi-format drawing tool S-TGIF. It has been shown that multi-continuous drawing tools with speech recognition reduce work time.

III.   METHODOLOGY

A.   Theory of Design and Color

The product design is to know how to plan and set up steps and know how to choose materials and methods to make as required following the characteristics, styles, and properties of each material according to creativity and creating new things. As for color theory, it is a characteristic that affects the eyes to see it as a color and affects psychology, that is, it has the power to create the intensity of light that affects emotions and feelings. Seeing colors through the eyes of the eye sends a feeling to the brain. Cause different feelings according to the influence of the color will consist of Primary, which is the colors that are mixed to create a new color. That looks different from the original color and Color Circle is the color 3 steps, which is the colors that are created by mixing in pairs, starting from the 3 primary colors, and then being born as a new color.

Fig. 1: Color Circle

B. Principles of Designing Elements on a Website

In website design and online marketing, UX (User Experience) and UI (User Interface) are very important. Because not only considering the beauty of the website, but also considering the use. This will make our product or service web page meet the needs of users all around.

Fig. 2: Coding UX and UI

C. Software

Raspbian is an operating system based on the Debian operating system, which is a derivative of the Linux operating system. It is designed to run on Raspberry PI hardware, so Raspbian commands are the same: The commands available on most Linux operating systems, including Ubuntu, are only slightly different. Raspbian comes in two versions: Raspbian Jessie with PIXEL and Raspbian Jessie Lite.
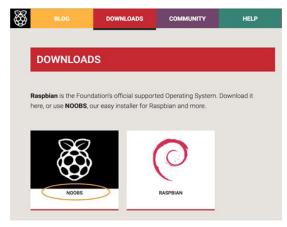

Fig. 3: Installing the Raspbian Operating System on the Raspberry Pi

Fig. 4: Raspberry Pi 4 Model B

IV. IMPREMENTATION

A. Operating Process

First, study the basic information. Second, design the structure. Third, build hardware and website. Fourth, testing hardware and website. Fifth, improve hardware and website. And finally, summary and evaluation of performance.
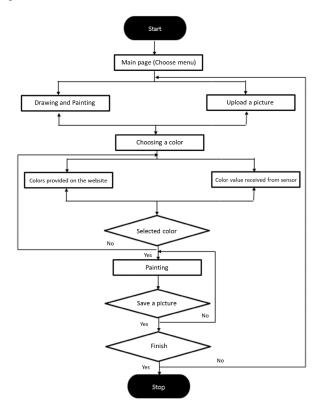

Fig. 5: Diagram Showing How Electronic Coloring Board Kit Works

B. Population and Samples

The sample group consisted of 50 volunteers, 13 men and 37 women. The age of sample group is between 15 and 30 years old.

Fig. 6: Example of Collecting Questionnaires

Fig. 7: Quality Assessment of the Electronic Coloring Board Kit

V. Results and Discussion

From testing the color accuracy of the sensor of the electronic paint board set 100 times (test 4 rounds 25 times each test on 25 colors) found that the first test Sensor receives a color correct 20 times, the 2nd test cycle, the sensor receives correct color 19 times, 3rd test, the sensor receives correct color 21 times, and final test. The sensor was able to receive color values accurate 23 times, totaling the sensor color accuracy of 83 times. Pass the test criteria to test the accuracy of fetching values from the base to the Picpixel website, the author will run a total of 10 experiments. If the accuracy of fetching the values from the base to the Picpixel website is greater than or equal to 8 times, it will be considered passed. Test 5-7 times, the flaws can be ignored. If less than that, it's considered bug fixing. Testing the integrity of different sizes of paintbrush strokes. The organizer will conduct a total of 50 experiments (5 tests, 10 rounds, 5 brush strokes), the test criteria will be determined as follows: The color accuracy of the sensor is greater than or equal to 40 times, it is considered to pass 25 tests. - 39 times, flaws can be overlooked If less than that, it's considered bug fixing. Testing the integrity of saving images to the device. The author will perform a total of 10 experiments if the accuracy of saving the image to the device. More than or equal to 8 times, it is considered to have passed 5-7 times. Defects can be overlooked. If less than that, it's considered bug fixing. The performance of the electronic paint board set by specifying the subject to be tested, divided into 4 topics: 1. Testing the accuracy of receiving the color of the sensor. 2. Testing the accuracy of extracting value from the foundation to the Picpixel website 3. Testing the integrity of different sizes of paintbrush strokes. 4. Testing the integrity of saving images to the device. From all tests, the organizer will bring the result as a percentage. Compared with the established criteria, the performance test results of the electronic paint board set. It was found that the color acquisition accuracy test of the sensor up to 83% of accuracy. Test of extraction accuracy from foundation to website Picpixel is 100% accurate. Test of completeness of different sizes of paintbrush

strokes is 72% for completeness and integrity test to save images into the device. 100% complete performance test results of the electronic paint board set with a total mean of 88.75%. passing the test criteria which shows that the device is efficient.

TABLE 1: Result of Quality Assessment

Title	Average	S.D.	Quality
Understanding of the use of equipment	4.30	0.61	Excellent
Speed of Processing	3.92	0.64	Excellent
Design	3.93	0.73	Excellent
Understanding of User Interface	4.33	0.60	Excellent
Data processing	4.05	0.69	Excellent

VI. Conclusion

The electronic coloring board helps develop creativity with following stages of study of design and developing electronic paint board kits and Picpixel website and study of user satisfaction. The electronic coloring board includes a website called "Picpixel" that is displayed through a coloring board with a color sensor. The user can place an object of the desired color on the sensor. The sensor reads the color value and sends the value to a database. After that, Picpixel's website will retrieve the information and display it on the website.

From testing the efficiency of the electronic paint board on all four sides, the total average was found for 88.75%. It was concluded that the device was efficient. In addition, the organizer has tested the satisfaction of The use of the electronic coloring board set and Picpixel website usage patterns based on questionnaire designed for a sample of 50 volunteers from the satisfaction test on the style of using the electronic paint board set with a total average of 4.05, users were satisfied at a high level as for the satisfaction test on the style of using the Picpixel website with an overall average of 4.19. The user satisfaction was at a high level. From the above evaluation result on performance, it can be concluded that the electronic paint board set performs well as intended. And users are satisfied with the style and functionality of the electronic paint board and the Picpixel website showed at very satisfactory level.

Fig. 8: Cover Design Effect of Electronic Coloring Board Kit

VII. Acknowledgment

Media Technology Department, King Mongkut's University of Technology Thonburi (KMUTT), Thailand.

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Machine Learning:
A Quantum Leap in Technology

Mehak Mahajan[1], Navleen Kaur[2]

[1]Student, Deapartment of Computer Application, Amritsar Group of Colleges, PTU, Kapurthala, Punjab
[2]Assistant Proffessor, Deapartment of Computer Application, Amritsar Group of Colleges, PTU, Kapurthala, Punjab
Email: [1]mehakmahajan128@gmail.com, [2]n.hundal08@gmail.com

Abstract—**The possibility of this research paper is to create attentiveness among upcoming scholars about recent advances in technology, specifically deep learning an area of machine learning which finds applications in big data analytics and artificial intelligence.**

Keywords: Machine Learning, Deep Learning, Big Data, Artificial Intelligence

I. Introduction

Machine learning, by its definition, is a field of computer science that evolved from studying pattern recognition and computational learning theory in artificial intelligence. It is the learning and building of algorithms that can learn from and make predictions on data sets. These procedures operate by construction of a model from example inputs in order to make data-driven predictions or choices rather than following firm static program instructions.

Machine learning is programming computers to optimize a performance criterion using example data or past experience. We have a model defined up to some parameters, and learning is the execution of a computer program to optimize the parameters of the model using the training data or past experience. The model may be predictive to make predictions in the future, or descriptive to gain knowledge from data, or both.

To solve a problem on a computer, we need an algorithm. An algorithm is a sequence of instructions that should be carried out to transform the input to output.

For example, one can devise an algorithm for sorting. The input is a set of numbers and the output is their ordered list. For the same task, there may be various algorithms and we may be interested in finding the most efficient one, requiring the least number of instructions or memory or both.

For some tasks, however, we do not have an algorithm—for example, to tell spam emails from legitimate emails. We know what the input is: an email document that in the simplest case is a file of characters. We know what the output should be: a yes/no output indicating whether the message is spam or not. We do not know how to transform the input to the output. What can be considered spam changes in time and from individual to individual. What we lack in knowledge, we make up

for in data. We can easily compile thousands of example messages some of which we know to be spam and what we want is to "learn" what consititutes spam from them.

We need machine learning in the following cases:
- Human expertise is absent. E.g. Navigating on Mars.
- Humans are unable to explain their expertise. E. g. Speech Recognition.
- Solution changes with time E.g. Temperature Control.
- Solution needs to be adapted to particular cases. E. g. Biometrics.
- Problem size is too vast for our limited reasoning capabilities. E.g. Calculating webpage ranks.

Consider the recognition of spoke speech, where an acoustic speech signal is converted to ASCII text. The pronunciation of a word may vary from person to person due to differences in age, gender or pronunciation, so in machine learning, the approach is to collect a large collection of sample utterances from diverse people and learn to plot these to words. As another example, consider routing packets over a computer grid. The trail maximizing the quality of service from source to destination changes regularly as the system traffic changes. A learning routing procedure is able to adapt to the best path by monitoring the network traffic.

Machine learning involves two types of tasks:
- Supervised machine learning: The program is "trained" on a pre-defined set of "training examples", which then facilitate its ability to reach an accurate conclusion when given new data.
- Unsupervised machine learning: The program is given a bunch of data and must find patterns and relationships or learning a model from unlabeled data.

A. Applications

Web page ranking that is, the process of submitting a query to a search engine, which then finds webpages relevant to the query and which returns them in their order of relevance. For an example of the query results for "machine learning". That is, the search engine returns a sorted list of webpages given a query.

To achieve this goal, a search engine needs to 'know' which pages are relevant and which pages match the query.

Such knowledge can be gained from several sources: the link structure of webpages, their content, the frequency with which users will follow the suggested links in a query, or from examples of queries in combination with manually ranked webpages.

Increasingly machine learning rather than guesswork and clever engineering is used to automate the process of designing a good search engine.

II. Deep Learning

Deep learning has revolutionized the technology industry. Modern machine translation, search engines, and computer assistants are all powered by deep learning. This trend will only continue as deep learning expands its reach into robotics, pharmaceuticals, energy, and all other fields of contemporary technology. It is rapidly becoming essential for the modern software professional to develop a working knowledge of the principles of deep learning.

Artificial neural networks (ANNs) or connectionist systems are computing systems inspired by the biological neural networks that constitute animal brains. Such systems learn (progressively improve their ability) to do tasks by considering examples, generally without task-specific programming. For example, in image recognition, they might learn to identify images that contain cats by analyzing example images that have been manually labeled as "cat" or "no cat" and using the analytic results to identify cats in other images. They have found most use in applications difficult to express with a traditional computer algorithm using rule-based programming.

An ANN is based on a collection of connected units called artificial neurons, (analogous to biological neurons in a biological brain). Each connection (synapse) between neurons can transmit a signal to another neuron. The receiving (postsynaptic) neuron can process the signal(s) and then signal downstream neurons connected to it. Neurons may have state, generally represented by real numbers, typically between 0 and 1. Neurons and synapses may also have a weight that varies as learning proceeds, which can increase or decrease the strength of the signal that it sends downstream.

Typically, neurons are organized in layers. Different layers may perform different kinds of transformations on their inputs. Signals travel from the first (input), to the last (output) layer, possibly after traversing the layers multiple times.

The original goal of the neural network approach was to solve problems in the same way that a human brain would. Over time, attention focused on matching specific mental abilities, leading to deviations from biology such as backpropagation, or passing information in the reverse direction and adjusting the network to reflect that information.

Neural networks have been used on a variety of tasks, including computer vision, speech recognition, machine translation, social network filtering, playing board and video games and medical diagnosis.

Machine learning promises to change the field of software development by enabling systems to adapt dynamically. Deployed machine learning systems are capable of learning desired behaviors from databases of examples. Furthermore, such systems can be regularly retrained as new data comes in. Very sophisticated software systems, powered by machine learning, are capable of dramatically changing their behavior without major changes to their code (just to their training data). This trend is only likely to accelerate as machine learning tools and deployment become easier and easier.

Machine learning promises to lower barriers even further; programmers will soon be able to change the behavior of systems by altering training data, possibly without writing a single line of code. On the user side, systems built on spoken language and natural language understanding such as Alexa and Siri will allow nonprogrammers to perform complex computations. Furthermore, ML powered systems are likely to become more robust against errors. The capacity to retrain models will mean that codebases can shrink and that maintainability will increase. In short, machine learning is likely to completely upend the role of software engineers. Today's programmers will need to understand how machine learning systems learn, and will need to understand the classes of errors that arise in common machine learning systems. Furthermore, they will need to understand the design patterns that underlie machine learning systems (very different in style and form from classical software design patterns). And, they will need to know enough tensor calculus to understand why a sophisticated deep architecture may be misbehaving during learning. It's not an understatement to say that understanding machine learning (theory and practice) will become a fundamental skill that every computer scientist and software engineer will need to understand for the coming decade.

A deep neural network (DNN) is an artificial neural network (ANN) with multiple layers between the input and output layers.[13][2] There are different types of neural networks but they always consist of the same components: neurons, synapses, weights, biases, and functions. These components functioning similar to the human brains and can be trained like any other ML algorithm.

For example, a DNN that is trained to recognize dog breeds will go over the given image and calculate the probability that the dog in the image is a certain breed. The user can review the results and select which probabilities the network should display (above a certain threshold, etc.) and return the proposed label. Each mathematical manipulation as such is considered a layer, and complex DNN have many layers, hence the name "deep" networks.

DNNs can model complex non-linear relationships. DNN architectures generate compositional models where the object is expressed as a layered composition

of primitives.The extra layers enable composition of features from lower layers, potentially modeling complex data with fewer units than a similarly performing shallow network.For instance, it was proved that sparse multivariate polynomials are exponentially easier to approximate with DNNs than with shallow networks.

Deep architectures include many variants of a few basic approaches. Each architecture has found success in specific domains. It is not always possible to compare the performance of multiple architectures, unless they have been evaluated on the same data sets.

DNNs are typically feedforward networks in which data flows from the input layer to the output layer without looping back. At first, the DNN creates a map of virtual neurons and assigns random numerical values, or "weights", to connections between them. The weights and inputs are multiplied and return an output between 0 and 1. If the network did not accurately recognize a particular pattern, an algorithm would adjust the weights. That way the algorithm can make certain parameters more influential, until it determines the correct mathematical manipulation to fully process the data.
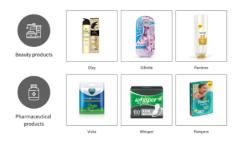
Recurrent neural networks (RNNs), in which data can flow in any direction, are used for applications such as language modeling.Long short-term memory is particularly effective for this use.

Convolutional deep neural networks (CNNs) are used in computer vision. CNNs also have been applied to acoustic modeling for automatic speech recognition (ASR).

A. Image Classification

For increased accuracy, image classification using CNN is most effective. First and foremost, your IDP solution will need a set of images. In this case, images of beauty and pharmacy products are used as the initial training data set. The most common image data input parameters are the number of images, image dimensions, number of channels, and number of levels per pixel.

With classification, you are able to categorize images (in this case, as beauty and pharmacy). Each category again has different classes of objects as shown in the picture below:

B. Applications

- Optical Character Recognition E.g. Scanning an image an extracting text from it.
- Speech Recognition E.g. Generating textual representation of speech from a sound clip.
- Artificial Intelligence E.g. Robotic Surgery
- Automotive Applications E. g. Self-Driving Cars
- Military and Surveillance E.g. Drones

III. Deep Learning in Big Data

Deep Learning and Big Data are two high-focus areas of data science. Deep learning algorithms extract complex data patterns, through a hierarchical learning process by analyzing and learning massive amounts of unsupervised data (Big Data). This makes it an extremely valuable tool for Big Data Analysers.

Big Data has 4 important characteristics, namely, Volume, Variety, Velocity and Veracity. They are Learning algorithms are mainly concerned with issues related to Volume and Variety. Deep Learning algorithms deal with massive amounts of data, i. e. Volume whereas shallow learning algorithms fail to understand complex data patterns which are inevitably present in large data sets. Moreover, Deep Learning deals with analyzing raw data presented in different formats from different sources, i. e. Variety in Big Data. This minimizes the need for input from human experts to retrieve features from all new data typesfound in Big Data.

Semantic Indexing, Data Tagging and Fast Information Retrieval are the main objectives of Deep Learning in Big Data. Consider data that is unstructured and unorganized. Haphazard storage of massive amounts of data cannot be used as a source of knowledge because looking through such data for specific topics of interest and retrieving all relevant and related information would be a tedious task. Using Semantic Indexing and Data Tagging, we identify patterns in the relationships between terms and concepts based on the principle that words used in the same context have similar meanings. The related words can then be stored close to each other in the memory. This helps us present data in a more comprehensive manner and helps in improving efficiency. A direct result of such a form of storage would be that search engines would work more quickly and efficiently.

IV. Deep Learning in Artificial Intelligence

Artificial Intelligence is the theory and development of computers which are capable of performing tasks which humans can. Deep learning represents the rudimentary level of attempts towards achieving this task. It is utilized in visual perception, speech recognition, game playing, expert systems, decision-making, medicine, aviation and translation between languages.

In the gaming industry, Artificial Intelligence could be useful as we could have a 'gamebot' stand as an opponent when a human player is not available. We could also have deep learning algorithms suggest how enemy spawns could be strategically placed in the arena to obtain different levels of difficulty. The military as well as aviation industries can use Artificial intelligence to sort information related to air traffic and then provide their pilots with the best techniques to avoid the traffic. A medical clinic can use Artificial Intelligence systems to organize bed schedules, staff rotations and provide medical information.

V. Conclusion

Deep learning techniques have been criticized because there is no way of representing causal relationships (such as between diseases and their symptoms), and the algorithms fail to acquire abstract ideas like "sibling" or "identical to." Not much theory is available for most of the methods which is disadvantageous to beginners. Deep Learning is only a small step towards building machines which have human-like intelligence. Further advancements must be made in order to achieve our ultimate goal. Organizations like Google, Facebook, Microsoft and Baidu (a Chinese search engine) are buying into this technology and exploring various avenues available. For example, Facebook is using deep learning to automatically tag uploaded pictures. Google's Deep Mind focusses on exploring new techniques in this area. Recent trends show that the interest in machine learning has only been growing with time and has sparked an interest in countries like India and Singapore. Thus it has emerged as one of the most promising fields of technology in recent times.

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A Centered Clustering and Weighted Scheme to Support Mobility in WSN

Ashaq Hussain[1], Er.Madhvi Arya[2]

[1,2]*Electronics and Communication Engineering, Swami Vivekanand Institute of Engineering & Technology*
Banur, Punjab, India
Email: [1]aashiqillahi@rediffmail.com, [2]madhviarya92@gmail.com

Abstract— **Wireless Sensor Networks (WSNs) are real-time embedded devices, which are made up of thousands of sensor nodes whose primary function is to collect data, analyze it, and then broadcast it over the network. In WSN, scholars are concerned about the sensor networks' limited battery life. To extend the WSNs lifespan, an energy-efficient routing protocol based on Fuzzy c-mean and sink mobility is proposed in this paper. To cover the full sensing area, the network has been set up and has been deployed. Then the FCM clustering technique is utilized for creating clusters in the network. The cluster heads (CHs) are selected by residual energy, the distance among neighboring nodes, and the distance between neighboring nodes to sink nodes. In the cluster, the node with the lowest weight would be chosen as the CH. The communication begins in the network when the CH node collecting and transmitting data to the sink node. In MATLAB software, the proposed model's performance is assessed and compared to the conventional models. In terms of alive nodes and total energy consumption, the simulated outcomes were evaluated. The results showed that the suggested model increases the lifespan of the network while consuming less energy.**

Keywords: Wireless Sensor Network, Cluster Formation, Fuzzy C Mean Clustering, Energy Efficient Protocol, e.t.c.

I. INTRODUCTION

WSNs are made of tiny sensors that collect data by interacting with one another, owing to developments in wireless networking. Sensor nodes are small sensing units that have a processor, storage, battery, and transceiver [1]. The size of each sensor node changes depending on the software. In some defensive or security systems, it could be microscopically small. Memory capacity, CPU, and battery life are all elements that influence the price [2].Climate tracking, ecosystem surveillance, medical, performance tracking, and safety are all frequent uses for WSNs in both household and business contexts. WSNs could be used to detect an incident in a military setting [3].

WSN is made up of tens to hundreds of little low-energy, low-cost, and clever SNs, as well as one or more BS [4]. Nodes are normally static and scattered throughout the sensing zone, but they can also be mobile

and interact with the environment. Wireless sensor communication's goal is to detect one or more properties of a "field of concern" or "sensing area" [5]. Sensor Nodes work together to sense and collect tracking criteria, but they can also work alone. They are usually equipped with non-rechargeable batteries and work until they run out of fuel once mounted in the target region.The sensor nodes work together, but they don't directly upload the raw data; instead, they have their own processing ability to ensure appropriate functioning and integration, and only convey the information that the lower-level note requires [6].

Sensor Nodes may perform a wide range of functions, including detecting the environment, interacting with nearby nodes, and, in many cases, doing simple arithmetic on the data obtained [7]. Figure 1.1 illustrates the block diagram of WSN, which consists of sensor node that is utilized for environment monitoring. The sensor nodes transmit the information to the sink nodes (base station) via wireless communication. The sink node then distributes the sensed data to the user through internet [8].
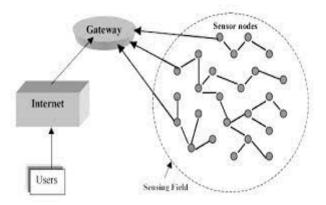

Fig. 1: Generalized View of WSN

Wireless networks have limited connectivity, flexibility, and energy consumption Sensor Networks can use their energy in a variety of ways, but one of the most energy-intensive sources is information processing, therefore routing is a key approach to remember[9]. Identifying and maintaining routes in WSNs is crucial

due to energy limits and transmission spectrum limits. Clustering was always one approach for solving the energy difficulties in WSNs. It separates the sensor node into numerous clusters, with one node acting as a leader node for each cluster, known as a Cluster head. The Cluster Member's function is to connect with the CH, acquire information from them, combine it, and send it to a central Base Station via a hierarchical routing system [10]. Clustering works by allowing Sensor Nodes to interface with their own CH solely, rather than sharing the transmission line with nodes from other clusters, to reduce internal collisions [11]. Data consolidation at CHs reduces network energy usage by reducing the overall quantity of information signals to be delivered to the BS.

Once the clusters are constructed, connectivity among the nodes can be intra- or inter-cluster. Intra-cluster networking refers to information flows between Cluster Member nodes and their associated Cluster leaders. Inter-cluster connectivity includes information sharing between the BS and CHs. Inter-cluster contact is an important feature of Sensor networks, and multi-hop based method, in which each Cluster Head delivers data directly to the Base Station. In multi-hop system, the nodes closest to the CH lose the most energy in multi-hopping due to relaying which ultimately reduces the network lifespan. In order to extend the lifetime of a wireless network, various researchers have proposed many protocols for routing, which are discussed in the next section of this paper.

II. Literature Survey

To meet the routing requirements in WSN, several researchers have proposed several approaches, out of which some are mentioned here: N. Ali et al. [13], introduced a Heterogeneous DSR PEGASIS Optimization Routing Protocol (HDPORP) that combined the benefits of both DSR and PEGASIS processes. The authors of this paper used Dijkstra's algorithm to find the shortest route between each node and CHs, and then an energy list, which keeps track of node power, to upgrade the network with high-energy nodes and eliminate low-energy nodes, in this simulation. When compared to other techniques, the HDPORP approach extends the life of wireless networks by 10%, as per the simulator data. MECHTA and S. HAROUS [14],describe an energy-aware Huffman coding-based LEACH for wireless communication networks. When compared to LEACH, the test results showed that the suggested strategy is successful in improving power utilization by roughly 38%.G. Abbas et al. [15], Enhanced Hybrid Multipath Routing (EHMR), a routing approach for wireless networks that uses hierarchical clustering and provides a next-hop selection mechanism between nodes based on a maximal remaining energy measure and a minimal hop count, was introduced in this work to maintain energy efficiency. For a higher packet delivery ratio and reduced delay rate, data traffic is load-balanced across multiple channels. When compared to alternative WSN routing methods, simulation results demonstrated that EHMR has a higher packet delivery ratio, uses less energy per packet forwarding, has a shorter end latency, and has a lower data rate influence on packet delivery ratio. [6]S. E. Bouzid et al. [16],demonstrated a unique WSN routing technique based on distributed Reinforcement Learning (RL). Researchers of this paper considered the distance between nodes, available energy, and hop count to the sink node while routing messages. Experiments and comparisons with existing approaches across a range of lifetime characteristics demonstrated the efficacy of the proposed methodology. Meysam Yari et al. [17],used a regulated topology, a threshold for residual power in nodes, and two metaheuristic approaches, SA and VNS, to increase the amount of energy left in the sensors. To increase the network lifespan, a suitable connection control between nodes was built in the network using a low-cost spanning tree. Simulations showed that the proposed technique extends sensor life while reducing energy use. Aruna Pathak [18],presented a PBC-CP based on the artificial bee colony approach. They took into account significant aspects in the PBC-CP methodology for CH selection, such as node energy, node degree, and distance from the base station to the node. It chooses the most energy-efficient technique for sending information from the CH to the BS, lowering the energy consumption of the sensor network. The suggested plan's efficacy was demonstrated in simulation trials. Piyush Rawat et al. [19], the Energy Efficient CH Selection Scheme (ECSS) was introduced as a clustering tool by the researchers of this paper. The proposed method was created to reduce system power consumption and thereby increasing the network's lifespan in a heterogeneous network. To test the effectiveness of the proposed ECSS approach, it was compared to other current approaches using a MATLAB simulation. Simulation results demonstrated that the suggested ECSS method improves network lifetime, throughput, and energy utilization when compared to current approaches. Yang Liu et al. [20],provided a novel improved routing method to boost the WSN's energy savings. The improved energy-efficient LEACH (IEE-LEACH) approach, which was recently proposed, takes into accounts both remaining node energy and network average energy. The proposed IEE-LEACH takes into account the number of ideal Cluster heads and inhibits nodes closer to the base station (BS) from entering the clustering to achieve appropriate performance in terms of sensor power usage reduction. Furthermore, the proposed IEE-LEACH employs single-hop, multi-hop, and hybrid transmissions to boost network energy efficiency, as well

as a new threshold for picking Cluster heads between SNs. Sultan Alkhliwi et al. [21],proposed EECRP-SID, an energy-efficient cluster-based routing method with secure intrusion detection, for HWSN. To identify attackers in cluster-based Wireless networks, an efficient intrusion detection system (IDS) based on LSTM "long short-term memory" was constructed on the Cluster heads. The EECRP-SID method was created in MATLAB, and testing results reveal that it outperformed the other methods on several performance parameters. Turki Ali Alghamdi [22],provided a unique clustering approach with the best CH selection in this case by considering four essential criteria: energy, latency, distance, and privacy. This work introduced a new hybrid method for picking the best Cluster heads termed fire fly substituted position update in dragonfly, which combines the principles of dragonfly and firefly algorithm methodologies. The performance of the recommended work was assessed by comparing it to other standard models in terms of the number of live nodes, network energy, latency, and hazard likelihood.

From the literature survey conducted, it is analyzed that several researchers have proposed several techniques to satisfy the routing conditions in WSN. In traditional models, scholars utilized several energy-efficient routing techniques in which the selection of cluster head was based on rotation and a probability threshold value. In addition to this, these techniques were utilized along with clustering schemes as cluster head selection played a crucial role in communication. The communication in the traditional models was performed when CHs gather the data from the sensor nodes and then sends it to a sink located outside the cluster. Furthermore, as the sink was situated outside the cluster, the traditional techniques faced various shortcomings. These techniques had a shorter lifespan as the sink had to travel a greater distance, which resulted in higher power consumption. Moreover, the traditional schemes also faced network instability as for cluster head selection because they relied on weightage computation that was based on residual energy and distances from the sink. Hence, a novel scheme is needed that would assure a successful transmission and would increases networks lifespan.

III. Proposed Model

To overcome the shortcomings of traditional models, a novel technique based on Fuzzy C means clustering is proposed in this paper to select nodes as candidates for cluster head selection. Furthermore, these nodes would not only cover the criterion of their distance from the sink but also would cover the distance from other nodes in the network that would further play a significant role in the network's routing enhancement. The FCM is utilized in the proposed scheme because it is a soft clustering algorithm that outperforms the k-means algorithm while dealing with overlapping data sets. The working of the Fuzzy C-means algorithm is given below

Analyze that x= {x1, x2, x3...xn} as the set of data points and v= {v1, v2, v3 ...vn} are its center points
1. Choose 'c' as a total number of clusters.
2. Evaluate the μij fuzzy membership by utilizing the formula given in equation 1.

$$\mu_{ij} = \frac{1}{\sum_{k=1}^{c} (d_{ij}/d_{ik})^{\frac{2}{m}-1}}$$ (1)

3. Determine the vj of each cluster's center.
4. Repeat the process until the j value is as low as possible.

In addition, another adjustment is made by taking into account the other quality factor, which is the average distance of the candidate CH node from its cluster neighbors. To evaluate the CHs distance, the other quality factors are into account as in comparison to other nodes CHs have lower distances, which would allow all nodes to transmit data at equal distance. Hence, all the parameters evaluated in the proposed work are residual energy, distance with sink, and the distance between the cluster and CH nodes. Hence the proposed technique overcomes the issues related to conventional models by allowing energy conservation and increasing the lifespan of the network. The next section describes the working of proposed algorithm.

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A. Methodology

The following is the procedure used by the suggested model to get the desired results:
Step1: The first stage is to set up the network that involves defining a number of parameters like the network radius (R), the BS radius (r), the cluster number (CN), the total number of nodes, and the initial energy. Aside from it, the system mentions various more factors that are shown in table 1.
Step2: After the network has been installed, the following step is to place nodes randomly in the sensing area. The nodes are placed in various sectors, with each sensor

node being assigned to a sector based on its geographic location. The diagram of nodes deployed in the sensing zone is shown in Figure 2.1.

Step3: When clusters are formed in the network. The suggested model accomplishes this by employing the Fuzzy C-means method, which groups related nodes into a single cluster.

Step4: The next step is to choose the CH in each cluster after the clusters have been constructed. The CH selection is performed by evaluating the distance among the particular node and neighboring nodes, its residual energy, and the distance between that particular node to the BS node. In the cluster, the nodes with the highest weight would be chosen as the CH.

Step5: If any node in the cluster has a bigger weight, the CH is changed. In this situation, the CH in its cluster broadcasts a message requesting re-clustering.

Step6: In the proposed model, the communication starts when the energy consumption for each sensor is calculated for transferring l-bits of data over a distance d, as shown in equation 2.

$$E_{Tx}(l, d) = \begin{cases} l.E_{elec} + lE_{fs}d^2 \ if \ d < d_0 \\ l.E_{elec} + lE_{mp}d^4 \ if \ d \geq d_0 \end{cases} \quad (2)$$

Where Eelec is the total energy consumed by the sensor nodes, Emp and Efs are the multi-path fading model and amplification coefficient in the free space system, and d0 is denotes the threshold value defined in equation 3.

$$d_0 = \sqrt{\frac{E_{fs}}{E_{mp}}} m \quad (3)$$

Step7: At last, the suggested model's performance is evaluated in various scenarios, with the results reported in the next section.

TABLE 1: NETWORK PARAMETERS

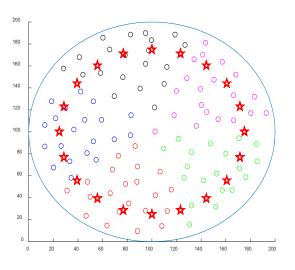| S.No	Parameters	Values
1	Network radius (R)	[100, 200, 300, 400] m
2	Mobile sink radius (r)	[0, 0.25R, 0.5R, 0.75R, R]
3	Mobile sink number (MN)	[1, 2, 3, 4, 5]
4	Mobile sink speed (w)	[$\pi/20, \pi/10, \pi/5$]
5	Cluster number (CN)	[3, 4, 5, 6, 7]
6	Number of nodes (N)	100
7	Packet length (l)	500 bits
8	Initial energy (Eo)	0.5J
9	Energy consumption on circuit (Eelec)	50 nJ/bit
10	Free-space model parameter (Efs)	10 pJ/bit/m2
11	Multi-path model parameter (Emp)	0.0013 pJ/bit/m4
12	Distance threshold (do)	$\sqrt{\frac{E_{fs}}{E_{mp}}}$ m

Fig.2: Nodes Deployed in the Network.

IV. RESULTS AND DISCUSSION

A. Discussions

In MATLAB software, the proposed model's performance is assessed and compared to that of the standard model. Various dependent elements, such as radius, weights, cluster size, and base station node speed, were varied to generate the simulated outcomes. In this section, the outcomes are briefly discussed.

B. Performance Evaluation

Furthermore, the suggested system's performance is tested in terms of the number of clusters that vary between 3,4,5,6, and 7, as illustrated in figure 3.1.
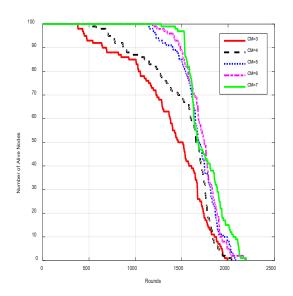

Fig.3: Comparison Graph for Varying Cluster Numbers

Fig 3 illustrates the suggested model's comparison graph in which the sink node's location is set at a 0.25R radius.The graph shows that when the 7 clusters are produced, the network works efficiently and has a longer lifespan. In this situation, all nodes work effectively until the 1350th round, after which they begin to die, while some nodes survive until the 2300th iteration. The performance of suggested models gets degraded when # clusters are generated in it. In this case, after 2000 simulations, all nodes die. The suggested model performs better when the total number of clusters created is 4,5, or 6, but it performs best when CN=7.

In terms of the number of living nodes and variable radius, the suggested model's performance is illustrated in Fig 4
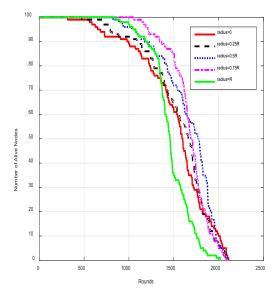
Fig.4: Alive Node Comparison with Varying Radius

Fig 4 illustrates the suggested model's comparison graph in terms of the number of alive nodes and varying the sink location. When r=0, the suggested model produces optimal outcomes, and when r=0, the nodes started to die and last until the 2100th simulation cycle. When sink load is located at 0.25R or 0.5R, the network's lifespan gets increases slightly as the nodes transmit data over the 2100th simulation round. If the 0.75R is the sink position, then the node's performance to transfer data gets better at the begging, but as the iteration number increases the nodes begin to die rapidly and only last up to 2100 rounds. When the sink position is r=R, the proposed model has a shorter lifespan.
In terms of total energy consumption by nodes, the suggested model's performance is assessed as illustrated in fig 5.
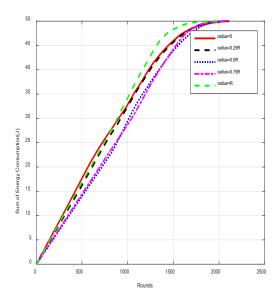

Fig. 5: Energy Consumption in the Proposed Model

Fig 5 shows the suggested model's energy comparison graph when the sink node's location is set to 0, 0.25R, 0.5R, 0.75R, and R. When the sink location is set at R, the suggested model consumes more energy i.e. 50j in just 1500 rounds. The least energy is utilized when the sink node is situated at 0.5, the suggested model uses 50j of energy after 1700 simulation rounds, and when r= 0.75 the suggested model utilizes 50j after 1600 simulation round

The proposed model's performance is also evaluated in terms of the number of alive nodes by adjusting the node weights, as illustrated in fig 6.
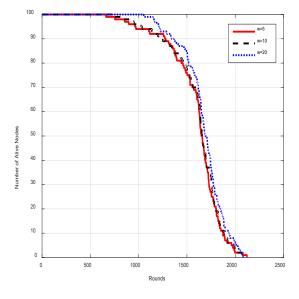

Fig. 6: Alive Nodes with Varying Weights

Fig 6 shows a comparison graph of alive nodes with different weights (w=5, w=10, and w=20). After extensively examining the graph, it is discovered that when w=5, the nodes are alive for 400 rounds and last until the 2150th round, extending the network's longevity. When the weight is set to 10, the nodes begin to die after 600 rounds, but as the iterations increase, the nodes begin to die drastically and only last until the 2100th round. Finally, when the weight reaches 20, the nodes work successfully until the 1100th round, after the nodes begin to die and last until the 2100th round.

The proposed strategy appears to be more successful and efficient in extending the wireless network's lifespan, as evidenced by the graphs and tables.

V. Conclusion

A novel model is proposed in this paper, which utilizes FCM to extend WSNs lifespan. In the MATLAB simulation software, the proposed model's performance is assessed and compared to that of the standard model. The simulation's outcomes were evaluated by the number of alive nodes and the amount of energy consumed. As per the findings, it is discovered that after 1000 simulation rounds, the nodes begin to die, and gets vanished at 1500 simulation rounds in conventional techniques. In the suggested model, the nodes work efficiently until the 1400th iteration, after that the nodes begin to die as the number of simulation rounds increases, and by the 2010th iteration, all nodes are dead in the suggested model. Furthermore, the traditional model consumes more energy, i.e. 50 j in only 1100th rotations, whereas the proposed model consumes less energy i.e. 50 after completing 2000 simulation rounds. The proposed model increases the network's lifespan and also improves the node's longevity. Moreover, numerous dependent parameters such as node weight, area, and sink position are adjusted to study the performance of the wireless network and subsequently improve their performance.

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An Improved CH Selection Approach in WSN to Improve Network Lifetime

Hurrah Nooren[1], Er. Madhvi Arya[2]

[1,2]*Electronics and Communication Engineering, Swami Vivekanand Institute of Engineering & Technology*
Banur, Punjab, India
Email: [1]nooreniqbal.01@gmail.com, [2]madhviarya92@gmail.com

Abstract— **Wireless Sensor Network (WSN) has become a wide area of research and is being used to perform numerous functions in many areas like healthcare, agriculture, the army, etc. Regardless of these applications, the expert's main focus is to keep the wireless system alive and operational for as long as possible. Several researchers have developed number of techniques to improve the network's lifespan, but these techniques were not optimal and have some shortcomings like cluster formation, cluster head selection, time-consuming, etc. To overcome these restrictions, a novel technique based on the uniform distribution of nodes and GWO optimization is presented in this paper. The suggested approach divides the wireless network's sensing region into grids, which function as clusters. To cover all sensing regions, the suggested scheme distributes nodes equally. To choose a cluster head in each cluster, the suggested scheme would employ the GWO optimization algorithm. In MATLAB software, the suggested scheme performance is evaluated and compared with conventional models. In terms of the number of dead and alive nodes, throughput, and remaining energy in the system, the simulation results were achieved. The simulation results showed that the proposed GWO-UD approach is more effective at extending the network's lifespan.**

Keywords: Wireless Communication, Optimization Algorithms, Clustering protocols, MATLAB, CH Selection etc.

I. INTRODUCTION

Wireless Sensor Networks (WSN) has become one of the most essential fields in recent years, which is developing rapidly. Wireless communication, MEMS (Micro-electromechanical systems) technology, and computation breakthroughs have led the way for low-energy, self-managed sensor, lightweight nodes, which are considered affordable and develops the sensor network's basic component. Sensor nodes have an important role in transmitting rapid changes in their application domains since they are loaded with processing and sensing capabilities [1]. WSNs often contain several actuators or sensor nodes that are considered resource constraints, whereas, in the network, these nodes can also communicate with other nodes. Aside from its potential to operate as a data fusion or relay node, each node's principal purpose is to check the environment by utilizing the onboard sensors. In WSNs, each node acts as a router by sending data from nearby nodes to the BS (Base Station) or sink. To transmit data to remote devices, the BS can be utilized for network gateway or for locally processing data [2].WSN is most commonly used to check the physical and environmental factors such as temperature, sound, disaster management, pressure, air pollution, forest fire, landslide, industrial, air pollution, industrial, healthcare monitoring, and security surveillance [3].

In WSNs, the energy source of the sensor nodes is powered typically by batteries that are inconvenient, impossible to replace, or recharge. As a result, the key problems in sensor networks are enhancing the efficiency of the energy and optimizing the network's longevity [4]. In the data-centric WSNs, the majority of research is centered on the network's design, energy-efficient, and effective data collection, as the data aggregation methods and the routing protocol that play a critical role in attaining it. For wireless sensor networks, Clustering has been found to be an energy-efficient and robust architecture among the different architectures that are considered for energy-efficient data collection. Figure 1.1 illustrates the wireless sensor network's clustering scenario.
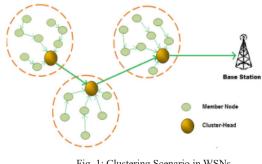

Fig. 1: Clustering Scenario in WSNs

Clustering divides the network into logical groupings based on the application's requirements and the network's features. When compared with the flat wireless sensor network, cluster-based wireless sensor networks have

several benefits like an increase in the network lifespan and energy efficiency [6]. WSNs based on clusters are a type of sensor network that is structured hierarchically. Several studies in WSNs highlight the importance of effective and efficient clustering architectures. Figure 1.1 depicts the clustering architecture that divides the network of WSN into virtual groups. This network-based on clustering logically divides the network into clusters. CH (Cluster Heads), GW (Gateway), and the member nodes are considered as the three sorts of nodes that exist in the MN (Member Nodes). CH is the localized coordinator of each cluster, which passes and aggregates data to the BS (Base Station). MNs on the other hand, are considered as the leaf nods, which submit data to the CH [8]. GW is located across two clusters and links two or more CHs, which are called gateway nodes. The GW node has the benefit to form a specified communication path of multihop intercluster, which is referred to as the network's backbone. Each CH saves the data from surrounding GWs in its routing table, which aids CHs in making quick routing decisions. The use of a backbone improves the efficiency of data communication [9].

During data fusion, CHs take data from other members in the cluster and transfer the fused data directly or indirectly to the base station through other nodes, which are termed middlemen nodes. When resource-constrained nodes use clustering strategies, they don't have to transmit their sensed data directly to the sink, which results in wastage of energy, interference, and inefficient resource consumption [10].To reduce this shortcoming, many researchers have used various clustering protocols like LEACH, HEED, etc. to propose the number of clustering techniques for WSN to reduce these shortcomings. The next section of this paper discusses various optimization techniques provided by researchers in recent years.

II. Literature Survey

Many scholars have developed various optimization-based techniques for WSNs, out of which some are discussed here: **Xinyi Liu et al. [11]**, developed a novel model of CH selection, path planning, and clustering based on the DE (Differential Evolution) algorithm. The suggested scheme performance was improved by minimizing the amount of calculation and reducing the energy consumption of the uniforming system. After developing the proposed model, the authors of this paper continued to optimize the proposed system by adjusting the methods of communication. **Preeti et al. [12],** Clustering approaches like Fuzzy C Mean (FCM), Mean-shift, Hierarchal clustering (HC), and K-mean (KMEAN) are simulated in this article, and the results are compared by using the factor of dissimilarity. In comparison with other methods of clustering, HC provided better outcomes. To identify a better formation process for WSN, researchers compared the effectiveness of several clustering algorithms. **M. Sitha Ram et al. [13],** improved the lifespan of the network by selecting suitable CH and novel paths by using meta-heuristic techniques. For effective CH selection, the K-GA (K-Genetic Algorithm) was presented. In a variety of scenarios, extensive simulations are carried out. In comparison to existing strategies, the simulation outcomes show that the suggested K-GA aids in identifying the optimal CH, and T-FA uncovers the ideal pathways for extending the network's lifespan by lowering end-to-end delay. **Deivanai Gurusamy et al. [14],** proposed a clustering algorithm to improve EH-WSN. The authors of this paper also examined the parameters that differed from the standard clustering parameters. Furthermore, the comparison of various methodologies comparison highlighted the problems and future areas of research in EH-WSN clustering algorithms. **YANG TAO et al. [15],** relying on the theory of interval type-2 TSK fuzzy logic, the researchers of this paper provides a UCT2TSK (unequal clustering method). As it outperforms other traditional and modern clustering algorithms in terms of throughput, and network lifespan, simulation findings show that UCT2TSK may successfully balance the consumption of energy and improve the efficiency of the energy. **Ramamurthy Garimella et al. [16],** in WSNs, the authors of this paper seeks to design attractive clustering issues where pattern coordinates are random variables. By utilizing the ns-2 simulator, the developed scheme was verified and simulation outcomes represented that the suggested constrained clustering LEACH (CC-LEACH) outperforms traditional protocols like LEACH and LEACH-C on the basis of the several performance parameters. **Sonam Lata et al. [17],** to improve the network's lifespan, researchers of this paper created the LEACH-FC (LEACH-Fuzzy Clustering) protocol and developed a fuzzy logic-based on cluster formation CH selection. The suggested approach was proved to be efficient in the energy load balancing at each node, improving WSN reliability. It surpasses previous standard algorithms in terms of increasing network lifespan and reduces energy consumption. **Alma Rodríguez et al. [18],** in WSNs, the researchers of this paper proposed an optimal protocol based on clustering and routing. To calculate CHs and determine the optimal CHs, the proposed scheme employed LS-II (Locust Search) approach. The simulation outcome represented that the suggested protocol provides a reduction of energy usage while also increasing the network lifespan in comparison to other protocols. **Masood Ahmad et al. [19],** proposed a novel technique based on MemA (Memetic Algorithm) to reduce the early convergence likelihood by using the local exploration strategies. The

proposed technique is compared to traditional schemes. In terms of control message overhead, re affiliation rate, cluster lifetime, and cluster count the suggested strategy beats current clustering techniques. **Rahul Priyadarshi et al. [20],** proposed a three-level heterogeneous clustering approach to improve the routine of the network. The new technique is simulated with the MATLAB simulator, and the outcomes are compared to traditional procedures to show how the suggested protocol outperforms other methods.

From the literature survey, conducted it was analyzed that several researchers have performed number of methods to enhance the efficiency of the network by decreasing the energy consumption in the wireless sensor network. In traditional models, experts utilized various optimization algorithms. For cluster head selection (CHs), these optimization algorithms utilized several QoS parameters such as energy, node degree, etc. In addition to this, the traditional methods provided optimal outputs but have some shortcomings. The network distribution was ineffective in the traditional models because it randomly distributed nodes, which could cause various communication challenges for cluster head. Furthermore, these models couldn't effectively handle complex issues. Inspired from these shortcomings, the proposed model in this paper will efficiently overcome the problems of the traditional techniques. A detailed description of the proposed work is given in the next section.

III. Proposed Model

To overcome the issues related to conventional approaches, an effective and convenient optimization algorithm called the Grey Wolf Optimization algorithm (GWO) is utilized in this paper. The GWO algorithm is effective to use as it has a high convergence rate and outperforms the performances of various other optimization algorithms. Furthermore, the network formation model will be upgraded, with the possibility to install sensor nodes uniformly to minimize network capacity issues. This will allow for effective network grouping as well as a systematic operating environment for the nodes. The performance of the proposed scheme will be evaluated after it has been deployed. For WSN, there are many evaluation factors such as network energy consumption balance analysis, total energy consumption, amount of survival nodes, etc. The methodology section of this paper would give a detailed working mechanism of this paper.

A. Methodology

The suggested GWO-UD based technique for achieving the required results is described below:

Step1: The suggested GWO-UD approach would firstly initialize the network, in which many critical characteristics such as area, sink position, the number of nodes, and so on

are specified. In the proposed work, $100*200m^2$ area will be used, in which 100 nodes are installed with an initial energy of 0.5j.Aside from this, various parameters are described in table 1.

TABLE I: DIFFERENT NETWORK PARAMETERS

Parameters	Values
Area	[100 200]
Sink Location	[50 150]
Number of Nodes	100
Initial Energy	0.5
Packet	4096
Number of Rounds	3000

Step2: the proposed model in the next step would distribute the nodes uniformly over the network. The entire sensing region would divide the sensing region into 3×3 grids and nodes are also deployed in these grids.

Step 3: In each grid, a total of 11 sensor nodes are put in the network randomly, covering the whole sensing region of the wireless network and automatically forming clusters in each grid.

Step4: The next step is to pick the CH in each grid after the network has been started and nodes have been distributed equitably throughout the network. The GWO method is utilized for this, and many parameters such as population, number of iterations, decision variables, and so on are defined. Table 2 lists the various GWO parameters as well as their configurational values.

TABLE II: GWO PARAMETERS

Parameters GWO	Values
Population	50
Decisions variable	1
Iteration	10
Coefficient a	[2 0]
Coefficient r1	[0 1]
Coefficient r2	[0 1]

Step 5: The CH selection is performed by calculating the sensor node's cost function in terms of residual energy, node degree, and distance between the sink node and sensor node. Equation 1 illustrates the formula for determining the cost function.

$$\text{Cost function} = \frac{W_3 \times sink\ distance}{\left(w_1 \times \frac{1}{R_E}\right) \times \left(w_2 \times \frac{1}{N_0}\right)} \quad (1)$$

Where R_E represents the residual energy of nodes, N_0 illustrates id node degree $W_1 = 0.1$, $W_2 = 0.4$ and $W_3 = 0.5$ and $W_1 + W_2 + W_3 = 1$.

Step 6: When CHs have been constructed in each grid, the next step is to start communication. In each grid, the sensor nodes provide information to respective CHs, who then send it to the sink node.

Step 7: CH uses more energy than the sensor nodes, it must be replaced after a specific number of rounds. Equation 1 is used to determine the next CH in the grid by evaluating each node's cost function.

Step 8: Finally, the suggested model's performance is validated and compared to standard models in terms of the number of alive and dead nodes, throughput, and remaining energy, and is briefly addressed in the next section.

IV. RESULTS AND DISCUSSION

In MATLAB Simulink software, the suggested GWO-UD approach performance is studied and compared to the standard PSO, HAS-PSO, and PBC-CP models. The results were calculated using a variety of performance matrices, including the total number of alive and dead nodes, throughput, and energy remaining. This section contains a full description of the outcomes.

A. Performance Evaluation

In terms of the overall number of alive nodes in the system, the suggested GWO-UD model is evaluated and compared to the traditional PSO, HSA-PSO, and PBC-CP models. The comparison graph of the alive nodes in the traditional and suggested models is shown in Fig 2.
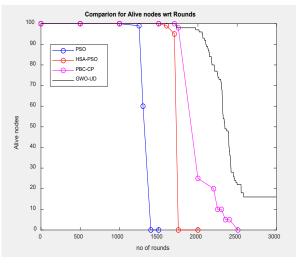
Fig 2: Comparison Graph for Alive Nodes in Traditional and Proposed Models

In terms of the total number of alive nodes in the wireless network, Fig 2 shows a comparison graph between the suggested GWO-UD model and the standard PSO, HSA-PSO, and PBC-CP models. The blue-colored line depicts the conventional PSO performance, while the red and pink colored lines reflect the conventional HSA-PSO and PBC-CP performance. The suggested GWO-UD model's performance, on the other hand, is indicated

by a solid black line. The produced graph shows that in a traditional PSO model, all nodes are alive until the 1200th round, after which nodes begin to die and by the 1510th round, all nodes are dead. In the traditional HSA-PSO model, all nodes are alive until the 1530th round, after which they begin to die, and by the 2000th round, all nodes are dead. Furthermore, in traditional PBC-CP, all nodes are alive until the 1900th round, after which they begin to die rapidly until all nodes are dead after the 2500th round. In the suggested GWO-UD model, all nodes are alive until the 1650th cycle, after which they begin to die slowly. However, even after the 3000th simulation round, certain nodes in the system are still alive and well.

In terms of the overall number of dead nodes in the system, the suggested GWO-UD model is calculated and compared to the traditional PSO, HSA-PSO, and PBC-CP models. The comparison graph of dead nodes in traditional and developed models is shown in Fig 3.
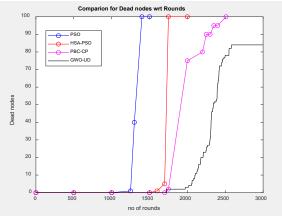

Fig 3: Comparison Graph for Dead Nodes in Traditional and Proposed Models

In terms of dead nodes in the wireless network, Fig 3 shows a comparison graph between the proposed GWO-UD model and the traditional PSO, HSA-PSO, and PBC-CP models. The blue-colored line depicts the standard PSO's performance, while the red and pink colored lines reflect the traditional HSA-PSO and PBC-CP performance. The suggested GWO-UD model's performance is indicated by a solid black line. The resulting graph shows that in the classic PSO model, nodes begin to die after executing the 1250th round, which then dies dramatically, and after doing the 1510th round, all nodes are dead. Furthermore, in the typical HSA-PSO and PBC-CP models, after the 1510th and 1700th simulation rounds, nodes begin to die and after the 1600th and 2500th simulation rounds, all nodes in these two traditional models are dead. In the suggested GWO-UD strategy, nodes begin to die after the 1650th cycle. Moreover, after the 3000th simulation cycle, some nodes remain in the system, extending the network's existence.

In fig 4, the suggested GWO-UD model's performance is examined and compared to that of standard models in terms of throughput.

In terms of throughput in the wireless network, Fig 4 shows a comparison graph between the suggested GWO-UD model and the standard PSO, HSA-PSO, and PBC-CP models. The blue-colored line depicts the conventional PSO's performance, while the red and pink colored lines reflect the traditional HSA-PSO and PBC-CP performance. The suggested GWO-UD model's performance is indicated by a solid black line. As per the graph, the value of throughput in the traditional PSO model begins to decrease only after 1480 rounds and hits zero at the 1510th round. The throughput of the conventional HSA-PSO and PBC-CP approaches begins to decline after the 1750th and 1800th simulation rounds, and eventually hits zero after the 2000th and 2500th simulation rounds. The suggested GWO-UD model has a high throughput of roughly 4105 till the 2000th simulation round. Even though the throughput gradually decreases but remains at 0.6 ×105after executing 3000 simulation rounds. This demonstrates that the suggested GWO-UD model is more effective and efficient in extending the WSN's lifespan.
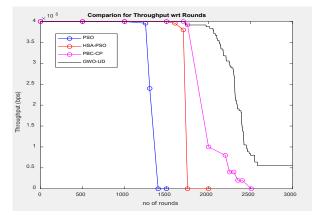
Fig 4: Comparison Graph for Throughput in Traditional and Proposed Models
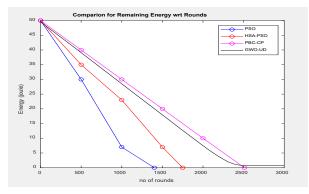
Fig 5: Comparison Graph for Remaining Energy

Finally, the suggested GWO-UD model's performance is evaluated and contrasted to that of the conventional PSO, HSA-PSO, and PBC-CP models in terms of total energy left in the system after various simulation rounds. The comparison graph of the suggested model with the old model for leftover energy is shown in Fig 5.

In terms of total energy left in the system, Fig 5 shows a comparison graph between the suggested GWO-UD model and classic PSO, HSA-PSO, and PBC-CP models. The blue-colored line depicts the regular PSO's performance, while the red and pink-colored lines reflect the traditional HSA-PSO and PBC-CP performance. As per the graph, the energy in the standard PSO and HSA-PSO models drops dramatically and approaches zero after just 1480 and 1650 simulation rounds, respectively. In the classic PBC-CP model, the energy decreases progressively as the number of rounds increases, eventually reaching zero after the 2500th simulation round. The remaining energy in the suggested GWO-UD model is progressively reducing, and the system still has roughly 1joue of energy after 3000 simulation rounds.

According to the graph, it was evaluated that the suggested GWO-UD technique is more effective and successful in extending the wireless network's lifespan.

V. Conclusion

Wireless sensor networks are seen as a futuristic technology that is presently being used in several applications. WSN also faces several obstacles such as these networks have a limited lifespan, deployment, robustness, efficiency, etc. A novel method based on the GWO optimization algorithm is proposed in this paper. In the MATLAB software, the suggested GWO-UD technique is validated and compared to standard PSO, HSA-PSO, and PBC-CP models. In terms of the total number of alive and dead nodes, throughput, and remaining energy, the stimulation outcomes are illustrated. According to the graphs, it was analyzed that all nodes are only alive for 1100, 1530, and 2000 rounds in the standard PSO, HSA-PSO, and PBC-CP models. After examining the graphs, it is clear that in the standard PSO, HSA-PSO, and PBC-CP models, all nodes are alive for only 1100, 1530, and 2000 rounds before starting to die. After 1500, 2000, and 2500 rounds in traditional PSO, HSA-PSO, and PBC-CP models, all nodes are dead, reducing their lifetime. In the suggested GWO-UD model all nodes until the 1800th round is alive, after that they begin to die slowly. Even though the nodes in the suggested GWO-UD strategy are dying, some nodes are still alive and living effectively after 3000 simulation cycles. Moreover, throughput drops rapidly to zero only after 1500th, 2000th, and 2500th rounds, respectively in the standard PSO, HSA-PSO, and PBC-CP models, whereas in the suggested model, throughput remains above 0.5105bps even after

the 3000th round. Furthermore, in standard PSO, HSA-PSO, and PBC-CP models, after 1480, 1650, and 2500th rounds, zero energy remains. After 3000 rounds, 1joue of energy is still accessible in the suggested GWO-UD paradigm. These findings demonstrate that the suggested GWO-UD approach is more successful and efficient in extending the network's lifespan.

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Security of Data in Cloud Computing: A Review

Er. Pavitar Singh

Assistant Professor, Department of CSE, Amritsar Group of Colleges, Amritsar.
pavitar.cse@acetedu.in

Abstract—This paper discusses the security of data in cloud computing. It is a study of data in the cloud and aspects relatedto it concerning security. The paper will go in to details of data protection methods and approaches used throughout the world to ensure maximum data protection by reducing risks and threats. Availability of data in the cloud is beneficial for many applications but it poses risks by exposing data to applications which might already have security loopholes in them. Similarly, use of virtualization for cloud computing might risk data when a guest OS is run over a hypervisor without knowing the reliability of the guest OS which might have a security loophole in it. The paper will also provide an insight on data security aspects for Data-in-Transit and Data-at-Rest. The study is based on all the levels of SaaS (Software as a Service), PaaS (Platform as a Service) and IaaS (Infrastructure as a Service).

Keywords: Data Security, Cloud Computing, Data Protection, Privacy, Risks and Threats

I. Introduction

The term word Cloud Computing has emerged recently and is not is widespread use. Of the several definitions which are available, one of the simplest is, "*a network solution for providing inexpensive, reliable, easy and simple access to IT resources*" [1]. Cloud Computing is not considered asapplication oriented but service oriented. This service-oriented nature of Cloud Computing not only reduces the overhead of infrastructure and cost of ownership but also provides flexibility and improved performance to the end user [2, 3].

A major concern in adaptation of cloud for data is security and privacy [4]. It is very important for the cloud service to ensure the data integrity, privacy and protection. For this purpose, several service providers are using different policies and mechanism that depend upon the nature, type and size of data.

One of the advantages of Cloud Computing is that data canbe shared among various organizations. However, this advantage itself poses a risk to data. In order to avoid potential risk to the data, it is necessary to protect data repositories.

One of the key questions while using cloud for storing datais whether to use a third-party cloud service or create an internal organizational cloud. Sometimes, the data is too sensitive to be stored on a public cloud, for example, national security data or highly confidential future product details etc. This type of data can be extremely sensitive and the consequences of exposing this data on a public cloud can be serious. In such cases, it is highly recommended to store data using internal organizational cloud. This approach can help in securing data by enforcing on-premises data usage policy. However, it still does not ensure full data security and privacy, since many organizations are not qualified enough to add all layers of protection to the sensitive data.

This paper is the study of data security techniques used for protecting and securing data in cloud throughout the world. It discusses the potential threats to data in the cloud and their solutions adopted by various service providers to safeguard data.

The remainder of the paper is organized as follows. Section 2 is the review of literature that provides an insight into the work already done in this area. Section 3 discusses the types of threats to data in cloud. Section 4 examines some efficient data security techniques adopted throughout the world. The final section is the conclusion which provides summary for this study.

II. Literature Review

In order to understand the basics of cloud computing and storing data securing on the cloud, several resources have been consulted. This section provides a review of literature to set a foundation of discussing various data security aspects.

Srinivas, Venkata and Moiz provide an excellent insight into the basic concepts of cloud computing. Several key concepts are explored in this paper by providing examples of applications that can be developed using cloud computing and how they can help the developing world in getting benefit from this emerging technology [1].

On other hand, Chen and Zhao have discussed the consumers concern regarding moving the data to the cloud. According to Chen and Zhao, one of the foremost reasons of why large enterprises still would not move their data to

cloud is security issues. Authors have provided outstanding analysis on data security and privacy protection issues related to cloud. Furthermore, they have also discussed some of the available solutions to these issues [5,6].

However, Hu and A. Klein provided a standard to secure data-in-transit in the cloud. A benchmark for encryption has been discussed for guarding data during migration. Additional encryption is required for robust security but it involves extra computation. The benchmark discussed in their study presents equilibrium for the security and encryption overhead [7].

Tjoa, A.M. and Huemer examine the privacy issue by preserving data control to the end user to surge confidence. Several Cloud computing attacks are reviewed and some solutions are proposed to overcome these attacks [8].

Therefore, Abdelkader and Etriby propose a data security model for cloud computing based on cloud architecture. They also developed software to enrich the effort in Data Security model for cloud computing further [9].

III. RISKS AND SECURITY CONCERNS IN CLOUD COMPUTING

Several risks and security concerns are associated with cloud computing and its data. However, this study will discuss about the virtualization, storage in public cloud and multitenancy which are related to the data security in cloud computing [3].

A. Virtualization

Virtualization is a technique in which a fully functional operating system image is captured in another operating system to utilize the resources of the real operating system fully. A special function called hypervisor is required to run a guest operating system as a virtual machine in a host operating system [5,10].

Virtualization is a foundational element of cloud computing which helps in delivering the core values of cloud computing. However, virtualization poses some risks to data in cloud computing. One possible risk is compromising a hypervisor itself. A hypervisor can become a primary target if it is vulnerable. If a hypervisor is compromised, the whole system can be compromised and hence the data [11].

Another risk with virtualization is associated with allocation and de-allocation of resources. If VM operation data is written to memory and it is not cleared before reallocation of memory to the next VM, then there is a potential for data exposure to the next VM which might be undesirable [12].

A solution to above mentioned issues is a better planning for the use of virtualization. Resources should be carefully usedand data must be properly authenticated before de-allocating the resources.

B. Storage in Public Cloud

Storing data in a public cloud is another security concern in cloud computing. Normally clouds implement centralized storage facilities, which can be an appealing target for hackers. Storage resources are complicated systems that are combination of hardware and software implementations and can cause exposure of data if a slight breach occurs in the public cloud [13].

In order to avoid such risks, it is always recommended to have a private cloud if possible for extremely sensitive data.

C. Multienancy

Shared access or multitenancy is also considered as one of the major risks to data in cloud computing [14]. Since multiple users are using the same shared computing resources like CPU,

Storage and memory etc. it is threat to not only a single user but multiple users.

In such scenarios there is always a risk of private data accidentally leaking to other users. Multitenancy exploits can be exceptionally risky because one fault in the system can allow another user or hacker to access all other data [15].

These types of issues can be taken care of by wisely authenticating the users before they can have access to the data. Several authentication techniques are in use to avoid multitenancy issues in cloud computing [16].

IV. DATA SECURITY IN CLOUD COMPUTING

Data security in cloud computing involves more than data encryption. Requirements for data security depends upon on the three service models SaaS, PaaS, and IaaS.

Two states of data normally have threat to its security in clouds; Data at Rest which means the data stored in the cloud and Data in Transit which means data that is moving in and out of the cloud. Confidentiality, and Integrity of data is based upon the nature of data protection mechanisms, procedures, and processes. The most significant matter is the exposure of data in above mentioned two states.
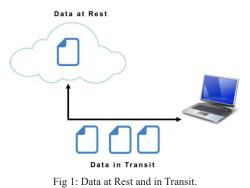
A. Data at Rest

Data at rest refers to data in cloud, or any data that can be accessed using Internet. This includes backup data as well as live data. As mentioned earlier, sometimes it is very difficult for organizations to protect data at rest if they are not maintaining a private cloud since they do not have physical control over the data. However, this issue can be resolved by maintaining a private cloud with carefully controlled access.

B. Data in Transit

Data in transit normally refers to data which is moving in and out of the cloud. This data can be in the form of a file or database stored on the cloud and can be requested for use at some other location. Whenever, data is uploaded to the cloud, the data at time of being uploaded is called data in transit. Data in transit can be very sensitive data like user names and passwords and can be encrypted at times. However, data in unencrypted form is also data in transit [17].

Data in transit is sometimes more exposed to risks than the data at rest because it has to travel from one location to another. (See Fig 1). There are several ways in which intermediary software can eavesdrop the data and sometimes have the ability to change the data on its way to the destination. In order to protect data in transit, one of the best strategies is encryption.

Fig 1: Data at Rest and in Transit.

V. MAJOR SECURITY CHALLENGES

Undoubtedly it is not easy to secure and ensure the safety of linked computers because a series of computers and clients are involved; this is known as multi-tenancy. The cloud service providers and cloud computing have to face many challenges, particularly in the area of security issues. Thus, it is very important to consider how these challenges are mimicked and how security models are implemented in order to ensure the security of clients and establish a safe cloud computing environment. The major challenges involved are:

1. Lack of Appropriate Governance

During cloud computing the services provider has full control. By passing this control to the provider there is a danger that the loss of control over authority parameters could possibly result in security being compromised, leading to problems in terms of data access and the application of the resources. This compromised security concern comes with another threat of creating a gap in security cover in cases where Service Level Agreements are not in place with the service provider. Further, the terms of use are also open to the liberty of user meaning

that access to data can be exploited quite easily. For instance, the Google search engine states that the user: "agrees that Google has no responsibility or liability for deletion or failure to store any content and other communication maintained or transmitted through use of the service [18]. Amazon also clearly state that they don't take any responsibility, liability or authority for unauthorized use, corruption, access, loss or deletion of data, or any other sort of access including harm to the application [19]. Hence, customers are faced with security concerns regarding their data and application, as hosted by the third party, service provider or mediator.

2. Lock-in

Another hurdle is inadequate standards of data format, a lack of operating methods and shortage of tools which collectively cause compromised portability between the services and applications, even between service providers. Consequently, the customer has to be dependent wholly and solely on the vendor.

3. Isolation Failure

The sharing of resources owing to multi-tenancy of cloud computing is itself a questionable characteristic. The shortage of separate storage can be deadly to businesses. Other concerns involving guest hopping attacks and their problems are considered to be a great hurdle in the use and implementation of cloud computing applications [20].

4. Malicious Attacks From Management Internally

Sometimes the architecture of cloud computing environments poses risks to the privacy and security of the customers [21]. Although it happens rarely, this risk is very difficult to deal with. Examples include the administrators and managers of cloud service providers who can sometimes act as malicious agents and threaten the security of the clients using cloud computing applications.

5. Insecure or Incomplete Data Deletion

In instances where clients request data to be deleted either partially or completely, this raises the question of whether it will be possible to delete the desired part of their data segment with accuracy. This makes it harder for the clients to subscribe to the services of the cloud-computing [22].

6. Data Interception

Unlike with tradition computing, the data in cloud computing is segmented and distributed in transit. This poses more threats due to the vulnerability and fragility of the computing technology and, in particular, sniffing and spoofing,third party attacks and reply attacks [23].

7. Compromise of Management Interface

Since the services of cloud computing are delivered remotely over the Internet and the resources are accessible to the service provider, third party access can result in malicious activities [24]. As a result the vulnerabilities, manipulation of services and involvement of the service provider are amplified. For instance, the customer may take over the machines and conversely the provider can take over the control by setting up no-go zones in the applications of cloud computing.

Other challenges related to security include the transfer of information within different applications of cloud computing, leakage of information while uploading data to cloud, attacks on privacy and security of user's data, loss or malicious manipulation of encryption keys and conflicts between service providers and customers on procedure and policies on the operation of cloud computing applications. [25].

There are also challenges that indirectly interact with or influence cloud computing but have no direct impact upon the integrity of cloud computing applications. Such scenarios include: modification of network traffic, network breaks and administrative issues, such as non-optimal use of resources, congestion and miss-connection. There are some other risks associated to the applications of cloud computing, for instance, the risk of social engineering attacks, natural disasters and theft of equipment [26].

VI. Protecting Data using Encryption

Encryption techniques for data at rest and data in transit can be different. For examples, encryption keys for data in transit can be short-lived, whereas for data at rest, keys can be retained for longer periods of time.
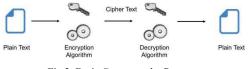
Fig 2: Basic Cryptography Process

Different cryptographic techniques are used for encrypting the data these days. Cryptography has increased the level of data protection for assuring content integrity, authentication, and availability. In the basic form of cryptography, plaintext is encrypted into cipher text using an encryption key, and the resulting cipher text is then decrypted using a decryption key as illustrated in Fig 2.

Normally there are four basic uses of cryptography:

A. Block Ciphers

A block cipher is an algorithm for encrypting data (to produce cipher text) in which a cryptographic key and algorithm are applied to a block of data instead of per bit at a time [27].

In this technique, it is made sure that similar blocks of text do not get encrypted the same way in a message. Normally, the cipher text from the previous encrypted block is applied to the next block in a series.

As illustrated in Fig 3, the plain text is divided in to blocksof data, often 64 bits. These blocks of data are then encrypted using an encryption key to produce a cipher text.

B. Stream Ciphers

This technique of encrypting data is also called state ciphersince it depends upon the current state of cipher. In this technique, each bit is encrypted instead of blocks of data. An encryption key and an algorithm are applied to each and every bit, one at a time [28].
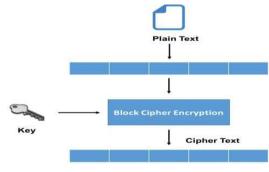

Fig 3: Block Cipher Mechanism

Performance of Stream ciphers is normally faster than block ciphers because of their low hardware complexity. However, this technique can be vulnerable to serious security problems if not used properly.
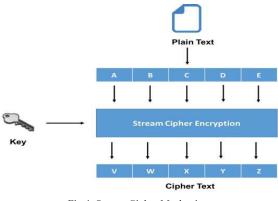

Fig 4: Stream Cipher Mechanism

As illustrated in Fig 4, stream cipher uses an encryption key to encrypt each bit instead of block of text. The resultant cipher text is a stream of encrypted bits that can be later decrypted using decryption key to produce to original plain text.

C. Hash Functions

In this technique, a mathematical function called a hash function is used to convert an input text in

to an alphanumeric string. Normally the produced alphanumeric string is fixed in size. This technique makes sure that no two strings can have same alphanumeric string as an output. Even if the input strings are slightly different from each other, there is a possibility of great difference between the output string produced through them.

This hash function can be a very simple mathematical function like the one shown in equation (1) or very complex.

$$F(x) = x \bmod 10 \tag{1}$$

Fig 5, below shows the mechanism of hash function cryptography.
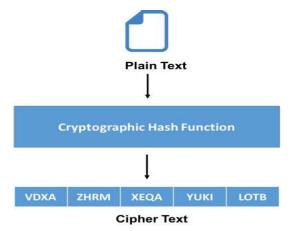
Fig 5: Cryptographic Hash Function Mechanism

All these above-mentioned methods and techniques are widely used in encrypting the data in the cloud to ensure data security. Use of these techniques varies from one scenario to another. Whichever technique is used, it is highly recommended to ensure the security of data in both private and public clouds.

VII. Conclusion

Increased use of cloud computing for storing data is certainly increasing the trend of improving the ways of storing data in the cloud. Data available in the cloud can be at risk if not protected in a rightful manner. This paper discussed the risks and security threats to data in the cloud and given an overview of three types of security concerns. Virtualization is examined to find out the threats caused by the hypervisor. Similarly, threats caused by Public cloud and multitenancy have been discussed. One of the major concerns of this paper was data security and its threats and solutions in cloud computing. Data in different states has been discussed along with the techniques which are efficient for encrypting the data in the cloud. The study provided an overview of block cipher, stream cipher and hash function which are used for encrypting the data in the cloud whether it is at rest or in transit.

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Dynamic Price Prediction Using Linear Regression

Kunal Arora[1], Sharanjit Kaur[2], Vinod Sharma[3]

[1,2,3]Computer Science & Engineering, Amritsar Group of Colleges, Amritsar, India
Email: [1]kunalarora145@gmail.com, [2]kaursharann181@gmail.com,[3]vinod.cse@acetedu.in

Abstract—Ride-on-demand (RoD) services, such as Uber and OLA cabs, are growing increasingly popular. RoD services use dynamic pricing to balance supply and demand, attempting to improve service quality for both drivers and passengers. Dynamic pricing, also known as real-time pricing, surge pricing, or time-based pricing, uses a variety of technologies to provide a range of prices on the fly. It enables companies to adjust rates based on algorithms and machine learning, while also taking into account rival pricing. It isn't intended for every type of business or industry, but it does have a favorable impact on the following: hospitality, travel, entertainment, e-commerce, retail, electricity, and public transit. Wealthier customers are more likely to use this pricing model since they have the financial capacity to deal with price fluctuations.Dynamic prices, on the other hand, frequently cause problems for travellers, as "unpredictable" prices prohibit them from making quick selections. To overcome this issue, it is necessary to provide more information to passengers, and projecting dynamic prices is a viable approach.Taking the Rapido dataset as an example in this paper, we focus on the estimation of dynamic prices, forecasting the price for each individual passenger order. Predicting prices will help passengers understand whether they could get a lower price in nearby locations or in a short period of time, thus alleviating their concerns. The prediction is carried out by studying the association between dynamic pricing and attributes taken from the dataset. We train one linear model as a representative and assess its output using real service data from diverse angles. Furthermore, we examine the contribution of features based on the model at various levels to determine which elements have the greatest impact on dynamic prices. Finally, we use an effective linear regression model based on evaluation outcomes to anticipate dynamic pricing. The study's goal is to make passengers happier by providing an accurate prognosis.

Keywords: Machine Learning, Prediction, Linear Regression, Target, Correlation, Ride-on-demand Services, and Dynamic price.

I. Introduction

Machine learning is a type of data processing that allows you to create analytical models automatically. It is a subset of artificial intelligence based on the idea that computers can learn from data, spot trends, and make judgments with minimal human input. It's commonly utilized nowadays, with the purpose of allowing computers to learn on their own, without the need for human interaction, and adjust their activities accordingly.Supervised learning, unsupervised learning, and reinforcement learning are the three primary domains of machine learning, respectively. In each case, there is a specific action to be taken and a certain result to be obtained by employing various forms of data. Machine learning algorithms are used in a wide range of applications, for example, educational data mining, Stock data mining, diagnosis of neurological disorders, power management, and sentiment analysis, etc.

In the area of education, Educational Data Mining (EDM) exploits statistics, computer learning and data mining to interpret and forecast educational data using different approaches. To better understand learners and their learning, EDM aims to use online learning modes and develop computational methods to evaluate the facts and figures in order to help learners. [1] On the other hand, nowadays, overwhelming stock details are available, and are only of value if correctly analyzed and mined. Using various mathematical and supervised learning methods, stock data may be significantly analyzed. [2] Moreover, neurological diseases are persistent and life-threatening disorders that have a bad effect on human life's overall routine. In the diagnosis of these diseases, deep learning strategies have attracted the enormous interest of scholars. [3]

Furthermore, in the background of smart cities, energy efficiency in the public sector is an important issue. To forecast energy consumption, machine learning models can be built to suggest the design of an intelligent machine learning-based public sector energy management framework that could be seen as part of the idea of a smart city. [4] Another application of machine learning is sentiment analysis using various kinds of techniques. Analysis of sentiment and viewpoint mining aid in the analysis of people's views, opinions, attitudes, thoughts and feelings. With the growth of social media like Twitter, Facebook, Quora, blogs, microblogs, Instagram and other social networks, the demand for sentiment analysis occupies the same space. [5] For the psychological study

network, artificial learning can also be used to recognize the times and fields of most influential concern. Among the most important research topics, world's highest affecting disorders such as depression (fourth largest disease) turn out to be excellent. [6]

Recent years are witnessing the rapidly rising worldwide ride-on-demand (RoD) services market, such as Uber and OLA cabs. RoD service attracts passengers by its comfort, affordable prices, and versatile service. In their daily transportation, a growing number of passengers now take RoD service as a standard option. Dynamic pricing is the central and distinctive characteristic of the RoD service and represents the attempt to balance supply (the number of cars on the road) and demand (the number of requests from passengers): higher prices decrease demand and increase supply in a busy area, whereas lower prices in a non-busy area do the opposite. For both drivers and passengers, this makes the service more responsive.

We extract relevant features and predict the dynamic prices based on the data, taking the Rapido dataset as an example. Rapido is an Indian online bike taxi RoD service, operating in over 75 cities across the country. Rapido was estimated to have over 15,000 registered riders in September 2018, with an average of 30,000 rides every day. The dynamic price (trip fare) of Rapido data may be influenced by many parameters such as pick-up location, drop location, travel distance, travel time and timestamp. We consider travel distance and travel time as the main features for predicting dynamic prices by analyzing the associations between dynamic prices and different data features. A linear regression model is trained to make predictions of the dynamic data price.

Linear Regression is one of the machine learning algorithms based on **supervised learning** where the outcome is estimated by the use of known parameters that are associated with output. It performs a **regression task**. Instead of trying to classify values into different groups, it is used to predict values within a continuous range. The known parameters are used to predict the unknown parameter or the result. When known and unknown parameters are plotted on the X and Y axes, it forms a continuous and steady slope. While training the model we are given:

x: input training data (univariate – one input variable(parameter))

y: labels to data (supervised learning)

When training the model – it fits the best line to predict the value of y for a given value of x. The model gets the best regression fit line by finding the best θ_1 and θ_2 values.

θ_1: intercept θ_2: coefficient of x

Our trained model predicts dynamic price (trip fare) with good precision and efficiency (i.e., 93.40%) by considering the features (travel distance & travel time) which are strongly correlated to dynamic price (trip fare).

II. RELATED WORK

The relationship between age and language has been studied as an example of one of these kinds of research. The model of Linear Regression can also be used to predict the age of the author of a text. Three separate data genres are used simultaneously to investigate the age prediction of the author: blogs, telephone conversations and online forum messages. The efficient features include both stylistic as well as content-oriented ones, after careful examination of different data characteristics. These characteristics are considered to be the main features that are going to be useful in age prediction. Correlations up to 0.74 and mean absolute errors between 4.1 and 6.8 years are obtained. In conclusion, content characteristics as well as stylistic features were discovered as strong indicators of the age of an individual.[7]. On the other hand, multiple linear regression models were used in one more analysis to predict the most significant yarn parameters of ring spun cotton yarns. With linear multiple regression analysis, they utilized AFIS (Advanced Fiber Information System) fiber properties, roving and yarn properties. The correlations between dependent variables, i.e., yarn properties and independent variables, i.e., fiber, roving, and yarn properties, has been calculated one by one. The results suggested that for each yarn property, the relationships between variables and yarn properties are nearly linear.

TABLE 1: GOODNESS OF FIT STATISTICS OF MODELS;
* STANDARD ERROR OF THE ESTIMATION

Parameter	Tenacity	Elongation	Unevenness	Hairiness
R	0.969	0.844	0.942	0.894
R2	0.938	0.712	0.887	0.799
Adj. R2	0.936	0.702	0.882	0.790
SEEE*	0.967	0.457	0.809	0.367

Table 1 shows the goodness of fit statistics of their models: multiple R, R^2, adjusted R^2 and SEE (Standard Error of Estimation). It can be seen from the table that all the models have very high values of R^2 and low values of SEE. The goodness of the fit statistics table indicates that their models' predictive powers are very high. In describing yarn properties, the strong performance of linear regression models showed that the relationships between their variables (properties of fiber, roving properties, yarn count and twist) and yarn properties were very nearly linear. Their models have found out that roving properties have a significant influence on all properties of the yarn. Their work has shown that AFIS fiber properties can be used effectively for the prediction of yarn properties.[8]

Recently, linear regression modeling technique has been used in a study named "Prediction of new active cases of corona virus disease (COVID-19) pandemic using multiple linear regression models". The COVID-19 pandemic has had a significant effect on the health, socio-economic and financial problems around the world. An overview of the daily statistics of people affected by the disease is taken to forecast the pattern of active cases in Odisha (Indian State) and India over the next few days. Based on the correlations among key features (total confirmed, active, deceased, positive cases) of the considered dataset, regression models are trained to predict future active cases. The score of R^2 tends to be 0.99 and 1.0 indicating a strong predictive model.[9] In this article, the author suggested to predict real estate values using linear regression model. The real estate market is one of the prime fields to apply the ideas of machine learning due to fluctuations in pricing, to forecast costs with high accuracy. The key features to predict the price of a house are physical conditions, concepts and location. A linear regression model has been trained to predict house prices in Mumbai city. The breaking down of past business trends and value ranges, and future advances has been carried out. The outcome of this research has shown that linear regression gives a minimum prediction error of 0.3713. Moreover, this research may help customers bring money into a legacy without switching to a broker.[10]

Another similar research has also been found to estimate the resale value of cars. In this research, the price of the car is considered as dependent variable for target prediction and other parameters are considered as independent variables for target prediction. Most significant parameters have been considered by establishing correlations between intended parameter and price of the car using past data. Furthermore, linear regression modeling technique has been applied to this problem. The model takes training data to be ready to make predictions of car prices. It is providing an accuracy of 90% and giving an error of 10%. Author has observed that linear regression model is better suited for the prediction of target variable (car price) and it is performing very well. Moreover, different machine learning algorithms and approaches can be implemented to get better efficiency.[11] On the other hand, temperature prediction can be an application of linear regression modeling technique. The author considered temperature as the independent variable and pollution, population as dependent variables. After analysis of temperature, population and pollution, predictions of temperature have been made using multiple linear regression models on the basis of various factors in the years 2013-2016. As the outcome of study, the predicted value (temperature) comes out to be accurate. Moreover, measures must be taken to prevent this increasing temperature or it will increase to an uninhabitable extent.[12]

In this paper, author has used linear regression technique for stock price prediction. Since it depends on the demand of the stock, and there is no fixed variable that can accurately predict the demand of one stock each day, Stock price prediction is a difficult task. There are many features influencing demand of stock. One of the features may be people's opinion on social media about products from certain companies, whose analysis can be done through process of sentiment analysis. The results of the sentiment analysis are used to forecast the stock price of the firm. To construct the prediction model, the linear regression approach is used. The sentiment analysis model has been generated with 60.39% accuracy using the Random Forest algorithm classifying tweet data, and the other with 56.50% accuracy with the Naive Bayes algorithm. In price prediction, linear regression models have an R2 value close to 1, which means that a lot of data was fitted by the model.[13] In this study, the landscape position has been used to estimate soil properties using regression methods. This study has been carried out by taking soil samples from Nebraska. Upper interfluves, sampling depth and an irrigation code are the independent variables used to predict dependent variables, i.e., soil properties. Only eight models for pH, organic matter, electrical conductivity, exchangeable K, base saturation percent, and available P and K had major contributions out of the 100 models produced. Such models had R^2 values higher than 0.50. A comparison of the average values observed and projected for each soil property at each sampling depth showed that the values observed typically dropped over the predicted values within a 95% confidence interval.[14]

In this paper, the intended study established regression models for predicting peak hourly load conditional on all previous days during a given day. In forecasting hourly load, it utilizes a companion time series, namely, daily average load. To define the connections between peaks, loads, holidays and weather, the models use diagnostic tests. One that has present weather as well as past average load, past peak load, holiday and weekend dummy variables is the best overall model. Using a non-linear uni- variate model for weather, one reduced form model was also developed and it performed better than any other reduced form model. Another analysis of different models produced in the study showed that conditional models perform no better than those of the reduced form ones. The best overall model mentioned above has given the best efficiency among all.[15]

III. Objectives

- To find correlations between each variable and the target variable.

- To build a linear regression model.
- To calculate efficiency of the model and errors in predictions.
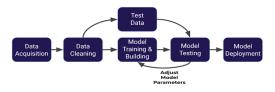
IV.   PROPOSED METHODOLOGY

Fig.1: Workflow Pipeline

The various phases of workflow pipeline of data analytics is shown in Figure 1 and is described as follows:
1. Data Acquisition: It is the first stage of data analytics, which comprises the data collection procedure. There may be multiple sources of data, such as downloading data files from the internet, acquiring real-world data via sensors or surveys, or obtaining real-world data from any organization or industry.
2. Data Cleaning: It is the process of preparing data for analysis by removing or changing data that is inaccurate, incomplete, irrelevant, duplicate, or in an incorrect format. Dealing with missing values, finding duplicity and deleting it, dealing with ludicrous values, and dealing with invalid formats, among other things, are all part of data cleaning. It's a laborious chore that can be made exciting and entertaining by applying data visualizations. Plots such as the histogram, line plot, bar graph, scatter plot, heat map, strip plot, regression plot, join plot, pair plot, and many others are included in visualizations.

Fig. 2: Data Cleaning Process

3. Test Data: This stage is also known as data separation. There are two common methods for splitting data. One method is to use a train-test split, in which the data is separated into two parts: training and testing. In fact, the first part is often a bigger subset of data (e.g., 80% of the original data) and the second part is typically a smaller subset of data (e.g., 20% of the original data) (the remaining 20 percent of the data). The training set is used to create a predictive model, which is then used to the test set to produce predictions. The Train-Test split is depicted graphically in Figure 3.

Fig. 3: Train –Test Split

4. Another method is the train-validate-test split, which divides the data into three parts: training, validation, and testing. The training set is used to build a predictive model, which is then evaluated on the validation set to generate predictions, tune the model, and choose the best performing model based on the validation set findings. The testing dataset isn't utilised much in model construction and planning, but it is used to create final predictions.
5. Model Training & Building: Machine learning algorithms are developed at this level. One or more machine learning methods are chosen to develop one or more models for the same problem based on the kind of target variable (i.e., continuous, categorical, etc.) and many other circumstances of the analytical problem. Linear regression, logistic regression, and others are examples of basic machine learning techniques. Finally, using the training dataset, the created model is trained.
6.Model Testing: This stage involves putting the trained model to the test by looking for flaws in predictions. With the help of the testing dataset, the difference between the actual value and the anticipated value (using trained model) of the target variable is determined. When using the Train – Validation – Test split method for data splitting, the validation set is also applied to the trained model. Figure 4 shows formulas for calculating several types of mistakes. Figure 5 also shows the formula for calculating the model's R-squared value. R-squared is a number that ranges from 0 to 1. If the R-squared value is more than 0.8, the model is regarded good.

```
#mean absolute error= 1/n summation of  (true value - predicted value)
#mean squared error=1/n summation(true value - predicted value)**2
#root meansquared error= sqrt(1/n summation(true value-predicted value)**2)
```

Fig. 4: Formulae for Error Calculation

```
#r**2 = 1 - (SSR/SST)
#where
#SSR = summation ((actual value - predicted value)**2),
#SST = summation ((actual value - mean of actual values)**2)
```

Fig. 5: Formula for R- squared Calculation

7. Model Deployment: Finally, the model that has been tested is deployed. This model can forecast the target or expected variable ahead of time.

V. Linear Regression Model

Linear Regression is a technique of statistical/supervised- machine learning that tries to model the linear relationship between the independent predictor variables X and the dependent variable Y of quantitative response
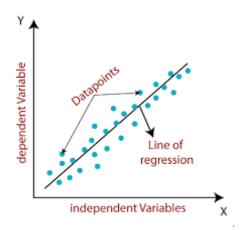

Fig. 6: Linear Regression Graph

It is important that the predictor and response variables are numeric. Mathematically, a general linear regression model is depicted in Figure 7.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \epsilon$$

$where\ \beta_i\ is\ coefficient\ and\ \epsilon\ is\ a\ mean - zero\ random\ error\ term$

Fig.7: Equation of Linear Regression Model

Based on number of predictor variables, linear regression can be classified into two categories:
1. Simple Linear Regression – One predictor variable
2. Multiple Linear Regression – Two or more predictor variable

VI. Software Specification

Tools used - Anaconda Navigator, Jupyter Notebooks, and Microsoft Excel 2013.

Packages used – numpy, pandas, time, datetime, matplotlib, seaborn, sklearn.

VII. Implementation And Analysis

In Rapido Dataset's review and implementation process, we divide the whole process into three parts.
1. Exploratory Data Analysis (EDA) - It refers to the essential method of conducting initial data investigations in order to uncover patterns, detect anomalies, and use summary statistics and graphical representations to verify conclusions.

2. Metric Calculation: It is basically a calculation based question, "What is the average duration between the 1st trip and the 2nd trip of customers?" Only those customers who have taken more than one trip are included here.
3. Model Building: It refers to building a model to predict trip fare using travel distance and travel time, measuring the accuracy of the model and using the model to predict trip fare for a trip with travel distance of 3.5 KMs and travel time of 15 minutes.

VIII. Results and Discussion

Initially, the dataset is in form of rows and columns with CSV (comma separated value) format. The dataset has been loaded into jupyter notebooks in a dataframe of pandas library. Figure 8 shows a sample of dataset, wherein 'trip_id' and 'customer_id' are unique identifiers for customer, timestamp is the time stamp of the trip in Epoch format, 'pick_lat' and 'pick_lng' are pick up latitude and longitudes, 'drop_lat' and 'drop_lng' are latitude and longitude of drop location, 'travel_distance' is distance of trip measured in KMs, 'travel_time' is the duration of trip measured in minutes, and 'trip_fare' is trip fare calculated in Indian Rupees. Here 'trip_fare' is our target variable.

Fig.8: Initial Dataset

In the EDA of dataset, we explore the data collectively as well as variable by variable in order to check the trends and correlativity of each variable with target variable. While analyzing 'timestamp' variable, we extracted date and time of the trip from it. A new column 'datetime' can be seen in Figure 9.

Fig. 9: Dataset with New Column 'Datetime'

Also, we add a new column namely 'weekday' by extracting week days from 'timestamp' variable. Figure 10 shows the overridden dataset.

Fig.10: Dataset with New Column 'Weekday'

Another finding comes into existence while analyzing 'travel_distance' variable. There are 231 customers whose 'travel_distance' is 0 which might correspond to cancelled trips, for which minimum fare of INR 20 is charged. Also, there are 3 customers whose 'travel_distance' is -1 which might correspond to some error. Both of these observations seem to be absurd, so its better to remove them from the dataset. Figure 11 depicts the number of records before and after removal.

```
In [77]: print('Number of records in dataset before removal:', df['trip_id'].count())
         df = df[df['travel_distance']>0]
         print('Number of records in dataset after removal:', df['trip_id'].count())

         Number of records in dataset before removal: 44587
         Number of records in dataset after removal: 44353
```

Fig. 11: No. of Records Before and After Removal

While performing EDA on 'travel_time' variable, we observe an absurd value for 'travel_time', i.e., 4134 minutes having 'trip_fare' of INR 60 and 'travel_distance' of 6.8 KMs. Figure 12 can be seen for the number of rows before and after removal.

```
In [90]: print('Number of records in dataset before removal:', df['trip_id'].count())
         df = df[df['travel_time']!=4134.388700]
         print('Number of records in dataset after removal:', df['trip_id'].count())

         Number of records in dataset before removal: 44353
         Number of records in dataset after removal: 44352
```

Fig. 12: No. of Records Before and After Removal

Also, there are some absurd values for 'trip_fare' if we look at the corresponding values of 'travel_distance' and 'travel_time'. For Example, 'trip_fare' INR 959 seems to be absurd in some cases. The number of rows before and after removal can be seen in Figure 13.

```
In [99]: print('Number of records in dataset before removal:', df['trip_id'].count())
         df = df[df['trip_fare']!=959]
         print('Number of records in dataset after removal:', df['trip_id'].count())

         Number of records in dataset before removal: 44352
         Number of records in dataset after removal: 44349
```

Fig.13: No. of Records Before and After Removal

We also check for null values and the results can be seen in Figure 14. It is clear that *there are no missing values in the dataset. So further we need not to clean the data for model building as it is already having no null values and no categorical column of object type.*
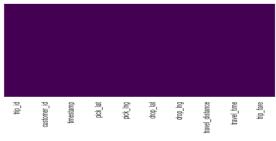

Fig. 14: Heatmap for Null Values

Based on the analysis, 'travel_distance' and 'travel_time' are the most suitable variables to predict 'trip_fare'. First reason of selecting these two is that both are numeric as required for linear regression model, and second can be seen from the heatmap showing the strong correlations in Figure 15.
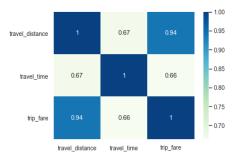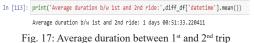

Fig.15: Heatmap for correlations with target variable

In the metric calculation for average duration between 1st and 2nd trip of customers, we first calculate the duration between 1st and 2nd trip of each customer (who has travelled more than once) individually as shown in Figure 16. Then we calculate the average of these durations as shown in Figure 17.

Fig.16: Duration between 1st and 2nd trip for Each Customer

```
In [113]: print('Average duration b/w 1st and 2nd ride:',diff_df['datetime'].mean())
          Average duration b/w 1st and 2nd ride: 1 days 00:51:33.220411
```

Fig. 17: Average duration between 1st and 2nd trip

Now in the model building phase of the process, we build a linear regression model taking 'travel_distance' and 'travel_time' as independent variables to predict 'trip_fare'. Figure 18 shows the scatter plot of true values v/s predicted values (predicted by built model) of trip fare. It is clear that plot of true and predicted values comes out to be almost linear, which is a good sign.
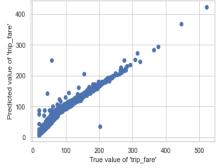

Fig. 18: Scatter Plot of True Values v/s Predicted Values

The intercept and coefficients of independent variables can be seen in Figure 19.

Fig.19: Intercept and Coefficients of Model

Figure 20 is showing various kinds of errors calculated for the model we built.

Fig. 20: Calculated Errors

The R- squared value for the model is shown in Figure 21. It is clear that the efficiency of our model comes out to be 93.40%.

Fig. 21: R- squared Value of the Model

In the last part of process, trip fare for distance of 3.5 KMs and duration of 15 minutes has been predicted by the model as shown in Figure 22.

Fig. 22: Final Prediction

IX. Conclusion and Future Work

Rapido is a Ride-On-Demand (ROD) service that employs dynamic pricing to balance supply and demand, hence improving service quality. The study largely focuses on exploratory data analysis (EDA), metric calculation, and model construction. The dependent algorithm variable turned out to be 'riding fare,' while the independent variables were 'journey distance' and 'travel time.' The efficacy of the Linear Regression Model for predicting dynamic trip prices is 93.40 percent. It is more adapted to predicting the goal variable, which is the trip fare, and it performs admirably. The next phase in this work will be to collect as much data regarding Rapido bike trips as possible. The more data collected after a dynamic pricing scheme is implemented, the better the results will be. Further this work can be carried out using different machine learning algorithms and techniques in order to get higher efficiency and lower errors.

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An Unfamiliar Appliance to Forecast Lung Cancer Based on Hazard Factors

Gurleen Kaur

Department of Computer Engineering & Technology, Guru Nanak Dev University
Amritsar, India
Email: gurleenkaur2832@gmail.com

Abstract—**The key task within the healthcare field is usually use for the diagnosis of the disease. If lung cancer is identify in before the usual time then we are able to save many lives. Machine learning classification techniques can considerably help the healthcare field just by offering a precise and easy diagnosis of different diseases. Additionally, saving time both formed professionals and patients. Moreover, lung cancer disease plays a crucial role in our life. Artificial Neural Network has been declared that only a single (machine) language which is beneficial for large or small scale text. Furthermore, it has been improve a computer system modelled on the nervous system with large strength. Firstly, here is a structure to decrease the contributed period utilized the Neural internet group having surged up to justify the algorithm which is used to clarify the patient having with chosen attributes which makes the cancer problems back to normal within not right way only but also, drop down the erroneous level.**

I. Introduction

Cancer is the evolution of non-typical cell. This is an infection in which the unusual cells. Contributed distribute the body tissues without any control. A cancer often occurs in the youngsters who usually get smoke which get entrance in the lungs, breast and is kidney, layout the cancer when infection occurs. This cancer is not just a lung cancer but the treatment of cancer is based on the lamp which can be called (tumor). Supposing, breast cancer mixed into infection into the lungs. It will be called metastatic cancer of breast not a cancer of a lung. The lung cancer is a set of soft and flexible organs made by the sacs of air, which are get in touch with bronchioles, blood vessel any many more. The food pipe (trachea) commence the entrance of breathe as an oxygen and roll out the carbon dioxide (which does work as a feedback from lungs to mouth) which snatched the air from tubular branches (called bronchi) into the lungs.The process of bronchi is that after getting the air it gets their position into different sets into smaller bronchies known as (bronchioles), lastly phenomenon microscopic. The alveoli can be called the tiny sacs breathe cell. An alveoli transmitted the oxygen into the blood cell through air. They get carbon-dioxide roll out from the blood which loose our body when we roll out the air from our body. NSCLS and SCLS are two major types of lung cancer.

Near to 92% of lung cancer are in NSCLS. It has further main three parts

Squamous Cell Carcinoma: This type of infection commence between from the lungs nearly the airways.

II. Literature Survey

Literature analysis creative writing processing on cancer procedure if equipment learning has losing very closely under description, consuming air to have better features in different ways when data is totally loosed.

NSCLS is the predominant in many of the universal area.

XUEYAN MEI [1] from five years with tiny cell of corner by FCBF about particular (forest) green diversity and more algorithm. Logistic Regression method made up Mohammad [2] which have very urgent tasks to find the different temporary data importance choose on their effectiveness. It have searched that the adaption and each natural diversity is the perfect experience method to long with is normally accepted by dexterous or toughest model with exemplifications and also size of knowledge.

Fresh innovations are to hold the medical practioner to concentrate on surgery to calculate the value of higher rate of RP.

[6] It is believed that highly assumed measures of arranging in the field of AI to check the risk of increasing RP.

[7] The effect of these arrangement are analyzed by the choric of some features and the impact of determined the possibilities of future assessment.

Advance, interior lung cancer sum to measure the learning of picture processing of lung cancer of tittle cells by using CT Scanning experiences. It is image scanning system is used analyze the information behind whole view of an image is hold and connecting the situation to measure the consumption of SVM.

III.   Problem Formulation

A.   Naïve Bayes

Naïve Bayesian is such a way of Bayesian rule implemented which is totally a justification trick of Bayes Theorem to assume the freedom along with predicators. In normal, Naïve Bayes attains the random features of presence-ness and also mismatch for another character which are on under Naïve Bayes. Naïve Bayes structure is effectively helpful to make a dataset.

B.   Support Vector Machine

In machine learning, SVM are supervised learning models with the associations of learning algorithm that examine data for categorization as well as analysis of regression.

1.   Working of SVM

In this, the given prospect is the verdict limit any else we will analyzed as it blue or anything that happens to the others will be assumed as another. The minimum SVM classifier works by making a direct parallel lines into two parts. All the recording data drop down from one hand of the line will be tagged as first class of all.

C.   Logistic Regression

It is a statistical experiment that uses a logistic function to form a binary dependent variable, however various difficult extension also take place. In regression analysis, logistic regression is predicting parameters of a logistic model in the form of binary regression. It is used to attain amount of ads in the presence of several explanatory variable. The process of this is little bit similar to multiple linear regression, with the condition that the response variable is binomial. The consequences is that the influence of every variable on the odds percentage of the observed event of interest. It is better to get good accuracy for various easy data sets and it works well when the dataset is linearly separable. It needs average or no muticoll nearify between independent variables. It has least use to increase the over fitting but it can over fit in highest dimensional datasets.

IV.   Results

The results obtained from the proposed algorithm in our experiment are listed below:

Thermo gram: It's a graphical representation of data in the form of any figure.

- To representation of data here we can use different colors.
- It is used to varying the records of different time period.
- Thermo gram further divided into two types

- Cluster map- It represent value and color depicted
- Spatial heat map- It represent the motion

TABLE 1: Comparison Table of Classifiers

Metrics	Logistic Regression	Naive Bayes	SVM
Accuracy	97%	88%	96%
Precision	98%	88%	97%
Recall	97%	88%	96%
F1-Score	98%	88%	97%

V.   Conclusion

The main agenda to research on the lung cancer to aware the people regarding this aliment. To improve this all they introduce a new word which is capable to do the found the lung cancer before usual time. Different instruments are designed for different stages of lung cancer like high, low or medium. So, this is very crucial which is done with the help of machine instead of human to identify the cancer. With the help of aids like AI, additionally, early detection is possible which helps to save lives. Additionally, this paper highlights that there are 3 subtypes of lung cancer may be distinct in diseases during genetic level.

VI.   Future Scope

Lung cancer detection is calculated to be the second main reason for death in worldwide [1, 2] among all the cancerous death recorded. Lung cancer is the primary root of cancer death in men; however, it ranked ninth position in women. It is possible to detect the cancer at very early stage, providing a much higher chance of survival to the patient. Apart from this, lung cancer can be detect through the symptoms value from the patient.

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Development of Repositioning Bed for Prevention of Pressure Ulcers in Patients

Sirimonpak Suwannakhun[1], Thaweesak Yingthawornsuk[2], Kantapat Kwansomkid[3],
Jaruwan Tummaporngul[4], Jutarat Kaewkhuean[5], Watcharapohn Intasorn[6]

King Mongkut's University of Technology Thonburi, Bangkok, Thailand
Email: 1sirimonpak.sut@kmutt.ac.th, 2thaweesak.yin@kmutt.ac.th, 3kantapat.kwansomkid@mail.kmutt.ac.th,
4jaruwan.tumm123@gmail.com, 5jutarat25112540@gmail.com, 6watcharapohn.int@gmail.com

Abstract— **Currently, the pressure ulcers, known as bedsores, are common among bed-bound patients. Bedsores are primarily caused by skin friction. In later stages, the humidity will damage the patient's skin and makes it swell; this might lead to a skin infection. There are many ways, by which bedsores can be treated or prevented in bed-bound patients for example, changing the patient's sleeping position every 2 hours, using an air mattress, and repositioning the patient's posture. Therefore, in this work we designed and developed a device that can help turning the bed-bound patient's laydown position onto a side position of body. The device is controlled using Arduino board to process the tasks assigned by a caretaker. Body temperature and humidity are monitored and measured by sensors and then notify the caretaker via audible signal. To know how the device functions correctly or not, the performance, quality, and property of device were evaluated by ergonomists, medical doctors, and nurses. As the evaluation result shown, the performance was found to be at average of 4.52, quality for 4.39, and properties for 4.05. All of which are highly ranked in the criteria.**

Keywords: Bed-bound Patients, Pressure Ulcers, Arduino

I. INTRODUCTION

A pressure ulcer is an important and common problem in hospitalized patients which has limitations in movement. This results in local injury to the skin and subcutaneous tissue of patient, often found above the bone nodes or in connection with the use of a medical device or another device. For a long time with an average pressure greater than 32 mm Hg, this causes ischemia and oxygen to the tissues, causing the death of tissues and skin that area the skin changes starting with a faint red color, which can be observed within 30 minutes, where the first stage of redness and redness will not fade away. Even after the posture has changed for more than 30 minutes, then it becomes swollen and watery to form a blister. In the end, there was a scratched wound if the pressure is left on the skin for more than 6 hours, the cells will begin to die. When the patient does not receive the proper care, the skin becomes sore. Noticeable within 2 weeks, pressure ulcers are often found in people with reduced mobility or who lay down in bed for a long time, including elderly patients, at 70% risk of developing pressure sores, which increases the risk of breakdown 4–6 times and tends to be higher in people with older ages. People with spinal cord injury Paralysis from bleeding in the brain People with cerebral symptoms cannot help themselves, including those who have critically injured for brain injuries.

Nowadays, the occurrence of pressure sores has many impacts on patients and their caretakers physically, mentally, emotionally, and socially. They become the dependent persons who have additional illnesses, including infection spreading into the bone and the bloodstream. This resulted in a longer stay in hospital and a higher cost of hospitalization. Many healthcare departments have developed a nursing practice guideline to prevent the development of pressure sores. The 60% of pressure ulcers can happen because the patients were unable to move along with 44.4% of the patients who had daughters, making them unable to care for the patients effectively due to too much weight of patients' body to handle. Most of the patients was pulled, dragged while turning or moving their position in bed and the 68.9% of patients was caused their skin to tear, which must be carefully moved. Especially the heavy patients should not be moved or lifted patients up by one person alone. To prevent the injury to patients, tossing and the posture of the patient are considered as the primary principle of prevention of pressure ulcers by turning the patient on his side every 2 hours. The way to prevent such injury is using air mattress which is a solution widely adopted. It reduces and distributes the pressure that will be applied to the skin, but this type of mattress is expensive.

From the above information, the idea to develop a turn-over device to prevent pressure ulcers for bed-bound patients has been proposed and the objective of our task is to develop a turn-over device to assist caretaker to reduce the incident that can make the pressure ulcers in bed-bound patients and make evaluation on the performance of a designed turnover device. The proposed device can be controlled to help turn the patient on its side and all

temperature and humidity can be checked and the device sounds the alert to the nurse or caretaker when a time to turn a patient to the side reaches.

II. Related Work

M. B. Pouyan *et al*. [1] presented a high-speed and efficient posture recognition algorithm that can be used in the widespread patient monitoring system. First, the entire pressure image is recorded using a commercial pressure plate system. The image enhancement is then applied to the raw pressure image and generates a binary signature for each of the different gestures. Finally, by using a binary pattern matching technique, a given posture can be categorized into one of the well-known gesture classes. Their comprehensive experiment showed that the proposed algorithm can predict the bed posture with a higher average of 97% in accuracy.

S. Nageswaran *et al*. [2] have used engineering methods to change the pressure accumulated from areas that are susceptible to pressure. Although the perceived pressure in these regions is greater than that is perceived in other regions, shifting protocols must be designed to channel or to rate pressure changes to avoid any injury in areas where there is no risk of pressure. This work aimed to define such a protocol using MATLAB program and hence design a mattress layout using Pro / Engineer: Number of partitions needed to cover the entire surface of the skin that meets the mattress.

D. Sen *et al*. [3] proposed the prevention of pressure ulcers by alerting the patient or caregiver to potentially dangerous levels of pressure that could lead to irreversible tissue damage. An analysis from two different animal models was presented. The measurement results showed that the contact pressure sampling rate, with real-time measurement and communication, can finally alert the caregivers to respond when the conditions require their intervention.

R. Meffre *et al*. [4] proposed a new approach to the study of pressure ulcers. This research group committed to develop the methods for analyzing the likelihood that a patient will develop pressure ulcers and detect risky situations. The idea is to link the movement disorders more accurately with autonomic nervous system (ANS) problems. Assessing the effects of discomfort in ANS (discomfort-induced stress) may be involved in the detection of ulcers. In their study, the motion was assessed through motion measurements. This assessment at the soft tissue interface and any support was developed to document six parameters: skin potential, skin resistance, skin temperature, skin hematoma, frequency of the instantaneous heartbeat and the frequency of breathing immediately the design of the measuring instrument and its result were presented.

S. Arias *et al*. [5] applied the proposed alternating pressure sequence for the air cell cushion. Six healthy volunteers were asked to sit on the air cell cushion in the same constant and alternating mode as a conventional foam cushion for 12 minutes. The interface pressure was monitored with a matrix sensor system. The contact area by user and pressure distribution were analyzed and it was found that the user's touch area is larger than that of fixed or foam cushions. Moreover, the new pressure distribution with alternating cushions is better than other cushions. The goal of the alternating sequence is to distribute pressure and stimulate the ischial region to promote blood flow and prevent pressure induced.

SN Ali *et al*. [6] have designed and developed fully functional and affordable smart E-pants to prevent pressure ulcers. The predominance of the patient's bones in motion by stimulation of the gluteal muscle when prolonged pressure was detected above the threshold. The device incorporates an electrode in a specially designed bra that automatically sends a discontinuous electrical stimulation through the interference current protocol. The electrical circuit consists of two main units, so these affordable and smart developed E-pants have shown clear results in preventing pressure ulcers.

S. Ostadabbas *et al*. [7] have proposed an efficient algorithm to find repositioning tables for bed-bound patients based on the risk of developing gastric ulcers. Their proposed algorithm takes data from a commercial pressure plate assembled on the bed surface and provides a sequence of next positions and repositioning times for each patient. The patient-specific relocation schedules reduce the overall cost of nurse staff involvement in patient transposition while reducing the likelihood of developing pressure ulcers.

C. Dobbins *et al*. [8] have adopted some of the current technologies used in the area and how they may be applied to the management and prevention of bedsores. They have developed a prototype system that works to demonstrate the enforcement of their approach in preventing pressure ulcers. This new and novel way of remotely monitoring patients is essential. An interesting approach to consider is the use of human digital memories, which provide a long record of the lifespan of the patient's physiological and environmental information.

N. Vuillerme *et al*. [9] has proposed the innovative technology based on the concept of sensory replacement. This work aimed to design, develop, and validate the biomedical technical assistive device for rehabilitation procedures for people with disabilities using a tactile biofeedback system with prosthetic tongue placed. His report described the architecture and principle of operation of these biological feedback systems and presented the results of a preliminary study of two feasibility studies conducted on healthy young volunteers.

S. Li *et al.* [10] designed a cushion to prevent pressure ulcers. An effective new method of customized cushion manufacturing (CCC) has been proposed and clinical research was being conducted to test the efficacy of the novel contoured cushions (CCC) in ten healthy trial participants. Two of participants who sat for extended periods per day and sixteen other spinal cord injury patients agreed to participate in this study. The results showed that the CCC was able to distribute the pressure beneath the bottom and reduced the peak and mean pressure and the pressure gradient, and significantly improved the stability. Participants experienced the increased euphoria and stability with the CCC. The positive correlation between the participants' mean pressure and body mass index (BMI) was presented.

III. Methodology

A. Bed-bound Patients

Bed-bound patients are the dependent patient group, referring to all patients with ADL Barthel Index from 4/20, such as patients with chronic disease or the elderly with disabilities and limitation of ability to do daily activities on their own, equipped with the medical equipment, or in need for caregivers to assist for the long continuation of the life span.

B. Pressure Ulcers

A pressure ulcer is an area of the skin and subcutaneous tissue that is subjected to local damage from constant pressure, friction, and shear. The pressured skin looks reddish and the destruction of the skin. Pressure ulcers are a significant problem related to the quality of care. Especially in a group of patients with less mobility. Figure1 shows the cause of pressure ulcers.
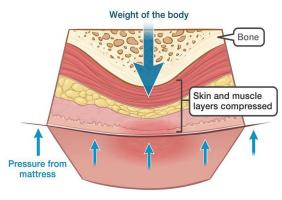

Fig. 1. Cause of Pressure Ulcers

C. Pressure Ulcers in Bed-bound Patients

Pressure ulcer was found in patients who were in bed for a long time and rarely turned to the side or patients who are unable to help themselves. There is a restriction in the movement, causing pressure ulcers on the skin at different positions, especially around the bone button, such as the coccyx, pelvis spine elbows, and heels.

D. Prevention of Pressure Ulcers in Bed-bound Patients

The sleeping position should be changed at least every 2 hours to reduce the pressure for too long lay down in the same position. Improving the blood circulation by using an accessory that relieves pressure can help reducing a risk of pressure ulcers caused by friction between the patient's skin and the bed liner.

E. Application of Arduino to Development of Repositioning Equipment

Arduino Uno R3 implemented by a program in the Arduino IDE controls the rotation of the motor which is used to pull the fabric sheet to the desired direction of turning the body of patient on its side for the specified time. In order to measure the temperature and humidity, the sensor was controlled through Arduino controller to process the signals collected from sensor and then make a sound to alert the caregiver to notify for a time when the patient should be turned over.
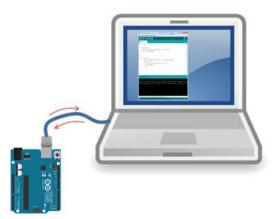

Fig. 2. Interfacing Arduino UNO R3 Board to Computer

IV. Imprementation

A. Operating Process

The whole study procedure is described as follows: First all relevant information regarding the problem and its solution was collected. Second, literature review on the related research reports and theories was made. Third, the proposed turn-over device for bed-mounted patients was designed and built. Fourth, testing of usability was made on the device. Fifth, satisfaction survey was made to a group of targeted samples. Sixth, the performance of device was analyzed and evaluated by experts and finally the device was used in real practice situation for bed-bound patients.
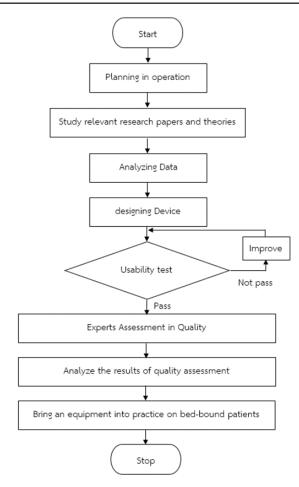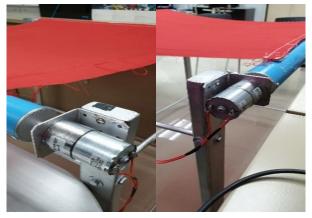
Fig. 3. Workflow of the Operation Process

Fig. 4. Assemble of Motors in the Prototype Structure and Spindle

B. Population and Samples

In the assessment of quality and satisfaction toward the designed turn-over device in various attributes made by four experts and six volunteer students, first two experts are ergonomics, one medical specialist and one nurse. All volunteers are undergraduate students consisting of three male and three female students, with a weight range of 40-60 Kgs, who are studying in department of Media Technology, King Mongkut's University of Technology Thonburi.

V. Results and Discussion

As results of assessment and evaluation shown, the assessed quality of the turn-over device which was considered in terms of properties was found to be at very good level. When considering in individual items, it was found that the temperature in the back of patient's body can be accurately measured and the position where the device touches the side of body. The humidity of the back and the position where the device touched the body were obtained at good level as well with an average of 4.00, in a group of volunteer students was also found with a mean of 3.15, in a group of experts in principle with a mean of 3.24, the patient able to correct the movement to the side of body with a mean of 5.00 obtained from a group of volunteer students, and finally a mean of 4.50 from a group of specialists. The ability of device to turn the patient and adjusted according to the nursing care plan was found to be 4.86 from testing with a group of students and specialist group with 4.44. The ability to apply the device can be used for other activities which was evaluated to have a mean of 5.00 in a group of student volunteers and 4.10 found in a group of experts. Notification of ability of device when the temperature is higher than the set value and the average risk of pressure ulcers showed the average of 4.40 found in the group of students and 4.50 found in the group of specialists. Ability to alert the caretaker when humidity is over a certain value was obtained from a group of student volunteers and a group of experts with averages of 4.86 and 4.50 respectively.

Table 1: Result of Quality Assessment

Equipment's Assessment	Average	S.D.	Quality
Performance	4.48	0.25	Excellent
Quality	4.43	0.17	Excellent
Equipment quality level	4.46	0.21	Excellent
Properties	4.32	0.35	Excellent
All of average	4.42	0.25	Excellent

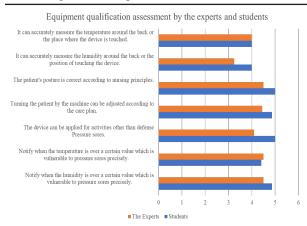Fig. 5. Test of Repositioning Bed with a Volunteer

Fig. 6. Comparison of Equipment Qualification Assessment Between Experts and Student Volunteers

VI. Conclusion

This work has been developed to produce a side-turning to prevent pressure ulcers in bed-bound patients. Contribution of our work can provide proper care to bed-bound patients and help reduce the burden of caretakers. The tilting aid was tested with a group of experts and student volunteers. Data were collected from the evaluation of a sample group and questionnaire was used to find the satisfaction results. The distribution of information as a result from the evaluation made on the development of tilting device can be concluded that the overall average of assessment and evaluation results was fund to be a mean value of 4.42 and S.D. value of 0.25. The development of the device that was proposed can perform well as planned. The comments by experts and some test results could improve the performance of device. However, more sample and testing scenarios may need with more time to study and further analysis for continuing the development of this application and more diversity in technology could be taken in account of improvement on better performance of device.

VII. Acknowledgment

Media Technology Department, King Mongkut's University of Technology Thonburi (KMUTT), Thailand.

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Further Developing Performance of Mobile Adhoc Network Using Enhanced Ant Colony Optimization

Er. Mohit Sood[1], Amit Singh[2]

[1,2]Department of Computer Applications, Amritsar Group of Colleges, Amritsar, India.
Email: [1]mohitsood1434@gmail.com, [2]amit_07singh@yahoo.co.in

Abstract—The hubs are interconnected with no brought together control. The correspondence between the hubs is completed by utilizing the portable hubs which are going about as switches. Directing in a versatile specially appointed organization is vital issues. The greatest test in networks is to discover the way between the correspondence end focuses. MANET hubs working on battery attempt to seek after the energy productivity by diminishing the energy they devoured. In this paper we utilizing the idea of Nature Inspired calculations (Swarm Intelligence Technique) like Ant Colony Optimization calculation. Essentially the convention depends on swarm knowledge. It is utilized to take care of complex issues by participation. The principle objective of this paper is to lessen overhead, enhance the energy, start to finish delay. In this paper we additionally utilize the idea of quad-restricted FANTs and multi-models based BANTs to course the information.

Keywords: Mobile Ad Hoc Networks (MANETs), Swarm Intelligence, Ant Colony Optimization Algorithm (ACOA).

I. Introduction

Current situation in remote correspondence frameworks and difficulties in Data correspondence structures are making quickly and this conveys a degree of new challenges in directing [3]. MANET formed by wireless hosts which may be mobile.As we know there is no pre-existing infrastructure. Mobile ad hoc systems are constituted by wireless mobile nodes disseminated without the need of predefined foundation; where each node has the same level in the system and they can go about as customer or server.

The nodes are free to join or there is no infrastructure. Wireless systems are gaining continuous importance due to the administrations offered by the high development of the gadgets.

There are a few issues of medium access, Productive routing, security and "Quality of Service" (QoS), Power administration. As the nodes compare over wireless connections, all the hubs must battle against the erratic character of wireless channels and interruption from the extra transmitting hubs.

These elements make it a challenging issue to exploit on information throughput regardless of the possibility that the client obliged QoS in wireless ad hoc systems is attained.

Routes between nodes may potentially contain multiple hopes (Nodes acts as router to forward packets for each other). Due to the spread of sensor gadgets, laptops, PDAs and other portable electronic gadgets, ad-hoc wireless networks are expanding in fame. In order to communicate with one another without an infrastructure to depend on, these gadgets need routing conventions that can work without any gateway to interface with. Swarm intelligence has been used to solve optimization problems in data networks. One such optimization problem is routing where swarm intelligence has been applied.

II. Mobile Adhoc Networks

Lately, large enhancements have occurred in the innovation used to assemble advanced hardware, Micro-Electro-Mechanical Systems (MEMS) and remote interchanges.

There has been a huge proportion of examination concerning steering in remote sensor organizations. As correspondence between hubs is central to most arrangements, steering in remote sensor networks is considered extremely basic.

The essential engineering of MANET comprises of hubs that are progressively self-coordinated into self-assertive and impermanent organization geography with no foundation support. The advantage of employing MANET is to offer a large degree of freedom at a minimal cost in comparison to other networking solutions.

The ease and speed of deployment of these networks make them ideal for recovery after a natural or manmade disaster, business associates sharing information during a meeting or conference, and military communications in a battlefield.

Portable Ad-Hoc Networks are self-ruling and decentralized remote frameworks. MANETs involve

mobile nodes that are allowed to move in and out the system. Nodes are the devices that are mobile and that participate in the networks such as mobile phone, laptop, personal digital assistance, MP3 player and PC.They can structure self-conclusive geographies relying on their mix with one another in the system.

These centers are gifted to mastermind themselves and in light of this intriguing capacity, they could be passed on frantically without the need of any base.MANET might have to navigate numerous connections to arrive at an objective. Versatility causes course changes.

III. ROUTING PROTOCOLS IN MANETs

Steering is portrayed as the demonstration of moving data from source to objective in an organization. The essential target of directing conventions is to limit delay, intensify the organization throughput, expand network lifetime and boost energy effectiveness. Deciding ideal directing way and internetwork bundle move are the two essential exercises engaged with steering. Portable Ad-Hoc Network is the quick creating designing from the past 20 years. The expansion in their predominance is because of the simplicity of sending, framework less and their dynamic nature. MANETs caused another arrangement of solicitations to be completed and to give capable better start to finish correspondence.

MANETs routing protocols are categorized into three main categories.
- Table driven/ Proactive
- Demand driven / Reactive
- Hybrid

A. Proactive Protocols

Proactive protocols are also known as table driven protocols. Nodes in a mobile ad hoc network consistently evaluate routes to all reachable nodes and attempt to maintain consistent, up-to-date routing information using a proactive routing protocol. When a network topology change occurs, respective updates must be propagated throughout the network to notify the change. Routes to all destinations are maintained by sending periodical control messages. This type of routing protocols has its advantages and disadvantages. One of its main advantages is the fact that nodes can easily get routing information and it's easy to establish a session. There is unnecessary bandwidth wastage for sending control packets. Proactive routing protocols are not suitable for larger networks, as it needs to maintain route information every node's routing table. This causes more overhead leads to consumption of more bandwidth. Some protocols that are considered as table- driven are: Destination sequenced Distance vector routing (DSDV), Wireless routing protocol (WRP), Fish eye State Routing protocol (FSR), Optimized Link State Routing protocol (OLSR), Cluster Gateway switch

routing protocol (CGSR), Topology Dissemination Based on Reverse path forwarding (TBRPF).

B. Reactive Protocol

Receptive directing conventions for portable specially appointed organizations are alluded as "on request" steering conventions. On-request directing is a well known steering class for remote specially appointed steering which gives an adaptable answer for somewhat huge organization geographies. The reactive protocols are mitigating the drawback of proactive protocols since it saves the power which was excessively used earlier in proactive protocols. In this design of protocol it discovers the route dynamically. The node communication starts with the initiation of a process called as route discover process in which the sending node broadcast route request to its adjacent nodes and they will further continue and determine the route from the sending node to the destination. The Reactive protocols are very advantageous as they are bandwidth efficient. Unlike the proactive protocols, the routes are created on demand only which results in much traffic overhead [1]. Different types of On- Demand protocols are: Ad hoc On Demand Distance Vector (AODV), Dynamic Source routing protocol (DSR), temporally ordered routing algorithm (TORA), Associatively Based routing (ABR).

IV. ANT COLONY OPTIMIZATION

As clarified by CH. V. Raghavendran[7], lately, the interest of mainstream researchers in ACO has been expanded. Due to strength, and versatile nature, ACO has at last figured out how to discover its applications in directing, task and booking. The fundamental thought behind insect based steering calculation is food looking through methodology of genuine insects. They assess unmistakable courses as they begin looking through food from their home and stroll towards the food.The ants are consideredas the small control packets, assigned the task to find a path towards their destination and gather information about it. A colony of ants has a wide range of duties like collecting food, building/guarding the nest, removing the dead ants, etc. and has simple one-to-one communication. The individual messages passed between ants are very insignificant, but the collective messages help in coordinated work control of ants without the presence of a centralized control system. Ants usea chemical substance pheromone for communication among them which they deposit on the ground while roaming around for search of food. Ants have ability to smell this pheromone. They can produce few different types of pheromones – usually one each to signify different work categories like collecting food trails, signifying emergency, moving dead ants, etc. The source of ACO is the pheromone trail laying and following behavior of ants which use pheromone as a communication medium.

The ants deposit pheromones on the ground while searching the environment for food. This pheromone attracts other ants and the ants tend to follow trails of previous ants. This mechanism enables the ants to find shortest paths between the nest and a food source. There are chances that when ants fan out to find food, any ant finds a short path to a new food source. It then takes some food with it and makes its way back to the nest. Since it is attracted by its own pheromone trail, it is likely that the ant follows its own path back to the nest, thereby leaving a second pheromone trail. If other ants happened to take a longer path to the food source, they arrive after the first ant and, when trying to make their way back to the nest, there is a good chance for them to be attracted by the short path, where already two pheromone trails have been laid.

This reinforces the short path even more and makes it more attractive. Concerning the longer path, pheromones tend to evaporate after some time, so in the long run the long paths will be forgotten and almost all ants will take the short path. The characteristics of ants are similar to the characteristics of MANETs. This helps us to apply the food searching characteristics of ants for routing packets in MANETs.

The basic principle of an ant routing algorithm is mainly the depositing of pheromone on the path followed by the ant. They follow simple rule of following the path which has higher concentration of pheromone. The pheromone concentrations on a path allow the other ants to find their way to the food source.

Thereby more ants follow the same path and more and more pheromone is deposited on the path which is the shortest route to the food source.

Ant routing basic principle can be defined as:

1. Each network node sends a number of discovery packets - forward ants (F-ANT) towards the selected destination nodes   of the network.
2. The stochastic tables replace the routing at each node in order to choose next hops as per the weighted probabilities available.
3. The routing tables are changed for selection of the next node in the network.
4. When forward ant (F-ANT) reaches the destination node, it generates a backward ant (B-ANT) and then dies. Similarly in MANETs routing, the new packet created and sent back to the source will propagate through the same path selected by the forward ant (F-ANT). This is shown in Figure 2(c).
5. Now backward ant (B-ANT) deposits pheromone on the crossed links. It means that it updates the routing table of the nodes along the path followed by forward ant (F-ANT). After arrival to the source node, the backward ant (B-ANT) dies [7].
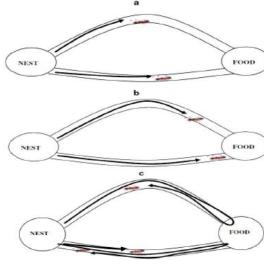

Fig. 1: Basic Ant Routing Principle

A. Related Work

The basic principal of Ant Colony Optimization is to searching the food. In which highest pheromone level is best path to route. In BECA/AFECA [2] was one of the first papers to propose power save protocol. It proposed two simple protocols. the Basic-Energy Conserving Algorithm(BECA) and the Adaptive Fidelity Energy-Conserving Algorithm (AFECA), with AFECA being extension of BECA that takes advantages of node density to allow nodes in dense areas to sleep for longer period of time. ACO [7] The rapidly changing and unpredictable nature of Mobile Ad-hoc networks. Its wide range of challenges like efficient routing, load congestion avoidance, energy Consumption.

Multicast Routing for Mobile Ad-Hoc Networks using Swarm Intelligence [6] multicasting as an efficient way of providing services for group oriented application.

Its involves transmission of packets to a group nodes identified by a single destination address.

B. Proposed Work

In ACO, subterranean insects come nearer from source to objective through number of ways. On their return, again they might utilize same number of ways. At whatever point the retrogressive subterranean insect specialists go to the source by means of various ways where they store the pheromone worth and time stamps at each middle hub, so here navigating through numerous ways might bring about loss of energy levels of the hubs. Thinking about this issue just as thinking about the benefits of AODV convention, a mix of both the conventions can be utilized to resolve this issue. The proportion of pheromone and the expense value(based on the energy level of the hubs) of a few ways from source to objective has been considered as a way main consideration.
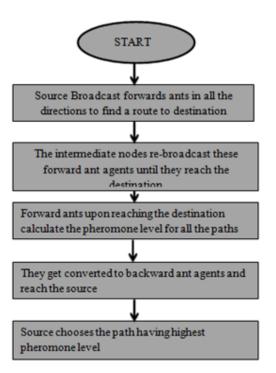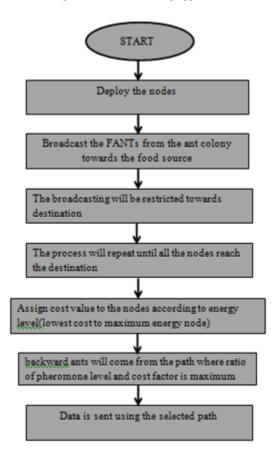
Fig.2: Flowchart of Existing Approach

Fig.3: Flowchart of Proposed Approach

In our study we take the ratio of the pheromone value and the cost value (based on the residual energy of the nodes) of the various paths traversed from source to destination. The highest ratio value path will be selected by the backward agents in routing.

In the proposed study each we will also use the concept of quad limited broadcasting method, where the FANTs will be broadcasted by each intermediate node during the route formation process in a particular quadrant towards the destination. This will be enhanced route discovery procedure. By this method, the nodes avoid broadcasting the FANTs in all the directions towards the destination. So our study will mainly focus on the limited broadcasting and multi-criteria (pheromone to cost ratio) in the formation of the path from source to the destination in order to improve the performance of the network.

V. SIMULATION AND RESULTS

In this part, the proposed strategy has been reproduced in NS2.35 and the reproduction results are introduced. The beneath charts show the examination of the energy burned-through in ACO and proposed work.

At first 100 joules of the energy was provided to the organization and after the information is sent through chosen way, it was seen that energy burned-through in proposed approach is less in contrast with energy devoured in ACO.
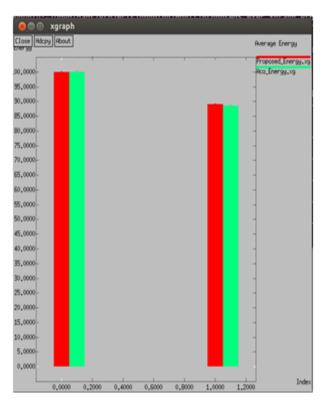

Fig. 4: Remaining Average Energy

Fig.5: Throughput

Above graph shows the throughput comparison between ACO and proposed approach. Throughput is amount of the data that is received at the destination in the network.

More the throughput better is the performance of the network. Since throughput in proposed scheme is 62Kbps and is 27Kbps in ACO, so it is shown that proposed scheme performed better than ACO.
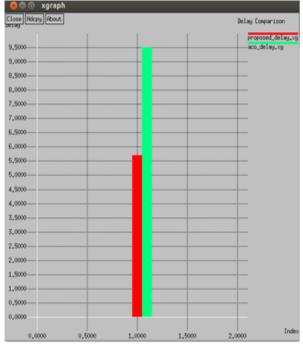

Fig.6 : Delay

This graph shows the delay comparison. Lesser the delay, better the network's performance. Proposed scheme shows the delay of approx 5.7 sec whereas the delay in the case of ACO was about 9.5 ms.
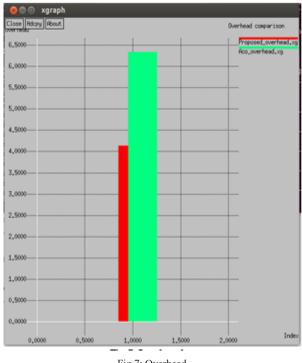

Fig.7: Overhead

Whenever the data is sent from any node, it appends a header on the packet. More the routing packets being sent in route discovery phase of the network, more is the routing overhead. The routing overhead for any network should be less. Proposed approach exhibited less routing overhead than the ACO.

VI. Conclusions

The incredibly fast geography of Ad Hoc frameworks and their confined data transmission makes the directing errand more irksome. The work mirrors that by utilizing the straightforward conduct of insects and honey bees advancement and developments in steering conventions should be possible, that assist with outflanking the standard MANET directing conventions like AODV. We simulated both Proposed scheme and the ACO and compared the performance of both the protocols. The various performance parameters considered for the comparison are- energy consumption, throughput, overhead and the delay. Proposed scheme exhibited the better performance than ACO. This section focuses on promising future research directions based on our current research. However, we would further like to expand our research and apply proposed scheme in combination with genetic algorithms to enhance the performance of the network.

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Data Science: An Emerging Technology and Its Applications

Sarabpreet Singh

Computer Science and Engeenring, Amritsar Group of Colleges, Amritsar, India
Email: sarabsingh.cse@acetedu.in

Abstract—**Data science is a scientific concept of technological system that "makes data helpful". Data are partitioned records of the real life (the physical world and human activities) and digitalized results of the real world. "Making data useful" mainly refers to the scientific objective of recognizing and manipulating the real world through collecting, collating, processing, and analyzing the fragmented data that reflect the real world**

I. Introduction

A fundamental principle of data science is that data are considered as an element of the cyberspace, while human society, the physical world, and the cyberspace (or the data space, the information space) are considered as the components of the ternary world we are in. Their connections and interactions in this ternary world define the technical characteristics of social development. For example, digitization (digitalization) is the basic approach to perceive human society and the physical world; cyberization is the basic approach to connect human society to the physical world; and intelligentization is the way that cyberspace acts on the physical world and human society. Digitization, cyberization, and intelligentization are the prominent features of the new round of technological revolution [1], and mark the core of the next generation of information technology. With such an epistemology as guidance, data science is expected to lay the sci- entific foundation for big data applications. Data science is expected to make major breakthroughs in the following areas[2]: (i) data space's mathe- matical structure, distribution characteristics, and evolution laws (at the data science level); (ii) data generation mechanism and principles, the mirroring relationship with the real world, virtual operation platforms, virtual-physical/human-machine interfaces, and visualization principles (at the connections level of the ternary world); (iii) the mechanism and methods of transforming data to information, information to knowledge, and knowledge to decision-making (at the data analysis and processing level); (iv) basic theories and methods involving learnability and learning theory, data interpretation and semantics, data and society (at the data application level).

A. Explore the Data Space Structure and Characters

Data space is the entirety of data formed by the digitized real world, which is also the entirety of data science research objects. Data science research nowadays basically focuses on how to use it as a tool for knowledge discovery, and barely considers data space itself as the main research object. The core of storing and processing big data lies in how data are structured and formalized. While the essence of formalization is to seek the mathematical representation of data, and the key to structurlaization is to set a minimum common dimension that allows all types of data to be expressed in the mathematical space. We expect to see that in addition to analytical tools such as mathematical spaces, the algebraic structure of data space is also studied. Data complexity and uncertainty in data space, especially how they are measured, evolved, and utilized, should remain a major object of data space research. The fundamental objective of data space research is to identify new breakthroughs for big data analysis and provide new frameworks, new tools, new methods, and new technologies for effective data analysis and processing. Any research in favor of this objective should be encouraged and enhanced[3].

B. Establish Big Data Statistics

Statistics has always been reckoned as a discipline that leads and guides people to analyze and use data. Its main connotation is to study the collection, processing, analysis, and interpretation of data. Traditionally, motivated by the specific research questions, data are obtained through sampling and survey methods, and are then modeled and analyzed to draw conclusions that will be verified. In the era of big data, it is a natural feature to possess big data and an eternal task to interpret big data, which calls for a new paradigm of "data prior to problems". This new paradigm will fundamentally change the object of statistical research. This fundamental change will drive the drastic transformation from statistics to data science. During such a trans- formation process, some basic points that are both directional and easily misleading need to be clarified on an urgent basis. The first is the statistical process. Does the statistical process

need to change as the research object changes? If yes, what is the appropriate process for interpreting big data? The second is the role of statistics. Statistics recognize the world through probabilities and correlations. Will big data bring along a cognitive revolution? Since big data can be as "big" as the size of the entirety, problems can be solved through queries, do we still need statistics? The last is the core task of statistics. Is causality analysis indeed unnecessary? Can causality analysis be replaced by correlation analysis? In recent years, there have been a lot of discussions on the above three questions at the epistemological level, but few attempts have been made at the scientific level. It is an urgent task for data science to establish new statistics theories and methods with wider coverage and higher effectiveness to cope with the big data challenges.

C. Innovate Storage and Computation Technologies

Big data bear some salient features, such as large scale, diversified types, rapid changes, and low value density. Thus, computers face chal- lenges in various steps of the data value chain, including big data acquisition, storage, and computation. Computability and computational complexity are fundamental issues concerning computer science. How- ever, in the big data scenario, the data scale itself tends to increase exponentially, leaving the growth of computing power behind. At this point, we must pay attention to whether the computational complexity theory that does not consider the laws of data scale growth in traditional computing theories is still valid or not. We must also focus on the inte- grated computational complexity when data storage, data import/export methods, and computation are closely related. Apart from computational complexity, data science also needs to explore the complexity of the data space itself and the complexity of data-driven models. Data science cannot simply rely on upscaling data size or model parameters for a slight improvement in model capabilities[6]. When a traditional Von Neumann architecture frequently loads data to the processor, there will be increasing data processing delays and memory wall issues. An integrated storage and computation architecture provides an effective approach to address the memory wall issues. Its core concept is to retain data in the memory for computation, which reduces the delay in data analysis and processing. However, there are still many problems to be solved in the basic theoretical study of integrated storage and computation.

D. Lay a Solid Foundation for Artificial Intelligence

Artificial intelligence is a representative technology that implements the data value chain and demonstrates the value of data. Statistics-based bottlenecks exist in many big data analyses in cutting-edge research for major national demands and critical science. The core of artificial intel- ligence is algorithm, and the core of algorithm is big data-based machine learning[4]. At

present, one of the main hurdles in the application of arti- ficial intelligence is that most of the known core algorithms and basic algorithms are ineffective for real big data. The unique advantage of deep learning lies in its robust capability of modeling any complicated data. As long as sufficient samples are supplied for training, it is capable of learning, applying, and hence providing a universal AI-based solution. However, it also has a fatal flaw because network structure design tends to be more artistic than scientific (difficult to design), and the result is not interpretable (difficult to explain). The big data-based sample training can be deceptive. The stability of deep learning is also worth studying, which is used to reveal whether there are small changes in the network learning results when there are small changes in the training set. This research direction plays a significant role in understanding and improving the deceptiveness of deep learning.

Data science is a very unique discipline that has a range of different new characteristics when compared with others. Such examples include the transformation of thinking mode (from the knowledge paradigm to the data paradigm), the transformation of the subject-object relationship between data and technology (from technology-oriented to data- oriented), the transformation of data application guidelines (from idealism back to realism), the main purpose of data product development (with data being the main focus of innovation of traditional products), and the three elements of data science (theory, practice, and essence). Therefore, instead of simply duplicating the experience of traditional disciplines, data science research should show respect for its special missions and attributes.

II. Appications of Data Science

A. Fraud and Risk Detection

The earliest applications of data science were in Finance. Companies were fed up of bad debts and losses every year. However, they had a lot of data which use to get collected during the initial paperwork while sanctioning loans. They decided to bring in data scientists in order to rescue them out of losses.

Over the years, banking companies learned to divide and conquer data via customer profiling, past expenditures, and other essential variables to analyze the probabilities of risk and default. Moreover, it also helped them to push their banking products based on customer's purchasing power.

III. Healthcare

The healthcare sector, especially, receives great benefits from data science applications.

A. Medical Image Analysis

Procedures such as detecting tumors, artery stenosis, organ delineation employ various different methods and frameworks like MapReduce to find optimal parameters for tasks like lung texture classification. It applies machine learning methods, support vector machines (SVM), content-based medical image indexing, and wavelet analysis for solid texture classification.

B. Genetics & Genomics

Data Science applications also enable an advanced level of treatment personalization through research in genetics and genomics. The goal is to understand the impact of the DNA on our health and find individual biological connections between genetics, diseases, and drug response. Data science techniques allow integration of different kinds of data with genomic data in the disease research, which provides a deeper understanding of genetic issues in reactions to particular drugs and diseases. As soon as we acquire reliable personal genome data, we will achieve a deeper understanding of the human DNA. The advanced genetic risk prediction will be a major step towards more individual care[5].

C. Drug Development

The drug discovery process is highly complicated and involves many disciplines. The greatest ideas are often bounded by billions of testing, huge financial and time expenditure. On average, it takes twelve years to make an official submission.

Data science applications and machine learning algorithms simplify and shorten this process, adding a perspective to each step from the initial screening of drug compounds to the prediction of the success rate based on the biological factors. Such algorithms can forecast how the compound will act in the body using advanced mathematical odelling and simulations instead of the "lab experiments". The idea behind the computational drug discovery is to create computer model simulations as a biologically relevant network simplifying the prediction of future outcomes with high accuracy.

D. Virtual Assistance for Patients and Customer Support

Optimization of the clinical process builds upon the concept that for many cases it is not actually necessary for patients to visit doctors in person[7]. A mobile application can give a more effective solution by *bringing the doctor to the patient instead.*

The AI-powered mobile apps can provide basic healthcare support, usually as chatbots. You simply describe your symptoms, or ask questions, and then receive key information about your medical condition derived from a wide network linking symptoms to causes. Apps can remind you to take your medicine on time, and if necessary, assign an appointment with a doctor.

This approach promotes a healthy lifestyle by encouraging patients to make healthy decisions, saves their time waiting in line for an appointment, and allows doctors to focus on more critical cases.

IV. SPEECH RECOGNITION

Some of the best examples of speech recognition products are Google Voice, Siri, Cortana etc[8]. Using speech-recognition feature, even if you aren't in a position to type a message, your life wouldn't stop. Simply speak out the message and it will be converted to text. However, at times, you would realize, speech recognition doesn't perform accurately.

V. FLIGHT PREDICTION

Airline Industry across the world is known to bear heavy losses. Except for a few airline service providers, companies are struggling to maintain their occupancy ratio and operating profits[9]. With high rise in air-fuel prices and need to offer heavy discounts to customers has further made the situation worse. It wasn't for long when airlines companies started using data science to identify the strategic areas of improvements. Now using data science, the airline companies can[10]:

1. Predict flight delay
2. Decide which class of airplanes to buy
3. Whether to directly land at the destination or take a halt in between (For example, A flight can have a direct route from New Delhi to New York. Alternatively, it can also choose to halt in any country.)
4. Effectively drive customer loyalty programs

VI. GAMING

Games are now designed using machine learning algorithms which improve/upgrade themselves as the player moves up to a higher level[11]. In motion gaming also, your opponent (computer) analyzes your previous moves and accordingly shapes up its game. EA Sports, Zynga, Sony, Nintendo, Activision-Blizzard have led gaming experience to the next level using data science.

VII. AUGMENTED REALITY

Data Science and Virtual Reality do have a relationship, considering a VR headset contains computing knowledge, algorithms and data to provide you with the best viewing experience[12]. A very small step towards this is the high trending game of *Pokemon GO*. The ability to walk around things and look at Pokemon on walls, streets, things that aren't really there. The creators of this game used the data from Ingress, the last app from the same company, to choose the locations of the Pokemon and gyms[13].

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Cryptocurrency as a Blockchain

Ms. Muskaan Sachdeva[1], Ms. Anupreet Kaur[2], Er. Bhuvnesh Kumar[3]

[1,2]*Students, Department of Computer Applications, Amritsar Group of Colleges*
[3]*Assistant Professor, Department of Computer Science Engg., Amritsar Group of Colleges*
PTU, Kapurthala, Punjab

Abstract- This paper identified the understanding of the crypto including bitcoin and blockchain. Cryptocurrencies have emerged as important financial software systems. Mining adds records of past transactions to the distributed ledger known as Blockchain, allowing users to reach secure, robust consensus for each transaction. Mining also introduces wealth in the form of new units of currency. Cryptocurrencies lack a central authority to mediate transactions because they were designed as peer-to-peer systems. They rely on miners to validate transactions. Cryptocurrencies require strong, secure mining algorithms.In this paper we survey and compare and contrast current mining techniques as used by major Cryptocurrencies.

Keywords: Cryto Currencies, Blockchain, Mining , Bitcoin.

I. Introduction of Cryptocurrency

Cryptocurrencies, or virtual currencies, are digital means of exchange that uses cryptography for security. The word 'crypto' comes from the ancient greek word, 'kryptós', which means hidden or private. A digital currency that is created and used by private individuals or groups has multiple benefits. Cryptocurrencies challenge the orthodoxy of how a currency works in ways that excite some and worry others. So, what exactly is cryptocurrency and why is it different? Unlike other currencies, all cryptocurrencies are entirely digital. No cryptocurrency prints money or mints coins. Everything is done online. Conventional forms of currency are generated by government and then circulated in the economy, via banks. Cryptocurrencies are a digital cash designed to be quicker, cheaper and more reliable than our regular government issued money.

To prevent fraud and manipulation, every user of a cryptocurrency can simultaneously record and verify their own transactions and the transactions of everyone else. The digital transaction recordings are known as a "ledger" and this ledger is publicly available to anyone. With this public ledger, transactions become efficient, permanent, secure and transparent.

Cryptocurrencies work using a technology called blockchain. Blockchain is a decentralized technology spread across many computers that manages and records transactions. Part of the appeal of this technology is its security.

More than 6,700 different cryptocurrencies are traded publicly, according to CoinMarketCap.com, a market research website. And cryptocurrencies continue to proliferate, raising money through initial coin offerings, or ICOs.

Fig.1: Crypto-Currency

The total value of all cryptocurrencies on April 13, 2021, was more than $2.2 trillion, according to CoinMarketCap, and the total value of all bitcoins, the most popular digital currency, was pegged at about $1.2 trillion.

II. How Does Cryptocurrency Works?

According to Satoshi Nakamoto, the founding father of Bitcoin, it is a *peer-to-peer electronic cash system.* In that, it is much similar to peer-to-peer file transactions, where there is no involvement of any central authority or regulator. Transactions are sent between peers using software called "cryptocurrency wallets." The person creating the transaction uses the wallet software to transfer balances from one account (AKA a public address) to another. To transfer funds, knowledge of a password (AKA a private key) associated with the account is needed. Transactions made between peers are encrypted and then broadcast to the cryptocurrency's network and queued up to be added to the public ledger. Transactions are then recorded on the public ledger via a process called "mining". All users of a given cryptocurrency have access to the ledger if they choose to access it, for instance by downloading and running a copy of the software called a "full node" wallet (as opposed to holding their coins in a third party wallet like Coinbase). The transaction amounts are public, but who sent the transaction is encrypted

(transactions are pseudo-anonymous). Each transaction leads back to a unique set of keys. Whoever owns a set of keys, owns the amount of cryptocurrency associated with those keys (just like whoever owns a bank account owns the money in it). Many transactions are added to a ledger at once. These "blocks" of transactions are added sequentially by miners. That is why the ledger and the technology behind it are called "block" "chain." It is a "chain" of "blocks" of transactions.

However, some altcoins use unique mechanics. For example, some coins offer fully private transactions and some don't use blockchain at all.

III. Blockchain

Blockchain is the technology that enables the existence of cryptocurency (among other things). Bitcoin is the name of the best- known cryptocurrency, the one for which blockchain technology was invented. A cryptocurrency is a medium of exchange, such as the US dollar, but is digital and uses encryption techniques to control the creation of monetary units and to verify the transfer of funds.

The term "blockchain technology" is the transparent, trustless, publicly accessible ledger that allows secure transfer the ownership of units of value using public key encryption and proof of work methods. The first successful implementation of blockchain technology was the Bitcoin Network.

A blockchain is a decentralized ledger of all transactions across a peer-to-peer network. The purpose of blockchain is to solve the double records problem without the need of a central server. The blockchain is used for the secure transfer of items like money, property, contracts, etc. without requiring a third-party intermediary like bank or government. Once a data is recorded inside a blockchain, it is very difficult to change it.

The blockchain is a software protocol (like SMTP is for email). However, Blockchains could not be run without the Internet. It is also called meta-technology as it affects other technologies. It is comprised of several pieces: a database, software application, some connected computers, etc.
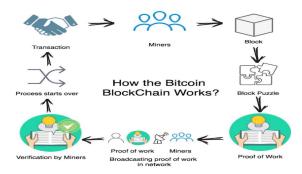

Fig.2: How Blockchain Work

Blockchain consists of three important concepts:
1. Blocks
2. Nodes
3. Miners

A. Blocks

Every chain consists of multiple blocks and each block has three basic elements:
- The data in the block.
- A 32-bit whole number called a nonce. The nonce is randomly generated when a block is created, which then generates a block header hash.
- The hash is a 256-bit number wedded to the nonce. It must start with a huge number of zeroes (i.e., be extremely small).

When the first block of a chain is created, a nonce generates the cryptographic hash. The data in the block is considered signed and forever tied to the nonce and hash unless it is mined.

For Example, A Bitcoin Block contains information about the Sender, Receiver, number of bitcoins to be transferred.

B. Nodes

One of the most important concepts in blockchain technology is decentralization. No one computer or organization can own the chain. Instead, it is a distributed ledger via the nodes connected to the chain. Nodes can be any kind of electronic device that maintains copies of the blockchain and keeps the network functioning. Every node has its own copy of the blockchain and the network must algorithmically approve any newly mined block for the chain to be updated, trusted and verified. Since blockchains are transparent, every action in the ledger can be easily checked and viewed. Each participant is given a unique alphanumeric identification number that shows their transactions.

C. Miners

Miners create new blocks on the chain through a process called mining. In a blockchain every block has its own unique nonce and hash, but also references the hash of the previous block in the chain, so mining a block isn't easy, especially on large chains.

Miners use special software to solve the incredibly complex math problem of finding a nonce that generates an accepted hash. Because the nonce is only 32 bits and the hash is 256, there are roughly four billion possible nonce-hash combinations that must be mined before the right one is found. When that happens miners are said to have found the "golden nonce" and their block is added to the chain. When a block is successfully mined, the change is accepted by all of the nodes on the network and the miner is rewarded financially.

Steps for Blockchain Transactions :

Step 1: Some person requests a transaction. The transaction could be involved cryptocurrency, contracts, records or other information.

Step 2: The requested transaction is broadcasted to a P2P network with the help of nodes.

Step 3: The network of nodes validates the transaction and the user's status with the help of known algorithms.

Step 4: Once the transaction is complete the new block is then added to the existing blockchain. In such a way that is permanent and unalterable.

Here, are some reasons why Blockchain technology has become so popular:

Resilience: Blockchains is often replicated architecture. The chain is still operated by most nodes in the event of a massive attack against the system.

Time Reduction: In the financial industry, blockchain can play a vital role by allowing the quicker settlement of trades as it does not need a lengthy process of verification, settlement, and clearance because a single version of agreed-upon data of the share ledger is available between all stack holders.

Reliability: Blockchain certifies and verifies the identities of the interested parties. This removes double records, reducing rates and accelerates transactions.

Unchangeable Transactions: By registering transactions in chronological order, Blockchain certifies the unalterability, of all operations which means when any new block has been added to the chain of ledgers, it cannot be removed or modified.

Fraud Prevention: The concepts of shared information and consensus prevent possible losses due to fraud or embezzlement. In logistics-based industries, blockchain as a monitoring mechanism act to reduce costs.

Security: Attacking a traditional database is the bringing down of a specific target. With the help of Distributed Ledger Technology, each party holds a copy of the original chain, so the system remains operative, even the large number of other nodes fall.

Transparency: Changes to public blockchains are publicly viewable to everyone. This offers greater transparency, and all transactions are immutable.

Collaboration: Allows parties to transact directly with each other without the need for mediating third parties.

Decentralized: There are standards rules on how every node exchanges the blockchain information. This method ensures that all transactions are validated, and all valid transactions are added one by one.

IV. TYPES OF CRYPTOCURRENCY

The following are the types of the Cryptocurrency are:

A. Bitcoin

Bitcoin is a cryptocurrency created in 2009. Marketplaces called "**bitcoin** exchanges" allow people to buy or sell bitcoins using different currencies. **Bitcoin** is a new currency that was created in 2009 by an unknown person using the alias Satoshi Nakamoto. Transactions are made with no middle men – meaning, no banks!

Bitcoin offers the promise of lower transaction fees than traditional online payment mechanisms and, unlike government-issued currencies, it is operated by a decentralized authority. There are no physical bitcoins, only balances kept on a public ledger that everyone has transparent access to. All bitcoin transactions are verified by a massive amount of computing power. Bitcoins are not issued or backed by any banks or governments, nor are individual bitcoins valuable as a commodity. Despite it not being legal tender, Bitcoin is very popular and has triggered the launch of hundreds of other cryptocurrencies, collectively referred to as altcoins. Bitcoin is commonly abbreviated as "BTC." Bitcoin is both a payment network and a modern type of currency. This creates a currency backed by code rather than items of physical value, like gold or silver, or by trust in central authorities like the U.S. dollar or Japanese yen.

1. How Bitcoin Works?

We define an electronic coin as a chain of digital signatures. Each owner transfers the coin to the next by digitally signing a hash of the previous transaction and the public key of the next owner and adding these to the end of the coin. A payee can verify the signatures to verify the chain of ownership.
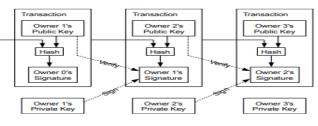

Fig. 3: Bitcoin Works

The problem of course is the payee can't verify that one of the owners did not double-spend the coin. A common solution is to introduce a trusted central authority, or mint, that checks every transaction for double spending. After each transaction, the coin must be returned to the mint to issue a new coin, and only coins issued directly from the mint are trusted not to be double-spent. The problem with this solution is that the fate of the entire money system depends on the company running the mint, with every

transaction having to go through them, just like a bank. We need a way for the payee to know that the previous owners did not sign any earlier transactions. For our purposes, the earliest transaction is the one that counts, so we don't care about later attempts to double-spend. The only way to confirm the absence of a transaction is to be aware of all transactions. In the mint based model, the mint was aware of all transactions and decided which arrived first. To accomplish this without a trusted party, transactions must be publicly announced , and we need a system for participants to agree on a single history of the order in which they were received. The payee needs proof that at the time of each transaction, the majority of nodes agreed it was the first received.

Bitcoins are traded from one personal 'wallet' to another. Awallet is a small personal database that you store on your computer drive, on your smathphone, on your tablet , or somewhere in the cloud.

2. Bitcoin Mining

Bitcoin mining is the process by which new bitcoins are entered into circulation, but it is also a critical component of the maintenance and development of the blockchain ledger. It is performed using very sophisticated computers that solve extremely complex computational math problems. Bitcoin mining is performed by high-powered computers that solve complex computational math problems; these problems are so complex that they cannot be solved by hand and are complicated enough to tax even incredibly powerful computers.

Fig. 4: Prediction of BTC till Dec 2021

Bitcoin Price Prediction for year 2021		
Month	Average Price ($)	Change (%)
Feb 2021	$53,544.16 USD	49.82 %
Mar 2021	$56,299.46 USD	57.53 %
Apr 2021	$51,539.90 USD	44.21 %
May 2021	$60,526.74 USD	69.36 %
Jun 2021	$59,998.95 USD	67.88 %
Jul 2021	$57,144.44 USD	59.89 %
Aug 2021	$48,900.82 USD	36.83 %
Sep 2021	$54,848.94 USD	53.47 %
Oct 2021	$59,885.33 USD	67.56 %
Nov 2021	$47,748.67 USD	33.6 %
Dec 2021	$59,358.80 USD	66.09 %

Fig. 5: Prediction of BTC till Dec 2021

All mining starts with the blockchain. This is an online decentralized ledger that records transactions throughout a network. A group of approved transactions is called a "block." These blocks are tied together to create a "chain," hence, the term "blockchain."

In the Bitcoin network, a miner's goal is to add individual blocks to the blockchain by solving sophisticated mathematical problems. This requires enormous computational and electrical power.

This miner receives a reward of 6.25 bitcoins. The reward rate is cut in half every 210,000 blocks, which roughly means every four years. This process, called "halving," is algorithmically enforced, ensuring a predictable, unalterable rate of introducing new bitcoins into the existing supply—eliminating concerns of inflation. Due to the inherent difficulty in mining bitcoins, there are a number of requirements when it comes to the actual mining process.

B. Ethereum

Ethereum (ETH) is the second most widely traded cryptocurrency, with a market capitalization of $459 billion.

Like other cryptocurrencies, Ethereum can be used for sending and receiving value globally and without a third party watching or stepping in unexpectedly. The Ether token that is carried by the Ethereum network is traded similarly to Bitcoin, but that's where the similarity ends.

Ethereum it is not solely a cryptocurrency like Bitcoin. It is also a "smart contract" platform, which hosts programs that can run using the Ethereum blockchain. These programs can in turn send transactions over the blockchain, allowing for a marketplace of decentralized apps. As such, Ethereum has fast become synonymous with "DeFi" or decentralized finance, a digital space where the crypto economy thrives. Investors can buy, sell, and trade on the Ethereum network.

Ethereum was first proposed in 2013 by developer Vitalik Buterin, who was 19 at the time, and was one of the pioneers of the idea of expanding the technology behind Bitcoin, blockchain, to more use cases than transactions.

While Bitcoin was created with the goal of disrupting online banking and day-to-day transactions, Ethereum's creators aim to use the same technology to replace internet third parties – those that store data, transfer mortgages and keep track of complex financial instruments. These apps aid people in innumerable ways, such as paving a way to share vacation photos with friends on social media. But they have been accused of abusing this control by censoring data or accidentally spilling sensitive user data in hacks, to name a couple of examples.

Ethereum 2.0, which was launched Dec. 1, 2020, aims to fix some of these issues. Other scaling technologies, such as Raiden – which has been in the works for years –

could help with the scalability problem as well.Before we get some ether, we need a place to put it. This brings us to the idea of an Ethereum "wallet." Like its real-world counterpart, an ethereum wallet is made for storing value. (It is common practice to use lower case for "ethereum" or "ether" when referring to the currency, but upper for the network or protocol.) Ethereum wallets store a user's private keys, which are secret keys that can be used to access ether.

Each key is a unique long and jumbled string of letters and numbers that looks like this:

> 073d9dbee8875e7c91422d80413c85ba5e8e9fe7cad5dc001871dac882d07f2f

Only the owners of the private keys can use them to spend the money associated with them. These days, ethereum wallets

There are several types of Ethereum wallets made specifically for storing these private keys:

- Desktop wallets
- Mobile wallets
- Hardware wallets
- Paper wallets

Choosing one depends on your preferences for convenience and security. Usually these two concepts are at odds with one another: the more convenient, the worse the security (and vice versa).

When it comes to cryptocurrency wallets, there's one major caveat to keep in mind: losing your private key means losing your ether, forever. It is a much bigger deal than misplacing a password for an online service. This is where the absence of trusted third parties becomes a double-edged sword. While intermediaries are no longer needed to verify transactions, there's no help desk to turn to for help recovering your secret key.

C. Litecoin

Litecoin (LTC) is a peer-to-peer cryptocurrency that was set up by Charlie Lee (a former Google employee) in 2011. It shares many similarities with bitcoin and is based on bitcoin's original source code.

Litecoin was designed to be used for cheaper transactions, and to be more efficient for everyday use. In comparison, bitcoin was being used more as a store of value for long-term purposes. The coin limit market cap is much higher on litecoin than bitcoin, and the mining process far quicker. This means transactions are faster and cheaper, although generally smaller in size.

There will never be more than 84 million Litecoins in circulation. On April 17, 2021, the value of one Litecoin was $310.73. Litecoin is a peer-to-peer virtual currency, which means it is not governed by a central authority. Litecoin's network offers instant, near-zero cost payments that can be conducted by individuals or institutions across the globe. Bitcoin, Litecoin, and many other cryptocurrencies use the proof-of-work (PoW) algorithm in order to secure their networks. Basically, PoW requires that one party proves to all the other participating parties in the network that a required amount of computational effort has been expended.

Litecoin can be used as an avenue for paying people anywhere in the world without an intermediary having to process the transaction. Its main benefit comes from its speed and cost-effectiveness. Litecoin transactions are typically confirmed in just minutes, and transaction fees are nearly negligible. This makes it an attractive alternative to Bitcoin in developing countries, where transaction fees may be the deciding factor on which cryptocurrency to support.

D. Tether (USDT)

Tether was one of the first and most popular of a group of so-called stablecoins, cryptocurrencies that aim to peg their market value to a currency or other external reference point to reduce volatility. Because most digital currencies, even major ones like Bitcoin, have experienced frequent periods of dramatic volatility, Tether and other stablecoins attempt to smooth out price fluctuations to attract users who may otherwise be cautious. Tether's price is tied directly to the price of the U.S. dollar. The system allows users to more easily make transfers from other cryptocurrencies back to U.S. dollars in a more timely manner than actually converting to normal currency.

Launched in 2014, Tether describes itself as "a blockchain-enabled platform designed to facilitate the use of fiat currencies in a digital manner." Effectively, this cryptocurrency allows individuals to utilize a blockchain network and related technologies to transact in traditional currencies while minimizing the volatility and complexity often associated with digital currencies. As of January 2021, Tether is the third-largest cryptocurrency by market capitalization, with a total market cap of $24.4 billion and a per-token value of $1.

Tether is a blockchain-based cryptocurrency whose cryptocoins in circulation are backed by an equivalent amount of traditional fiat currencies, like the dollar, the euro, or the Japanese yen, which are held in a designated bank account. Tether tokens, the native tokens of the Tether network, trade under the USDT symbol.

Tether (USDT) is a stablecoin, a type of cryptocurrency which aims to keep cryptocurrency valuations stable.

Tether is used by crypto investors who want to avoid the extreme volatility of other cryptocurrencies while keeping value within the crypto market.

In April 2019, the New York Attorney General accused Tether's parent company of hiding an $850 million loss.

Tether tokens trade under the USDT symbol. Tether tokens can be transacted on popular cryptocurrency exchanges that include Binanace, CoinSpot, BitFinex, and Kraken. Tether (USDT) offers a way for investors to avoid the extreme volatility of other cryptocurrencies. By moving value to USDT, a trader might reduce their risk of exposure to a sudden drop in the price of cryptocurrencies. It is also much quicker and cheaper to transfer BTC into Tether rather than the U.S. dollar. Tether is the first and most well-known stablecoin in the crypto world. Other stablecoins include True USD (TUSD), Pazos Standard (PAX), and USD Coin (USD).

E. Dogecoin

Dogecoin is a cryptocurrency with a fun and friendly brand picture that aims to be a supportive introduction to cryptocurrency. Billy Markus, an Oregon programmer, came up with the concept for a kind of "joke" cryptocurrency. He reasoned that a more lighthearted coin, rather than Bitcoin, would have a greater chance of gaining mainstream acceptance. Although Dogecoin is nowhere near the scale of Bitcoin, the 'joke' currency's market cap has risen from more than $1 billion in early January to $47 billion , according to CoinMarketCap.

As the name implies, it is mainly based on the Doge meme that swept the Internet in 2013.Dogecoin is an open-source peer-to-peer digital currency popular among Shiba Inus around the world. "Doge" is our amusing and friendly mascot! The Shiba Inu is a Japanese breed of dog that has become popular as an online meme and is associated with Dogecoin.

Dogecoin has one of the most active and largest communities in the cryptocurrency world. This group has banded together to support a variety of charitable endeavours and other ventures. They were also able to fund a NASCAR race.

Unlike Bitcoin, Dogecoin has no upper limit, which means there are actually more than 100 billion dogecoins in circulation.

Dogecoin, which began as a joke, has gained celebrity support from people like Elon Musk and Snoop Dog, rock musician Gene Simmon driving up the price. Musk expressed his interest in the coin once more in April, saying, "Doge barking at the stars." Following Elon Musk;s tweet, a amounts of Dogecoin (DOGE), causing the price to rise froma 24- hour low of 0.062 dollars to 0.078 dollars, a 20% increases.

The key explanation for the price increase is said to be the rising value of other crypto types such as Bitcoin and Ethereum, which has propelled the value of Dogecoin.

The DOGE run seems to be unstoppable. Now cryptocurrency briefly replaced the payments-focused XRP as the fourth-largest cryptocurrency by market capitalization.

Fig. 6: Prediction of DOGE

For years, the price of a Dogecoin remained at a fraction of a penny. It finally crossed the penny threshold in January 2021 but has since soared beyond most people's wildest expectations.

On April 20, it reached a high of $0.41, meaning it had grown by 7600% since the start of the year. A further surge in early May saw it climb to even higher levels: it topped $0.70 at once stage, representing growth of 14,000% in 2021. While it's now sitting at around $0.50, that's still an impressive performance.

Dogecoin's growth has in part been sparked by those endorsements from the likes of Musk and Cuban, but it was also talked up by Reddit users as part of the stock-price pumping campaign that included GameStop and other heavily shorted companies.

V. Challenges and Issues

The form of cryptocurrencies is not free from some financial problems and security concern. I analyzed several studies and cryptocurrency platformsand also observed some cryptocurrency selling forums in order to explore challenges and issues that are exist in such a virtual phenomenon. The main problems and impacts of cryptocurrency can include:

Security Threat: Hackers and malicious users can create as much as they want from virtual currency if they break the system and know the method of virtual currency creations. This will lead to ability to create fake virtual currency or steal virtual currency by just changing the accounts balances. For examples, selling in game virtual items and virtual currency is against World of Warcraft (WoW) game policies. Therefore, many users log into WoW gold selling websites to buy virtual gold in order to pay for virtual items that they need. Many of WoW gold selling websites are not reliable and they vulnerable to hacking and many users are complaining about paying real money for nothing or for fake virtual currency.

Collapse Concerns in Cryptocurrency Systems: Unlimited issuing of virtual currency in the variety virtual communities will lead to economic problems since its issuing is not based on the demand and supply.

It is possible for some providers such as Second Life to issue unlimited Linden dollars and increase their virtual items prices in order to gain more real revenues. On the other hand, it will suffer from inflation and economic issues leading to collapse in the virtual currency system.

Impact on Real Monetary Systems: Since some virtual currency systems are connected with the real world monetary systems, they may affect demands and supply facilities of real world money. For example, enabling users to purchase virtual and real goods and services with virtual currency in some platforms may reduce the demands on real money. Users will no longer depend on real money to buy what they want and they will use virtual money instead. On the other hand, some platforms enable users to exchange their virtual currency with their real currency and this will increase the demands on the real world currency. This fluctuation will affect on the real monetary system.

Gold Farming Risks: Gold farming term is very popular in china and developing countries. Gold farmers are players who plays in social games such as World of Warcraft in order to gain gold, which is virtual currency of the game, and then sell it for real money. In fact, huge cash flow is generated from gold farming process and it is not controlled and regulated. This will increase fraud and financial risks where virtual currency is exchanged with real money in unreliable environment.

Money Laundering: Money laundering is one risk that is very likely to rise with the use of VC especially with platforms that enable users to exchange virtual currency with real money. In practical case occurred in Korea in 2008, the police arrested a group of 14 persons for laundering $38 million obtained from selling virtual currency. The group converted the amount of $38 million, which is generated by gold farming, from Korea to a paper company in China as payments for purchases.

Unknown Identity Risks: Since creating an account in most of virtual currency platforms such as social games and social networks is not authenticated, financial transaction cannot be monitored very well. Gamers and users can create more than one account with unknown identities and use them for illegal tractions. There is no way to recognize the source of creating or cashing out the virtual currencies. Moreover, unknown identity will enable criminals to get paid with virtual currency for their crimes.

Black Market for Cryptocurrency: The financial position of some social games such as Second Life and World of Warcraft are mature enough to create black market for buying and selling their virtual currency. The increasing popularity of virtual currency in online environment has lead to a thriving black market for trading virtual currency with real money. The way of receiving the payment is risky since many, malicious users may not complete the payment or they dispute after paying.

VI. Conclusion

The emergence of Bitcoin has sparked a debate about its future and that of other cryptocurrencies. Despite Bitcoin's recent issues, its success since its 2009 launch has inspired the creation of alternative cryptocurrencies such as Etherium, Litecoin, and Ripple. Moreover, the confidence and trust rate of using cryptocurrency is noticeably high as it can be seen in several cases that have been stated in this paper besides the survey results. However, users have not realized the full picture of using cryptocurrency. In fact, many cryptocurrency forms do not deserve that much of trust yet. Many concerns and challenges and issues are exiting in many cryptocurrency platforms and they are clearly outlined,in the above sections of this paper. The future of Cryptocurrency concept is promising, revealing more opportunities to bring positive changes and progress to e-Business and e-Payment sectors. With the rapid progress and improve of technology, cryptocurrency will not stop processing.

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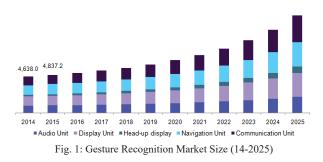# Artificial Intelligence and Gesture Based Motion Control and Accident Avoidance Systems in Onboard Ships

Dr. T. Sasilatha[1], Padmapriya J.[2], Karthickmanoj R.[3]

[1,2,3]*Department of EEE, AMET Deemed to be University*
Chennai,Tamil Nadu, India
Email: [1]sasilatha08@gmail.com, [2]priyajecay@gmail.com, [3]karthickmanoj.r@gmail.com

Abstract—**Object identification and control through automation is becoming vital in Autonomous Ships. It has gained conscience in the recent days owing to the growing domain of Gesture Recognition and automation based of the growth of multiple sectors implementing automations. Several automobile companies and markets are trying to implement or on the verge of final implementation of the imaging and gesture control strategies for motional control. Gesture detection, identification and control mechanisms are gaining momentum and is a huge market worldwide and Asia pacific to be specific. Random urgencies and the trending algorithms of Machine Learning and Deep Learning strategies have made the Automotive Control of Cruise or Ships even more vulnerable. This paper implements a strategy to detect and control Ship Navigation through Gesture Control and also deploy Advanced AI Algorithms to check and implement the strategy and tabulate the results based on the accuracy of the same.**

Keywords: Gesture Control; Object detection; Object Tracking, Python, Accident Avoidance, Ship Navigation, Computer Vision

I. Introduction

Automotive Navigation is much the need of the time. Emergence of new economic situations, emerging new markets, unearthing new opportunities in each and every domain such as Retail, E Commerce, Media, Automobile and Transportation, IT, Healthcare, Imaging concepts all require Imaging detection and Gesture control mechanisms to advance the technology and also demand a high rate of accuracy. Fig1 provides an illustrative view of the prevailing and the predictive market share for the Gesture Control markets. In this paper we propose to implement Ship Navigation Mechanism using Gesture Control and accident avoidance systems using the advanced Artificial Intelligence based algorithms to detect, classify and determine the accuracy of the predictive navigation.

Fig. 1: Gesture Recognition Market Size (14-2025)

Gesture is primarily used worldwide to allow clients & companies to perform advanced computational strategies in updated domains. It has been used as a vital communication tool for the Deaf and Dumb Communications, Communication protocol for the Physically impaired and very less used in control navigational systems. Pre Fed Gesture Datasets, in terms as collection of images are pre-fed and applied with specific algorithms to get the desired signal outputs.
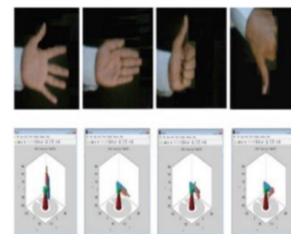

Fig. 2: Hand Gestures and Respective Inclination Symbol References Worldwide

While impressive examination has been deployed concerning Gesture Recognition and classification

investigation, restricted research has been led on control of ships or navigational control of ships using Gesture. This paper implements to deploy the use of Gesture recognition control and use improvised AI Algorithms to test, calibrate and check the accuracy levels of the prediction and prevent vital in the control navigation of the ships so as to avoid accidents and predict aided transport facilities using the GPS or locational assistance.

Implementation of the same is done conceptually and illustratively in this paper. This paper implements the concept of applying Gesture based control navigation for the ships and accident avoidance of the same using predictive AI Algorithms and testing the accuracy of the algorithms and providing an illustrative chart for the same. Overcoming the flaws in the existing models of navigation and determining the highest rate of accuracy in the detection and classifications are mandatory and is the need of the hour.

Thus a strategy deploying latest artificial intelligence or neural networks and a parallel detection algorithm in depicting the objects taking into account the fluctuations and illuminations of the environment, considering the latest datasets would be recommendable.

II. Existing System

Research works has been done in the navigational control of the ships. But there are some restrictions on the same. Mostly previous researches use only controller based navigational analysis system. Traditional methods are deployed for the analysis of the same and predicting the accuracy, which is very much lesser due to the concepts utilized. Moreover, during the detection process, only the segmentation techniques are deployed. This may have produced the desired results, but the accuracy prediction of the gesture detection will not be the near to the same when the same is applied in real time scenarios. Mostly K Means Clustering is being used for the prediction purposes. There are many other algorithms available, hence it is necessary to make a detailed study by implementing the same and making comparisons on the level of accuracy of the navigational control and predictive analysis of the accident avoidance systems used in ship navigation.

Some research works as been implemented in MATLAB. Statically the measures of this control navigational system which is processed in terms of object detection, Algorithmic application and processing of the frame data is to be considered during the time of pre-processing the Gesture dataset before applying to the classifier. Accuracy needs to be designed and implemented in a much more sophisticated model so as to achieve the desired detection accuracy levels. Comprehensive analysis over a certain selected dataset only is possible in the existing systems.
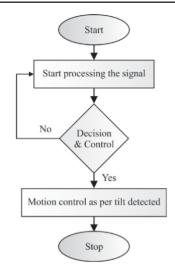

Fig. 3: Existing Flow Models of Gesture Control Navigation

III. Proposed System

In this paper we have come up with idea of using Convolutional Neural Network approaches, specifically Discrete Wavelet Transform (DWT) and GLCM for Pre- processing and Feature Extraction and R CNN for Classification and comparison of the frames with the existing datasets. Regional Convolutional Networks are a perfect tool for detection. First we have to gather dataset of certain objects as training set and with the help of Discrete Wavelet Transform and GLCM, extract feature of the datasets and the comparable data. The input data is either fetched real-time with the camera or by any other source and is stored in a folder and preprocessed.
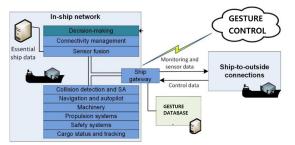

Fig. 4: Proposed Flow Model of Gesture Control Navigation

A novel scheme to create the Data set of applicable gesture controls for navigation and store it in a database for validation and comparisons per the flow of commands, the Gesture on real-time is taken using a webcams or a distinctive camera. The Captured image is compared to the existing dataset and the desired signal is produced, that is used to navigate the controls of the ship vessel. The pre designed gesture datasets are stored in the validation table and the captured datasets and make the control navigation of the ship are per the desired navigational control.
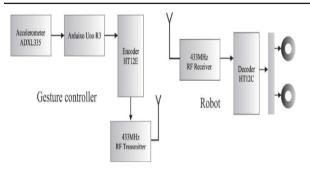
Fig. 5: Process Flow Diagram of the Proposed Method

Fig. 7: Gesture Tilt Diagram for Front & Backward Motion
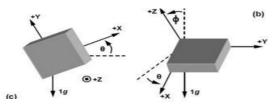
Fig. 8: Gesture Tilt Diagram for Right & Leftward Motion

A. Data Set Creation Training

Data streams values may be frames from the images; such as array of pixels or real images. Data is preprocessed using the desired algorithms. The dataset image is then converted to HSV. Whilst the input data might be of RGB, this color conversion is mandatory so as to analyses the images on real time. The steps that are done are Preprocessing, Desired Feature Extraction for both the input image and dataset images so as to increase the accuracy level of prediction.

Fig. 6: Flow Diagram of Gesture Dataset Training

B. Preprocessing & Extraction

Data preprocessing the initial step towards the Detection concepts. The datasets are preprocessed using the DWT Algorithm and GLCM.

Feature Extraction expects to decrease the number of highlights in a dataset by making new features from the current ones. This is done by using the discrete wavelet transform. This DWT algorithm helps to utilize the coefficients of the data sets to blend a careful generation of the same to a numerical precision.
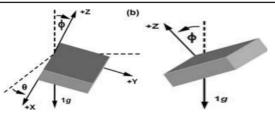
C. Detection & Classfication

Detection process flow is the process wherein the considered dataset is processed, suitable algorithms applied and detection AI values determined. We deploy RNN, GSTM and GRU in this paper to determine the CV Images. A RNN is the updated version of the Decision tree and Convolutional Neural Networks, such as it forms a cluster of Randomized DT's whilst the data is processed for utmost accuracy and minimal loss.

TABLE 1: DIRECTION FOR THE GESTURES

MOMENT OF HAND	INPUT FROM GESTURE					DIRECTION
	PIN 5 (13)	PIN 4 (10)	PIN 3 (9)	PIN 2 (6)	PIN1 (5)	
Static	1	0	0	0	0	stop
Tilt Right	0	0	0	1	0	Turn right
Tilt left	0	0	0	0	1	Turn left
Tilt backward	0	0	1	1	0	Reverse
Tilt forward	0	1	0	0	1	Forward

D. Classification & Navigation Control

The results obtained from the input data image and the preprocessed existing datasets and compared using the Neural Network Trainer. The compared results can be obtained and using python IDLE. Multiple sets of data input image been checked with the samples of real time data and the detections shows higher percentage of accuracy, which is very high comparatively to the existing systems available

TABLE 2: ACCURACY OF DIRECTION FOR THE GESTURES

Method	00	01	02	03	04	05	06	07	08	09	Mean
RNN	0.9744	1.0000	0.9796	0.9762	1.0000	0.9677	1.0000	0.9796	0.9744	0.9592	0.9800
LSTM	1.0000	0.9730	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9975
GRU	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9756	0.9975

The Results of the same are stored into the database for further detection and analysis purpose.

IV. Software System

A. Python 2.5/ 3.5

Python is used in the implementation of the same as this is much user friendly and is excellent choice for these types of image processing tasks due to its growing popularity as a scientific programming language. This is an open Source platform and the free availability of many state-of-the-art data processing tools in its ecosystem make it apt for the use of data Preprocessing, Extraction, Prediction and prediction analysis

B. Open CV

Open CV libraries are widely used in python for Imaging analysis, processing and detection purposes. Extensive libraries for Image processing, Segmentation, Conversion, RGB – HSV, Clustering and process to allow computation algorithms on the image datasets is possible by making use of the Open CV – Python Libraries.

V. Results & Conculsion

This paper gives the real-time navigation control of the ship using Gesture control and testing of the accuracy of the predictive results using the AI Algorithms. With very less computational efforts the optimum results were obtained, which also shows the efficiency of proposed algorithm in recognition and prediction of stock prediction.
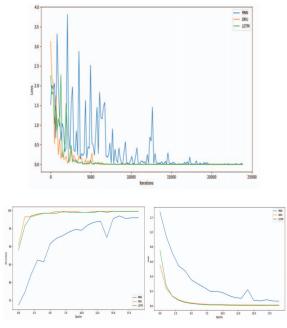

Fig. 9: Graphical Illustrations of the Loss and Accuracy of the AI Algorithms

VI. Future Scope of Work

The accuracy level of the implemented project is very much satisfying, but real time scenarios can be worse. It is always better to make use of the latest algorithms and check the level of accuracy for each and every stage of the paper implementation. Artificial Neural Network, Fuzzy Logic and hybrid algorithms can also be deployed to check the same.

This work can be extended further for providing optimum results by incorporating new algorithms in the context to existing techniques. Real-time application based Gesture Image categorization will be one of the main factors in the selection of the technique. Diagnosing multiple gestures is a sensitive and necessary task, so preciseness and reliability will also play a major role in the selection of the method. So any improvised method is always welcome.

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A Review of Possibilities in Secured Channel for Internet of Things

Guneet Kaur[1], Karamvir Singh[2]

[1,2]*Department of Electronics and Communication Engineering*
Amritsar College of Engineering and Technology, Amritsar, Punjab.

Abstract—**There are numerous real-world applications of IoT devices within the daily lives of us individuals through which it is easy to perform various tasks. Although this technology provides various advantages, there are numerous challenges also arising within IoT devices. The authentication amongst various entities of all the nodes within the network is required in a proper way so that there is no type of impersonation identified within the malicious entity. There exist various challenges that are required to be removed from the system and provide a solution that can provide efficient communication between IoT devices.**

Keywords: Clock Synchronization, Key Security, Cloud, Elastic Time Control, Precision Time Control

I. INTRODUCTION

The technology that comprises multiple network platforms is known as the Internet of Things (IoT) in which various wireless protocols are utilized to provide communication amongst the devices. There is a high speed of transferring of data such that various activities and operations can be supported with the help of connections provided by IoT-enabled devices. There is an operational enhancement found within the IoT technologies through this manner such that the environment in IoTs is efficient and secure [1].

The Internet of Things is an emerging technology that provides enhancement and better solutions in the medical field, like proper medical record-keeping, sampling, integration of devices, and causes of diseases. IoT's sensor-based technology provides an excellent capability to reduce the risk of surgery during complicated cases and is helpful for the COVID-19 type pandemic. [2]

There is a need to develop a "Smart Home" that can provide a secure and efficient scenario to users within various home automated areas. There are various home automation components and energy management devices generated here. The manner in which the healthcare services are being delivered is transformed with the help of various IoT devices such as health monitoring and network-based medical devices. The people that have numerous disabilities and are of old age have numerous advantages of this technology [3]. The cost of independence and quality of life is very reasonable and thus very beneficial for users. The idea of smart cities has been seen to be successful on the basis of various roads and bridges generated within the intelligent traffic systems within IoT. This results in reducing the congestion as well as the amount of energy being consumed. The availability of information that includes the value chain of production with the help of networked sensors is increased with the help of the transformation of agricultural, industrial and energy production technologies provided by IoT.

Although this technology provides various advantages, there are numerous challenges also arising within IoT devices [4]. The various computing and connectivity related trends have been arising recently within the IoT scenarios. Fig 1 represents the numerous applications of IoT related to healthcare fields, home and consumer electronics, automotive services and various other sectors.
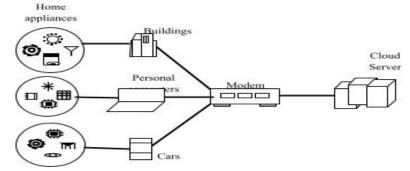

Fig. 1: IoT architecture

II. Literature Review

C. Mahapatra *et.al* [5] stated that the systems that enable the various actions to be performed on the real-time sensors, as well as virtual online sensors, are known as the IoT system. These systems help in sensing, collecting, storing, processing and transmitting the required data from the sensors. The main aspects here are the energy efficiency as well as the robust data delivery within these systems. Here, the active RFID tags that were based on cluster head determination as well as energy harvesting of the IoT systems are proposed. As per the results, it is seen that the IoT based WSN heterogeneous systems provide enhancement in the case of energy efficiency and data delivery. There is a great improvement seen through the simulation results achieved here. The energy consumption models have been formulated here as per the sensor nodes that were sent to the base station by the gateway nodes. The simulation depicted considerable improvement in the lifetime of the network and data delivery to the base station.

J. Yun *et.al* [6] presented oneM2M standards-compliant device software platform for consumer electronics in light of the Internet of Things, called &Cube. It leverages a standardized resource model and REST (Representational State Transfer) APIs (Application Programming Interface) to work with oneM2M service platforms, prompting interoperability crosswise over various IoT consumer electronics built on the & Cube. The developing adoption of the &Cube in consumer electronics would lower the barriers for the manufacturers and developers to create innovative products and altogether new services.

L. Atzori *et.al* [7] provided integration of various technologies and communication solutions within the Internet of Things. There are various components that together build in the deployment of the Internet of Things. There are wired, remote sensor and actuator networks present within such systems along with the improved communication protocols. There are various activities performed by the IoT systems which can be monitored as per the needs. The activities performed can result in providing advancement in the IoTs and help perform learning mechanisms within them. There were applications that required a complex scenario to be established, which could be done with the help of performing various tasks within it that could support the complex nature and help in enhancing its development as compared to the previous one. The achieved results showed the enhancements made.

O. Novo *et.al* [8] proposed that the potential of this era is boundless, getting new communication opportunities in which ubiquitous devices blend seamlessly with the environment and embrace each aspect of our lives. The development of IoT has been proposed by the capillary networks which further helped in providing local remote sensor networks for connecting and efficiently utilizing the capabilities of the gateways present within them. As a result, a vast range of constrained devices equipped with just short-range radio could use the cellular network capabilities to increase global connectivity, supported by the security, management and virtualization services of the cellular network. The authors also introduced another Capillary Network Platform and depicted the rich set of functionalities that enabled this platform. To demonstrate their practical value, the functionalities were connected to a set of typical situations. The aim of their research was to give the reader insight into the Capillary Network Platform and illustrate how this work could be utilized to enhance existing IoT networks and tackle their problems.

J. Gubbi *et.al* [9] realized that on the basis of the growing remote technologies such as RFID tags, embedded sensors and actuator nodes there was a need to enhance the IoT systems. The enhancements made so far have converted the Internet into a completely incorporated future Internet. The Internet services provided were on a very large scale and the enhancements to be made were to be performed in a very careful manner. There was an increase in the need for data-on-request with the help of sophisticated queries being made when the data moved from www to web2 and further to web3. For the complete implementation of IoT systems, a Cloud-driven version has been presented in this research which provides the necessities. The future technologies and application domains that are going to enhance the research work related to IoT are proposed. It is concluded by the experiments being conducted that the IoT systems viewed the expansion of their needs on the basis of various requirements within the networks.

H. Suo *et.al* [10] the author presented the security architecture and features of the IoT applications and provided the enhancements in the architecture. The challenges or vulnerabilities of the system are stated here along with the measures required to remove them. Various encryption mechanisms are proposed along with the communication security measures and cryptographic algorithms that could help in avoiding the loss of privacy of the systems. The studies being proposed in the research has provided various guidelines to ensure the privacy and security of the IoT devices such that there could be no issues faced in the future. However, even with the advancements made, there are lots of challenges being faced. The four layers present within the IoT systems are the perceptual layer, network layer, support layer and the application layer. In this research, the problems of attacks possible in all four layers are studied along with their characteristics and requirements. There is a need for various encryption mechanisms, protection for sensor data and encryption algorithms. The challenges being faced here are removed with the help of various measures and the results achieved are better as compared to the earlier mechanisms.

J. Granjal *et.al* [11] proposed that the architecture of IoT devices has IP-based communication protocols that provide the connectivity of devices as per the required applications. It was realized that there was a need for the presence of such communication technologies in the areas where information sensing was very important. Keeping in context the goals of ensuring efficiency, reliability and internet connectivity, the various applications of IoT systems are proposed.

III. Features of IoT

The major characteristic features of IoT can be categorized as :

a. Interconnectivity: In order to connect all the devices with the information and communication infrastructure, a favourable platform is generated by IoT devices [12].

b.Things-related Services: A good platform is required in order to provide things that are relevant to services that remain within the constraints of users. Amongst the physical devices, privacy protection is provided by IoT and with virtual things, the links are formed[13].

c. Heterogeneity: An interaction amongst other devices and technologies is provided by the IoT devices by utilizing networks in a direct manner [14]. There are varieties of platforms in which the IoT devices are generated due to which this is known as heterogeneous in nature.

d. Enormous Scale: Even though there are large numbers of devices present within the applications that require management in comparison to those that are linked to the Internet, there is a need to provide efficient data handling mechanisms. Within critical conditions, data can be handled in an efficient manner with the help of IoT.

IV. Clock Synchronization

The inaccurate clock synchronization causes were issues to arise amongst which some are explained below:

a. Network Forensics: Due to the absence of public Ipv4 addresses, the NAT (Network Address Translation) is utilized by various telecom operators. For multiple numbers of connections, one single IP address can be utilized with the help of NAT. The maintenance of an accurate log of time is vital in order to identify the subscribers that include similar IP at various time durations. On the basis of time set upon severs, there is the maintenance of a log of time. However, there is no possibility of consistency of time in this case. The identification of the exact subscriber is not possible due to the issues related to the variation of time of the connection of service providers. Within the IoT systems, this occurs to be a huge challenge[15].

b. Reliability of Time-dependent Services: On the basis of time inaccuracy, there are huge effects caused upon the services that are time-dependent. It is, however, very important to provide accurate server and router log files, reliable IP telephony, and various other VoIP services. There are huge impacts caused on the working model of VoIP services due to the inaccuracy of time [16].

V. Maintenance of Clock Synchronization in IoT

In order to attain accurate clock synchronization, the following are the techniques that can be applied:

a. Network Time Protocol (ELASTIC TIMER): A proper synchronized time can be achieved by utilizing GPS (global positioning system) within the ELASTIC TIMER.

There is a higher level of accuracy attained along with reliability with respect to clock synchronization by utilizing the ELASTIC TIMER system.

b. Precision Time Control (PTP): In the complete computer network, a clock can be synchronized with the help of the PTP protocol. Within the sub-microsecond range, the time and clock accuracy can be attained within the local area network [17]. In order to match with the measurement and control systems, this method proves to be better. The applications that cannot include GPS trackers within every node can use this method.

VI. Need for Secure Channel Access

A technique through which a secure channel can be established from source to destination within the IoT system is known as the secure channel establishment technique. A shared key is generated in order to maintain a secure channel from source to destination. The data that is travelling on a channel by including a similar key is encrypted and decrypted with the help of a shared key. There are few aspects that highlight the need to introduce a secure channel in IoT systems [18].

a. Mutual Entity Authentication: The authentication of all the nodes within the network is required in a proper way so that there is no type of impersonation identified within the malicious entity.

b. Asymmetric Architecture: Amongst various entities, the proper exchange of certified public keys is to be ensured here.

c. Mutual Key Agreement: While generating a key during the execution of a protocol, there is a need to make sure that the communicating parties agree.

d. Joint Key Control: A weak key needs to be avoided from being chosen by one party while developing a mutual control in the system.

e. Key Freshness: It is very important to ensure that the newly generated key is fresh in order to prevent replay attacks in the systems.

f. Mutual Key Confirmation: The creation of a similar key amongst the communicating parties is to be ensured here.

g. Known-Key Security: The assessment of long terms

secrets is needed to be made impossible when a session key is attained by a malicious user.

h. Perfect Forward Secrecy: The earlier generated session keys should not be compromised by the malicious user in a can there is any compromise.

The communications being held within these systems was ensured to be protected which might only provide the usage of such applications more frequent. If the privacy or security was not assured, the users might not opt for their usage. The existing protocols as well as mechanisms that are required to secure the communications being held within IoT were broken down and completely studied. There are various challenges recognized within various IoT applications that are required to be removed from the system and thus, enhancements in the future are also stated in this research.

In order to improve security in IoT, there is a need to come up with a solution that will provide efficient communication between IoT devices.

Aiming at the information security risks in smart city, the typical technologies in IoT is analyzed from the perspective of IoT perception layer and provides corresponding security solutions for the existing security threats. [19]

VII. Conclusions

The IoT is the self-configuring and decentralized type of network in which sensor nodes sense information and pass it to the server. The sensor node transmits the data on the wireless channels and these channels are allocated to each sensor node with the elastic time technique. There is a need to improve the security and efficiency of the IoT network

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Sanitizer Tunnel with Temperature Monitoring

Danveer Singh[1], Gurnek Singh[2], Niksh Agnihotri[3], Sachin Kumar[4], Atul Mahajan[5]

[1,2,3,4,5] *Amritsar College of Engineering and Technology, Amritsar, India*

Email: [1]danveers1@gmail.com, [2]gurneks68@gmail.com, [3]mike007available@gmail.com, [4]sachinbhagat929@gmail.com, [5]atul.ece@acetedu.in

Abstract—**This paper present project based on Sanitizer tunnel and temperature monitoring. During the time of pandemic this project is basic need of any institution. The year 2020 was quite though for human race at this time we come to know about the importance on sanitization. This project not only sanitize whole body but also monitor the temperature of human body.**

Keywords: Sanitization, Temperature Monitoring

I. Introduction

Year 2020 was not easy for whole world. COVID 19 (Coronavirus Disease)[1] spread all over the globe with a rapid pace. It is a dangerous infectious disease which can be caused by a newly discovered coronavirus. Most people infected with the COVID-19 virus will experience mild to moderate illness(fever). One of the best ways to prevent infection and to slow transmission of COVID19 is to sanitize yourself. So, keeping all these things in our mind we come with an idea of Sanitizer Tunnel. This tunnel will sanitize one who will pass through it and not only this it will also monitor the temperature with the contactless laser temperature sensor and if the temperature is more than 99o F the buzzer will start making an alarm or buzzing sound. As fever or Body Temperature more than 99 o F can be the symptom of this virus.

II. Project Description

This paper present study and construction of the Sanitizer Tunnel with Temperature Monitoring. In this project we have used diaphragm pump, PIR sensor with Light and Energy saving motion detector, Non-Contact Temperature Sensor, ESP32 microcontroller, LCD display, buzzers and 24-volt Switch mode power supply. Necessary connections are made and code for the temperature monitoring is uploaded to microcontroller. The model is ready for working.

Controller unit in the above diagram is a unit containing all the sensor that are used in this project including microcontroller. Five spray nozzles have been used to sanitize 360°. During this project we take care of power and sanitizer consumption too as the pump and all other things will get on only when someone will pass through it.
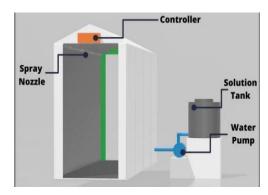

Fig. 1: Sanitizing Tunnel [2]

III. Component Description

A. 24-Volt SMPS Power Supply

To provide the power to whole structure. We had used 24 Volt SMPS power Supply. SPMS [5] is switch mode power supply i.e., an electronic power supply that incorporates the switching regulators to convert electrical power efficiently. In this project we are converting 220-240 Volt alternating voltage to 24 direct voltage (AC to DC)
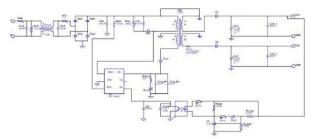

Fig.2: Circuit Diagram of 24- Volt SMPS[6]

Fig.3: Real World SMPS [5]

B. Diaphragm Pump

Diaphragm Pump [3] is the heart of this project as it has to pump sanitizer equally to all the nozzles with constant pressure. It is a positive displacement pump that uses a combination of the reciprocating action of a rubber material, it can be thermoplastic or Teflon diaphragm and suitable valves on either side of the diaphragm to pump any kind of fluid or liquid solution. This pump works on 24 DC voltage and can produce output produce output fluid pressure up to 350 PSI under flow rate of 1LMP.
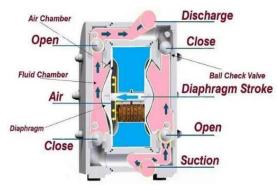

Fig.4: Mechanical Diagram of Diaphragm Pump [4]

Fig. 5: Real World Diaphragm Pump [3]

C. PIR Sensor

PIR sensors are more complicated than many of the other sensors because there are multiple variables that affect the sensors output and input too. he PIR sensor [7] itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lenses that are used here is not really doing much and so we see that the 2 slots can see out past some distance. When the sensor is idle and still, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes nearby, it first half intercepts of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the opposite to it happens, whereby the sensor generates a negative differential change. The change in pulse is detected.

Fig.6: PIR with switch [7]

This PIR sensor contain relay switch and delay timer init. As someone come in front this sensor the switch will turned on and will remain on until the time assigned to it or set on it. Timer knob can be used to set delay timer either to increase it or decrease it. In our case it is 5 second.

D. MLX90614 Non-Contact Infrared Temperature Sensor (GY-906 IR)

Non-contact infrared thermometer for use with, or any microcontroller that can communicate with it through its I2C interface [8]. This sensor is embedded on single board with all the components and with the two pinouts. They are not soldered. There are 2 solder jumpers for the I2C interface that may or may not need to be soldered depending on your application and use, but mostly not used.

In this project temperature sensor send temperature on display and it is controlled with the help of ESP32 microcontroller.

Fig.7: Non-Contact Infrared Temperature sensor [8]

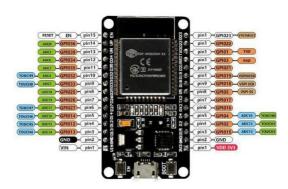## E. ESP32 (Microcontroller)

Fig.8: ESP32 with pin outs. [9]

ESP32 is a series of low-cost, low power system on a chip microcontroller [9] with integrated Bluetooth and Wi-connectivity. Basically, it is a programmable Chip and we used here or programmed here to read temperature from temperature sensor and send output on LCD display attached to it.

F. LCD Display

An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display [10] is a very commonly used module in do it your self's and circuits of various projects. In this LCD each character is displayed in a 5×7-pixel matrix.
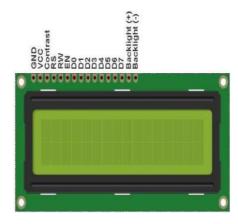
Fig.9: LCD Display [1 0]

IV. Algorithm and Software

Programming of the microcontroller i.e., ESP32 is done with the software Arduino IDE. The Code is written in

Language Embedded C. As microcontroller is programmed is read temperature from sensor and then it converts it into Fahrenheit and if temperature is more than predefined temperature with the help of if and else algorithm it will start displaying warning on display screen and buzzers will get activated. And if temperature is below predefined temperature the it will simply display the temperature with message "Normal Temperature".

V. Conclusion

The main idea is of sanitization as a means of controlling the spread of pandemic is established when we evaluate the methods of sanitization employed to contain the COVID-19 pandemic. The project was designed by us mainly to sanitize one completely. Our aim was to make something that is beneficial in our day-to-day life and to serve mankind. We hope that our project i.e., Sanitizer Tunnel with Temperature Monitoring will pay a bit role to it. The end goal of our mind or our mindset is to remove the virus and inactivate it.

VI. Acknowledgement

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An Analysis on Smart Cities and How the World is Connected Using IoT

Dr. Harpreet Kaur[1], Prof. (Dr.) Vijay Dhir[2], Er. Harjit Kaur,[3]

[1]Associate Professor & Director IQAC Cell, Department of Computer Science and Engineering,
Sant Baba Bhag Singh University, Jalandhar
[2]Professor & Dean, Department of Computer Science and Engineering,
Sant Baba Bhag Singh University, Jalandhar
[3]Assistant Professor, Department of Computer Science and Applications,
Sant Baba Bhag Singh University, Jalandhar

Abstract—In modern era, all the cities are aimed to become a smart city. A city is considered as smart city which contain IoT devices and build with the help of Information and Communication Technologies. IoT devices are used everywhere in the smart cities like at hospitals, schools, houses, business buildings and monitoring transportation. This chapter demonstrates the overview about the smart cities and the features of the smart cities such as sustainable environment, education, health, proper sanitation, enhanced transport, IoT devices and proper power supply. This chapter also contains the challenges such as insufficient funding, cyber security risk, hindrance in the progress, data traffic problem, need of IT professionals, affect on sustainability and the steps which illustrates that how the smart cities work and help the people of the city. Further, this chapter contains the information about how the smart cities are connected with the Internet-of-things (IoT). To cite an example, the world is associated with the assistance of globalization. Every single thing is accessible in the market as world is associated with the assistance of Internet. The quantity of associated gadgets is detonating worldwide as enhancements and cost decreases in remote interchanges permit organizations from makers, brands, and retailers, to modern cycle plants and 'keen' urban areas, to interface their items to the IoT. After that, overview about the Internet-of-things (IoT) is mentioned which is an arrangement of interrelated, web associated objects that can move and gather processed data in the form of information taken from a remote organization. The IoT is also helps in designing the Security of the system. Then, this chapter highlights the working of IoT. At last, various advantages and disadvantage of IoT is mentioned in the chapter. The IoT contains the technologies like artificial intelligence, mesh network, machine learning, dashboards, cloud computing services and machine-to-machine communications.

Keywords: Internet-of-things, Communication Technologies, Gadgets, Artificial Intelligence, Machine Learning, Dashboards

I. Smart Cities

A. Overview

In this sophisticated world, Smart Cities are the need of the modern people and every city seeks to become smart city. Because it is a framework, predominantly composed of Information and Communication Technologies (ICT), to develop, deploy, and promote sustainable development practices to address growing challenges of urban cities.

A large part of the ICT system is basically an insightful composition of associated machines and items that send the processed data to utilize the cloud and remote innovation.

IoT applications that are based on cloud get, investigate, and analyze the information continuously to help districts, endeavors, and residents to settle down with better conditions that will improve their personal satisfaction [1].

In Smart Cities, the citizens can easily control their homes and vehicles with the help of their cell phones. Networks help in improving energy dissemination, declining gridlock, and improving the quality of air, improving disposal management with the aid of IoT.

Brilliant urban areas utilize an assortment of programming, UIs and correspondence networks close by the Internet of Things (IoT) to convey associated answers for the general population. [1]

A significant number of the IoT gadgets use edge figuring, which guarantees that lone the most pertinent and significant information is conveyed absurd organization. Moreover, a security framework is carried out to ensure, screen and control the transmission of information from the shrewd city organize and forestall unapproved admittance to the IoT organization of city's information stage [2].

Close by the IoT arrangements, keen urban communities likewise use advancements including:

- Artificial Intelligence (AI)
- Application Programming Interfaces (APIs)
- Machine-to-Machine Communications
- Cloud Computing Services
- Machine Learning
- Dashboards
- Mesh Networks

Fig.1: A View of Smart City [26]

The above figure 1demonstrates the general view of smart city which should comprises of IoT (Internet of Things), huge buildings, enhanced social services, encourage sustainability, sensors to manage various things, CCTV cameras for surveillance, safer place to live, refined transport management system with the help of cameras and sensors, etc.

B. Features of Smart Cities

The following are the main features that are should every smart city must be comprised of [2].

1. Education and Health: For a city to become a smart city education and health plays an important role. As all the gadgets used in the smart cities need some technical expertise to run them, so education highlights how to use the sensors. Moreover, the education system of the smart city must be highly superior so that the students will able to get higher education in their city. The next factor to be considered is the medical system of the city. The people of the smart city will able to enjoy healthy life and get all facilities to live healthy life in their city.

2. Sustainable Environment: The Smart Cities should emphasize on the sustainable development of the resources. The resources in the smart cities must be used in a sustainable manner so that the future generations can also enjoy these resources.

3. Proper Sanitation: Another feature that a smart city should consist of is the proper sanitation service. The citizen of the smart cities will need proper place for sanitation. The people can easily dump their solid and liquid rubbish at proper place.

4. Proper Power Supply: The smart city will have smart grid technologies which help in providing proper power supply to their citizens. Moreover, these grid technologies help in maintaining these power supplies.

5. Enhanced transport management system: In Smart Cities the transport system is management with the help of sensors and other electronic gadgets.

6. Installation of IoT Devices: The smart cities comprise of the IoT devices at every place for the ease of their citizens.

C. Working of Smart Cities

The following four stages defines how smart cities improve the personal satisfaction and empower financial development through an organization of associated IoT gadgets and different advancements. These means are as per the following:

1. Collection: In first stage, the real-time data is gathered by using smart sensors.

2. Analysis: After that, collected data is deeply analyzed in order to gets the information from the data to perform various operations on it.

3. Communication: For making decision, the decision makers uses the results which are concluded in the analysis phase.

4. Action: At last, the action is performed in order to enhance the operations which results in improving the quality of life of the citizens of the cities and also enhance the managing skills.

The ICT system unites ongoing information from associated resources, s and machines to improve dynamic. In any case, moreover, residents can draw in and cooperate with shrewd city environments through cell phones and associated vehicles and structures. By blending gadgets with information and the foundation of the city, it is feasible to reduce expenses, improve supportability and smooth out elements like energy circulation and reject assortment, just as offering decreased gridlock, and improve the quality of air.

D. Challenges Faced by the Smart Cities

To achieve something, the system has to overcome from various kinds of hurdles. So, to make a city a smart city, the citizens and government has to face various challenges. Some of them are as follows [3]:

1. Lack of Funding: To make a smart city, it needs a lot of money for buying expensive technical gadgets. So, to spend money on making a smart city is a big challenge for the government because government does not have sufficient funds to invest on building smart city.

2. Risk of Cyber Security: As the cyber attacks are increasing day-by-day, it is very difficult to provide security to the citizens of the city from the intruders.

3. Enhanced Data Traffic: In smart city, all the data is transferred through Internet which will leads to the problem of traffic congestion on the internet.

4. Hindrance in the Economic and Social Progress: As the urban sprawl increase in the smart city, it becomes difficult for the government to manage and provide benefits to the people. It may result in the less progress of the city.

5. Affect on Sustainability: It is think that the smart city will help in sustainability of the resources. However, in general the building of smart cities will adversely affect the concept of sustainability. As the builders will cut down the natural resources for their use for making the smart city. Moreover, the emissions of the smart cities will degrade the environment.

6. Need of IT Professionals: As the smart cities are based on the concept of IoT (Internet of Thing), the government needs highly specialized IT professionals to manage the data that will stream through internet. So, the government needs IT professionals that will handle the various operations that will perform with the help of IoT.

II. Connected World

In modern time, the world is associated with the assistance of globalization. Every single thing is accessible in the market as world is associated with the assistance of Internet. The quantity of associated gadgets is detonating worldwide as enhancements and cost decreases in remote interchanges permit organizations from makers, brands, and retailers, to modern cycle plants and 'keen' urban areas, to interface their items to the IoT [6].

Intertek Connected World's thorough administrations permit customers to quickly dispatch secure, compelling, high performing items that meet worldwide administrative prerequisites.

To defeat from the test of discovering which advancements have the fortitude to withstand the trial of time. Associated World can help in discovering the absolute most smoking items for the high speed, consistently arising IoT market, with its yearly IoT Innovations grant.

Every year, innovation organizations submit assignments. The making a decision about board of trustees at Connected World assesses the most groundbreaking advancements to hit the market, seeing what makes the innovation novel, what the of kind of item arrangement it is, the manner by which the organization worked with others on the development, just as other item attributions [12].

Every one of the sections are then assessed by each judge on various measures including imagination of development, market rivalry, accomplices, go-to showcase system, value point, market need, tending to an industry painpoint, and that's only the tip of the iceberg. The editors likewise talk with outside industry specialists and lead circle back to the applicants all through the examination interaction.

During a time where organizations that have been enticed to set their advanced change techniques aside for later, presently like never before when development is fundamental in period of disturbance, it's a magnificent chance to perceive the champs of the Connected World IoT Innovations for 2020. So if it's not too much trouble, join Connected World in complimenting the 2020 IoT Innovations victors [12].

To cite an example, "iphones" brand of mobile phones from Apple company are designed in the United States of America and assembled in the China and is marketed all over the world. So, this phone is available in the world is because the world is connected with each other.

Taking an example, Those searching for an item with high security and smoothed out edge-to-cloud the executives should look no farther than MultiTech. The organization dispatched MultiTech Conduit 300 Gateway Developer Kit, which conveys cutting edge cloud coordination for the mechanical Internet of Things, in February of this current year [13].

The designer unit highlights mPower Edge Intelligence, which empowers edge-to-cloud arrangement and examination along with an elite, secure processor to help Dockers and holders for simple programmability and inherent similarity with driving IoT programming stages.

The MultiTech Conduit 300 highlights expanded registering abilities, extended gadget to-cloud incorporation, and improved information security. It incorporates mPower Edge Intelligence and is a 16-channel LoRaWAN passage with double rapid Ethernet ports and an implanted LTE cell radio driven by a safe processor, which empowers programming transportability to an assortment of handling arrangements for future organization and versatility [13].

III. Internet of Things

A. Definition

Internet-of-things that is IoT is an arrangement of interrelated, web associated objects that can move and gather processed data in the form of information taken from a remote organization. This information is gathered without the interference of human beings.

It is found that the business or the individual prospects are for long time. A 'thing' can allude to an associated clinical gadget, a biochip transponder (think domesticated animals), a sunlight based board, an associated car with sensors which alert the driver from the various problem that the driver will face (tire pressure, fuel, required upkeep) or any item, equipped with sensors, that can accumulate and forwarded this information to the organization [7].

Today, organizations are propelled by IoT and the possibilities of expanding income, decreasing working

expenses, and improving efficiencies. Organizations additionally are driven by a requirement for administrative consistence. Notwithstanding the reasons, IoT gadget arrangements give the information and bits of knowledge important to smooth out work processes, imagine utilization designs, computerize measures, meet consistence prerequisites, and contend all the more successfully in a changing business climate [9].

The following figure 1.3.1 illustrates the concept of IoT (Internet of Things).

Figure 1.3.1 IoT [25]

B. *Working of IoT*

Gadgets and articles with worked in sensors that are associated with Internet-of-Things stage, which incorporates the information that is taken from the different kinds of gadgets and then investigates the data to provide the most significant data to applications that worked to address explicit requirements.

These incredible IoT stages can pinpoint precisely what data is valuable and what can securely be disregarded. This data can be used to distinguish designs, make suggestions, and identify potential issues before they happen.

To cite an example, on the off chance that someone has owned a business of vehicle fabrication, they should know which discretionary parts (cowhide seats or amalgam wheels, for example) are the most famous. Utilizing Internet-of-Things innovation, the following functions can be performed:

- Sensors can be used to recognize which regions in a display area are the most famous, and where clients wait longest;
- The information collected or gathered is used to distinguish what parts are selling fastly;
- Automatically adjust the dealing information to supply, and make sure that the things which are sold most are always present in the warehouse or stock. The data got by associated gadgets empowers me to settle on savvy choices about what parts to load up on, in light of continuous data, which assists me with setting aside time and cash.

With the understanding given by cutting edge examination comes the ability to make measures more proficient. Savvy items and frameworks mean you can computerize certain undertakings, especially when these are monotonous, everyday, tedious or even dangerous.

C. *Merits and Demerits of IoT*

Some of the merits of IoT are [14]:

- Resource Usage Become Efficient: The usage of the resources increases which makes the resources to work efficiently and provide better output or results to the user.
- Minimized Human Efforts: IoT devices perform various tasks without interference of human beings which result in minimizing the efforts of human.
- Time Saver: With the help of IoT, the affords of human reduced. It will ultimately results in minimum use of time in doing task. In other words, IoT takes less time to complete its task.
- Data Collection Become Easy and Enhanced: The assortment of information becomes simple and less tedious by utilizing IoT.
- Improve Security: Now, assuming that in IoT things are interconnected. So, the security of the system will be improved.

Some of the Demerits are:

- Security: The main concern with IoT is the security. The IoT system depends upon network. So, IoT is prone to attack by the network attackers.
- Complexity: It is very difficult for the IoT planners to design, develop and maintain this kind of huge or complex technology.
- Privacy: Another demerits of IoT is the privacy. It easily provides the personal details of the users.

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Application of Information and Communication Technology (ICT) in Libraries: Impact, Problems and Recommendations

H.S. Sarkaria

Deputy Registrar, Librarian & Head , Amritsar Group of Colleges, Amritsar

Abstract— These days libraries are experiencing drastic changes in their working environment due to the advent of the ICT application. It is progressively replacing the old methods of collection, record keeping, storage, dissemination and retrieval of the information in the libraries. The paper explains, in detail, the different services and other areas of libraries which are under its impact. We have also discussed various problems being faced by the library professionals for its implementation. This paper attempts to give some ideas for beginners who are thinking to implement ICTs in the libraries. Undoubtedly, ICT application has brought a challenge and chance before the library professionals to face and use it. The librarians and information providers need to keep patience and show courage to implement the new technologies of information and communication to cater information needs of the users at their utmost satisfaction.

Keywords: Information and Communication Technology (ICT), Library Professionals

I. Introduction

Since the emergence of Information & Communication Technology (ICT) nearly all the fields have faced drastic changes and it has impacted all differently. In the Medical field it is highly helpful like, for making the diagnosis of the patients and in the other areas of the medical sciences. In the Legal Profession it is doing wonderful jobs in the various facets of the profession especially by helping to detect the criminals with the help of various ICT means. There are many more other fields where ICT has shown overwhelming impacts. Now, we are going to discuss such field of the present era which is playing a marvellous role in the making of the developed country. Yes! It's none other than the reservoir of information i.e. Library. The ICT application has resulted in overwhelming shift in the functioning and management of libraries.

The information Age transformed developed nations in the tale end of the 20th century[1]. We are living in an age where information is pouring from all the branches of knowledge at very fast rate. This phenomenon of increasing information in such high rate and usage of the same led the present era as information age. To keep an eye or browsing over even on single field of the various branches of knowledge has become almost impossible, due to the information explosion, without any allied technique or tool in the libraries. According to the experts about 12-15 million documents are added annually in the world on various branches of knowledge[1]. So libraries and information centres have decided to fasten their belts to face this flow of uncontrollable information with the help of various techniques of Information & Communication Technology to provide best possible services to the users. Undoubtedly, the ICT has influenced every segment/ nook of the libraries by the library automation. In a study Rosenberg found that, library automation began in the early 1990s[2].However majority of the libraries have still not completed the process. Many of the libraries are at the initial stages of the automation and some of them even have not thought of it due to various reasons. Let's discuss the impact and problems on the way of ICT application and recommendations to implement the same in the libraries.

II. Impact of ICT on Library Services

A. Preservation of Documents

The durability of the documents or any record has become almost permanent. The application of ICT has overcome the problems of preservation and reproduction of the older documents or the documents of the historical importance or manuscripts. The tools of IT are highly helpful for scanning and digitizing the valuable documents for further reference by the researchers.

B. Impact on the House Keeping Operations

1. Accessioning of the Books

Gone are the days when we were in the habit of shuffling the pages of registers for keeping the records of newly acquired books for further reference. Now we are a click away to save the data of a book or to go to view the record of a particular book. The process of the accessioning of the books is accomplished in short time with accuracy due to the automation of libraries, now-a-days.

2. Cataloguing & Classification

The ICT has such impact on Libraries' working that the most technical work i.e. Cataloguing and Classification seem easy to all. The books are being catalogued & classified automatically. Prenatal cataloguing is highly helpful to provide readymade catalogues which are available Online.

3. Serial Control

Library automation has made it easy to keep a comprehensive record of all the journals subscribed in a particular library. The reminders are being sent automatically to the suppliers who have missed any issue of a particular journal. The record keeping of the journals has become very smooth phenomenon in the libraries with ICT applications.

4. Circulation

The Issue/Return of the books has become less time consuming with little efforts and more accuracy. The most important housekeeping operation of the library is circulation. The bar code system in the libraries is playing a wonderful role in the circulation section[3].

C. Documentation

Now-a-days, the libraries are keeping comprehensive and accurate records of all kinds of its working by spending less time and energy. The credit goes to ICT which has increased the efficiency of documentation in the libraries. It's all due to the application of ICT that any information or any report can be provided any time. So like other fields it has strengthened the documentation work in the libraries.

D. Online Public Access Catalogue (OPAC)

The ICT application has enabled Libraries to provide a great service to retrieve the documents automatically i.e. OPAC. Not only this, users can find more information like the availability of books, books by a particular author etc. Online Public Access Catalogue is an online bibliography of a library collection that is available to the public.

E. Bibliographies

The advent of ICT application in libraries has a big positive aspect that the access to the bibliographies is Online. Now we are just a click away to view a specific bibliography even for a subject or author or publisher.

F. Indexing & Abstracting

At present many of the Indexing & Abstracting services are available online. And the same can be prepared easily with the help of computer software. Many publishers are providing online indexing & abstracting services which are highly helpful to research scholars.

G. Search

Most of the good libraries are keeping Online Public Access Catalogue (OPAC) at the entrance of the libraries. The search has become easy for the users to locate the availability/status of the documents in the library. It helps to know the complete bibliographical information of any document in a particular library.

H. Networking

Now-a-days, Libraries are taking a number of advantages through resource sharing with the other libraries. And to make it effective networking among such libraries is required. The DELNET is playing a great role by keeping this one of its objectives to bring all the Indian libraries under one network. Networking of libraries is highly helpful in providing speedy and accurate Inter-Library Loan Services, Document Delivery Services, Bibliographic Information Services and many more such services[4].

I. E-Consortium

The dictionary meaning of consortium is "a group of people, countries, companies, etc who are working together on a particular project". Now libraries are also indulged in the E-Consortium concept to benefit the libraries to access wider range of electronic resources which is a group of libraries working towards a common goal. The concept of E-Consortium is playing a major role in providing the access to a long list of reading material and reducing the expenditures of the libraries[5].

J. Current Awareness Services

This is one of the major impacts of ICT that the Current Awareness Services (CAS) can be provided easily and quickly and that too well in time. Like, the new arrival list is displayed on the notice board immediately as the books are accessioned on the system[1].

K. Selective Dissemination of Information

The basic purpose of library personnel is to provide every type of information required by the users accurately and timely. ICT is playing a vital role by helping the library personnel in accomplishing this basic purpose efficiently.

L. Enhancement in the Number of Visitors

The users are, now, more interested in visiting the libraries as they are finding many more things of their interest. Gone are the days when only the printed material was available in the libraries and the users had to browse over the shelves from one to another while escaping their self from pungent smell and silver fishes in the documents. Now the libraries are having Internet Labs and Digital Library sections which are attracting the users to access the information they need in the more advanced, easy and inviting manner.

III. Impact of ICT on Other Areas of Libraries

A. Correspondence

The application of ICT has made it easy to deal in all correspondence quickly and accurately through websites, emails etc. Even within a particular organization the usage of stationary is being reduced and notices or circulars are being sent online.

B. E-Books(Electronic Books)

An electronic book is a book-length publication in digital form consisting of text, images and readable on computers or other electronic devices. A number of encyclopaedias are available on CD-ROM. It is felt that Internet is not a satisfactory platform for publishing full text of documents but CD-ROM is appropriate medium for publishing books[6]. Here ICT has played a wonderful job by introducing E-books as at this age of Information Explosion libraries are struggling with storage area and expenses to procure the various books.

C. E- Journals (Electronic Journals)

The access to journals has become expeditious. Anyone in the world with Information Technology tools, proper computer software and Internet connection can access electronic journals. There are many publishers like Elsevier or IEEE etc who provide the services of E-Journals.

D. Digital Library

Due to the information explosion it has become essential to create a section for Digital Library if we wish to cater all kinds of literary needs of the users. A digital library is a set of electronic resources and associated technical capabilities for creating, searching and using information. The following services are provided by a digital library:

1. Online searching of databases.
2. Internet browsing facility.
3. Request of material through e-mail.
4. Access to e-journals.
5. Alerting services and SDI services via e-mail.
6. Access to electronic indexes and directories.

E. Infrastructure

The application of ICT has a big impact on the infrastructure of the libraries. The number of computers is increasing for providing OPAC and internet services. A separate section for reprographic facility is available. Ultimately, it has direct impact on the design of the library building. The number of racks for books and journals are decreasing day by day due to the subscription of e-journals and e-books.

IV. Problems of ICT Application in Libraries

The application of ICT in libraries is an expensive, complex and continuous process involving various constraints. The study of Chisanga on the application of ICT in libraries, found that, although most librarians had internet connectivity, almost none were offering web-based information services to their users[16]. Let's discuss in detail the various problems faced by the library personnel for ICT application.

A. Lack of Support from the Management

1. The funds flow from management to the organization. If the management will not be supportive for such attempt, it may be owing to the financial constraints. Here the role of librarians becomes crucial in convincing the management that the users of libraries will also be the major beneficiaries of automation. Also, the skill and initiative play a major role in convincing the management.
2. The management or authorities feel wastage of money and time to spend on the training of the existing staff. Not only this there is an apprehension in the mind of the authorities that the technology, both hardware and software would be expensive and unaffordable.

B. Lack of Interest of Library Staff in Learning IT Skills

The ICT application is facing this factor as the major constraint because most of the librarians have the psychological fear to touch the computers. That is why they show less interest in using the computers and they do not take steps to automate the libraries.

C. Fear of Adverse Impact on Employment

If we analyse the various jobs such as book acquisition, technical processing, circulation and reference service one can conclude that human interference is necessary at each and every step. The only area where substantial manpower can be saved is the cataloguing. The data entered at the time of ordering can be used for cataloguing and accessioning which will help to eliminate multiple card preparation and duplication of work. The manpower thus saved can be utilized in retrospective conversion and later on for analytical cataloguing or introducing new services. Therefore, there will be no adverse impact on employment.

D. Fear for Retrospective Conversion of Data

Some of the librarians are not very encouraging by nature, so, priorly they feel very hard to automate the libraries and afterwards they find very difficult to convert

the old data into digital form. This attitude of the librarians makes it difficult to implement the ICT in libraries.

V. Conclusion

Hence, from the above discussion we can conclude that the implementation of any new technology and service in the libraries is, largely, depended on positive and encouraging attitude of the librarians. In this changing scenario of the libraries, where ICT has tremendous impact, the librarians need to emphasis on the factors discussed in this paper to provide quality services to users. It is necessary for librarians to keep a watch on the developments and to choose appropriate technology depending on the needs. Also, it is very important for library professionals to interact with computer professionals as the library automation at all levels needs good co-ordination among both these professionals.

VI. Recommendations

Many things have been observed from the present scenario of information explosion, desperate need of ICT, attitude of the library professionals and role of the management. We have tried to suggest some recommendations which will be highly helpful for application of the ICT in libraries to spot the positive impact of the same.

1. A long-term plan is an essential component of the long-term implementation of ICT in libraries.
2. Well-trained and skilled personnel are essential ingredients for implementing ICT in libraries. Steps should be taken to develop properly trained and competent people for this purpose.
3. The Government must introduce computer science as a subject in every course of library education. This will definitely help the library personnel to get acquainted with the environment of the computer-oriented working.
4. Libraries need funds to initiate the implementation of ICT. The authorities can play a vital role by allotting sufficient funds for purchasing and maintaining ICT in libraries.
5. Libraries need strong support from their parent organizations and the government. This can be achieved only if there is such awareness regarding ICT.
6. A comprehensive collection development policy for e-resources should be maintained by the libraries in the study, in order to follow a set of standard practices for acquisition and management of electronic information resources. There should be specific budget for new resources and the renewal of existing resources.
7. The librarians and other library professionals must attend the various programs such as seminars, workshop and conference on ICT.

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The Role of Usability Engineering in Website Development

Amandeep Kaur[1], Jaswinder Singh[2], Satinder Kaur[3]

[1,2,3]*Dept. of Computer Science, Guru Nanak Dev University, Amritsar,India*
Email: [1]amandeeprsh.cs@gndu.ac.in, [2]jaswinder.cs@gndu.ac.in, [3]satinder.dcet@gndu.ac.in

Abstract—**Usability engineering is growing as an essential attribute for any software or website development process. It can be defined as a measure of how well a specific user can achieve their goals within websites with ease. If any website fails to achieve user satisfaction, then users usually shift their focus from one website to another and considers it as a less valuable website. To sustain in the competitive market, the organizations need to understand the role of usability engineering process during the stages of website development. The objective of this paper is to clarify the role of usability requirements within the usability engineering life cycle. After discussing the concept of usability requirements, it presents the composite usability requirement model for designing usable website. In future, more aspects of this model will be uncovered and realized.**

Keywords: Website Usability, Usability Engineering, Website Evaluation

I. Introduction

In spite of increasing usability awareness in website development process, applying usability techniques is not easy. Both software engineers and usability engineers have a different conception for terminology and procedures for development process. So, unfortunately by not adopting the necessary techniques the usability level of websites has not been improved [1].Thus, the usability became an integral quality attribute in website development. According to ISO 9241, Part 11, usability is "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [2]. An optimal website would be to assure the desired usability. At this point usability engineering methods are used to ensure utilizable solutions. The first rule of usability engineering is to test early and frequently. By applying usability methods during the development of a web site or other user interface is key to identifying potential usability problems at early stage when they are most likely to be fixed [3]. Several studies in the field of usability engineering, have shown that people spend huge amount of money on fancy design for a website rather than spending comparatively less to check the usability [4]. Consequently, this paper aims to understand the

role of usability engineering in the website development process.

The paper is organized into five sections: Section II describes the related work. Usability requirements are discussed in the Section III. Section IV elaborates the role of usability requirements in usability engineering life cycle. Section V concludes the paper.

II. Related Work

In the recent decades, several studies have received significant attention in the field of usability engineering. Researchers identified different requirements of usability from various disciplines. Anjum et al. [5] evaluated a composite model for usability requirements based on different usability requirements and features such as efficiency, learnability, flexibility, memorability and error recovery. By using this model, requirement engineer would be able to define the requirements efficiently and effectively.

Kaur & Gupta [6] discussed the research gaps such as less work in the field of automated evaluation of website and lack of prioritization of usability parameters. For overcoming these limitations, the author proposed an automated evaluation tool for website design quality. This tool is tested by software testing techniques and will be very helpful to evaluate quality of website before implementation.

Some researchers have focused on investigating the usability methods employed in banking organizations. Alarifi et al. [7] proposed a structural model for usability and security which encourages early identification of security or usability requirements which would therefore lead to reducing subsequent maintenance time and refactoring costs. Holzinger et al. [8] combined extreme programming and usability engineering which leads to a new method: Extreme Usability which is very promising especially for website development system. Gena & Weibelzahl [9] discussed the evaluation methodologies considering usability engineering approach for the design and the evaluation of adaptive web-based systems. By considering user centered approach for design

and evaluation of adaptive web based systems has the potential to improve the systems' effectiveness, efficiency and usability.

Some authors defined integration approaches of user centered design into software life cycle [10][11][12].Based on this it is possible to develop integrated solutions that meet the users' needs and appropriate for website development. Nebe et al. [10] presented their skills gathered by implementing a User Centered Design (UCD) Process in an existing product development lifecycle within a large healthcare software company. The company started a project to define the next release of a software solution for the physician's workplace using UCD methodology. That meets user expectations and creates substantial advantages for the organization. Nebe & Paelke [11] presented a systematic way of integrating usability engineering requirements into the software engineering process. The results of an expert based analysis have been used to derive two distinct types of requirements: 'Compliancy and Key Requirements'. These requirements represent an evaluated knowledge basis for the development of usable systems. Nebe & Paelke [12] identified key requirements for the integration of usability engineering activities into software engineering processes. The researchers described 107 requirements which defined objectives and characteristics of activities as well as quality and success criteria of integration and were ranked and evaluated by usability engineering experts to provide an indication of their validity and relevance. Heiskari et al. [13] defined that usability should be integrated into the requirements engineering process by making it the responsibility of the whole product development organization. This, however, requires usability to be understood as a more comprehensive characteristic of a product than just user interface design. This could be accomplished by providing usability training for the entire development organization to achieve the goal.

Few authors described usability engineering methods, focused on identifying usability problems before completing a product [3]. They identified which methods are most effective and related to user centered design.

After studying the literature, it is observed that the developer should have enough information to develop a set of usability requirements for the website. Requirements specification keeps designers and developers focused on the goals of the usability based on the preferences.

III. USABILITY REQUIREMENTS

Usability engineering specifies set of user-centered processes in website development. Its purpose is to accomplish the web site providers' goals and to increase the potential for user success and satisfaction by understanding complex set of user variables. A usability requirement specifies how to meet the perceptive needs of the intended users of your website. It provides concrete objectives for usability and its criteria that can be tested. Users would be able to efficiently use an interface to accomplish the goals that it has been designed to support. Based on previous literature study the following composite usability requirements model is derived which basically comprises of user and system requirements.
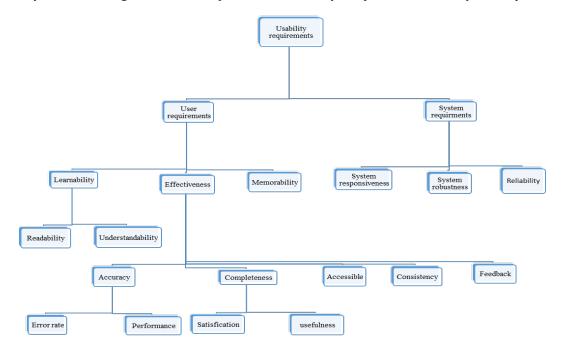

Fig 1: Composite Usability Requirements Model

Based on the previous study of literature, the following points can be considered for usability requirement.

1. Determine what the usability criteria is and how it is measured.
2. Set priority of usability criteria.
3. Determine the basic conditions that must exist in website to successfully fulfill the requirements.
4. Set a realistic percentage of users that must accomplish their objectives.
5. Choose different styles from six styles of usability requirements that can be verified and ensure usability during website development [14].

A. User Requirements

It is important to analysis user requirements that will describe **what are the expectations of the user? And how they will interact with the website**. Use proper documentation in your scenarios to develop your requirements. It will comprise of outline of tasks that user want to accomplish within website.

B. System Requirements

Specification of system requirements is also an essential attribute for enhancing usability of website. And also for hardware and software to run smoothly and efficiently. Failure to meet these requirements can result in degradation of performance. System requirements will always vary depending on the different websites design and no two website would have identical requirements. These can be set by users, company or even large group.

IV. ROLE OF USABILITY REQUIREMENTS IN USABILITY ENGINEERING LIFE CYCLE:

A website involving consideration and participation of users is likely to be more usable. So, usability engineering can also be referred as user centered design.
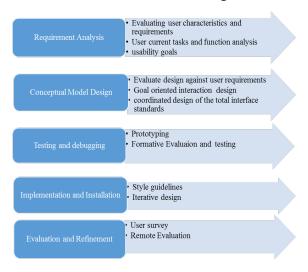
Fig 2: Usability Engineering Life Cycle Model

This model is an iterative lifecycle process that puts an emphasis on involvement of user in the designing and testing phase. High desirable usability can only be achieved using systematic usability methods. Several steps of it are iterative and can be overlapped. In fig 2: basic levels of usability engineering life cycle are portrayed.

It is clear that the most basic characteristics in the usability engineering life cycle process are empirical user testing and rapid prototyping, combined with iterative design. Some of the recommended methods should be used throughout the development process.

V. LIMITATIONS AND FUTURE WORK

This paper has tried to define composite usability requirement model based on various usability attributes and the role of usability requirements in usability engineering life cycle model. Security is another domain which has been not clearly integrated in this model as it is harder to achieve full security according to context and the further research could be done on this. The cost factor for incorporating usability engineering life cycle model must be considered. However, not all projects can afford all the key attributes and recommended methods of model. The future work of domain of usability engineering will be enhanced.

VI. CONCLUSION

This paper identifies key requirements for embedding usability engineering activities in website development. These requirements define objectives and success criteria for ensuring usability. In this paper, a model for usability engineering is introduced that can help to define the requirement specification more accurately and appropriately from end-users. Although this study could not cover all aspects of usability engineering life cycle process, yet it highlights the notable aspects and relationships between user requirements and usability engineering lifecycle.

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Detection of Shilling Attack in Recommender System Using Various Techniques

Nirmal Kaur[1], Dr. Vijay Dhir[2]

[1]*Research Scholar, Department of Computer Science and Application, Sant Baba Bhag Singh University, India*
[2]*Professor, Department of Computer Science and Application, Sant Baba Bhag Singh University, India*
Email: [1]nkparhar.sbbs@gmail.com, [2]Drvijaydhir@gmail.com

Abstract—A literature review shows that recommendation systems have been extensively modified and evaluated in a variety of domains. Due to the limited performance from various cyber attacks, the adoption of a recommendation program is in the early stages of security programs. One of the most common attacks on the recommendation system is shilling attack. There are other strategies available to identify shilling attacks built on user measurement patterns. The performance of ratings on target objects varies between attack user profiles and actual user profiles. To distinguish specific profiles, the affected profiles are known as attack profiles. In addition to the cyber attacks, real cyber attacks occur in a community that is solved by Petri Net methods. These attacks can be falsely predicted (shilling attacks) by users which can increase security threats. By identifying attacks on various shillings without knowing the priori, the Recommendation System has a problem with low accuracy. Basically, the recommendation attack is divided into a nuke and Push attack that promotes and discourages the recommended target object. The strength of the shilling attack is usually measured by the filling size and the attack size.

Keywords: Algorithms, Recommended Techniques, Recommended System.

I. Introduction

In the modern era, a huge amount of data, applications and items are available on the internet. All the vendors attract the user to buy their products by offering tempting advertisements to them. But in reality all the products that are available on the internet are not good for the user and they got trapped by the false vendors. To protect user from these false vendors, various recommendation systems come into existence. Moreover, these recommended systems save the time of the user by recommending different items to them according to their interest.

Recommendation system is becoming the need of the society and industries as a lot of data and information are available on the internet and user need some to get useful information from a bulk amount of data. In industries, recommended system helps them to earn a great amount of profit by standing out differently from their competitors. For example, Netflix has organized a challenge for their users to perform better to recommend the application and win a price having worth of 1 million dollars. Hence, it is considered as a useful and powerful tool in the modern world of the e-commerce.

II. Recommendation Techniques

Recommendation System is build with various techniques and algorithms. Some of them are as follow:
1. Content Based Recommended System
2. Collaborative Filtering Recommended System
3. Hybrid Filtering Recommended System

A. Content Based Recommended System

The first technique of Recommended System is known as Content Based Method. In this technique, the problem is firstly categorized as a regression or a classification problem. In this technique, a model is build for regression as well as classification problem on the basis of content taken from the users past behavior. For classification and regression model the main focus is on the answers given by the users. Hence, this approach is also known as item centered approach. As all the optimization, computations and modeling are done on the items. This model takes the data for learning from the users by asking questions from the users and then uses their answers for training the system. The product which got highest ranking from the users is recommended first. In other words, the ranking given by the user helps the system to rank the items.

In second case, when we work with features of item, our method is then centered on user. All the computations, modeling and optimization is done by the user.

The main advantage of Content Based Methods is that it is the transparent method for recommending items to the user. Whereas its disadvantage is that it has limited content to analyze and requires over specialization.

B. Collaborative Filtering Recommended System

The next technique for recommending system to the user is the collaborative filtering method. This system works on getting data from different users that has similar interest. Collaborative Filtering methods are further

divided into two categories:
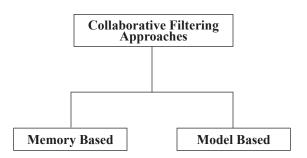 a. Memory Based Technique
  b. Model Based Technique

Fig.1: Categories of Collaborative Filtering Methods

1. Memory Based Technique:

The memory based collaborative filtering technique is further divided into two sub categories: User based and Item Based. In users based memory techniques, the new recommendation is provided to the user with the help of the nearest neighbors technique in which the new recommendation is given by identifying the most popular types of items selected by the user. This method evaluates the distances between the various users and represents the items based on the interactions of the users. Hence, it is known as user centered as the users similar behavior is taken into consideration for recommending new item to the user.

In second type that is in Item Based Collaborative Filtering approacha new recommendation to the user is provided with the help of item based technique in which the main aim is to find the items that the user has already brought or interacted. Hence, from its past buying or window shopping, the new items are suggested to the user. Moreover, in item-centered technique the researchers evaluate the distances between the items.

Table 1: Comparison Between User based and Item Based Collaborative Filtering Models

S. No.	Parameters	User-Based	Item Based
1	Interactions	User-Users	Item-Items
2	Variance	High	Low
3	Degree of bias	Low Bias	Highly Bias
4	Results Obtained	More Personal	Less Personal
5	Centered Around	User	Items

2. Model Based Techniques

In Model based collaborative filtering method, a user-item interactions are represented in the form of latent model with the help of matrix factorization algorithm. This algorithm decomposes the data taken from user-item interaction into dense and smaller matrices by taking product of the interactions. There are two matrices whose

product is taken. First factor matrix contains the data taken from user and second factor matrix contains item data.

Table 2: Comparison Between Memory Based and Model Based Collaborative Filtering Method

S. No.	Parameters	Memory Based	Model Based
1	Recommendation	Calculates similarity between user and items	Pre computed model
2	Interactions	User-Item, Item-Item	User-Item
3	Data Representation	No specific Format	Matrix representation
4	Techniques used	Pearson correlation algorithm, adjusted-cosine based, correlation-based and cosine similarity	Decision tree, Clustering, Association Rule, Regression
5	Disadvantages	Time consuming, Scalability	Expensive, Data may be lost because of putting data in particular format.

C. Hybrid Filtering Technique

As its name suggest, Hybrid Filtering technique is the combination of above two mentioned (Content filtering and Collaborative Filtering) methods. Hence, it contains thefeatures of both content filtering and collaborative filtering methods. It can be implemented in two ways: firstly, the two techniques are implemented one after another and secondly, these two techniques are combined and then implemented. These two techniques are combined to overcome from the problem of sparsity and cold start. For example, NewsDude.

The following are the seven main hybridization Techniques.
  1. Weighted Hybridization: In weighted hybridization, the numerical component values of different recommendation are added. The output of this system gives a linear combination produced by the intermediate results.
  2. Switching Hybridization: In this technique, the various components are available to the user to select one from different recommendation components.
  3. Mixed Hybridization: In this technique, a set of the recommendations are generated independently for every component and these components are joined together to rank them provide to the user.
  4. Feature Hybridization: In this, the features of different techniques are added together to form a one recommendation system to the user.
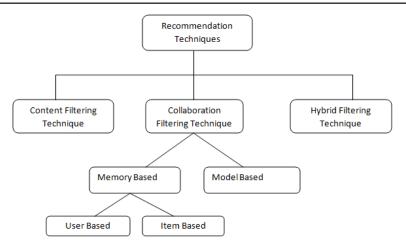
Fig. 2: Classification of Techniques

TABLE 3: COMPARISON OF CONTENT FILTERING, COLLABORATION FILTERING AND HYBRID FILTERING

S. No.	Parameters	Content Filtering	Collaborative Filtering	Hybrid Filtering
1	Recommendation Based on no. of users	Single User	Many users with similar interest	Combination of both
2	Information about user	Personal information of the user is required	Do not required	Depend upon situation
3	Recommendation based on combination of both.	Content (characteristics) of user or items	User-user and item-item interactions	Combination of both
4	Demerits	Require more specialization	Scalability, Data sparsity, cold start problem	Expensive, Increase complexity
5	Merits	Transparency and independent of the user	Serendipitous Recommendation	Overcome problems of both the techniques
6	Interpretability	Easy to Interpret	Hard to Interpret	Hard to Interpret

5. Feature Augmentation: In this technique, the set of features are given to the intermediate method and then this intermediate method provides final output as a recommendation system.

6. Cascade Hybridization: In this technique, the priorities are given to the items and the recommendations to the items are given according to the priorities of the items.

7. Meta Level: In this technique, one recommendation model is act as an input to the other recommendation model to provide output.

III. CHALLENGES FACED BY THE RECOMMENDATION SYSTEM

1. Privacy: The main problem faced by the recommendation system is the privacy. As the reviews from different users are taken with the help of questionnaires and answers are not hidden from other users. Hence, there is no privacy in the recommendation system and users easily see the answers of other people and try to copy the answers.

2. Scalability: As the number of users increase, the recommendation has more data to be processed.

Hence, the recommendation system should be scalable so that system can easily handle the additional data which increases with the result of increase in the number of users.

3. Interpretability: As the data comes from different sources, it is difficult to interpret the data in the recommendation system. The data in content based recommendation system gets easily interpret as compared with collaborative based recommendation system.

4. Synonymy: It is very difficult for the machine to find difference between two similar data. So recommendation systems are not able to understand the synonyms of the word and treated it as a different word which is given by the user as a review for recommending the system.

5. Cold Start: The other problem faced by the new users is known as cold start because it is difficult for the recommendation system to suggest new items to a new users as their profile of buying the products are empty and system could not able to recommend items according to their interest.

IV. Literature Review of Different Authors

S. No.	Authors	Research Work
1.	Jaysri , P. Subathra, and Dr. (Col.) *et al.*	Review various filtering techniques, mainly focus on collaborative techniques.
2.	Ekstrand , J.T. Riedl, and J.A. Konstan *et al.*	Provide outlook to the techniques of recommendation system.
3.	Gunawardana and Shani	Provide a way how to choose various algorithms for their recommendation system.
4	Portugal, P. Alencar, and D. Cowan *et al.*	Reviewed a use of Machine Learning in the recommendation system.
5.	Ouhbi , B. Frikh, E. Zemmouri *et al.*	Proposed a system to overcome a problem of existing approaches by using the concept of deep learning.
6	Zhang , L. Yao, A. Sun, and Y. Tay *et al.*	Reviewed a technique based on deep learning recommendation system
7	M. Z. Kurdi	Have used lexical classifiers which help in detecting the feelings of users using content based recommendations
8	M. A. Ghazanfar and A. Prügel-Bennett	Have focused on extending the methods to handle the problems of scalability and cold start.

V. Evaluating Methods

The recommendation system is evaluated in ways. If the recommendation system is based on numeric values such as matching probabilities or ratings prediction. Then, the system is evaluated by finding Mean Square Error metric. In second case, if the recommendation system is not producing numeric values, then it is evaluated by the Humans. For examples, the review stars given by the humans to every items.

VI. Conclusion

In this paper, a method of obtaining a shilling for user-based recommendation programs based on the loyalty of group users and the timeline series is suggested. The concept is based on the assumption that the reliability of the users of the group has a negative correlation with the variance of the rating. Considering the characteristics of the group and the timing of the shilling attack, a reliability test model based on a predictive forecast model to determine the approximate guess is approaching. Suspected measurement time categories are determined by the design of a timeline for each item, and then data streams and windows windows. In analyzing the characteristics of the clause attack by group users, an uncommon method of group acquisition is suggested based on the time series and the timeline window. We test the method across different datasets and real data in e-commerce to validate the model and algorithm. Test results show that the proposed method works best when it detects a shilling attack within a short-term window. The timely use of the proposed method increases in line with the increase in the data rate, while traditional acquisition methods may not achieve such a result. In a group loyalty model, only the average rating is considered between users. In the future, additional factors will be considered, including behaviors such as personal knowledge and social interactions. We will continue to explore the issue of cash acquisition from both parties, the timeline and the reliability of the group users. When calculating the loyalty of group users, other factors will be used, such as social relationships, user preferences (such as likes or dislikes).

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Newly Emerged Concept-E-Commerce, its Forms and Tools to Implement and Usage in the Modern Economic World

Varun Mehra

Assistant Professor, Department of Applied Sciences, Amritsar Group of Colleges, Amritsar
Email: varun.as@acetedu.in

Abstract—**Electronic commerce, commonly known as E-commerce or ecommerce is a boom in the modern business. E-commerce is trading in products or services using computer networks, such as the Internet. Electronic commerce draws on technologies such as mobile commerce, electronic funds transfer, supply chain management, Internet marketing, online transaction processing, electronic data interchange, inventory management systems, and automated data collection systems. E-Commerce is most considered and chosen way of purchasing different types of products and services. Modern electronic commerce typically uses the World Wide Web for at least one part of the transaction's life cycle, although it may also use other technologies such as e-mail. Electronic commerce is generally considered to be the sales aspect of e-business. It also consists of the exchange of data to facilitate the financing and payment aspects of business transactions. This is an effective and efficient way of communicating within an organization and one of the most effective and useful ways of conducting business. It is a market entry strategy where the company may or may not have a physical presence.**

I. INTRODUCTION

A. E-Commerce World- What We Understand

E-commerce (electronic commerce) is the buying and selling of goods and services, or the transmitting of funds or data, over an electronic network, primarily the internet. These business transactions occur either as business-to-business (B2B), business-to-consumer (B2C), consumer-to-consumer or consumer-to-business. The terms e-commerce and e-business are often used interchangeably. The term e-tail is also sometimes used in reference to the transactional processes that make up online retail shopping. A more complete definition is: E-commerce is the use of electronic communications and digital information processing technology in business transactions to create, transform, and redefine relationships for value creation between or among organizations, and between organizations and individuals. In the last decade, widespread use of e-commerce platforms such as Amazon, Flip kart and eBay has contributed to substantial growth in online retail. In 2007, e-commerce accounted for 5.1% of total retail sales; in 2019, e-commerce made up 16.0% in 2020.

B. Methodology–Nature of the Functioning of E-Commerce

E-commerce is powered by the internet, where customers can access an online store to browse through, and place orders for products or services via their own devices.

As the request is set, the client's internet browser will convey to and fro with the worker facilitating the online store site. Information relating to the request will then, at that point be handed-off to a focal PC known as the request administrator - then, at that point sent to data sets that oversee stock levels, a vendor framework that oversees instalment data (utilizing applications like PayPal), and a bank PC - prior to returning again to the request chief. This is to ensure that store stock and client reserves are adequate for the request to be prepared. After the request is approved, the request director will inform the store's web worker, which will then, at that point show a message advising the client that their request has been effectively prepared. The request supervisor will then, at that point send request information to the distribution centre or satisfaction division, all together for the item or administration to be effectively dispatched to the client. Now unmistakable as well as computerized items might be dispatched to a client, or admittance to assistance might be conceded.

The main types of electronic commerce are: business-to-business (B2B); business to- consumer (B2C); business-to-government (B2G); consumer-to-consumer (C2C); and mobile commerce (mcommerce).

C. Usage of E-Commerce in Modern Society and Economic World- its assumptions

Benefits of e-commerce include its around-the-clock availability, the speed of access, the wide availability of goods and services for the consumer, easy accessibility and international reach.

1. Availability

Beside blackouts or booked support, web based business locales are accessible 24x7, permitting guests to peruse and shop whenever. Physical organizations will in general open for a decent number of hours and may really close totally on certain days.

2. Speed of Access

While customers in an actual store can be eased back by swarms, internet business destinations run rapidly, which is controlled by figure and data transfer capacity contemplations on both buyer gadget and web based business website. Item pages and shopping basket pages load in no time flat or less. An internet business exchange can contain a couple of snaps and take under five minutes.

3. Wide Accessibility

Amazon's first motto was "Earth's Biggest Bookstore." They could make this case since they were a web based business website and not an actual store that needed to stock each book on its racks. Internet business empowers brands to make a wide exhibit of items accessible, which are then transported from a stockroom after a buy is made. Clients will probably have more achievement discovering what they need.

4. Easy Availability

Clients shopping an actual store might struggle figuring out which walkway a specific item is in. In e-commerce business, guests can peruse item class pages and utilize the website search highlight the discover the item right away.

5. International Reach

Physical organizations offer to clients who truly visit their stores. With internet business, organizations can offer to any client who can get to the web. Online business can possibly broaden a business' client base

6. Cost

Unadulterated play online business organizations stay away from the expense related with actual stores, like lease, stock and clerks, in spite of the fact that they might bring about transportation and stockroom costs.

II. E-Commerce Facilitator Tools:

1. Internet: A gigantic web entrance has added to development of E-business. Web and advanced cells are turning into a necessary piece of each life. Web is not any more a wellspring of data however has turned into a significant device for shopping, picking up, conveying and in any event, getting administration from handymen, craftsmen, specialists and so forth Inventory network is likewise becoming more slender and more brilliant as advanced stages are assisting with bettering interface with the clients who essentially diminishes the waste and supporting to green organizations.

The web client populace was little during the 1980s, encountering a lethargic however consistent development until 1994 because of an expanding number of text-based clients (e.g., those utilizing email and record move functions).Then, with the presentation of the World Wide Web and resulting mixed media content extension, the quantity of net clients detonated. In fact, the web has developed significantly more rapidly than some other medium ever (Strauss *et al.*, 2007).

The International Telecommunication Union (ITU), a United Nations body, as of late anticipated in 2015 that 3.2 billion individuals will be on the web. The populace in May 2015 remained at 7.2 billion. In the year 2000 there were only 400 million web clients around the world.

2. Payment Gateways: A payment gateway is an e-commerce application service provider service that authorizes credit and debit cards payments for e-businesses, online retailers, bricks and clicks, or traditional brick and mortar. The life blood of online business is the payment routes which comprises credit card, debit card, online banking payments, electronic funds transfer. The world is transforming from cash to digital money and thus there is a need of payment gateways for sustainable future ecommerce.

3. Analytics: Analytics is the scientific process of transforming data into insight for making better decisions. Analytics assists organizations with get-together, arrange, break down, and report on all that their clients do. The enormous expansion in the volume of information has constrained the organizations to zero in on investigation to comprehend the conduct of the client. There are essential investigation capacities accessible with the online business players like crate size examination, normal request esteem, change proportion yet we need further investigation answer for significant experiences of the purchaser.

4. Social Media: Businesses are increasingly making use of social media in order to market their goods and services. Social media refers to websites and computer programs that allow people to communicate and share information on the internet using a computer or mobile phone. Social media has played a great role in brand building and informing various offers to the customers. It also helps in getting the feedback about the product or service. It provides a platform for brand building, advertisements, developing a community of trusted users, spreading word of mouth etc.

III. Underlying Factors in E-Commerce:

Rapid growth of digital commerce in India is mainly due to increased use of smart phones. ASSOCHAM Study (2015) tracked down the most elevated development rate in the clothing portion, practically 69.5 percent more than 2014, trailed by electronic things, up 62%, child care items, up 53%, excellence and individual consideration items at 52% and home goods at 49%. Mobiles and mobile accessories have taken up the maximum share of the digital commerce market in India, noted the study. Moreover, almost 45 per cent online shoppers reportedly preferred cash on delivery over credit cards (16 per cent) and debit cards (21 per cent). Only 10 per cent opted for internet banking and a scanty 7 per cent preferred cash cards, mobile wallets, and other such modes of payment. The 18-25 years of age group has been the fastest growing age segment online with user growth being contributed by both male and female segments. New methodologies have evolved. The role of geographic distances in forming business relationships is reduced. E-Commerce is the future of shopping. With the deployment of 3G and 4G and now 5G wireless communication technologies, the internet economy will continue to grow robustly. In the next 3 to 5 years, India will have 30 to 70 million internet users which will equal, if not surpass, many of the developed countries. Internet economy will then become more meaningful in India. Awais Muhammad and Samin Tanzila (2012) show that the utilization of the web has made the world a worldwide town. The utilization of the Internet has decreased distances and united individuals. A country's spine trade and will be fortified whenever supported by electronic instruments in which web based business assumes an indispensable part. With the rapid expansion of internet, Ecommerce is set to play a very important role in the 21st century, the new opportunities that will be thrown open, will be accessible to both large corporations and small companies. The role of government is to provide a legal framework for E-Commerce so that while domestic and international trade are allowed to expand their horizons, basic rights such as privacy, intellectual property, and prevention of fraud, consumer protection etc are all taken care of. It was also proposed

that the future of E-Commerce is difficult to predict. There are various segments that would grow in the future like: Travel and Tourism, electronic appliances, hardware products and apparel. There are also some essential factors which will significantly contribute to the boom of the E-Commerce industry in India i.e. replacement guarantee, M-Commerce services, location based services, multiple payment option, right content, shipment option, legal requirement of generating invoices for online transactions, quick Service, T & C should be clear & realistic, the product quality should be same as shown on the portal, dedicated 24/7 customer care centre should be there. The use of Internet has reduced the distances and brought the people together. A nation's back bone is commerce and it will be strengthened if backed by electronic tools in which e-commerce plays a vital role. The important feature in ecommerce is privacy which not only increases competitive advantage but confidence level also. E-commerce brings sellers and potential buyers at the distance of one click and it saves time as it is cost effective, as E-commerce is becoming key to success Internet banking, one among the innovative and significant internet based services has experienced explosive growth and led to transformation of traditional banking practice. Online banking or net banking in today's dynamic age of banking has made things much easier for the people and saves a lot of time for its customers. The traditional way of standing in the queues and filling up all the forms are well solved and now it is no hassle for making any transaction with the banks by virtue of internet banking. The financial institutions which operated traditionally are now able to lower their operational costs and increase the consumer retention by virtue of technology. Internet banking as a latest and potential means for banking now holds a similar importance as that of ATM's, phone banking and traditional bank branches. The largest discrepancy between the customer expectations and perceptions is in terms of empathy which includes Bank locations and ATM machines in convenient places and telebanking and internet banking facility. The use of e-commerce is basically unaffected by the size of the city where the household lives. Geographically remote consumers are discouraged from purchasing goods by the fact that they cannot inspect them beforehand. Leisure activities and cultural items (i.e., books, CDs, and tickets for museums and theatres) are the only goods and services for which e-commerce is used more in isolated areas. Finally, e-banking bears no relationship to city size. In choosing a bank, non-urban customers give more importance to personal acquaintance than do urban clients, partly because bank account holders in remote areas are more likely to have taken out a loan from their bank. Ozok *et al* (2007) identified ten items contributing to overall

consistency in e-commerce customer relationship management. These items are consistency of transaction steps, consistency of Web site design, consistency of navigation, consistency of promotions, consistency of in-stock indications, consistency of product variety, consistency of fraud protection, consistency of product guarantees, consistency of overall site fairness, and consistency of return policies. This list of consistency items includes three usability items. Rust and Chung, (2006) recommends to know not exactly what clients do in a specific online business contact yet in addition what they do (and how they see and feel) across different contacts. Snellman and Vihtkari, (2003) in their review uncover that, by and large, disappointments are extremely normal in both, relational assistance experiences and innovation based help experiences. In relational assistance experiences, unpleasant or rude help and time-related perspectives are the most widely recognized reasons for disappointment. Then again, disappointment in innovation based experiences is frequently identified with disappointments in innovation, administration plan, or the assistance interaction. It can be concluded that sites with good usability have a better chance of having successful CRM implementation in their business. Consistency of promotions, in-stock indications, product variety, fraud protection, guarantees, fairness, and return policies indicate mainly that customers in fact demand a high level of security-related information as well as trustworthiness and high ethics on the shopping site to become regular customers of evendors. Customers demand equal and consistent treatment concerning products and product related services. As more and more banks will succeed in online banking, a day will come when it will reach a common place as ATM's. It has not only increased the banking transactions but also has reduced the time and cost factor. It has brought revolution in the banking industry. Chou and Chou (2000) reveal that with the astonishing growth of electronic commerce, banks around the world now see a huge potential market for internet banking. In order to provide efficient services to its customers, a bank needs to design and implement a robust internet system. Several technological issues must be considered before adapting to a specific internet environment, including network technologies, platform and standards, scalability, security and intelligent software agents. In order to meet the needs of global business communities, the banking industry needs to carefully select suitable networking technologies to serve the internet market. As banks select electronic commerce as one of their mission-critical business processes, managing risk and liability become important. Internet security is always a major concern in a digital economy; it involves the application of both technical and nontechnical practices. The non-technical ways of

pursuing security on the internet include formulating a corporate security policy and educating and training users about that policy. On the other hand, major technical measures consist of access controls, authentication, encryption, firewalls, audit, antivirus tools, and self-assessment tools. The bank needs to select suitable security tools and policy to protect itself and its customers. Specific security policy can be posted on the website for user's reference.

IV. Conclusion

A developing country may well attempt to be modernized if it introduces e-commerce effectively and efficiently. It will improve its output and lead to its competitive advantage. Information Technology (IT) has uplifted ecommerce worldwide. Now it's at ease to enter to a new market and marketers' can easily evaluate their product and company's performance. A growing number of firms in various industries, such as banking, education, commerce, and tourism, etc. have improved their services by both incorporating technologies into their service delivery process. Integration of technology in services is becoming very common; however, very little academic research has been conducted to examine its influence. The issues related to Ecommerce are also on the rise which is posing serious threat to its tall future and hence demands right strategies on part of marketers. The research works on E-commerce propose good number of variables to be taken care of if marketers need to be successful in this newly business model. The factors which will significantly contribute to the success of the E-Commerce industry and focused upon should be consistency of transaction steps, consistency of Web site design, replacement guarantee, MCommerce services, consistency of promotions, consistency of in-stock indications, consistency of product variety, location based services, multiple payment option, right content, shipment option, legal requirement of generating invoices for online transactions, quick Service, T & C should be clear & realistic, the product quality should be same as shown on the portal. The important features in ecommerce are privacy which not only increases competitive advantage but confidence level of the customers. The researchers also suggest 18-35 as the good customer age to be promising and to be targeted irrespective of gender for better results. Social media may be a boon for brands and marketers looking to reach target buyers without wasting big bucks on traditional media, but luxury brands have recently found it challenging as unauthorised sellers are luring buyers, most of who fall in to the temptation of getting discounts of up to 50-70% have cropped up using platforms like Facebook, Instagram, Twitter and WhatsApp. Firms must closely monitor such accounts and spend money on legal checks controls. In a marketplace

model, the ecommerce firm provides just the technology platform while sellers on the site own the inventory. Most E-commerce companies have call centres to connect with customers; the pressing need is the initiative to set up call centres to deal exclusively with merchants as increasing the number of sellers in a marketplace becomes the next battlefront in the E-Commerce. The need is 24/7 call centres should be dedicated. The banks also need to select suitable security tools and policy to protect itself and its customers. E-Commerce is a boon for any country- if given right impetus and good environmental framework to prosper can significantly lead to country's progress and development.

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A Review Article on Optimal Clock Synchronization for Wireless Sensor Networks

Dr. Harpal[1], Dr. Gaurav Tejpal[2], Dr. Harjot Kaur[3]

[1]*Assistant Professor, ECE, AGC, Amritsar*
[2]*Professor ME, AGC, Amritsar*
[3]*Assistant Professor ECE, AGC, Amritsar*
Email: [1]*paras.harpal@gmail.com,*[2]*gaurav_tejpal@rediffmail.com,* [3]*jot2812@yahoo.com*

Abstract—**The probabilistic way is recommended to read by far off timepieces around handing out programs controlled by unbounded hit-or-miss interaction delays. The tactic is capable of time clock synchronization precisions more advanced than people manage simply by earlier revealed time clock synchronization algorithms. The theme is highlighted simply by representing any time company that keeps on the outside (and for this reason, internally) synchronized timepieces around a good approach, interaction and also time clock failures.**

Keywords: Clock Synchronization, Wireless Sensor Networks

I. INTRODUCTION

All of our existing an effective, effective, along with a unified strategy to the downsides involving synchronizing, initializing, along with bringing in timepieces regarding solutions along with unique variations of breakdowns: lock up, omission, along with randomly breakdowns along with along with without having communication authentication. This can be the initial acknowledged remedy in which attains exceptional accuracy—the precision involving synchronized timepieces (with admiration in order to actually time) is actually as well as in which specific with the main equipment clocks. This option would be likewise exceptional according to the volume of substandard operations that could be accepted to make this happen accuracy. Latest advancements with micro-electromechanical (MEMS) technological innovation currently have triggered the rollout of tiny, low-cost, along with low-power sensors. Cellular alarm systems (WSNs) tend to be large-scale systems of which receptors, specializing in watching along with checking many areas of a bodily world. In these systems, facts coming from every alarm is actually agglomerated using *facts union* to make a solo purposeful final result, that makes time period synchronization amongst receptors very desirable. That report studied along with evaluating current time clock synchronization practices with different color schemes involving factors such as accuracy, accuracy and reliability, value, along with complexity. The style concerns displayed below can certainly help builders in both picking a current

synchronization standard protocol or perhaps in interpreting a fresh standard protocol in which is most effective in order to the exact desires of any sensor-network application. Lastly, laptop computer offers a beneficial platform where creative designers can easily assess innovative along with current synchronization protocols.

A. Gradient Clock Synchronization

As with classic sent out time synchronization, many of us look at a system connected with nodes pre-loaded with electronics alarm clocks by using surrounded drift. Nodes calculate reasonable time ideals centered for their electronics alarm clocks along with information Geneva Chamonix transfers, along with the aim is always to synchronize your nodes'reasonable alarm clocks when directly as you can, whilst pleasing a number of quality conditions. The latest attribute connected with grading time synchronization *GCS* regarding short) is usually to want that this skew concerning virtually any a pair of simply no desy'reasonable alarm clocks always be surrounded with a neo lowering purpose of the *skepticism with information wait* (call this specific the *length*) concerning both the nodes, as well as other system parameters. That is defined, many of us need in the area nodes to generally be directly synchronized, and let isolated nodes so that you can be more freely synchronized. Many of us difference GCS by using classic time synchronization, along with a focus on quite a few functional inspirations regarding GCS, mainly that comes with warning along with ad-hoc networks.
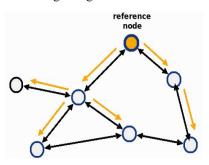

Fig.1: Shows Gradient Clock Synchronization

B. *Distributed Clock Synchronization*

Most people assess your spatial removing algorithm formula regarding Solis, Borkar along with Kumar (2005) intended for time clock synchronization more than multi-hop instant networks. Particularly, intended for one of any haphazard instant community, we all reveal that with good chance the big mistake difference is usually O(1) seeing that the quantity of nodes from the community increases. Provided help with the feasibility regarding time-based computing m significant instant networks. We provide bounds on the settling time of a distributed algorithm

C. *Distant Clock Synchronization*

The use of optical clocks or oscillators in future ultraprecise navigation, gravitational sensing, coherent arrays, and relativity experiments will require time comparison and synchronization over terrestrial or satellite free-space links. Here, we demonstrate full unambiguous synchronization of two optical time scales
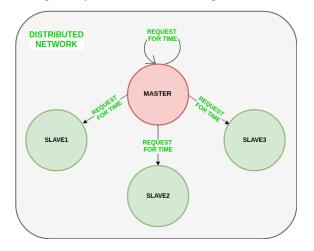
Fig.2: Shows Distributed Clock Synchronization
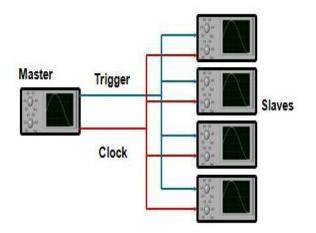
Fig.3: Shows Distant Clock Synchronization

across a free-space link. The time deviation between synchronized time scales is below 1 fs over durations from 0.1 to 6500 s, despite atmospheric turbulence and kilometer-scale path length variations. Over 2 days, the time wander is 40 fs peak to peak. Our approach relies on the two-way reciprocity of a single-spatial-mode optical link, valid to below 225 attoseconds across a turbulent 4-km path. This femtosecond level of time-frequency transfer should enable optical networks using state-of-the-art optical clocks or oscillators.

II. CONCLUSION

Inside the international community connected with corporations employed with all the understanding connected with Global Nuclear Occasion (TAI), Fischer wall clocks as well as moment guitar scales usually are in contrast via the particular Worldwide Setting Method (GPS) and also by using telecom satellites with regard to two-way satellite tv on PC some time and regularity switch (TWSTFT). A wavelengths on the state-of-the-art major cesium fountain of youth wall clocks is often in contrast with the amount of 10e-15 (a relative, a day averaging) as well as moment guitar scales is often synchronized by having a doubt of merely one nanosecond. Long run changes connected with around the world timepiece side by side comparisons will be needing additionally a noticeable difference connected to the neighborhood transmission submission systems. Such as, the longer term ACES (atomic timepiece collection throughout space) goal will display far off moment degree side by side comparisons for the doubt a higher level 100 ps.

To make certain the particular ACES soil musical instrument will most likely be synchronized to help the neighborhood moment degree with PTB without having a substantial doubt share, we've launched an opportunity for adjusting timepiece side by side comparisons via to prevent fibers. The doubt under 50 playstation on the long distance connected by 2 km may be revealed around the college connected with the PTB. Fractional treatments are actually so on the whole a good applicant with regard to synchronization connected with increased moment switch tools along with the neighborhood realizations connected with UTC.Dependant on all these studies we all appraisal the particular doubt stage with regard to adjusted moment switch via to prevent material above extended distances.

Most of these results usually are in comparison to the existing position as well as enhancements connected with satellite tv on pc dependent moment switch techniques, using a concentration on the calibration procedures for detailed systems.

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A Survey on Genetic Algorithm for Linear Transport Problem in Wireless Sensor Networks

Dr. Harjot Kaur[1], Dr. Gaurav Tejpal[2], Dr. Harpal[3]

[1]Assistant Professor ECE, AGC, Amritsar
[2]Professor ME, AGC, Amritsar
[3]Assistant Professor, ECE, AGC, Amritsar
Email: [1]jot2812@yahoo.com, [2]gaurav_tejpal@rediffmail.com, [3]paras.harpal@gmail.com

Abstract—The partitioned algorithms are actually adaptive treatments that may acquire methods of complications in the evolutionary course of action determined by organic selection. Having replacement familial algorithms meant for handling typically the one-dimensional vehicles issue is discussed. Utilizing it, for instance the partnership in between advice homes in the area not to mention familial owners will be investigated meant for minimal complications, along with the worth of homes in the area thicker compared to bit strings will be demonstrated. Couple of familial algorithms (GAs) actually brings to you for ones resolved fee vehicles trouble (FCTP). Together algorithms involve education within the elements regarding perfect solutions. All the algorithms mostly be different while in the tactic put to use to handle the Natural limits regarding FCTP: as the GA depending on the permutation advice may be categorized as being a decipherer tactic, typically the intercellular substance advice looks like a primary strategy encoding through special owners to help keep feasibility. All the editors evaluate equally GAs is related to at random, resulted in instances. All the simulations display typically the appropriateness for the approaches-in distinct for the intercellular substance representation-and exhibit one's own favorable position to a new GA that appears to consist of meant for vehicles complications.

Keywords: Genetic Algorithm, Linear Transport System, Wireless Sensor Networks

I. Introduction

Transmissible algorithms (GAs), that can be instructed stochastic huge batch mountaineering algorithms, are really a common search engine optimization solution and tend to be put on to particular qualifying criterion search engine optimization reactions to relatively problematic strategy landscapes. There are certain endeavors to dab GA towards multi criteria search engine optimization problems. That GA decision instrument is usually influenced by a new single-valued aim element because of this, certainly no overall ways to eliminate multi criteria search engine optimization issues were evolved as a result far. Within this document, a brand new method to change for better for the different factors dilemma in a single-criterion issue is presented. The situation involving change for better leads to the desire for the development of your *Pareto* create opinion strategy to operate your multi criteria search engine optimization by means of GAs. Meant for settling strategy create, that is definitely individuals of a several development for the GA, your Pareto creates is undoubtedly found. That health and fitness

Involving human population users over the following GA development is undoubtedly worked out by the extended distance metric using a blueprint in the Pareto range the last generation. Even as we don't wish to pay put together your goals ultimately, all of us end up with this approach extended distance metric in your good Pareto spot involving the last treatments, as being the health and fitness for the ongoing solutions. This unique latest GA-based multicriteria optimization method consists of right here, and it's effective at management virtually any usually made multi criteria search engine optimization problem. The most important reason behind your method detailed at length in that document and then a in-depth mathematical example. Up front home computer made benefits indicate our way leads to far better, and even way more Pareto treatments, as opposed to simple stochastic search engine optimization methods

A. Linear Transport Problem

A powerful execution hereditary algorithms in order to resolve bicriteria dependable moving dilemma (BSTP) that is certainly typically the expansion individuals preceding work. The standards living space method for typically the bicriteria analogue process are certainly inlaid with the composition with hereditary algorithms (GA) for locating typically the non dominated elements throughout the standards space. The actual consist of a formula is certainly known as through Chemical language. The actual computational outcomes reveal the fact that consist of algorithms can be valuable with respect to resolving typically the bicriteria dependable
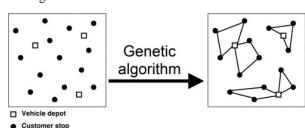
moving dilemma

Fig.1: Shows Linear Transport Problem

B. Nonlinear Transport Problem

People report a new nonstandard transmitted criteria, procedure for a nonlinear moving problem. This valuable provides a lot of our early on homework to the running(a) moving problem. Cutting edge "chromosome structures" and even "transmitted operators" are actually taught safeguard feasibility. Cap networks produces an effective opportunity for which real-world complications so are widely used by different styles of technology: mail messages, hydraulic, electro-mechanical, electric, and even logistics. That moving situation (TP) is understood as the essential 'network ' problems. After the TP situation is a member of added fixed charge pertaining to building a comfortable and satisfying a need for people, it's labeled as predetermined price moving situation (fcTP).

This concern is just about the NP-hard (IE/OR) complications which might be really difficult to eliminate by means of regular methods. This valuable document aspires to indicate use of occupying tree-based Inherited Algorithmic rule (GA) method for resolution nonlinear predetermined price moving problem. Many of our fresh approach will lie upon a GA manifestation, together with a feasibility important factor and even a difficult strategy of a chromosome. Numerous numeric trial and error answers are offered to indicate the potency of a recommended strategy
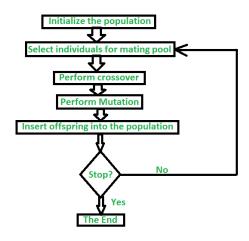
Fig.2: Shows Non-Linear Transport Problem

II. Conclusion

Nonlinear Mounted Ask for Vehicles Situation (NFCTP) is known as a different associated with preset price transfer obstacle, and that is in order to cruise ship to choose from sums of products in order to fulfill the necessitates in bare minimum comprehensive price tag, upon ailment the fact that virtually any plan possesses a hard and fast price tag irrelative in order to his or her delivery amount of money whether it's employed, together with a adjustable price tag direct relative for the quadratic of their delivery amount of money to provide a nonlinear term. It pieces of paper seeks in acquiring a cost effective strategy to unravel NFCTP. With these pieces of paper, NFCTP is without a doubt designed by using a incorporated integer programs model. Depending on steady-state transmissible algorithmic rule when composition, and then minimal price tag circulation algorithmic rule when decipherer, some cross types transmissible algorithmic rule named *NFCTP-HGA* is without a doubt suggested when an alternative strategy of this model. Making the most of nonlinear plan and then wonderful networking plan associated with NFCTP, the *NFCTP-HGA* algorithmic rule possesses great effectiveness with the sensation to be enforced upon desktop computer, computational precious time, essential recollection just for the reckoning, and then power to look for worldwide optimum. The usage of the *NFCTP-HGA* algorithmic rule is without a doubt highlighted along with examples. Statistical tests show the fact that the *NFCTP-HGA* algorithmic rule can be a valuable and then a strong strategy to unravel NFCTP, notably pertinent in order to signify continuum problems.

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Detection of Transmission Line Fault Using Microcontroller

Chetan Verma[1], Bimal Kumar[2], Ajaypal Singh[3]

[1,2,3]Department of Electrical Engineering
Amritsar College of Engineering and Technology, Amritsar, Punjab, India
Email: [1]chetan.verma@acetdu.in, [2]bimal.eee@acetedu.in, [3]ajapal.eee@acetedu.in

Abstract—**The transmission lines are the main part of the power system and also transmission lines have most of the possibility of faults whether there is conductor break or there is lightning stroke or the surges, being electrical engineer it's on us to maintain the stability of the power system so we have made a prototype of the power system in which we will illustrate the how fault occur in the line and how it gets clear. This paper represents what is the fault condition and why we have to clear the fault to maintain stability in the power system. In this paper we have made a prototype to explain the working of line faults but in low voltages manner you may consider the voltage is stepped down by some instrument like Potential transformer. Although there are various fault sensing devices in practical power systems, this may also be considered in the power system to detect and clear the fault.**

Keywords: Overhead Line (OH Line), Liquid Crystal Display(LCD), Line to Line Fault (LL Fault), Line to Ground Fault (LG Fault), Double Line to Ground Fault (LLG Fault), Triple Line to Ground Fault (LLLG Fault), Triple Line Fault (LLL), R,Y,B Phases of Supply in Sequence RYB.

I. Introduction

Electric power transmission lines are the heart of today's world which pump life into the modern-day world, delivering electricity to consumers at their homes, offices and industries. It is important to ensure a smooth operation of transmission lines to deliver a minimally interrupted power supply making necessary for reliable operation of electrical power lines. This need has given rise to fault location detection techniques so that the economic impact of the fault situations can be found and their correction can be done in a simpler and precise way. Underground and overhead cables have been widely implemented due to their reliability and limited environmental concerns. To improve the reliability of a distribution system, accurate identification of a faulted segment is required in order to reduce the interruption time during fault. Therefore, a rapid and accurate fault detection method is required to accelerate system restoration, reduce outage time, minimize financial losses and significantly improve the system reliability.

When fault occurs on transmission lines, detecting fault is necessary for the power system in order to clear fault before it increases the damage to the power system.

When any fault occurs in the line with clearing it also we have to be precise which kind of fault it is. How can it be removed and how can it affect the performance of power systems? In the power system we have a lot of assemblies installed in it and they are very costly hence we have to do every possible effort in order to save the equipment from damaging itself.

II. Objectives of the Paper

The motivation of the paper is to detect and determine the various types of fault of a transmission line model, while considering both accuracy and speed. The main objectives of the paper are:

1. To design an efficient and robust automatic fault detection system for overhead power transmission lines.
2. To reduce response time needed to rectify and save expensive transformers from damage or theft which usually occurs during longer power outages.
3. To maintain proper electricity in the rural and urban areas.
4. To ensure stability and reliability of the power supply system in the country to boost economic growth.
5. To maintain the uninterrupted power supply in the areas where electricity is required 24/7 like hospitals and other emergency services.
6. To clear the line faults as soon as possible.
7. To protect the equipment from overvoltages and surges due to Symmetrical and Unsymmetrical faults.

III. Classifications of Overhead Transmission Line

Talking about the transmission lines we divide them by length following all the types of lines are explained. There are three main types of Overhead Transmission Lines:

1. Short Transmission Line: The line length is up to 60 km and the line voltage is comparatively low less than 20KV.
2. Medium Transmission Line: The line length is between 60 km to 160 km and the line voltage is between 20kV to 100kV.
3. Long Transmission Line: The line length is more than 160 km and the line voltage is higher than 100KV.

Now when it comes to the Overhead line there would be a question that why do we use OH lines why not underground so following are the advantages of the OH lines over Underground cables :

- Overhead power cables are cheaper to install and maintain than underground power cables.

- They are also quicker to fix whenever faults develop. However, they are more susceptible to damage, and many people do not like the way they look.

- Some estimates put the costs of underground power cables at as much as four times the cost of the overhead option. This is the primary reason why most cables are overhead.

- Faults and damage to the lines are easier to locate, so they are quicker to repair. This saves money and reduces the amount of time that homes and businesses are without power.

- Overhead power lines also have a higher capacity than underground options, and they typically need fewer substations.

Talking about the faults the possibility of fault is maximum at the Overhead lines and the percentage of fault is at different equipments is different which is shown by the following table:

Apparatus	Probability of Fault
Overhead Line	50%
Underground Cable	9%
Transformer	10%
Generator	7%
Switchgear	12%
CT/PT Relays	12%

As seen from the above table we can see that the maximum probability of fault is on the Overhead Line because it is exposed to an environment facing different environmental conditions.

So we do have to protect this overhead line. In the next topic of this paper we will discuss the different types of faults which occur in the transmission line.

Mostly these faults occur in the 11kV feeders.

IV. Types of Fault In Overhead Transmission Line

Following are types of faults in the OH lines :
- Open Circuit Fault
- Short Circuit Fault.
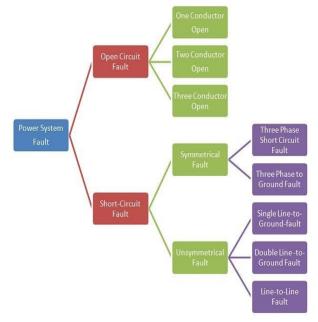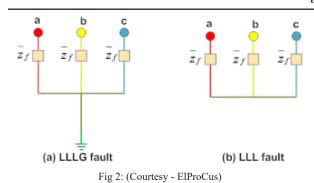
Fig. 1: (Courtesy - Circuit Globe)

Open Circuit Faults: are the faults where the conductor gets open due to broken conductor etc , but we will discuss only the short circuit fault as per our paper is concerned.

Short Circuit Faults: are the faults where the conductors of the different phases come into contact with each other with a power line, power transformer or any other circuit element due to which the large current flows in one or two phases of the system. The short-circuit fault is divided into the symmetrical and unsymmetrical fault.

Symmetrical Faults: The faults which involve all the three phases are called symmetrical faults in this type of fault the system in prefault i.e. before the fault is in balanced state and post fault i.e after the fault is also in the balanced state, Following are the types of symmetrical faults:

1. *LLL Fault*: These types of faults are balanced, i.e., the system remains symmetrical even after the fault. The LLL fault occurs rarely, but it is the most severe type of fault which involves the largest current. This large current is used for determining the rating of the circuit breaker. The figure on the next page shows the symmetrical LLL fault.
2. *LLLG Fault*: The three-phase line to ground fault includes all the three phases of the system. The LLLG fault occurs between the three phases and the ground of the system. The probability of occurrence of such type of fault is nearly 2 to 3 percent.

(a) LLLG fault   (b) LLL fault

Fig 2: (Courtesy - ElProCus)

Above figure describes the LLLG and LLL fault where Z_F is the fault impedance where it denotes some medium like a tree falls on the three lies so if it has moisture it may will make LLL faults

where Z_F will be the fault impedance of the part of tree where it is touched to the line.

Now talking about the unsymmetrical faults basically in this paper we are going to make this part as important as our project is mostly related to unsymmetrical faults.

Unsymmetrical Faults**:** The faults which give rise to unsymmetrical currents, i.e., current differing in magnitude and phases in the three phases of the power system are known as the unsymmetrical fault. It is also defined as the fault which involves the one or two phases such as LG, LL, LLG fault. The unsymmetrical makes the system unbalanced.The system before fault i.e. prefault is balanced and the system after the fault is unbalanced. These faults are classified into three types.

Single-Line-to-Ground Fault
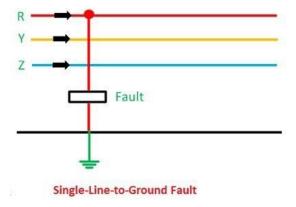
Fig 3: (Courtesy - Circuit Globe)

1. *LG Fault*: The single line of ground fault occurs when one conductor falls to the ground or contacts the neutral conductor. The 70 – 80 percent of the fault in the power system is the single line-to-ground fault. This type of fault only involves a single phase and ground i.e. when a conductor breaks on to the ground thus the fault occurs is called LG fault.
2. *LL Fault:* The line-to-line fault or LL fault occurs when two conductors are short circuited. The major cause of this type of fault is the heavy wind. The heavy

wind swinging the line conductors which may touch together and hence cause short-circuit. The percentage of such types of faults is approximately 15 – 20%. In the practical power system when a conductor breaks and falls into another conductor thus the fault so produced is called LL fault also due to birds the conductor gets oscillating and when the birds take off and due to this the two phase conductor gets short circuited so this fault is called LL fault.

Line-to-Line Fault
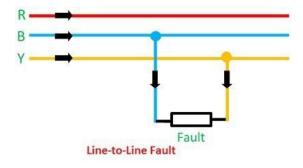
Fig. 4: (Courtesy - Circuit Globe)

3. *LLG Fault* In LLG or Double line to ground fault, the two lines come in contact with each other along with the ground. The probability of such types of faults is nearly 10 %.: When two conductors get shorted and both of them then fall to ground this fault is so called as LLG fault also when due to rain or storm the moisturized tree falls on two conductors LLG fault is introduced.

Double Line-to-Ground Fault
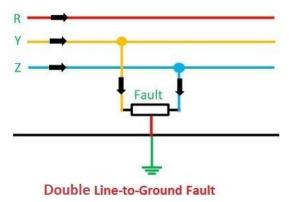
Fig 5: (Courtesy - Circuit Globe)

Now we have discussed all the faults so far in this paper now we will introduce Z_F, Z_F is the fault impedance which may be zero if the conductor gets broken and falls directly to ground and if it gets shorted due to a tree or any medium the fault impedance gets introduced. The fault current then flows through this impedance and the MVA rating for the circuit breaker is defined by this short circuit current. Now on the next page we will discuss the fault percentage of all these faults in the power system.

Type of Fault	Probability of Fault	Severity
LG	85%	Least Severe
LL	8%	
LLG	5%	
LLL	2%	Most Severe

LG fault mostly occurs on the 11kV line, i.e. feeders of 11kV lines and mostly one connector breaks in the feeder i.e the most possible fault is LG Fault.

V. Algorithm of Fault Detection in Overhead Transmission Line Prototype

For our project we have used Arduino as a microcontroller because its programming is simple and can be done in a simple software "Arduino IDE".

We have made a prototype of 11kV AC 3 phase system in which we have made every phase's voltage different to continuously monitor the change of the voltage at these phases during normal conditions the phases will have normal voltage levels and load on them will be active and they will continuously deliver power to the load.

Now talking about abnormal conditions i.e. faulty condition the voltage on the phases will change accordingly to the type of fault occurred. We will discuss each case of fault and then the program one by one.

LG Fault: Now in case of Line to ground fault the line voltage will be altered after fault and with the analog read function of the arduino we will be able to figure out the line whose voltage is being altered. Now the display will show the type of fault and on which phase out of R , Y, B it has occurred.

LL Fault: In case of Line to line fault, the voltages of two phases will become the same and all the parameters are being measured by the arduino by analog read function. After the detection of the same line voltages by arduino it will show the name of the phases where the fault is occurring.

LLG Fault: In case of Double line to ground fault the potential of two conductors gets zero at fault end hence its easier to locate the type of fault by the analog read function by the arduino and correctly displaying the fault on the LCD.

VI. The Code of the Fault Detection for Arduino

```
const int buzzer = 13 ;
#include <LiquidCrystal.h>
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
void setup() {
  Serial.begin(9600);
  lcd.begin(16, 2);
  pinMode(buzzer,OUTPUT);
  lcd.print("Fault Detector");
}
void loop() {
  int Rphase = analogRead(A0);
  int Yphase = analogRead(A2);
  int Bphase = analogRead(A4);
  float Rphasevoltage = Rphase * (5.0 / 1023.0);
  float Yphasevoltage = Yphase * (5.0 / 1023.0);
  float Bphasevoltage = Bphase * (5.0 / 1023.0);
  digitalWrite(buzzer,LOW);
  Serial.print("R Phase Voltage =");
  Serial.println(Rphasevoltage);
  Serial.print("Y Phase Voltage =");
  Serial.println(Yphasevoltage);
  Serial.print("B Phase Voltage =");
  Serial.println(Bphasevoltage);

while (Rphasevoltage >= 4.5) //t
{
    while (Rphasevoltage == Yphasevoltage && Yphasevoltage
== Bphasevoltage && Yphasevoltage >=4.5 &&  Bphasevoltage
>=4.5 )
    {
      Serial.println("LLLG Fault");
      lcd.setCursor(0, 1);
      lcd.print("LLLG FAULT");
      tone(buzzer, 5); // Send 1KHz sound signal...
      delay(5);        // ...for 1 sec
      noTone(buzzer);    // Stop sound...
      delay(5);        // ...for 1sec

      Rphasevoltage = 4.5;
      Yphasevoltage = 4.5;
      Yphasevoltage = 4.5;
    }
            while (Rphasevoltage == Yphasevoltage &&
Yphasevoltage >= 4.5)
    {
      Serial.println("LLG Fault in RY Phase");
      lcd.setCursor(0, 1);
      lcd.print("LLG RY Phase");
```

```
     tone(buzzer, 50); // Send 1KHz sound signal...
     delay(50);        // ...for 1 sec
     noTone(buzzer);    // Stop sound...
     delay(50);        // ...for 1sec

     Rphasevoltage == 5;
     Yphasevoltage == 5;


        }

             while (Rphasevoltage == Bphasevoltage &&
Bphasevoltage >= 4.5)
     {
        Serial.println("LLG Fault in RB Phase");
        lcd.setCursor(0, 1);
        lcd.print("LLG RB Phase");
        tone(buzzer, 50); // Send 1KHz sound signal...
        delay(50);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(50);        // ...for 1sec
        Rphasevoltage == 5;
        Bphasevoltage == 5;
     }
        Serial.println("LG Fault in R Phase");
        lcd.setCursor(0, 1);
        lcd.print("LG Fault R Phase");
        tone(buzzer, 100); // Send 1KHz sound signal...
        delay(100);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(100);        // ...for 1sec

        Rphasevoltage == 5;
     }
while (Yphasevoltage >= 4.5)
{
     while (Rphasevoltage == Yphasevoltage && Yphasevoltage
== Bphasevoltage && Bphasevoltage >=4.5 && Rphasevoltage
>=4.5)
     {
        Serial.println("LLLG Fault");
        lcd.setCursor(0, 1);
        lcd.print("LLLG FAULT");
        tone(buzzer, 5); // Send 1KHz sound signal...
        delay(5);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(5);        // ...for 1sec
        Rphasevoltage = 4.5;
        Yphasevoltage = 4.5;
        Yphasevoltage = 4.5;
     }
             while (Bphasevoltage == Yphasevoltage &&
Bphasevoltage >= 4.5)
     {
        Serial.println("LLG Fault in BY Phase");
        lcd.setCursor(0, 1);
        lcd.print("LLG BY Phase");
        tone(buzzer, 50); // Send 1KHz sound signal...
        delay(50);        // ...for 1 sec
```

```
     noTone(buzzer);    // Stop sound...
     delay(50);        // ...for 1sec


     Bphasevoltage == 5;
     Yphasevoltage == 5;
        }
             while (Rphasevoltage == Yphasevoltage &&
Rphasevoltage >= 4.5)
     {
        Serial.println("LLG Fault in RY Phase");
        lcd.setCursor(0, 1);
        lcd.print("LLG RB Phase");
        tone(buzzer, 50); // Send 1KHz sound signal...
        delay(50);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(50);        // ...for 1sec
        Rphasevoltage == 5;
        Yphasevoltage == 5;
     }
        Serial.println("LG Fault in Y Phase");
        lcd.setCursor(0, 1);
        lcd.print("LG Fault Y Phase");
        tone(buzzer, 100); // Send 1KHz sound signal...
        delay(100);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(100);        // ...for 1sec
        Yphasevoltage == 5;
     }
while (Bphasevoltage >= 4.5)
{
             while (Rphasevoltage == Yphasevoltage &&
Yphasevoltage == Bphasevoltage && Rphasevoltage >=4.5 &&
Yphasevoltage >=4.5)
     {
        Serial.println("LLLG Fault");
        lcd.setCursor(0, 1);
        lcd.print("LLLG FAULT");
        tone(buzzer, 5); // Send 1KHz sound signal...
        delay(5);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(5);        // ...for 1sec

        Rphasevoltage = 4.5;
        Yphasevoltage = 4.5;
        Yphasevoltage = 4.5;
     }

             while (Rphasevoltage == Bphasevoltage &&
Rphasevoltage >= 4.5)
     {
        Serial.println("LLG Fault in RB Phase");
        lcd.setCursor(0, 1);
        lcd.print("LLG RB Phase");
        tone(buzzer, 50); // Send 1KHz sound signal...
        delay(50);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(50);        // ...for 1sec
        Bphasevoltage == 5;
```

```
        Bphasevoltage == 5;


    }

            while (Bphasevoltage == Yphasevoltage &&
Yphasevoltage >= 4.5)
    {
        Serial.println("LLG Fault in YB Phase");
        lcd.setCursor(0, 1);
        lcd.print("LLG YB Phase");
        tone(buzzer, 50); // Send 1KHz sound signal...
        delay(50);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(50);        // ...for 1sec
        Bphasevoltage == 5;
        Yphasevoltage == 5;
    }

        Serial.println("LG Fault in B Phase");
        lcd.setCursor(0, 1);
        lcd.print("LG Fault B Phase");
        tone(buzzer, 100); // Send 1KHz sound signal...
        delay(100);        // ...for 1 sec
        noTone(buzzer);    // Stop sound...
        delay(100);        // ...for 1sec
        Bphasevoltage == 5;

    }

}
```

End of the Program.

VII. SIMULATION OF CIRCUIT IN PROTEUS
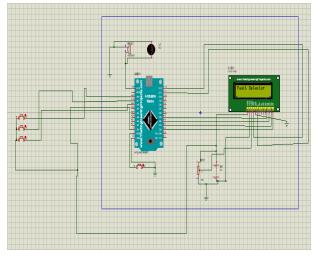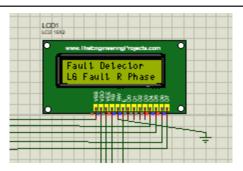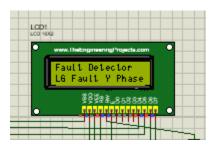
Fig.6: Testing Circuit of the Main Project in Simulation Software
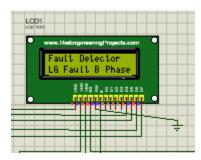
The circuit of the fault detector is being simulated first in the software i.e. proteus 8 and results are produced by it wic will be shown in the next paragraph in this paper.

VIII. RESULT

After the simulation of the project we found that the code was properly working and the display was correctly displaying the faults on it.

LLL Fault

LLG Fault on R & Y Phase

LLG Fault on R & B Phase

LLG Fault on B & Y Phase

LG Fault on R Phase

LG Fault on Y Phase

LG Fault on B Phase

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[09] Fig 1,3,4,5 from Circuit Globe

[10] Fig 2 from ElProCus

Author Index

Department of Computer Science and Engineering
AMRITSAR GROUP OF COLLEGES, AMRITSAR
12 Km Stone, Amritsar-Jalandhar G.T. Road
Amritsar, Punjab 143001