Declaration

Metric 3.3.2

I declare that all the data, reports and other information enclosed in the criteria are authentic to the best of my knowledge.

Criteria In-charge

Dr. Goutam Varma

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NATIONAL CONFERENCE
ON
RECENT TRENDS IN TECHNOLOGY & MANAGEMENT

NRTTM - 2023

25th March 2023

Conference Proceeding

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Acknowledgements'

We Received Academician , Researchers and Industry Peoples from The National Conference On "Recent Trend in Technology & Management (NRTTM-2023)"

The Main Object of NRTTM is to highlight the ever increasing and critical needs to encourage innovative Engineering and Management solution for the society need.

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Chairman's Message

Anoop Mishra
Chairman, SVGI

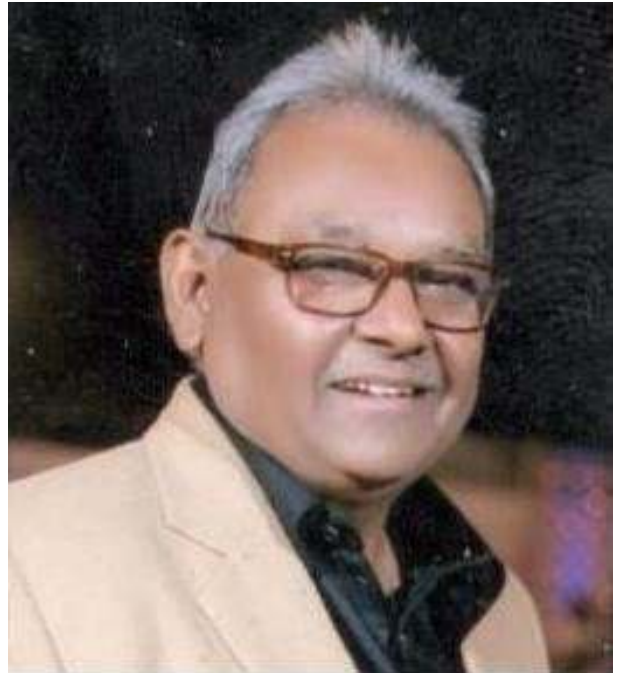I am glad to know that Faculty of Swami Vivekanand College of Engineering is going to organize National Conference on "Recent Trends in Technology & Management" (NRTTM-2023) on 25th March 2023.

Such conferences are organized to dispense latent and innovative ideas, extremely helpful for the researchers and scholars in the field of academics and industry to be successful in their research-oriented endeavors. I am heartily thankful to the organizing committee of the conference. I extend my heartiest wishes for the grand success of the conference.

I appreciate all the participants for showing a keen interest in making it a successful Conference and contributing new ideas and research findings. I wish them for their endeavors to spread knowledge.

With Best Wishes

"Swami Vivekanand Group of Institutions"

Mr. Anoop Mishra

Director's Message
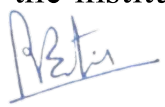
It is a matter of great pleasure for me to welcome you all to the National Conference on "Recent Trends in Technology and Management" (NRTTM-2023) organized by Faculty of Swami Vivekanand College of Engineering, on March 25, 2023.

New technologies that are being developed are making life easier, more sophisticated, and better for everyone. Today, technology is developing at an almost exponential rate. New technology assists businesses in lowering costs, improving customer experiences, and boosting profitability. Also, this conference will assist us in learning about current management and technical trends.

I would like to express my personal gratitude to all guests, participants and researchers, for their continued support, as well as to our students, faculty and staff, whose work and dedication have provided significant contributions to the institutes continuing growth and success.

With Best Wishes

"Swami Vivekanand Group of Institutions"

Mr. Sachin Mishra

Principal's Message

Success comes to those who work hard and stays with those who don't rest on past laurels. Education is a multi-stage process of building character, acquiring knowledge and improving skills for life-long learning to lead a happy and peaceful life.

 SVCE started its journey in the year 2004 with the aim of providing education to students and empowering them so that they can be financially independent, socially conscious, morally upright and emotionally balanced.

We provide high-end undergraduate   education and research opportunities in new frontiers of Engineering and Technology with special focus towards Leadership & Innovation. Students are provided with opportunities for interaction with the experts from the Industry through Guest Lectures, Industrial Visits, Vocational Training (internships), student chapters of International Professional bodies, sponsored projects etc. To align with the curricula, we have excellent faculty, state-of- the-art infrastructure and laboratories. Spacious green campus, good library and peaceful atmosphere ensure that learning becomes a wonderful experience.

I would warmly welcome you to come and visit to experience for yourself all that Swami Vivekanand College of Engineering, Indore.

Dr. Pradeep Kumar Patil

About Institute

Swami Vivekanand College of Engineering came in to being existance in the year 2004 under the auspices of Swami Vivekanand Takniki Sansthan, Indore, to fulfill the demand of an ideal technical institution. Institution aspires to develop itself into a model technical institution of repute under the guidance of ateam of experienced and dedicated academicians.

As a technical and professional college it is duly approved by the Govt. of Madhya Pradesh and A.I.C.T.E., New Delhi. It is affiliated to R.G.P.V Bhopal & DAVV Indore. The college runs B.Tech. courses in Civil Engg., Mechanical Engg.. Computer Science Engg., Electronics & Communication Engg., Information Technology and Electrical & Electronics Engg. The Institute runs P.G. programs in ME,EC,MBA,CSE and EE. The college is spread over 25 acres of land, bestowed upon with a beautiful natural surrounding and an eco friendly atmosphere conducive to all activities of a technical & professional institution.

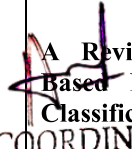# National Conference on Recent Trends in Technology & Management
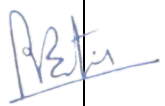
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Artificial Intelligence and Robotics

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ABSTRACT

Robotics is that field concerned with the connection of perception to action. Artificial Intelligence must have a central role in Robotics if the connection is to be intelligent. Artificial Intelligence addresses the crucial questions of: what knowledge is required in any aspect of thinking; how that knowledge should be represented; and how that knowledge should be used Robotics challenges AI by forcing it to deal with real objects in the real world. Techniques and representations developed for purely cognitive problems, often in toy domains, do not necessarily extend to meet the challenge.

Robots combine mechanical effectors, sensors, and computers. AI has made significant contributions to each component. We review AI contributions to perception and object oriented reasoning. Object-oriented reasoning includes reasoning about space, path-planning, uncertainty, fitting, and friction. We concluded with three examples that illustrate the kinds of reasoning or problem solving abilities we would like to endow robots with.

I. INTRODUCTION

Artificial Intelligence and Robotics have a common root and a (relatively) long history of interaction and scientific discussion. The birth of Artificial Intelligence and Robotics takes place in the same period (1950), and initially there was no clear distinction between the two disciplines. The reason is that the notion of **"intelligent machine"** naturally leads to robots and Robotics. One might argue that not every machine is a robot, and certainly Artificial Intelligence is concerned also with virtual agents (i.e. agents that are not embodied in a physical machine). On the other hand, many of the technical problems and solutions that are needed in order to design robots are not dealt with by Artificial Intelligence research. A clear separation between the fields can be seen in the '70, when Robotics becomes more focused on industrial automation, while Artificial Intelligence uses robots to demonstrate that machines can act also in everyday environments.

A clear separation between the fields can be seen in the 1970, when Robotics becomes more focused on industrial automation, while Artificial Intelligence uses robots to demonstrate that machines can act also in everyday environments.

Summarizing, the borderline between the work in Artificial Intelligent and Robotics is certainly very difficult to establish; however, the problems to be addressed in order

to build intelligent robots are clearly identified by the research community, and the development of robots is again viewed as a prototypical case of AI system. Following the title of the paper we shall refer to this body of research as AI Robotics.

We conclude this brief introduction with a disclaimer: the views presented in the paper are those of AI research, that use robots as a preferred model of intelligent agent and there is no attempt to provide a comprehensive survey. In the recent years, Robotics researchers have also tackled some of the issues that are dealt with in the present paper, but the view of Robotics research towards Artificial Intelligence may not be properly reflected in the paper. The paper is organized as follows. In the next section we address the major scientific issues in the field. Then we look at the connections and relationships with other topics addressed in this collection, and with other disciplines.
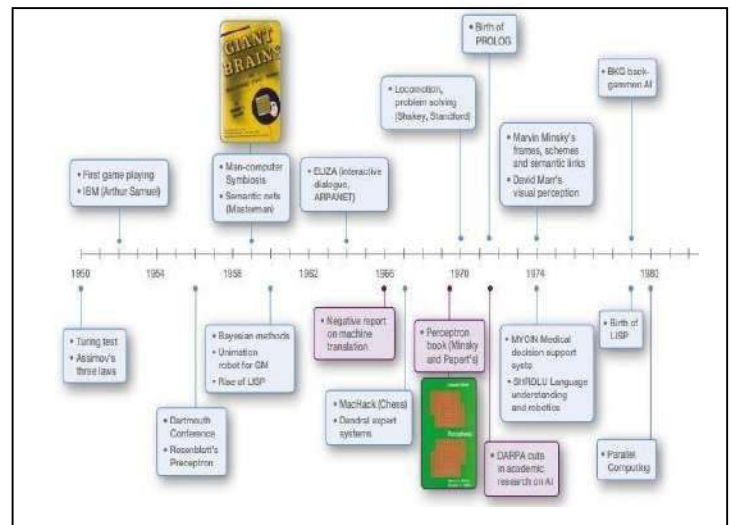
II. RESEARCH ISSUES

In this section we analyse the recent work which can be characterised as AI Robotics, by arranging it into the two basic issues in robot design: Action and Perception.

A. Action

While there is nowadays a general agreement on the basic structure of the autonomous agent/robot, the question of how this structure can be implemented has been subject to a long debate and is still under investigation. Agents and, specifically, robots, usually present various kinds of sensing and acting devices. The flow of data from the sensors to the actuators is processed by several different modules and the description of the interaction among these modules defines the agents architecture. The first, purely deliberative, architectures [12,22] view the robot as an agent embedding a

high-level representation of the environment and of the actions that it can perform. Perceptual data are interpreted for creating a model of the world, a planner generates the actions to be performed, and the execution module takes care of executing these plans. In practice a sense-plan-act cycle is repeatedly executed. The problem is that building a high-level world model and generating a plan are time consuming activities and thus these systems have shown to be inadequate for agents embedded in dynamic worlds. Reactive architectures focus on the basic functionalities of the robot, such as navigation or sensor interpretation, and propose a direct connection between stimuli and response. Brooks's subsumption architecture [4] is composed by levels of competence containing a class of task oriented behaviours. Each level is in charge of accomplishing a specific task (such as obstacle avoidance, wandering, etc.) and the perceptual data are interpreted only for that specific task. Reactive architectures, while suitably addressing the dynamics of the environment, do not generally allow the designer to consider general aspects of perception (not related to a specific behaviour), and to identify complex situations. In fact, the use of a symbolic high level language is not possible, since it would necessarily require building a world model, and thus reasoning is usually compiled into the structures of the executing program. The lack of previsions about the future limits these systems in terms of efficiency and goal achievement.

The above considerations led to a renewed effort to combine a logic-based view of the robot as an intelligent agent, with its reactive functionalities. To this end a new research field is developing in the last years:

Cognitive Robotics. The most recent view of cognitive robots, that has been accepted, for example in the EU framework, certainly keeps the original goal of embedding a reasoning agent into a real robot, but also takes a more general perspective, by looking at the perception/action cycle in a broader sense, in bio-inspired systems, as well as in the work on recognition and generation of emotional behaviours. Cognitive Robotics aims at designing and realizing actual agents (in particular mobile robots) that are able to accomplish complex tasks in real, and hence dynamic, unpredictable and incompletely known environments, without human assistance. Cognitive robots can be controlled at a high level, by providing them with a description of the world and expressing the tasks to be performed in the form of goals to be achieved. The characterizing feature of a cognitive robot is the presence of cognitive capabilities for reasoning about the information sensed from the environment and about the actions it can perform. The design and realization of cognitive robots has been addressed from different perspectives, that can be classified into two groups: *action theories and system architectures.*

The characterizing feature of a cognitive robot is the presence of cognitive capabilities for reasoning about the information sensed from the environment and about the actions it can perform. The design and realization of cognitive robots has been addressed from different perspectives, that can be classified into two groups: action theories and system architectures.

Action theories A number of theories of actions have been developed in order to represent the agent's knowledge. They are characterized by the expressive power, that is the ability of representing complex situations, by the deductive

services allowed, and by the implementation of automatic reasoning procedures. Several formalisms have been investigated starting from Reiter's Situation Calculus [27, 13]: A-Languages (e.g., [14]), Dynamic Logics (e.g., [11]), Fluent and Event Calculi (e.g., [8]).

Architectures There are many features that are considered important in the design of agents' architectures and each proposal describes a solution that provides for some of these features. Approaches to architectures that try to combine symbolic and reactive reasoning are presented for example in [1,26] also called *Hybrid Architectures*. We can roughly describe a layered hybrid architecture of an agent with two levels: the deliberative level, in which a high-level state of the agent is maintained and decisions on which actions are to be performed are taken, and the operative level, in which conditions on the world are verified and actions are actually executed. The embodied intelligence approach generalizes Brooks's ideas (see e.g., [32], [25]). The robot is a real physical agent tightly interacting with the environment and the robot behaviour is generated not by the robot controller alone, but it emerges by means of the interactions between the robot with its body and the environment. Other contributions to the realization of robot architectures come from evolutionary computing, where evolutionary robotics is a research field aiming at developing robots through evolutionary processes inspired by biological systems [23]. For example, neuro-fuzzy systems have been successfully used in the design of robot architectures.
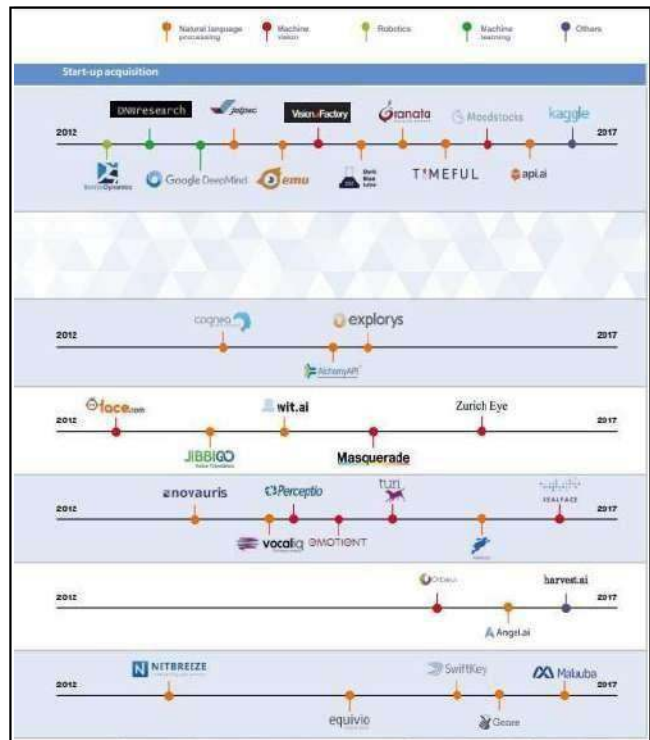
B. Perception

Robot perception is a prominent research field in AI and Robotics. Current robotic systems have been limited by visual perception systems. In fact, robots have to use other kinds of sensors such as laser range finder, sonar, and so on in order to bypass the difficulties of vision in dynamic and unstructured environments.

A robotic agent acting in the real world has to deal with rich and unstructured environments that are populated by moving and interacting objects, by other agents (either robots or people), and so on. To appropriately move and act, a robot must be able to understand the perceptions of the environment. Understanding, from an AI perspective, involves the generation of a high-level, declarative description of the perceived world. Developing such a description requires both bottom-up, data driven processes that associate symbolic knowledge representation structures with the data coming out of a vision system, and top-down processes in which high-level, symbolic information is employed to drive and further refine the interpretation of the scene.

To accomplish its tasks, a robot must be endowed with selective reasoning capabilities, in order to interpret, classify, track and anticipate the behavior of the surrounding objects and agents. Such capabilities require rich inner representations of the environment firmly anchored to the input signals coming from the sensors. In other words, the meaning of the symbols of

the robot reasoning system must be anchored in sensorimotor mechanisms.

A related system [6] is based on three level of representations: the subconceptual, the conceptual and the symbolic level. In particular, the main assumption is that an intermediate representation level is missing between the two classes of representations mentioned above. In order to fill this gap, the notion of conceptual space is adopted, a representation where information is characterized in terms of a metric space. A conceptual space acts as an intermediate representation between subconceptual (i.e., not yet conceptually categorized) information, and symbolically organized knowledge.

III. INTERACTION WITH OTHER AI FIELDS

Machine Learning : Learning approaches are being applied to many problems arising in the design of robots. According to the structure adopted above, both action and perception can be supported by learning approaches. Moreover, several approaches that include a training step are pursued ranging from machine learning approaches to genetic programming, and neural networks.

From the standpoint of action, learning approaches can be used for the basic action skills, specifically locomotion, but also learning cooperative behaviours, adaptation to the environment, and learning opponents' behavior, among others.

Edutainment : Toy robots are very promising to be used both for research purposes and for education, because of low costs and high attraction for students. Even though, at this moment, the available educational kits seem to provide too limited capabilities, toy robots are certainly an interesting

commercial market. Consequently, the design of intelligent toy robots is an interesting opportunity for AI researchers.

The experience with Aibo robots [33] shows this potential: they have been successfully used by many research groups in the world not only in the RoboCup competitions (Four-Legged League), but also for demonstrating other AI and Robotics research issues.
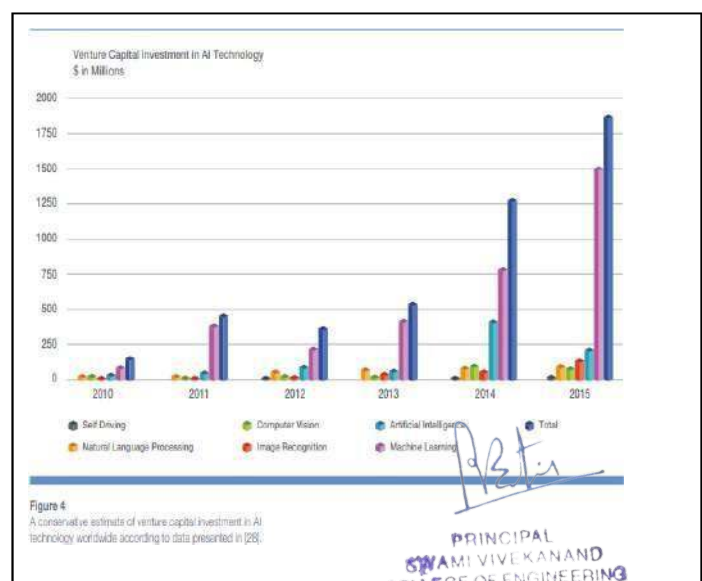
Multi agent systems : A multi-robot system (MRS) can be considered as a multi-agent system (MAS), but the techniques for achieving coordination and cooperation in MAS are often not well suited to deal with the uncertainty and model incompleteness that are typical of Robotics.
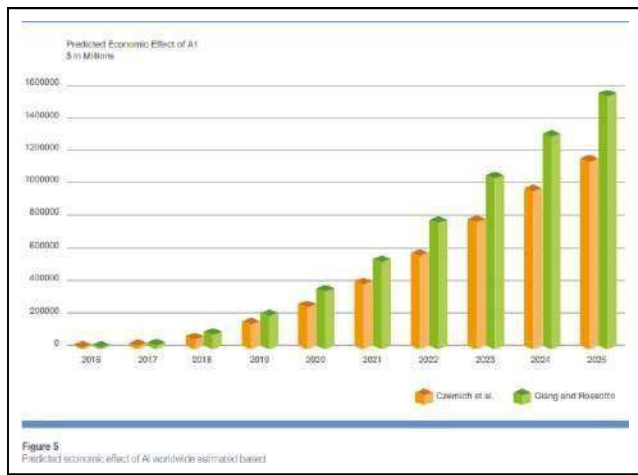
Multiple robots may achieve more robust and more effective behavior by accomplishing coordinated tasks that are not possible for single robots. Groups of homogeneous and heterogeneous robots have a great potential for application in complex domains that may require the intelligent use and merge of diverse capabilities. The design, implementation, and evaluation of robots organized as teams pose a variety of scientific and technical challenges.

Natural Language Processing : It is an obvious requirement of home and service robotics the ability to interact with people in natural language; therefore, natural language processing techniques find an interesting application domain on robots.

Evolutionary Computation and Genetic Programming : Evolutionary Robotics is a new approach that looks at robots as autonomous artificial organisms that develop their own skills in close interaction with the environment without human intervention. Evolutionary robotics thus applies techniques coming from evolutionary computation.

Edge computing in robots is defined as a service provider of robot integration, testing, design and simulation. Edge computing in robotics provides better data management, lower connectivity cost, better security practices, more reliable and uninterrupted connection.

Figure 4
A conservative estimate of venture capital investment in AI technology worldwide according to data presented in [28].

Figure 5
Predicted economic effect of AI worldwide estimated based

IV. INTERACTION WITH OTHER DISCIPLINES

Robotics is a multidisciplinary field: to make an operational robot, several contributions from many disciplines are needed: physics, electrical engineering, electronic engineering, mechanical engineering, computer science, AI, and so on.

It is therefore difficult also to have a common background of terms, notations and methodologies. In this sense, the efforts to define a common ontology of terms for a robotics science [15] are noteworthy.

In particular, AI Robotics interacts with several research disciplines outside AI.

Industrial Robotics : Many contact points may be found between AI, Robotics and Industrial Robotics. In early days there were not clear and cut distinctions between the two fields, as already mentioned. Today, research in Industrial Robotics is oriented towards the safe and intelligent control of industrial manipulators and in the field of service robotics. The methodologies in Industrial Robotics are grounded in Automatic Control Theory [30].

The relationship between the robot and the environment is generally modelled by means of several types of feedback systems. Moreover, methodologies are typically based on numerical methods and optimization theory.

Computer Vision : Robot Vision is specific with respect to computer vision, because Robot Vision is intrinsically active, in the sense that the robot may actively find its information sources and it can also reach the best view position to maximize the visual information.

Moreover, Robot Vision must be performed in real-time, because the robot must immediately react to visual stimuli. In general, the robot cannot process for a long time the same image because the environmental conditions may vary, so the robot has to deal with approximate, but just in time information.

Mechatronics: Mechatronics encompasses competencies from electrical engineering, electronic engineering, mechanical engineering. All of these competencies are strictly related to AI and Robotics. The research field of electrical engineering concerns motors and actuators, while

electronic engineering mainly concerns boards for robot control, for data acquisition and in general for the hardware that makes the robot operational. Mechanical engineering concerns of course the mechanical apparatus of the robot itself. From this point of view, Mechatronics, AI and Robotics have tight relations: Mechatronics mainly focuses on the robot hardware at all levels, while AI and Robotics take care of the software that makes the robot operative and autonomous.

Human Robot Interface : The field of Human Robot Interface (HRI) is related to the interaction modalities between the user and the robot. This field may be subdivided into two subfields: the cognitive HRI (cHRI) and the physical HRI (pHRI) [2].

Cognitive HRI analyzes the flow of information between the user and the robot and it mainly focuses on interaction modalities, which may span from textual interfaces to voice and gestures. The interface may be more or less intelligent in the sense that the robot may be constrained by a fixed set of commands or it may interpret a string written in natural language or a sequence of gestures performed by the operator.

The interface may also be adaptive in the sense that the robot may adapt to the operator through a suitable training phase. Physical HRI instead concerns the design of intrinsically safe robots. The main idea is to interpose compliant elements between motors and moving parts of the robot in order to prevent damages in case of impact, and without performance loss.

V. APPLICATIONS

Robotnik is that work to bridge this gap and bring profiles together, so that SMEs can involved in several R&D projects related to robotics and Artificial Intelligence also benefit from this technology, without the need to have specialised personnel on staff. For instance, **INMERBOT**, a project that combines AI and multi-robotic systems for inspection and maintenance applications in immersive environments.

Robotics in defence sectors: The defence sector is undoubtedly the one of the main parts of any country. Each country wants their defence system to be strong. Robots help to approach inaccessible and dangerous zone during war. DRDO has developed a robot named **Daksh** to destroy life-threatening objects safely. They help soldiers to remain safe and deployed by the military in combat scenarios. Besides combat support, robots are also deployed in *anti-submarine operations, fire support, battle damage management, strike missions, and laying machines.*

Robotics in Medical sectors: Robots also help in various medical fields such as laparoscopy, neurosurgery, orthopaedic surgery, disinfecting rooms, dispensing medication, and various other medical domains.

Robotics in Entertainment: Over the last decade, use of robots is continuously getting increased in entertainment areas. Robots are being employed in entertainment sector, such as movies, animation, games and cartoons. Robots are very helpful where repetitive actions are required. A camera-wielding robot helps shoot a movie scene as many times as needed without getting tired and frustrated. A big- name **Disney** has launched hundreds of robots for the film industry.

Robots in the mining industry: Robotics is very helpful for various mining applications such as robotic dozing, excavation and haulage, robotic mapping & surveying, robotic drilling and explosive handling, etc. A mining robot can solely navigate flooded passages and use cameras and other sensors to detect valuable minerals.

CONCLUSION

"Since 2000, a third renaissance of the connectionism paradigm arrived with the dawn of Big Data, propelled by the rapid adoption of the internet and mobile communication."

Programming languages played a major role in the evolution of AI. Driven by the necessity of translating AI into commercial products, hybrid languages are emerging, which combine the best from all paradigms without compromising speed, capacity and concurrency.

Machine vision integrates image capture and analysis with machine learning to provide automatic inspection, scene recognition and robot navigation. Scene reconstruction along with object detection and recognition are the main sub-domains of machine vision.

The development of AI is closely coupled with our pursuit of understanding the human brain. A long-term goal of computational neuroscience is to emulate the brain by mimicking the causal dynamics of its internal functions so that the models relate to the brain function.

There are many lessons that can be learnt from the past successes and failures of AI. To sustain the progress of AI, a rational and harmonic interaction is required between application specific projects and visionary research ideas. Along with the unprecedented enthusiasm of AI, there are also fears about the impact of the technology on our society. A clear strategy is required to consider the associated ethical and legal challenges to ensure that the society as a whole will benefit from the evolution of AI and its potential adverse effects are mitigated from early on. Such fears should not hinder the progress of AI but motivate the development of a systematic framework on which future AI will flourish. Most critical of all, it is important to understand science fiction from practical reality. With sustained funding and

responsible investment, AI is set to transform the future of our society - our life, our living environment and our economy.

Robotics and AI are playing an increasingly important role in any country's economy and its future growth. We need to be open and fully prepared for the changes that they bring to our society and their impact on the workforce structure and a shift in the skills base. Stronger national level engagement is essential to ensure the general public has a clear and factual view of the current and future development of robotics and AI.

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Approach to Optimize Authorship Verification in Online Social Networks Using LSTM Deep Neural Network

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Abstract

Due to the proliferation of web-based applications and the growth in the amount of data created and stored, the World Wide Web now contains an unprecedentedwealthofinformationforitsusers.TheInternethasevolvedintoaglobalforumforthefreeflowofinformation,knowledge,andideas.Theuseofsocialnetworking siteslikeTwitter,Facebook,andGoogle+continuestoriserapidlysincetheyenableuserstoexchangeopinionsonissues,talkwithothergroups orpostmessagesworldwide.TheexpandedusageofOnlineSocialNetwork(OSN)hasbecomenecessarytoappeartogrowofAuthorshipVerification(AV),OSNistheenviron mentin which users can connect with other users to discuss ideas of any topics then expansion data and information. AV considered as a resource of researches and information in different ways, as is the case Sentiment Analysis (SA). This approach is contrasted to a prior extraction of features and teaching technique that wasineffectiveinproducingimprovedresultsusingtheTweetsAPIdataset.Twitterisaprominent online community where users publish and respond to short messages known as "tweets," the new model will be able to provide a higher degree of accuracy. In this study, we introduced the Long Short-Term Memory (LSTM) deep neural network technique. What this model entails was tested on a Twitter-based dataset, and it produced improved results with an accuracy of 98.65, precision of98.74, andF1-score of98.76.

Keywords: Optimization, Authorship verification, Sentiment analysis, Neural network, dataset ,etc.

I. Introduction

Many other attractive and user-friendly facilities have been established in recent years and the people are participating extensively & increasingly inmultiple internet exercises, such as publishing so many kinds of content (blogging, writing reviews etc), as well as having various types of interactionsand relationships. The enormous quantity of information thus produced by individuals has never been accessible before and is very useful from variousperspectives. An excellent phenomenon that has significantly affected this broad involvement and comprises a major part of the information produced istheSNSs(SocialNetworkSites).Perhapsinthehistorytoresearchtherelationships,behaviours,interactionaswellascharacteristicsofcertainpeople'sgroups, there was a need to produce a considerable effort, not to acquire very extensive data about them but to get the distributed information m in thenewsituationandalsowiththeemergenceofsocialnetworksandalsothevastnumberofactivitiesthatareloggedbytheirusers.OnlineSocialNetworks(OSNs) are the most common way to share information across the globe. Social networks are the focus of many services as well as integrate a variety ofnew information and communication capabilities in the community of users. A social network is best seen as a visual structure with nodes and bordersrepresenting the users and their interactions. According on the topology of the network utilised, nodes & edges may be labelled or unlabeled on a   socialnetworkstructure.DuetothepopularityofsocialintelligencewebsitessuchasFacebook,YouTube,Twitter,LinkedIn,Pinterest,Googl   e+,TumblerandInsta gram have become a favourite medium for technology and social exchange among various users including consumers and organizations. Socialnetworkmembersplayacrucialroleandarefullyresponsiblefortheinformationsharedinthenetworks.Consumerswil lexchangeinformati   onthroughwebsit   es, movies and files that are relevant. People disclose sensitive material via the establishment of tremendous faith and others have the same trustin the given information. The rapid repute of social networks online and availability of large quantities of data make it an easy goal for the adversaries.Social media feature extraction is a general term for methods of building variables from the communication graph expressing the location and value ofindividual nodes concerning others. The extraction feature is the transformation into a numerical function, which is used for the automatic training ofarbitrarydataincludingtextandimages.It represents an effectivecompactfunction forinterestingsections ofanimage

II. ReviewofLiterature

Today's social network is an emerging field of science. For data collection and production of knowledge, the volume of data transmitted by OSN in theform of text and pictures is enormous. There are many methods, including machine learning, for social network research. A range of observingcharacteristics is derived from user knowledge by machine learning algorithms. ML applications in the area of SN research involve spammer detection,userrecognition,connectionestimation,trollpagedetection,friendlyfeedback,identificationofthepopulationorcluster,patternanalysis,politicalblog

opinion analysis, and so on. The development of the ML technique has attracted significant attention for different purposes both from industry andresearchcommunities**M.L.Brocardo(2013)**Inthisstudytheypresentasupervisedlearningmethod,coupledwiththeanalysisofn-gramforauthorshipauthentication in short texts, to make some steps to achieve this objective. An analytical assessment based on the Enron email dataset including 87 usersgives extremely successful findings comprised of a 14.35% Equal Error Rate (EER) for 500 character message blocks. **A. A. Azeta et al. (2014)** thepurpose of this article is to offer a social media educational system anti-cultism accessible via three modes: web, mobile and voice. The technologysupports on-campus study and engagement and also helps students to prevent cultism on campus via the filtering of social media terms linked to cultureor crime. Relevant research techniques and implementing tools were used in the execution of this project. The initiative provides a multimodal platformtopromoteandstimulateactiveinvolvementbystudentsintheeducationalsystem. **D.Trångetal.(2015)**Introducesadifferenttechniqueforevaluatingthe effectiveness of social media detection techniques. In brief, dual artificially "hijacked accounts" are created by choosing two true consumer accountsby random & changing the residual messages after a number of consecutive messages. This enables us to generate huge quantities of preparing orpotentially test information, which isn't straightforward for this issue. What's more, the method made is utilized to dissect the nature of a changedadaptation of the current COMPA framework. **B. Boenninghoff et al. (2019)**In this study, we suggest a novel topology for similarity learning in theneuralnetworkthatimprovestheeffectivenessoftheverificationtaskbyusingsuchdifficultdatasets.Therehavebeenaseriesofsuccessfultechnologicalmethods forthisjob;manyofthemarebasedonconventionallinguisticcharacteristicssuchasn-grams.Thesealgorithmsprovideoutstandingresultsforcertain kinds of textual materials such as books &novels. Nonetheless, verification of forensic authorship for social media is considerably more difficultsince messages tend to be very brief with several genres and subjects. Traditional techniques based on characteristics such as n-grams have littleeffectivenessatthistime.**M.Liangetal.(2020)**thispaperpresentsanewend-to-endsemantinecorrelationlearningmodelbasedonadeephashnetworkand semantical expansion for cross-media social network search (DHNS). The method integrates deep network learning with hash code approximationfor data sources into a types of buildings for optimising data that successfully maintains intra-mediated similarities and intermediate correlations,minimising the loss of cross-media correlation as well as the loss of binary hash approximation. Moreover, their method increases the semanticizedconnectionbycreatingthegraphoftheimage-wordlink,andbyminingthepossiblesemanticizedrelationshipbetweenimagesandwordsandbygettingsemantic integration based on both a deep internal as well as an external depth of knowledge. Findings further suggest that DHNS delivers improvedcross-mediabenchmarkingdetectionefficiency.

III. ResearchMethodology

Intheproposedmethodology,thedataiscollectedfromTwitterAPI.Inpreviousworkvariousmachinelearningalgorithmswereappliedinwhichfeatureextraction techniques were also applied, but due to some limitations in these techniques the result achieved Were not upto the mark, therefore a newtechniqueofwordembeddinghasbeenintroducedfollowedbyNgramwhichisfurtherclassifiedusingclassificationmodelLSTM.LSTMrevolutionisedthe two areas of ML & neurocomputing. The extraction stage consists of two steps: first, choose the best characteristics, and then extract the n-gramdepending on the chosen features. Selecting excellent features seeks to enhance the quality of n-gram extraction and decrease the computer complexityandnoise.

Preprocessing

Pre-processing is the overall term for all the transformation of the data, including centering, normalization, rotation, shifting, shear, etc., before beingtransformedintothemodel.In preprocessing,thedatahasbeencleanedbyremovingpunctuations,hashtagandemojissoastoobtainthetext only.

Featureextraction

MLalgorithmslearnofapredefinedsetoftrainingsdatacharacteristicstogeneratetestdataoutput.Butthefundamentalissuewithlanguageprocessingis that ML algorithms cannot operate directly on the raw text. We require certain methods of extraction to transform text into a matrix (or vector) ofcharacteristics. FE is a kind of reduction in dimensionality where a high number of picture pixels are successfully shown so that interesting imagecomponentsareeffectivelyrecorded.Someofthemostcommonextractiontechniquesinclude:

Natural language processing (NLP): It is an area of languages, computer science, & AI which focuses on computer-human language interactions, inparticularly on how computers are programmed for the processing and analysis of vast quantities of natural language data. The outcome is a computerableto"understand"thecontentsoftexts,suchasthelanguage'scontextualcomplexities.Thesystemcancorrectlyextractinformatio nandinsightsfromth epapers,classifyandarrangethedocumentsthemselves.

Therefore, by analyzing **N-grams** (mainly bigrams) we may solve this issue instead of individual words (i.e. unigrams). This may maintain local wordordering. If we take into consideration all possible bigrams in the reviews provided, we can always eliminate **N-grams** with high frequency, since theyarepresentinnearlyalltexts.Thesehigh-frequencyN-gramsareusuallyreferredtoasarticles,determiners, etc.

Word embedding is one of the vector space models representing information. Word embedding retains contexts & word connections so that relatedwords are more correctly detected. **Word embedding** includes a number of different implementations like **word2vec**, GloVe, FastText and so on.Word2vec is one of the most common word embedding implementations that Google developed in 2013. It discusses word embeddi ng using two-layer shallow NNs to detect contextual significance. **Word2vec** is excellent at grouping related words and generating very precise estimates about thesignificanceofwords basedonprevious.

LongShort-TermMemory(LSTM)

LSTM networks are a kind of RNN that may be dependent on order in sequence issues. LSTMs are a complicated field of deep learning. It may bedifficulttounderstandwhatLSTMsareandhowbidirectionalandsequence-to-sequenceterminologyconnecttothearea.LSTMhasbeenusedprimarilyto represent long-term connections. The GRU is given in this section as a modification of the LSTM cell before additional LSTM network designs aredescribed. GRU was designing time series in order to provide a method to enhance the capacity to prevent long-term dependency by improving short-terminformationintegration.

LSTM cell can add or remove cell state information by using various gates within cell. Gates allows data to enter cell state or prevents it from accessingthecellstatewiththeaidofthemultiplicationand sigmoidNNlayer.

A sigmoid layer generates a no. among 0 & 1 that determines how much information is to be allowed through gate. Output value near 0 would not letsomethingthroughgate,whileinformation isallowedbyavaluecloseto1.

ProposedAlgorithm

Step1.CollectingthedatasetusingTwitterAPI,and separatingitintrainandtestcsvmanually.

Step2.PerformEDAonthedataset,analyzethedatasetthenfiningthedatasetbyremovepunctuation,hashtags,emojisetc..,thenagainvisualize thedata.

Step 3. Extracting features like, Syntactic Features and semantic

features.Step 4.Mergingthefeatureanditintoa onefeaturepack.

Step 5. Building an LSTM-based model for the verification task and feeding it a training dataset. Give it some time to learn how to

behave.Step 6.Evaluatethemodel's efficacybyputtingittouseon thetestdata whentrainingiscomplete.
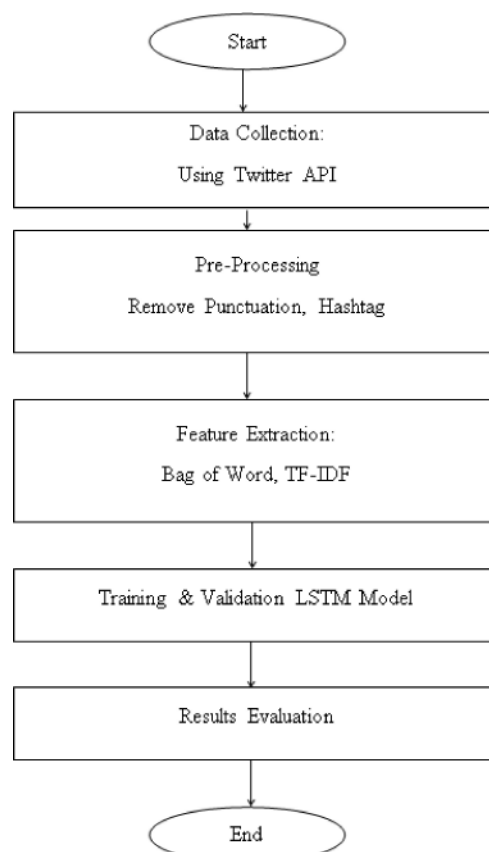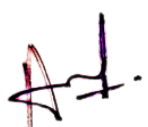
ProposedFlowchart

Figure1:FlowChartofproposedMethodology

IV. ResultandDiscussion

DatasetDescription

The proposed methodology in this research has been implemented in python 3.0 using Tweets API dataset. Twitter has separated itself as an immediatecorrespondence medium to an extremely huge crowd. Tweets are exact and pass on the message in a smart way and this has prompted Twitter turningout to be famous that it is presently impacting worldwide scenes. In this post, we will examine the solid sources to procure free Twitter datasets. Twitterinformational indexes can be adequately used in the space of scholarly examination, social undertakings, and concentrating on advertising strategies. Ihave gathered files of different free Twitter datasets collected from different sources which can be exceptionally compelling for somebody searching fora solidwellspringofTwitterinformationalindexes.

PerformanceParameters

Theresultisevaluatedusingvariousperformanceparameterswhichareaccuracy,precision,recallandF-measure.

TrueNegatives(TN)-Forecastednegativevalues(wheretheactualclassvalueis"no"andthepredictedvalueis"not")arespot-on.Forinstance,ifbothactual and predicted classes indicate that the passenger in question has perished, you know that the worst case scenario has indeed come to pass. Whentheactualclassappears,thepredictedclass,afalsepositive,and afalsenegativealltakeonanegativetone.

True Positives (TP) -Both the actual class value and the anticipated class value are accurate. Consider the distinction between predicted class value,whichstatesthat"Thispassengerislikelytobetheexactonenexttime,"andclassvalue, whichstatesthat"hassurvivedtheabovepassenger."

False Negatives (FN) –Forecasted class is false, whereas real class is true. In other words, depending on how valuable each passenger class is, we maybeabletodeterminewhetherornotpassengers havesurvived.

False Positives (FP) –When the actual class is "No" but the anticipated class is "Yes," In other words, if the class prediction indicates that a passengerwilllivebuttheclassrealindicatesthattheyhavenot,thenthepassengerhas actuallypassedaway.

Accuracy-Itisasimpleaccuracyindicatorthatisdirectlyrelatedtothetotalnumberofmeasurements.Duetothenearlyequalnumberoff alsenegativesand falsepositives in symmetricaldatasets,theyprovidebetterstatisticalprecision.

Accuracy=TP+TN/TP+FP+FN+TN

Precision-Theaccuracyofapredictionismeasuredasapercentageofcorrectpositiveobservationsrelativetothetotalnumberofpositiveobservationsex pected.

Precision=TP/TP+FP

Recall (Sensitivity)-Yes, it is the proportion of expected favourable comments relative to all positive comments made during

class.Recall=TP/TP+FN

F1score- Itisrecall&precisionweightedaverage.Thisscorethereforetakesintoaccountbothfalsenegatives&falsepositives.F1

Score=2*(Recall*Precision)/ (Recall+Precision)

Table5.1andfigure5.1representthecomparisonvaluesofbaseandproposedresults.TheproposedresultsusedfourparameterslikeAccuracy,Pre cision,RecallandF-Score.Theseparameters formulas givebetterresults comparison toprevious results.

Table1:Tableofexistingmethodologiesmatrices

Algorithms/Results	Accuracy	Precision	Recall	F1Score
SVM	78	68	86	76
LogisticRegression	77	81	81	75
RandomForest	77	64	86	73
XG-Boost	76	59	90	71

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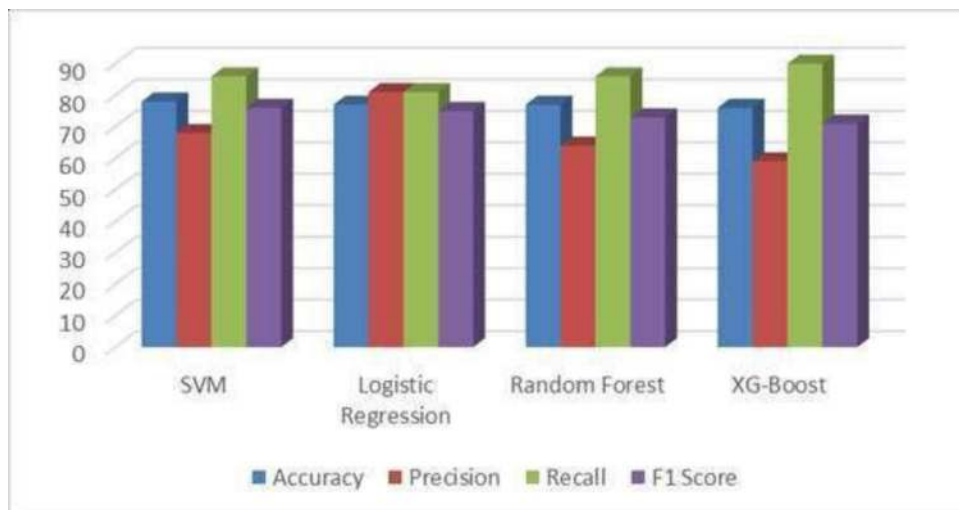
Figure2:Existingmethodologiesmatrices

Table2:ComparisontableofvariousMLalgorithmswithproposedLSTM neuralnetwork

Algorithms/Results	Accuracy	Precision	Recall	F1Score
SVM	78	68	86	76
LogisticRegression	77	81	81	75
RandomForest	77	64	86	73
XG-Boost	76	59	90	71
NovelLSTM	**98.65**	**98.74**	**98.78**	**98.76**

Figure3:ComparisonofvariousMLalgorithmswithproposedLSTMneuralnetwork

IV. Conclusion

AsignificantnumberofInternet-connectedindividualsworldwidecurrentlyusesocialmedia(SM)andsocialnetworkingsites(SNS).Withtheadvantageofnearimmediateconnecti ontopossiblybillionsofotherindividuals,thetemptationmightbetoconnecttosocialmediaaseasilyandasfastaspossible.It is now possible for anybody in the globe to communicate their thoughts and ideas via micro-blogging sites such as Twitter, Facebook, or blogs so on.In this context, a new, human compromised mechanism for the verification of authorship for hacked social media accounts is introduced. Major textualfeatures are extracted from Twitter-based dataset. The above proposed model is constructed in Python 3.0 in which the feature extraction algorithmWord2vec is applied followed by N-gram model. Further LSTM model is applied for classification purpose which was compared by the previous workin which Bagofwordswasusedforfeatureextractionandhadsomelimitations whichwereovercomebynewproposedmodel.

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Heart disease prediction system using data mining and neural networks

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Abstract: Data mining is gaining importance in every field such as e-commerce, marketing, health industry etc. In modern day to day life and tensions human are suffering more from diabetes and heart problems. The health care industry is rich in information but poor in knowledge .Various Data mining techniques are used to predict the disease from the data sets. Data mining is a component of a wider process called knowledge discovery from databases. It involves scientists from a wide range of disciplines such as computer scientists, mathematicians and statisticians, as well as those working in the fields such as machine learning and artificial intelligence, information retrieval and pattern recognition .Before a data set can be mined, it first has to be cleaned which removes errors and ensures consistency and takes missing values into account .By using data mining technique time is reduced in detecting the disease with accuracy

Keywords: - *Data mining, KDD, ANN, cholesterol, obesity, diabetes, blood pressure*

I INTRODUCTION

Heart is a vital organ of human body .A healthy heart is necessary for good health. Now a days due to bad food habits and junk food such as pizzas, burgers etc. and lack of physical exercise human beings are suffering from cholesterol ,blockages and various other diseases such as diabetes which leads to improper functioning of the heart and other organs of the body. In this review paper we discuss the various problems caused by heart disease and efficient prediction and detection of the same so that an individual can take preventive measures time to time and get diagnosis of the disease in time.

There are a number of factors which increase the risk of having a heart disease.

The World Health Organisation (WHO) has surveyed that 12 million deaths that occur throughout the world are due to heart disease. Approximately 17.3 million

people died throughout the world due to heart disease in the year 2008.WHO estimated that by the year 2030, 80% of the deaths worldwide will be due to heart disease. By using various data mining techniques we can predict the disease accurately .An efficient heart disease prediction system can discover and extract hidden knowledge related with heart disease from a historical heart disease database .It can answer complex queries for diagnosing heart disease and thus help the medical practitioners to take accurate decisions and diagnose the disease efficiently.

III LITERATURE REVIEW

Data mining is the nontrivial process of identifying valid, novel, potentially useful and ultimately understandable patterns in data. With the widespread use of database and the explosive growth in their sizes, organizations are faced with the problem of information overload. Data mining techniques support automatic exploration of data.

Data mining attempts to source out patterns and trends in the data and infers rules from these patterns. With these rules the user will be able to support, review and examine decisions in some related business or scientific area. Data mining or knowledge discovery in databases is the non-trivial extraction of implicit, previously unknown and potentially useful information from the data. This includes a number of technical approaches such as clustering, data summarization, classification, finding dependency networks, analyzing changes and detecting anomalies.

Symptoms of heart attack can include:

➢ Uncomfort, pain in the chest, arm or below the breast bone. Fullness, indigestion, heart burn or burning sensation in the chest.
➢ Sweating, vomiting, nausea.
➢ Difficulty in breathing, uneasiness, rapid or irregular heartbeats.

Stages of KDD:-

The stages of KDD, starting with the raw data and finishing with the extracted knowledge are as follows.

*Selection:-*This stage is concerned with selecting or segmenting the data that are relevant to some criteria.

Preprocessing: - It is the data cleaning stage where unnecessary information is removed. When the data is drawn from several sources it is possible that the same information is represented in different sources in different formats. This stage reconfigures the data to ensure a consistent format, as there is a possibility of inconsistent formats.

Transformation: - The data is not merely transferred across, but transformed in order to be suitable for the task of data mining. In this stage the data is made usable and navigable.

*Data mining:-*This stage is concerned with the extraction of patterns from the data.

*Interpretation and evaluation:-*The patterns obtained in the data mining stage are converted into knowledge, which in turn, is used to support decision making.

Data visualization: - it makes it possible for the analyst to gain a deeper, more intuitive understanding of the data. Data visualization helps users to examine large volumes of data and detect the patterns visually. Visual displays of data such as maps, charts and other graphical representations allow data to be presented compactly to the users.

Artificial Neural Network: - Artificial neural networks models have been studied for many years in the hope of achieving human like performance in several fields. In Neural Networks, basic elements are neurons or nodes. These neurons are interconnected and within the

network they worked together in parallel in order to produce the output functions. From existing observations they are capable to produce new observations even in those situations where some neurons or nodes within the network fails or go down due to their capability of working in parallel. An activation number is associated to each neuron and a weight is assigned to each edge within a neural network. In order to perform the tasks of classification and pattern recognition neural network is mainly used [5]. ANN is based on the biological neural networks in the human brain and described as a connectionist model Fig -1: A Sketch of a Neuron in the Human Brain
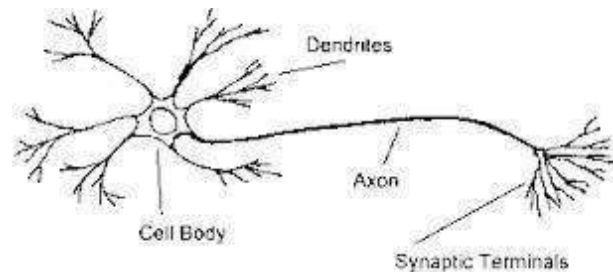
Fig 1. A Sketch of a Neuron in the Human Brain

It is based on the neuron, a cell that processes information in the human brain [6]. The neuron cell body contains the nucleus, and has two types of branches, the axon and the dendrites. The axon transmits signals or impulses to other neurons while the dendrites receive incoming signals or impulses from other neurons. Every neuron is connected and communicates through the short trains of pulses [6]. The nodes are the artificial neuron and the directed edges represented the connection between output neurons and the input neurons. In training phase, the internal weights of the neural network are adjusted according to the transactions used in the learning process. For each training transaction the neural network receives in addition the expected output. This allows modification of weight.
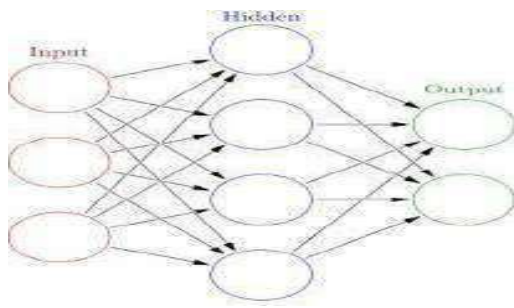
Fig 1.1 Artificial Neural Networks

Factors causing heart disease include
- ❖ Family history of heart disease
- ❖ Obesity
- ❖ Cholesterol
- ❖ Physical inactivity
- ❖ Hypertension
- ❖ Poor diet
- ❖ High blood pressure
- ❖ High blood cholesterol
- ❖ Smoking

II METHODOLOGY

Data mining techniques like clustering, association rule mining, classification algorithms such as decision tree, C4.5 algorithm, naïve bayes are used to explore the different kinds of heart based problems. Data mining methods such as k-means clustering and c4.5 algorithm are used for validating the accuracy of medicinal data. These algorithms can be used to enhance the data storage for practical and legal purposes

Various data mining techniques and algorithms are used such as association, clustering, decision trees for the efficient prediction and detection of cardiovascular heart attacks which leads to sudden deaths. When the cholesterol level of bad cholesterol increases in the blood it narrows the passage of blood flow of arteries and veins which leads to blockage of blood in the blood vessels and this results in heart attacks.

DATA MINING TOOLS
There are various data mining tools used for data mining purpose. These are WEKA, TANAGRA, MATLAB and .NET FRAMEWORK.

.NET FRAMEWORK: It is a software framework developed by Microsoft which runs primarily on Microsoft windows. It provides secure communication and consistent applications. It provides language interoperability (each language can code written in other languages) across several programming languages.
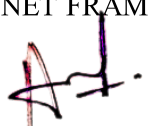
WEKA: It is a data mining tool which was developed in New Zealand by the University of Waikato that implements data mining algorithms using JAVA language. WEKA is a collection of machine learning algorithms and their application to the data mining problems. These algorithms are directly applied to the dataset. WEKA supports data file in ARFF format. WEKA is open source software and hence, it is not dependent on any platform. It includes algorithms for data processing, classification, regression, clustering, association and also visualization tools.
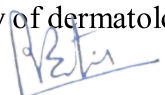
TANAGRA: It is open source software as researchers can access to the source code and add their own algorithms and compare their performances, if it conforms to the software distribution license. It includes several data mining algorithms from statistical learning, machine learning, and data analysis and database area.

MATLAB: It is a data mining tool built in high level language. It provides interactive environment for visualization, numerical computation and programming. The built in math functions, language and tool explore various approaches and helps to reach a solution faster than with the spreadsheet of traditional programming languages like C,C++

J48 TECHNIQUE
Decision tree is a kind of classifying and predicting data mining technology, belonging to inductive learning and supervised knowledge mining technology. As decision tree is advantageous in fast construction and generating easy-to-interpret If-Then decision rule, it has become the most widely applied technique among numerous classification methods. Decision tree algorithm has been applied in many medical tasks, for examples, in increasing quality of dermatologic

diagnosis, predicting essential hypertension, and predicting cardiovascular disease. Decision tree is one of the most popular tools for classification and prediction. Production of a decision tree is an efficient method for classification of data. This tree using a top-down strategy to build a test on each node. J48 decision tree method is the implementation of c4.5 decision tree in weka data mining tool. J48 decision tree supports continuous and discrete features. It can also manage features with missing value.

NAÏVE BAYES ALGORITHM

Naïve Bayes Rule is the basis for many machine-learning and data mining methods. The rule (algorithm) is used to create models with predictive capabilities. It provides new ways of exploring and understanding data. A naive Bayes classifier is a term dealing with a simple probabilistic classification based on applying Bayes theorem. In simple terms, a naïve Bayes classifier assumes that the presence (or absence) of a particular feature of a class is unrelated to the presence (or absence) of any other feature. It learns from the "evidence" by calculating the correlation between the target (i.e., dent) and other (i.e., independent) variables. Depending on the precise nature of the probability model, naive Bayes classifiers can be trained very efficiently in a supervised learning setting Naive Bayes classifiers often work much better in many complex real-world situations than one might expect. Here independent variables are considered for the purpose of prediction or occurrence of the event. The algorithm is used to create models with predictive capabilities. It provides new ways of exploring and understanding data. For example, a patient may bed to have certain symptoms. Based on the observation, Bayes' theorem can be used to compute the probability that a proposed diagnosis is correct. Bayes Theorem finds the probability of an even occurring given the probability of another event that has already occurred. If B represents the dependent event and A represents the prior event, Bayes theorem can be stated as follows, P (B given A) = Prob (A and B) / Prob (A) To calculate the probability of B given A, the algorithm counts the

number of cases where A and B occur $P(C_i/X) > P(C_j/X)$ for all $1 <= j <= m$ and $j! = i$.

NEURAL NETWORK

Artificial Neural Network is a data processing algorithm, originated from human brain. The system includes a large number of tiny processors to handle data processing. The processors act in the form of an interconnected network parallel to each other to solve a problem. Using programming knowledge, in this networks a data structure is designed that can act as neurons. This data structure is called the neuron.

Neural network is a parallel, distributed information processing structure consisting of numerous quantities of processing elements called node, they are interconnected via unidirectional signal channels called connections. Each processing element has a single output connection that branches into many connections and each conveys the equivalent signal.

The NN can be classified in two main groups according to the way they learn. They are supervised learning and unsupervised learning. In supervised learning the network compute a response to each input and then compares it with the target value. If the computed response differs from the target value, the weights of the network are adapted according to a learning rule. Examples of supervised learning are Single layer perceptron and Multilayer perceptron. In unsupervised learning the networks learn by identifying special features in the problems they are exposed to. Example for unsupervised learning is self organizing feature maps.

TABLE I. COMPARISON OF DATA MINING TOOLS WITH TECHNIQUES AND ACCURACY

Data Mining tools	Techniques	Accuracy
Weka 3.6.4	J48 Technique	95.56%
Weka 3.6.4	Naive Bayes	92.42%.
Weka	Neural Network	79.19%
TANAGRA	Fuzzy Logic	83.85%
Weka 3.6.6	Naive Bayes	99.52%
TANAGRA	Decision Trees	52.33%
.NET data mining tool	Neural Network	96.5%

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IV RESULTS AND DISCUSSION

In medical field, Data Mining provides various techniques and has been widely used in clinical decision support systems that are useful for predicting and diagnosis of various diseases. These data mining techniques used in heart diseases takes less time and make process fast for the prediction system to predict heart diseases with good accuracy in order to improve their health. In this work, K-means clustering and MAFIA algorithm for Heart disease prediction system and achieved the accuracy of 89% as we can see that there is vast scope of improvement. In our proposed system we will implement the improved algorithm of clustering which achieve the accuracy more than the present algorithm.

The thesis will be of help to the doctor's to efficiently and effectively detect the cardiovascular disease based on the training algorithm and input parameters supplied to the neural network for training the algorithm. The use of decision trees, association rules, WEKA tool and various data mining techniques will be useful to the doctors to detect heart attack symptoms early so that they can diagnose the patient with appropriate skill and in this way they can attempt to save the precious lives of human beings which are dying due to heart attacks.

As there are deaths due to heart attack at very rapid rate due to tensions, incorrect food habits, lack of physical movement and regular exercise, diabetes. The doctor can advise the patients early so that he can prevent from being dead early due to sudden attack.

Our research will provide enough data to the medical field to predict cardiovascular heart attacks so that a patient can take precautions to avoid sudden death due to stroke. It will help the doctors to advise the patient that such types of attacks are going to occur in the near future so that the patient can get checkup of blood pressure, bad cholesterol and lipid profile. A person suffering from diabetes is also at risk of heart attacks.

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Prediction and Improving Academic Performance of Students Using Various Classification Techniques

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Abstract- One of the ultimate goals of the learning process is the success of student learning. Using data and students' achievement with machine learning to predict the success of student learning will be a crucial contribution to everyone involved in determining appropriate strategies to help students' performance. Data mining combines machine learning, statistics and visualization techniques to discover and extract knowledge from large database. One of the biggest challenge that in technical education faces is to improve students' performance. This study found that the classification machine learning algorithm was most often used in predicting the success of students' learning. Four algorithms that were used most often to predict the success of students' learning are KNN, Naive Bayes, SVM and Decision Tree.

Keywords: students' learning, technical education.

1. INTRODUCTION

Due to the huge amount of data in educational databases, predicting the performance of students has become more difficult. The shortage of an established framework for evaluating and tracking the success of students also isn't currently being considered. There are two primary reasons why such kind of occurring. First, the research on existing methods of prediction is still insufficient to determine the most appropriate methods for predicting student performance in institutions. Second, it is the absence of inquiry of the specific courses.

The real goal is to have an overview of the systems of artificial intelligence that were used to predict academic learning. This research also focuses on how to classify the most relevant attributes in student data by using prediction algorithm. Using educational machine learning methods, we could potentially improve the performance and progress of students more efficiently in an efficient manner. Students, educator and academic institutions could benefit and also have an impact.

2. RELATED WORKS

There are many studies in the learning field that investigated the ways of applying machine learning techniques for various educational purposes. One of the focuses of these studies is to identify high-risk students, as well as to identify features which affect the performance of students.

The study conducted by C.B Kotsiantis [1] is one of the initial studies which investigated application of

machine learning techniques in distance learning for dropout prediction. The most significant contribution by this study was that it was a pioneer and carved the path for several such studies. While machine learning algorithms had been previously implemented in several settings, this was perhaps the first time that these techniques were applied to an academic environment. Bhardwaj and Pal [2] conducted a study in India, Faizabad to determine factors that most heavily affected student performance. They used Bayesian Classification for their study.

The study by Erkan Er [3] was based upon Kotsiantis' as well as other similar studies. It concluded that Naive Bayes indeed performed better than any other machine learning algorithm. However, the crucial contribution of this study was that time-invariant features may be detrimental to the machine learning process, and hence are better left out of the study entirely. He also concluded that "Instead of demographic characteristics of students, using initial attendance and homework grades produces better prediction rate at earlier stages." Prediction of student's performance can be used as a basis for early intervention on the potential failure of students to achieve learning objectives; and at the same time able to make changes to learning strategies in order to facilitate student diversity [1]. This is also supported by the availability of student data that can be processed to make predictions such as behavioral data, type and frequency of activities carried out (both in online and offline learning settings), age, height and weight, previous academic achievement; as well as latent data such as personality and their motivation as well as external data such as parenting patterns, parental support makes the data contained in educational institutions abundant, multi-data and qualified to be analyzed.
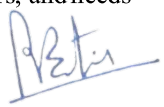
This study aims to systematically examine the use of machine learning algorithms to predict student achievement. So this paper is expected to make a scientific contribution to researchers in the area of predicting student learning achievement, computer science, and statistics (or data science). It is hoped that the results of this systematic paper can provide insight into the most effective machine learning algorithms for predicting student achievement and increase stakeholders' understanding of the implementation of machine learning to predict student achievement.

Student's performance in the educational process can literally be defined as something that is obtained from changes in the behavior of students based on their experiences, besides that learning outcomes are also a realization of the potential or capacity possessed by students [1]. These learning outcomes from students can be seen from their behavior, both behavior in the form of understanding knowledge, thinking skills, or motor skills [2]; an outcome of the process of changing student behavior after attending lessons [3]. The concrete form of student's performance can be seen from their understanding of the knowledge being studied, their expertise in processing information and making decisions based on certain thoughts or motor skills [4]. Based on those understandings, student's performance can be observed and measured in the realm of students' knowledge, attitudes and skills after following a series of lessons. Student's performance depends on the teaching and learning process they go through, so that learning outcomes can be used as considerations in improving the quality of the learning process.

On the other hand, a similar terminology is learning achievement which is a measure of student achievement after participating in learning activities in the form of an assessment scale (either letters, numbers or certain symbols [5]. Giving a weight or rating for student's achievement in learning requires the preparation of suitable assessment indicators, and needs

to be ensured of the validity and the reliability [6]. This value can then be used as a description of student's performance in a certain period of time [7].

Student's performance is obtained after passing various measurements (in various forms of assessment) after students carry out several learning processes.

3. METHODOLOGY

Data mining is the knowledge discovery process from a huge data volume. The mechanism works in large dataset where the student performance in the end semester examination is evaluated.

A. Data selection and transformation

In this step only those fields were selected which were required for the data mining process. The student register number, 10th, 12th, degree marks in each semester wise, assignment, gender, parent's education, income were taken as data source.

B. Algorithms

1. Decision Tree

Decision Tree classifier is the regression model which is represented in the form of tree structure. The purpose of Decision Tree classifier is to breakdown the dataset into smaller subset. The tree consists of decision nodes and leaf nodes.[19] In our proposed architecture the attribute which delivers maximum information will act as a decision node. The node which is present as the top most of the decision node acts as a predictor which is called as root node. The node which cannot be further divided is known as leaf node. The steps involved in the decision tree are specified below:

- Process 1: Start the root.
- Process 2: Perform the test.
- Process 3: Follow the edges corresponding to the outcome.

- Process 4: go to step 2 until reaches leaf node.
- Process 5: Predict the outcome associated with the leaf.

2. K-Nearest Neighbour

K-Nearest Neighbour is one of the basic and essential classification algorithms in machine learning. It is non-parametric and makes any underlying assumptions about the distribution of data.

The steps involved the KNN is listed below:

- File the training data in a sample points array.
- The Euclidean distance measure.
- Make the least distance range available.

4. RESULTS DISCUSSION AND ANALYSIS

The application was constructed ended up being a framework for binary student data to be inputted and outputted in the form of a prediction value for the likelihood of clearing a target course. The framework was constructed with the help of the sklearn framework as we as Keras API, plus the dataset that was fetched from kaggle to train the ML models. The purpose of the application was twofold, one being technical in that it provided a scientific comparison study on how these ML model performed from these certain parameters in this certain environment (datatype/data size), the other one being to provide a method of predicting the likelihood of whether certain students would clear a given course, given their previous courses. As far as those end goals/purposes are concerned, the quota has been fulfilled sufficiently and correctly. As to why Decision Tree outperformed KNN, can be theorized because the number of parameters in an Decision Tree increases linearly with the amount of the input. On the other hand, a KNN model does not. The Decision Tree method is an excellent classification algorithm. It's a

supervised learning method that's mostly used to divide data into categories. A collection of label data is used to train Decision Tree. However, it is believed that large data sets are not suited for the Decision Tree method. When the data set contains additional noise, such as overlapping target classes, Decision Tree does not perform well. The Decision Tree will underperform if the number of features for each data point exceeds the number of training data samples.

The chosen method was a quantitative approach due to the nature of computer science and machine learning problems. They are inherently quantifiable and measurable. The method was broken down into small achievable and measurable milestones that could be worked on separately. The approach however was done in an ad hoc basis, as it wasn't clear at the start which software tools and hardware to use, whether to use a cloud-based solution or a native one. All these approaches were figured out on the spot when the thesis needed it. The metrics that were measured (Accuracy, Classification Error ,Sensitivity, Specificity) were chosen due to the abundance of resources surrounding them, the sheer volume of mathematical equations describing them, and due to measuring just the accuracy of a model doesn't tell the whole story.

The first research question of the thesis was to figure out if ML algorithms were an appropriate way to find and identify these student patterns. To that extent, the study deems it to be an appropriate way. As the approach was when a pattern was generated, then the research question was fulfilled, the study was successful in that regard.

The second research question was to figure out how to implement the Decision Tree, SVM, Naïve Bayes, and KNN models, and to figure out which model performed best in terms of accuracy and other parameters on an

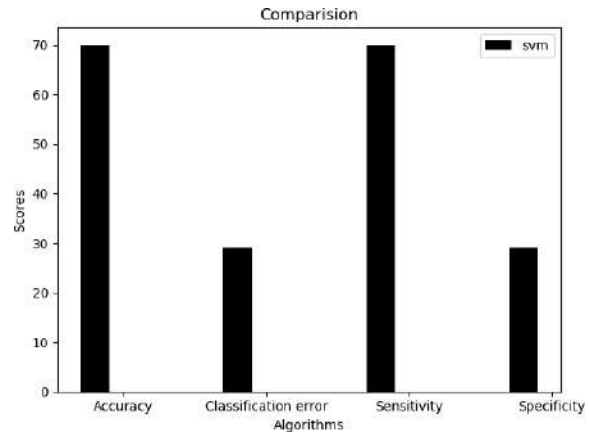open-source ML framework using student data from higher education data.
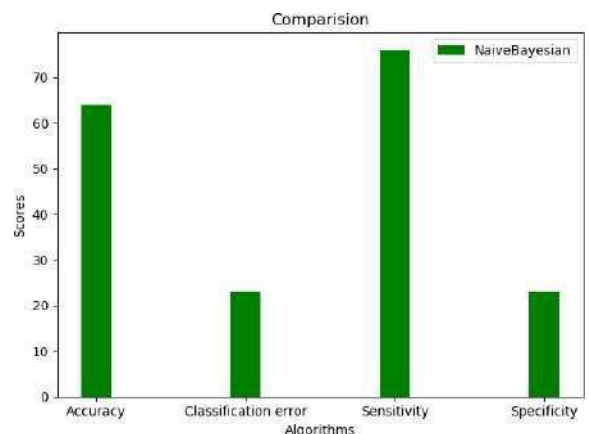

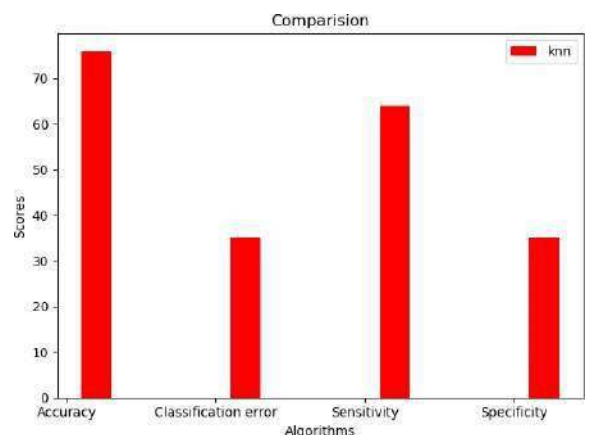Fig.1: SVM Algorithm
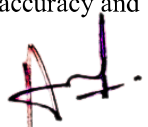

Fig.2: Naïve Bayes Algorithm

Fig.3: Knn Algorithm
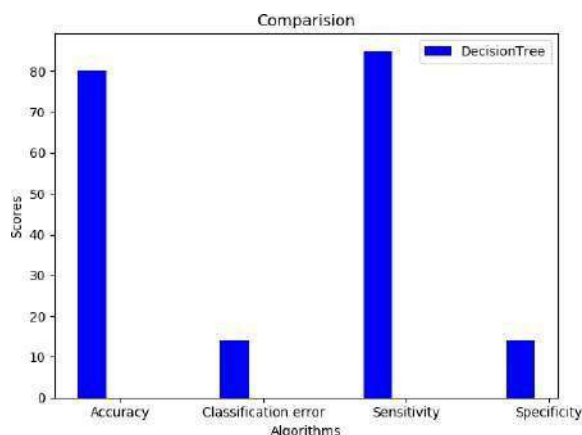
Fig.4: Decision Tree Algorithm
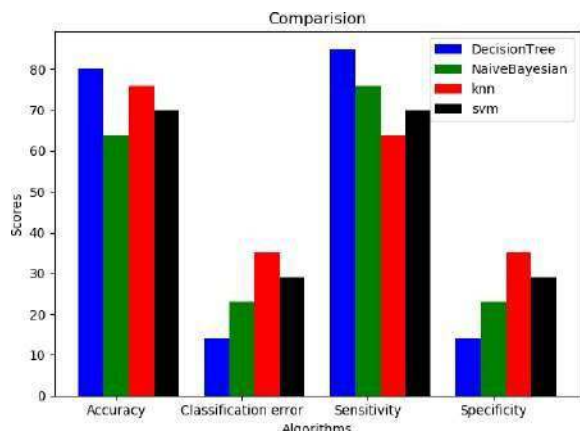
Fig.5: Comparison of Algorithms

5. CONCLUSION

This research aims to systematically examine the extent to which the implementation of machine learning algorithms and modeling gives out best results in predicting student's performance. The results showed that the most widely used type of machine learning algorithm to predict student's performance was the algorithm.

The most widely used machine learning algorithms to predict student's performance are K Nearest Neighbor Support Vector Machine (SVM), Naïve Bayes, and Decision Tree algorithms. The data used in this research article uses a variety of datasets. In general, predictions of student's performance are classified into 2 to 3 classifications such as pass/fail; or file/pass/excellent.

The findings from this implementation are that Decision tree has outperformed all other algorithms at least for the given dataset. But the results may change when different size and type of dataset is used.

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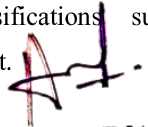COLLEGE OF ENGINEERING
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Region - Based Convolution Neural Network (RCNN) Methods of Image Processing That Can Detect Glaucoma

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Abstract- This review article discusses the use of a variety of image processing methods with the purpose of providing an automated diagnosis of glaucoma. Glaucoma is a neurological illness that affects the optic nerve and may lead to a loss of some of one's eyesight. Eye problems affect a significant number of individuals in the world's rural and semi-urban regions, and this is true in every region. The examination of a picture of the retinal fundus using image processing is now the gold standard for diagnosing retinal diseases. Image registration, image fusion, image segmentation, feature extraction, image enhancement, morphology, pattern matching, image classification, analysis, and statistical measures are some of the essential image processing methods for detecting eye illnesses.

Keywords- Image Registration; Fusion; Segmentation; Statistical measures; Morphological operation; Classification.

I. INTRODUCTION

Lots of people in rural and semi-urban areas suffer from eye diseases such as Diabetic Retinopathy, Glaucoma, Age based Macular Degradation etc. Glaucoma is a pathological condition of optic nerve damage and is second leading cause of vision loss. It is known as silent thief of sight. It comes along with an ongoing destruction of optic nerve head (ONH) caused

and clinical study. The information about the optic disk can be used to examine severity glaucoma. The location of the optic disk is an

by an increase in intraocular pressure within eye. The optic nerve carries image information to brain. Due to damage to large number of nerve fibres, a blind spot is created leading to loss of vision. One of the indicators of glaucomatous eye is change in appearance of optic disk. Optic disk is elliptical in shape having bright orange-pink color with a pale centre. Due to degeneration of nerve fibre orange pink color disappears and become pale. i.e enlargement of depression called cup and thinning of neuroretinal rim. The pale centre called cup is devoid of neuroretinal tissue. For normal eye, cup-to-disc ratio is 0.3 to 0.5. For glaucomatous eye, ratio becomes 0.8.

Approximately, 5 million people live with a glaucoma risk while around 800.000 people suffer from glaucomatous damages in Germany [1]. If the optical imaging of the retina is taken then by performing the series of image processing operations, automated early detection of eye disease is possible.

With great improvement in field of medical imaging, Image processing technique helps in early diagnosis of glaucoma and other eye disease. Retinal fundus images assist trained clinicians to diagnose any abnormality and any change in retina. These images are captured by using special devices called ophthalmoscopes. Medical image analysis and processing has great significance in non-invasive treatment important issue in retinal image analysis as it is a significant landmark feature. Fig.1 shows the fundus camera and retinal fundus image.
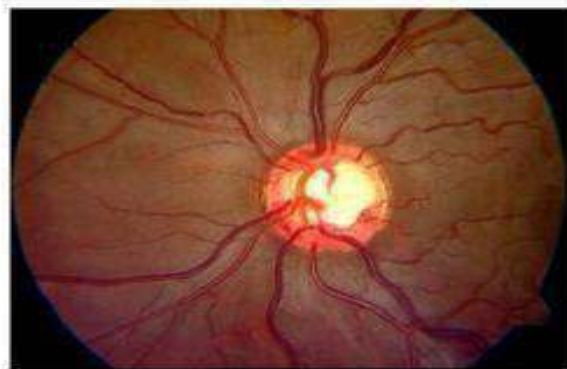
Fig. 1 Digital fundus camera and acquired retinal fundus image

II. IMAGE PROCESSING TECHNIQUE

Various image processing techniques used in automated early diagnosis and analysis of various eye disease are Enhancement, Registration, Fusion, Segmentation, Feature extraction, Pattern matching, Classification, Morphology, Statistical measurements and Analysis [2][3].

Image Enhancement- Image enhancement includes varying brightness and contrast of image. It also includes filtering and histogram equalization. It comes under preprocessing step to enhance various features of image.

Image Registration- Image Registration is an important technique for change detection in retinal image diagnosis. In this process, two images are aligned onto a common coordinate system. Images may be taken at different times and with imaging devices In medical diagnosis, it is essential to combine data from different images and for better analysis and measurements images are aligned geometrically.[4]

Image Fusion- Image fusion is a process of combining information acquired from number of imaging devices. Its goal is to integrate contemporary, multisensor, multi-temporal or multi-view information into a single image, containing all the information so as to reduce the amount of information.

Feature Extraction- It is the process of identifying and extracting region of interest from the image.

Segmentation- Segmentation is the process of dividing an image into its constituent object and group of pixels which are homogenous according to some criteria. Segmentation algorithms are area-oriented instead of pixel oriented. The main objective of image segmentation is to extract various features of image which can be merged or split in order to build object of interest on which analysis and interpretation can be performed. It includes clustering, thresholding etc.

Morphology- Morphology is the science of appearance, shape and organization. Mathematical morphology is a collection of non-linear processes which can be applied to an image to remove details smaller than a certain reference shape. Various morphological operation are erosion, dilation, opening and closing.

Classification- Classification is an important technique of image analysis for estimation of statistical parameter according to the gray level intensities of pixels. It includes labeling of a pixel or group of pixels based on the grey values and other statistical parameters. For understanding the contents of an image, image analysis functions are used [5].

III. LITERATURE REVIEW

Several studies are reported in literature for detection of optic disk and detection and classification of glaucoma. The work is as follows:

In Year 2006, Kevin Noronha performed a work, "Enhancement of retinal fundus Image to highlight the features for detection of abnormal eyes"[6]. This work specifies the methods used to detect main features of retinal fundus images such as optic disk, fovea, and exudates and blood vessels using different techniques. To determine the optic Disk and its centre Author find the brightest part of the fundus and apply Hough transform.

In Year 2007, Sangyeol Lee performed a work, "Validation of Retinal Image Registration Algorithms by a Projective Imaging Distortion Model"[4]. A variety of methods for retinal image registration have been proposed. Authors also present the validation tool for any retinal image registration method by tracing back the distortion path and accessing the geometric misalignment from the coordinate system of reference standard.

In Year 2008, S. Sekhar performed a work," Automated localization of retinal optic disk using hough transform"[7]. The retinal fundus image is widely used in the diagnosis and treatment of various eye diseases such as diabetic retinopathy and glaucoma. The proposed methodology consists of two steps: in the first step, region of interest (ROI) is found by image by means of morphological processing, and in the second step, optic disk is detected using the Hough transform.

In Year 2010, Zhuo Zhang performed a work," ORIGA-light : An Online Retinal Fundus Image Database for Glaucoma Analysis and Research"[8]. Author present an online dataset, ORIGA-light, which aims to share clinical retinal images with the public. Author had updated the system continuously with more clinical ground-truth images. The proposed

method focuses on optic disk and cup segmentation.

In Year 2010, Vahabi Z proposed," The new approach to Automatic detection of Optic Disc from non-dilated retinal images"[9]. Author describes a new filtering approach like Sobel edge detection, Texture Analysis, Intensity and Template matching to detect Optic Disc. The proposed algorithm is applied in wavelet domain on 150 images of Messidor dataset.

In Year 2011, Zafer Yavuz performed a work," Retinal Blood Vessel Segmentation Using Gabor Filter And Tophat Transform"[10]. In this, Author gave a method for retinal blood vessels segmentation by applying firstly Gabor filter to enhance blood vessels and then applying top-hat transform. Later on, the output is converted to binary image with p-tile thresholding.

In Year 2012, Nilan jan Dey performed a work," Optical Cup to Disc Ratio Measurement for Glaucoma Diagnosis Using Harris Corner"[11]. In this paper, CDR is determined using Harris Corner. Harris comer detector [12,13] measures the local changes of the signal with patches shifted in different directions by a small amount. It is based on the local auto-correlation function of a signal.

In Year 2012, R. Geetha Ramani performed a work," Automatic Prediction of Diabetic Retinopathy and Glaucoma through Retinal Image Analysis and Data Mining Techniques"[5]. This paper proposed a novel approach for automatic disease detection. Retinal image analysis and data mining techniques are used to accurately categorize the retinal images as either Normal, Diabetic Retinopathy and Glaucoma affected.

In Year 2012, ManjulaSri Rayudu proposed," Review of Image Processing Techniques for Automatic Detection of Eye Diseases"[14]. The review paper provides information about the application of image processing techniques for automatic detection of eye diseases. The key image processing techniques to detect eye

diseases include image registration, fusion, segmentation, feature extraction, enhancement, pattern matching, image classification, analysis and statistical measurements.

IV. GLAUCOMA DETECTION ALGORITHM

For assessment of glaucoma, cup-to-disc ratio is most widely accepted index. Early research was done for detection and localization of optic disk. The various algorithms used in this direction are vessel's direction matched filter, curvelet transform, active contour model, fuzzy c-mean clustering, artificial neural networks, k-NN regressor, pyramidal decomposition, edge detection, entropy filter and feature vector[15-21].

Other techniques include averaging filter, template matching technique and canny edge detector. S.Sekhar et al. [22] applied Hough transform to detect Optic Disk. After preprocessing a binary image is obtained which can be used to find the contours of OD. Morphological closing is performed on ROI to calculate the magnitude gradient of edge detection and fill the vessels according to (1).

$$f \bullet B = (f \oplus B) \ominus B . \qquad (1)$$

For removing any peaks, morphological opening is applied according to (2).

$$f \circ B = (f \ominus B) \oplus B \qquad (2)$$

Where f is the grayscale image, B is binary structuring element; $\oplus$ is dilation $\ominus$ is erosion operators

Gopal Dat Joshi et al.[23] described cup-to-disc ratio(CDR) calculation by applying morphological operations and hough transformation for detecting glaucoma. Within the optic region, cup is segmented using vessel bends(r-bends for specifying cup boundary) and pollar information. These r-bends are non-uniformly distributed on the OD region. So for detection of cup boundary local interpolating spline is applied.

Aliaa Abdel et al.[15] proposed matched filter approach. During preprocessing, illumination equalization and adaptive histogram equalization methods are applied for luminosity and contrast normalization respectively. The retinal vessels are segmented using 2D Gaussian matched filter. R. Chrastek et al. [24] proposed a method for optic nerve head segmentation and its validation. The method includes morphological operations, Hough transform, and active contour model.

V. RESULTS

As a part of survey of various image processing techniques, the author has implemented some of the techniques like preprocessing; histogram equalization morphological operation etc. and result are as follows:

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a.) Original Image   b.) Gray Scale of original image   c.) After Histogram Equalization

d.) Original Histogram   e.)Enhanced Contrast   f.) Binary image
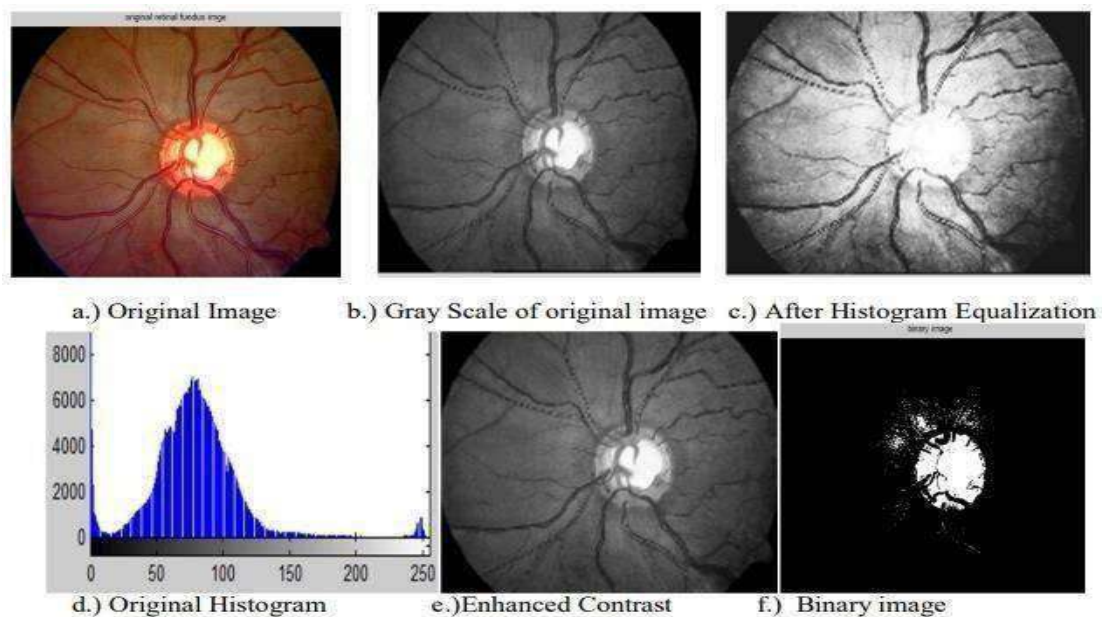
VI. CONCLUSION

The author of this research came to the conclusion that the optic disc has to be segmented as the initial step in the process of glaucoma detection and diagnosis. Following the completion of the picture capture step, the preprocessing stage begins with the application of thresholding, illumination, and histogram equalisation. Various methods, including as the Hough transform, k-means clustering, fuzzy c-means clustering, active contour method, matching filter approach, vessel bends, and morphological procedures, are used to segment the optic disc and cup. After that, the CDR is computed, and classification is performed in order to determine if the patient's eye state is normal or glaucomatous.

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A Review on Machine Learning Based Fake News Detection and Classification

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Abstract: Fake news has become a significant challenge in recent years due to the ease of creating and sharing misleading or false information on social media and other online platforms. As a result, there is an increasing need for automated methods to detect and combat fake news. Machine learning (ML) techniques have emerged as a promising solution due to their ability to learn patterns and features from large amounts of data. In this review paper, we survey the recent advancements in ML techniques for fake news detection. We categorize the existing approaches into three groups based on the type of input data: textual-based, image-based, and social network-based. We discuss the strengths and limitations of each approach and highlight the challenges and opportunities in developing effective and scalable solutions. We conclude with a discussion of the open research questions and future directions for ML-based fake news detection. Fake news has become a major issue in today's digital age, where misinformation and propaganda can spread rapidly and have serious consequences. Machine learning has emerged as a promising approach to detecting fake news, leveraging the power of algorithms and data to identify patterns and features that distinguish fake from real news. In this review paper, we survey the existing literature on machine learning techniques for fake news detection, including approaches based on natural language processing, feature engineering, deep learning, and ensemble methods. We analyze the strengths and limitations of each approach, identify common challenges and open research questions, and discuss the potential for future advances in this field. Our review provides a comprehensive overview of the state-of-the-art in machine learning for fake news detection and highlights the need for interdisciplinary collaboration and ethical considerations in developing effective and scalable solutions.

Keywords: Fake News Detection · Heterogenous Data · Social Networks

I INTRODUCTION

Fake news has become a major concern in recent years, particularly in the context of social media and online communication. The spread of fake news has the potential to cause harm by misinforming the public, stirring up emotions, and even manipulating the outcomes of important events such as elections. As a result, there has been a growing demand for methods to detect and combat fake news.

Fake news can be defined as intentionally misleading or fabricated information presented as if it were true. It can take many forms, such as articles, images, videos, or social media posts, and can cover a wide range of topics, from politics to health to entertainment. Fake news is often created to influence public opinion or to make a profit, and can be spread through social media or other online platforms.

Fake news detection is the process of identifying and verifying the authenticity of information in order to prevent its spread.

There are many methods for detecting fake news, ranging from manual fact-checking by journalists to automated algorithms that analyze text and images for signs of manipulation or inconsistency.

One of the challenges in detecting fake news is that it can be difficult to distinguish between real and fake information, particularly in the age of sophisticated digital manipulation. For example, a photo or video can be manipulated to make it appear as if something happened when it did not, or to alter the context of an event in a misleading way. Similarly, text can be edited or taken out of context to change its meaning.

To address this challenge, researchers have developed a variety of techniques for fake news detection. One approach is to use machine learning algorithms to analyze patterns in text or images that may indicate manipulation or inconsistency. For example, an algorithm might look for inconsistencies in the language or tone of a news article, or it might compare the content of an image with other images in a database to detect signs of manipulation.Another approach to fake news detection is to use human fact-checkers to manually verify the accuracy of information. This can be a time-consuming process, but it can also be more accurate than automated algorithms in some cases, particularly when dealing with complex or nuanced information.Regardless of the method used, fake news detection is an important tool for maintaining the integrity of public discourse and preventing the spread of harmful misinformation. By identifying and correcting fake news, we can help to ensure that people have access to accurate and reliable information that can inform their decisions and actions.

n recent years, fake news has become a major problem in the world of journalism and social media. With the widespread use of social media platforms, the spread of fake news has become even more rapid and far-reaching. This has raised serious concerns about the impact of fake news on

public opinion and decision-making. To address this problem, there has been a growing interest in the development of automated techniques for detecting fake news.
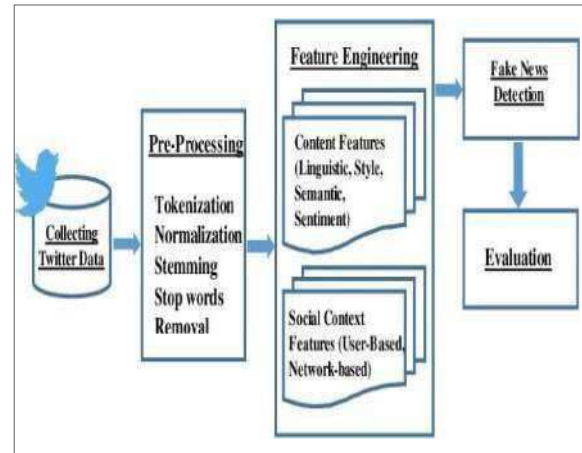
Fig.1Fake news detection

Fake news detection involves identifying and distinguishing between real and fake news articles. This task is challenging because fake news articles often mimic the style and content of real news articles, making it difficult to differentiate between them. Therefore, researchers and practitioners have been exploring different methods and techniques to develop effective fake news detection systems.

This paper provides a review of the existing literature on fake news detection, with a focus on the different techniques and methods that have been proposed to address this problem.

Overview of Fake News Detection Techniques

Fake news is a growing problem that has become increasingly challenging to detect due to its sophisticated and rapidly evolving nature. Various techniques have been developed to identify and mitigate the spread of fake news. In this overview, we will discuss some of the common fake news detection techniques.

Text-based Analysis: Text-based analysis is a popular technique for detecting fake news that involves analyzing the content of a news article to identify inconsistencies, contradictions, and misleading information.

Text-based analysis can include natural language processing (NLP), sentiment analysis, and other linguistic analysis techniques.

Source Credibility Analysis: Source credibility analysis involves evaluating the reliability and trustworthiness of the news source. This technique involves analyzing the historical behavior of the source, their reputation, and their previous publications.

Social Network Analysis: Social network analysis is another approach to detect fake news by analyzing the relationships between users and their interactions on social media platforms. This technique involves identifying communities of users who share and propagate fake news and analyzing their behavior patterns and networks.

Machine Learning: Machine learning techniques involve training algorithms on large datasets of fake and genuine news articles to identify patterns and features that distinguish between them. Machine learning models can be trained using supervised, unsupervised, or semi-supervised learning approaches to classify news articles as fake or genuine.

Fact-Checking: Fact-checking involves verifying the accuracy and authenticity of news articles by cross-checking the information with credible sources and authoritative databases. Fact-checking can be done manually by human experts or using automated tools that employ NLP and other techniques.

II PROBLEM STATEMENT:

The main challenge in fake news detection using machine learning is the lack of a standard definition of fake news, which can make it difficult to create a dataset of labeled news articles. Furthermore, fake news can be intentionally created to be difficult to detect, which can make it challenging to develop accurate detection methods. Another challenge is the potential for bias in the data used to train machine learning models, which can result in models that are not generalizable to other datasets.

we identify some gaps and limitations in existing research on fake news detection using machine learning:

Identification of the gaps and limitations in existing research on fake news detection using machine learning

Lack of standardized datasets: One of the major limitations in existing research is the lack of standardized datasets for fake news detection. Most studies use their own datasets, which may not be representative of real-world scenarios, making it difficult to compare and generalize the results.

Limited explanation and interpretability: Many machine learning techniques used for fake news detection lack transparency and interpretability, making it difficult to understand how the model makes predictions. This can undermine trust in the system and limit its practical applicability.

Adversarial attacks: Adversarial attacks pose a significant challenge to machine learning-based fake news detection. Adversaries can modify news articles to evade detection by machine learning algorithms, leading to false positives and false negatives.

Limited cross-lingual and cross-platform applicability: Most existing research focuses on English-language news articles and social media platforms, limiting the applicability of the techniques to other languages and platforms.

Lack of attention to temporal dynamics: Fake news is a dynamic phenomenon, with news stories emerging and evolving over time. However, most existing studies treat fake news detection as a static problem, ignoring the temporal dynamics of the news.

Lack of consideration of user behavior: Fake news dissemination is a social process, and user behavior plays a critical role in the spread of fake news. However, most existing studies do not consider user behavior in their models, limiting their ability to detect fake news in social media settings. addressing these gaps and

limitations is critical for the development of more robust and effective machine learning-based techniques for fake news detection. By developing standardized datasets, improving interpretability, addressing adversarial attacks, expanding cross-lingual and cross-platform applicability, considering temporal dynamics, and incorporating user behavior, researchers can improve the reliability and practical applicability of fake news detection systems.

III PURPOSE AND SCOPE OF THE PAPER

The purpose of this paper is to review and analyze the existing research on fake news detection using machine learning techniques. The scope of the paper is to provide a comprehensive overview of the strengths and limitations of different machine learning algorithms and approaches used for fake news detection. The paper aims to identify the gaps and challenges in the current research and provide recommendations for future research and development of effective and scalable fake news detection methods. Additionally, the paper discusses the ethical and social implications of using machine learning for fake news detection and the need for transparency and accountability in this area. Overall, the paper aims to contribute to the ongoing efforts to combat the spread of fake news and promote the integrity and reliability of information in the public sphere.

III   RELATED WORK

Fake news detection has become a critical area of research in recent times due to the widespread dissemination of misinformation and propaganda through various online platforms. Researchers and experts from different fields have proposed different approaches to identify and combat fake news. In this literature review, we discuss some of the significant works done in the area of fake news detection.

Fake news has become a critical problem in our society, and researchers have been

exploring various approaches to detect and combat it. One of the most promising techniques is using machine learning (ML) algorithms to identify fake news articles. In this section, we provide an overview of the existing research on fake news detection using machine learning techniques. Supervised, unsupervised, and semi-supervised learning approaches are commonly used in fake news detection. In this section, we compare these approaches and their advantages and disadvantages for fake news detection. Machine learning algorithms are widely used in fake news detection, and researchers have explored different algorithms' effectiveness in identifying fake news. In this section, we analyze different machine learning algorithms and their effectiveness in detecting fake news.

Analysis of different machine learning algorithms and their effectiveness in detecting fake news

Support Vector Machines (SVM): SVM is a widely used algorithm in fake news detection, and it works by identifying a hyperplane that separates real and fake news articles. SVM can achieve high accuracy when trained on high-quality labeled data. However, SVM can be sensitive to the choice of hyperparameters and may not perform well when the data is noisy or imbalanced.

Decision Trees: Decision trees work by splitting the data into smaller subsets based on different features and constructing a tree-like model. Decision trees can be effective in identifying important features and can handle noisy and missing data. However, decision trees may overfit the data and require pruning to avoid this problem.

Neural Networks: Neural networks are a powerful algorithm for fake news detection and can learn complex relationships between features. Neural networks can achieve high accuracy when trained on large datasets, but they require significant computational resources and can be challenging to interpret.

Logistic Regression: Logistic regression is a widely used algorithm in fake news detection and works by modeling the probability of a news article being fake based on its features. Logistic regression can achieve high accuracy when the data is well-balanced and has clear separations between real and fake news. However, logistic regression may not perform well when the data is noisy or imbalanced.

Random Forest: Random forest is an ensemble learning algorithm that combines multiple decision trees to improve accuracy and reduce overfitting. Random forest can achieve high accuracy in fake news detection, even when the data is noisy or imbalanced. However, random forest can be computationally intensive and may not be suitable for large datasets. Overall, each algorithm has its strengths and weaknesses, and the choice of algorithm depends on the specific goals of the analysis, the quality and quantity of data, and the computational resources available. Neural networks and random forest are generally considered the most effective algorithms for fake news detection, but they require significant computational resources and may not be suitable for all datasets. SVM, decision trees, and logistic regression are more widely used and can achieve high accuracy when properly trained and evaluated.

Comparison of supervised, unsupervised, and semi-supervised learning approaches for fake news detection

Supervised learning: Supervised learning requires labeled data, where each article is labeled as real or fake. Supervised learning algorithms use this labeled data to train a model that can classify new articles as real or fake. Supervised learning is widely used in fake news detection and can achieve high accuracy when the labeled data is of high quality. However, the lack of labeled data is a major challenge for supervised learning in fake news detection.

Unsupervised learning: Unsupervised learning does not require labeled data and instead learns patterns and structures from unlabeled data. Unsupervised learning can

identify clusters and anomalies in the data, which can be useful for detecting fake news. However, unsupervised learning can be challenging to interpret, and the results may not be as accurate as supervised learning.

Semi-supervised learning: Semi-supervised learning combines the advantages of supervised and unsupervised learning by using a small amount of labeled data and a large amount of unlabeled data. Semi-supervised learning can achieve higher accuracy than unsupervised learning while requiring less labeled data than supervised learning. However, semi-supervised learning can be challenging to implement and may not be suitable for all types of data.

Overall, each approach has its advantages and disadvantages, and the choice of approach depends on the availability and quality of data, the computational resources, and the specific goals of the analysis. Supervised learning is most effective when a large amount of labeled data is available, while unsupervised learning is more suitable for exploratory analysis and identifying unknown patterns. Semi-supervised learning can be a good compromise between the two approaches, but it requires careful selection of the labeled data and may not always be feasible.

Critique of the limitations and challenges of machine learning-based fake news detection techniques

While machine learning-based fake news detection techniques have shown promise, they also face several limitations and challenges. In this section, we critique some of these limitations and challenges:

Limited labeled data: One of the most significant challenges for machine learning-based fake news detection is the availability of labeled data. Creating high-quality labeled data can be time-consuming and expensive, and the lack of labeled data can limit the accuracy of the model. Additionally, labeled data may not always

represent the diversity of fake news that exists, leading to biased models.

Complex nature of fake news: Fake news can take many different forms and can be challenging to define and identify. Machine learning models that rely on specific features may not be able to capture the complexity of fake news, leading to inaccurate predictions.

Adaptability to evolving fake news: Fake news can evolve quickly, making it challenging for machine learning models to adapt and stay up to date. As new forms of fake news emerge, machine learning models may need to be retrained, which can be time-consuming and may require significant computational resources.

Difficulty in interpreting results: Machine learning models can be complex and difficult to interpret, making it challenging to understand why a particular article is classified as fake news. The lack of interpretability can be a barrier to trust and may limit the models' usefulness in real-world applications.

Biases in the data: Machine learning models can reflect biases in the data used to train them, leading to inaccurate predictions. Biases can be introduced by the source of the data, the labeling process, or the algorithm itself. while machine learning-based fake news detection techniques have shown promise, they also face several limitations and challenges that need to be addressed. Future research should focus on developing more effective ways to address these challenges and improve the accuracy and reliability of machine learning-based fake news detectiontechniques.

Researchers have used different ML algorithms such as neural networks, support vector machines, decision trees, and logistic regression to detect fake news. These algorithms work by learning patterns and features from large datasets of real and fake news articles. By training these algorithms, they can predict whether a new article is fake or not based on its features.One

approach to feature extraction is based on textual analysis, where the content of an article is analyzed for signs of fake news, such as sensational language, clickbait headlines, and inaccuracies. Another approach is source-based analysis, which evaluates the credibility of the source and its past behavior to determine if the news is likely to be fake.Researchers have also explored the use of social media data, such as user interactions and community structures, to identify fake news. Social media analysis has shown promising results, as it can capture the spread of fake news through social networks and identify key actors in the propagation of fake news.

A significant challenge in fake news detection is the lack of labeled datasets, which makes it difficult to train ML algorithms. Researchers have addressed this challenge by using semi-supervised and unsupervised learning techniques, which can learn from unlabelled data and identify patterns in the data without relying on labels.

Overall, fake news detection using ML is a rapidly evolving field, and researchers are constantly developing new approaches and techniques. While there is still room for improvement, ML-based fake news detection has shown promising results and has the potential to significantly contribute to the fight against the spread of fake news.

A Deep Learning Framework for Fake News Detection" by R. Zheng et al. (2021)

This study proposed a deep learning framework for detecting fake news. The framework was trained on a large dataset of news articles and achieved high accuracy in identifying fake news.

V. Kaur et al. (2021): This study compared the performance of various machine learning algorithms for fake news detection on social media platforms. The authors found that the random forest algorithm outperformed other algorithms in terms of accuracy.

M. Rahman et al. (2021): This study proposed a fake news detection model that

used transfer learning and stacked ensemble models. The authors achieved high accuracy in identifying fake news on a benchmark dataset.

T. Ahmad et al. (2022): This study compared the performance of different neural network-based approaches for fake news detection. The authors found that the convolutional neural network (CNN) outperformed other neural network models in terms of accuracy.

Wang et al. (2022) :This study proposed a multimodal approach that combines text, image, and user-based features for fake news detection. The authors achieved high accuracy in identifying fake news on a large-scale dataset.

Qian et al. (2020) proposed a novel approach to detect fake news by analyzing linguistic features and user behaviors on social media. The authors used a dataset of tweets related to COVID-19 and trained a deep learning model to classify them as real or fake. The results showed that their approach outperformed several baseline models and achieved a high accuracy of 88.6%.

Shu et al. (2020) investigated the effectiveness of using deep learning models to detect fake news on social media. The authors collected a dataset of tweets related to politics and trained multiple deep learning models to classify them as real or fake. Their results showed that the best-performing model achieved an accuracy of 81.4%, demonstrating the potential of deep learning methods for fake news detection.

In addition to machine learning methods, researchers have also explored the use of network analysis techniques to detect fake news. A study by **Zannettou et al. (2020)** proposed a framework to identify and track fake news campaigns on social media. The authors analyzed a dataset of tweets related to the 2018 US midterm elections and found that fake news campaigns tend to be highly coordinated and involve a small group of users. Their findings suggest that network analysis can be a valuable tool for identifying and tracking fake news campaigns.

Karadzhov et al. (2020) proposed a model that uses transformer-based language models to detect fake news. The authors found that their model achieved high accuracy in detecting fake news, even when it was presented in a deceptive manner.

Thakur et al. (2020) proposed a model that uses a combination of deep learning and graph theory techniques to detect fake news. The authors found that their model achieved high accuracy in detecting fake news by considering both content and network features.

In conclusion, the literature shows that there are several promising approaches to detecting fake news, ranging from machine learning-based techniques to deep learning and graph theory-based methods. As the problem of fake news continues to grow, it is crucial to develop effective techniques to combat it.

One of the popular approaches to fake news detection is based on the analysis of textual features. In their paper, "Detecting Fake News on Social Media with Hybrid CNN and RNN Models," Zeng et al. (2018) proposed a hybrid convolutional neural network (CNN) and recurrent neural network (RNN) model to identify fake news. The model combined the strengths of both CNN and RNN by utilizing CNN for feature extraction and RNN for sequence modeling. The authors tested their approach on real-world datasets and achieved promising results.

Another approach to fake news detection is based on source credibility. In their paper, "Combating Fake News: A Survey on Identification and Mitigation Techniques," Shu et al. (2017) conducted a comprehensive survey of the existing techniques for identifying and mitigating fake news. The authors identified source credibility as one of the critical factors for fake news detection. They proposed using machine learning algorithms to evaluate the

credibility of sources based on their historical behavior and other features.

In addition to textual features and source credibility, other researchers have proposed using social network analysis to identify fake news. In their paper, "Fake News Detection on Social Media: A Data Mining Perspective," Shu et al. (2019) proposed a three-layer framework for detecting fake news on social media. The framework used social network analysis to identify communities of users who share and propagate fake news. The authors tested their approach on a large dataset and achieved promising results.

In conclusion, fake news detection is a complex and challenging task that requires the integration of various approaches and techniques. The works discussed in this literature review demonstrate the potential of machine learning, social network analysis, and other techniques for fake news detection. Further research is needed to develop more effective and efficient methods for identifying and combating fake news.

IV METHODOLOGY

The research methods used for this review include a comprehensive literature search and analysis of relevant papers published in academic journals and conference proceedings. The search was conducted using various academic search engines, including Google Scholar, IEEE Xplore, ACM Digital Library, and ScienceDirect. The keywords used for the search included "fake news detection," "machine learning," "supervised learning," "unsupervised learning," "semi-supervised learning," and "classification algorithms."

The data sources for this review include academic papers, conference proceedings, and technical reports published in reputable journals and conference proceedings. The papers included in this review were selected based on their relevance to the topic and the quality of the research presented. The selection criteria included papers published in the last decade, papers that propose novel

methods or algorithms for fake news detection, and papers that compare and evaluate existing methods.

The data sources used in this review are diverse, including studies from various countries and regions worldwide. The papers used in this review cover a range of topics related to fake news detection using machine learning, including feature extraction, classification algorithms, and evaluation metrics. Additionally, we have included recent studies that investigate the use of deep learning and natural language processing techniques for fake news detection. Overall, the research methods and data sources used in this review provide a comprehensive and up-to-date analysis of the state-of-the-art in fake news detection using machine learning.

Criteria and factors used for evaluating and comparing machine learning techniques for fake news detection

n this section, we describe the criteria and factors used for evaluating and comparing machine learning techniques for fake news detection:

Accuracy:

Accuracy is a crucial criterion for evaluating machine learning techniques for fake news detection. It measures the proportion of correctly classified instances over the total number of instances. The higher the accuracy, the better the performance of the technique.

Precision and Recall:

Precision and recall are metrics used to evaluate the performance of binary classifiers. Precision measures the proportion of true positives among all positive predictions, while recall measures the proportion of true positives among all actual positive instances. A good fake news detection technique should have both high precision and recall.

F1-Score: The F1-score is the harmonic mean of precision and recall and is a measure of a classifier's overall performance. It provides a single value that

summarizes the trade-off between precision and recall.

Efficiency: Efficiency measures the computational resources required by the machine learning technique to classify instances. A good fake news detection technique should be efficient in terms of time and memory requirements.

Generalization: Generalization measures the ability of the machine learning technique to perform well on new and unseen data. A good fake news detection technique should be able to generalize well to new data.

Explainability: Explainability measures the extent to which the machine learning technique can provide interpretable results. A good fake news detection technique should be explainable to users to build trust and understandability.

Robustness: Robustness measures the ability of the machine learning technique to perform well under various conditions, such as changes in the distribution of data or the presence of adversarial attacks.

These criteria and factors provide a comprehensive framework for evaluating and comparing machine learning techniques for fake news detection. By considering these factors, researchers can develop more effective techniques for detecting fake news and improve the accuracy and reliability of fake news detection systems.

V CONCLUSION

This paper provides an overview of the existing research on fake news detection using machine learning techniques. Our analysis reveals that there are various approaches to detecting fake news, including supervised, unsupervised, and semi-supervised learning methods, that leverage textual, behavioral, and network features to model the characteristics of fake news.

We found that different machine learning algorithms have been used for fake news detection, with varying degrees of effectiveness depending on the features and

data used. Evaluation criteria and factors, such as accuracy, interpretability, scalability, and robustness to adversarial attacks, were used to compare and evaluate different methods.

However, we also identified several limitations and challenges of current fake news detection methods, including data availability and quality, model interpretability, adversarial attacks, cross-platform and cross-lingual applicability, temporal dynamics, and user behavior. These challenges point to the need for further research and development of more effective and scalable solutions for combating the spread of fake news.Our review also highlights several opportunities for improving fake news detection, including hybrid approaches, natural language processing, human-in-the-loop, explainable AI, and cross-domain learning. These opportunities suggest that interdisciplinary collaboration and innovation are crucial for developing effective and scalable solutions to the problem of fake news detection.Overall, this paper provides a comprehensive overview of the current state of research on fake news detection using machine learning techniques, highlighting the progress made so far and the challenges that remain to be addressed.

Implications for future research and development of fake news detection methods using machine learning

1. Based on our review, there are several implications for future research and development of fake news detection methods using machine learning. These include:
2. Data quality and availability: There is a need for better quality and more diverse data for training and testing machine learning models. Future research should focus on collecting and annotating more reliable and representative datasets.
3. **Model interpretability:** Model interpretability is crucial for building trust in the results and facilitating human decision-making. Future research should

focus on developing more interpretable models that can explain their decisions and provide insights into the factors contributing to fake news.

4. **Adversarial attacks**: Adversarial attacks can undermine the effectiveness of machine learning models. Future research should focus on developing more robust models that are resistant to adversarial attacks.

5. **Cross-platform and cross-lingual applicability**: Fake news can spread across multiple platforms and languages, making detection challenging. Future research should focus on developing methods that can be applied across different platforms and languages.

6. **Temporal dynamics:** The temporal dynamics of fake news can affect its spread and impact. Future research should focus on developing models that can capture the temporal dynamics of fake news and adapt to changing contexts.

7. **User behavior:** User behavior can be an important factor in the spread of fake news. Future research should focus on integrating user behavior data into machine learning models to improve their accuracy and effectiveness.

   Hybrid approaches: Hybrid approaches that combine different machine learning techniques can leverage the strengths of each approach and improve overall performance. Future research should focus on developing hybrid approaches that are effective and scalable. Overall, future research should focus on developing more effective, interpretable, and robust machine learning-based methods for fake news detection that can be applied across different platforms, languages, and contexts. Collaboration between researchers and practitioners from different domains can facilitate the development of more innovative and interdisciplinary solutions to combat the spread of fake news.

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Nostalgia between existence and homelessness in V.S. Naipaul's The Mimic Men and Among the Believer an Islamic Journey

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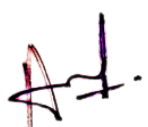**Dr. Vanshika R Gangwani[2]**

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ABSTRACT

The characters of V.S.Naipaul deal with heartbreaking existence, homes and developing truths of diaspora people. The isolation is a principal theme found in almost all of Naipul's works. It creates from rootlessness and coldness by exile; physical, psychological or social. Naipaul is a writer who uplifts us repeatedly to question, to write about the globe with the liberty of a person with no house, no state, and no connecting. The notion of "house" and "displaced" has always been persists theme of Diaspora literature, especially the literature of the Caribbean. The historical dislocation of the islands combined with the cross-cultural and different varieties of the area have been helpful to give hike to what can be mentioned as a dual society. It is very much clear that we have a society which is senseless and very much casual with confuse ideologies. The fractured

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behavior of the society gives the feeling of "homelessness" and is best defined as contradictory since it insists on roots and rootlessness: "home and homelessness" at the same time. The writer describes the people who had left their own country and try to settle themselves in alien place without familiar ambience with little faithfulness and with perceive that they are entering into a new and a beautiful world. The present paper aims to explore the feeling of nostalgia in an alien land and sense of belongingness for the native land.

Key words: Diaspora, Nostalgia, Migration, Identity Crisis and Home.

INTRODUCTION

The notion of 'Diaspora' comes into postcolonial literature in 1990 which is known as post-colonial theory. In the domain of diaspora literature, contrasting racial classes, build on their cultural ancestry, it has racial, historical, and cultural specificities; thus, the situation of the displaced people it is very complicated because they not able to find a "home" of their own V.S. Naipaul himself experienced, and repeatedly described in his fiction, this particular heart feeling urge. Throughout his life he has desired a place to identify his own existence. From genealogical mining, especially in his homeland (the alien), through the quest for his cultural roots(India), and finally to his place o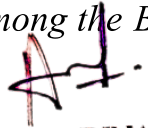f education (England) - he has attempted to search for his own identity. Being an Indian by ancestry, a Trinidadian by birth, and an

Englishman by education, V.S. Naipaul possesses a multi- cultural background. As a colonial, he has always needed to locate his place in the world through writing. Prolific and critical in both fiction and nonfiction, he presents colonial anxieties in his quest for self-identity. For him, journey is a way to understand oneself, to achieve self-knowledge. Fragmentation, alienation, and exile are common terms associated with postcolonial literature.

Naipaul wanted to get his liabilities of having no cultures and traditions. He has achieved success in making use of this liberty to obtain the emotional liberty. It is this mental and emotional freedom and lack of any relevance of understanding at the individual level to any especial place or culture which makes Naipaul a judge of the circumstances where disorder and chaos are at large. For Naipaul who has experienced colonial dislocation, the art of fiction has represented in the other ways where the lost self of man could be retrieved, clarified and restored.

The effects of the displacement of people_ their forced migration their desired migration deportation, their voluntary emigration, their movement to new lands their assumptions about their nostalgic place , their sufferings, aloofness, anxiety, pain everything Naipaul has presented in *The Mimic Men* and *Among the Believer in an Islamic Journey.*

The Mimic Men and Among the Believers

VS Naipaul's the other two novels *The Mimic Men* and *Among the Believers* are the fine portrayal of the rewriting of post-colonial discourse, and the firsthand experience of the travels made by author himself. The former portrays the picture of a man who is banished and now writes about the past traumatic experience of the colonial period while the latter is the journey taken by the author himself in the third world countries and writes down his experience of people, culture and society. *The Mimic Men* was published in 1967. It is the mixture of both fiction and nonfiction. It language is awry and whimsical, and the narration is not in a chronological order. It is Naipaul's first novel which discusses about the obscenity and the related to the sex. The story revolves round a man namely Ralph Singh who is Indian born now lives in Caribbean Islands. He is a politician who is on banishment in London. The protagonist while in exile in London attempts to share his socio-political experience by writing it. Ralph writes about the time of colonization and decolonization about the former British colonies. His memoirs present the picture of traumatic and disaster experience of colonizers in the hands of colonized. The another non-fictional account of Naipaul's *Among the Believer* published in 1981 share the authors experience about some Muslim nation which he travelled and got the

firsthand experience. What is the common between the two books is the experience that the author and the protagonist shares with the readers.

 The trauma and suffering of colonization and the escape from such disastrous moment becomes the predominate theme of the novel *The Mimic Men*. Ralph attests through his memoirs an escape from the land which is filled with calamity and catastrophe. He searches the new meaning of life where he could feel his existence. What the readers do experience in Naipaul's *A House for Mr. Biswas* where a man is in search of the new house. The house stands for the metaphor for the utopian state same in this narrative writing for protagonist becomes the escape. He unburdens himself through his memoirs. The memoirs of Singh are filled with the flashbacks and they turn the personal account of the protagonist. Although Ralph Singh jots down about the colonized states and their condition but at the same time he starts to write down about himself too. His writing revels the fact that he himself became the victim of oppression of banishment and now he wants to find the place which is disaster free similarly as Mr Biswas in *A House for Mr Biswas*. The flashbacks in the Singh's memoirs reveal his state of consciousness and his search for the new place what we can call utopia. Ralph Singh spends his childhood on the island called Isabella but at the end he was exiled from his own motherland and then eventually he settles down in London. So his writing becomes the first hand experience like in *Among the Believers*. In the former the narrator shares his dreams and aspirations while in the later the author tells his experience to the readers. If TS

Eliot would not have titled his poem *The Hollow Men* Naipaul might have entitled this novel with this name.

Ralph is completely aware about his instability, something which he perceives through the suppression of banishment. "Each person concealed his own darkness. ---The threat of other people's lives, the remembered private landscapes, the relationship…" (27-28). There are many people who are trying to escape from the past and deny their memory which is related to some event in one way or the other. Ralph after getting married with an English girl has woven the number of dreams but one he finds that she too carries darkness with her he feels his insecurity of place- less- ness and the loss of his identity. His one dream dashes but it gives the birth of another very soon. The displacement that he has gone through now attempts to replace his dream of utopia. Like *A House for Mr.Biswas, The Mimic Men* also conveys the message of homelessness and it also becomes one of the leitmotifs of the narrative. Ralph's unconsciousness s filled with the dream of constructing the new home and new place.
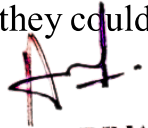
In the book *Among the Believers,* the authors decipher the deep layers of the meaning of the different Islamic cultures and their values. Naipaul takes the account of the countries such as Iran, Pakistan Indonesia and Malaysia. He explores the Islamic history and Islamic civilization in these countries. Naipaul takes the account only converted countries so that he leaves the Arab world. His dream to find out the underlying structures and dreams and aspirations in these

Islamic countries become the utopia for the people and the authors well. The revolution of the iron and its pre-revolution nostalgia and the post revolution utopia is being portrayed by the author in this account. The pre and post history of Iran becomes the predominate motif of the author. Pakistan's history becomes the controversial and mismatching. Its creation and its essence through the Islamic history and culture have been unravelled by the author explicitly. The dreams and the aspirations of the people and their culture has been highlighted the author in a very detailed way. Indonesia and Malaysia like Pakistan are also being portrayed in a very detailed way by the author. The belief system and the conflict between to make the Islam more pure and the pluralism are being shown by the author.

Both the books in one way and the other reveal the pre, present and the future conditions of the people and their culture.

Conclusion

The diaspora writer Naipaul's overview is filled with the remembrance of the past and the thinking of the future. Besides the diaspora writers living in abroad and tasting the western culture but their unconscious is engaged with their own motherlands directly or indirectly. They highlight the scattered past in their fiction and now try to assemble that and to create and reconstruct a new future where they could survive and can restore their dreams and aspirations.

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Design & Simulation of Stand Alone Solar-Wind Hybrid System for Rural Tribal Areas

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Abstract— **The India is known as country of villages and Indian economy based on agriculture. The Indian villagers required sufficient power supply because, the electrical energy is the basic requirements in modern era, but some rural tribal areas of India still facing electric power cut or electricity transmission lines not installed. Indian population are increasing day by day and energy demand are also increasing exponentially but the conventional energy sources are limited and exhaustible, not eco-friendly. Solar energy have been deemed clean, inexhaustible, unlimited and environmental friendly, But solar energy source is dependent on unpredictable factors such as weather and climatic conditions therefore for backup wind system used for continuous energy supply whole year.**
The main objective of my research work is to analyse the possibilities for installation of solar-wind stand-alone hybrid system in Rural Tribal areas on the basis of cost & location wise. To supply electric power in these areas first we proposed the small solar-wind stand-alone Hybrid system according availability of solar radiation and wind speed in these tribal areas.
Keywords— Smart Grid, HOMER, Hybrid System, Tribal Areas, On-Grid, Smart Meter, MATLAB

Introduction

There are many types of energy in which one type of energy Electrical Energy, before generation of electrical energy all work based on mechanical system but after invention of electric power generation everything based on electric power. The electric energy generation is the basic building block of any country development in present time. The electric power generation not possible on all locations so we generate power and transmitted to other location but in transmission many losses occurs and result is that power loss and black out situation. In our thesis work we try to reduce this electric power loss and remove the blackout situation by analyzing the proposed solar-wind grid connected hybrid system.
As the population increases day-by-day, so the demand of electricity increases simultaneously. All the electricity is supplied in cities, industries, mills and factories.
The renewable energy sources are inexhaustible and pollution free and these are available free of cost. These sources have been used by human beings in many applications like driving windmills for grinding corn and pumping water, propelling ships, etc. The cost of harnessing energy from renewable energy sources was high because the technologies used at that time were not as advance as now.

I. LITERATURE SURVEY

Literature review has helped to attain the conceptual clarity and to frame my theoretical perspective. Stand alone & Renewable Global Status Report provides a comprehensive and timely overview of renewable energy and energy policy development worldwide, World wind energy scenario, Global investment in renewable energy, Global demand for renewable energy, Total renewable power capacity worldwide, **New Policies Scenario, Efficient World Scenario, Global warming effect on environment etc.,** annual global support for renewables in New policies Scenarios.

Z. Benhachani, B. Azoui, R. Abdessemed, M. Chabane study the sizing and economic optimization of a stand-alone photovoltaic-wind hybrid system with storage batteries. Two methods are developed. The first method is based on the average annual monthly values in which the size of photovoltaic (PV) .In the second method, the determination of the size of these two components of the system is based on the worst month.
M. Bashir, J. Sadeh Over last two decades, solar and wind energies have become an alternative to traditional energy sources, In tribal areas can also energized using this renewable sources.

II. SURVEY OF IDENTIFIED AREAS

In India most of people's lives in villages and they are isolated from main city. In which some villages suffer for electricity supply therefore they use the different sources of energy. The survey of lighting fuel and cooking fuel uses in some villages are conducted near to study areas.
On the basis of survey the villagers use the different sources of energy for lighting as shown in table 1& Fig. 1 below.

Table 1.1

Different sources of energy for lighting used in villages

S.No.	Village	Candle	Battery	latern	Panel	Kero.	Elect.	Gen.	Solar	Biogas
1	CHIKLIYA	55	25	59	0	60	60	0	38	6
2	SHAHPURA	31	0	56	0	56	22	9	0	0
3	AMKHEDA	42	23	77	0	64	84	13	32	0
4	KHADAN KHURD	20	3	29	11	0	30	1	0	5
5	PADALIYA	90	35	99	0	100	100	0	0	82
6	SITAPAT	30	3	33	0	0	56	1	0	31
7	KHANPUR	57	20	65	0	65	65	4	0	47

IQAC COORDINATOR
SWAMI VIVEKANAND
COLLEGE OF ENGINEERING
KHANDWA ROAD, INDORE

PRINCIPAL
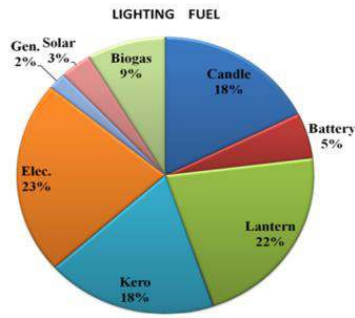SWAMI VIVEKANAND
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Fig. 1 Pi Graph of different sources used by villagers for lighting

On the basis of survey the villagers use the different sources of energy for cooking as shown in table 2& Fig.2 below

Table 1.2

Different sources of energy used by villagers for cooking

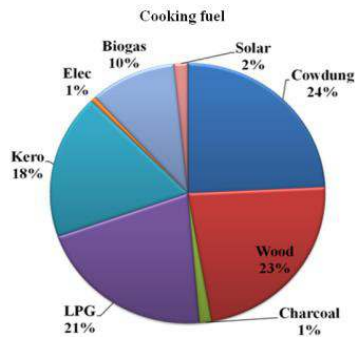| S.No.	Village	Cowdung	Wood	Charcoal	LPG	Kero.	Elect.	Biogas	Solar
1	CHIKLIYA	59	59	2	38	54	0	36	0
2	SHAHPURA	68	68	0	57	32	2	4	0
3	AMKHEDA	63	60	1	80	58	9	12	0
4	KHADAN KHURD	30	27	0	30	23	0	1	0
5	PADALIYA	100	100	8	79	76	61	67	32
6	SITAPAT	56	41	0	52	37	0	3	0
7	KHANPUR	65	65	17	49	49	0	51	0

Fig. 2 Pi Graph of different sources used by villagers for cooking

The data of electric load calculated on basis of 24 hours requirements and average data of solar collected yearly month wise and these data feed in HOMER software for proposed model.

III. SYSTEM DATA FOR PROPOSED MODEL

The proposed stand-alone Solar-Wind Hybrid system required some basic data to analyze the feasibility of system in tribal areas. For proposed a solar-wind hybrid system collection of electric load requirement a survey conducted in village Borli, Dhar, M.P. The 24 hours data of electric load of survey location used for system design and these basic data required in HOMER software as shown in table 3 below and wind data and solar data in table 4 feed average months wise because the system is based on conventional model. In my thesis work this is the research point, what happen the data feed month wise and data feed real time wise.

Table: 1.3 Electrical Load data

Houses Category	Load Type	Rated Power (Watts)	Quantity	Hours	Energy Wh/day	Total Energy kWh/Day
Small 197 Houses	Light	15	197	5	14775	22.79
	Radio	15	21	4	1260	
	Fan	75	15	6	6750	
Medium 56 Houses	Light	20	56	5	5600	25.45
	Radio	15	25	6	2250	
	Fan	75	28	6	12600	
	TV	200	5	5	5000	
Large 32 Houses	Light	30	32	5	4800	40.11
	Radio	15	29	6	2610	
	Fan	75	28	7	14700	
	TV	200	9	5	18000	
1 School	Light	15	2	3	90	0.87
	Fan	75	2	4	600	
	Computer	60	1	3	180	
1 Store	Light	20	1	7	140	0.52
	Fan	75	1	5	375	
	TV	200	1	5	1000	
		Total Load (kWh/Day)				89.74

The data of electric load calculated on basis of 24 hours requirements and average data of solar-wind collected yearly month wise and these data feed in HOMER software for proposed model.

Table 4

Average Wind and Solar Data for Village Borli (M.P.), INDIA

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed (m/s)	2.57	2.89	2.86	3.38	4.11	4.30	3.06	3.27	2.80	2.17	2.22	2.36
Solar radiation (kWh/m² /d)	4.18	5.65	6.35	6.99	7.20	6.08	4.77	4.12	5.19	5.79	4.70	4.21

IV. METHEDOLOGY

The generation, transmission and distribution of electric energy are based on conventional Grid system since generation of Electrical Energy. The conventional Grid system generation point of building block of electricity but energy saving and continues power supply point of view grid not supply power in tribal areas. so stand-alone solar-wind hybrid system is best option in these areas to electrified. We proposed a small solar-wind hybrid on grid model using HOMER software for village Borli, Dhar, M.P.
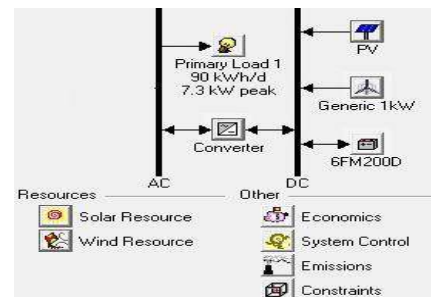

Fig.3: Simulations results of On-Grid

The HOMER software use the data feed by us and after simulation, display the number of feasible combination of

solar system and also suggest the optimized combination of system. The data in both hybrid model on-grid and off-grid feed on the basis of month wise collected data. The load demand data vary day to day but these are the traditional based hybrid system so we use month wise data. In Nano antenna based system these data updated time to time using digital GPS based device. In both proposed systems on-grid, we find the scope where data may be updated with real time, so we proposed these systems.
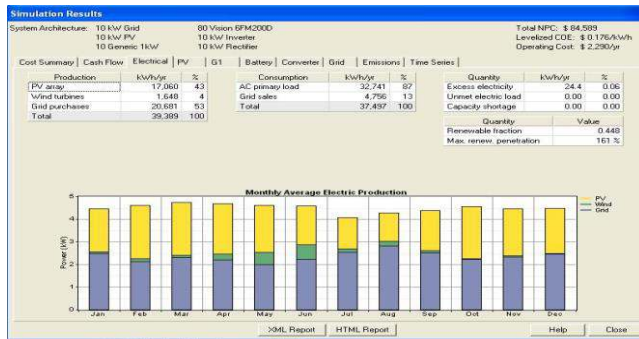

Fig.4 Renewable output power on-grid

In on-grid system 10 kW wind generator, 10 kW PV panels and 10 kW grid connections provided. The production of total renewable power output is 39389 kWh/yr. in which generation by solar 17060 kWh/yr. (43%), wind 1648 kWh/yr. (4%), and grid purchasing 20601 kWh/yr. (53%) in on grid hybrid system.

V. CONCLUSION

The conventional grid system uses the fix tariff system and use the single source to supply electric power. As we proposed the solar system based on conventional grid pattern in which all the data required are month wise or year wise according to these data, we analyzed the electric power generation and distribution.

We conclude this the Nano antenna based system is better than old tradition solar system in all aspect like multi supply source instead of single source as in old grid system.

The data used for analysis not month wise or year wise, whereas real time data used in Smart Grid system with the help of digital based devices. Smart Grid system provides.

the alternative source of energy that's why continues the supply and avoid the blackout situations.

VI. FUTURE SCOPE

The Nano antenna based solar system technology is better than conventional solar system in all respect, as multiple supply sources, real time data collection, and multiple supply tariff system. The coming era in electric power generation, transmission and distribution required the smart system. In future all devices will be converted in smart devices because smart technology not only help in power generation but also help in electric power saving.

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Design & Simulation of Stand Alone Nano Antenna based Rooftop Solar-PV System for remote areas

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Abstract— **The Energy is the basic requirements for to do any think. The Indian population are increasing day by day and energy demand are also increasing exponentially but the conventional energy sources are limited and exhaustible, not eco-friendly. Solar energy have been deemed clean, inexhaustible, unlimited and environmental friendly, But solar energy source is dependent on unpredictable factors such as weather and climatic conditions therefore Roof Top PV solar system with storage system like battery backup used for continuous energy supply through whole year. The cost of energy generation by Roof Top PV solar system is minimum and system eco-friendly. The main objective of this thesis work is to provide the electric power in remote areas where transmission line are not installed or power available only for few hours therefore on the basis of survey conducted in village Managawan (MP) for electricity requirement, a stand-alone Roof Top PV solar system is proposed.**
Keywords— Nano Antenna, HOMER, Hybrid System, On-Grid, MATLAB

Introduction

Energy is the basic requirement to do any type of work without energy nothing possible in present. There are many types of energy in which one type of energy Electrical Energy, before generation of electrical energy all work based on mechanical system but after invention of electric power generation everything based on electric power. The electric energy generation is the basic building block of any country development in present time. The electric power generation not possible on all locations so we generate power and transmitted to other location but in transmission many losses occurs and result is that power loss and black out situation. In our thesis work we try to reduce this electric power loss and remove the blackout situation by analyzing the proposed solar-wind grid connected hybrid system.

India is a developing country, there are total 6, 38,596 villages in India, in which 5, 93,732 villages are inhabited. Out of 5, 93,732 villages, 5,127 villages are electrified only for some hours & rest 38605 villages are using kerosene lamp for lighting their houses. India is not economically stable as it is a developing country. As the population increases day-by-day, so the demand of electricity increases simultaneously. All the electricity is supplied in cities, industries, mills and factories.

The renewable energy sources are inexhaustible and pollution free and these are available free of cost. These sources have been used by human beings in many applications like driving windmills for grinding corn and pumping water, propelling ships, etc. The cost of harnessing energy from renewable energy sources was high because the technologies used at that time were not as advance as now..

I. LITERATURE SURVEY

Literature review has helped to attain the conceptual clarity and to frame my theoretical perspective. Smart Grid & Renewable Global Status Report provides a comprehensive and timely overview of renewable energy and energy policy development worldwide, World wind energy scenario, Global investment in renewable energy, Global demand for renewable energy, Total renewable power capacity worldwide, New Policies Scenario, Efficient World Scenario, Global warming effect on environment etc., annual global support for renewables in New policies Scenarios.

Fatma M. Abdel Hamied, Korany R. Mahmoud1, Mohamed Hussein and Salah S. A. Obayya- They worked to introduce a new modification to the conventional Archimedean spiral NA to improve its radiation/harvesting efficiency and directivity. Published in ERC, Vol. 111, 25–34, 2019
Z. Benhachani, B. Azoui, R. Abdessemed, M. Chabane – "Study the sizing and economic optimization of a stand-alone photovoltaic-wind hybrid system with storage batteries".

II. SYSTEM DATA FOR PROPOSED MODEL

The proposed Nano Antenna based system required some basic data to analyze the conventional grid system in comparison with tradition system. For proposed a stand-alone Nano antenna based solar system collection of electric load requirement a survey conducted in village Managawn Rewa, M.P. The 24 hours data of electric load of survey location used for system design and these basic data required in HOMER software as shown in fig. 1 below and solar data in table 2 feed average months wise because the system is based on conventional model. In my thesis work this is the research point, what happen the data feed month wise and data feed real time wise.
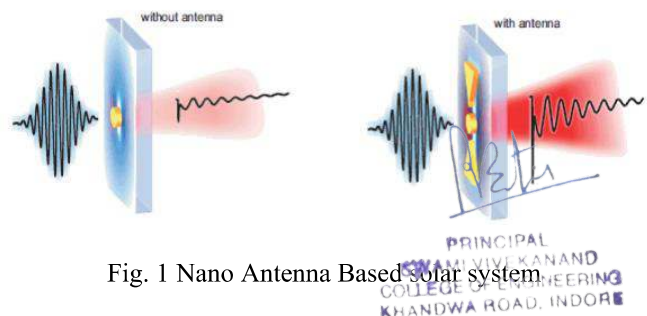

Fig. 1 Nano Antenna Based Solar system

The data of electric load calculated on basis of 24 hours requirements and average data of solar collected yearly month wise and these data feed in HOMER software for proposed model.

Table: 1 Electrical Load Calculation

Houses Category	Load Type	Rated Power (Watts)	Quantity	Hours	Energy Wh/day	Total Energy KWh/day
Small 197 Houses	Light	15	197	5	14775	22.79
	Radio	15	21	4	1260	
	Fan	75	15	6	6750	
Medium 56 Houses	Light	20	56	5	5600	25.45
	Radio	15	25	6	2250	
	Fan	75	28	6	12600	
	TV	200	5	5	5000	
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1 Store	Light	20	1	7	140	0.52
	Fan	75	1	5	375	
	TV	200	1	5	1000	
				Total Load (kWh/Day)		89.74

III. MODERNIZATION OF GRID SYSTEM

The generation, transmission and distribution of electric energy are based on conventional Grid system since generation of Electrical Energy. The conventional Grid system generation point of building block of electricity but energy saving and continues power supply point of view. The present time required changes in electrical grid system so that to analyse the significant of new technology like "Smart Grid". We proposed a small solar system on grid model using HOMER software for village Manganw, Rewa, M.P.

Table: 2 Electric Loads Hourly

TIME (HOURS)		1	2	3	4	5	6	7	8	9	10	11	12
KW	Jan to Dec	3.50	3.47	3.40	3.39	3.54	3.77	3.96	3.75	4.05	3.93	3.72	3.73
TIME (HOURS)	Jan to Dec	13	14	15	16	13	18	19	20	21	22	23	24
KW		3.93	4.03	3.85	3.87	3.81	4.08	4.04	3.89	4.03	3.80	3.46	3.40

On the basis of electric load data, solar & wind data HOMER software design the system model as follow.
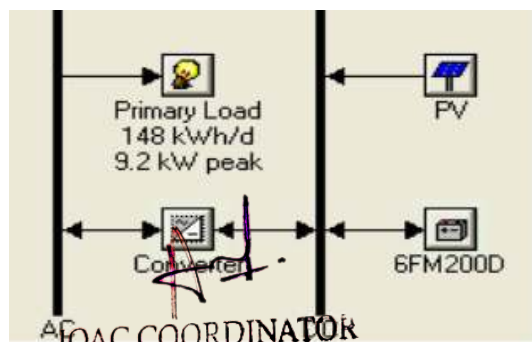

Fig.2 Off-Grid (Stand Alone) Model

The electric power requirement of village Managanw, Rewa, M.P. is around 98 kWh/day for this load, we proposed a solar system using HOMER software, to analyze the significant of new technology like Smart Grid. Smart Grid means the data of electric load, power generation, transmission and distribution in present old technology calculated month wise or year wise but in smart grid technic all data calculated on present time and data updating using all digital based devices. The data of electric load may be varying season to season in tradition technic. In tradition old grid system the load forecasting is major problem. We also analyze this problem in smart grid technic to solve the problems.

In faulty condition major problem is that to find the exact faulty location, according to load variation how the react the electrical device all thesis thinks. We have to analyze in smart grid system so proposed an on-grid. In a system the system is better than other analyzed in comparison with smart grid system.

IV. SIMULATION RESULTS

The proposed solar-wind hybrid model simulates in HOMER software and generates the number of feasible combination of system with optimized result as shown in fig.3 on-grid. It is difficult manually to finalize the feasible combination of components, which are actually used in Installation of solar system. We provide the number of different combinations to HOMER software, on the basis of different combination, HOMER calculate the solar radiation of whole year and other devices prices.

Fig.3: Simulations results of On-Grid

The HOMER software use the data feed by us and after simulation, display the number of feasible combination of solar system and also suggest the optimized combination of system. The data in both hybrid model on-grid and off-grid feed on the basis of month wise collected data. The load demand data vary day to day but these are the traditional based hybrid system so we use month wise data. In Nano antenna based system these data updated time to time using digital GPS based device. In both proposed systems on-grid, we find the scope where data may be updated with real time, so we proposed these systems.
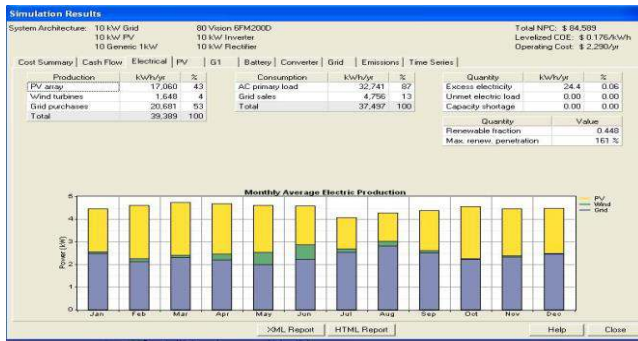
Fig.4 Renewable output power on-grid

In on-grid system 10 kW wind generator, 10 kW PV panels and 10 kW grid connections provided. The production of total renewable power output is 39389 kWh/yr. in which generation by solar 17060 kWh/yr. (43%), wind 1648 kWh/yr. (4%), and grid purchasing 20601 kWh/yr. (53%) in on grid hybrid system.

V. CONCLUSION

The conventional grid system uses the fix tariff system and use the single source to supply electric power. As we proposed the solar system based on conventional grid pattern in which all the data required are month wise or year wise according to these data, we analyzed the electric power generation and distribution.

We conclude this the Nano antenna based system is better than old tradition solar system in all aspect like multi supply source instead of single source as in old grid system.

The data used for analysis not month wise or year wise, whereas real time data used in Smart Grid system with the help of digital based devices. Smart Grid system provides.

the alternative source of energy that's why continues the supply and avoid the blackout situations.

VI. FUTURE SCOPE

The Nano antenna based solar system technology is better than conventional solar system in all respect, as multiple supply sources, real time data collection, and multiple supply tariff system. The coming era in electric power generation, transmission and distribution required the smart system. In future all devices will be converted in smart devices because smart technology not only help in power generation but also help in electric power saving.

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Power Quality Improvement through Different PWM Techniques in power Converters

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Abstract—According to the development of electric energy consumption and increasing nonlinear loads in power systems, production of high quality of electric power is the main problem of power engineering. Therefore, it is needed to evaluate the problems of quality in the power systems is enhanced. Comprehensive knowledge of power quality issues is important in today's electrical power system operating environment; the main view of this paper is to improve the power quality by using PWM Techniques and discussed on how to reduce harmonic in power system. In this paper, the quality of power provides an explanation for in term of definitions, causes and effect. For Improving peak voltage and harmonic effect reduction, different PWM techniques are used. Most of PWM method used in reducing the issue of power quality like Single PWM, Multi PWM, and Sinusoidal PWM. The traditional Regular Sampled PWM method may be used to harmonic minimization and additionally harmonic elimination PWM to be closely reproduced the usage of simple algebraic equations. This paper describes the consequences of power quality problem using MATLAB simulation.

Keywords— Power Quality, PWM Techniques, SPWM, Harmonics, PWM-AC controller

I. Introduction

Power quality, the term which is used to define the power of electricity and it is used to drive the electrical load and ability to drive function used in electric power. With the improper strength of power, an electrical load or device may additionally malfunction and device will be damaged before time period. In power system, there are many causes for making the power quality poor. There is the various meaning of power quality as per different people.

The power quality term is described by standard IEEE 1100. According to this, PQ is a terminology that decides the powering and grounding of any equipment in a suitable manner. In another manner, PQ is a set of electrical boundaries that gives the instruction to any equipment to work in such a manner that there is no loss in the performance of like expectancy [1].

The quality of power is affected due to variation in voltage and current or frequency on the end side of the device. Voltage sag problem is the major issue in power quality. The primary cause of power quality problem occurs due to uses of highly solid state switching device, nonlinear load and electronically switched loads in equipment. In highly solid state switching device, the power quality issue and the problem have considered. In the case of non-sinusoidal current flow in the transmission line and distribution system, prevalent power semiconductor switches are used [2].

In power system, voltage distortion, harmonics, and distortion are generated due to the electronic load. There are many reasons for affect power quality like as loss in computer data, memory loss in sensitive equipment such as PLC machine, computer [2].

The most affecting part of the distributions system is voltage sag and swells. It also expands power quality issue affecting especially industries where in concerned losses may be reached very excessive values. Voltage sags are because of faults somewhere else within the device. They have received special attention now because spectacular failure has highlighted the problem that results from the performance of computer controlled loads and adjustable speed drives during these voltage sags/swells. Sags/Swells can cause components over heating or destruction. Sags/Swells not only cause considerable productivity loss but there are also hard to control. Sag /Swell are events of short duration but high impact. In industry, the problem of voltage Sag/Swell occurs around 10% to 90% in power system [3]. The main reason of voltage Sag is a short circuit, fluctuation in light, the flow of largest current and problem of voltage swell we have presented due to a single line to earth fault on the system, which can result in a temporary voltage increment on the phases [4].

II. PWM TECHNIQUES

The number of PWM technique used in controlling resulting value of output voltage and frequency in an inverter circuit and all techniques are explained below:

- **Single-Pulse-Width-Modulation:**

In single PWM method, a single pulse is generated in a half cycle and as per the change in the pulse width the RMS value of output voltage changes as well. The output AC voltage and gating signal is shown figure 1(b). The gate signals are produced by comparison of the input signal Vc or the amplitude of message with reference signal Vcar or the amplitude of carrier. The frequency of message signal is analyzed with the help of fundamental frequency in AC output voltage.

Fig. 1 Single Pulse Width Modulation

The output voltage Vrms is defined as:

$$V_o = V_s \sqrt{\frac{2t_{on}}{T}} = V_s\sqrt{2\delta}$$

Where δ is duty ratio,

Modulation Index (MI)

$$m_a = \frac{V_c}{V_{car}}$$

Value of modulation index varies from 0 to 1. According to modulation index it's varies pulse 0 to π/p and change in output voltage 0 to Vs.

- **Multiple-Pulse-Width-Modulation:**

In Multiple PWM method, there is multiple output pulse generated during half cycle period and all pulses width are equal. The gating signals are produced due to comparing the amplitude of message or control signal with the amplitude of carrier or reference signal. In Multi PWM technique frequency of the message signal sets the output frequency (f0) and carrier frequency (fc).

The number of pulses is calculated in half cycle during this expression:

$$P = \frac{f_c}{2f_0}$$

In figure-2 shows the output sinusoidal wave generator using multiple PWM technique.

Fig. 2 Multiple PWM Technique

- **Sinusoidal-Pulse-Width-Modulation (SPWM):**

In simple source inverter, during each cycle, as per our requirement, the switches can be turned Off and On. Due to this switching condition, the output is the square wave. For getting pure sinusoidal waveform we have to increase the number of switching timing as per cycle. In Sinusoidal PWM technique waveform is produced due to comparing the given modulated waveform through triangular waveform at high frequency. In comparing both waveforms the resulting output voltage is negative or positive it depends on whether the voltage of the signal is smaller or larger than the carrier waveform.
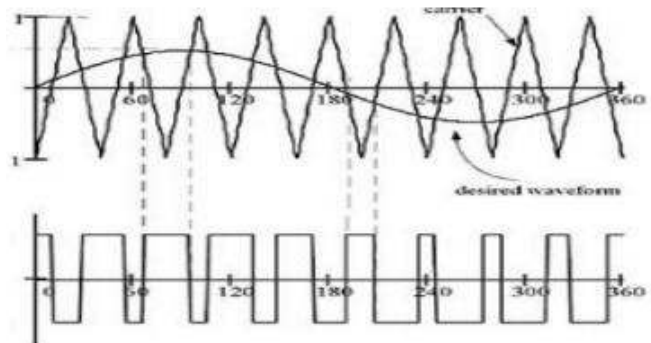

Fig. 3 Sinusoidal Pulse Width Modulation

The output voltage Vrms is defined as:

$$V_o = V_s \sqrt{\frac{p\delta}{\pi}} = V_s \sqrt{\sum_{m=1}^{2p} \frac{\delta_m}{\pi}}$$

Where p is number of pulses and δ is width of pulse.

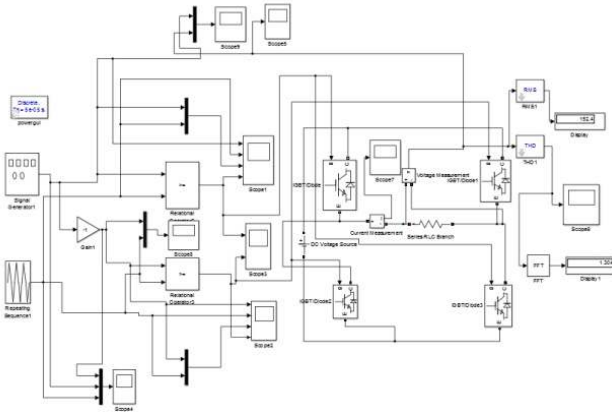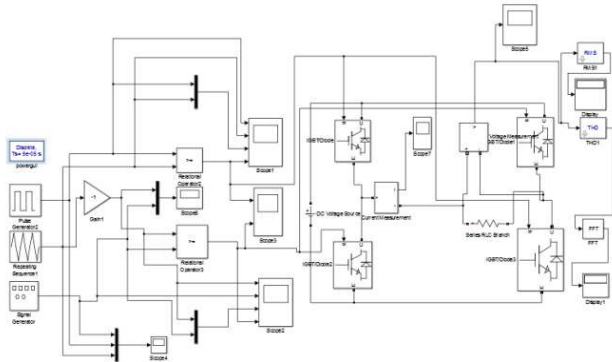## III. SIMULATION MODEL

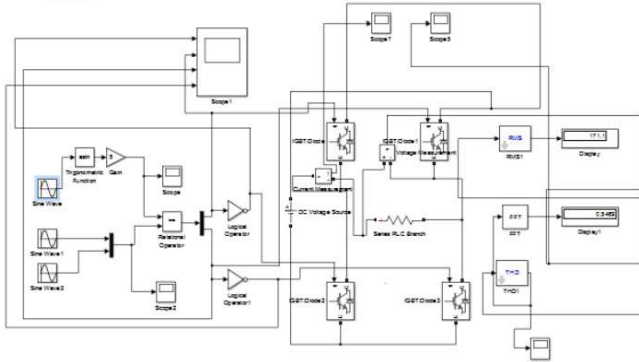Fig. 4- Single Pulse PWM

Fig. 5- Multi Pulse PWM

Fig. 6- Sinusoidal PWM

IV. RESULTS

In this result, we have discussed the issue of power quality in equipment and the affecting parameter in power quality and analyzed the different correction method for reduce the problem in power system. In above simulation, we have explained all three types of PWM techniques like single pulse, multi pulse and sinusoidal PWM technique to improve the quality of power and explained how to decrease harmonic in electric device presented on a single-phase load. The term harmonic current is used for reducing the existing problem in designing of any equipment. The total harmonic in all three methods is measured by use of FFT scheme.

Fig.7- Harmonic analysis of voltage on Single Pulse Modulation

Fig. 8- Harmonic analysis of voltage on Multi Pulse Modulation

Fig. 9 Harmonic analysis of voltage on Sinusoidal Pulse Modulation

In above simulation model, we have described all three PWM methods and voltage 220V DC used as the input voltage. THD is calculated at 10 kHz carrier frequency is generated 50Hz frequency output at load R=10k ohm.

Table 1

PWM Technique	Fundamental (50 Hz)	THD (%)
Single-PWM	164.4 V	84.69
Multi-PWM	180.0 V	82.61
Sinusoidal-PWM	212.3 V	54.69

Thus our objective is met with these results. From Table-1, it can be seen that the sinusoidal PWM has good fundamental component and less harmonics. Technically in single and multi PWM method more harmonic have present and fundamental voltage are less compare to the input voltage. THD can be reduced by a greater extent using proper filter design.

V.   CONCLUSION

This paper gives a wide background of power quality in terms of its issues, definitions, causes, effects. Harmonic distortions levels, in general, are within limits in all areas except for one residential and one commercial area .In most areas, the 3rd and 5th harmonics are the highest suggesting heavy usage of computers and pulsed converters respectively. Specific power quality causes will be identified and its effect will be investigated. From there, the best and cost effective mitigation means can be proposed. This type of analysis will be more useful as the end result motivates the improvement of the power quality in that particular area. Some problems can also be improved, solved and mitigated by using some useful software tools

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"Electrical Load frequency control in Electric Vehicles using AI Techniques"

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Abstract—**There are several challenges associated with electric vehicles. This work discusses the effect of electric vehicles on the load frequency deviation. This project shows a case study of designing a controller that can withstand optimal results in a two-area power system when the input parameters of the system are changed. Load Frequency Control (LFC) is used to regulate and control the output frequency signal of the electric generated power within an area in response to changes in system loads. The gain constants in the case of conventional controllers remain same throughout, for changes in the load value. However, Load cannot be the same throughout, load deviates from time to time. This work presents a new design of various types of load frequency controllers based on different types of Artificial Intelligent (AI) optimization techniques such as Fuzzy logic, ANN tuner for a single area power system. The performance of the controller under study shows an enhancement in the frequency deviation signal as well as the peak overshoot and settling time for the frequency output signal. The performance of the proposed scheme is validated using MATLAB/ SIMULINK tools.**

Keywords— Area Power System, Electric Vehicles, Load Frequency Control, Artificial Neural Networks (ANN), Adaptive Neuro Fuzzy Inference Systems (ANFIS)

Introduction

The input mechanical power is utilized to control the frequency of the generators and the variation in the frequency and tie-line power are detected, which is the extent of the alteration in the rotor angle. A decently outlined power framework ought to have the capacity to give satisfactory levels of power quality by keeping the frequency and voltage size inside the middle of as far as possible. As the loading in a power system is not constant so the controllers for the system must be aimed to provide quality service to the power system. The power flow and frequency in an interconnected system are well regulated by AGC. The main purpose of the AGC is to retain the system

frequency constant and almost inert to any disturbances. Generally, two things are being controlled in AGC i.e. voltage and frequency. Both have separate control loops and independent of each other. Apart from controlling the frequency, the secondary majors are to maintain a zero steady-state error and to ensure optimal transient behavior within the interconnected Areas.

The objective is to design a controller to apprehend preferred power flow and frequency in a two Area power system. Changes in the power system load influence chiefly the system frequency, while the reactive power is less delicate to changes in frequency and is fundamentally reliant on vacillations of voltage size. Therefore, the control of the true and reactive power in the power system is managed independently. The load frequency control fundamentally manages the control of the system frequency and genuine power in as much as the programmed Voltage controller circle directs the progressions in the reactive power and voltage extent. Load frequency control is the premise of numerous progressed ideas of the vast scale control of the power system.

I. LITERATURE SURVEY

Literature review has helped to attain the conceptual clarity and to frame my theoretical perspective. Anestis G. Anastasiadis et al. "Effects of Increased Electric Vehicles into a Distribution Network".

This paper introduced that Grids face another and significant test: the approaching mass infiltration of module Electrical Vehicles (EVs). By and by, the models of transmission and conveyance networks are yet cantered on the customary plan and operational standards.

Anil Annamraju and Srikanth Nandiraju "Coordinated control of conventional power sources and PHEVs using Jaya algorithm optimized PID controller for frequency control of a renewable penetrated power system". This paper talked about that in sustainable infiltrated power frameworks, recurrence unsteadiness emerges because of the unpredictable idea of sustainable power sources (RES) and burden unsettling influences.

Neofytos Neofytou et al. "Modeling Vehicles to Grid as a Source of Distributed Frequency Regulation in Isolated Grids with Significant RES Penetration". This paper examined that the fast improvement of the innovation utilized in electric vehicles, and specifically their entrance in power systems, is a significant test for the territory of electric force frameworks.

II. SYSTEM DATA FOR PROPOSED MODEL

Load Frequency Control (LFC) is being used for several years as part of the Automatic Generation Control (AGC) scheme in electric power systems. One of the objectives of AGC is to maintain the system frequency at a nominal value (50 Hz).The frequency is sensed by a frequency sensor. The change in frequency and tie-line real power can be measured by a change in rotor angle δ. The load frequency controller amplifies and transforms the error signal, i.e., (Δfi) into real power command signal ΔPci, which is sent to the prime mover via governor (that controls the valve mechanism).
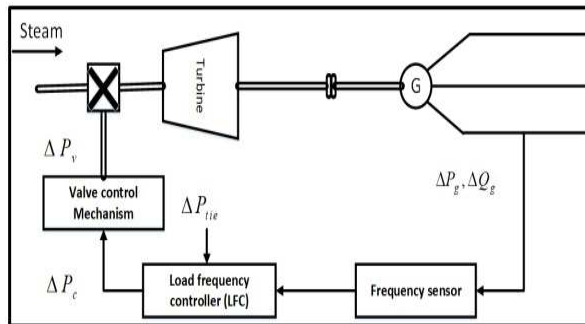
Fig. 1 Block diagram Load frequency control

The LFC problem in power systems has a long history. In a power system, LFC as an ancillary service acquires an important and fundamental role to maintain the electrical system reliability at an adequate level. It has gained importance with the change of power system structure and the growth of the size and complexity of interconnected systems.
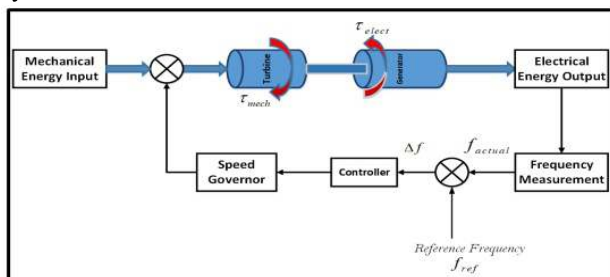

Fig.2- Block diagram of AGC

To provide stability, a constant frequency is required which depends on active power balance. If any change occurs in active power demand/generation in power systems, the frequency cannot behold its Rated value. Hence,

oscillations increase in both power and frequency. Thus, the system is subjected to a serious instability problem. To improve the stability of the power networks, it is necessary to design load frequency control (LFC) systems that control the power generation and active power at tie lines of the interconnected systems.
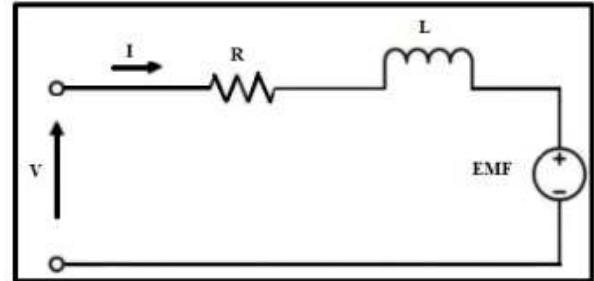
III. ELECTRIC CAR MATHEMATICAL MODEL

Fig 3 - Equivalent circuit of DC motor

We know that:
• The voltage across a resistor can be written: I*R
• The voltage across an inductor can be written: $L * dI\ dt$
• According to Kirchhoff's law, the sum of all voltages across a closed path in a circuit is equal to zero. Thus,

$$V = (t) * R + L * dI\ dt + (t)\ (24)$$

The Torque in an electric DC motor can be written:

$$T(t) = KT * I(T)$$

With the motor torque, constantly defined its manufacturing characteristics
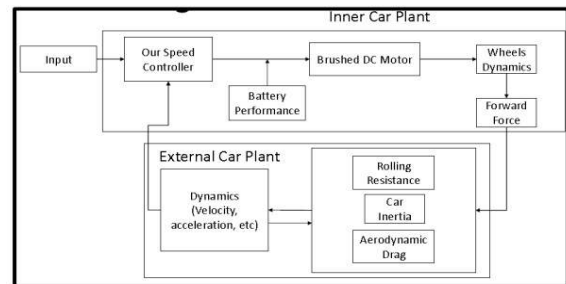

Fig 4- Model diagram of Electrical Vehicle

IV. SIMULATION RESULTS

In this section, the results obtained after the simulating model. The load variation and EV charging are set to start at 5 sec.
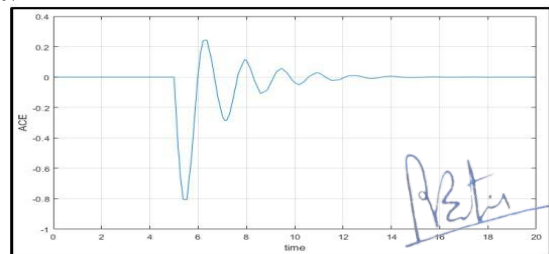

Fig 5- ACE for ANN-PI controller

Figure depicts the graph of area control Error (ACE) for the PID controller-based model. This value is supplied to the PID block as an input. The simulation is done for 50 seconds in total.
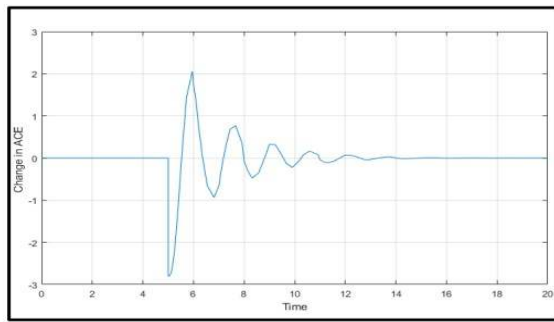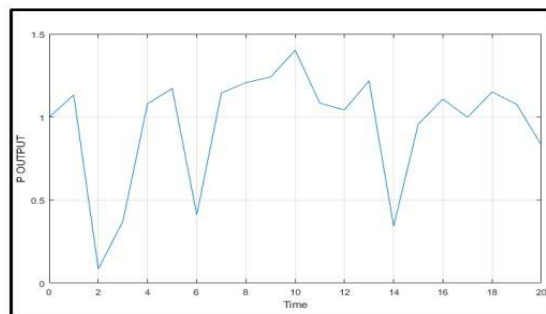

Fig 6- Change in ACE for ANN-PI controller
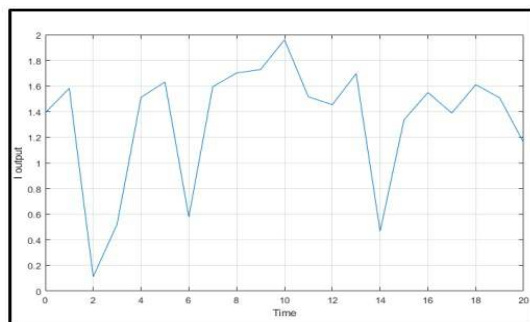

Fig 7- Output signal from ANN for Proportional gain

Fig 8- Output signal from ANN for Integral gain

V. CONCLUSION

Load Frequency Control (LFC) is used to regulate and control the output frequency signal of the electrically generated power within an area in response to changes in system loads. This article discusses the effect of electric vehicles on the load frequency deviation. This project shows a case study of designing a controller that can withstand optimal results in a two-area power system when the input parameters of the system are changed. Two methods of Load Frequency Control were studied considering an isolated power system.

The performance of the controller's understudy is tested and validated using MATLAB/SIMULINK tools. In comparison, it is found that ANN-PI has a minimum peak, whereas ANFIS has a minimum percentage overshoot out of the three. The simulation result in proof that the new

techniques are succeeded to improve the controller performance.

VI. FUTURE SCOPE

1. In the future, a signal processing tool can be utilized to their effect on results.
2. Some of the Hybrid techniques like Wavelet Neural Network etc. can be checked to see improvement in results.
3. By adding generation control and governor dead band into the system will look more realistic and nonlinear.

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TO STUDY THE POWER FACTOR IMPROVEMENT IN NSAIL: AN ANALYSIS

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Abstract- We have study power factor improvement technique because it will help to conserve the electrical energy. All inductive loads in a plant draw inductive reactive power from the source, reducing the power factor of whole plant. This causes higher distribution losses in addition to the penalty imposed onto the plant by supplier. Thus it is desired to implant suitable power factor correction techniques to improve the power quality along with many other benefits. Many different techniques are in use to improve the power factor according to the plant and facilities. We will discuss the power factor correction techniques used in National Steel and Agro Industries Ltd. (NSAIL) Dhar. We have performed practical study on Continuous Galvanized Line (CGL) and Cold Rolling Mill (CRM) showing the benefits achieved by power factor improvement in power system of National Steel and Agro Industries Ltd. (NSAIL) Dhar.

Keywords- Power Factor Correction, CRM, CGL, NSAIL, Capacitor Bank.

Introduction

In this study we emphasizes on the analysis of reactive energy and power factor in NSAIL steel plant. There will be a detailed evaluation of the reactive power consumption, and also the addition of capacitors which improves the power factor. Solutions to the issue, like the implementation of capacitors bank are discussed for NSAIL use.

The power factor (PF) of an Alternating Current (AC) electric power system is defined as the ratio of the real power flowing to the load to the apparent power in the circuit, and is a dimensionless number between 0 and 1.

$$P.F. = \frac{Actual\ Power}{Apparent\ Power} \quad or \quad P.F. = Cos\Theta$$
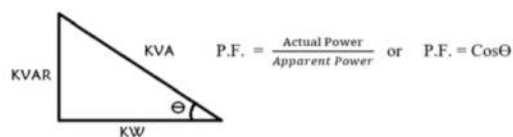
Fig1: Power Factor

We measure Active power (KW) , because it is our real power , we are perform the work and it is usable power. We measure Reactive power in (KVAR) and we cannot perform work with the help of this power.

Due to the unstable of power factor we can define as following reasons.

1. There are many LED lights, halogens, & lamps
2. There are many Bridle motors, POR (Pay off reel) motors, Deflectors roll motors, etc. has low power factor.
3. Compressor, Blowers motors are under excited motors i.e., Synchronous motors so it have low power factor.

1MVA & 2MVA Transformers are very inductive and shows very low power factor.

CGL line: CGL (Continue galvanizing line) consists of 2 inductor loads of 350kW each and several other components like bridle motors, POR (Pay off reel) motors, Deflectors roll motors, etc. Due to these inductive loads, power factor is reduced considerably. To improve the power factor of the plant we employ 3 Capacitor banks of 5*50kVAR (a total of 250kVAR) each. Out of these 3 banks, 2 are at use while one remains on standby for emergency/overloading conditions.

Fig2: Capacitor Bank at NSAIL

Fig3: HT Breaker Main Incomer at NSAIL

Fig4: LT Breaker Main Incomer at NSAIL

I. PROBLEM DEFINATION

Low power factor is one of the serious problems in any industry. Almost all the load is inductive which draws inductive power from the source. This may lead to unwanted fluctuations in power and may lead to equipment failure causing a shut-down, which is not appreciated in any industry.

Furthermore, MPEB imposes a serious penalty on the industry for any power factor below 0.95. An incentive is awarded to the facility which maintains its average power-factor above 0.99 or 99%. Thus it is encouraged to keep power factor above 99%, which in turn possesses a huge challenge as loading conditions in industries are always a variable.
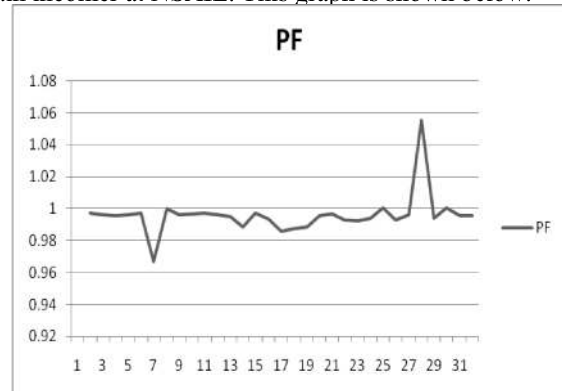
We analyzed the power consumed by NSAIL in Dec 2022 and obtained the graph for the same is shown below.

UPDATE POWER FACTOR MAIN INCOMER O/G

DATE	KW READING CURRENT READING	PREVIOUS	DIFF (KW)	KVA READING CURRENT READING	PREVIOUS	DIFF (KVA	PF
1-Dec-22	3047.97	3027.42	20.55	3072.45	3051.85	20.6	0.99757
2-Dec-22	3062.51	3047.97	14.54	3087.04	3072.45	14.59	0.99657
3-Dec-22	3077.58	3062.51	15.07	3102.17	3087.04	15.13	0.99603
4-Dec-22	3090.8	3077.58	13.22	3115.44	3102.17	13.27	0.99623
5-Dec-22	3107.82	3090.8	17.02	3132.5	3115.44	17.06	0.99766
6-Dec-22	3124.048	3107.82	16.228	3149.28	3132.5	16.78	0.9671
7-Dec-22	3138.25	3124.48	13.77	3163.05	3149.28	13.77	1
8-Dec-22	3155.23	3138.25	16.98	3180.09	3163.05	17.04	0.99648
9-Dec-22	3172.46	3155.23	17.23	3197.37	3180.09	17.28	0.99711
10-Dec-22	3190.38	3172.46	17.92	3215.34	3197.37	17.97	0.99722
11-Dec-22	3206.86	3190.38	16.48	3231.88	3215.34	16.54	0.99637
12-Dec-22	3226.09	3206.86	19.23	3251.2	3231.88	19.32	0.99534
13-Dec-22	3245.13	3226.09	19.04	3270.46	3251.2	19.26	0.98858
14-Dec-22	3265.86	3245.13	20.73	3291.24	3270.46	20.78	0.99759
15-Dec-22	3284.19	3265.86	18.33	3309.69	3291.24	18.45	0.9935
16-Dec-22	3302.64	3284.19	18.45	3328.4	3309.69	18.71	0.9861
17-Dec-22	3320.48	3302.64	17.84	3346.46	3328.4	18.06	0.98782
18-Dec-22	3337.82	3320.48	17.34	3364	3346.46	17.54	0.9886
19-Dec-22	3356.4	3337.82	18.58	3382.66	3364	18.66	0.99571
20-Dec-22	3375.46	3356.4	19.06	3401.78	3382.66	19.12	0.99686
21-Dec-22	3393.57	3375.46	18.11	3420.02	3401.78	18.24	0.99287
22-Dec-22	3410.52	3393.57	16.95	3437.1	3420.02	17.08	0.99239
23-Dec-22	3426.45	3410.52	15.93	3453.12	3437.1	16.02	0.99438
24-Dec-22	3441.41	3426.345	15.065	3468.17	3453.12	15.05	1.001
25-Dec-22	3460.15	3441.41	18.74	3487.04	3468.17	18.87	0.99311
26-Dec-22	3477.75	3460.15	17.6	3504.7	3487.04	17.66	0.9966
27-Dec-22	3495.62	3477.75	17.87	3521.63	3504.7	16.93	1.05552
28-Dec-22	3508.65	3494.62	14.03	3535.74	3521.63	14.11	0.99433
29-Dec-22	3522.58	3508.65	13.93	3549.7	3535.78	13.92	1.00720
30-Dec-22	3538.47	3522.58	15.89	3565.66	3549.7	15.96	0.99561
31-Dec-22	3555.75	3538.47	17.28	3583.01	3565.66	17.35	0.99597
					Average Power Factor		0.995

We observed some irregularities in data for power factor on 24-Dec, 27-Dec and 29-Dec as power factor was observed more than 1 suggesting that data recording software is not very precise (to be analyzed in later papers).

According to the data we observed we plotted various graphs for Power Consumed (kW) and total power (kVA) as shown below.
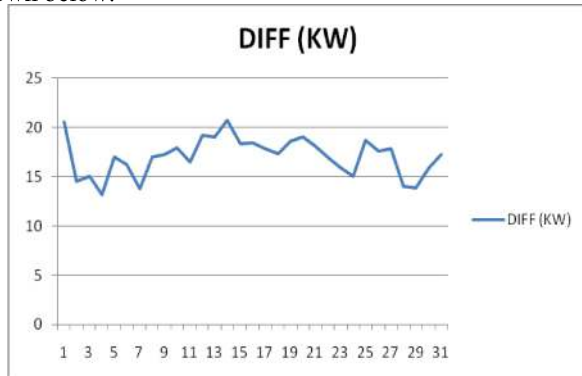
DIFF (KW) is the difference in current reading and previous reading of power consumed (Active power) by NSAIL during Dec 2022. X-axis represents each day of December month.
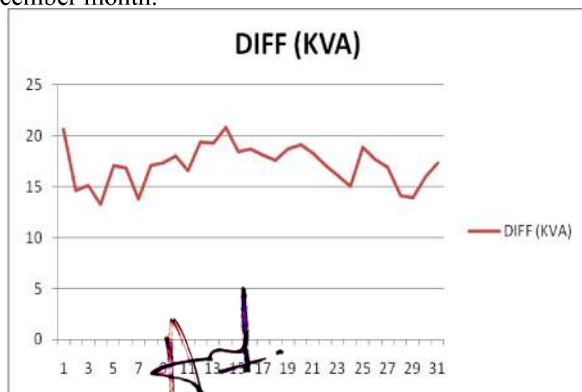
DIFF (KVA) is the difference in current reading and previous reading of total power (Apparent power) recorded by NSAIL during Dec 2022.

This data helped us to calculate the power factor of the main incomer at NSAIL. This graph is shown below.

As mentioned above, this data shows some descrepencies in power factor graph as power factor shall not have values more than 1.

Here we propose a better recording system of power for NSAIL. Also the power factor correcting capacitor banks as power factor graph dives below 0.98 on 6-Dec suggesting a surge in power on that day which was confirmed later.

II. FUTURE SCOPE

We wish to employ various methods to study and improve the power factor of NSAIL using MATLAB simulations. Using HT/LT breaker to observe power factor of CGL (Continue Galvanizing Line) and CRM (Cold rolling mill) and compare the data sheet of NSAIL with MATLAB simulation via Graphical representation.

III. RESULT

We summarize the above analysis in form of a table shown below.

Dec-22			
DATE	FROM	TO	CURRENT MONTH
	01-12-22	31-12-22	
	OPEN	CLOSE	DIFFRENCE
kWH	3047.97	3555.75	507.78
kVAH	3072.45	3583.01	510.56
AVERAGE POWER FACTOR			0.994554998

IV. CONCLUSION

We are accurately perform and analysis of power factor improvement in NSAIL in CGL plant and maintaining power factor between 0.8 to 0.99 means 99% accuracy with the help of capacitor bank and due to some disturbance so we can simulation in MATLAB in future.

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Abstract—According to the development of electric energy consumption and increasing nonlinear loads in power systems, production of high quality of electric power is the main problem of power engineering. Therefore, it is needed to evaluate the problems of quality in the power systems is enhanced. Comprehensive knowledge of power quality issues is important in today's electrical power system operating environment; the main view of this paper is to improve the power quality by using PWM Techniques and discussed on how to reduce harmonic in power system. In this paper, the quality of power provides an explanation for in term of definitions, causes and effect. For Improving peak voltage and harmonic effect reduction, different PWM techniques are used. Most of PWM method used in reducing the issue of power quality like Single PWM, Multi PWM, and Sinusoidal PWM. The traditional Regular Sampled PWM method may be used to harmonic minimization and additionally harmonic elimination PWM to be closely reproduced the usage of simple algebraic equations. This paper describes the consequences of power quality problem using MATLAB simulation.

Keywords— Power Quality, PWM Techniques, SPWM, Harmonics, PWM-AC controller

I. Introduction

Power quality, the term which is used to define the power of electricity and it is used to drive the electrical load and ability to drive function used in electric power. With the improper strength of power, an electrical load or device may additionally malfunction and device will be damaged before time period. In power system, there are many causes for making the power quality poor. There is the various meaning of power quality as per different people.

The power quality term is described by standard IEEE 1100. According to this, PQ is a terminology that decides the powering and grounding of any equipment in a suitable manner. In another manner, PQ is a set of electrical boundaries that gives the instruction to any equipment to work in such a manner that there is no loss in the performance or life expectancy [1].

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The quality of power is affected due to variation in voltage and current or frequency on the end side of the device. Voltage sag problem is the major issue in power quality. The primary cause of power quality problem occurs due to uses of highly solid state switching device, nonlinear load and electronically switched loads in equipment. In highly solid state switching device, the power quality issue and the problem have considered. In the case of non-sinusoidal current flow in the transmission line and distribution system, prevalent power semiconductor switches are used [2].

In power system, voltage distortion, harmonics, and distortion are generated due to the electronic load. There are many reasons for affect power quality like as loss in computer data, memory loss in sensitive equipment such as PLC machine, computer [2].

The most affecting part of the distributions system is voltage sag and swells. It also expands power quality issue affecting especially industries where in concerned losses may be reached very excessive values. Voltage sags are because of faults somewhere else within the device. They have received special attention now because spectacular failure has highlighted the problem that results from the performance of computer controlled loads and adjustable speed drives during these voltage sags/swells. Sags/Swells can cause components over heating or destruction. Sags/Swells not only cause considerable productivity loss but there are also hard to control. Sag /Swell are events of short duration but high impact. In industry, the problem of voltage Sag/Swell occurs around 10% to 90% in power system [3]. The main reason of voltage Sag is a short circuit, fluctuation in light, the flow of largest current and problem of voltage swell we have presented due to a single line to earth fault on the system, which can result in a temporary voltage increment on the phases [4].

II. PWM TECHNIQUES

The number of PWM technique used in controlling resulting value of output voltage and frequency in an inverter circuit and all techniques are explained below:

Single-Pulse-Width-Modulation:

In single PWM method, a single pulse is generated in a half cycle and as per the change in the pulse width the RMS value of output voltage changes as well. The output AC voltage and gating signal is shown figure 1(b). The gate signals are produced by comparison of the input signal Vc or the amplitude of message with reference signal Vcar or the amplitude of carrier. The frequency of message signal is analyzed with the help of fundamental frequency in AC output voltage.

Fig. 1 Single Pulse Width Modulation

The output voltage Vrms is defined as:

$$V_o = V_s \sqrt{\frac{2t_{on}}{T}} = V_s \sqrt{2\delta}$$

Where δ is duty ratio,

Modulation Index (MI)

$$m_a = \frac{V_c}{V_{car}}$$

Value of modulation index varies from 0 to 1. According to modulation index it's varies pulse 0 to π/p and change in output voltage 0 to Vs.

Multiple-Pulse-Width-Modulation:

In Multiple PWM method, there is multiple output pulse generated during half cycle period and all pulses width are equal. The gating signals are produced due to comparing the amplitude of message or control signal with the amplitude of carrier or reference signal. In Multi PWM technique frequency of the message signal sets the output frequency (f0) and carrier frequency (fc).

The number of pulses is calculated in half cycle during this expression:

$$P = \frac{f_c}{2f_0}$$

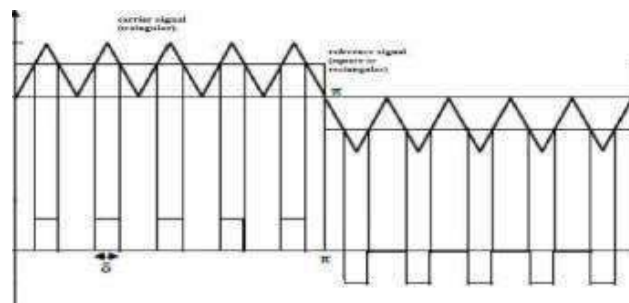In figure-2 shows the output sinusoidal wave generator using multiple PWM technique.

Fig. 2 Multiple PWM Technique

Sinusoidal-Pulse-Width-Modulation (SPWM):

In simple source inverter, during each cycle, as per our requirement, the switches can be turned Off and On. Due to this switching condition, the output is the square wave. For getting pure sinusoidal waveform we have to increase the number of switching timing as per cycle. In Sinusoidal PWM technique waveform is produced due to comparing the given modulated waveform through triangular waveform at high frequency. In comparing both waveforms the resulting output voltage is negative or positive it depends on whether the voltage of the signal is smaller or larger than the carrier waveform.
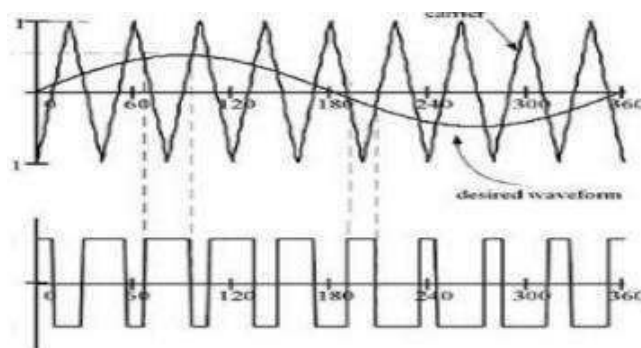

Fig. 3 Sinusoidal Pulse Width Modulation

The output voltage Vrms is defined as:

$$V_o = V_s \sqrt{\frac{p\delta}{\pi}} = V_s \sqrt{\sum_{m=1}^{2p} \frac{\delta_m}{\pi}}$$

Where p is number of pulses and δ is width of pulse.
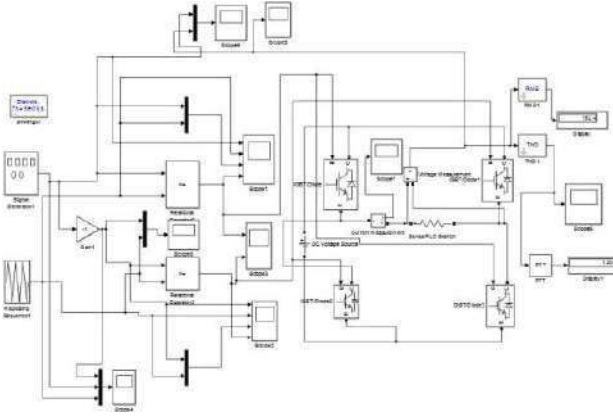
III. SIMULATION MODEL

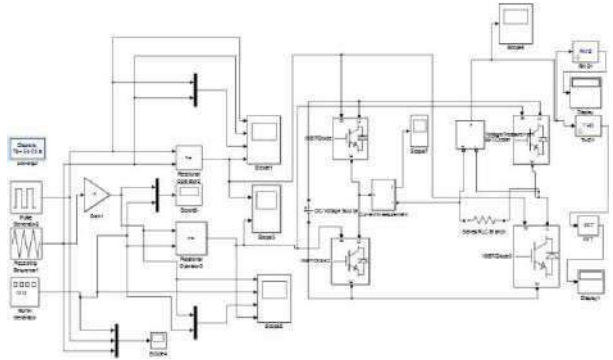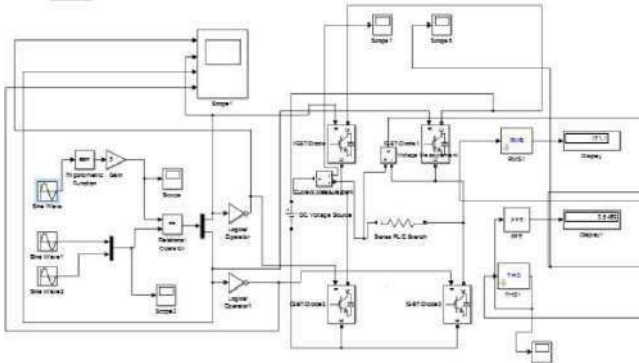
Fig. 4- Single Pulse PWM

Fig. 5- Multi Pulse PWM

Fig. 6- Sinusoidal PWM

IV. RESULTS

In this result, we have discussed the issue of power quality in equipment and the affecting parameter in power quality and analyzed the different correction method for reduce the problem in power system. In above simulation, we have explained all three types of PWM techniques like single pulse, multi pulse and sinusoidal PWM technique to improve the quality of power and explained how to decrease harmonic in electric device presented on a single-phase load. The term harmonic current is used for reducing the existing problem in designing of any equipment. The total harmonic in all three methods is measured by use of FFT scheme.
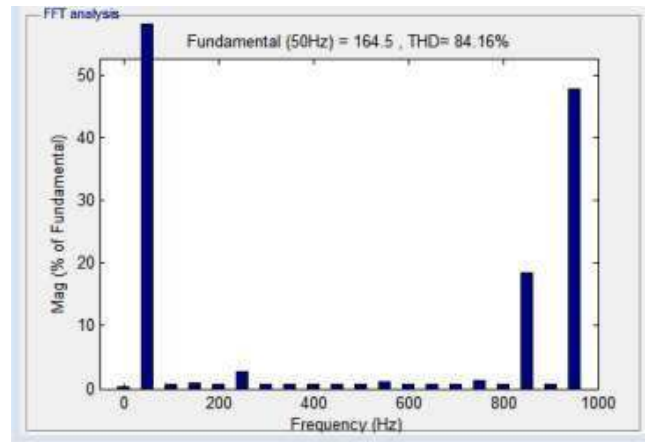

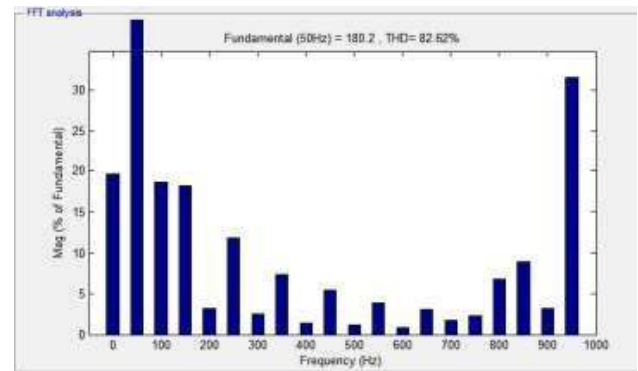Fig.7- Harmonic analysis of voltage on Single Pulse Modulation

Fig. 8- Harmonic analysis of voltage on Multi Pulse Modulation
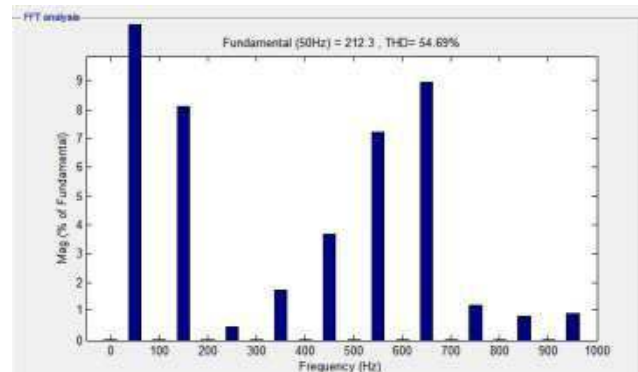

Fig. 9 Harmonic analysis of voltage on Sinusoidal Pulse Modulation

In above simulation model, we have described all three PWM methods and voltage 220V DC used as the input voltage. THD is calculated at 10 kHz carrier frequency is generated 50Hz frequency output at load R=10k ohm.

Table 1

PWM Technique	Fundamental (50 Hz)	THD (%)
Single-PWM	164.4 V	84.69
Multi-PWM	180.0 V	82.61
Sinusoidal-PWM	212.3 V	54.69

Thus our objective is met with these results. From Table-1, it can be seen that the sinusoidal PWM has good fundamental component and less harmonics. Technically in single and multi PWM method more harmonic have present and fundamental voltage are less compare to the input voltage. THD can be reduced by a greater extent using proper filter design.

V. CONCLUSION

This paper gives a wide background of power quality in terms of its issues, definitions, causes, effects. Harmonic distortions levels, in general, are within limits in all areas except for one residential and one commercial area .In most areas, the 3rd and 5th harmonics are the highest suggesting heavy usage of computers and pulsed converters respectively. Specific power quality causes will be identified and its effect will be investigated. From there, the best and cost effective mitigation means can be proposed. This type of analysis will be more useful as the end result motivates the improvement of the power quality in that particular area. Some problems can also be improved, solved and mitigated by using some useful software tools

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Load Frequency Control of Different Sources in Interconnected Power System- A Review

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Abstract- Power plants using both renewable and conventional energy make up the hybrid power system. Due to this integration, there are problems with the power quality, such as slow settling times and more transient contents. The frequency changes brought on by such connectivity are the fundamental problem for the hybrid power system. The Load Frequency Controller (LFC) design guarantees the power system's dependable and effective operation. LFC's primary job is to keep the system frequency within safe bounds, which also keeps power within a certain range. For an LFC to supply the system with enough power, it should be backed with contemporary and sophisticated control mechanisms. This study provides a thorough analysis of various LFC structures in a variety of power system configurations.First, a description of a power system based on renewable energy and the need for LFC development are given. Single-area, multi-area, and multi-stage power system designs were examined for the fundamental operation. Utilized were many controller types that were designed using various control strategies that had been explored. Graphical analysis was used to compare different controllers and techniques. There is a list of potential study areas in the supplied future scope of work. Finally, the paper emphasises the necessity of improved LFC design in situations with complicated power system architectures.

Index terms-**Load frequency control, renewable energy systems, multi-area power system, optimization algorithms, artificial neural networks.**

I. INTRODUCTION

Modern, linked power systems' main area of concern is power system stability. It is referred to as a power system's capacity to stabilise itself following the elimination of disruptions. While an unstable system loses control through desynchronizing, this event could have a disastrous effect on how well the power system functions. Maintaining synchronism between various components of the power system is a significant task for power system engineers as stability considerations have become an inherent aspect of the design of a dependable system [1]. Electricity must be produced in accordance with load side demand while also taking losses into account. A stable power system runs within a defined region, and various external factors may cause the power system's nominal frequency to diverge to an unstable region [2].

Two control loops—one primary and the other secondary—are used in contemporary power systems to regulate frequency [3]. The first one is in charge of stopping the frequency transients caused by governor droop that can cause steady state error [4]. The second approach, sometimes referred to as automatic gain control or load frequency control, has the potential to maintain a consistent level of system frequency regulation. In the beginning, load frequency management was achieved using traditional PID controllers; however, as research progressed, intelligent controllers, fuzzy controllers, sliding mode controllers, and tilt integral derivative controllers were created.A more effective real-time control of the power system is provided by a modern controller architecture based on sliding mode control and adaptive control pattern. To enhance performance, more study is being done on support vector machine-based controllers and brain emotional learning-based intelligent controllers.

This work focuses on the study of existing load frequency control strategies and suggestions for further improvements. The performance analysis was conducted for understanding the results of different simulated parameters. The shortcomings in different techniques were noted and the future road map was defined for better controller design. With the installation of renewable energy systems, the integration problem is getting complex. The improved power system design is only achieved with better power quality by implementing various load frequency control techniques.

II. LITERATURE REVIEW

Due to the incorporation of numerous renewable energy sources and the introduction of novel systems like autonomous grids, micro-grids, nano-grids, and smart grid technologies, modern power networks are undergoing a rapid transformation [5]. The production of active electricity is uncertain due to the interconnection of renewable energy sources, such as wind turbines, tidal turbines, geothermal plants, biomass plants, hydro power plants, and solar cells, etc. Figure 1 [6] illustrates this.The use of solar energy resources has been the subject of extensive investigation. Solar energy is viewed as an easier alternative to hydro energy systems because of its cheaper construction costs and portability. Hydro energy systems are traditionally thought of as the best environmentally friendly source of energy, but their initial cost and time of development are high [7]. Thus, frequency fluctuations lead to the unreliable operation of the power system. Nowadays, a power system must be unbundled into its horizontal and vertical components because it is not vertically integrated but rather a deregulated entity. In such cases, it is crucial to analyze the situation and build improved frequency controller units. Numerous studies have been conducted to create and

enhance the design of load frequency controllers [8]. A PID controller was used by Krishan et al. in [9] to work on the autonomous generation regulation of multi-area power plants. In [10], effective generation rate-constrained robust multivariable predictive-based load frequency control was accomplished. The developed controllers, however, do not offer particularly impressive settling time, peak overshoot, or peak undershoot values. A load frequency controller's primary responsibility is to immediately stabilize by adjusting its parameters in response to its surroundings [11,12]. There has been extensive study done to develop the perfect load frequency controller, but the majority of these controllers have poor settling time concerns. More recently, the intelligent design technique has become popular in LFC design. An LFC design based on an artificial neural network was aimed at the deregulated power market in [13,14]. It is an illustration of an intelligent controller with a system for learning from external events and situations. Smaller settling periods and lower transient values are required to quickly approach the steady state response [15,16].
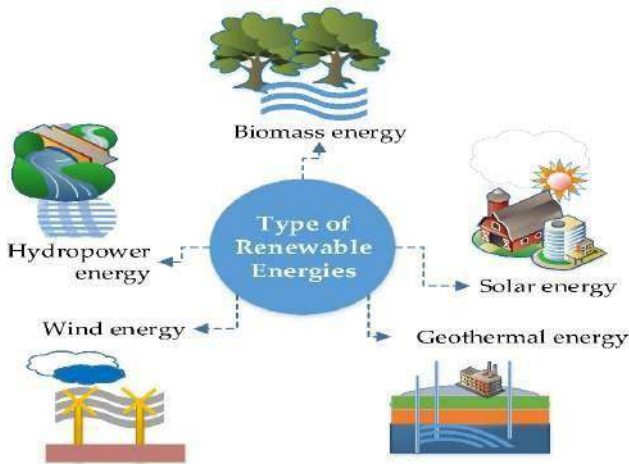

Figure 1. Renewable Energy Systems.

When applied for attack detection on LFC in [17], the stochastic process with unknown input estimators serves as an illustration of the cyber security technique used in LFC applications. The best firefly algorithm was employed in [18] to control load frequency in unregulated situations.

III. RESEARCH MOTIVATION

The focus of this research is on understanding various LFC control techniques in hybrid power systems based on renewable energy sources. Numerous LFC control techniques for connected hybrid power systems are presented in the literature review. These methods concentrate on giving hybrid power systems the best possible control for increased power system responsiveness. Most researches focused on the conventional, integrated power networks that are ageing [19]. The development of renewable energy sources is currently a global priority due to their environmental friendliness and low operating costs. Power quality problems result from the integration of renewable energy sources with a conventional power grid. Maintaining load frequency control while supplying the necessary quantity of power is not always simple. Issues with frequency deterioration are brought on by the inertia of

the power system and intermittent generation [20]. A greater number of interconnected systems could result in problems such voltage instability, frequency skew, and poor power quality. To overcome these difficulties and improve the level of integration of renewable energy sources in current power system networks, some inventive work and fresh ideas are required. Reviewing prior study, it was found that scientists tended to concentrate on conventional LFC development, but that load frequency control research has been stimulated by the ongoing integration of renewable energy sources into existing power grids [21]. The present review, which describes the integration of renewable energy sources with existing power system networks, was motivated by this.

IV. REVIEW ON LOAD FREQUENCY CONTROL WITH RENEWABLE ENERGY SOURCES

systems. In contrast to the latter, which is often a tied power system, the former is an isolated power system. The integration of renewable energy sources creates transients and frequency deviations, and environmental non-linearity affects the power system's regular operation [22]. The introduction of contemporary methods for power generation, transmission, and distribution has complicated how the power system functions. In the area of load frequency controllers, research and development is being done to address power quality issues in complicated power systems. For the improvement of power quality and the system's responsiveness to irregularities, a variety of control schemes and optimization algorithms have been proposed [23]. Figure 2 displays the application of LFC in several fields along with optimization methods. For LFC optimization, many algorithms are applied to enhance the transient response and settling time.

Classical control, optimum control, adaptive control, variable structure control, and robust control are some of the several control techniques used in LFC development. The deregulation of the power system was brought about by the government's reform of laws and regulations. Nowadays, transmission congestion is a problem since power is traded like any other commodity. The difficulties of transmission congestion brought on by multi-area deregulated networks centre on the requirement for complex LFC structures. Distributed generation is gaining popularity as more people install renewable energy systems in their homes. A better-designed LFC can handle the power quality problems brought on by the power generated at several isolated places. The power system can be divided into single-area and multi-area power systems depending on how it is configured.

In contemporary power systems, LFC controllers are intelligently tuned using a variety of soft computing techniques [24]. A FOFPID controller has been created for islanded micro grids utilizing the multi-objective external optimization method [25]. The PI-PD cascade controller's AGC regulation in multi-area power systems was optimized using the Flower Pollination algorithm [26]. To iteratively stabilize the power system transients in a hybrid context, the iterative proportional-integral-derivative H controller was created [27].The load frequency control of a hydrothermal system in a deregulated environment has been established

using the biogeography-based optimized three-degrees-of-freedom integral-derivative controller [28]. A framework for cost-effective load frequency regulation in hybrid power systems was developed using the modified multi-objective genetic algorithm [41]. In this instance, the power system quality is kept up to par economically and to satisfy consumer demands.

V. MULTI-AREA POWER SYSTEM

Renewable energy sources like wind and solar can be used with traditional power plants in today's flexible power networks. The connectivity of several generation sources increases instability, making load frequency regulation a challenging issue in multi-area power systems. The amount of frequency deviation in each area of control is used to determine the LFC design for a multi-area power system. The tie line power deviation is a severe problem in systems that are coupled because it can cause transients and power system instability. A sudden change in the demand and power produced by renewable energy sources might result in extremely unstable output power.

Figure 2 depicts the tie line power exchange between various locations. Each area is made up of conventional units with distributed generation and is connected by different sub-systems. Transients and harmonics are two examples of issues brought on by the interaction of various locations. Power flow on the connected lines becomes a problem due to power imbalances, hence frequency control entails measuring power flow on the connected lines. The entire power system is characterized by frequency management, and reliable functioning depends on this control. The entire quantity of active power generation must match the active power consumption at any given moment in order to keep the power system frequency constant.
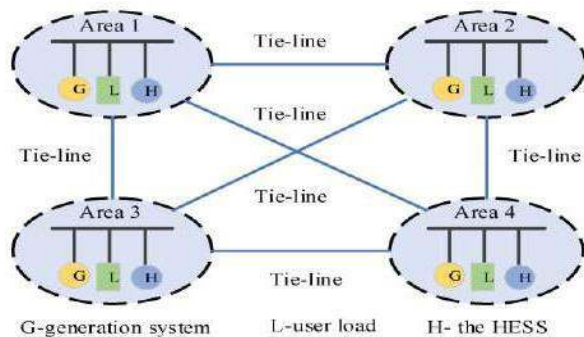

Figure 2. Power between areas

VI. CONTROLLERS BASED ON DIFFERENT CONTROL TECHNIQUES

As research has been done to address one of the shortcomings in the current controllers, various controllers have been produced over time. Artificial Neural Network (ANN) controllers were created as a result of the advancement of intelligent computing techniques, simplifying the decision-making process in control structures. Multi-level control schemes between two extreme values were produced as a result of the development of fuzzy logic; these controllers increased the amount of control and accuracy of output signals.

Every control system experiences non-linearity, hence non-linear control systems have been created to address irregularities. The statistical analysis and approaches for creating better control systems were proved by the work in probability. While the swarm intelligence incorporated the principles of colonial intelligence for the development of ant colony optimization and particle swarm optimization, numerous algorithms, such as Genetic and Differential Evolution, were developed to address various inadequacies in power systems. Figure 3 illustrates many soft computing techniques. As various fields grow over time, better control algorithms are produced. Swarm intelligence and evolutionary tactics are developed as a result of metaheuristic methods. Ant colony optimization and particle swarm optimization are subfields of swarm intelligence, while the genetic algorithm and differential evolution are some of the fundamental evolutionary techniques.
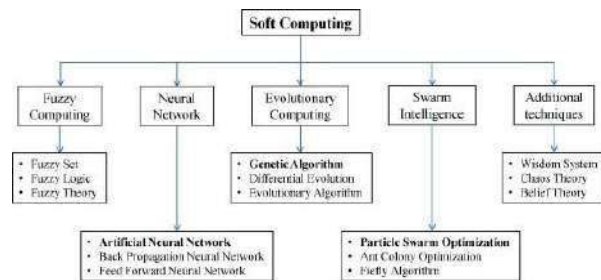

Figure 3 Soft computing techniques

VII. CONCLUSIONS

Modern power systems depend on LFC to supply power consistently, effectively, and reliably. Both single-area and multiple-area power system types are covered. Under conditions of various uncertainties, non-linear output, and multi-variable power system conditions, the primary goal of LFC is to provide frequency regulation in power systems while continuously monitoring the load demand. This article examines numerous LFC power system topologies that have been algorithmically improved. The most recent developments in LFC structure used in different types of renewable energy systems are succinctly addressed. The conclusion of this work emphasizes the necessity for further research and development in the field of load frequency controllers. This work is anticipated to be a valuable resource for knowledge in the area of load frequency control for renewable energy systems.

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Gear fault detection usign finite element analysis methods

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Abstract— **In every mechanical system, gears play a crucial role, making gear failure analysis a vital area of study. Improving upon the current trend in gear fault analysis research requires a shift in focus. Gear defects are difficult to identify and analyses, thus ANSYS simulation has only been used occasionally to aid with the process. With the use of ANSYS.inc software, this study aims to accomplish the aforementioned goal by analyzing the consequences of different gear defects using finite element analysis.**

Keywords—spur gear, fault, deformation, Ansys, Catia V5, boundary condition, fracture, pitting, wear

I. INTRODUCTION

Gear fault detection using Ansys is a process that involves analyzing static structural analysis on different type of faulty gear. Ansys is a powerful simulation software that provides tools and capabilities for designing and analyzing complex mechanical systems, including gears. With Ansys, engineers can create 3D models of gear systems, simulate their behavior under various operating conditions, and analyze vibration signals generated by the gears to detect faults.

Gear faults can be caused by various factors such as wear and tear, inadequate lubrication, misalignment, and manufacturing defects. Early detection of gear faults is essential for preventing catastrophic failure, reducing downtime, and minimizing maintenance costs. Ansys can be used for gear fault detection to simulate different fault scenarios and optimize the design and operation of gear systems to improve their reliability and performance.

II. LITERATURE SURVEY

There have been several studies conducted on gear fault detection using Ansys. Here are some examples of previous studies:

1. "Simulation and analysis of gear faults using Ansys software" by D. Zeghlache and A. Belhocine (2019): This study presented a simulation and analysis of gear faults using Ansys software. The authors modeled different gear faults, including tooth wear and broken teeth, and analyzed the vibration signals generated by the gears to detect the faults.

2. "Fault diagnosis of gear transmission system using Ansys software" by L. Liu and S. Chen (2019): This study proposed a fault diagnosis method for gear transmission systems using Ansys software. The authors simulated gear faults, including gear tooth crack and gear tooth wear, and analyzed the vibration signals generated by the gears to diagnose the faults.

3. "Gear fault detection and diagnosis using Ansys software" by A. M. Mohamed et al. (2018): This study presented a gear fault detection and diagnosis method using Ansys software. The authors modeled different gear faults, including gear tooth wear and gear tooth crack, and analyzed the vibration signals generated by the gears to detect and diagnose the faults.

III. PROBLRM STATEMENT

The problem statement for gear fault detection using Ansys is to develop an accurate and reliable method for detecting and diagnosing gear faults in mechanical systems through simulation software. The primary objective is to identify and analyze the vibration signals generated by gears to detect any abnormalities or faults that may result from factors such as wear and tear, inadequate lubrication, misalignment, and manufacturing defects.

The ultimate goal of gear fault detection using Ansys is to improve the performance and reliability of gear systems by detecting faults at an early stage, thereby preventing catastrophic failure, minimizing downtime, and reducing maintenance costs. Furthermore, the aim is to optimize the design and operation of gear systems for improved efficiency and durability, which is crucial for industries such as aerospace, automotive, and manufacturing, where high-precision gears are essential components of the machinery. Ansys software provides engineers with a powerful tool to simulate various fault scenarios and optimize the design and operation of gear systems for maximum performance and reliability.

IV. OBJECTIVE

The objective of gear fault detection using Ansys is to develop a reliable and accurate method for detecting and diagnosing gear faults in mechanical systems using simulation software. The primary focus is on analyzing the vibration signals generated by gears to identify any abnormalities or faults that may arise due to factors such as wear and tear, inadequate lubrication, misalignment, and manufacturing defects.

The specific objectives of gear fault detection using Ansys include:

- Developing a robust and accurate method for detecting gear faults using Ansys software.
- Simulating different gear fault scenarios to determine the impact of various factors on gear system performance.

- Identifying critical parameters that affect gear system performance and reliability.
- Optimizing gear system design and operation to enhance efficiency, reliability, and durability.
- Providing an early warning system for gear faults to prevent catastrophic failure, minimize downtime, and reduce maintenance costs.
- Improving gear system performance and increasing their lifespan.

Achieving these objectives can assist industries such as aerospace, automotive, and manufacturing in enhancing their gear systems' reliability, performance, and durability, leading to increased productivity and reduced maintenance costs.

V. METHODOLOGY
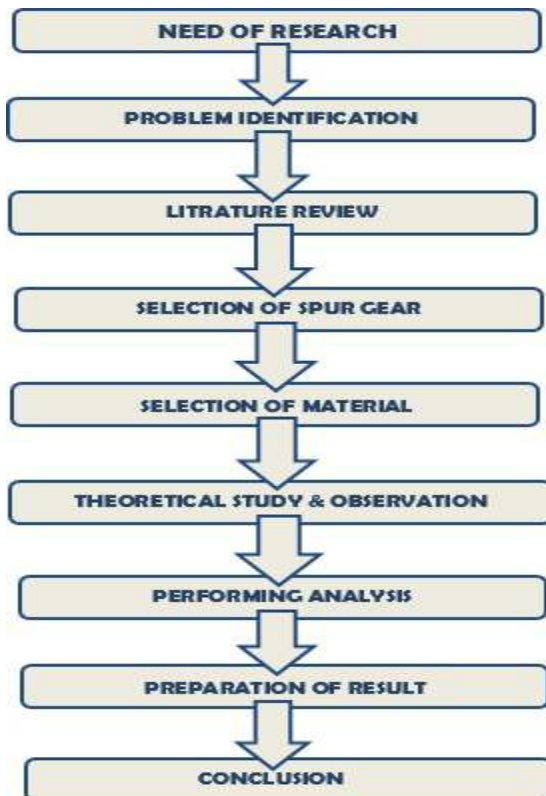
Figure: Methodology Adopted

VI. DESIGN OF SPUR GEAR

When it comes to creating intricate and detailed designs, CATIA is a powerful tool. In the field of mechanical design, CATIA is a software package. In our work we use CATIA V5 as a design tool for design of spur gear.

Figure 2: Normal Gear   Figure 3: Fracture faulty gear
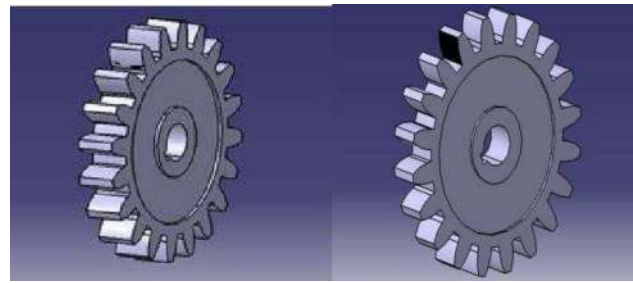
Figure 3: Pitting faulty gear   Figure 4: Wear faulty gear

VII. ANALYSIS OF SPUR GEAR

Ansys 19.2 are used for analysis of various faulty gears. We are doing static structural analysis for detection of faulty gear using Ansys. First of all we generate meshing in spur gear.
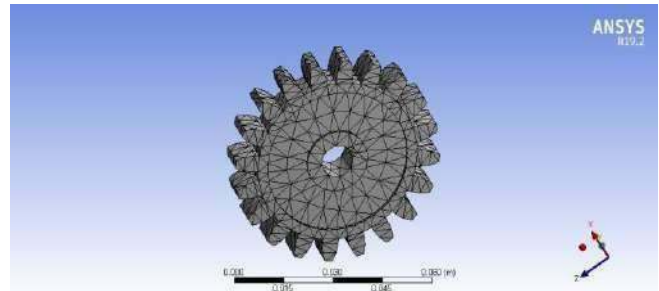
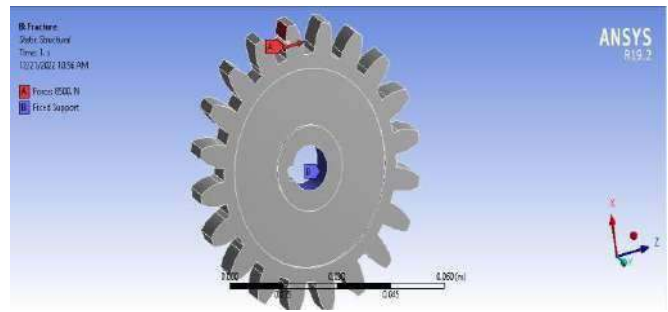Figure 5: Meshing of spur gear

Boundary conditions

Figure 6: Load applied

Object Name	Force	Fixed Support
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	2 Faces	1 Face
Definition		
Type	Force	Fixed Support
Define By	Vector	
Magnitude	8500. N (ramped)	
Direction	Defined	
Suppressed	No	

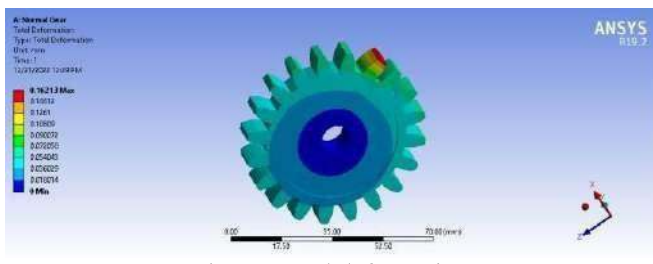**Static structural analysis**
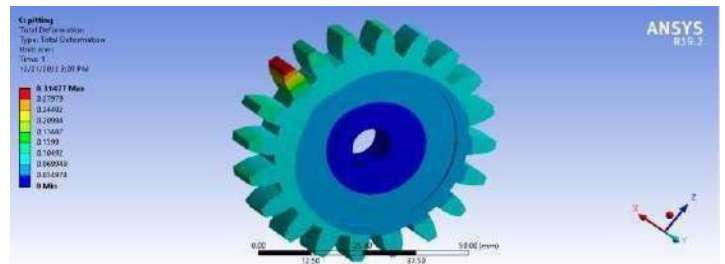 I.   Normal gear

Figure: Total deformation
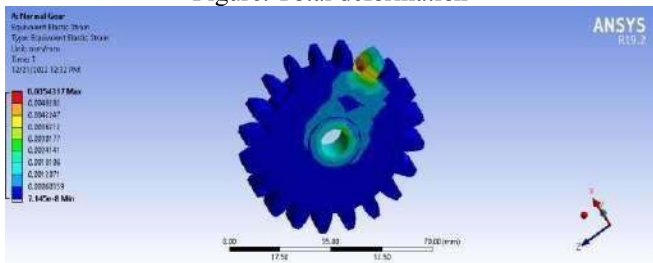

Figure: Total deformation
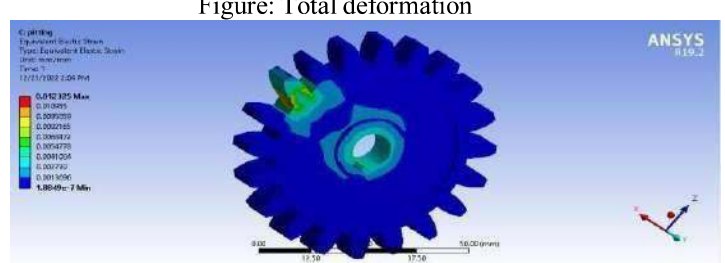

Figure: Equivalent Elastic Strain
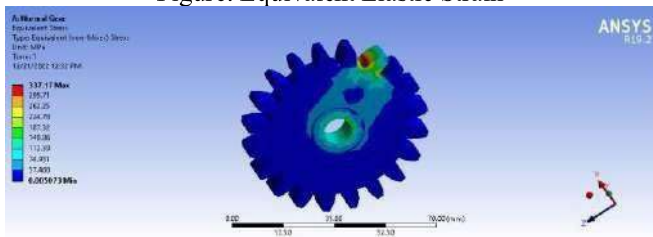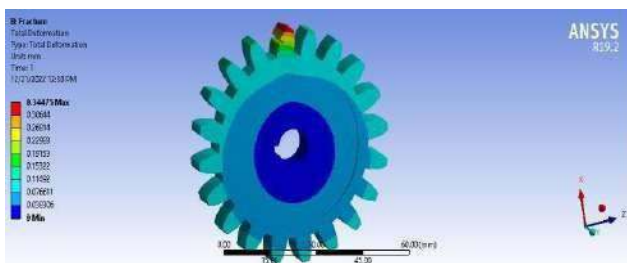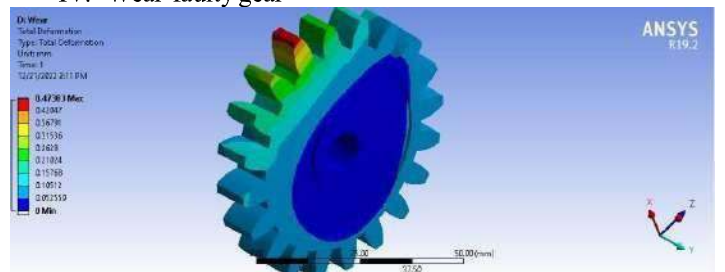

Figure: Equivalent Elastic Strain

Figure: Equivalent (Von Misses) Stress

Figure: Equivalent (Von Misses) Stress

II. Fracture Faulty gear

IV. Wear faulty gear
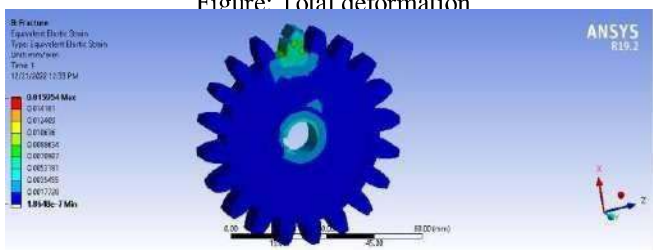

Figure: Total deformation

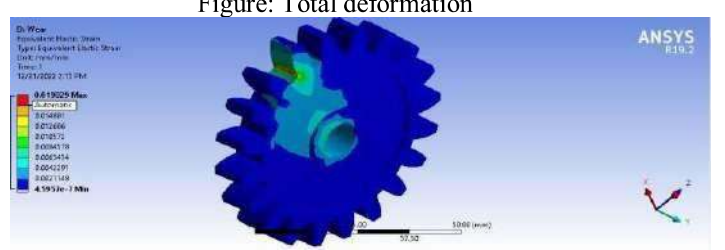Figure: Total deformation

Figure: Equivalent Elastic strain
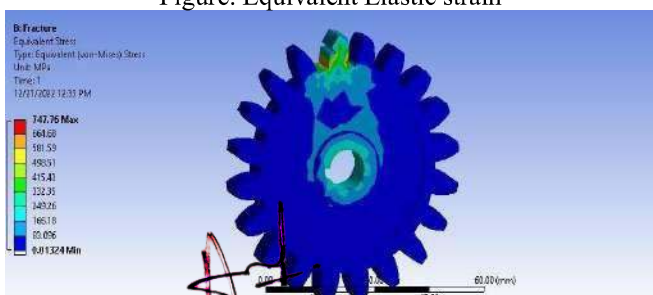

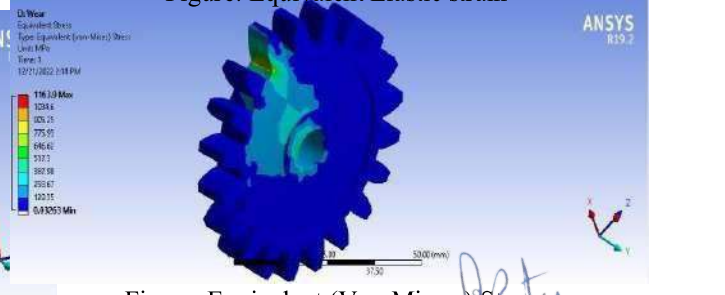Figure: Equivalent Elastic strain

Figure: Equivalent (Von Misses) Stress

Figure: Equivalent (Von Misses) Stress

III. Pitting Faulty gear

VIII. Result and discussion

In our research we take four spur gear in which one is normal spur gear with on defect and the other is fracture, pitting and wear faulty gear. We applied same load in each type of gear raise the value of total deformation, Equivalent elastic strain and Von- misses stress. Value of each type of spur gear are given in table below:
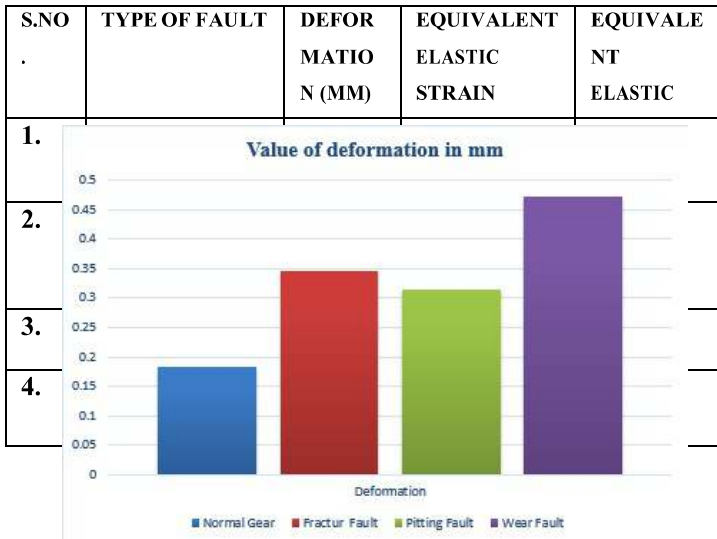
S.NO.	TYPE OF FAULT	DEFORMATION (MM)	EQUIVALENT ELASTIC STRAIN	EQUIVALENT ELASTIC
1.				
2.				
3.				
4.				

Value of deformation in mm

Figure : Comparison of different deformation value in different type of faulty gear
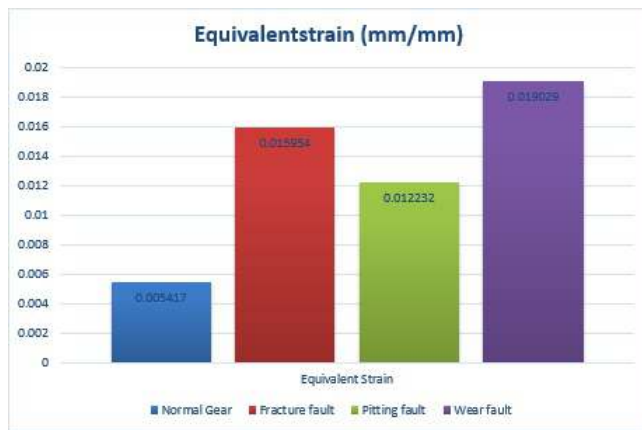

Equivalentstrain (mm/mm)

Figure: Equivalent Elastic Strain

Figure: Graphical representation of stress

IX. Conclusion

With the above result we can easily say detect the fault gear and also categories between different type faults. Normal gear shows minimum deformation and faulty gear show higher deformation value according to their nature of fault. Also it is necessary to keep material property same so that we can easily detect the faulty gear.

The comparison of value of deformation, Equivalent strain and stress are show in both tabular and graphical format the value of shows that in faulty gear value of deformation, strain and stress fluctuate more than double in faulty gear as compare to normal gear on the result behalf of this we can easily find that our gear is faulty or not. We also has comparison between different types of faulty gears in this result.

Equivalent (Von-Misess) Stress in Mpa

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Mechanical Characterization of Hybrid Short Fiber Reinforced Epoxy Polymer Composite

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Abstract The purpose of the study is to determine how changes in fiber weight percentage affect various mechanical properties of fiber reinforced epoxy composites. In the current work, the samples are made utilising epoxy as in matrix phase and jute, munja, polypropylene, and hybrid fibers in the reinforcing phase. Reinforcement fiber weight is varied for the samples by 3 and 5 percentage, respectively. In this study, the mechanical characteristics like tensile strength, flexural, and impact strength are assessed. Each composite sample is made by using a hand layup procedure.

Key Words - mechanical properties, matrix phase, reinforcing phase, hand layup procedure

Introduction

We are all a part of contemporary civilization, and as time goes on, we observe changes taking place all around us. These changes are only made possible by new inventions and industrial progress. All industries are currently attempting to improve their skills and to meet the growing demand of the emerging world. As consumer demand for goods rises, industries are under pressure to produce goods to meet this demand, which raises the demand for raw materials. Because metals are used in the production of many physical goods or have an impact on them, there is a growing market for them, which has led to rising metal prices and a search for metal substitutes [1]. Using composite materials improves constructive qualities while lowering the weight and price of items. In recent years, many metals have been replaced with fiber reinforced polymer composites in industrial and commercial uses [2]. A range of fibers, including natural fibers like jute, banana, pineapple, kenaf, bamboo, coconut, sun hemp, abaca, and munja fibers, are used to create fiber reinforced polymer matrix composites. synthetic fibers created from a combination of natural and synthetic fibers, such as glass, carbon, kevlar, polypropylene, etc[3]. Fibers that are harder and stronger than the matrix ingredients typically appear in discontinuous phase in fibre reinforced polymer matrix composites. Fibers that are tougher and stronger than the matrix ingredients

typically appear in a discontinuous phase in fiber reinforced polymer matrix composites [4]. Polymer is a continuous phase substance that is utilized as a component of matrices [5].

MATERIALS AND METHODS

Reinforcement Material

This study, the preparation of a fiber-reinforced polymer composite involves the employment of four different types of fibers.

1Jute Fibers

2Munja Fibers

3 Polypropylene Fibers

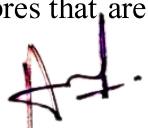4.Hybrid Fiber

Jute Fibers

The class of fiber that jute fiber belongs to is blast fiber. It is a cheap natural fiber that is widely available. India is the country that produces the most jute fibers [6]. Jute fibers have a very broad potential in polymer matrix composites as a fibrous reinforcement. There are two varieties of jute fiber that are sold commercially: white jute (Corchorus capsularis) and tossa jute (Corchorus olitorius) [7]. Jute fibers of 15 mm in length are used in this study's reinforcing phase.

Fig.1 Jute fibers of 15 mm length.

2 Munja Fibers

Generally speaking, Munja is known as Kana, Sarkanda, or Munja. The name of the plant is Saccharum Munja. It exhibits incredibly strong capabilities that can be applied to reinforcing components in polymer matrix composites [8]. In this investigation, the reinforcement phase uses Munja fibres that are 15 mm long.

Fig.2 Munja fibre of 15 mm length.

Polypropylene Fibers

A thermoplastic polymer, polypropylene is also referred to as polypropene. It is a partly crystalline polymer that is created from the propylene monomer using chain growth polymerization. Fibers made of polypropylene are strong, lightweight, and resistant to corrosion [9]. In this investigation, the reinforcement phase uses polypropylene fibers that are 15 mm long.

Fig 3. Polypropylene fiber of 15 mm length.

Hybrid Fiber

A hybrid fiber is a combination of two or more different types of fibers. By compensating the lack of one fiber with another, hybrid fiber can increase the desired qualities of fiber reinforced composite [10]. In the current investigation, a synthetic fiber, polypropylene fiber, and two natural fibers, jute and munja, both of 15 mm length, were used in equal weight percentages.

Matrix Material

Epoxy Resin and Hardener

Epoxy resin is widely used in industries because it is inexpensive, readily available, and non-toxic. It also has exceptional qualities like high strength, resistance to chemicals, resistance to moisture, and resistance to corrosion. It cures at a room temperature. It is a thermosetting polymer resin with low viscosity [11]. In this investigation, Matalam System B Hardner and Lapox Matalam System B epoxy resin made by Atul Limited are employed in a 2:1 ratio.

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Fig 4. Epoxy resin and hardener

Composite Preparation Method

In this study, an open mould hand lay up method are used. It is the most straightforward method of producing composites. It costs less and involves fewer setup, setup tools, and equipment. Using liquid thermosetting polymers, we may easily use the hand lay up method with a wide range of fibers, such as long or short fibers [12]. The hand lay up method may be used to fabricate fiber reinforced polymer composites in a range of sizes, whether little or large, but it comes with the restriction that the composite's geometry must be basic and flat [13].
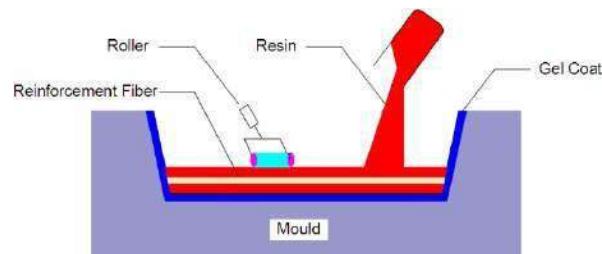

Fig.5 Schematic diagram of hand lay up process

EXPERIMENTATION

Three types of fibers—jute, munja, and polypropylene fiber—with varying weight percentages of fibre content are used to construct composite samples for tensile, flexural, impact, and hardness tests. In addition to the fibres stated above, Lapox Matalam System B epoxy resin and Matalam System B Hardner are employed in the matrix phase in a 2:1 ratio. Similar to how jute, munja, and polypropylene fibres are combined at various weight percentages in the reinforcement phase, Lapox Matalam System B epoxy resin and Matalam System B Hardner are combined at a 2:1 ratio in the matrix phase to create hybrid fibres.

Table1: List of fiber reinforced polymer composites prepared are as follows.

S.No.	Abbreviation for Composite Samples	Description

1	3JFEPC	Composite prepared with 3% jute fibre as in weight percentage with epoxy
2	3MFEPC	Composite prepared with 3% munja fibre as in weight percentage with epoxy
3	3PFEPC	Composite prepared with 3% polypropylene fibre as in weight percentage with epoxy
4	3HYEPC	Composite prepared with 3% hybrid fibre as in weight percentage in equal ratio with epoxy
5	5JFEPC	Composite prepared with 5% jute fibre as in weight percentage with epoxy
6	5MFEPC	Composite prepared with 5% munja fibre as in weight percentage with epoxy
7	5PFEPC	Composite prepared with 5% polypropylene fibre as in weight percentage with epoxy
8	5HYEPC	Composite prepared with 5% hybrid fibre as in weight percentage in equal ratio with epoxy

Fig 6. Composite samples prepared by hand lay up process

MECHANICAL TESTING

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Tensile, flexural, impact and hardness testing methods of test standard ASTM D638, ASTM D790, ASTM D256, and ASTM D2240 respectively are used to identify the mechanical properties of fiber reinforced epoxy composite

Tensile test

Tensile testing is a destructive testing procedure. On a universal testing machine, it is carried out (UTM). The test specimen is clamped in the jaws of the UTM, and tensile force is gradually applied to it until it fractures. This test demonstrates how much resistance the material offers to an axial pull. This study makes use of a universal testing machine, model number UTE 40, manufactured by Fuel Instruments and Engineering Pvt. Ltd. with a cross head travel speed of 10 mm/min.

Flexural testing

Flexural testing is a destructive testing procedure. On a universal testing machine, it is carried out (UTM). This test is used to determine flexural strength, which is a measurement of a material's resistance to bending. With the aid of two nearby lower supports, the specimen is horizontally positioned on the Universal Testing Machine for the flexural test, and a load is then imparted to the test specimen's top surface in the middle. Flexural tests are performed on the Universal Testing Machine Model No. 40 by Fuel Instruments and Engineering Pvt. Ltd. for the current study. In this test, the specimen is mounted on two lower supports that are 50 mm apart, and a load of 5 mm/min is applied at the centre.

Impact testing

Impact testing is a destructive testing procedure. It is performed on impact testing machine. The test is performed on the specimen to determine the impact strength of the material. Impact strength is the ability of a material to absorb suddenly applied load or shock load. In present study izod impact test is conducted on Impact Testing Machine made by Krishna Enterprises. During the izod impact test, the test sample is clamped vertically in the fixture and the notch side is kept towards the striking face of swinging pendulum.

Fig.8 Impact testing machine

Table 2 : Mechanical testing results

S. No.	Composite Name	Tensile Strength in MPa	Flexural Strength in MPa	Impact Strength in J/cm^2
1	3JFEPC	38.48	43.52	64
2	3MFEPC	33.66	39.21	58
3	3PFEPC	24.27	30.12	46
4	3HYEPC	30.31	36.71	50
5	5JFEPC	42.91	48.21	76
6	5MFEPC	37.93	43.32	64
7	5PFEPC	27.33	32.15	52
8	5HYEPC	34.88	41.18	56
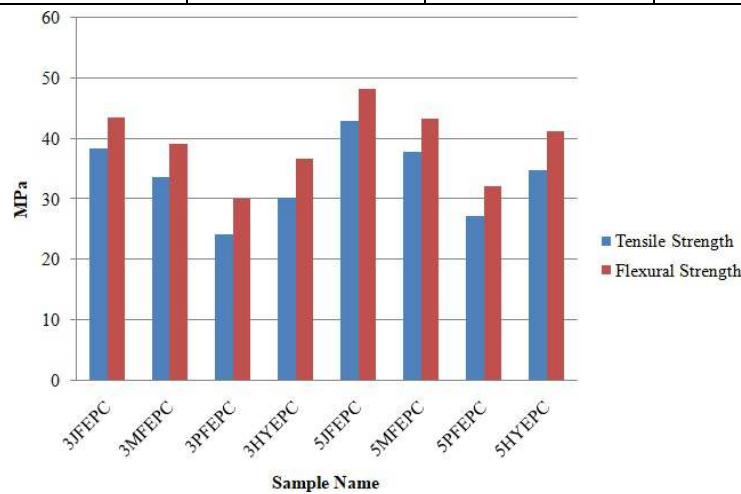
Fig.9 Comparison of tensile and flexural strength of different composite samples.

In the tensile test 3JFEPC sample showed a tensile strength of 38.48 MPa and 5JFEPC sample showed a tensile strength of 42.91 MPa. In the flexural test 3JFEPC sample showed a flexural strength of 43.52 MPa and 5JFEPC sample showed a flexural strength of 42.91 MPa. In impact test 3JFEPC sample showed an impact strength of 64 J/cm^2 and 5JFEPC sample showed an impact strength of 76 J/cm^2. In case of jute fibre reinforced epoxy composite the tensile strength, flexural strength and impact strength increases with the increase in weight percentage of reinforcement.

In tensile test 3MFEPC sample showed a tensile strength of 33.66 MPa and 5MFEPC sample showed a tensile strength of 37.93 MPa. In the flexural test 3MFEPC sample shows flexural strength of 39.21 MPa and 5MFEPC sample shows flexural strength of 43.32 MPa. In impact test 3MFEPC sample shows impact strength of 58 J/cm^2 and 5MFEPC sample shows impact strength of 64 J/cm^2. In case of Munja fibre reinforced epoxy composite tensile strength, flexural strength and impact strength increases with the increase in the weight percentages of reinforcement.

In the tensile test 3PFEPC sample showed a tensile strength of 24.27 MPa and 5PFEPC sample showed a tensile strength of 27.33 MPa. In the flexural test 3PFEPC sample showed a flexural strength of 30.12 MPa and 5PFEPC sample showed a flexural strength of 32.15 MPa. In impact test 3PFEPC sample showed an impact strength of 46 J/cm^2 and 5PFEPC sample showed an impact strength of 52 J/cm^2. In case of Munja fibre reinforced epoxy composite tensile strength, flexural strength and impact strength increases with the increase in the weight percentage of reinforcement.

In tensile test 3HYEPC sample showed a tensile strength of 30.31 MPa and 5HYEPC sample showed a tensile strength of 36.71 MPa. In flexural test 3HYEPC sample showed a flexural strength of 30.12 MPa and 5HYEPC sample showed a flexural strength of 41.18 MPa. In impact test 5HYEPC sample showed an impact strength of 50 J/cm^2 and 5HYEPC sample showed an impact strength of 56 J/cm^2. In case of hybrid fibre reinforced epoxy composite tensile strength, flexural strength and impact strength increases with the increase in the weight percentage of reinforcement.

CONCLUSION

The results of tensile, flexural and impact test showed that the tensile, flexural and impact strength increases when we increase the weight percentage of reinforcement fibres in the composite. The jute fibre reinforced epoxy composite showed the higher values of tensile, flexural and impact strength as compared with the other composite samples. There are no remarkable benefits found of hybridisation of jute, Munja and polypropylene fibres in the case of hybrid fibre reinforced epoxy composite, even jute fibre composite showed a higher value of impact, tensile and flexural strength as compared to the hybrid fibre reinforced epoxy composite.

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FUTURE SCOPE

It is seen from present study if we increase the weight percentage of reinforcement fibre in composite it improves mechanical properties so there is a scope of study of mechanical characteristics by varying weight percentage of reinforcement constituent. In the present study short fibres of 15mm length are being used in the reinforcement phase so there is also a scope to vary the fibre length and analysis of mechanical properties. In present work comparative study of tensile, flexural and impact strength are made. There is also a scope to study other mechanical characteristics like hardness, density, compression strength and thermal properties.

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Review papar on biodegreble composite fibre human hair

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Abstract— Due to their low cost, respectable mechanical properties, and high aspect strength, biological fibres have recently caught the attention of researchers, engineers, and scientists as a potential alternative reinforcement for FRP (fibre reinforced polymer) composites. Human hair is one of the finest biological fibres. Three to four tonnes overall of human hair fibres are wasted each year in India, creating a problem for the ecosystem. This same useless human hair fibre is currently being explored in the material science discipline to discover a commercial application.

In essence, human hair is a nano-composite biological filament with known microstructures. To demonstrate that human hair is a biological composite fibre, a variety of methods but also tools have been employed to investigate its various properties.

Keywords— Composite; mechanical and fiber characteristics; human hair

I.INTRODUCTION

Biological fibers were first utilized in composite structures about 3000 years ago in ancient Egypt, which straw along with clay were combined in order to construct the walls. From an economic and environmental standpoint, biological fibers have recently emerged as an appealing reinforcement for polymeric materials. The world is becoming more environmentally conscious, which has sparked interest in the study and creation of recyclable materials. Natural resources like vegetation, animals, or minerals can be used to produce biological or natural fibers.
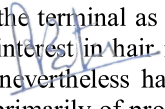

With the escalation of the worldwide shortage of energy and ecological risk, the unique benefits of biological fabrics such as their abundance quantity, non-toxicity, non-irritation of the eyes, skin, or respiratory system, noncorrosive property, organic fiber embedded polymer composites are becoming increasingly important.

Have sparked considerable interest due to their ability to serve as alternatives to synthetic reinforcement [2]. The lower weight and greater numbers of biological fibers when compared to synthetic fibers increase fuel efficiency and decrease emissions in automotive applications.

Hair is a kind of protein fiber that develops from dermal or skin follicles. It is one with the distinguishing features of animals.

Aside from areas of unblemished skin, the human body is covered in follicles that generate thick the terminal as well as fine vellus hair. The most prevalent interest in hair is in hair growth, hair types, and hair care, nevertheless hair is also an essential biomaterial composed primarily of protein, particularly keratin. Keratins are proteins that consist of

long strands (polymers) of amino acids. In terms of raw components, hair is made up of 50.65% carbon dioxide, 20.85% oxygen, thereby 17.14% nitrogen, and 6.36% hydrogen, and 5.0% sulfur. Cytosine, serine as a glutamine, is the threonine, glycine, leucine, valine, and arginine are among the amino acids found in hair.

II. Research Contribution

D. C. Mohan et. al [1] studies the fabrication of bio-composites by using the coconut shell in powder form, with the shells of walnut and husk of rice as reinforcements. These reinforcements are added and the testing was done as per the ASTM standards to examine the mechanical nature in both types of samples with moisture and without moisture. When compared single fiber glass reinforced composite with hybrid composite, the test result shows that hybrid samples have better properties under mechanical loads. The main conclusion is that addition of shells of the walnut with fibers of coconut shell will improve the properties.

P. Kaliappan et. al. [2] finds the impact of fibers mixture along with orientation on the mechanical nature of composite. Design of the specimens is done with neem and abaca fibers. Here, composites are made in combination i. (abaca with glass fiber), ii. (Fibers of neem and glass), and iii. (abaca+glass+neeem fibers). The above composites were designed in three variations, in which fibers are set and oriented at various angles. The research shows better properties of composites made by abaca and neem fibers, at an inclination of 45°.

M. Messiry et. al. [3] studied the consequences of low content of volume of fibers on the features of the jute cloth bolstered building material composites, suggesting jute as an acceptable answer for the forming advanced matrix shapes. The present work examines the making of a jute material bolstered by the compound matrix material that shield the jute material and raise the sturdiness of cement sheets composed with fibers. Pultrusion technique is adopted to investigate that the basic jute stuff reinforced composites having contrast fiber volume fraction with changing the blending ratios in the matrix material. The modified material having low content of volume of fibers has higher value of properties when compared with untreated jute fabrics samples.

D. Duraibabu et. al. [4] utilizes the hand layup process for fabricating the composites using coconut sheath fibers. Samples were made in combination with compression moulding technique. Samples made are the simple untreated (UTCSE) composite and the treated (TCSE) composite. The segments are prepared and are set as per the ASTM to measure the mechanical nature of composites. The result shows high value of these properties when comparison is done with the treated (TCSE) over the untreated (UTCSE).

M. Reddy et. al. [5] recent work is based on fibers obtained by silk orchid originate in Myanmar. These fibers are utilized as reinforcing material with matrix as the epoxy to design the samples. Hand-layup procedure is used to prepare the specimens of the composite by raising the fibers weight in the multiple of 5 taken in grams. Test samples were prepared as per standards of ASTM. Mechanical strengths were obtained for each of the test samples with UTM machine. The experimental results are then validated

OBJECTIVE

1. To review characteristic of human hair composite.

2. To review the finite element analysis of human hair

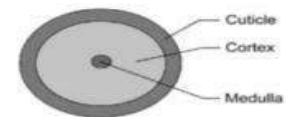3. To evaluate the experiment on the human hair with the chemical.

IV. REVIEW OF HUMAN HAIR FIBRE
Mechanical properties of human hair

Aside from areas of unblemished skin, the human body is covered in follicles that generate thick the terminal as well
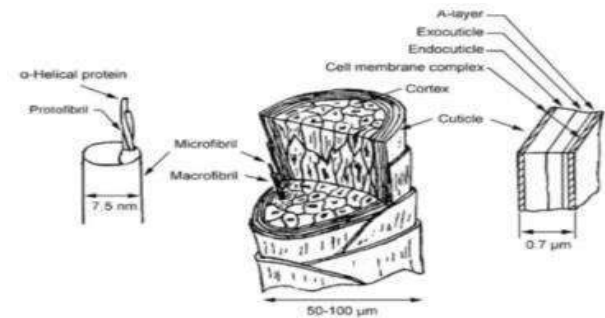
Schematic of hair fiber structure

Cross section of a human hair fiber

as fine vellus hair. The most prevalent interest in hair is in hair growth, hair types, and hair care, nevertheless hair is also an essential biomaterial composed primarily of protein, particularly keratin. Keratins are proteins that consist of long strands (polymers) of amino acids. In terms of raw components, hair is made up of 50.65% carbon dioxide, 20.85% oxygen, thereby 17.14% nitrogen, and 6.36% hydrogen, and 5.0% sulfur. Cytosine, serine as a glutamine, is the threonine, glycine, leucine, valine, and arginine are among the amino acids found in hair.

The term "hair" is commonly used to apply to a different structure:

The part beneath the epidermis known as the hair follicle or, when pulled from the skin, the bulb. This organ is situated in the skin's outer layer and contains stem cells that not only re-grow hair after it falls out, but are employed as well to regrow skin after a wound. The hard filamentous portion

that extends beyond the skin's surface is known as e sha. A slice of a person's hair strand can be loosely divided into three zones.

Fig.No.2Human hair composite samples for experimentation

V. Experiments on human hair with chemicals BHU

Hair is a protein-based fiber with a highly hierarchical arrangement of subunits derived from -keratin chains via intermediate subunits.

Experiments on human hair with chemicals bHU Hair is a protein-based fiber with a highly hierarchical arrangement of subunits derived from -keratin chains via intermediate subunits. Popescu or Hocker [5] proposed attaching strands to the fiber. Homas et al. [15] defined that the hair follicle contains a significant quantity of Sulphur because -amino acid the protein cysteine (HO2CCH (NH2) CH2SH) is a key component of the proteins known as keratin in hair fiber, and they focused on a comparative study of the chemical composition of human hair from different races on different continents. Hu et al. [16] investigated protein-based composite biomaterials that can be formed into a broad variety of composites with tunable characteristics, including cell response control. They offered new biomaterials, which was a critical need.

VI. Finite element analysis of human hair bhu

Using mathematical principles, Jager et al. [22] carried out the terminal differentiation of hair the matrix keratinocytes and attempted to optimize the percentage of hair from humans' fiber in different matrixes. Matthew and others [23] used the ANSYS and the ABAQUS modules to perform finite element modeling of composite substances and buildings as technology advanced. Soden et al. [24] were successful in conducting tests on lamina properties, lay-up configurations, and loading conditions for a variety of fiber reinforced composite laminates. Mangalgiri [25] investigated composite materials for aerospace uses by using human hair as a fiber.

VII. Thermal analysis of human hair

Overall, if the composition within the laminate structure is known, FEA appears to be well adapted to estimating the mechanical behavior of composite structure. However, when the composition of the laminate structure is unknown, the difference between simulation and the results of experiments can theoretically be even 100%, as evidenced by the findings of their investigation.

VIII. Nanotechnology and other methods are being used to

investigate human hair to be a biological bHU Recently, Ray and the researchers Okamoto [29] conducted studies on the human hair using a nano-indentation method and discovered that as the indentation depth increased, the hardness or elasticity modulus of hair dropped. Hey also discovered that the mechanical characteristics of the hair surface deteriorated from root to tip. Wei et al. [6] also

reviewed the cross section or elasticity for human hair fiber or keratin using Atomic Force Model (AFM) or pointed out that while it is possible to obtain nano-mechanical information such as elastic modulus or elasticity from AFM, measuring hardness using an AFM is difficult. They also investigated the nanomechanical characteristics of hair to be a function of time.

IX. The ecological significance of human hair

Human hair is deemed a refuse substance in most areas of the globe, and it can be found in urban trash sources, causing a variety of environmental problems. Gupta [32] investigated human hair as a refuse and its usage and found that human hair has a wide range of applications spanning from agriculture to medical to engineering. Hybrid composites are composites formed by fusing two or more different kinds of fibers, fiber-particles, or particle-particles in a shared matrix. Hybrid composites have some advantages over using only one form of fiber or particle in a polymer matrix.

Human hair, jute fibers sisal, the plant hemp, plantain, and other natural fabrics. Natural particles such as almond, coconut, walnut, and wood, among others, are sustainable, economical, and can be burned for energy recovery. Morton or Hearle [33] showed the swot.

Furthermore, Babu and others, [34] conducted research on biologically based polymers and found that it has received a lot of attention as a result of environmental worries and the awareness that the world's hydrocarbon resources are limited. Finally, Saxena and others, [35] evaluated the potential of human hair fiber and predicted its worth as the most hopeful ecological fibre in a short time.

X. Application

Composite materials are typically employed for buildings, bridges, and other structures including boat hulls, swimming pool panels, racing car bodywork, shower stalls, bathtubs, storage tanks, imitation granite, and cultured marble sink and worktops. They are also being used more and more in standard automobile applications.

XI. Conclusion

Various inferences have been made and outlined as a result of the extensive study of the research presented: To begin, it is obvious that human hair is the most widely used hybrid fiber in the area of novel materials for engineering science. The experimental findings for various manufacturing processes described in the literature demonstrate that the effect of neighboring human hair within the network does not follow a set pattern under different working circumstances. In such situations, more scientific experimental investigations for a wide variety of working factors are required. Second, extensive laboratory research has been conducted to investigate the effect of human hair to be a hybrid fiber in various matrixes.

1. In terms of labour, equipment, overhead, etc., the cost of composites is less expensive economically than the basic or traditional materials.

2. To establish the advantages of human hair composites in a particular application, the entire life cycle economics must be taken into account and contrasted with those of conventional materials.

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Review on Mechanical Characteristics of Natural Fiber Reinforced Epoxy Polymer Composites

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Abstract— Composite materials, plastics, and ceramics have dominated the field of developing materials during the past two decades. The amount of applications for composite materials has increased continuously, aggressively entering and dominating new markets. Modern composites make up a large share of the market for engineered materials, appearing in everything from everyday products to sophisticated specialist applications. Although composite materials have already demonstrated their value as weight-saving ones, the present challenge is to make them cost-effective. This review paper focuses on the advancement of biomaterials in the field of orthopedics and discusses global evaluations review reports on natural fibers and their applications. An effort is being made to make use of the advantages of renewable resources for the creation of biocomposite materials based on bio-epoxy resin and natural fibers like Agave sisalana.

Keywords—mechanical characteristics, natural fibers, short fibers, sustainable solution

I. INTRODUCTION

Composite materials are the materials which are being in use from the civilization of human society. Two major components, reinforcing material and matrix material, are used to create composites. In this study, we want to investigate the mechanical properties of a composite consisting of polymer as matrix and natural fibers as reinforcement.

A composite material is a combination of two or more materials that exhibits better qualities when used together than when the individual components are utilized separately.

When compared to bulk materials, the composite materials' key benefit is their low density and combination of high strength and stiffness, which allows for a reduction in weight for final items. Composites can be utilized for electrical applications as well as those involving mechanical energy, such as shielding cables and acting as wire insulators, where the mechanical and electrical properties of the material play a crucial role.

II. LITRATURE REVIEW

Nur Izzah *et al.* (2022) This study examines the problems with natural fibre waste management and the drawbacks of synthetic fibres. Lignocellulosic fibres are commonly used as a reinforcing material in natural reinforcement fibre composite, according to this review's findings. This review also demonstrates how fibre hybridization is crucial to enhancing dynamic mechanical characteristics.

Habib Awais *et al.* (2021) Composite is used in a multitude of applications due to its unique properties, including reuse, waste use, environmentally friendly nature, biocompatible, good strength, and an alternative to plastic. By proportionally enhancing the tensile and bending strength of the fibre reinforcement, impact strength was raised.

Taslima Akter (2021) Researchers are paying more attention than ever to natural fibres, especially plant fibres because they are affordable, readily available, and environmentally beneficial. Plant fiber-based composites are being used more and more frequently in a variety of industries. Since synthetic polymers have long been a source of environmental pollution, researchers are looking for alternatives that are less harmful to the environment. In addition to adding environmentally beneficial material, plant-based fibers enhance the mechanical qualities of composites. Before the creation of composites, chemicals or filler agents are occasionally added to plant fibers in the hopes of changing their qualities.

The fibers were chemically processed in 10% of the NaOH solution at the room temperature. The sizes of short fibres of 5mm and upto the 8mm are used in this.

In this work the composite lamina was fabricated by hand moulding method using polyester resin.

The flexural test and tension test were carried out As per ASTM standards.

III. OBJECTIVE

1. To review mechanical properties of natural fiber reinforced polymer composite.

2. Tabulate the natural properties of different polymer composite.
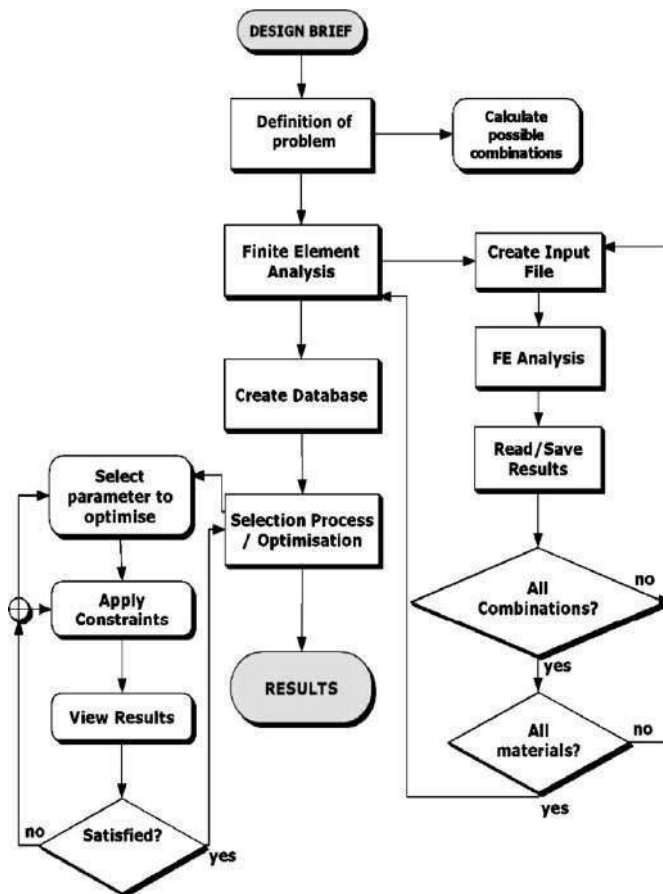
IV. Metodlogy

Fig. 1 Methodology [4]

Natural fibers are handier for people than synthetic fibers since they have special qualities including biodegradability, renewability, and eco-friendliness. Natural fibers are safe, less dense, and simple to work with.

The earliest known cultivated plant, natural fiber has the following inherent qualities: low weight, low price, high specific strength and particular stiffness. These characteristics have made them very appealing for a wide range of industrial uses.

Table1: Properties of Natural Fiber Composite [5]

Name of fiber	Diameter	Length (mm)	Density (kg\mm^3)	Moisture gain %
Abca	18.2	4.9	1500	14
Alfa	-	-	890	-
Bagasse	20	1.7	900	-
Banana	-	2.9	1325	-
Bamboo	25	2	1500	-
Coir	17.5	1.25	1250	13
Cotton	14.5	42	1550	8.59

VI. Application

Composite materials are typically employed for buildings, bridges, and other structures including boat hulls, swimming pool panels, racing car bodywork, shower stalls, bathtubs, storage tanks, imitation granite, and cultured marble sink and worktops,. They are also being used more and more in standard automobile applications.

It has applications in the maritime, aerospace, and auto industries in addition to being utilized as a component in rockets and aircraft.

VI. Conclusion

Composite materials have a lot of potential in the coming decades since they are materials with a high strength to weight ratio, are non-corrosive by nature, have low specific gravities, and have high damping characteristics, among other properties.

Future structural component development will necessitate increasing usage of composite materials, which will increase the requirement for advanced developed standards for industrial application.

1. In terms of labour, equipment, overhead, etc., the cost of composites is less expensive economically than the basic or traditional materials.

2-To establish the advantages of composites in a particular application, the entire life cycle economics must be taken into account and contrasted with those of conventional materials.

VIII. Future Scope

In the home, composite materials are used for things like furniture, windows, doors, mending, and civil building. To improve the performance of the pieces, we can use composite materials in the maritime, chemical, and sporting industries. With the aid of the review, we come to the conclusion that composite materials have many benefits and applications across a variety of industries, enabling us to improve our quality of life.

The use of fiber-reinforced polymers in high cycle fatigue applications is a further crucial area of research.

Reduction in the cost of the raw materials and the production of composite materials is an area for improvement.

Efforts are being undertaken to make the epoxy resin matrix more durable and eligible for various applications.

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PARTIAL REPLACEMENT OF CEMENT WITH COCONUT HUSK ASH.

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Abstract—- This research is primarily aimed about study of factors and strength of mixing Coconut Husk Ash (CHA) as a partial replacement with OPC (5% as per cement volume) by conducting Compression test on Cement Concrete (i.e., cement replaced with 5% of CHA). The main purpose of this study is to determine that is the coconut husk ash can be replaceable with cement or can it be able to give similar strength in concrete with 5% of replacement of cement (i.e., this can be cheaper way of making concrete with less use of Cement quantity). For this purpose, we have collected coconut husk ash and replaced it with 5% OPC in Cement concrete, and then we have casted 6 moulds of cement concrete to test 3 of them in the duration of 7 days of curing and remaining after 28 days of curing. Hence, we have designed mix of M25 cement concrete in which we will continue this research.

I. INTRODUCTION

Every year the world produces at least 30 million tons of coconut which are abundant in coastal areas of tropical countries. The coconut husk is composed of 30% fiber and 70% pith, with high lignin content and phenolic content. Due to these content the coconut fibers are very elastic and durable.

Due to the high cost of construction materials like Cement and Reinforcement bars, has led to increased cost of construction, this coupled with the pollution associated with necessitated a search for an alternative binder which can be replaced in cement in cement production. More so disposal of agricultural waste materials such as Rice, Maize, Sugarcane and Coconut Husks are constituted an environmental challenge.

Hence, it's a great idea to convert them into useful materials to minimize their negative effect on the environment.

The American society of testing materials (ASTM) defines Pozzolans as siliceous or aluminous materials which possess little or no cementitious properties but will, in the presence of moisture, react with lime [Ca (OH)2] at ordinary temperature to form a compound with pozzolanic properties. Examples of pozzolans include class C fly ash, which contain more than 10% CaO, blast furnace slag and silica fumes. ASTM C 618 – 78 specifies that any pozzolana that will be used as a cement binder in concrete requires a minimum of 70 % silica, alumina and ferric oxides. BS 3892: 1965 parts 1 and 2 specify a maximum loss on ignition of 12%, maximum MgO content of 4% and SO3 of 2.5% respectively.

II. LITERATURE REVIEW

As per International Journal of Scientific and Technology Research-(ISSN 2277-8616)

The cost of cement used in concrete works is on the increase and unaffordable, yet the need for housing and other constructions requiring this material keeps growing with increasing population.

Thus the need to find alternative binding materials that can be used solely or in partial replacement of cement.

Vignesh Kumar Nagarajan March (2014), Carried out an experimental study on partial replacement of cement with coconut husk ash in concrete. Agricultural waste material, in this case, coconut Husks, which is an environmental pollutant, are collected and burnt in the open air (Uncontrolled combustion) for three hours and that product is incinerated in muffle furnace at 800oC for 6 hrs to produce coconut Husk ash (CHA), which in turn was used as pozzolana in partial replacement of cement in concrete production.

Author has produced concrete mortar cubes by replacing 0 and 5 percent of OPC with CHA. He has concluded that, the setting time increases with increase in the amount of coconut Husk ash. He also noticed that, with increase in percentage replacement of OPC with CHA, the compressive strength decreases.

The optimal 28 days strength for OPC-CHA mix is recorded at 10% replacement.

III. OBJECT OF THIS STUDY

The objective of this study is to determine the suitability of coconut Husk ash (CHA) for use in partial replacement of cement in concrete production.

The objectives include as certaining the optimum replacement level of Portland Cement with CHA that will still give required compressive strength as well as compare the setting times of OPC paste with OPC- CHA pastes at various replacement levels.

This research indicates that most materials that are rich in amorphous silica can be used in partial replacement of cement. It has also been established that amorphous silica found in some pozzolanic materials reacts with lime more readily than those of crystalline form. Use of such pozzolanas can lead to increased compressive and flexural strengths.

On the other hand, the main purpose of this research is to determine that the coconut husk ash can give similar strength with cement or it can be able to give similar strength in concrete with 5% of replacement of cement.

IV. MATERIAL USED

Cement- Cement is one of the binding material in the construction work. A cement is a binder, a chemical substance used for construction that sets, hardens, and adheres to other materials to bind them together.

Cement mixed with fine aggregate produces mortar for masonry, or with Sand and gravel, to produces concrete. Ordinary Portland cement (OPC) is used conforming to IS:1489(part-1). Tests conforming to IS 4031 conducted on cement are given below-

Table 1 :- Physical Properties of Cement.

Physical properties	Test results
Fineness	95%
Consistency	31%
Initial setting time	115 min
Final setting time	450 min
Specific gravity	3.15

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Coarse Aggregate- Coarse Aggregates comprise as much as 60% to 80% of a typical concrete mix, so they must be properly selected to be durable, blended for optimum efficiency, and properly controlled to produce consistent concrete strength, workability and durability. Coarse aggregate maximum size of 20mm is used conforming to IS: 383-2016. Tests conforming to IS: 2386 (Part-3) conducted on aggregate are given below-

Table 2 :- Physical Properties of Coarse Aggregate.

Physical properties	Test result
Fineness modulus	6.5
Impact value	18.10
Abrasion value	26.6%
Specific gravity	2.5

Fine Aggregate (Sand)- Sand is a vital ingredient of concrete as a fine aggregate. Sand act as a filler and add more volume to the concrete, making it a stronger product. Fine Aggregate conforming to Zone-II was used as per the guidelines of IS 383-2016. The sand which was passing through 4.75mm sieve is used. The sand was air dried. Tests conforming to IS: 2386 conducted on fine aggregate and their results are given below-

Table 3 :- Physical Properties of Fine Aggregate

Physical properties	Test Result
Fineness Modulus	2.81
Specific gravity	2.7
Water absorption	1.20%

Coconut Husk Ash- Coconut husk ash is a substitute method for producing silica from agricultural waste production with lower production cost. They can be used for the production of aluminum matrix composite using stir casting method. The percentage chemical composition of CHA and OPC is shown in table below.

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Table 4:- Chemical Composition of Cement

Oxide	Composition % in CHA
SiO_2	37.97
Al_2O_3	24.12
Fe_2O_3	15.48
Cao	4.98
MgO	1.89

Fig.1- Coconut Husk Ash

Fig.2- Burning of Coconut Husk

The burned ash collected and sieved through IS Sieve (150 Microns). The resulting ash, which has the required fineness, was collected for use.

Using a mix design ratio of 1:1.7:2.9 and water binder ratio of 0.48, a total of 12 Concrete cubes of size 150mm x 150mm x 150mm were cast using varying OPS-CHA ratio of 100:0, 95:5 respectively, i.e., 6 cubes per percentage replacement.

The cubes were cured and crushed after 7 and 28 days respectively to determine the compressive strength.

V.   METHODOLOGY

The Coconut Husk was sun dried for forty-eight hours to remove moisture from it. It was then subjected to uncontrolled combustion using open air burning for three hours and allowed to cool for about 12 hours.

VI.   PREPARATION OF SPECIMENS

Mixing-

Generally, there are two methods for concrete mixing. The selection of the method is totally dependent on the size of the construction work. The two methods of concrete mixing are mentioned below.

1. Hand Mixing
2. Machine Mixing

Here hand mixing method has been carried out for the mixing of a concrete. Firstly, Fine and coarse aggregate spread in alternate layer and after that cement is placed over them and the elements are mixed dry using a shovel until the color is consistent, followed by gradual addition

of water and the ingredients are mixed until a homogeneous blend is formed.

Casting-
The molds are cleaned and oiled before casting. Then the molds are filled with concrete mix and a temping rod is used to compact the concrete by poking repeatedly into the concrete. Compaction of each layer should not be less than 35 strokes per layer. Concrete surface is leveled by trowel. After casting, molds are put on the vibrator to remove the entrapped air in concrete.

Curing-
After placing fresh concrete in molds, it was allowed to set for 24 hours. Ten a day after, molds are removed and after weighing of each concrete cube, they are put into the water for curing periods of 7 and 28 days.

VII. TESTS

A comparative study of concrete mix is carried out to find the effect of replacing Cement by Coconut Husk. Properties of Coconut Husk Ash mix concrete in term of workability and compressive strength have been studied and the results are as follows –

Slump test (IS: 1199-1959)- Slump test is performed to determine the consistency of concrete. This can be either in laboratory or in site of work. Procedure: In slump test, the mold shall be filled in four layers and each layer shall be tamped with 25 stokes of the rounded end of the temping rod (steel bar, 16mm diameter and 60cm long, bullet-pointed at lower end). After the top layer has been tamped, the concrete shall be struck off level with the trowel. The mold shall be removed from the concrete immediately by raising it slowly in a vertical direction. Slump shall be measured by determining the difference between the height of the mold and that of the highest point of the specimen being tested.

Fig.3- Slump Test

The slump test values at different % of Coconut Husk Ash (CHA) as a replacement of Cement in concrete are shown below –

Table 5:- Results of Slump Test

W/C Ratio	%CHA	Slump Value
0.48	0%	50 mm
0.48	5%	40 mm

Compressive Strength Test (IS: 516-1959)- The compressive strength test of hardened concrete was established as per the guidelines of Indian Standards. Compressive strength is calculated by dividing the maximum load by the original cross-sectional area of a specimen in compression test. The size of tested concrete specimens was 150 x 150 x 150 mm with the age of 7 & 28 days.

a. **Procedure:** Specimens stored in water shall be tested immediately on removal from the water and while they are still in the wet condition. Surface water and grit shall be wiped off the specimens. The load shall be applied without shock and increased continuously at a rate of approximately 140 kg/sq cm/min until the resistance of the specimen to the Increasing load breaks down and no greater load can be sustained. The maximum load applied to the specimen shall then be recorded and the appearance of the concrete and any unusual features in the type of failure shall be noted.

Fig.4- Compressive Strength Test

b. **Calculation:** The measured compressive strength of the specimen shall be calculated by dividing the maximum load applied to the specimen during the test by the cross-sectional area. calculated from the mean dimensions of the section (see also 4.5.1 of IS:1199-1959) and shall be expressed to the nearest kg per sq cm, Average of three values shall be taken as the representative of the batch provided the Individual variation is not more than ± 15 percent of the average. The average of three specimens gives the crushing strength of concrete.

Compressive Strength = Load / Area of Specimen

VIII.   RESULT

Following are the results of compressive strength test at 7 Days of curing and 28 Days of curing (0% Replacement of cement) in Table 6.

And,Table 7 is the results of 5% replacement respectively.

Where, Table 2 is the average result of Compression Test in 7 & 28 days.

Table 6 :- Results of 0% Replacement

Age	S. No.	Weight of cube (Kg)	Load (KN)	Compressive Strength (N/mm^2) = P/A
7 Days	1	8.422	445	19.77
	2	8.427	485	21.55
	3	8.633	483	21.47
28 Days	1	8.437	698	31.02
	2	8.442	701	31.15
	3	8.402	704	31.28

Fig.5- Graphical Representation of 0% Replacement
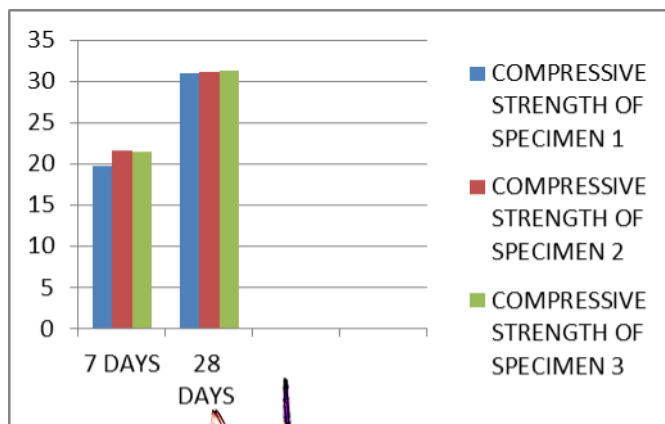
Table 7 :- Results of 5% Replacement

Age	% Replacement	Weight of cube (Kg)	Load (KN)	Compressive Strength (N/mm^2) = P/A
7 Days	5%			
	1	8.417	456	20.26
	2	8.390	512	22.75
	3	8.303	476	21.15
28 Days	5%			
	1	8.582	630	28
	2	8.140	683	30.35
	3	8.456	595	26.44

Fig.6- Graphical Representation of 5% Replacement
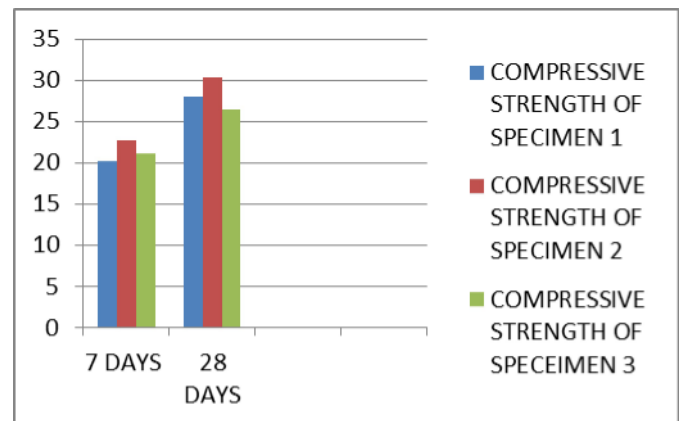
Table 8:- Average results of Replacement.

% Replacement	Curing Age (Days)	Average Strength (N/MM^2)
0%	7	20.93
0%	28	31.32
5%	7	21.38
5%	28	28.26

IX.   CONCLUSION

From the results obtained, CHA/OPC mix showed some promise for use in reinforce concrete as well as mass concrete structures in building construction.

The compressive strength of the cubes at 28 days curing indicates that 5% replacement levels meet the requirement respectively for concreting.

In conclusion, the study reveals that 5% partial replacement of OPC with CHA using W/C ratio of 0.48 are suitable for production of concrete. Further areas of research are recommended.

This includes the use of CHA under controlled conditions, since the Calcination temperature and time appears to have a marked effect on the amorphous of the ash and altering water/cement ratio.

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STABLIZATION OF SOIL USINGSAW WOODASH ANDLIME

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ABSTRACT :- This research dwells on how black cotton soil should be stabilized and made a suitable subgrade material using sawdust and lime. Black cotton soil will deteriorate the structures built on them, because of their volume change behaviour due to presence of minerals. In this paper We used Waste Saw Dust Ash and lime as stabilizer because, the yearly production of saw dust in the country is about 13% of volume of wood log. Effective utilization of waste Saw Dust Ash as stabilizer could result in solution of landfill problems. Sawdust was burnt to ashes in a furnance at a temperature 0f 800 degree C and then mixed with BCS in varying proportions of 16%, 20%. Since the mixes showed that the use of 16% sawdust ash gave better results, the BCS treated with optimum Sawdust ash content of 16% was further stabilized with 2%, 4% lime. Optimum reduction in liquid limit, differential free swell, plasticity index as well as optimum increase in CBR and specific gravity was achieved when BCS treated with 16% swadust ash was stabilized with 4% Lime. Black cotton soil consolidates under load and volumetric changes occur due to seasonal moisture variation, such problem get manifested through shrinkage, swelling and non-uniform settlement. A detailed study has been carried out to know the improvements in certain properties of expansive soil by changing the % of Saw Dust and lime. The results show that the parameters of the soil are getting changed and enhance its strength with the addition of saw dust and lime. It also offers another way to dispose of sawdust.

Keywords:- stabilized , subgrade , sawdust , Saw Dust Ash , shrinkage , swelling , settlement , expansive , lime.

1. Introduction

Soil stabilization is a process of treating a soil in such a manner as to maintain, or improve the performance of the soil as a road construction material. The soil stabilization refers to the process of changing soil properties to improve strength and durability. There are many techniques for soil stabilization including compaction, by adding material to the soil.

Infrastructure projects such as highways, railways etc , requires soil material in very large quantity. Usually, large areas are covered with highly plastic and black cotton soil, which is not suitable for such purpose. Extensive laboratory tests have been carried out by various researchers using saw dust ash and have shown promising results for application of such expansive soil after stabilization.

Expansive/Black cotton soil has the property of swelling when moisture is added to it and to shrink when the moisture is removed. These sudden changes of volume in black cotton soil cause many problems to the structure which come in contact with them or are constructed above them. In India the expansive soils have liquid limit value from 40 to 100% and their plasticity index value ranges between 20 to 65%.

Several attempts have been made towards stabilizing the black cotton soils. The most common and most widely used method for doing so is the addition of lime. It has been observed that the addition of lime to soil improves the engineering properties of the soil as a result of cation exchange, flocculation, and pozzolonic reaction.

Various researchers have reported on the stabilization of black cotton soil with lime. The recommendations for the percentages of lime needed for the adequate stabilization of black cotton soil ranges from 0 to 10%. Other additives such as groundnut shell ash and baggase ash have also been used in recent times to stabilize black cotton soil.

Sawdust also known as wood dust consists of wood formed from cutting, grinding or even drilling of wood with a saw or any other similar tool. Sawdust is generally being perceived as a waste because its potential has not been fully harnessed especially in this part of the world. The two known uses of saw dust in Africa, particularly in Nigeria are for cooking where it serves as fuel and also in poultry where it serves as a soft floor for the poultry birds. In other part of the world, especially in Europe and in America, the saw dust has been successfully converted to many important uses as fuel, wood base board among others. It is also said that the sawdust is used as fuel for burning of bricks that generates steam for the parboiling process.

2. LITERATURE REVIEW

Research has already been carried out on the use of SDA as partial replacement in concrete (A.A.Raheem 2012). No doubt ,it has been found out that it can act as a significant pozzolana in concrete. Further the use of Saw Dust Ash as highway pavement material has been tested and has shown an increase in particle size distribution of lateritic soil and maximum which falls under A-2-7 as per AASHTO classification (JOSEPH ET AL.). Geotechnical properties of south-western Nigerian Soil was again tested

by Ogunribido (2012) who was proved that saw dust Ash is an effective soil stabilizer for black cotton soil and road quality can enhanced by its addition to the soil. N. ChiranthanaandK.ArunKumarandPadmanabham Narayan " STABILITY OF RED CLAY AND BLACK COTTON SOIL WITH SAWDUST ASH AS AN AMMENDEMENT " in the year 2014.

3. MATERIALS USED

In this process the materials are available that is Black cotton soil and Saw Dust Ash and Lime. The experimental investigations on soil sample are done to understand the index and engineering properties of the collected soil sample. This experimental study helps to classify the soil.

3.1 Sawdust
Saw dust ash (SDA) is a fine grey to black powdery substance with a larger specific surface area and finer particle size than Cement and it is produced by the burning of Sawdust ash , which is mainly organic in nature. The chemical composition of the sawdust ash is as it contains insignificant amounts of heavy metal 33.20% CaO.

3.2 Lime
Lime in form of quicklime, CaO, was used for the treatment of the soil –SDA mixture. The lime is a pure amorphous solid produced from natural limestone. It is a white, caustic, alkaline, crystalline solid at room temperature.
Although hydrated lime, Ca (OH_2) could be used, lime in form of CaO offers the advantage of hydrating the soil moisture to become hydrated lime. It is thereby a better drying agent by addition of calcium to react with silica and alumina in the clayey soil. It has a melting point of 2600 degree C.

3.3 Black Cotton Soil
Black cotton soils are susceptible to detrimental volumetric changes with moisture. They are residual deposits formed from lava or trap rocks, occupy mostly the arid and semi-arid regions and also cover a very large area of the world. They are rich in montmorillonite which is responsible for its expansive nature but little is also present when their parent rock is rich in potash bearing mineral. The soil is problematic for engineering construction.

4. METHODS OF EXPERIMENT

4.1 Production of Sawdust Ash
The collected sawdust was placed inside the furnace and burnt at a temperature set at 800 degree C for a period of about 8 hours until the entire sawdust was completely reduced to ash. After the burning of the

sawdust into ash, it was allowed to cool gently in the furnance. This was done to prevent the ingress of moisture before being removed. The resulting sawdust ash produced was sieved through 75 micron test sieve and placed in air tight bags until it was ready to use.

4.2 Experimental Procedure
All the experimental procedures in this research were carried out on the basis of standard tests of soil. The tests carried out on the natural black cotton soil and the mixture of black cotton soil + sawdust ash + lime included Atterberg's limits, specific gravity, differential free swell, optimum moisture content, maximum dry density, and California bearing ratio. The experiment was conducted in two stages. The first stage involves the addition of sawdust ash in various % as 16% and 20% by weight of the black cotton soil. In second stage both the sawdust and lime were added to the black cotton soil. The lime added was in various % of 2% to 4% by the weight of the black cotton soil.

4.2.1 Atterberg's Limits
For the determination of Atterberg's limits such as liquid limit, plastic limit and shrinkage limit the standard methods was used. The Atterberg's limit of the natural black cotton soil was first determined for proper classification of the soil and later the Atterberg's limits for the optimum mix of BCS+SDA+ LIME was determined {Liquid limit (IS: 2720-Part-5-1970), Plastic limit (IS: 2720-Part-5-1970)}.

4.2.2 Specific Gravity
Specific gravity of the natural soil sample and that of optimum mix for BCS + SDA + LIME were determined in this study (IS : 2720-Part-3, sec-1, 1980).

4.2.3 Differential Free Swell
Differential free swell (DFS) test was carried out for the determination of the expansiveness of the soil. The method for the determination of the DFS of the sample was used in this study (IS : 2720-Part-40-1977).

After that the sample is treated with some % of sawdust ash and various tests were carried out to get the properties of the soil after mixing. After mixing sawdust ash in soil some % of lime is also used in the same sample to stabilized the black cotton soil.
After that we get final results.

5. RESULTS

5.1 Properties of black cotton soil:-

Table: - 1 This table shows the properties of the black cotton soil before test the sample with SDAL.

The table shows the properties of the untreated black cotton soil. The liquid limit of the soil determined using the Casagrande's apparatus was 67% while the Plastic limit was 20.79% and Plasticity index was 46.21%. This value of 46.21% is evidence of the high plasticity of the soil. The shrinkage limit of the soil, at 13.31%, confirms that the soil is poor quality, based on the classification of

5.3 RESULTS AFTER MIXING THE SOIL SAMPLE WITH SAWDUST ASH AND LIME

The results of the testes carried out on the soil sample mixed with SDA and lime are given below.The addition of 16%SDA and 2% lime increased the maximum dry density from 1.31gm/cc to 1.42gm/cc. The addition also resulted in an increase in the CBR value from 9.2% to 19.1%. However, a further increase in the lime content to 4% resulted in increase of MDD and CBR values. The addition of 4% lime however reduces the plasticity index of the soil.

Sample	LL %	PL %	PI %	Gs	DFS %	OMC %	MDD gm /cc	CBR %
BCS	67%	20.79%	46.21%	2.24	64 %	38%	1.31	9.2%
BCS+16%SDA+2%lime	44%	21.6%	10%	2.66	24.4 %	31 %	1.42	19.1 %
BCS+16%SDA+4%lime	40%	21.4%	67.5%	2.71	22.6 %	29.6%	1.46	21.64%

Table: - 3

S.No	Property	Symbol	Value
1	Liquid limit	W L	67%
2	Plastic limit	Wp	20.79%
3	Plasticity index	Ip	46.21%
4	Shrinkage limit	Ws	13.31%
5	Specific gravity	Gs	2.24
6	Differential free Swell	DFS	64%
7	Optimum moisture content	O.M.C.	38%
8	Maximum dry density	M.D.D	1.31 gm/cc
9	CBR Value	BSL	9.2%

soils in terms of shrinkage limit. Also, because the California bearing ratio (CBR) and the Maximum dry density (MDD) values were small, the soil clearly needs to be stabilized before it can be used as a subgrade material.

5.2 RESULTS AFTER MIXING SOIL SAMPLE WITHSAWDUST ASH

The results of the tests carried out on the soil sample mixed with SDA are given below.The addition of SDA in percentage to 16% increased the maximum dry density from 1.31g/cc to 1.4g/cc.The addition also resulted in an increase in the CBR value from 9.2% to 14.7%.However ,a further increase in SDA content to 20% resulted in reduction of both the MDD and CBR values, and also increasing the OMC,rather than reducing it.The addition of 20% SDA did not also result in a significant change in plasticity index,specific gravity or the differential free swell.

5.4 COMPARATIVE ANALYSIS OF THE PROPERTIES OF UNSTABILIZED AND STABILIZED BCS

The given table shows a comparison of the properties of natural black cotton soil, black cotton soil stabilized with 16% SDA and black cotton soil stabilized with the combinations of optimum 16% SDA and optimum 4% lime. The liquid limit of the BCS decreased from 67% to 40% with the addition of 16% SDA and 4% lime, which is a reduction of about 27% in LL value. The decrease in the liquid limit is as a result of the flocculation and subsequent reduction in the amount of absorbed water which occur when SDA and lime are added. The plastic limit subsequently increased by 20.79% to 21.4% when 16%SDA and 4% lime was added. The increase in the PL implies that with the increase in the water content, the soil mixture changes from the plastic state to the semi solid state. The soil achieves greater worka

Table : - 2

Sample	LL %	PL %	PI %	Gs	DFS %	OMC %	MDD Gm/cc	CBR %
BCS	67%	20.79%	46.21%	2.24	64%	38%	1.31gm/cc	9.2%
BCS+16%SDA	44%	23.8%	27.7%	2.62	31%	33.4%	1.4gm/cc	14.7%
BCS+20%SDA	44%	23.8%	27.7%	2.62	31%	33.6%	1.36gm/cc	10.1%

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bility as a result also higher shear strength when this occurs. Similarly, the Plasticity index decreased to 8.5% on the addition of the 16% SDA and 4% lime.

The specific gravity, which was determined using the pycnometer method, improved from an initial value of 2.24 in the 100% BCS to a value of 2.62 when 16% SDA was added, and to 2.71 when 4% lime was further added to the sample. The optimum moisture content in the 100% BCS was found to be 38% but this decreased to 33.4% when 16% SDA was added and to 29.6% with the further addition of 4% lime to the sample. The reduction of the OMC is attributed to the hydration reactions which continue until lime fixation point, which corresponds to 4% lime was reached.

The maximum dry density was found to be 1.31gm/cc in the 100% BCS. The addition of 16% SDA has increased its value to 1.4gm/cc. Further addition of the 16% SDA and 4% lime increases its value to 1.46gm/cc.

The differential free swell had a decrease of 31% when 16% SDA was added. That is,it decresed from an initial value of 64% and further decresed by 29.6% with the addition of 4% lime.

The CBR value is increased from 9.2 to 14.7% when 16% SDA was added, and upon the further addition of 4% lime, it increased to 21.64%.

6. CONCLUSION

It can be concluded from this investigation that black cotton soil can be properly stabilized for use as subgrade material. Adequate strength was achieved with 16% SDA and 4% Lime. The importance of the results is that unlike other stabilization cases where higher quantities of lime were required for the optimum stabilization of the BCS, suitable results were achieved at just 4% lime and 16% SDA. Also, Sawdust is an inexpensive by-product of wood processing industries, and its utilization greatly minimizes environmental pollution.
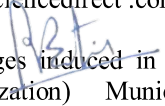
S.No.	Property	Symbol	Black cotton Soil (untreated)	BCS treated with 16% SDA	BCS Treated with 16% SDA and 4% lime
1	Liquid limit (%)	Wl	67%	44%	40%
2	Plastic limit (%)	Wp	20.79%	23.8%	21.4%
3	Plasticity index	Ip	46.21%	27.7%	8.5%
4	Specific gravity	Gs	2.24	2.62	2.71
5	Differential free swell	DFS	64%	31%	22.6%
6	Optimum moisture content	OMC	38%	33.4%	29.6%
7	Maximum dry density gm/cc	MDD	1.31	1.4	1.46
8	CBR (%)	CBR	9.2%	14.7%	21.64%

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PARTIAL REPLACEMENT OF CEMENT WITH WHEAT STRAW ASH

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Abstract- Nowadays the world population increasing rapidly and increasing urbanization has resulted in various negative aspects for society, one of them rising demand for food due to the production of food is increasing, on the other hand, organic waste is such as wheat straw ash rice husk is also increasing Simultaneously, a major ecological challenge is the disposal of agricultural waste from burning biomass. In this study, an environmentally friendly solution is proposed to investigate the incorporation of Wheat straw ash (WSA) by replacing 5 to 10% of cement in concrete. WSA gives an environmentally friendly solution for its disposal. Many researchers are supervising several experimental studies focusing on discovering the possibility of using alternatives as cement replacement materials that are ecological, economical, and efficient. Alternatives include industrial and agricultural waste whose potential benefits can be appreciated through recycling, reuse, and recovery processes. With the use of these wastes as supplementary and replacement materials, significant energy savings and a reduction in cement consumption occur, which helps to reduce the release of carbon dioxide into the environment.

Keywords—Wheat Straw Ash, cement replacement, agricultural waste

1. INTRODUCTION

Concrete is one of the most widely used building materials in the world, concrete is a product obtained artificially by Harding of a mixture of cement, sand Gravel, and water in a predetermined proportion.

Wheat is one of the primary sources of food for billions of people. Annual global wheat production was around 705 million tons, of which 75% was produced by 18 countries and about 20% was produced by the Eu-27. The average yield of wheat straw stalks is around 1.3-1.4 kg per kg of grain. This puts the global wheat straw estimate at around 534 million tons. In underdeveloped and developing countries, wheat straw is burnt in the open field causing environmental issues and health problems huge amount obtained after burning wheat straw probably has no use, and getting rid of it is also a problem this research, therefore, evaluates the feasibility of using WSA in concrete as a partial replacement of cement. Many relatively new complementary cement materials, such as wheat husk ash, sewage sludge ash, and ashes, have been extensively studied. The development of natural materials to produce concrete composite construction materials for construction has been continuous for many years. India is one of the largest wheat producers, and per capita wheat consumption is higher than in any other country. There are three main producers of biomass that come from wheat straw, wheat hulls, and wheat bran. Wheat straw and wheat husk, and wheat bran feed have been used for cattle, poultry, fish, and others.

In the villages, wheat straw is also used for cooking and other purposes by burning. After a large amount of wheat straw has been burnt, ash is produced and dumped, resulting in an environmental problem, although some time is spent on agricultural land. To reduce the cost of building materials and raise environmental issues, significant efforts are being made worldwide to use local waste and secondary materials to improve the performance of building materials. Traditional building materials are out of reach of most of the world's population because of the weakness of their affordability. Wheat straw is one of the most important agricultural products available worldwide. During growth, wheat plants pick up silicic acid from the soil and accumulate in their structures. This silica is concentrated burning at high temperatures to remove other elements, making ash very valuable. Wheat straw contains 15% of the ash after burning and thus every 1000kg of wheat straw burned produces 150 kg of ash The safe disposal of wheat straw, aids in the production of ecological cement-based composites, sustainable consumption of raw materials used in cement

production, and reduction of construction costs. It would also add economic value to wheat straw, creating an incentive for farmers to refrain from the open burning of wheat straw. Among other plant residues, wheat husk ash, bagasse ash, etc. have been successfully investigated for their use in cement.

2. LITERATURE REVIEW

Journal of Engineering and Technology (JET) Vol.4, No. 2 August 2009 Aboshio, A. Ogork, E. N. & Balami D. A

Pozzolanas are often used to blend with OPC or to partially replace OPC. Pozzolanas are natural or artificial materials which contain Silicon dioxide and/or alumina. They are not cementitious themselves but when finely ground and mixed with lime, the mixture will set and harden at ordinary temperature in the presence of water, like cement (ASTM 618-94a cited in Neville 2003).

According to Zheng (1996), Tashima, etal 2009, about 100 million tons of wheat husk is produced annually all over the world. Approximately, 20kg of wheat husk are obtained from 100kg of wheat. Wheat husks contain organic substance and of inorganic materials. WSA is obtained by the combustion of wheat husk. WSA is 20% by weight of wheat husk and serve no economic purpose for either agriculture or industrial usage (Mehta, 1977; Dahiru and Zubairu, 2008). Prasad et al (2000) reported that WSA contains

3. OBJECT OF THE STUDY

To make eco-friendly concrete

To reduce the cost of the constitution

To reduce pollution of carbon dioxideduring the manufacturing of cement in factories

To reduce and reuse biodegradable wasteWSA.

To use crop residue as a workable material by partially mixing it with cement in theconcrete.

4. EXPERIMENTAL DETAILS

Locally available ordinary port and cement (OPC) grade 43 in conformity with Indian standards were used wheat straw is burned after burning completely

wheat straw are turned into ash. Wheat straw ash is sleeved through 250-micron standard mesh and the resulting sample was used for partial replacement of cement in the concrete WSA was used in replacement made by 5% weight of cement.

5. MATERIALS

5.1. Cement

Cement is one of the binding materials in construction work cement mixed with fine aggregate produces mortar for masonry or with sand and gravel produces concrete ordinary Portland cement (OPC) of grade 43 is used conforming to IS269-2015.

Table-1: physical properties of cement

Physical properties	Percentage
Fineness	5%
Consistency	31%
Initial setting time	115min
Final setting time	195min
Specific gravity	3.15

Table-2 chemical properties of cement

Chemical properties	percentage
Lime (CaO)	60 to70%
Silica (SiO_2)	17 to 25%
Aluminum (Al2O$_3$)	3 to 8%
Iron oxide (fe$_2O_3$)	0.5 to 6%
Magnesia (MgO)	0.1 to 4%
Sulphur trioxide (SO_3)	1 to 3%
Soda and/or potash (Na_2O+k_2O)	0.5 to 1.3%

Coarse Aggregates

Aggregates comprise as much as 60% to 80% of a typical concrete mix, so they must be properly selected to be durable, blended for optimum efficiency, and properly controlled to produce consistent concrete strength, workability, and durability. A coarse aggregate maximum size of 20mm is used conforming to IS 383-2016. Tests conforming to IS 2386 conducted on aggregate.

Following is the table showing physical properties of coarse aggregate.

Table-3 physical properties of coarse aggregate

Physical properties	Test result
Fineness modulus	6.5
Specific gravity	2.5
Water absorption	0.85%
Impact value test	18.10
Abrasion test	26.6%

Fine Aggregate

Sand is a vital ingredient of concrete as a fine aggregate. Sand act as a filler and adds more volume to the concrete, making it a stronger product. Sand conforming to Zone-il was used as the fine aggregate as per IS 383-2016. The sand which was passing through a 4.75mm sieve is used. The sand which was passing through a 4.75mm sieve is used. The sand was air-dried. Tests conforming to IS 2386 were conducted on fine aggregate.

Table-4 Physical properties of fine aggregate

Physical properties	Test result
Fineness modulus	2.81
Specific gravity	2.7
Water absorption	1.20%

Wheat Straw Ash

Wheat straw is the stalk left over after wheat grains are harvested. Traditionally, it has been treated as a waste. In some countries, farmers burn it, contributing to air pollution and creating a public health hazard. However, these stalks still have value. wheat straw Ash is obtained by burning the wheat straw stalk. The composition of wheat straw is cellulose 39.0% and hemicelluloses 38.7% and lignin 20%.

Figure-1 Wheat Straw Ash

Table-5. chemical composition of WSA (mass%)

Substance element	WSA
C	27.6
Na_2c	0.1
MgO	2.5
Al_2O_2	1.5
SiO_2	47.5
P_2O_2	3.0
S	1.1
Cl	0.3
K_2O	10.1
CaO	5.5
TiO_2	0.1
Fe_2O_2	0.5
BaO	0.1

Water

Water plays an important role in the mixing of concrete. Water Cement Ratio signifies the ratio between the weight of water to the weight of cement applied in the concrete mix. Generally, the water-cement ratio remains under 0.4 to 0.6 with adherence to IS Code 10262 (2009) for nominal mix (M10, M15 …. M25) The strength of concrete is directly impacted by the water-cement ratio. It enhances the strength if employed in a perfect ratio and if the ratio is improper, the strength will be reduced.

6. METHODOLOGY

6.1. Mixing

After the collection of material fine aggregates and coarse aggregate is spread in alternate layers and after that cement is placed over them followed by the gradual addition of water and the ingredients are mixed until a homogeneous blend is formed.

6.2 Casting of the Specimens

The molds are cleaned and oiled before casting. Then the molds are filled with concrete mix and temping rod is used to compact the concrete by poking repeatedly into the concrete. Concrete surfaces are leveled molds are put on the vibrator to remove the entrapped air in concrete.

6.2 Molds opening and curing

I. Molds are open after 24 hours and take away the Specimens.
II. Specimens are put into the water tank for curing.
III. Specimens are taken away from the water tank for the tests.

7. Tests

7.1 Slump cone test

A slump cone test is used to mature the consistency of fresh concrete it is before it sets. It is performed to check the workability of freshly made concrete.

The mold is carefully lifted vertically upwards, so as not to disturb the concrete cone. The concrete then slumps (subsidies). The slump of the concrete is measured by measuring the distance from the top of the slumped concrete to the level of the top of the slump cone.

Fig 2- Slump Cone Test

7.2 Compressive strength test

These Specimens are tested by a compression testing machine after seven days of curing or 28 days of curing. Load should be applied gradually at the rate of 140 kg/cm2 per minute till the Specimens fail. Load at the failure divided by the area of the cube gives the compressive strength of concrete. These specimens are tested by a compression testing machine after seven days of curing or 28 days of curing. Load should be applied gradually at the rate of 140 kg/cm2 per minute till the cube fail. Load at

the failure divided by the area of Specimens gives the compressive strength of concrete.

7.3 Results

Table 6- Average Results of Specimens

% Replacement	Curing age (Days)	Average Comp. Strength (n/mm^2)
0%	7	17.98
0%	28	20.21
5%	7	24.06
5%	28	28.30
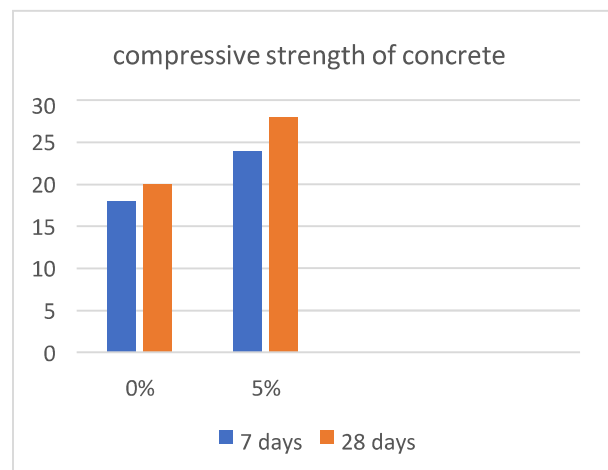
Fig 3- Graphical representation of results

8. Conclusions

The replacement of cement with WSA in concrete enhances the compressive strength of concrete, while reducing the workability of concrete, due to the fineness of WSA particles as compared to cement particles the overall conclusion by mixing 5% of WSA in cement in concrete enhances. The compressive strength of concrete by mixing 5% of WSA in cement can reduce the cost of construction and become economical as well as wheat straw is also used due to this carbon emissions during manufacturing is also can be reduced.

9. Recommendation

The overall aim of the research proposes that the use of wheat straw ash increases compressive strength

but reduces workability an advanced research study may be needed in the future to increase the workability of WSA concrete with different mineral and chemical admixtures.

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PARTIAL REPLACEMNT OF CEMENT BY SUGARCANE BAGASSE ASH AND COARSE AGGRGATE BY JHAMA BRICK AGGREGATE

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Abstract—-There is an increase in demand and utilization of cement and many scientists are in search for developing alternative binding materials that can be eco-friendly and helps towards waste management. The use of agricultural and industrial waste produced can help in reduction of waste is in focus.

Methods: In this work one of the Argo wastes named sugarcane bagasse ash (SCBA) has been used as partial replacement of cement. SCBA is produced by burning of sugarcane bagasse which is left after extraction of juice from sugarcane. At high temperature under controlled condition bagasse is burned to obtain ash which contains high amorphous silica. In this paper the cement by weight is replaced 0%, 5%, 10%, by SBCA in concrete. And the use of concrete is truly large and day by day the cost of the conventional material is also rising so it is beneficial to use the optional materials for making the concrete. The project focuses on coarse aggregate in concrete; the study has been done on the replacement of coarse aggregate with demolished brick aggregate known as Jhama brick. The optional source is Jhama bricks as coarse aggregate. Jhama brick produced due to over burning. The brick has irregular shape and it is also used of coarse aggregate. We replaced the coarse aggregate in ratio of 0%, 5% and 10% by weight in M25 grade of concrete.

The result has come that as the percentage of replacement increases, the strength of concrete is decreases.

INTRODUCTION

India is a developing country. Developing infrastructure leads to consumption of concrete. Cement and aggregate have big value in concrete. Thus, replacement of cement and aggregate becomes need in last decays and the partially replacement will contribute to a good point to the research area. Number of research doing work on the replacement of cement and aggregate by number of materials like sugarcane and Jhama brick's respectively cement is the most commonly used building material throughout the world and it will retain its status in near future also because of demand and expansion of construction industry all over the world. Further the greatest challenge before the concrete construction industry is to serve the two pressing needs of human society, namely the protection of environment and meeting the infrastructure requirements of our growing population Structures which are constructed in aggressive environments are liable to be subjected to acidic attack. One of such major problems is HCl attack against concrete structures due to which there will be loss of weight and reduction in strength of concrete ultimately sacrificing age of the structure. Contaminated ground water, seawater, industrial effluents are some of the sources of sulphate that attack concrete. The use of blended cements has shown a sharp result in resisting the sulphate attack on concrete, sugarcane bagasse ash which shows pozzolanic properties is being used as a partial replacement in concrete in regular intervals of 5% and 10%. SCBA is being produced from sugar manufacturing units as a waste material which will be grinded to the fineness less than cement for obtaining good bonding between cement and SCBA (Sugarcane bagasse ash).

The major volume concrete is filled with aggregate. The inclusion of aggregate in concrete reduces its drying shrinkage properties and improves many other properties such as compressive strength etc. But it is costly to transport, so local sources are needed to reduce the cost of transport, but due to geographical constraints this is not available at all places, therefore it necessitates finding other sources and alternative from local sources. The many materials are used as an alternative source for natural coarse aggregate such as recycled low quality crushed brick, recycled coarse aggregate, coconut shell, recycled plastic aggregate, well burnt brick etc. For this work select a Jhama class brick as an alternative source for coarse aggregate. This material was chosen because in brick making, a large number of bricks are rejected due to non-conformity is the distorted form of brick produced due to high temperature control in the kiln. These rejected bricks can also be potential source of coarse aggregate. According to general definition concrete is a composite material so by taking advantage of the situation for the people, this paper presents the research that carried out on the concrete when natural coarse aggregate is partially replaced by Jhama Class brick aggregate.

LITERATURE REVIEW

R Srinivasan and k. Sathya had concluded that blended SCBA in concrete had higher compressive power, tensile electricity and flexural strength in evaluation than that of without SCBA. They got here to an end that cement could be partially changed through SCBA up to an extent of 10%. They even concluded that with the addition of

greater SCBA, the density of concrete will decrease and **low weight concrete is produced.**

Banger Sayable S. et al concluded that with partial alternative of cement in concrete with, SCBA strength of concrete can be extended with discount in use or cement. They even concluded that Bagasse Ash high-quality use is with addition in cement alternatively than land filling.

C. Tariq Ali, et. al. (2013) [3] generated a study on concrete which incorporated Over Burnt Brick Ballast Aggregate partially due to their abundance. 5%, 10%, 15%, and 20% (M05, M10, M15, M20) incorporation was used as partial replacement of natural coarse aggregate in concrete. Analysis of incorporated concrete was done in fresh state as well as hardened state to evaluate different properties of a concrete i.e., slump, compaction factor test, unit weight, and compressive strength are evaluated. From all the results and experimental approach, it was concluded that concrete formed with over burnt brick ballast aggregate showed beneficial performance as compared with the concrete made up of natural aggregate obtained from local resources. The over burnt brick ballast aggregate showed 14.75% increase in compressive strength for 20% replacement. The investigation discovered decline in the unit weight, the adequate gain in compressive strength

I. AIM & OBJECTIVES OF THE STUDY

The main aim of the concrete mix design is to find out the desired proportion of each ingredient which are cement, coarse aggregate, fine aggregate, water etc. to obtain the required properties of resulting mix.

Objective: -
- To achieve a specified compressive strength for a specified grade.
- To maintain workability of concrete mix throughout work.
- For achieving durability.
- To achieve economy by selecting appropriate concrete ingredients.
- To obtain maximum possible yield per bag of cement.
- To avoid honey combing and bleeding.
- To comply with various standards.
- To reduce wastage of concrete by correct proportioning.

II. MATERIAL USED

Cement-: Cement is one of the binding materials in the construction work. A cement is a binder, a chemical substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete. Ordinary Portland cement (OPC) is used conforming to

IS:1489(part-1). Tests conforming to IS 4031 conducted on cement are given below.

Table 1: - Physical Properties of Cement

Physical Properties	Test Results
Fineness	95%
Consistency	31%
Initial setting time	115 min
Final setting time	450 min
Specific gravity	3.15

Coarse Aggregate- Coarse Aggregates comprise as much as 60% to 80% of a typical concrete mix, so they must be properly selected to be durable, blended for optimum efficiency, and properly controlled to produce consistent concrete strength, workability and durability. Coarse aggregate maximum size of 20mm is used conforming to IS: 383-2016. Tests conforming to IS: 2386 (Part-3) conducted on aggregate are given below.

Table 2: - Physical Properties of Coarse Aggregate

Physical properties	Test result
Fineness modulus	6.5
Impact value	18.10
Abrasion value	26.6%
Specific gravity	2.5

Fine Aggregate (Sand)- Sand is a vital ingredient of concrete as a fine aggregate. Sand act as a filler and add more volume to the concrete, making it a stronger product. Fine Aggregate conforming to Zone-II was used as per the guidelines of IS 383-2016. The sand which was passing through 4.75mm sieve is used. The sand was air dried. Tests conforming to IS: 2386 conducted on fine aggregate and their results are given below.

Table 3: - Physical Properties of Coarse Aggregate

Physical properties	Test results
Fineness modulus	2.81
Specific gravity	2.7
Water absorption	1.20%

Sugarcane bagasse ash: - Sugar cane bagasse ash (SCBA) is an abundant byproduct of the sugarcane and ethanol industry. SCBA is generally used as a fertilizer or is disposed of in landfills, which has led to intensified environmental concerns. In recent years, SCBA research has mainly been focused on utilization in construction materials due to the abundance and pozzolonic characteristics of SCBA.

.Table 4: - Chemical composition of sugarcane bagasse ash

Mineral	Percentage%
SiO_2	73
Al_2O_3	6.7
Fe_2O_3	6.3
Cao	2.8
MgO	3.2
P_2O_5	4.0
Na_2O	1.1
K_2O	2.4
Loss of ignition	0.9

III CONCRETE MIX DESIGN

Concrete mix design can be defined as the method of calculating a suitable quantity of materials of concrete and find out the required proportions with the object of producing concrete of certain minimum strength and durability as economically as possible.

Mix design of concrete is a process of calculating the quantity of materials like cement, sand, aggregate, water and admixture to achieve or make specified strength of concrete.

In simple words it is the method of calculating the quantities of ingredients that makes the required grade of concrete.

Data Required for Mix Proportioning

The following data is required for concrete mix design calculations of a particular grade of concrete: -

- Grade designation
- Type of cement, and of cement (if applicable)
- Maximum nominal size of aggregate.
- Minimum cement/cementations material content and maximum water cement/ cementitious materials ratio to be adopted; (Exposure condition as per table 3 and 5 of IS 456)
- Workability required at the time of placement
- Transportation time
- Method of placing
- Degree of site control (good/fair) or value of established standard deviation, if any.
- Type of coarse aggregate (angular/sub-angular/gravel with some crushed particles rounded gravel/manufacture coarse aggregate)
- Type of fine aggregate (natural sand /crushed stone or gravel sand /manufactured sand/mixed sand);
- Maximum cement content
- Whether a chemical admixture shall not be used and the type of chemical admixture and the extent of use;
- Whether a mineral admixture shall or shall not be used and the type of mineral admixture and

the extent of use and any other specific requirements like early age strength requirements.

STEPS OF CONCRETE MIX DESIGN PROCEDURE AS PER IS CODE 10262 – 2019

Step-1: - calculate target mean strength of concrete

In order that not more than the specified proportions of test results are likely to fall below the characteristic strength, the concrete mix has to be proportioned for higher target mean compressive strength f'ck.

The Target mean characteristic strength is given by the following relation:

fck=25

S=4

X=5.5

f'ck=fck+1.65S

f'ck=25+1.65x4

f'ck=31.6N/mm^2

OR

f'ck=fck+X

f'ck=25+5.5

f'ck=30.5N/mm^2

Whichever is higher = 31.6 N/mm^2

Where, f'ck = Target mean strength (compressive) at end of 28 days, in N/mm2;

fck = characteristic strength (compressive) at end of 28 days, in N/mm2;

S = standard deviation, in N/mm2 (see 4.2.1 IS: 10262 - 2019)

X = Factor as per Grade of Concrete, as per table 1

Table 5 value of X

S. No.	Grade of Concrete	Value of X
1	M-10	5
	M-15	
2	M-20	5.5
	M-25	
3	M-30	6.5
	M-35	
	M-40	
	M-45	
	M-50	
	M-55	
	M-60	
4	M-60 & ABOVE	8

TABLE 6 ASSUMED STANDARD DEVIATION (S)

S. No.	Grade of Concrete	Value of S
1	M-10	**3.5**
	M-15	
2	M-20	**4**
	M-25	
3	M-30	**5**
	M-35	
	M-40	
	M-45	
	M-50	
	M-55	
	M-60	
4	M-65	**6**
	M-70	
	M-75	
	M-80	
	M-85	

Step-2: - Selection of Water-Cement Ratio

• Different types of cement, aggregates of various maximum size and supplementary cementitious materials, grading, surface texture, shape, and other characteristics may produce concrete of different compressive strength for the same free water-cement ratio.

• Therefore, a proper relationship between the water-cement ratio and the strength of concrete should preferably be established for the materials actually to be used.

• In case such data is not available, related water-cement ratio (by mass) (w/c) corresponding to the compressive strength at 28 days may be selected from the relationship shown in Fig.1, for the expected 28 days strength of cement.

• The final w/c is arrived at, based on the results of all the trials and any change in strength of cement shall get adjusted in the trials. In case, the actual strength of cement is known, the curve corresponding to the actual strength of cement may be used.

• The water-cement ratio selected as mentioned above shall be checked against the limiting water-cement ratio for the requirements of durability and the lower of the two values adopted.

• Where supplementary cementitious materials are used, that is, mineral admixtures, the water cementitious materials ratio (w/cm) shall be calculated, in accordance with Table 5 of IS 456 and this w/cm shall be as per **Table 3 and Table 5 of IS 456** or as specified.
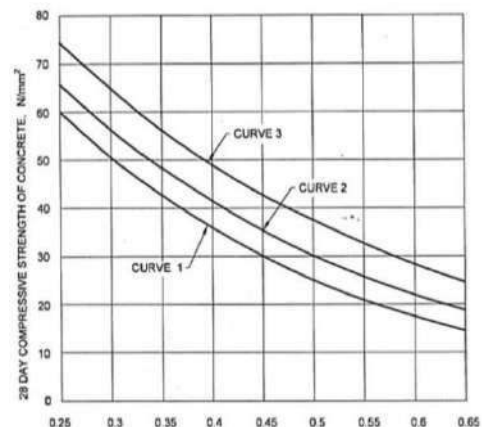
Fig. 1

RESULTS AND ANALYSIS

Table 7 Compressive strength of cube given in table

Age in Days	Percentage of Strength
1 day	16%
3 days	40%
7 days	65%
14 days	90%
21 days	94%
28 days	99%

Table 8 Observation Table for 7 and 28 days Concrete Cube Strength prepared with SCBA

NO.	Description	Date of casting	Date of tasting	Max load carried in 7 Days by specimen in (KN)
	For 0% replacement			
1	Specimen 1	08/11/2022	15/11/2022	445
	Specimen 2	08/11/2022	15/11/2022	485
	Specimen 3	08/11/2022	15/11/2022	483
	For 5% replacement			
2	Specimen 1	10/11/2022	17/11/2022	350
	Specimen 2	10/11/2022	17/11/2022	361
	Specimen 3	10/11/2022	17/11/2022	403
	For 10% replacement			
3	Specimen 1	12/11/2022	19/11/2022	353
	Specimen 2	12/11/2022	19/11/2022	378
	Specimen 3	12/11/2022	19/11/2022	403

Table 9 Observation Table for 7 and 28 days Concrete Cube Strength prepared with SCBA & Jhama Bricks

NO.	Description	Date of casting	Date of tasting	Max load carried in 28 Days by specimen in (KN)
	For 0% replacement			
1	Specimen 1	08/11/2022	06/12/2022	698
	Specimen 2	08/11/2022	06/12/2022	701
	Specimen 3	08/11/2022	06/12/2022	701
	For 5% replacement			
2	Specimen 1	10/11/2022	08/12/2022	578
	Specimen 2	10/11/2022	08/12/2022	598
	Specimen 3	10/11/2022	08/12/2022	622
	For 10% replacement			
3	Specimen 1	12/11/2022	10/12/2022	542
	Specimen 2	12/11/2022	10/12/2022	461
	Specimen 3	12/11/2022	10/12/2022	586

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CALCULATIONS

Compressive strength of concrete formula

The compressive strength of specimen can be calculation by dividing maximum load carried by dividing maximum load carried by the specimen by cross-section area of the specimen cube.

Compressive strength of concrete = max. lode carried by specimen /top surface area of specimen

The surface area of specimen: = 150 x 150
= 22500mm2
= 225 cm^2

For 5% Replacement of Material

Max load carried in 7 days by specimen 1　　= 350KN
Compressive strength of specimen1 in 7 days = 15.56N/mm^2
Max load carried in 28 days by specimen 1　　= 578KN
Compressive strength of specimen 1 in 28 days = 25.69N/mm^2

Max load carried in 7 days by specimen 2　　= 361KN
Compressive strength of specimen 2 in 7 days = 16.04N/mm^2
Max load carried in 28 days by specimen 2　　= 598KN
Compressive strength of specimen 2 in 28 days = 26.58N/mm^2

Max load carried in 7 days by specimen 3　　= 403KN
Compressive strength of specimen 3 in 7 days = 17.91N/mm^2
Max load carried in 28 days by specimen 3　　= 622KN
Compressive strength of specimen 3 in 28 days = 27.65N/mm^2

For 10% Replacement of Material

Max load carried in 7 days by specimen 1　　= 353KN
Compressive strength of specimen1 in 7 days　　= 15.69N/mm^2
Max load carried in 28 days by specimen 1　　= 542KN
Compressive strength of specimen 1 in 28 days = 24.09N/mm^2

Max load carried in 7 days by specimen 2　　= 378KN
Compressive strength of specimen 2 in 7 days = 16.80N/mm^2
Max load carried in 28 days by specimen 2　　= 461KN
Compressive strength of specimen 2 in 28 days = 20.49N/mm^2

Max load carried in 7 days by specimen 3　　= 403KN
Compressive strength of specimen 3 in 7 days = 17.91N/mm^2
Max load carried in 28 days by specimen 3　　= 586KN
Compressive strength of specimen 3 in 28 days = 26.05N/mm^2

Result of cube test: -
For 0% Replacement
Average Compressive strength at 7 Days　　= 20.93 Mpa
Average compressive strength at 28 Days　= 31.32 Mpa

For 5% Replacement
Average Compressive strength at 7 Days　　= 16.51Mpa
Average compressive strength at 28 Days　= 26.64Mpa

For 10% Replacement
Average Compressive strength at 7 Days　　= 16.80Mpa
Average Compressive strength at 28 Days = 23.54Mpa

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CONCLUSION

Based on results and observation made in experimental research study. The following conclusions are drawn.

[1] By this experiment we observed that with increase in percentage of over burnt brick bat waste and sugarcane bagasse ash strength of concrete decreases.

[2] Now we have to find out what is the reason for the decrease in strength, whether it is sugarcane bagasse ash or over burnt bricks.

[3] The actual reasons for decrement in strength of concrete to be continued in our next research papers.

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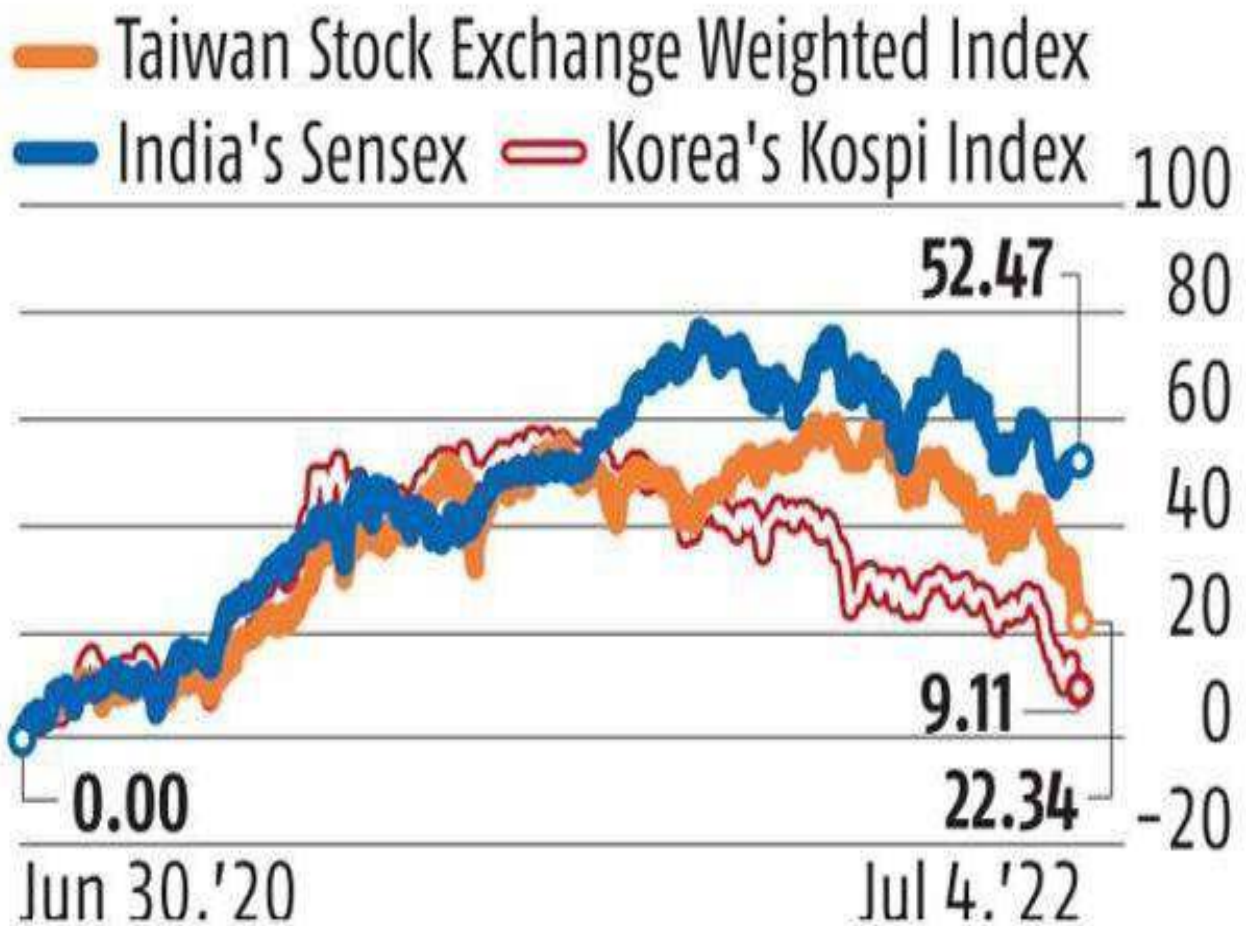[7]. aggregate." International journal of environment. Vol-2., Issue-2., pp80-86

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Stock exchange: Asian indexes and how to analyze them?

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ABSTRACT
This study looks at how to analyze Asian indexes for trading and investing. Term Stock exchange refers,
 a platform where we can buying or selling securities like stocks and bonds through online or in physical
 form for trading as well as investing purpose.
Asian Stock Exchange are sizable and fast growing. Since 1990, Asia's capitalization has more than doubled in U.S. dollar terms to $13.7 trillion, 30 percent of world capitalization. Excluding Japan and Australia, it has risen almost tenfold. The financial hubs of Hong Kong SAR, Singapore, and Japan dominate the region, accounting for two-thirds of Asian equity assets. Markets in some other countries, such as Malaysia, and Taiwan Province of China, are also sizable. But, for the most part, market capitalization remains well below industrial country levels.

Keywords: Stock exchange, Indexes, Trading, Investing, Technical Analysis, Fundamental Analysis, Bulls, Bear.

Introduction
According to United Nations, There are 48 Countries in Asian Continent. Amsterdam is world First Stock Market were Shares Traded But in Asia, Japan Will Created First Asian stock market index. To measure the pulse of the market, The Nikkei newspaper issued the Nikkei 225 index as early as 1950, the first in Asia, Another widely used index in Japan, came into use much later, in 1969. The Japanese also invented the candlestick chart, now widely used by stock traders. A rice

trader, Munehisa Homma, used these colorful charts to track movements rice prices, a practice followed much later by stock traders.

EURUSD,Daily

. After the Korean War, South Korea established the Korean Stock Exchange (KSE) and second exchange, the KOSDAQ, was launched to attract new technology companies and other Growing businesses. It proved to be a Massive success.

The first Thai exchange was established in Bangkok. At first, it did attract a Little bit attention and died a slow death. But the Thais give it another shot to the Securities Exchange of Thailand (SET) started trading, this time more successfully so. Singapore had joined the club two years earlier.

The history of China's stock markets is Very complex. The Opium Wars and the Treaty of Nanking allowed the British and other nations to establish Colonies in China and get access to the countries markets. In

Shanghai – in an area called the International Settlement – and Guangzhou, foreigners traded rubber, coal and other goods under their own laws. Stocks were popular too, and in June 1866 a first list of shares was nailed to a wall.

Theoretical Framework:
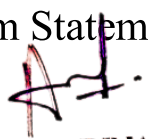
1) Technical Analysis Approach

In Technical Analysis method relies on the analysis of past price movements and trading volumes from financial time series data to find current trends Via Price Action, The trends result in a forecast and an executed trading plan. The technical Analysis assumes that present stock prices reflect all information from real-time news and other known market pressures. Technical trading commonly relies on regression and moving average plans to make predictions It Contains Various Technical Indicators like RSI, Bollinger Bands, MACD etc.

2) Fundamental Analysis Approach

Fundamentals Analysis are the best strategy that relies on the information about the Real value of the underlying business instead of time series data about the stock price. This method uses data from a firm's balance sheet and forecasted earnings released each quarter. In this way, the fundamentals trading strategy includes both historical and forecasted business performance data. The aim here is to find and incorporate new knowledge into trading decisions *before* the rest of the market is updated. Significantly, this strategy is a departure from technical trading and the theoretical foundation of EMH and RWT. Finally, asserts that prediction, forecasting, and recommender systems are well suited to technical trading data.

Problem Statement:

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The main issue with this study is that a lot of research has been done on the connection between Trading and Investing in Asian stock market. However, not all of the studies have come up with the same conclusions because some say there is a positive connection, others say there is a negative connection, and a few say there is no connection. Because of this, the topic has been chosen so that it can be concluded. The vast majority of the exploration has been finished on evolved nations and a not very many emerging nations and, surprisingly, a couple of on Asian Stock exchange which has no legitimate end in this way, the subject is centered around the Asian Stock exchange.

Methodology:

The research design used in this study was an Practically cross-sectional design. This study uses hypothesis testing to find the major problems for Trader and Investor toward the skills that are the essential need to stay in the Asian stock Exchange Graph Represent show that more than 50% people overall think that knowledge/ skills is the important and essential requirement to enroll in Asian trading and investing system. In this research paper, H1(Alternative Hypothesis) is required to deeply analyze whether investors/ traders who have more than 2 years' experience and belong to a financial and non-financial background have significant differences between these two groups or not. To prove this H1(Alternative Hypothesis), Two paired T-Test has applied. Data collected via International graph issuing by financial Institution.

PEER PRESSURE

Taiwan Stock Exchange Weighted Index

India's Sensex — Korea's Kospi Index

52.47

9.11

0.00

22.34

100
80
60
40
20
0
-20

Jun 30.'20   Jul 4.'22

The drivers of Asia's financial acceleration

Government Focus on Financial Sector Reform & Market Development

Rising Household Wealth & Sophistication

Increased Trade/FDI Flows Intra-region

China : One-Belt-One-Road & Exchange Control Liberalization

Asia's Financial Acceleration

Japan : Tokyo as Global Financial Centre & CPTPP

Increased Cross-Border Banking Flows

Technological Adoption & Advances : e.g. India Digitalization

Hong Kong/Singapore : Track Records of Success

Source: Morgan Stanley Research

Conclusion:

In this research paper, the research analyzed How to trade and invest in Asian Stock Exchange through technical and Fundamental Approach in financial sectors are very essential and prove by many experienced traders/investors that Due to a lack of knowledge many traders and investors get a big loss, if we ask anyone why they don't invest, and they'll either tell you they don't have enough money to take the plunge, or they'll confess they're too afraid to join the investing world. So, here is the important role of Psychology toward the awareness and providing the best and enough knowledge to traders and investors. This study will

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tell whether there is a no significance difference between financial traders and investors and of the Asian stock market toward knowledge and skills is the need of Asian investors and Trader This study is also used to suggest if the financial or educational company/organization is able to get enough information and knowledge and aware the people from their Research activity can increase profit and reduce losses of Asian investors.

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Factors that affect the HR selection method

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ABSTRACT

In this process, the main factor Human resource, through which company's human recruitment and selection is incomplete. Selection of right and efficient employees for the relevant field is very necessary and in today's scenario it is vast role to select the right candidate is difficult according to work pressure and working requirement and environment of the company or institution. Therefore, in this process, the methods to select the right candidate who work effectively and efficiently with organisational interest and factors through which the selection process can be easily work to generate the relevant source for the organization growth.

Keywords – Human resource Management, Selection, process of selection

INTRODUCTION

Human resource management is strategic approach for nurturing and supporting employees and ensuring a positive workplace environment. Its functions vary across different businesses and industries, but typically include recruitment, selection, compensation and benefits, training and development and employee engagement.

"The process of acquiring, training, appraising, and compensating employees, and of attending to their labour relations, health and safety, and fairness concerns." (Dessler, 2020)

How HRM works

HR is the essential and most value added department in the organizations. To portrait with example as, the PMS (performance Management System) of an organization like Infosys would be different from an organization like Walmart. Let's study each process deeply,

1. **Human Resource Planning:** We consider Human Resource Planning as the process of people forecasting, but it also involves the processes of Evaluation, Promotion and Layoff.

   1. **Recruitment:** It is the process of attracting applicants that match a certain Job criteria.
   2. **Selection:** It is the process of short listing candidates who are the nearest match in terms

qualifications, expertise and potential for a certain job after recruitment.

3. **Hiring:** it is the process of deciding upon the final candidate who gets the job according to the organisation criteria.

4. **Training and Development:** It is the process of making the employee work smoothly in the organisation and onboarding employee for his skills and abilities upgradation.

2. **Employee Remuneration and Benefits Administration:** The process involves deciding the salaries and wages, Incentives, Fringe Benefits and Perquisites etc. Money is the prime motivator in any job.

3. **Performance Management:** It is meant to help the organization to train, motivate and reward workers in order to meet organizational efficiently. Nowadays there is an automated performance management system (PMS) that evaluate the performance of the employees and assess them accordingly on their training and development needs.

4. **Employee Relations:** Employee relations include Labour Law and Relations, Working Environment, Employee health and safety, Employee- Employee conflict management, Employee- Employee Conflict Management, Quality of Work Life, Workers Compensation, Employee Wellness and assistance programs, Counselling for occupational stress.

Dale Yoder said, "Selection is the process by which candidates for employment are divided into classes those who will be offered employment and those who will not."

Selection is the process of choosing the right candidate, who is most suitable for a vacant job position in an organization. In others words, selection is the process of interviewing the candidates and evaluating their skills, which are required for a specific job and then choosing the suitable candidate for the vacant position. But the difference of recruitment and selection is still confusing in the mind of the people that why they are differently termed. To clarify the confusion and there is the vast difference as recruitment is the pool of candidates and selection is the choosing the right skill for the organisation that can add value and efficiency to the organisation to meet the organisational goals, for that some of the difference stated below :

Difference between Recruitment and Selection

Basis of difference	Recruitment	Selection
Meaning	A process of actively searching and hiring applicants for a job role is known as recruitment.	A process of choosing suitable applicants from the shortlisted can
Activity	It is an activity to boost the candidate pool.	It is an activity to find the ideal candidate.
Process	It allows the candidates to apply for a vacant place.	This process allows to proceed with suitable applicants.
Process for candidates	In recruitment, we advertise the job role and encourage the candidates to apply.	Selection is the process in which we finally appoint the candidate

Step	It is the first step of hiring process.	It is the second step of the hiring process.
Mode of expense	This process is economical.	The process is comparatively expensive.
Contractual process	There is no contractual relation in the recruitment process.	Selection involves a contractual relation between the organisation and employee.

Selection Process

1. **Preliminary Screening:** Preliminary screening facilitates the manager to shortlist the candidates and eliminate those who are not suitable for the

vacant. Preliminary interviews help to eliminate unwanted applicants form. In this interview round, the candidates are questioned about their qualifications, experiences, etc.

2. **Selection test:** This type of test is either a written test or a personality test that tries to find out some particular skill or ability of the employees either based on their intelligence, personality, physical capacity, etc. Some of the important selection tests that are performed for the selection of employees are as follows:

- **Intelligence test:** It refers to the measurement of one's intelligence based on memory, reasoning, etc. It is an indicator of one's ability to make decisions and judgments.
- **Aptitude test:** This test is taken to check if the candidate has the talent to learn new skills or the capability to grasp those skills that are needed to perform the specified job.
- **Personality test:** This test of the employee is conducted to understand the personal characteristics of the candidates, such as their values, mindset, patience, beliefs, etc.
- **Trade test:** It is a test to determine a candidate's actual talents, i.e., they are given work according to their specified jobs. These tests are based on the employee's level of knowledge and competency in the professional areas.
- **Interest test:** Every individual has their own set of interests or particular fields that they would like to work in. The interest test helps determine the candidate's area of interest and the kind of job that would suit him. This ensures that the employees work with greater enthusiasm and efficiency.

3. Employment interview: An interview is a formal conversation and interaction between the candidate and the interviewer. It is conducted to test the individual's capability. The interviewer's job is to question the candidate and obtain as much information as possible.

4. Reference and Background Checks: Personal details such as names, addresses, and contact details of the references may also be requested to be provided to attain extra information about the candidates.

5. Selection Decision: The candidates who qualify for the tests, interview rounds, and reference checks ultimately get selected for the final decision. In this process, the manager decides whom to select among those final candidates qualifying for that particular job.

6. Medical Examination: After the selection decision and before the job offer is provided, the candidate goes through a medical examination to prove that they are physically and mentally fit for that job.

7. Job Offer: The other steps is receiving the job offer. The job offer is provided only to those who have passed all the prior tests. The job offer is provided through a letter of appointment, which is approved by the candidate's acceptance. The letter of appointment normally contains the date on which the candidate has to report to the organisation.

8. Contract of Employment: When the job offer is provided and accepted by the candidate, the certain documentation has to be check and completed. The information necessary to be written in the contract of employment may differ according to the level of the job. Some of the details that the contract include are as follows- Job Title, Duties, Responsibilities, Date of joining of the employee, rates of pay, allowances, the disciplinary procedure, work rules, working hours,

leave rules, illness, grievance procedure, termination of employment, etc.

Importance of Selection Process

Following are the importance of the selection process in any organization:

1. Selecting skilled personnel reduces the training costs of the organization.
2. Organizations who understand their personnel's value invest a large sum in selecting the relevant candidate for the vacant job.
3. Selecting personnel who are satisfied with their work enhances the efficiency of both the personnel and the organization.
4. Selection increases the productivity of the organisation.
5. Selection helps in growth of the nation from unemployment issue, etc.
6. Selection helps in increasing the economies of scale
7. It helps in enhancing standard of living.

Factors influencing Selection Process

Factors influencing employee selection process are listed below

1. Nature of Post

The process of selection of employee varies according to type of personnel to be recruited in particular organisation. For Example, selection process of probationary officer of a bank differs from that of selection of officer for Indian Police Service.

2. Number of Candidates

Selection process depends on the response of candidates to the recruitment process, inviting applications for the post. For instance, for clerical and other physical jobs, more candidate tend to apply. The selection process would be longer if the candidates are more to screen and if the number of candidates are short then process becomes shorter.

3. Selection Policy
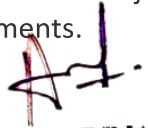
Selection policy and process are quite inter related as it depend upon the organisation to organisation. As some organisation has several steps of selection to select the right candidate and some organisation has simple and small process of selection.

4. Cost factor

Selection process cost depend upon the financial condition of the organisation, sound and stable companies possess high cost selection process and with low budget companies possess low cost selection process.

5. Level of Educational Qualification and Experience and Exposure

The selection process is totally on the experience & qualification of the candidates which completes the organisational suitable need. For example, the finance department need the finance experienced and qualified person in same field. So, company hires right candidates for right vacant job which fits with all requirements.

To improve the selection process

1. Diversify and redefine your job requirement

If not enough qualified candidates are applying in your company, then the problem may be hidden in requirement. In 2015, US and Canada researchers suggested that poor job postings are the main cause for low application.

But what will be the good job advertisement for job opening?

According to these researchers, job postings should be more of the laundry list of requirements. They should also be inspirational. And why this company can be good choice for career?

New approach to discover talent

Nowadays, the approach for recruitment is on portals and discovering applicants from there.

Portal like LinkedIn, the most used portal from mostly all the organisations, Naukri, Upwork, Shine etc., still selection is the major issue.

To overcome such issue and find the candidates in less time is to approach the existing employees to fill up the position as they are well aware of the organisation's goal, culture, environment and statists, with some employee referrals policies.

This will enhance the selection process faster, effectively and efficiently.

3. Background check strategy

Screening is expensive and time-consuming, so screening of only the final

candidate will reduce the cost and helps to take decision faster for final process.

To make background checks more efficient and faster, consider tailoring your screening process to the needs of each position.

4. Attitude and training for skills
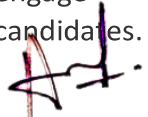
Hiring for attitude access a wider talent pool we can conduct attitude test to hire the better employees for long term as they have right mindset to learn, grasp and develop the new skills quickly and helps in the contribution in the organisation for long term.

In the present scenario the skills and technologies changes faster as the tools using three years before may differ from the current secnerio.

5. Eliminate bias and boost efficiency

Nowadays, Selection can be in automation process i.e., AI – based, which can reduce or eliminate biasness and boost the applicants. The AI tools also known as Recruitment marketing.

- AI for screening can reduce your time per hire and eliminate bias.
- Candidate rediscovery tools help you re-engage past candidates.
- Chatbots can boost engagement with new candidates.
- It allows to use marketing techniques such as multichannel approach, targeted ads, and deep analytics to discover, attract, and engage better-qualified candidates.

6. Collect and analyse feedback from candidates

The best and time and money practice is to collect data of feedback from the existing candidates and the candidates whom the organisation has not fired. It will create employer brand and reduce the time as candidates' feedback will add value for the organisation and selection will in great pace. Automation tools will speed up the process quickly and fastly.

7. Keep optimizing your onboarding program

As Selection is not the last process of hiring, to increase the goodwill of the brand onboarding is steamily necessary for the further progression. As onboarding help in integration of the employees, help in understanding the vision, culture, environment of the organisation which will help in growth efficiently and effectively. We can use LMS method will help in smooth function of the new hire. Definitely it is not the easy and quick process but it can build the employer brand effectively.

Conclusion

Human Resource management is the vast and most required field for every organisation. It helps in providing skilled employees for the growth of the organisation in various process. It is never ending project which leads to continuous process in the organisation. Since 1920 and till date vast difference is being seen throughout this process, the improvements, techniques, methods, procedures etc. being implemented so far and still an ongoing process. Variations are the part of the Human resource management time to time.

Selection is the crucial and important part of the Human resource management. From where the productivity is maintained for the organisation. The skill, qualification experience

and to analyse the correct requirement for that suitable job and bring the applicant on board in the main part for selection. To analyse the correct form of recruitment and screening the things with all tests and interviews successfully is the major task in it. And selection process not ends here onboarding of candidate through full integration& evaluation is needed.

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A fuzzy logic approach for monitoring water quality

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Abstract— **The state of the water body or resource in relation to its intended usage is referred to as the water quality. It can be described in qualitative or quantitative terms. The Water Quality Index(WQI) identifies the quality of the water. When calculating the Water Quality Index, we take into account 8 factors. To compute these characteristics, we shall use nanosensors. Compared to traditional sensors, that provides reliable results.**

Keywords— *WQI, simulation, fuzzy logic, and nanosensor*

I. INTRODUCTION

By normalising results to subjective grading curves, the water quality index (WQI) is a number that incorporates several water quality variables into a single number (Miller et al., 1986). It has been used to assess the water quality for resources including rivers, streams, and lakes, among others. The National Sanitation Foundation (NSF) created a widely used water quality indicator (WQI) in 1970. (Brown and others, 1970). To calculate WQI, we take into account 8 factors, including dissolved oxygen (DO), fecal coliform, pH, temperature change, total phosphate, nitrate, turbidity, and total solids.

The WQI ranges are described as follows: (Brown and others, 1970:

- 90-100: Excellent
- 70-90: Good
- 50-70: Medium
- 25-50: Bad
- 0-25: Very Bad

II. NANOSENSOR TO COMPUTE WQI PARAMETERS

2.1- pH sensors based on Zinc Oxide Nanotubes/Nanorods

pH sensor devices were made by using ZnO nanotubes and nanorods grown on gold thin films. The created ZnO nanotube and nanorod pH sensors demonstrate a pH-dependent electrochemical potential difference versus an Ag/AgCl reference electrode across a wide dynamic pH range and show high reproducibility, repeatability, and long-term stability. We discovered that the ZnO nanotube pH sensor has a sensitivity that is up to twice that of the ZnO nanorod pH sensor. This can be attributed to the fact that small dimensional ZnO nanotubes have a higher level of surface and subsurface oxygen vacancies and provide a larger effective surface area with higher surface-to-volume ratio as compared to ZnO nanorods.

It takes two steps to create a ZnO nanotube pH sensor: first, well-aligned ZnO nanorods undergo low-temperature aqueous chemical growth (ACG), and then those nanorods are etched to produce ZnO nanotubes. The electrochemical potential of this sensor exhibits a linear response to pH values between 1 and 14.

2.2 Dissolved Oxygen sensor-

By using multiple scan cyclic voltammetry, a layer of gold nanoparticles (GNP) and functionalized carbon nanotubes (f-CNT) was created on a glassy carbon electrode (GCE). Electrochemical impedance spectroscopy (EIS), X-ray diffraction, and field emission scanning electron microscopy (FE-SEM) were used to examine the electrochemical data and surface morphology (XRD).

The dissolved oxygen electrochemical sensor has a high sensitivity of 196.5 $\mu A\ L\ mg^{-1}\ cm^{-2}$, a low detection limit of 0.1 mg/L, and a well-linear response range of 0 to 50 mg/L (R = 0.9988).

2.3 Total Coliform SWNT sensor

Because to its distinctive electrical and mechanical characteristics, the carbon nanotube (CNT) has received a lot of interest. Recently, chemical vapor deposition was used to create an extremely porous CNT membrane (CVD). For the electrochemical detection of E. coli, this membrane electrode is used. The ideal conductive free-standing membrane can keep the target bacteria in close proximity to the electrode and confine them to a small area, dramatically improving electron transfer efficiency and dramatically increasing bacterial concentration without actually increasing bacterial population, respectively. The detection limit of this sensor is 1×10^6 cfu/ml.

2.4 Nitrate determination using a three-dimensional nano-structured silver on gold array electrode

In a natural aquatic environment, nitrate is extensively distributed. International organizations set a 0.8 mol/L nitrate limit for drinking water because nitrate intake above a certain point results in health issues. For the purpose of determining nitrate in neutral conditions, electrodeposion on an Au-IDA microelectrode has been used to create 3D nano-structured dendritic silver. As a result, a successful nitrate measurement is guaranteed by the electrode's unique 3D shape, which has an incredibly high electro catalytic activity for nitrate reduction. On a glass substrate, a layer of 300Å/2000Å Au/Ta was deposited and patterned using the lift-off method. Sensing area was established as 1 mm after being covered with SU-8 negative photo resist as an insulating layer. In all arrays, the finger length (L) is 1000 μm. The electrode gap is 20 μm.[10], and the electrode breadth is 25 μm. With a potential step of -0.2 V_0, silver films were

electrodeposited by chronoamperometry onto an Au-IDA microelectrode in a 0.1 mol/L KNO₃ containing 5 mol/L AgNO₃ solution (pH=6.0) (vs. SCE). 100s was the optimum time for preparation of 3D nano-structured dendritic silver as sensing film. Nitrate concentrations ranging from 25μmol/L to 1000μmol/L are found to be linearly connected to the peak current values determined by nitrate reduction, which were seen at EAu/3DAgNPs. Nitrate detection has a dynamic range of 10-1000 μmol/L.

2.5 Nano Thermal Sensors for Water Environment Temperature Sensing-

Focused ion beam chemical vapour deposition (FIB-CVD) of tungsten over atomic force microscope (AFM) cantilevers is utilised to create nano temperature sensors. Using the hot stage of the environmental scanning electron microscope, the nanosensor was calibrated in water (ESEM). The outcomes of the experiment demonstrate the advantages of the temperature coefficient of resistance (TCR). This sensor is simpler to manufacture and more dependable than other sensors.

2.6-TDS sensor for total dissolved solids measurement

HI 9032 is the most technologically advanced bench top conductivity meter in the market. This sensor is able to detect a wide range of total dissolved solids in aquatic environment. In this meter TDS factor can be adjusted from 0.01 to 0.99. TDS ranges are: 0 to 199 .9 mg/L (ppm), 0 to 1999 mg/L . An RS232 serial port is built into the meter for interfacing with a computer and data transfer. HI 9032 has six memorized programs to meet application needs and uses the new platinum 4-ring probe for a more accurate and stable measurement.[12]

2.7 Nephelometric turbidity sensor for measuring turbidity

This sensor is based on the principle that the intensity of the light scattered by the suspended matter is proportional to its concentration. The measuring system is comprised of the following sub-systems as shown in figure 1: An optical sensor (photodiode) and the signal conditioning circuit. A light source (red laser diode) and the laser driver circuit located in the device housing. The laser diode emits light, that is transmitted through an optical gap to the water sample. A PIC (Peripheral Interface Controller) microcontroller with a built in 10-bit Analog-to-Digital converter, a wireless zigbee transceiver for transferring turbidity measurements to measurement server (or a remote LCD display) and a local LCD module to display the turbidity measurement after digital processing.[13]
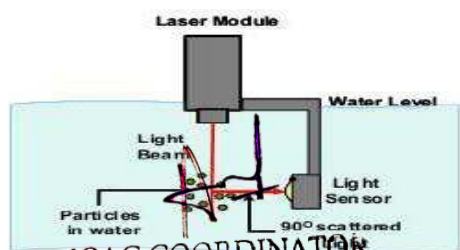
Figure1: Nephelometric turbidity sensor

2.8 Molybdenum-blue sensor for measuring Phosphate

The molybdenum-blue reaction in an acidic sample serves as the foundation for the colorimetric technique. This optical technique sends 690 nm light through a 20 mm sample chamber. The pump takes a discrete water sample at user-programmable intervals. Before transferring the sample to the reaction chamber and adding acid, a sample blank is measured to account for the color or turbidity of the sample. A conditioning reagent and color reagent allow a color to emerge in direct proportion to the concentration of orthophosphate in the sample.

A photo-diode detector and a 690nm optical filter are used to measure the light transmission after this solution is drawn into the combination pump/optical cell. A microcontroller transforms the detector's output into mg/l P or mg/l PO4 as needed. [14]

III. WATER QUALITY INDEX CALCULATION BY FUZZY LOGIC APPROACH AND NANAOSENSORS

3.1 Defining the input variables:

To construct the water quality index, we require 8 contaminants as input variables

(i) The following table lists the dissolved oxygen (DO)-Q values for various levels of dissolved oxygen:

DO(% Saturation)	Q-Value
0	0
10	8
20	13
30	20
40	30
50	43
60	56
70	77
80	88
85	92
90	95
95	97.5
100	99
105	98
110	95
120	90
130	85
140	78

(ii)Fecal Coliform (FC) - Q values for different level of fecal coliform are as follows

Table:2 Q-values for FC

Fecal Coliform(colonies/100 ml)	Q-value
0-1	98
2	89
5	80
10	71
20	63
50	53
100	45
200	37
500	27

1000	22
2000	18
5000	13
10000	10
20000	8
50000	5

(iii) pH - Q values for different level of pH are as follows:

Table:3 Q-values for pH

pH (units)	Q-Value
<2	0
2	2
3	4
4	8
5	24
6	55
7	90
7.2	92
7.5	93
7.7	90
8	82
8.5	67
9	47
10	19
11	7
12	2
>12	0

(iv) Temperature change(CH TEMP)-   Q values for different level of change in temperature are as follows:

Table:4 Q-values for Temperature Change

Change in Temperature (^{0}C)	Q-value
-10	56
-7.5	63
-5	73
-2.5	85
-1	90
0	93
1	89
2.5	85
5	72
7.5	57
10	44
12.5	36
15	28
17.5	23
20	21
22.5	18
25	15
27.5	12
30	10

(v) Total Phosphate - Q values for different level of total phosphate are as follows:

Table:5 Q-values for Total Phosphate

Total Phosphate(mg/l P)	Q-value
0	99
0.05	98
0.1	97
0.2	95
0.3	90
0.4	78
0.5	60
0.75	50
1	39
1.5	30
2	26
3	21
4	16
5	12
6	10
7	8
8	7
9	6
10	5
>10	2

(vi) Nitrate - Q values for different level of Nitrate are as follows:

Table:6 Q-values for Nitrate

Nitrate-N (mg/l NO$_3$)	Q-Value
0	98
0.25	97
0.5	96
0.75	95
1	94
1.5	92
2	90
3	85
4	70
5	65
10	51
15	43
20	37
30	24
40	17
50	7
60	5
70	4
80	3
90	2

(vii) Turbidity - Q values for different level of turbidity are as follows:

Table:7 Q-values for Turbidity

Turbidity(NTU)	Q-Value
0	97
5	84
10	76
15	68
20	62
25	57
30	53
35	48
40	45
50	39
60	34
70	28
80	25
90	22
100	17
>100	5

(viii) Total dissolved solid (TDS) - Q values for total dissolved solid are as follows:

Table:8 Q-values for TDS

TDS (mg/l)	Q-value
50	86
100	83
150	78
200	72
250	67
300	59
350	52
400	47
450	40
500	30

3.2 Fuzzyfication

That includes the process of turning grades of membership for linguistic terms in fuzzy sets from crisp values. Each linguistic phrase is given a grade using the membership function. Fuzzification is the procedure that involves a domain transformation where the crisp inputs are changed into fuzzy inputs (Nilesh and Gopal et. al 2009). It is necessary to first identify the membership function for each point in order to convert crisp inputs into fuzzy inputs. The following linguistic variables and membership functions were defined for the sake of our model.

(i) Linguistic variable for Dissolved oxygen (DO): 6 types of linguistic variables are defined for the input variable dissolved oxygen.
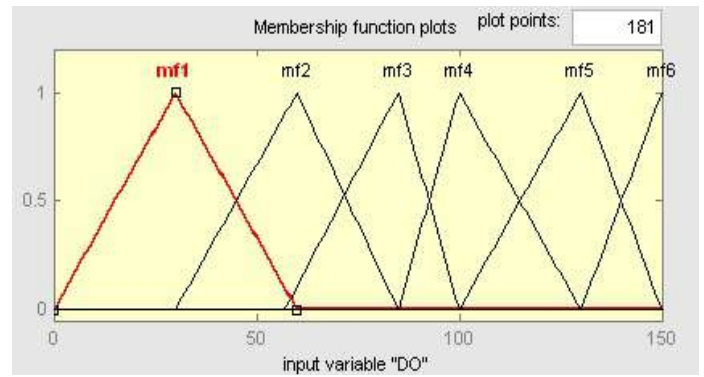
Fig.2 Membership function for DO

(ii) Linguistic variable for Fecal Coliform (FC) : 4 types of linguistic variables are defined for the input variable fecal coliform.
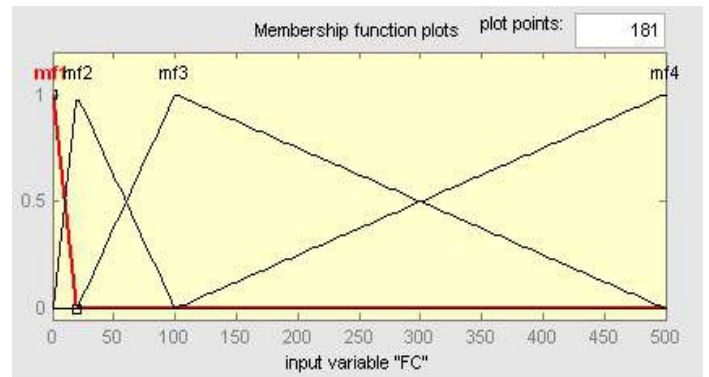
Fig.3 Membership function for FC

(iii) Linguistic variable for pH : 6 types of linguistic variables are defined for the input variable pH
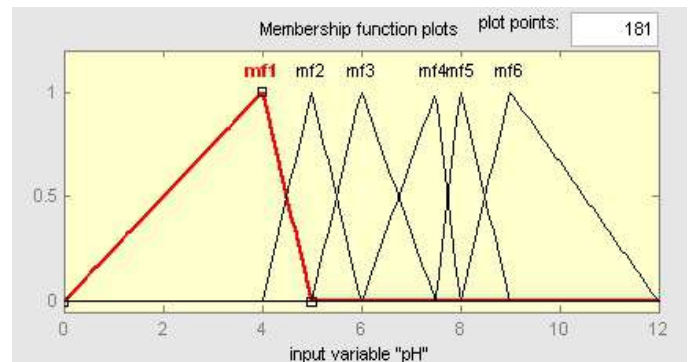
Fig.4 Membership function for pH

(iv) Linguistic variable for Temprature Change : 6 types of linguistic variables are defined for the input variable change in temperature
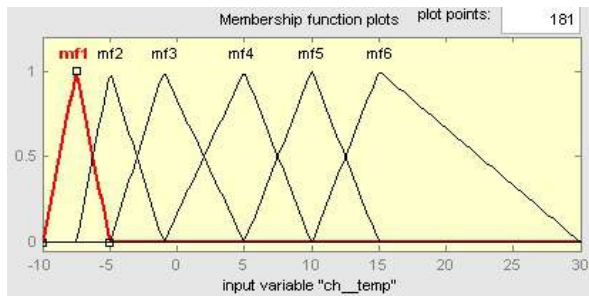
Fig.5 Membership function for ch_temp

(v) Linguistic variable for Total Phosphate: 5 types of linguistic variables are defined for the input variable total phosphate.
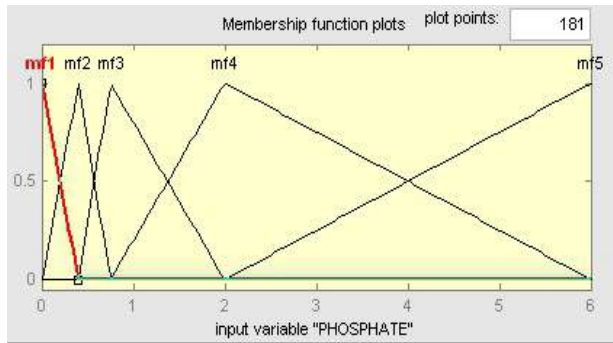
Fig.6 Membership function for PHOSPHATE

(vi) Linguistic variable for Nitrate : 5 types of linguistic variables are defined for the input variable Nitrate.
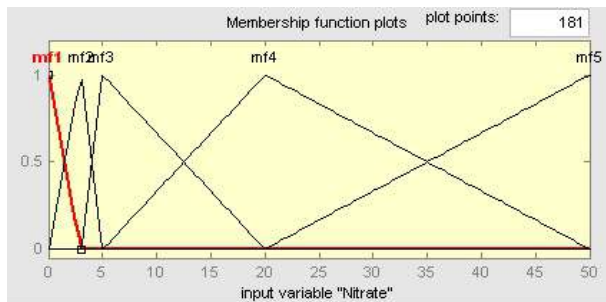
Fig.7 Membership function for Nitrate

(vii) Linguistic variable for Turbidity : 5 types of linguistic variables are defined for the input variable turbidity.
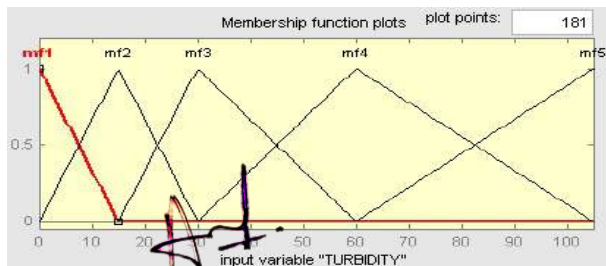
Fig.8 Membership function for TURBIDITY

(viii) Linguistic variable for Total dissolved solid : 5 types of linguistic variables are defined for the input variable total dissolved solid.
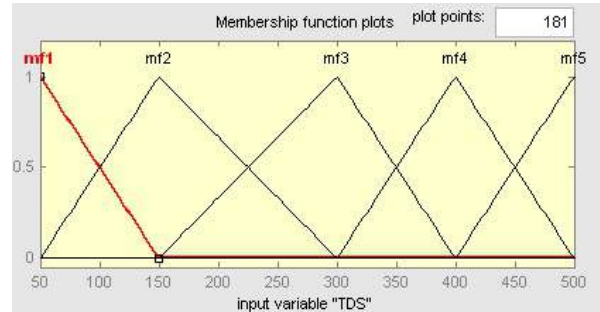
Fig.9 Membership function for TDS

(ix) Linguistic variable for Q-value : Following types of linguistic variables are defined for the output variable Q-value .
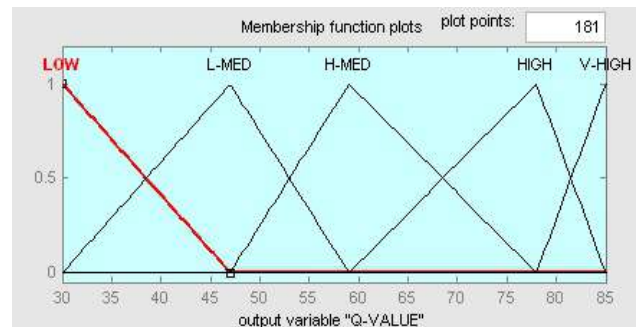
Fig.10 Membership function for Q-VALUE

3.3 Fuzzy inference rules

In this step the knowledge pertaining to the given control problem is formulated in terms of a set of fuzzy inference rules(Mohammad Abdul Azim and Abbas Jamlipour et al(2006)). Fuzzy inference rule for the given problem are as follows.
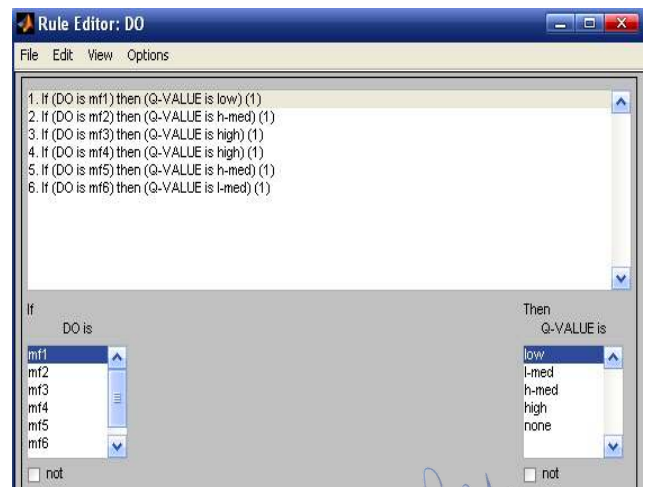
Fig.11 Rules calculating Q-value for DO

3.4 Defuzzification-

The centre of gravity approach is applied in our MATLAB FLC module to produce clean output. This technique determines a fuzzy set's weighted average (John Yen ,Reza Langari et al. 2007). The formula below can be used to explain the outcome of applying COA defuzzification on the ambiguous conclusion "Y is A."

$$y = \frac{\sum \mu A(y_i) \times y_i}{\sum \mu A(y_i)}$$

If y is discrete and by the formula

$$y = \frac{\int \mu A(y_i) \times y_i \, dy}{\int \mu A(y_i) \, dy}$$

If y is continous.

3.5 Simulation result-

We applied our suggested model to calculate Water Quality Index and found that our model gives satisfactory simulation results.
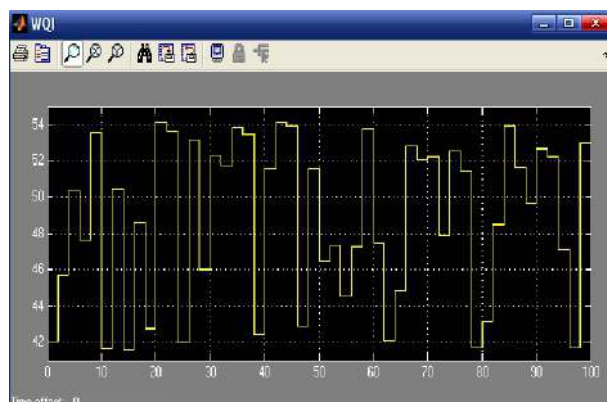
Fig.12 Simulation result showing WQI

Table:9 Calculation of Water Quality Index (WQI)

Test	Result	Unit	Q-value	Weight factor	Subtotal
DO	80	% sat	75.2	0.17	12.78
Fecal Coliform	12	#/100 mL	71.93	0.16	11.51
pH	6	std units	71.66	0.11	7.883
Change T	4	degrees C	62.36	0.1	6.236
Total phosphate	0.5	mg/L PO4-P	67.49	0.1	6.749
Nitrates	5	mg/L NO3	62.34	0.1	6.234
Turbidity	4	NTU	81.27	0.08	6.502
TS	140	mg/L	74.02	0.07	5.181
					63.075

We consider 8 parameters for determining WQI. So according to the rule addition of weight factor for 8 quality factors are .87 and subtotal is 63.075 so WQI is calculated by dividing the later by former in the following way

63.075/.87= 72.5 .

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COMMON RANDOM FIXED POINT THEOREMS FOR RANDOM OPERATORS SATISFYING GENERALIZED CONTRACTIVE CONDITION IN HILBERT SPACES

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Abstract

In this paper, using the concept of semi-compatibility, occasionally weakly compatibility and commutativity of random operators, we construct a sequence of measurable functions and its convergence to the unique common random fixed point of four random operators defined on a nonempty closed subset of a separable Hilbert space satisfying a generalized contractive condition. In case of deterministic operators our results are extends and generalized many known and existing results in fixed point literature.

Key words: Random operator, semi-compatible, occasionally weak compatible, commutative.

Mathematics Subject Classification: 47H10, 24H55.

1. Introduction

Random or stochastic integral equations are important in the study of many physical phenomena in life science, engineering and technology. Recently, the study of random fixed points have attracted much attention and some of the recent literatures in random fixed points may be noted in Beg and Shahzad [7], Choudhury [12], Papageorgiou [13], Sehgal and Waters [16], Xu [17] and references mentioned there in. In particular, random iteration schemes leading to random fixed points of random operators have been discuss by Choudhury and Ray [10], Choudhury and Upadhyay [11]. Beg and Shahzad [7], Beg and Abbas [6] studied the structure of common random fixed points and random coincidence points of compatible random operators. Beg, Abbas and Azam [8] obtained sufficient conditions for existence of random fixed point of a non expansive rotative random operator and establish the existence of random periodic points for random single valued ε-contractive and ε-expansive random operators. Badshah and Sayyed [4], Badshah and Gagrani [2], proved some random fixed point theorems for random multivalued operators in Polish spaces. Badshah and Shrivastava [5] introduce the concept of semi-compatibility in Polish spaces and proved some random fixed point theorems for random multivalued operators in Polish spaces. Recently, Badshah and Pariya [3] establish a common random fixed point theorem for six random operators using the concept of semi compatibility, weak compatibility and commutativity of random operators in Polish spaces. Earlier, Rashwan and Albaqeri [14,15] proved random fixed points for occasionally weakly compatible mappings under contractive conditions involving two generalized altering distance functions in and

complete separable metric space. Also they proved common random fixed point theorem and gave some application to random integral equations via contraction mappings of a pair of weakly increasing using an altering function in a partially ordered complete separable metric spaces. More recently, Chandelkar, Pariya and Gupta [9] proved common random fixed point of asymptotically regular mappings in Polish spaces.

2. Preliminaries

In this paper, (Ω, Σ) denotes a measurable space, with Σ — a sigma algebra of subset of Ω and H stands for separable Hilbert space and X is a nonempty subset of H.

Definition 2.1. A function $f : \Omega \to X$ is said to be measurable if $f^{-1}(B \cap X) \in \Sigma$ for every Borel subset of B of H.

Definition 2.2. A function $f : \Omega \times X \to X$ is said to be random operator, if $F (. , x): \Omega \to X$ is measurable for every $x \in X$.

Definition 2.3. A measurable function $\xi: \Omega \to X$ is said to be random fixed point of random operator $F : \Omega \times X \to X$, if $F(\omega, \xi(\omega)) = \xi(\omega)$ for all $\omega \in \Omega$.

Definition 2.4. A random operator $F : \Omega \times X \to X$ is said to be continuous if for fixed $\omega \in \Omega$, $F (\omega, .): X \to X$ is continuous.

Definition 2.5. [7] Let X be a subset of Hilbert space H. Random operators $S, T : \Omega \times X \to X$ are said to be commutative if $S (\omega, .)$ and $T (\omega, .)$ are commutative for each $\omega \in \Omega$.

Definition 2.6. [6] Let X be a complete separable metric space, mappings $f, g : X \to X$ are compatible if $\lim_{n \to \infty} d(fg(x_n), gf(x_n)) = 0$, provided that $f(x_n)$ and $g(x_n)$ exists in X and $\lim_{n \to \infty} f(x_n) = \lim_{n \to \infty} g(x_n)$. Random operator $S, T : \Omega \times X \to X$ are compatible, if $S (\omega, .)$ and $T (\omega, .)$ are compatible for each $\omega \in \Omega$.

Definition 2.7. Let X be a subset of Hilbert space H. Random operators $S, T : \Omega \times X \to X$ are said to be weakly compatible if $T(\omega, \xi(\omega)) = S(\omega, \xi(\omega))$ for some measurable mapping $\xi: \Omega \to X$ and $\omega \in \Omega$, then $T (\omega, S(\omega, \xi(\omega))) = S (\omega, T(\omega, \xi(\omega)))$ for every $\omega \in \Omega$.

Al-Thagafi and Shahzad [1] introduced the concept of occasionally weakly compatible mappings and gave some remarks for the notion of occasionally weakly compatible which is a proper generalization of weakly compatible.Every weakly compatible mappings with coincidence points are occasionally weakly compatible, but the converse is not true(for example see [1]).

Thus, we define occasionally weakly compatible (owc) random operators as follows:

Definition 2.8. Let X be a subset of Hilbert space H and let two self-mappings S, T : $\Omega \times X \to X$ are said to be occasionally weakly compatible (owc) if and only if there exists a coincidence point of S and T, at which S and T commute.

Definition 2.9. [3] Let X be a subset of Hilbert space H. Random operators $S, T : \Omega \times X \to X$ are said to be semi-compatible if $d (S (\omega, T (\omega, \xi_n(\omega)), T(\omega, \xi(\omega)))) \to 0$ as $n \to \infty$, whenever $\xi_n: \Omega \to X$ is

sequence of measurable mapping such that $\lim d(S(\omega, \xi_n(\omega)), \xi(\omega)) \to 0$, *and* $\lim d(T(\omega, \xi_n(\omega)), \xi(\omega)) \to 0$ as $n \to \infty$ for each $\omega \in \Omega$, and for some measurable mapping $\xi : \Omega \to X$.

In this paper, we construct a sequence of measurable functions and its convergence to the unique common random fixed point of four random operators defined on a nonempty closed subset of a separable Hilbert spaces satisfying generalized contractive condition using the concept of semi-compatibility, occasionally weakly compatibility and commutativity of random operators in Hilbert spaces. Also the result of this paper are new and improve, generalized the many known and existing results for random operators and deterministic operators using various types of compatibility..

3. Main Results.

Theorem 3.1. Let X be a non empty closed subset of separable Hilbert Space H. Let A, B, S and T be four random operators from $\Omega \times X \to X$ satisfying

$$A(\omega, X) \subset T(\omega, X) \text{ and } B(\omega, X) \subset S(\omega, X) \tag{3.1}$$

$$\|A(\omega, x) - B(\omega, y)\|^2 \le \alpha(\omega)\|S(\omega, x) - T(\omega, y)\|^2 + \beta(\omega)(\|S(\omega, x) - A(\omega, x)\|^2 + \|T(\omega, y) - B(\omega, y)\|^2) + \frac{\gamma(\omega)}{2}(\|S(\omega, x) - B(\omega, y)\|^2 + \|T(\omega, y) - A(\omega, x)\|^2) \tag{3.2}$$

For every x, y $\in$ X and for each $\omega \in \Omega$, where α, β, γ are measurable mappings from $\Omega \to (0,1)$ such that $\alpha(\omega) + 2\beta(\omega) + 2\gamma(\omega) < 1$. $\tag{3.3}$

If either (i)(A,S) are semi-compatible, S or A continuous and (B, T) are occasionally weakly compatible random operators, **or** (ii) (B,T) are semi-compatible, B or T continuous and (A, S) are occasionally weakly compatible random operators Then random operators A, B, S and T have unique common random fixed point.

Proof: Let $\eta_0 : \Omega \to X$ be a arbitrary measurable mapping and define a sequence of measurable function $\eta_n : \Omega \to X$ by

$$A(\omega, \eta_{2n}(\omega)) = T(\omega, \eta_{2n+1}(\omega)) = \xi_{2n}(\omega) \text{ (say) and}$$

$$B(\omega, \eta_{2n+1}(\omega)) = S(\omega, \eta_{2n+2}(\omega)) = \xi_{2n+1}(\omega)$$

If $\xi_{2n}(\omega) = \xi_{2n+1}(\omega) = \xi(\omega)$ for *some* measurable mapping $\xi : \Omega \to X$ for each $\omega \in \Omega$ and for some n, then we say that $\xi(\omega)$ is random fixed point of A, B, S and T, therefore we suppose that no two consecutive terms of sequence $\{\xi_n(\omega)\}$ are equal.

Now we consider for each $\omega \in \Omega$

$$\|\xi_{2n}(\omega) - \xi_{2n+1}(\omega)\|^2 = \|A(\omega, \eta_{2n}(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2$$

$$\leq \alpha(\omega) \, \|S(\omega, \eta_{2n}(\omega)) - T(\omega, \eta_{2n+1}(\omega))\|^2$$

$$+ \beta(\omega) \, (\|S(\omega, \eta_{2n}(\omega)) - A(\omega, \eta_{2n}(\omega))\|^2$$

$$+ \|T(\omega, \eta_{2n+1}(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2)$$

$$+ \frac{\gamma(\omega)}{2}(\|S(\omega, \eta_{2n}(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2$$

$$+ \|T(\omega, \eta_{2n+1}(\omega)) - A(\omega, \eta_{2n}(\omega))\|^2)$$

$$= \alpha(\omega) \| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2$$

$$+ \beta(\omega) \, (\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2)$$

$$+ \frac{\gamma(\omega)}{2}(\| \xi_{2n-1}(\omega) - \xi_{2n+1}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n}(\omega) \|^2)$$

$$= \alpha(\omega) \| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2$$

$$+ \beta(\omega) \, (\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2)$$

$$+ \frac{\gamma(\omega)}{2}(\|(\xi_{2n-1}(\omega) - \xi_{2n}(\omega)) + (\xi_{2n}(\omega) - \xi_{2n+1}(\omega))\|^2)$$

$$= \alpha(\omega) \| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2$$

$$+ \beta(\omega) \, (\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2)$$

$$+ \frac{\gamma(\omega)}{2}[2\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + 2\| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2$$

$$- \|(\xi_{2n-1}(\omega) - \xi_{2n}(\omega)) - (\xi_{2n}(\omega) - \xi_{2n+1}(\omega))\|^2]$$

[By Parallelogram law $\forall \, \mathbf{x, y} \in \mathbf{X}, \|\mathbf{x} + \mathbf{y}\|^2 + \|\mathbf{x} - \mathbf{y}\|^2 = 2\|\mathbf{x}\|^2 + 2\|\mathbf{y}\|^2$]

$$= \alpha(\omega) \| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2$$

$$+ \beta(\omega) \, (\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2)$$

$$+ \gamma(\omega) \, (\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2)$$

$$- \frac{\gamma(\omega)}{2}[\|(\xi_{2n-1}(\omega) - \xi_{2n}(\omega)) - (\xi_{2n}(\omega) - \xi_{2n+1}(\omega))\|^2]$$

$$\leq \alpha(\omega) \| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2$$

$$+ \beta(\omega)(\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2)$$

$$+ \gamma(\omega)(\| \xi_{2n-1}(\omega) - \xi_{2n}(\omega) \|^2 + \| \xi_{2n}(\omega) - \xi_{2n+1}(\omega) \|^2)$$

$$= (\alpha(\omega) + \beta(\omega) + \gamma(\omega))\|\xi_{2n-1}(\omega) - \xi_{2n}(\omega)\|^2 + (\beta(\omega) + \gamma(\omega))\|\xi_{2n}(\omega) - \xi_{2n+1}(\omega)\|^2$$

$$\Rightarrow (1 - \beta(\omega) - \gamma(\omega))\|\xi_{2n}(\omega) - \xi_{2n+1}(\omega)\|^2$$

$$\leq (\alpha(\omega) + \beta(\omega) + \gamma(\omega))\|\xi_{2n-1}(\omega) - \xi_{2n}(\omega)\|^2$$

$$\Rightarrow \|\xi_{2n}(\omega) - \xi_{2n+1}(\omega)\|^2$$

$$\leq \frac{\alpha(\omega) + \beta(\omega) + \gamma(\omega)}{1 - \beta(\omega) - \gamma(\omega)}\|\xi_{2n-1}(\omega) - \xi_{2n}(\omega)\|^2$$

$$\Rightarrow \|\xi_{2n}(\omega) - \xi_{2n+1}(\omega)\| \leq k\|\xi_{2n-1}(\omega) - \xi_{2n}(\omega)\|$$

Where k $= \left[\frac{a(\omega) + \beta(\omega) + y(\omega)}{1 - \beta(\omega) - y(\omega)}\right]^{1/2}$

Hence, in general we see that

$\|\xi_{2n}(\omega) - \xi_{2n+1}(\omega)\| \leq k^{2n}\|\xi_0(\omega) - \xi_1(\omega)\|$ for each $\omega \in \Omega$ and n = 0, 1, 2, 3, ……….

Now we show that for $\omega \in \Omega, \{\xi_{2n}(\omega)\}$ is Cauchy's sequence, for its positive p, we have for $\omega \in \Omega$

$$\|\xi_{2n}(\omega) - \xi_{2n+p}(\omega)\|$$

$$= \|\xi_{2n}(\omega) - \xi_{2n+1}(\omega) + \xi_{2n+1}(\omega) - \xi_{2n+2}(\omega) + \ldots + \xi_{2n+p-1}(\omega) - \xi_{2n+p}(\omega)\|$$

$$\leq \|\xi_{2n}(\omega) - \xi_{2n+1}(\omega)\| + \|\xi_{2n+1}(\omega) - \xi_{2n+2}(\omega)\| + \ldots + \|\xi_{2n+p-}(\omega) - \xi_{2n+p}(\omega)\|$$

$$\leq (k^{2n} + k^{2n+1} + \ldots\ldots k^{2n+p-})\|\xi_0(\omega) - \xi_1(\omega)\|$$

$$\Rightarrow \|\xi_{2n}(\omega) - \xi_{2n+p}(\omega)\| \leq \frac{k^{2n}}{1-k}\|\xi_0(\omega) - \xi_1(\omega)\| \text{ for all } \omega \in \Omega$$

Taking limit as n $\longrightarrow \infty$ so $\|\xi_{2n}(\omega) - \xi_{2n+p}(\omega)\| \longrightarrow 0$

If follow that $\{\xi_{2n}(\omega)\}$ is Cauchy sequence for $\omega \in \Omega$ and hence it convergence in separable Hilbert space H.

Now let for each $\omega \in \Omega$, $\{\xi_{2n}(\omega)\} \longrightarrow \xi(\omega)$ as n $\longrightarrow \infty$ *for* some measurable mapping $\xi(\omega)$, *where* $\xi : \Omega \to X$. Again by the closeness of X and consequently the $\{\xi_{2n}(\omega)\}$ and its subsequence converges to some measurable mapping $\xi(\omega)$, *where* $\xi : \Omega \to X$

i.e. $A(\omega, \eta_{2n}(\omega)) \longrightarrow \xi(\omega)$, $T(\omega, \eta_{2n+1}(\omega)) \longrightarrow \xi(\omega)$, $S(\omega, \eta_{2n+2}(\omega)) \longrightarrow \xi(\omega)$, and $B(\omega, \eta_{2n+1}(\omega)) \longrightarrow \xi(\omega)$ for each $\omega \in \Omega$.

Case I. If S is continuous.

We have $S(\omega, A(\omega, \eta_{2n}(\omega))) \longrightarrow S(\omega, \xi(\omega))$ and S $(\omega, S(\omega, \eta_{2n+2}(\omega))) \longrightarrow S(\omega, \xi(\omega))$.

Also by the semi-compatibility of the random operators (A, S) gives

$A(\omega, S(\omega, \eta_{2n}(\omega))) \longrightarrow S(\omega, \xi(\omega))$, for each $\omega \in \Omega$.

Step I. For each $\omega \in \Omega$, we have

$$\|A(\omega, S(\omega, \eta_{2n}(\omega))) - B(\omega, \eta_{2n+1}(\omega))\|^2$$

$$\leq \alpha(\omega) \|S(\omega, S(\omega, \eta_{2n}(\omega))) - T(\omega, \eta_{2n+1}(\omega))\|^2$$

$$+ \beta(\omega)(\|S(\omega, S(\omega, \eta_{2n}(\omega))) - A(\omega, S(\omega, \eta_{2n}(\omega)))\|^2$$

$$+ \|T(\omega, \eta_{2n+1}(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2)$$

$$+ \frac{\gamma(\omega)}{2}(\|S(\omega, S(\omega, \eta_{2n}(\omega))) - B(\omega, \eta_{2n+1}(\omega))\|^2$$

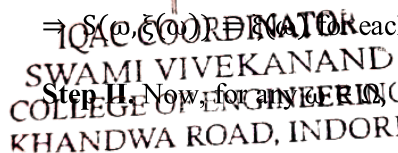$$+ \|T(\omega, \eta_{2n+1}(\omega)) - A(\omega, S(\omega, \eta_{2n}(\omega)))\|^2)$$

Taking limit $n \longrightarrow \infty$ and we obtain

$$\|S(\omega, \xi(\omega)) - \xi(\omega)\|^2 \leq \alpha(\omega)\|S(\omega, \xi(\omega)) - \xi(\omega)\|^2 + \beta(\omega)(\|S(\omega, \xi(\omega)) - S(\omega, \xi(\omega))\|^2 +$$

$$\|\xi(\omega) - \xi(\omega)\|^2) + \frac{y(\omega)}{2}(\|S(\omega, \xi(\omega)) - \xi(\omega)\|^2 + \|\xi(\omega) - S(\omega, \xi(\omega))\|^2)$$

$$\|S(\omega, \xi(\omega)) - \xi(\omega)\|^2 \leq \alpha(\omega)\|S(\omega, \xi(\omega)) - \xi(\omega)\|^2 + \gamma(\omega)\|S(\omega, \xi(\omega)) - \xi(\omega)\|^2$$

$$\Rightarrow [1 - \alpha(\omega) - \gamma(\omega)]\|S(\omega, \xi(\omega)) - \xi(\omega)\|^2 \leq 0$$

$$\Rightarrow S(\omega, \xi(\omega)) = \xi(\omega) \text{ for each } \omega \in \Omega.$$

Step II. Now, for any $\omega \in \Omega$, we also obtain

$$\|A(\omega, \xi(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2$$

$$\leq \alpha(\omega)\|S(\omega, \xi(\omega)) - T(\omega, \eta_{2n+1}(\omega))\|^2$$

$$+ \beta(\omega)(\|S(\omega, \xi(\omega)) - A(\omega, \xi(\omega))\|^2 + \|T(\omega, \eta_{2n+1}(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2)$$

$$+ \frac{\gamma(\omega)}{2}(\|S(\omega, \xi(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2 + \|T(\omega, \eta_{2n+1}(\omega)) - A(\omega, \xi(\omega))\|^2)$$

Taking limit $n \longrightarrow \infty$, we get

$$\|A(\omega, \xi(\omega)) - \xi(\omega)\|^2$$

$$\leq \alpha(\omega)\|\xi(\omega) - \xi(\omega)\|^2 + \beta(\omega)(\|\xi(\omega) - A(\omega, \xi(\omega))\|^2 + \|\xi(\omega) - \xi(\omega)\|^2)$$

$$+ \frac{\gamma(\omega)}{2}(\|\xi(\omega) - \xi(\omega)\|^2 + \|\xi(\omega) - A(\omega, \xi(\omega))\|^2)$$

$$\Rightarrow [1 - \beta(\omega) - \frac{\gamma(\omega)}{2}]\|A(\omega, \xi(\omega)) - \xi(\omega)\|^2 \leq 0$$

$$\Rightarrow A(\omega, \xi(\omega)) = \xi(\omega) \text{ for each } \omega \in \Omega.$$

Hence $A(\omega, \xi(\omega)) = \xi(\omega) = S(\omega, \xi(\omega))$ for each $\omega \in \Omega$.

Since $A(\omega, X) \subset T(\omega, X)$ and hence there exists measurable mapping $g : \Omega \to X$ such that

$A(\omega, \xi(\omega)) = T(\omega, g(\omega))$ therefore,

$\xi(\omega) = A(\omega, \xi(\omega)) = S(\omega, \xi(\omega)) = T(\omega, g(\omega))$ for each $\omega \in \Omega$.

Step III. For any $\omega \in \Omega$, we have

$$\|A(\omega, \eta_{2n}(\omega)) - B(\omega, g(\omega))\|^2$$
$$\leq \alpha(\omega)\|S(\omega, \eta_{2n}(\omega)) - T(\omega, g(\omega))\|^2$$
$$+ \beta(\omega)\,(\|S(\omega, \eta_{2n}(\omega)) - A(\omega, \eta_{2n}(\omega))\|^2 + \|T(\omega, g(\omega)) - B(\omega, g(\omega))\|^2)$$
$$+ \frac{\gamma(\omega)}{2}(\|S(\omega, \eta_{2n}(\omega)) - B(\omega, g(\omega))\|^2 + \|T(\omega, g(\omega)) - A(\omega, \eta_{2n}(\omega))\|^2)$$

Taking limit $n \to \infty$ and using the above result, we get

$$\|\xi(\omega) - B(\omega, g(\omega))\|^2$$
$$\leq \alpha(\omega)\|\xi(\omega) - \xi(\omega)\|^2 + \beta(\omega)\,(\|\xi(\omega) - \xi(\omega)\|^2 + \|\xi(\omega) - B(\omega, g(\omega))\|^2)$$
$$+ \frac{\gamma(\omega)}{2}(\|\xi(\omega) - B(\omega, g(\omega))\|^2 + \|\xi(\omega) - \xi(\omega)\|^2)$$

$$\|\xi(\omega) - B(\omega, g(\omega))\|^2 \leq \beta(\omega)\|\xi(\omega) - B(\omega, g(\omega))\|^2 + \frac{\gamma(\omega)}{2}\|\xi(\omega) - B(\omega, g(\omega))\|^2$$

$$\Rightarrow \|\xi(\omega) - B(\omega, g(\omega))\|^2 \leq 0$$

So that $\xi(\omega) = B(\omega, g(\omega))$ for each $\omega \in \Omega$,

Therefore $\xi(\omega) = B(\omega, g(\omega)) = T(\omega, g(\omega))$.

Since (B, T) are occasionally weakly compatible random operators, this gives $B(\omega, T(\omega, g(\omega))) = T(\omega, B(\omega, g(\omega)))$ And $B(\omega, \xi(\omega)) = T(\omega, \xi(\omega))$ for each $\omega \in \Omega$.

Step IV. For any $\omega \in \Omega$, we have,

$$\|A(\omega, \xi(\omega)) - B(\omega, \xi(\omega))\|^2$$
$$\leq \alpha(\omega)\|S(\omega, \xi(\omega)) - T(\omega, \xi(\omega))\|^2$$
$$+ \beta(\omega)\,(\|S(\omega, \xi(\omega)) - A(\omega, \xi(\omega))\|^2 + \|T(\omega, \xi(\omega)) - B(\omega, \xi(\omega))\|^2)$$
$$+ \frac{\gamma(\omega)}{2}(\|S(\omega, \xi(\omega)) - B(\omega, \xi(\omega))\|^2 + \|T(\omega, \xi(\omega)) - A(\omega, \xi(\omega))\|^2)$$

$$\| \xi(\omega) - T(\omega, \xi(\omega)) \|^2$$

$$\leq \alpha(\omega) \| \xi(\omega) - T(\omega, \xi(\omega)) \|^2$$
$$+ \beta(\omega) \left(\| \xi(\omega) - \xi(\omega) \|^2 + \| T(\omega, \xi(\omega)) - T(\omega, \xi(\omega)) \|^2 \right)$$
$$+ \frac{\gamma(\omega)}{2} \left(\| \xi(\omega) - T(\omega, \xi(\omega)) \|^2 + \| T(\omega, \xi(\omega)) - \xi(\omega) \|^2 \right)$$

$$\Rightarrow [1 - \alpha(\omega) - \gamma(\omega)] \| \xi(\omega) - T(\omega, \xi(\omega)) \|^2 \leq 0$$

So that $\xi(\omega) = T(\omega, \xi(\omega))$ for each $\omega \in \Omega$.

Thus, $A(\omega, \xi(\omega)) = B(\omega, \xi(\omega)) = S(\omega, \xi(\omega)) = T(\omega, \xi(\omega)) = \xi(\omega)$ for each $\omega \in \Omega$.

Therefore $\xi(\omega)$ is common random fixed point of random operator A, B, S and T.

Case II. When A is continuous, we have

$A(\omega, A(\omega, \eta_{2n}(\omega))) \longrightarrow A(\omega, \xi(\omega))$, for each $\omega \in \Omega$.

Also by the semi-compatibility of (A, S), we have

$A(\omega, S(\omega, \eta_{2n}(\omega))) \longrightarrow S(\omega, \xi(\omega))$, for each $\omega \in \Omega$.

Step I. for each $\omega \in \Omega$, consider,

$$\| A(\omega, S(\omega, \eta_{2n}(\omega))) - B(\omega, \eta_{2n+1}(\omega)) \|^2$$

$$\leq \alpha(\omega) \| S(\omega, S(\omega, \eta_{2n}(\omega))) - T(\omega, \eta_{2n+1}(\omega)) \|^2$$
$$+ \beta(\omega) \left(\| S(\omega, S(\omega, \eta_{2n}(\omega))) - A(\omega, S(\omega, \eta_{2n}(\omega))) \|^2 \right.$$
$$+ \| T(\omega, \eta_{2n+1}(\omega)) - B(\omega, \eta_{2n+1}(\omega)) \|^2 \Big)$$
$$+ \frac{\gamma(\omega)}{2} \left(\| S(\omega, S(\omega, \eta_{2n}(\omega))) - B(\omega, \eta_{2n+1}(\omega)) \|^2 \right.$$
$$+ \| T(\omega, \eta_{2n+1}(\omega)) - A(\omega, S(\omega, \eta_{2n}(\omega))) \|^2 \Big)$$

Taking limit $n \longrightarrow \infty$ and process the step I of case I, we obtain

$$\| S(\omega, \xi(\omega)) - \xi(\omega) \|^2 \leq \alpha(\omega) \| S(\omega, \xi(\omega)) - \xi(\omega) \|^2 + \beta(\omega) \left(\| S(\omega, \xi(\omega)) - S(\omega, \xi(\omega)) \|^2 + \right.$$
$$\| \xi(\omega) - \xi(\omega) \|^2) + \frac{\gamma(\omega)}{2} (\| S(\omega, \xi(\omega)) - \xi(\omega) \|^2 + \| \xi(\omega) - S(\omega, \xi(\omega)) \|^2)$$

$$\| S(\omega, \xi(\omega)) - \xi(\omega) \|^2 \leq \alpha(\omega) \| S(\omega, \xi(\omega)) - \xi(\omega) \|^2 + \gamma(\omega) \| S(\omega, \xi(\omega)) - \xi(\omega) \|^2$$

$$\Rightarrow \| S(\omega, \xi(\omega)) - \xi(\omega) \|^2 \leq 0$$

$$\Rightarrow S(\omega, \xi(\omega)) = \xi(\omega) \text{ for each } \omega \in \Omega.$$

Step II. Now, for any $\omega \in \Omega$, we have,

$$\|A(\omega, \xi(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2$$

$$\leq \alpha(\omega)\|S(\omega, \xi(\omega)) - T(\omega, \eta_{2n+1}(\omega))\|^2$$

$$+ \beta(\omega)\left(\|S(\omega, \xi(\omega)) - A(\omega, \xi(\omega))\|^2 + \|T(\omega, \eta_{2n+1}(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2\right)$$

$$+ \frac{\gamma(\omega)}{2}\left(\|S(\omega, \xi(\omega)) - B(\omega, \eta_{2n+1}(\omega))\|^2 + \|T(\omega, \eta_{2n+1}(\omega)) - A(\omega, \xi(\omega))\|^2\right)$$

Taking limit $n \to \infty$, and the process step II of case I, we get

$$\|A(\omega, \xi(\omega)) - \xi(\omega)\|^2$$

$$\leq \alpha(\omega)\|\xi(\omega) - \xi(\omega)\|^2 + \beta(\omega)\left(\|\xi(\omega) - A(\omega, \xi(\omega))\|^2 + \|\xi(\omega) - \xi(\omega)\|^2\right)$$

$$+ \frac{\gamma(\omega)}{2}\left(\|\xi(\omega) - \xi(\omega)\|^2 + \|\xi(\omega) - A(\omega, \xi(\omega))\|^2\right)$$

$$\Rightarrow \|A(\omega, \xi(\omega)) - \xi(\omega)\|^2 \leq 0$$

i.e. $A(\omega, \xi(\omega)) = \xi(\omega)$ for each $\omega \in \Omega$. Hence $A(\omega, \xi(\omega)) = \xi(\omega) = S(\omega, \xi(\omega))$ for each $\omega \in \Omega$.

Since $A(\omega, X) \subset T(\omega, X)$ and hence there exists measurable mapping $g' : \Omega \to X$ such that

$A(\omega, \xi(\omega)) = T(\omega, g'(\omega))$. Therefore, $\xi(\omega) = A(\omega, \xi(\omega)) = S(\omega, \xi(\omega)) = T(\omega, g'(\omega))$.

Step III. For any $\omega \in \Omega$, we have

$$\|A(\omega, \eta_{2n}(\omega)) - B(\omega, g'(\omega))\|^2$$

$$\leq \alpha(\omega)\|S(\omega, \eta_{2n}(\omega)) - T(\omega, g'(\omega))\|^2$$

$$+ \beta(\omega)\left(\|S(\omega, \eta_{2n}(\omega)) - A(\omega, \eta_{2n}(\omega))\|^2 + \|T(\omega, g'(\omega)) - B(\omega, g'(\omega))\|^2\right)$$

$$+ \frac{\gamma(\omega)}{2}\left(\|S(\omega, \eta_{2n}(\omega)) - B(\omega, g'(\omega))\|^2 + \|T(\omega, g'(\omega)) - A(\omega, \eta_{2n}(\omega))\|^2\right)$$

Taking limit $n \to \infty$, using the above result and proceeding step III case I, we get

$$\|\xi(\omega) - B(\omega, g'(\omega))\|^2$$

$$\leq \alpha(\omega)\|\xi(\omega) - \xi(\omega)\|^2 + \beta(\omega)\left(\|\xi(\omega) - \xi(\omega)\|^2 + \|\xi(\omega) - B(\omega, g'(\omega))\|^2\right)$$

$$+ \frac{\gamma(\omega)}{2}\left(\|\xi(\omega) - B(\omega, g'(\omega))\|^2 + \|\xi(\omega) - \xi(\omega)\|^2\right)$$

$$\Rightarrow \|\xi(\omega) - B(\omega, g'(\omega))\|^2 \leq 0$$

So that $\xi(\omega) = B(\omega, g'(\omega))$ for each $\omega \in \Omega$, therefore $\xi(\omega) = B(\omega, g'(\omega)) = T(\omega, g'(\omega))$.

Now using the occasionally weakly compatibility of (B, T), we have $B(\omega, T(\omega, g'(\omega))) = T(\omega, B(\omega, g'(\omega)))$ and $B(\omega, \xi(\omega)) = T(\omega, \xi(\omega))$ for $\omega \in \Omega$.

Step IV. For any $\omega \in \Omega$, we have

$$\| A(\omega, \xi(\omega)) - B(\omega, \xi(\omega))\|^2$$

$$\leq \alpha(\omega)\|S(\omega, \xi(\omega)) - T(\omega, \xi(\omega))\|^2$$
$$+ \beta(\omega)\left(\|S(\omega, \xi(\omega)) - A(\omega, \xi(\omega))\|^2 + \|T(\omega, \xi(\omega)) - B(\omega, \xi(\omega))\|^2\right)$$
$$+ \frac{\gamma(\omega)}{2}\left(\|S(\omega, \xi(\omega)) - B(\omega, \xi(\omega))\|^2 + \|T(\omega, \xi(\omega)) - A(\omega, \xi(\omega))\|^2\right)$$

$$\| \xi(\omega) - B(\omega, \xi(\omega))\|^2$$

$$\leq \alpha(\omega)\|\xi(\omega) - T(\omega, \xi(\omega))\|^2$$
$$+ \beta(\omega)\left(\|\xi(\omega) - \xi(\omega)\|^2 + \|B(\omega, \xi(\omega)) - B(\omega, \xi(\omega))\|^2\right)$$
$$+ \frac{\gamma(\omega)}{2}\left(\|\xi(\omega) - B(\omega, \xi(\omega))\|^2 + \|B(\omega, \xi(\omega)) - \xi(\omega)\|^2\right)$$

$$\Rightarrow \| \xi(\omega) - B(\omega, \xi(\omega))\|^2 \leq 0$$

So that $\xi(\omega) = B(\omega, \xi(\omega))$ for each $\omega \in \Omega$.

Thus, $A(\omega, \xi(\omega)) = B(\omega, \xi(\omega)) = S(\omega, \xi(\omega)) = T(\omega, \xi(\omega)) = \xi(\omega)$ for each $\omega \in \Omega$.

Hence, $\xi(\omega)$ is common random fixed point of the random operators A, B, S and T.

Similarly, we can also complete the proof for 'or' part when B or T is continuous and (B, T) are semi compatible and (A, S) are occasionally weakly compatible.

Uniqueness. Let $\zeta : \Omega \to X$ be another common random fixed point of the random operators A, B, S and T then for each $\omega \in \Omega$,

$$\| \xi(\omega) - \zeta(\omega)\|^2 = \| A(\omega, \xi(\omega)) - B(\omega, \zeta(\omega))\|^2$$

$$\leq \alpha(\omega)\|S(\omega, \xi(\omega)) - T(\omega, \zeta(\omega))\|^2$$
$$+ \beta(\omega)\left(\|S(\omega, \xi(\omega)) - A(\omega, \xi(\omega))\|^2 + \|T(\omega, \zeta(\omega)) - B(\omega, \zeta(\omega))\|^2\right)$$
$$+ \frac{\gamma(\omega)}{2}\left(\|S(\omega, \xi(\omega)) - B(\omega, \zeta(\omega))\|^2 + \|T(\omega, \zeta(\omega)) - A(\omega, \xi(\omega))\|^2\right)$$

$$\leq \alpha(\omega)\|\xi(\omega) - \zeta(\omega)\|^2 + \beta(\omega)\left(\|\xi(\omega) - \xi(\omega)\|^2 + \|\zeta(\omega) - \zeta(\omega)\|^2\right)$$
$$+ \frac{\gamma(\omega)}{2}\left(\|\xi(\omega) - \zeta(\omega)\|^2 + \|\zeta(\omega) - \xi(\omega)\|^2\right)$$

$$[1 - \alpha(\omega) - \gamma(\omega)]\| \xi(\omega) - \zeta(\omega)\|^2 \leq 0$$

Which is implies that $\xi(\omega) = \zeta(\omega)$ for each $\omega \in \Omega$.

Hence $\xi(\omega)$ is a unique common random fixed point of random operators A, B, S and T.

Corollary 3.1. Let X be a non empty closed subset of a Hilbert Space H. Let A, B, S and T be four random operators from $\Omega \times X \to X$ satisfying (3.1) , (3.2) and (3.3). If either (i) pair (A, S) are semi compatible, S or A is continuous and (B, T) are weakly compatible random operators (ii) pair (B, T) are semi-compatible, B or T is continuous and (A, S) are weak compatible random operators, Then random operators A, B, S and T have unique common random fixed point.

Proof: Since weakly compatible mapping are occasionally weak compatible mapping and so result follows from theorem 3.1.

Corollary3.2. Let X be a non empty closed subset of a separable Hilbert Space H. Let A, B, S and T be four random operators from $\Omega \times X \to X$ satisfying (3.1), (3.2), (3.3) Then random operators A, B, S and T have unique common random fixed point.

Proof: The proof of corollary follows immediate from theorem 3.1.

Theorem3.2. Let X be a non empty closed subset of a Hilbert Space H. Let A, B, S, T: $X \to X$ is satisfying

$$A(X) \subset T(X) \text{ and } B(X) \subset S(X) \tag{3.2.1}$$

$$\|A(x) - B(y)\|^2 \le a\|S(x) - T(y)\|^2 + b(\|S(x) - A(x)\|^2 + \|T(y) - B(y)\|^2) + \frac{c}{2}(\|S(x) - B(y)\|^2 + \|T(y) - A(x)\|^2) \tag{3.2.2}$$

For every $x, y \in X$ where a, b and c are constants such that a + 2b + 2c < 1

$$\tag{3.2.3}$$

If either (i)(A,S) are semi-compatible, S or A is continuous and (B,T) are occasionally weakly compatible **or** (ii)(B,T) are semi-compatible, B or T is continuous and (A,S) are occasionally weakly compatible. Then the sequence defined by (3.2.4), by starting with an arbitrary element

$$x_0 \in X, \quad y_{2n} = Ax_{2n} = Tx_{2n+1}, \quad y_{2n+1} = Bx_{2n+1} = Sx_{2n+2}, \quad n = 0, 1, 2, \ldots \tag{3.2.4}$$

Converges to a unique common fixed point of A, B, S and T.

Proof. The proof of the theorem is immediately follows from theorem 3.1 by assuming Ω to be a singleton set.

Corollary3.3. Let X be a non empty closed subset of a Hilbert Space H. Let A, B, S, T: $X \to X$ is satisfying (3.2.1), (3.2.2) and (3.2.3). If either (i) (A, S) are semi-compatible, S or A is continuous and (B, T) are weakly compatible or (ii)(B, T) are semi-compatible, B or T is continuous and (A, S) are weakly compatible. Then the sequence defined in (3.2.4) converges to a unique common fixed point of A, B, S and T.

Proof. Since weakly compatible mappings are occasionally weakly compatible mappings and so the proof of the theorem is immediately follows from theorem 3.2.

Corollary3.4. Let X be a non empty closed subset of a Hilbert Space H. Let A, B, S, T: $X \to X$ is satisfying (3.2.1),(3.2.2) and (3.2.3) Then the sequence defined in (3.2.4) Converges to a unique common fixed point of A, B, S and T.

Proof. The proof of the theorem is immediately follows from theorem 3.2.

Conclusion: The results of this paper are new in case of random and deterministic operators for the occasionally weakly compatible and semi compatible maps. If in addition, we put S = T = I(Identity Operator) in inequality (3.2.), then we get the corollary 3.2, which is the main results of Choudhury [12]. Thus the result of this paper are improved and generalized many known and existing results for random operators and deterministic operators in fixed point theory.

Competing Interests. The authors declare that they have no competing interests.

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Fixed Point Theorems for Occasionally Weakly Compatible Mappings in Fuzzy-3 Metric Spaces

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Abstract

In this paper we prove some common fixed point theorem for occasionally weakly compatible mapping in fuzzy metric spaces by taking average of some elements.

Keywords : Occasionally weakly compatible (owc) mappings, fuzzy metric space.

1 Introduction

Fuzzy set was defined by Zadeh [26]. Kramosil and Michalek [14] introduced fuzzy metric space, Grorge and Veermani [6] modified the notion of fuzzy metric spaces with the help of continuous t-norms. Many researchers have obtained common fixed point theorems for mappings satisfying different types of commutativity conditions. Vasuki [25] proved fixed point theorems for R-weakly commutating mappings. Pant [18, 19, 20] introduced the new concept reciprocally continuous mappings and established some common fixed point theorems. Balasubramaniam er al. [4], have shown that Rhoades [22] open problem on the existence of contractive definition which generates a fixed point but does not force the mappings to be continuous at the fixed point, posses an affirmative answer. Pant and Jha [20] obtained some analogous results proved by Balasubramaniam et. Al. Recent literature in fixed point in fuzzy metric space can be viewed in [1, 2, 9, 16, 24].

In this paper we prove some common fixed point theorems for more general commutative condition i.e. occasionally weakly compatible mappings in fuzzy-3 metric space.

2 Preliminary Notes

Definition 2.1 [26] A fuzzy set A in X is a function with domain X and values in [0,1].

Definition 2.2 [23] A binary operation $* : [0, 1] \times [0, 1] \to [0, 1]$ is a continuous t-norms if it satisfies the following conditions:

(i) *is associative and commutative;

(ii) *is continuous;

(iii)a*1 = a for all a ∈ [0,1];

(iv) a*b≤ c*d whenever a ≤ c and b ≤ d, and a, b, c, d ∈ [0,1].

Definition 2.3 *[6] A 3-tuples (X, M,*) is said to be a fuzzy metric space (shortly FM Space) if X is an arbitrary set, * is a continuous t-norm and M is a fuzzy set of X^2 × (0, ∞) satisfying the following conditions, for all x, y, z ∈ X and s, t > 0 ;*

(FM 1): M(x,y,t) > 0;

(FM 2): M(x, y, t) = 1 for all t > 0 if and only if x = y;

(FM 3): M(x, y, t) = M(y, x, t);

(FM 4): M(x, y, t) * M(y, z, s) ≤ M(x, z, t + s);

(FM 5): M(x, y, .) : (0,∞) → (0,1] is left continuous.

(X, M,*) denotes a fuzzy metric space, M (x,y,t) can be thought of as degree of nearness between x and y with respect to t. We identify x = y with M(x, y, t) = 1for all t > 0. In the following example every metric induces a fuzzy metric.

Example 2.4 (Induced fuzzy metric [6]) Let (X, d) be a metric space. Denote a * b = a.b

& for all a, b ∈ [0,1] and let M_d be fuzzy sets on X^2 × (0, ∞) defined as follows

$$M_d(x,y,t) = \frac{t}{t+d(x,y)}$$

Then (X, M,*) is a fuzzy metric space. We call this fuzzy metric induced by a metric **d** as the standard intuitionistic fuzzy metric.

Definition 2.5 [11] Two self mappings f and g of a fuzzy metric space (X,M,*) are called compatible if $\lim_{n\to\infty} M (fg x_n, gf x_n, t) = 1$ wherever { x_n} is sequence in X such that

$\lim_{n\to\infty} f x_n = \lim_{n\to\infty} g x_n = x$ for some x in X

Definition 2.6 [5] Two self maps f and g of a fuzzy metric space (X, M,*) are called reciprocally continuous on X if $\lim_{n\to\infty} f x_n = fx$ and $\lim_{n\to\infty} gf x_n = gx$ wherever, { x_n} is sequence in X such that

$\lim_{n\to\infty} f x_n = \lim_{n\to\infty} g x_n = x$ for some x in X.

Definition 2.7 [6] Let (X, M,*) be a fuzzy metric space. Then

(a) A sequence {x_n}in X is said to converges to x in *X* if for each ε > 0 and each t > *0*, there exist n_o ∈ N such that M(x_n,x,t) > 1 – ε for all n ≥ n_o.

(b) A sequence $\{x_n\}$ in X is said to be Cauchy if for each $\varepsilon > 0$ and each $t > 0$, there exist $n_o \in N$ such that $M(x_n, x_m, t) > 1 - \varepsilon$ for all n, m $\geq n_o$.

(c) A fuzzy metric space in which every Cauchy sequence is convergent is said to be complete.

Definition 2.8 Two self maps f and g of a set X are occasionally weakly compatible (owc) iff there is a point x in X which is a coincidence point of f and g at which f and g commute. A.Al-Thagafi and Naseer Shahzad [4] shown that occasionally weakly is weakly compatible but converse is not true.

Example 2.9 [3] Let R be the usual metric space. Define S, T: R $\rightarrow$ R by Sx = 3x and Tx = x^2 for all x $\in$ R. Then Sx = Tx for x = 0, 3 but ST0 = TS0, and ST3 $\neq$ TS3. Hence S and T are occasionally weakly compatible self maps but not weakly compatible.

Example 2.10 [3] Let R be the usual metric space. Define S, T: R $\rightarrow$ R by Sx = 2x and Tx = x^2 for all x $\in$ R. Then Sx = Tx for x = 0, 2, but ST0 = TS0, and ST2 $\neq$ TS2. Hence S and T are occasionally weakly compatible self maps but not weakly compatible.

Lemma 2.11 [12] Let X be a set and f, g owc self maps of X. If f and g have a unique point of coincidence, w = fx = gx, then w is the unique common fixed point of f and g.

Lemma 2.12 Let (X,M,*) be a fuzzy metric space. If then exist q $\in$ (0, 1) such that

M (x,y,qt) $\geq$ M (x,y,t) for all x, y $\in$ X & t > 0 then x = y.

Definition 2.5: A binary operation *: $[0, 1] \times [0,1] \times [0,1] \rightarrow [0,1]$ Is called a continuous t – norm if ($[0,1]$, *) is a abelian topolgical monoid with unit -1 such that

$$a_1 * b_1 * c_1 \leq a_2 * b_2 * c_2$$

when each $a_1 \leq a_2,, b_1 \leq b_2, c_1 \leq c_3$ for all $a_1, a_2, b_1, b_2, c_1, c_2$ are in $[0,1]$

Definition 2.6: The 3 tuple (X, M, *) is called a fuzzy 2- metric space if X is an arbitrary set * is a continuous t-norm & M is a fuzzy set in $X^3 \times [0,\infty)$ satisfying the following conditions for all x, y, z, u $\in$ X & t_1, t_2, t_3 > 0

(FM'-1): M (x, y, z, 0) = 0

(FM'– 2): M(x, y, z, t) = 1 if t > 0 & When at least two of the three points are equal.

(FM'– 3): M (x, y, z, t) = M (x, z, y, t) = M (y, z, x, t)

(FM'– 4): M (x, y, z, t_1+t_2+t_3) > M (x, y, u, t_1) * M (x, u, z, t_2)* M (u, y, z, t_3)

(This corresponds to tetrahedron inequality in 2 - metric space)

The function value M (x, y, z, t) may be interpreted as the probability that area of triangle is less than t.

(FM'– 5): M(x, y, z, .): $[0, \infty) \to [0,1]$ is left continuous.

Definition 2.7: Let (X, M, *) is a fuzzy 3 metric space

(1) The Sequence $\{x_n\}$ in fuzzy 3 metric space X is said to be convergent to a point $x \in X$ if $\lim\limits_{n \to \infty}$ M $(x_n, x, a, t, s) = 1$ for all $a \in X, t > 0, s > 0$

(2) A Sequence $\{x_n\}$ in fuzzy 3 metric space X is called a Cauchy sequence if
$$\lim\limits_{n \to \infty} (x_{n+p}, x_n, a, t) = 1 \text{ for all } t > 0 \ \& \ p > 0$$

(3) A fuzzy 3 metric space in which every Cauchy sequence is convergent is said to be complete.

Definition 2.8: A function M is continuous in fuzzy 3 metric space iff when $x_n \to x$, $y_n \to y$, then M($x_{n,}$, y_n, a, t, s) = M(x, y, a, t, s) for all $a \in X$ & $t > 0$, $s > 0$.

Example of fuzzy 3-metric space 2.3

Let X be the set {1, 2, 3, 4} with 2 metric defined by

$$d(x, y, z) = \begin{cases} 0 & \text{if } x = y, y = z, z = x \text{ and } \{x, y, z\} = \{1, 2, 3\} \\ \dfrac{1}{2} & \text{otherwise} \end{cases}$$

for each $t \in [0, \infty)$ defined $a*b*c = abc$

$$M(x, y, z, t, s) = \begin{cases} 0 & \text{if } t = 0 \\ \dfrac{t}{t+s+d(x,y,z)} & \text{if } t > 0, \ s > 0 \text{ where } x, y, z \in X \end{cases}$$

then (X, M,*) is a fuzzy 3-metric space

Lemma 2.3:

Let (X, M, *) be a fuzzy metric space. If then exist (0, 1) such that

M (x, y, qt, s) ≥ M (x, y, t, s) for all x, y $\in$ X & t > 0, s > 0 then x = y

Lemma 2.4:

let (X, M, *) be the fuzzy 3- metric spaces if there exist q ∈ (0,1) such that

M (x, y, a, qt, s) ≥ M (x, y, a, t, s) then x=y, for all x, y ∈ X, a ∈ X, t > 0, s > 0

Lemma 2.4:

Definition 2.10 *Let (X,d) be a compatible metric space, $\alpha \in [0,1]$, f:X → X a mapping such that for each x,y ∈ X*

$\int_0^{d(fx,fy)} \varphi(t)dt \leq \alpha \int_0^{d(x,y)} \varphi(t)dt$ *where $\varphi : R^+ \to R$ is lebesgue integral mapping which is summable,*

$$\varepsilon > 0, \int_0^s \varphi(t)dt > 0$$

nonnegative and such that, for each. Then f has a unique common fixed z ∈ X such that for each $x \in X, \lim_{n\to\infty} f^n x = z$

Rhodes[30], extended this result by replacing the above condition by the following

$$\int_0^{d(fx,fy)} \varphi(t)dt \leq \alpha \int_0^{max\{d(x,y),d(x,fx),d(y,fy),\frac{1}{2}[d(x,fy)+d(x,fx)]\}} \varphi(t)dt$$

Ojha et al.(2010). Let (X,d) be a metric space and let $f: X \to X$, $F: X \to CB(X)$ be single and a multi valued map respectively, suppose that f and F are occasionally weakly commutative (owc) and satisfy the inequality

$$\int_c^{d(Fx,Fy)^p} \varphi(t)dt \leq \int_c^{\substack{max\{ad(fx,fy)d^{p-1}(fx,Fx),ad(fx,fy)d^{p-1}(fy,Fy),\\ad(fx,Fx)d^{p-1}(fy,Fy),cd^{p-1}(fx,Fy)d(fy,Fx)\}}} \varphi(t)dt$$

For all x,y in X, where p ≥ 2 is an integer a ≥ o and 0 < c < 1 then

f and F have unique common fixed point in X

MAIN RESULT

Theorem 3.1

Let (X, M, *) be a complete fuzzy – 3 metric space & let A, B, S, T, U & V be

self mapping of X. Let the pairs {A, T} & {B, U} & { S, V} be owc. If their exist a, q ∈ (0,1) such that

$$\int_0^{M\,(Ax,By,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{Min\,\{M\,(Tx,Uy,a,t,s),M\,(Tx,Ax,a,t,s),M\,(By,Uy,a,t,s),M\,(Ax,Uy,a,t,s),M\,(By,Tx,a,t,s)\}} \varphi(t)d(t) \quad (1)$$

$$\int_0^{M\,(Ax,Sz,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{Min\,\{M(Tx,Vz,a,t,s),M(Tx,Ax,a,t,s),M(Sz,Vz,a,t,s),M(Ax,Vz,a,t,s),M(Sz,Tx,a,t,s)\}} \varphi(t)d(t) \quad (2)$$

For all x, y, z ∈ X for all t > 0, s > 0 then there exist

Unique point w ∈ X Such that Aw = Tw = w

Unique point p ∈ X such that Bp = Up = p

Unique point r ∈ X such that Sr = Vr = r

More over w = p = r so that there is a unique common fIxed point of A, B, S, T, U & V

Proof: Let points {A, T}, {B, U}, {S, V} be owc so that x, y, z ∈ X such that

Ax = Tx, By = Uy, Sz = Vz   (i)

we claim   Ax = By

 If not by (1)

$$\int_0^{M(Ax,By,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{Min\,\{M\,(Tx,Uy,a,t,s),M\,(Tx,Ax,a,t,s),M\,(By,Uy,a,t,s),M\,(Ax,Uy,a,t),M\,(By,Tx,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M\,(Ax,By,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{Min\,\{M\,(Ax,By,a,t,s),M\,(Ax,Ax,a,t,s),M\,(By,By,a,t,s),M\,(Ax,By,a,t,s),M\,(By,Ax,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M(Ax,By,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{M\,(Ax,By,a,t,s)} \varphi(t)d(t)$$

Hence Ax = By & Ax = Tx = By = Uy--------(ii)

Similarly by (2)

$$\int_0^{M(Ax,Sz,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{Min\,\{M\,(Tx,Vz,a,t,s),M\,(Tx,Ax,a,t,s),M\,(Sz,Vz,a,t,s),M\,(Ax,Vz,a,t,s),M\,(Sz,Tx,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M(Ax,Sz,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{Min\,\{M\,(Ax,Sz,a,t,s),M\,(Ax,Ax,a,t,s)\,M\,(Sz,Sz,a,t,s),M\,(Ax,Sz,a,t,s),M\,(Sz,Ax,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M(Ax,Sz,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{M(Ax,Sz,a,t,s)} \varphi(t)d(t)$$

Hence Ax = Sz & Ax = Tx = Sz = Vz -------------(iii)

By (ii) & (iii) Ax = Tx = By = Uy = Sz = Vz

Suppose that there is another point f such that Af = Tf then by (1) We get

Af = Tf = By = Uy

So Ax = Af & W = Ax = Tx is Unique point of coincidence of A & T.

{Now by lemma Let X be a set, f, g owc self maps of X. If f & g have unique point of coincidence, w = fw = gw then w is unique common fixed point of f & g.

Now by this lemma 2.11, w is the only common fixed point of A & T.

Similarly α ∈ X is unique fixed point such that α = Bα = Uα

Assume that w ≠ α then M (w, α, a, qt, s) = M(Aw, Bα, a, qt) then we get

$$\int_0^{M(w,\alpha,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{Min\ \{M\ (Tw,U\alpha,a,t,s),M\ (Tw,Aw,a,t,s),M\ (B\alpha,U\alpha,a,t,s),M\ (Aw,U\alpha,a,t,s),M\ (B\alpha,Tw,a,t,s)}} \varphi(t)d(t)$$

$$\int_0^{M(w,\alpha,a,qt,,s)} \varphi\ (t)d(t) \geq \int_0^{Min\ \{M\ (w,\alpha,a,t,s),M\ (w,w,a,t,s),M\ (\alpha,\alpha,a,t,s),M\ (w,\alpha\ t,s),M\ (\alpha,w,a,t,s)\}} \varphi(t)d(t)$$

$$\geq \int_0^{M\ (w,x,a,t,s)} \varphi(t)d(t)$$

Therefore by lemma 2.3 w = α
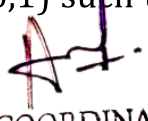
If γ ∈ X is unique fixed point such that γ = S γ = V γ then similarly we can prove that similarly

   w= γ = α

Hence w is common fixed point of A, T, B, U, S & V

Theorem 3.2

Let (X, M, *) be a complete fuzzy – 3 metric space & let A, B, S, T, U & V be self mapping of X. Let the pairs {A, T} & {B, U} & {S, V} be owc. If their exist a, q ∈ (0,1) such that

$$\int_0^{M\ (Ax,By,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{M\ (Min\ \{\ M(Tx,Uy,a,t,s),M(Tx,Ax,a,t,s),M(By,Uy,a,t,s),M\ (Ax,Uy,a,t,s),M\ (By,Tx,a,t,s)\})} \varphi(t)d(t)$$

(3)

$$\int_0^{M\ (Ax,Sz,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\emptyset\ (Min\ \{M\ (Tx,Vz,a,t,s),M\ (Tx,Ax,a,t,s),M\ (Sz,Vz,a,t,s),M\ (Ax,Vz,a,t,s),M\ (Sz,Tx,a,t,s)\})} \varphi(t)d(t)$$

(4) (4)

for all x, y, z ∈ X & ∅: [0,1]→ [0,1] such that ∅ (t) > t for all 0<t<1, 0<s<1

then there exist unique common fixed point of A, B, S, T, U & V

Proof:

The proof follows from theorem 3.1

Theorem 3.3

Let (X, M, *) be a complete fuzzy – 3 metric space & let A, B, S, T, U & V be

self mapping of X. Let the pairs {A, T} & {B, U} & {S, V} be owc. If their exist

a, q ∈ (0,1) such that

$$\int_0^{M\ (Ax,By,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\emptyset\ \{M\ (Tx,Uy,a,t,s),M\ (Tx,Ax,a,t,s),M\ (By,Uy,a,t,s),M\ (Ax,Uy,a,t,s),M\ (By,Tx,a,t,s)\}} \varphi(t)d(t) \qquad (5)$$

$$\int_0^{M\ (Ax,Sz,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\emptyset\{M\ (Tx,Vz,a,t,s),M\ (Tx,Ax,a,t,s),M\ (Sz,Vz,a,t,s),M\ (Ax,Vz,a,t,s),M\ (Sz,Tx,a,t,s)\}} \varphi(t)d(t) \qquad (6)$$

for all x, y, z ∈ X & ∅ (t, 1,1, t, t, s) > t for all 0< t <1, 0< s <1 then there exist

a unique common fixed point of A, B, S, T, U & V

Proof: Let points {A, T}, {B, U}, {S, V} be owc so that x, y, z ∈ X such that

Ax = Tx, By = Uy, Sz = Vz ---------(iv)

we claim   Ax = By

If not by (5)

$$\int_0^{M(Ax,By,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\emptyset\{M\ (Tx,Uy,a,t,s),M\ (Tx,Ax,a,t,s)M\ (By,Uy,a,t,s),M\ (Ax,Uy,a,t,s),M\ (By,Tx,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M(Ax,By,a,qt,s)} \varphi(t)d(t)$$

$$\geq \int_0^{\emptyset\ \{M\ (Ax,By,a,t,s),M\ (Ax,Ax,a,t,s)\ M\ (By,By,a,t,s),M\ (Ax,By,a,t,s),M\ (By,Ax,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M\ (Ax,By,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\varnothing\ \{M\ (Ax,By,a,t,s),1,1,M\ (Ax,By,a,t,s),M\ (By,Ax,a,t,s)\}} \varphi(t)d(t)$$

This is the contradiction, hence

Ax = By & Ax = Tx = By = Uy ------- (v)

Similarly by (6)

$$\int_0^{M\ (Ax,Sz,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\varnothing\ \{M\ (Tx,Vz,a,t,s),M\ (Tx,Ax,a,t,s),M\ (Sz,Vz,a,t,s),M\ (Ax,Vz,a,t,s),M\ (Sz,Tx,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M\ (Ax,Sz,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\varnothing\ \{M\ (Ax,Sz,a,t,s),M\ (Ax,Ax,a,t,s),M\ (Sz,Sz,a,t,s),M\ (Ax,Sz,a,t,s),M(Sz,Ax,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M(Ax,Sz,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{\varnothing\ \{M\ (Ax,Sz,a,t,s),1,1,M\ (Ax,Sz,a,t,s),M\ (Sz,Ax,a,t,s)\}} \varphi(t)d(t)$$

$$\int_0^{M\ (Ax,Sz,a,qt,s)} \varphi\ (t)d(t) \geq \int_0^{M(Ax,Sz,a,t,s)} \varphi(t)d(t)$$

Hence Ax = Sz & Ax = Tx = Sz = Vz ------------- (vi)

(v) & (vi) Ax = Tx = By = Uy = Sz = Vz

 Suppose that there is a another point f such that Af = Tf then by (5) Af = Tf = By = Uy

So Af = Ax & w = Ax = Tx is the unique point of coincidence of A & T.

Now by the lemma w is only unique common fixed point of A & T.

Similarly $\alpha, \gamma \in X$ is unique common fixed point such that $\alpha = B\alpha = U\alpha$ & $\gamma = S\gamma = V\gamma$

Thus α is common fixed point of A, B, S, T, U & V. The uniqueness of the fixed point hold from (5) & (6).

Theorem 3.4

Let (X, M, *) be a complete fuzzy 3 metric space & let A, B, S, T, U & V be self mapping of X. Let the pairs {A, T} & {B, U} & {S, V} be owc. If their exist a q ∈ (0,1) & t ⋝ 0, s > 0 such that

$$\int_0^{M(Ax,By,a,qt,s)} \varphi(t)d(t) \geq \int^{M(Tx,Uy,a,t,s)\ *M(Ax,Tx,a,t,s)_*M\ (By,Uy,a,t,s)\ *\ M\ (Ax,Uy,a,t,s)} \varphi(t)d(t) \quad (7)$$

$$\int_0^{M(Ax,Sz,a,qt,s)} \varphi(t)d(t) \geq \int_0^{M(Tx,Vz,a,t,s)\,*\,M(Ax,Tx,a,t,s)\,*\,M(Sz,Vz,a,t,s)\,*\,M(Ax,Vz,a,t,s)} \varphi(t)d(t) \quad (8)$$

then there exist a unique common fixed point of A, B, S, T, U & V

Proof: Let points {A, T}, {B, U}, {S, V} be owc so that x, y, z ∈ X such that

Ax = Tx, By = Uy, Sz = Vz ---------(vii)

we claim   Ax = By

If not by (7)

$$\int_0^{M(Ax,By,a,qt,s)} \varphi(t)d(t) \geq \int_0^{M(Tx,Uy,a,t,s)\,*\,M(Ax,Tx,a,t,s)\,*\,M(By,Uy,a,t,s)\,*\,M(Ax,Uy,a,t,s)} \varphi(t)d(t)$$

$$\int_0^{M(Ax,By,a,qt,s)} \varphi(t)d(t) \geq \int_0^{M(Ax,By,a,t,s)\,*\,M(Ax,Ax,a,t,s)\,*\,M(By,By,a,t,s)\,*\,M(Ax,By,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M(Ax,By,a,t,s)\,*\,1\,*\,1\,*\,M(Ax,By,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M(Ax,By,a,t)} \varphi(t)d(t)$$

Therefore Ax=By, i.e. Ax = Tx =By=Uy --------- (viii)

Similarly by (8)

$$\int_0^{M(Ax,Sz,a,qt,s)} \varphi(t)d(t) \geq \int_0^{M(Tx,Vz,a,t,s)\,*\,M(Ax,Tx,a,t,s)\,*\,M(Sz,Vz,a,t,s)\,*\,M(Ax,Vz,a,t,s)} \varphi(t)d(t)$$

$$\int_0^{M(Ax,Sz,a,qt,s)} \varphi(t)d(t) \geq \int_0^{M(Ax,Sz,a,t,s)\,*\,M(Ax,Ax,a,t,s)\,*\,M(Sz,Sz,a,t,s)\,*\,M(Ax,Sz,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M(Ax,Sz,a,t,s)*1*1*M(Ax,Sz,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M(Ax,Sz,a,t,s)} \varphi(t)d(t)$$

Hence Ax= Sz i.e. Ax = Tx = Sz = Vz -----------(ix)

So by (viii) & (ix)

Ax = Tx =By=Uy = Sz = Vz

Suppose that there is a another point f such that Af = Tf then by (7) Af = Tf = By = Uy.

So Af = Ax & w = Ax = Tx is the unique point of coincidence of A & T.

Now by the lemma w is unique common fixed point of A & T.

Similarly $\alpha, \gamma \in X$ is unique common fixed point such that $\alpha = B\alpha = U\alpha$ &

$\gamma = S\gamma = V\gamma$

Thus α is common fixed point of A, B, S, T, U & V. The uniqueness of the fixed point hold from (7) & (8).

Corollary 3.5: Let (X,M,*) be a complete fuzzy -3 metric space & let A, B, S, T, U & V be self mapping of X. Let the points (A,T), (B, U) & (S,V) be owc. If there exist a point

q ∈ (0, 1) for all x, y, z, ∈ X & t > 0 s > 0such that

$$\int_0^{M\,(Ax,By,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{M\,(Tx,Uy,a,t,s)\,*\,M\,(Ax,Tx,a,t,s)\,*\,M\,(By,Uy,a,t,s)\,*M\,(By,Tx,a,2t,s)\,*\,M\,(Ax,Uy,a,t,s)} \varphi(t)d(t)$$
(9) (9)

$$\int_0^{M\,(Ax,Sz,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{M(Tx,Vz,a,t,s)*M(Ax,Tx,a,t,s)*M\,(Sz,Vz,a,t,s)*M\,(Sz,Tx,a,2t,s)\,*\,M\,(Ax,Vz,a,t,s)} \varphi(t)d(t)$$
(10) (10)

Then there exist a unique common fixed point of A, B, S, T, U & V

Proof:

We have

$$\int_0^{M\,(Ax,By,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{M\,(Tx,Uy,a,t,s)*M(Ax,Tx,a,t,s)*M\,(By,Uy,a,t,s)*M\,(By,Tx,a,2t,s)*M\,(Ax,Uy,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M\,(Tx,Uy,a,t,s)\,*\,M\,(Ax,Tx,a,t,s)\,*\,M\,(By,Uy,a,t,s)\,**\,M\,(Tx,Uy,a,t)\,*\,M\,(Uy,By,a,t,s)\,*\,M\,(Ax,Uy,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M\,(Tx,Uy,a,t,s)\,*\,M\,(Ax,Tx,a,t,s)\,*\,M\,(By,Uy,a,t,s)*M\,(Ax,Uy,a,t,s)} \varphi(t)d(t) \quad (11)$$

Similarly

$$\int_0^{M\,(Ax,Sz,a,qt,s)} \varphi\,(t)d(t) \geq \int_0^{M(Tx,Vz,a,t,s)*M\,(Ax,Tx,a,t,s)*M\,(Sz,Vz,a,t,s)*M\,(Sz,Tx,a,2t,s)*M\,(Ax,Vz,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M (Tx,Vz,a,t,s)*M(Ax,Tx,a,t,s)*M(Sz,Vz,a,t,s)*M(Tx,Vz,a,t,s)*M(Vz,Sz,a,t,s)*M (Ax,Vz,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M (Tx,Vz,a,t,s) * M (Ax,Tx,a,t,s) * M (Sz,Vz,a,t,s)*M (Tx,Vz,a,t,s) * M (Vz,Sz,a,t,s) * M (Ax,Vz,a,t,s)} \varphi(t)d(t)$$

$$\geq \int_0^{M (Tx,Vz,a,t,s) * M (Ax,Tx,a,t,s) * M (Sz,Vz,a,t,s)*M (Ax,Vz,a,t,s)} \varphi(t)d(t) \quad (12)\ (12)$$

therefore by (3), (4) & theorem 3.4 we gat A, B, S, T, U & V have common fixed Point.

Corollary 3.6: Let(X,M, *) be an complete fuzzy -3 metric space & let A, B, S, T, U & V be self mapping of X. Let the points (A,T), (B, U) & (S, V) be owc. If there exist a

point q ∈ (0,1) for all x, y, z, ∈ X & t > 0 such that

$$\int_0^{M(Ax,By,a,qt,s)} \varphi (t)d(t) \geq \int_0^{M (Tx,Uy,a,t,s)} \varphi(t)d(t) \quad (13)\ (13)$$

$$\int_0^{M (Ax,Sz,a,qt,s)} \varphi (t)d(t) \geq \int_0^{M (Tx,Vz,a,t,s)} \varphi(t)d(t) \quad (14)$$

Then there exist a unique common fixed point of A, B, S, T, U & V.

Proof:

The proof follows from corollary 3.5

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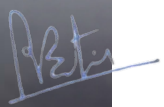
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Entrepreneurship in India

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Brief Contents

10

The Importance of Intellectual Property

Dr. Amit Kumar Marwah
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LEARNING OBJECTIVES

After reading this chapter, the reader should be able to:

1. Understand various aspects of Intellectual Property (IP),the stages of an invention cycle and the types of IPs,

2. Explain the process of obtaining a patent, what is patent infringement,

3. Explain trademarks and what is protected under trademark law, the process of obtaining a trademark,

4. Explain copyright, exclusions from copyright protection, how to obtain a copyright, what is copyright infringement, and copyrights & the Internet.

10.1 Introduction

The term Intellectual Property (IP) is not new. Knowingly or unknowingly people are dealing with any one of the Intellectual Property (IP) in their daily lives. Whether it is a novel one reads in the bus, or branded clothes one wears or the latest mobile phone in the market- IP is everywhere! And this makes it so valuable and worth

protecting. Specially, in present times, when the world is observing strong waves of innovation, and to ride these waves and to reap the benefits of the innovation and hard work involved in putting ideas to commercial use stage, an innovator or rather anybody should have an idea about the concepts of Patents, Trademarks, Copyrights and other forms of IP. This also ensures that the time, money and energy spent is fruitfully recovered till the benefits become open for use by all.

IP relates to original ideas or results that emanate from brainstorming or research, and generally it includes some critical business information. IP contributes enormously in the development of any nation's economy and society. The range of intellectual property is not limited to any field of engineering, literary artistic and even musical works.

Any thought or idea which is developed by anyone into new or creative work in any field comes under intellectual property. The legal rights with which person or entity protects his/her intellectual work or properties from being used or exploited are broadly termed as "Intellectual Property Rights" or IPR.

One might think that IPR is a recent buzz word but the first recorded reference to IPR dates to 500 BC. On 14th July 1967. World Intellectual Property Organization (WIPO) was established to protect IP throughout the world.

IPRs are recognized globally for the following reason:

- They provide incentive to the individual or an entity for new creations.
- They provide recognition to the creators and inventors behind the IP.
- They ensure the tangible reward for the IP.
- They endure and maintain the availability of the original products.
- They are important for economic growth and advancement in technology sector.

They are important for business growth in the field of technology.

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10.2 Stages of an Invention Cycle

It is a general assumption that IP protection is required only when the final product is ready. But this is a common misconception. IPR associated with the product life cycle can be classified into the following stages (as a typical invention cycle):

(*i*) Idea Stage

At the idea stage, an individual or a company can either file a Provisional Patent Application (PPA) or keep it a trade secret to safeguard an idea.

(*ii*) Research & Development Stage

This important stage of the invention cycle demands appropriate IP protection. Patents, trademarks, copyrights of design registration can be applied for.

(*iii*) Testing Stage

Since this the last stage before the product is launched, it is recommended to complete all the IP filings before the end of this stage. This ensures safeguarding of the product from the potential infringement before it is launched into the market.

(*iv*) Commercialization Stage

Once the product is available in the market, continuous monitoring of IP is needed. Also, use of innovation management strategies and IP commercialization tools becomes essential to get the best results.
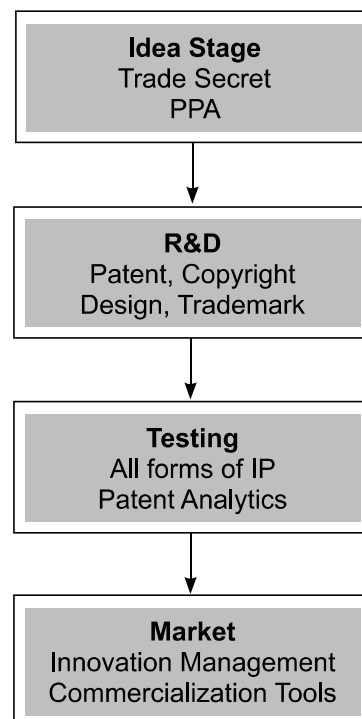
Fig. 10.1: Stages of an Invention Cycle

10.3 Types of Intellectual Property (IP)

Intellectual Properties (IPs) are broadly classified into two categories, namely:

1. Copyrights
2. Industrial Property

10.3.1 Copyrights

Copy right is the auto-generated Intellectual Property right. It provides protection to the creators in the field of literary, music or artistic work for a period of minimum 50 years. Rights related to copyright includes all the rights of performers (actor, musicians, and singers), rights of broadcasting organisation etc. The main reason behind protecting such works is to encourage creativity and intellectually stimulate the general public.

10.3.2 Industrial Property

Industrial property is further divided into two sections: one is information and second is innovation. Industrial property dealing with information section includes sign of products and services so that by seeing that sign the consumer may know about the product or services. If a mobile company is selling mobile having the sign of a bitten apple, then the consumer may get easily the name of that company by which the product was manufactured. For providing such protection industrial property 'Trademark' is used to identify and distinguish the product or service of
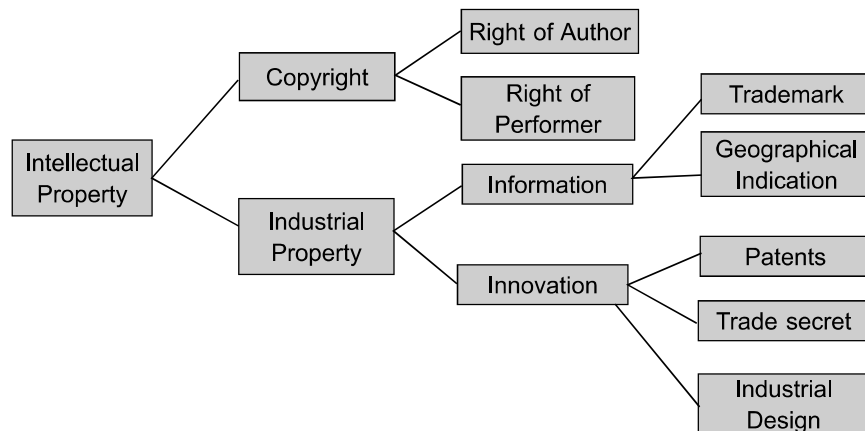
Fig. 10.2: Types of Intellectual Property

an entity from another; 'Geographical Indication 'indicates the particular area from where goods are manufactured or produced (e.g. Alphonso Mango has received Geographical Indication (GI) tag in October 2018).

Another division of Industrial property focuses on Innovation which includes Patents (e.g. a technical invention), Industrial Design (the rectangular design of an iPhone) and Trade Secrets (e.g. manufacturing process of Mc Donald Pizza).

The entire lot of IP can again be divided into 2 categories from business perspective:

(*i*) the limited life IP where the duration is limited after which it comes into the public domain and people can use it and

(*ii*) the unlimited life IP where it is not subjected to renewal, but it can be kept alive forever.

10.3.3 Brief Information about Major forms of IP

Patent is a statutory/legal right granted to a patentee for owning the right which prevents others either to make, use, sell, or import an invention for a limited period of time, usually up to 20 years if it fulfils the criteria of being new and non-obvious to an expert in the technology area, and has a utility or application (for example, any technological invention).

Patents can be of following three types:

(*i*) **Utility patent:** This patent may be granted to anyone who either invents or discovers any new and/or useful process, or a machine, or an article of manufacture, or any composition of matter, or does any new and useful improvement(s);

(*ii*) **Design patent:** This patent may be granted to anyone who invents a new or an original design for an article of manufacture; and

(*iii*) **Plant patent:** This patent may be granted to anyone who either invents or discovers and asexually reproduces any distinct or a new variety of plant.

Trademark is a common law right to protect a unique mark such a name, logo, or other form of visual identity which identifies goods or services offered by an entity (for example, the bitten apple logo of Apple Inc®).

Copyright is another form of IP which legally protects the original (either published or unpublished) works of authorship that are fixed in a tangible form. Copyright laws protect paintings, photographs, literary works, live performances, movies, and software (or example, rights over musical compositions, novels, paintings etc.).

A Geographical Indication (GI) is a sign which is used on products that either has a specific geographical origin or possess qualities or has a reputation due to that origin. Essentially, the GI tag provides an assurance of quality and uniqueness, attributed to the place of its origin (for example, Darjeeling tea, Nagpur oranges, Madhubani paintings, Kashmir pashmina, etc. and recently in October 2018 Alphonso Mango has received GI tag for Maharashtra).

Design registration is a legal right to protect a new and innovative design for an existing product. It provides protection to the visual and aesthetic aspect of a product (for example, unique shape of a phone or a car).

10.4 Who can Apply for a Patent?

According to patent law, a person who has invented a new product or design or implemented a new idea may apply/file for a patent, but with certain exceptions. For some of the cases if the inventor may not be able to apply then the application for the patent can still be processed. Following are some of the cases where the inventor is not able to apply for patent but still the application for the patent can be processed:

- if the inventor is deceased or incapacitated then the application for the patent may be processed by the legal administrator or the legal representative (e.g. Guardian).

- if more than two persons have invented a new creation then the application can be processed as joint inventors.

10.5 The Process of Obtaining a Patent

To encourage innovation and scientific research, use of new technology and for industrial progress the patent law is constituted in India. India is a member-state of Word Intellectual Property Organisation *(WIPO). WIPO*

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is an international organisation which is responsible for the promotion and the protection of IP throughout the world. In respect of patents, India is also a member of the following International Organisations and Treaties:

- World Trade Organization (WTO) (w.e.f. Jan. 1-1995).
- World Intellectual Property Organisation *(WIPO)* (since Jan. 1, 1995).
- Paris Convention for the protection of Industrial Property (w.e.f. Dec. 7, 1998).
- Patent Co-operation Treaty (PCT) (w.e.f. Dec. 7, 1998).
- Budapest Treaty (w.e.f. Dec. 17, 2001).

The various steps involved in obtaining a patent are as follows:

(*i*) Step 1: It is always recommended to conduct Prior Art search to check whether the invention is novel or not. After the search if it is found novel, then the applicant may proceed for filing the patent application. Who can file application is mentioned in article 2. based on the circumstances.

(*ii*) Step 2: The patent application along with provisional specifications or complete specifications may be filed at any of the following offices in India:

(*a*) **Mumbai Patent Office:** For Madhya Pradesh, Goa, Gujarat, Chhattisgarh, Maharashtra, Union territories of Daman, Diu, Dadar & Nagar Haweli.

(*b*) **New Delhi Patent Office:** For Jammu & Kashmir, Punjab, Rajasthan, Haryana, Himachal Pradesh, Uttar Pradesh, Uttaranchal, Delhi, and the union territory of Chandigarh.

(*c*) **Chennai Patent Office:** For Kerala, Andhra Pradesh, Karnataka, Tamil Nadu, and Union Territory of Pondicherry and Lakshadweep.

(*d*) **Kolkata Patent Office:** For Rest of India.

After successful passing through the patent office, an application number will be issued by the patent office. The applicant can track the status of the application using that application number.

(*iii*) Step 3: The patent office publishes the patent application in the official Patents Journal, published every week by the patent office on its website after the 18 months from the date of filling application or the date when the application is recommended to the check the novelty of the invention (whichever is earlier). On publication, the patent specification including drawings and deposits are available in the public domain.

(*iv*) Step 4: The application is then passed through the process of patent examination where it is allotted to the patent examiner who has a specialization in that particular field for which the invention is concerned. For this process the applicant has to fill the formal request with official fee within the 48 months from the date of filling application or the date when the application is recommended to the check the novelty of the invention (whichever is earlier).

(*v*) Presently in patent office there are four broad categories of the technical specification namely; (i) Chemistry and allied subjects (ii) Biotechnology, Microbiology and allied subjects (iii) Electrical & Electronics and related subjects (iv) Mechanical & other subjects.

(*vi*) Step 5: Within 1-3 months the First Examination Report is issued based on the procedural as well as patentability grounds.

(*vii*) Step 6: The application has to pass through the changes and the objections made in the step 5 by the applicant under next 12 month. If all the changes and objections are overcome then a patent is granted for the 20 years. If the required changes and objections are not overcome within the given time frame then the patent application could get rejected. A patent is granted only when the application has not been successfully opposed by the third party.

(*viii*) Step 7: Once the patent is issued, the applicant needs to maintain the patent by paying an annual renewal fee from third year onward till the life of the patent before patent office. It is compulsory to commercialise your patent within 36 months from grant of patent for which you need to submit a status of working of the patent periodically. In case the applicant does not submit the working of the patent as stipulated by the patent office, then the patent can be revoked by the patent office.

10.6 Patent Infringement

Under the Indian Patent Act 1970, there are no defined activities of the patent infringement; however, the act provides the protection rights to a patentee to exclude any other parties from selling, manufacturing, importing, using etc. It is an act of prohibition for the use of patented invention without permission from the patent holder. It can be therefore concluded that violation of the monopoly rights constitutes patent infringement.

As per the section 104(A) of Indian Patent Act (IPA), 1970 in a patent infringement suit, where

- The subject matter or content of a patent is a part of the process of obtaining a new product, or

- There is substantial likelihood that a identical product can be made by the patented process, and

- A patent holder or a person having the interest in the patent from him, has proved that the product is identical to the product that is obtained directly by the process which is patented.

In the above conditions if the patent holder, through the reasonable efforts, could not prove or establish that the infringer has actually use the process then the court may give directions to the defendant so as to prove that the process used by him/her to obtain the product, which is identical to the product obtained by the patented process, is altogether different from the patented process.

As per the section 47 of IPA 1970, there are following exceptions for the infringement and non-infringement activities:

- For government use

- For research work

- For supplying patented drugs to health institutes.

- Use of patented invention on foreign vessels

- Parallel import

- As a ground for defence

10.7 Types of Trademarks

Trademarks are one of the forms of Intellectual Property (IP). It is separately used for product & services. It is named as product trademark and service trademark as per the application. It is represented as ^{TM} with the name of product or services.

Following are the important functions of the trademark:

- It provides the exclusive right to the owner of the mark to use the mark to identify the product and services.

- It provides protection from making fraudulent use of trademarks.

- It provides protection from trademark infringement.

- It protects skills and intellect of any person or company.

A Trademark falls under different class based upon the goods manufactured and services offered. WIPO (World Intellectual Property Organisation) has administered The Nice Classification which is an international classification of goods and services. The 11th edition of the NCL which came into force on January 1, 2018, provides a comprehensive list of different classes of trademarks. There are total 45 classes of trademarks out of which 1 to 34 falls under the category of goods and 35-45 deals with services.

10.7.1 Various Classes of Trademarks

There are 45 different classes of the trademarks and each class categorizes what is protected under each class.

10.7.2 Trademarks Exclusions

One will be unable to obtain registration for trademarks which are not having any distinctive character.

- Trademarks which exclusively consist of signs or indications and which only designate the quality, quantity, kind, desired purpose, value or geographical origin of the goods or services to be traded under the mark will not be registered.

- Such signs will not be registered which exclusively indicate the time of production of goods or that of rendering of services.

- Trademarks which consist exclusively of signs or indications which are customary in the current language or in the bona fide and established trade practices will not be registered.

- Trademarks which exclusively consist of the shape resulting from the nature of the goods, or a shape which is needed to obtain a technical result or a shape which provides substantial value to the goods are also excluded from protection.

- Trademarks which are contrary to public policy or to the principles of morality, applications made in bad faith or trademarks which are to deceive the public with their nature, quality or geographical origin of the goods or service will not be registered.

However, if a trademark has acquired distinctiveness through its use, it will not be refused registration for the reasons in the paragraph above.

10.7.3 The Process of Obtaining a Trademark

Following is the process of obtaining a trademark:

Step 1: Once the mark has been finalized, it is recommended to conduct a trademark search to check availability and strengths of the mark.

Step 2: After a positive result the trademark application is filed before a appropriate trademark registry at the following Trademark offices in / India

(*a*) **Mumbai Registry:** For Maharashtra Madhya Pradesh & Goa.

(*b*) **New Delhi Registry:** For Punjab, Haryana, Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir, Union Territories of Delhi & Chandigarh.

(*c*) **Kolkata Registry:** For Bihar, Orissa, West Bengal, Assam, Arunachal Pradesh, Manipur, Mizoram, Meghalaya, Sikkim, Tripura, Nagaland and Andaman & Nicobar Island.

(*d*) **Ahmedabad Registry:** For Rajasthan, Gujarat and Union Territories of Daman, Diu, Dadra and Nagar Haveli.

(*e*) **Chennai Registry:** For Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, and Union Territory of Pondicherry and Lakshadweep island.

Step 3: Trademark registry office issued an application number and official receipt to applicant. Around 10-12 months will be taken to receive the

Examination Report. The applicant has to make necessary changes and objection suggested in examination report within 30 days of the reception of the examination report.

Step 4: After that the mark is published in the official Gazette of Trademark Registry. This is the opposition period of three month where the third party can oppose the mark from the date of publication.

Step 5: If the third party has no objection on the mark then the Trademark Registry Office will issue a registration certificate.

Trademark registration is valid for a period of 10 years and has to be renewed once the registration phase is over. After receiving the certificate, the applicant is eligible to use the symbol ^{TM}. The applicant has the right to use the symbol ® while processing through the registration process. However, there are certain rules to use the symbol ® such as:

1. It can only be used once the mark is registered and not while the application is pending.

2. It can only be used in connection with the goods and services listed in the trademark application.

3. It can only be used as long as the registration is alive and active.

10.8 Copyrights

Copyright is an auto-generated Intellectual Property (IP) but still it comes under some exceptions. The following three exceptions are allowed for the use of a work without seeking permission from the copyright holder and by paying fees:

- *Fair use:* If any copyrighted material is used by other than the author for the fair purpose then the other person does not need to take permission. A four-factor analysis method must be applied to each use to ascertain whether the use is fair or not.

    (*i*) The first factor caters to the character and purpose of the use of the work.

    (*ii*) The second factor calls for the creativity of the work. Creative works are given more protection than those which are factual in nature.

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(*iii*) The third factor considers the amount of the work that is being used. Generally, weightage in favour of fair use is given to a small amount of work where a large amount would be given more weightage in favour of requesting permission.

(*iv*) The fourth factor considers how the intended use of the work would impact the market for the work or the end use. Generally, the more restricted is the use, there will be less impact on the market.

• *Face to Face instructions:* In a traditional classroom with face-to-face teaching, the teacher or the instructor and the students of an (non-profit) educational institution are at the same place and the teaching and learning also takes place at the same time. In this type of arrangements all performances and displays of a work are allowed.

• *Virtual instructions:* Virtual instruction is when a course is delivered either fully online or when some parts of face-to-face instructions are taught online using learning management systems (LMS). Virtual instructions involve transmitting class materials to students via a digital medium.

10.8.1 What is Protected by a Copyright?

All the literary, dramatic, musical and artistic works and producers of cinematographs films and sound recording published or unpublished work are protected by Copyright Protection in India. Registration for copyright is not mandatory rather it is an auto-generated intellectual property right. However, it is advisable to register for the copyright. The copyrighted material is represented by the symbol ©.

The term or tenure of protection granted for copyright work varies and depends upon the work which is to be protected. Literary, musical or artistic works (other than photographs) are granted copyright protection for the period which covers the lifetime of the author and 60 year from the year in which the author dies. In case the work is not published or performed or offered for sale or broadcast to anyone, during the lifetime of the author, even then the copyright protection shall continue for the period of 60 years from the end of the year in which any of these acts are done relating to the works.

10.8.2 How to Obtain a Copyright?

Following are the steps to obtain a copyright:

Step 1: In India the copyright registry office is at New Delhi and applicant must apply in that office. It must contain a 'Statement of Particulars' (SoP) and 'Statement of Further Particulars' (SoFP). The application is processed with signature of the author himself or the advocate who is representing him and provided with the power of attorney.

Step 2: A filing number, a filing date and a receipt will be provided to the applicant by the copyright registry office after the application is accepted.

Step 3: For the period of 30 days the application undergoes through the process of objection by the third party. If there is any objection from the third party then a hearing will take place and the matter will be resolved during this period of 30 days.

Step 4: Next to this period the application is subjected to the examination phase if the there is no objection in step 4. If some corrections or changes are required in the application after the examination phase, then the applicant has given the period of 30 days to resolve it.

Step 5: After resolving the objections and the required changes, the Copyright Registry issues the registration certificate.

10.8.3 Copyright Infringement

Under the copyright Act the copyright owner is allotted with the exclusive right to protect his work and the process of using the copyrighted work without the permission of copyright owner is known as copyright infringement. There are three elements that must be needed in order for the infringement to occur.

1. A valid copyright should be possessed by the copyright holder.

2. The person who is allegedly infringing it must have access to the copyrighted work.

3. The duplication or copying of the copyrighted work should be outside the exceptions.

For copyright infringement the legal penalties are as below:

1. The infringer has to pay the actual amount of damages and profits.

2. A penalty in the range from $200 to $150,000 can be imposed for each work infringed.

3. The infringer has to pay for the attorney's fees and court costs.

4. The Court can issue an injunction to stop the infringing acts.

5. The Court can impound the illegal works.

6. The infringer can be sent to imprisonment.

10.8.4 Copyright & the Internet

Internet technology is developing quite faster than the laws that govern it. The legislation or the courts have established new laws that apply to the internet; copyright laws are among them. A very common myth about the internet is that any content that is posted online can be copied or downloaded. In reality, anything one browses on the internet is of equal potential of being protected by copyright as anything one sees in the library or any book shop.

CASES

Case - 1 (Benz)

Someone, selling undergarments in India, used the Benz Tristar logo. The authorities stopped it because the right holder has the right to use the mark in the way he or she wants. So, even if you are not working in those businesses, you can stop others from using it. You could also prevent people from using it. If it is a reputed mark, the exclusive set of rights on a patent related to the right to make, the right to sell the right to use, the right to offer for sale and the right to import an invention lies with the patentee.

1. Why Benz Tristar logo was prohibited to be used for an undergarments company, even though the businesses were different?

2. Are there any limitations related to the scope of use of logos?

3. What the undergarment company could have done, if it really wanted to use the Benz logo?

4. Can you cite any similar case?

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Case - 2 (Apple wins trademark case against Xiaomi)

Apple Inc has successfully prevented the Chinese smart phone maker Xiaomi, Inc from registering its "Mi Pad" tablet computer as a trademark in European Union on the grounds that the name was too similar to Apple's "iPad". The European Union's General Court, had given the decision that Mi Pad was not to be registered as a trademark because the similarity of the signs would confuse the consumers. Even though the iPads of both Xiaomi's Mi and Apple are both tablet computers, the court said that is not sufficient to consider the dissimilarity between the signs, resulting from the presence of the additional letter 'M' at the beginning of Mi Pad, and a high degree of visual and phonetic similarity between the two signs still remains.

In 2014, Xiaomi filed an application with the Intellectual Property Office of the European Union (EUIPO) to register Mi Pad under an EU trademark. Subsequently, Apple lodged a complaint which was upheld by EUIPO in 2016 on the basis that consumers might think Mi Pad was a variation on Apple's iPad trademark. The court agreed with the decision of EUIPO and conveyed that English-speaking consumers would most likely understand the prefix "Mi" as meaning "my" and therefore could pronounce the "i" of Mi Pad and iPad in the same manner.

(Source: https://telecom.economictimes.indiatimes.com/news/apple-wins-trademark-case-against-xiaomi/61941109)

(a) Can two similar sounding signs be registered in different countries?

(b) Suggest your views against the act by Xiaomi.

(c) If you were a patent attorney representing Xiaomi, what would be your strong points?

(d) Can you discuss any similar case?

Questions for Self Assessment

1. What is the term of a Patent in India?

(*i*) 5 years   (*ii*) 10 years

(*ii*) 15 years   (*iv*) 20 years

2. Which one of the following cannot be protected by Intellectual Property Rights?

   (*i*) A book on mathematics   (*ii*) A program code in C++

   (*iii*) Lyrics of a song   (*iv*) A new product

3. A patent can be granted if the invention is

   (*i*) Novel   (*ii*) Non-obvious

   (*iii*) Capable of industrial applicability

   (*iv*) All of the above

4. Patent Amendments Acts were carried out in the following year

   (*i*) 1996   (*ii*) 2000

   (*iii*) 2002   (*iv*) 2008

5. Which of the following inventions can be patented as per Section 3 of the Patents Act, 1970?

   (*i*) A method of treating human beings from diabetes

   (*ii*) A topography of integrated circuits

   (*iii*) A human made microorganism

   (*iv*) A perpetual motion machine

6. Which among the following form is used for application for grant of patent

   (*i*) Form 1   (*ii*) Form 2

   (*iii*) Form 3   (*iv*) Form 4

7. In the case of application where the complete specification is filed directly, the priority date for such applications

   (*i*) Date on which the provisional application was filed

   (*ii*) Date on which the patent application for a divisional application was filed

   (*iii*) Date on which the complete specification was filed

   (*iv*) All of the above

8. Once the Controller publishes the notice of a surrender of patent, any person interested may, within _____ give notice of opposition to the Controller

(*i*) 1 month   (*ii*) 2 months

(*iii*) 3 months   (*iv*) 4 months

9. An invention capable of industrial application means that the invention is capable of

(*i*) Being assembled in an industry

(*ii*) Being imported by the industry

(*iii*) Being exported by the industry

(*iv*) Being used in the industry

10. An applicant, originally a resident from Mumbai, now residing in USA and runs his Business in USA, files an application in India through a law firm based in Delhi. The applicant's appropriate office for submitting the application is

(*i*) USA   (*ii*) Mumbai

(*iii*) Delhi   (*iv*) Chennai

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Sub-Terahertz MIMO Array Antenna for Future Wireless Applications

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Abstract— In the era of wireless communication, requirement of wireless devices are increasing rapidly. To fulfil the demand of services like as video conferencing, real time data transmission, internet of things (IOT), high bandwidth and high data rate are required so for the future wireless communication sub-terahertz frequency band is going to play an important role because it provides large bandwidth and high data rate upto 10 Gbps so for the future wireless applications 2×4 MIMO array antenna design is proposed, this design resonates at 0.281 and 0.282 THz as well as for the transmission capability CCL and TARC is also discussed.

Keywords-Sub-THz, MIMO antenna, 0.1-0.3 THz, CCL, TARC, Microstrip Patch Antenna.

I. INTRODUCTION

The wireless communication is the current hot topic of the current and future generations of the antenna designs for the transmit and receive operations [1]. The 4G is able to provide voice and data upto certain extent, but unable to cooperate with the large bandwidth and more than 1 Gbps data rates [2]. 5G technology can provide high data rate services of more than 1 Gbps and has solution of increasing demand of wireless users due to wide frequency bands. 5G has very low latency in comparison with the 4G [3]. But, for object/substance detection, aviation, defense, agriculture, and medical fields/sciences especially in detection of infected tissues, large bandwidth, very high spectral efficiency, high data rate, very large capacity are required [4].

As multimedia, video calling, and other real time services are demanding bandwidth on demand (BOD) and voice on demand (VOD) wireless applications, therefore, need of high capacity for these wireless devices is also increasing rapidly [5-8]. In this case 4G technology is not sufficient to provide that much high data rate, so the large bandwidth range is to be allocated. Such demand of the bandwidth and capacity has been slightly compromised with the fifth generation (5G) frequency [9].

5G communication can provide traffic capacity upto 10 Mb/s, and sub sub-terahertz communications can provides up to 1–10 Gb/s so Beyond 5G communications, sub terahertz communications can be a good choice for connectivity of devices and network [10]. Sub-THz region is covered from (0.1–0.3) THz [11] sub terahertz band is helpful to provide high-speed data transmission within a short range [12]. Sub

terahertz technology can be extended to THz technology, as THz frequency band lies between 0.1-10 THz so it can provide large bandwidth results high data rate, THz technology has a vast application horizon like detection of chemical substances in explosives, drug detections, imaging and spectroscopy [13], environmental pollution monitoring [14], directional communication links, satellite communications, and heterogeneous networks [15] as well as non-ionizing property of THz help in detection of infected tissues [16]. Compactness of antenna with high efficiency is a major challenge, there is a major advantage of sub terahertz that with the increasing the frequency antenna achieves compactness in size. Antenna can be design in two way one is SISO (Single input single output) and other is MIMO (Multiple input multiple output), as SISO has drawback of limited channel bandwidth, and fading issue MIMO antenna design is preferable [17].

Nanoribbon antenna was designed using Graphene on silicon di oxide, in this antenna inset feed introduced and this antenna was operating at a frequency of 0.585 THz [18]. An antenna was operating in frequency band 0.290 - 0.316 THz, this antenna occupies the size of 20×3.5×0.126 mm^3, in this design periodic array was selected with 15 radiating elements on polycarbonate layer, this antenna achieved 11.71 dBi gain and 70.8% radiating efficiency [19]. Another sub terahertz antenna was designed 294 - 410 GHz with gain of 5.14 dBi, as a modification 1×4 elements was selected to enhancement in gain of 13.6 dBi [12]. Gold-based radiating element based antenna was designed on silicon substrate with the height of 600μm, this antenna was fabricated in 1×4 array [20]. Deoxyribonucleic Acid shape of radiating element was selected to resonate in sub-terahertz band (0.22-0.32 THz) and terahertz (1.38–2.89 THz), partial ground was introduced for the impedance bandwidth enhancement [21].

II. ANTENNA DESIGN

2×4 MIMO antenna is proposed for sub terahertz frequency band, this antenna occupies the size of 2348.18×1200 μm^2, proposed design is shown in figure 1(a) and cross section view is shown in figure 1(b). Elliptical radiating element have the advantages of better return loss, good directivity and radiation pattern so this shape is selected to construct on Polyimide substrate (ε$_r$=3.5, tanδ=0.0027, h=80.8 μm) as well as inset feed is used for the impedance matching.

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Isolation is important factor for improving antenna performance parameter, for the isolation improvement a rectangular slot is introduced on the ground side. All dimensional parameters are given in table I.

<div align="center">TABLE-I
DIMENSION OF PROPOSED ANTENNA</div>

Parameter	Value (μm)	Parameter	Value (μm)	Parameter	Value (μm)
sl	2348.18	sh	80.8	R3	109.2
sw	1200	gh	1.9	cl	105.83
feedl	252.95	R1	118	cw	10.7
feedw	15	R2	126	slotw	80
rx	613.17	ry	155.55	Rx	155.5
Ry	817.5				
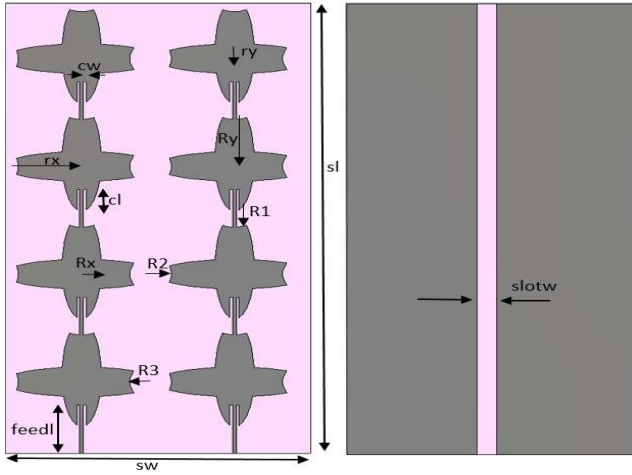
Fig. 1(a). Schematic diagram for proposed MIMO antenna
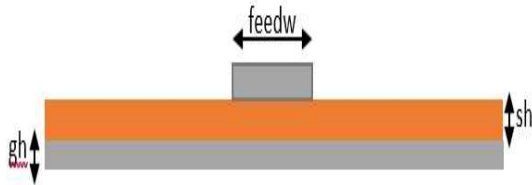
Fig. 1(b). Cross sectional view for proposed MIMO antenna

III. RESULT AND DISCUSSION

A. Return loss and isolation

Inset feed is used in the design for the impedance matching so proposed MIMO array antenna resonate at 0.281 THz and 0.282, S_{11} and S_{22} is shown in figure 2. In MIMO configuration radiating elements are fabricated in a close distance to maintain the compactness of system but due this mutual coupling

affects the antenna performance. To decrease the effect of mutual coupling, isolation is improved so after the rectangular slot is cut from the ground -20 dB isolation is achieved. S_{12} and S_{21} is shown in figure 3.
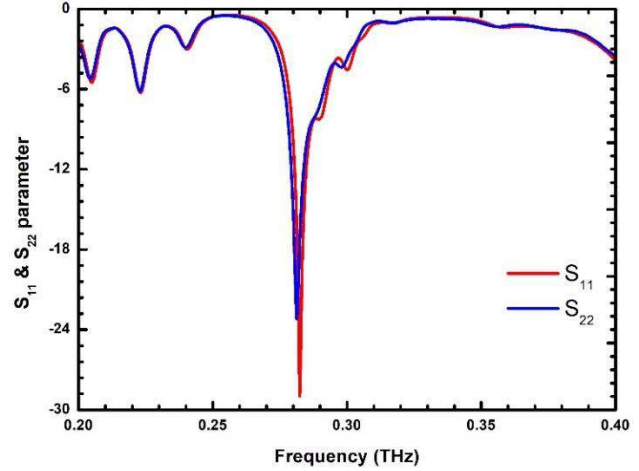
Fig. 2. S_{11} and S_{22} parameter for proposed MIMO antenna
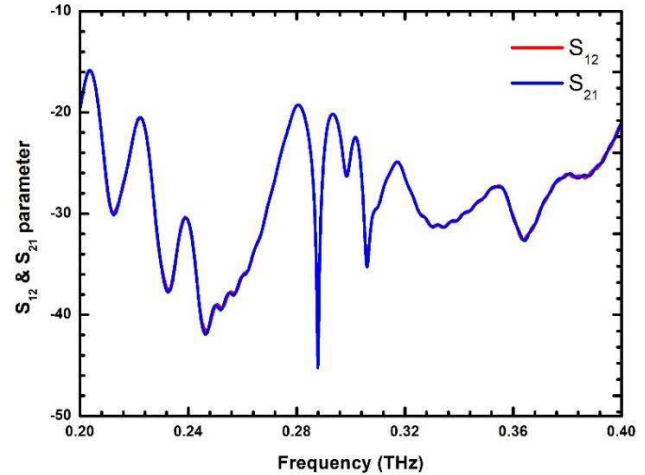
Fig. 3. S_{12} and S_{21} parameter for proposed MIMO antenna

B. Gain and efficiency

In the design three circle is cut from each of the side of elliptical patch, and array is formed with 4 radiating element in later modification MIMO configuration is used so the gain is achieved 9.7 dBi and radiating efficiency 90.2% at 0.281 THz and 89.1% at 0.282 THz. Response of gain and efficiency is shown in figure 4 and 5.

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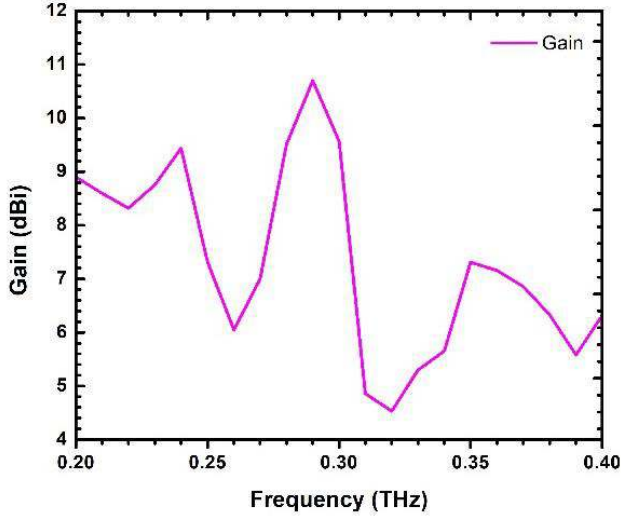
Fig. 4. Gain for proposed MIMO antenna
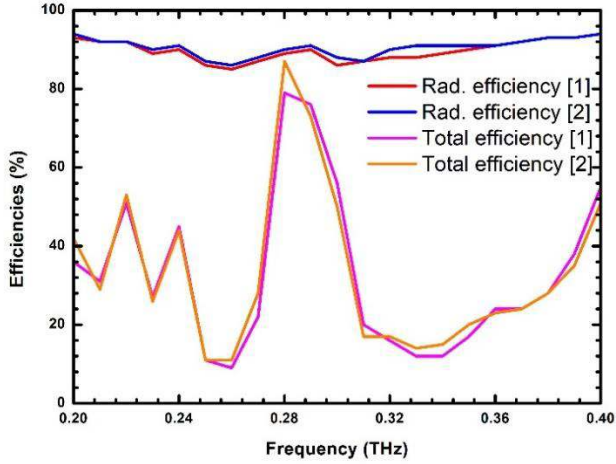
Fig. 5. Efficiencies for proposed MIMO antenna

C. Channel capacity loss (CCL)

When the transmission is occurred, there are some losses, so these losses are calculated by channel capacity loss (CCL) and it is represented in bits/s/Hz and the standard value of CLL is less than 0.4 CCL is given by equation 1 [22].

$$CCL = -\log_2 Det(\phi^R) \quad (1)$$

where,

$$\phi^R = \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix}$$

$$\phi_{11} = 1 - (|s_{11}|^2 + |s_{21}|^2)$$

$$\phi_{22} = 1 - (|s_{22}|^2 + |s_{12}|^2)$$

$$\phi_{12} = s^*_{11} s_{12} + s^*_{21} s_{22}$$

$$\phi_{22} = s^*_{22} s_{21} + s^*_{12} s_{11}$$

0.052 bits/s/Hz CCL is obtained at resonating frequency, response of CCL is shown in figure 6.
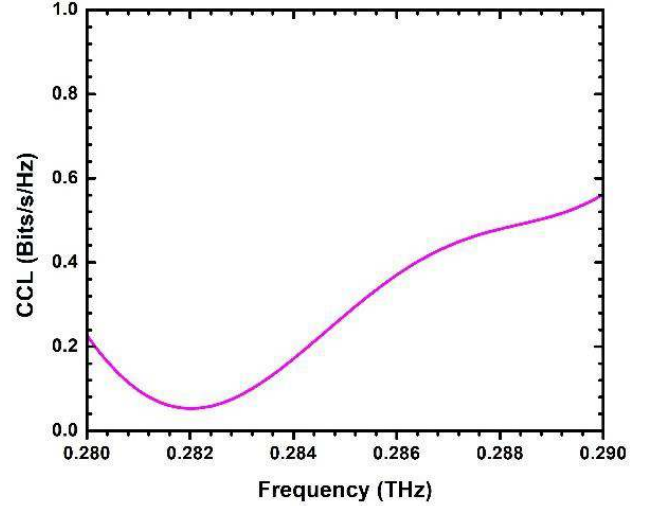
Fig. 6. Channel capacity loss for proposed MIMO antenna

D. Total active reflection coefficient (TARC)

Total active reflection coefficient (TARC) is also known as return loss of whole MIMO antenna array, TARC is affected by mutual coupling and phase of wave and it is given by equation 2 [23, 24].

$$\Gamma_a^t = \frac{\sqrt{\sum_{i=1}^{N} |b_i|^2}}{\sqrt{\sum_{i=1}^{N} |a_i|^2}} \quad (2)$$

where, excitation vector and scattering vector is denoted by a_i and b_i respectively.

Overall TARC is given by equation 3

$$\Gamma_a^t = \frac{\sqrt{|S_{ii} + S_{ij} * e^{i\theta}|^2 + |S_{ji} + S_{jj} * e^{i\theta}|^2}}{\sqrt{N}} \quad (3)$$

where, θ is phase angle between two ports.

At resonating frequency, TARC -5.97 dB is obtained and response is shown in figure 7.

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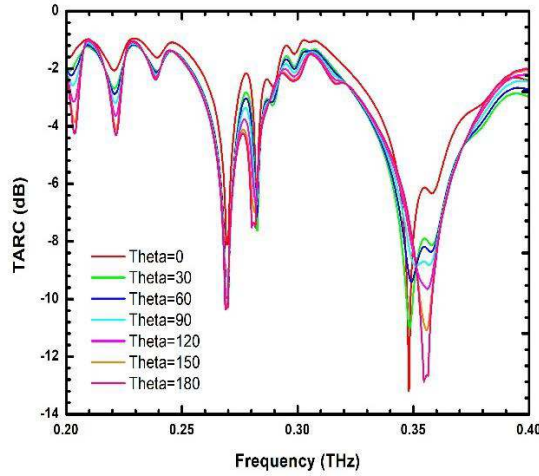
Fig. 7. Total active reflection coefficient for proposed MIMO antenna

E. Radiation pattern

Main lobe magnitude of E-field is obtained 24.2 dB V/m and -27.2 dB A/m for H field, MIMO array antenna shows main lobe direction 3^0 and 8^0 as well as beamwidth 30.3^0 and 61.8^0 is achieved for E field and H field respectively. Normalized E-field and H-field radiation pattern at resonant frequency shown in figure 8 and figure 9.
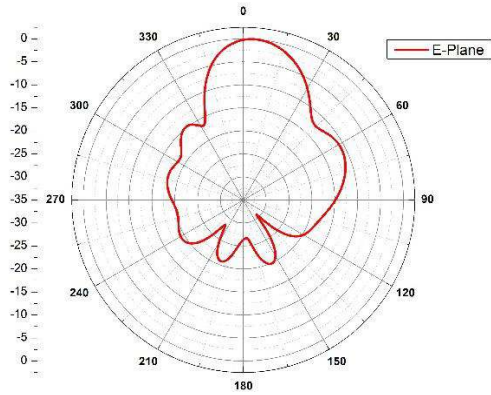
Fig. 8. Normalized E-Field for proposed MIMO antenna
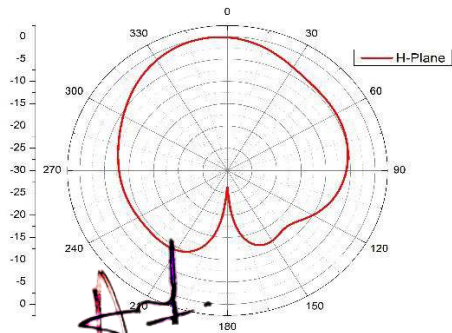
Fig. 9. Normalized H-Field for proposed MIMO antenna

TABLE II
COMPARISON OF THE PROPOSED ANTENNA WITH
AVAILABLE REFERENCES

Ref	Freq. (THz)	Size (μm^2)	Efficiency (%)	Gain (dBi)	CCL (bits/s/Hz)	TARC (dB)
[12]	0.294-0.410	1122×188	89%	9.6	-	-
[19]	0.292-0.294	20000×3500	70.8	11.71	-	-
[20]	0.75-1.10	2000×1000	> 70	> 10	-	-
[21]	0.22-0.32, 1.38-2.89	500×400	-	< 4 (<1 THz), 9.03 (2.71 THz)	-	-
Proposed work	0.281, 0.282	2348.18×1200	89.1, 90.2	9.7	0.052	-5.97

IV. CONCLUSION

MIMO array antenna is suitable for gain enhancement as well as improving to reduce the effect of fading and channel limitation, proposed antenna achieves 9.7 dBi gain at 0.282 THz and -20 dB S_{12} and S_{21} as well as CCL is obtained 0.052 bits/s/Hz and -5.97 dB TARC so this antenna is suitable for future sub-terahertz wireless applications.

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Ultra Wideband MIMO Antenna Design with High Isolation for THz Application

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Abstract— **In this paper, antenna designed is proposed for Ultra wideband 2×2 MIMO antenna design with high isolation for THz application, it is designed using rectangular shape radiator with a cut of circular shape and occupies the size of 133×255 μm^2 which provide -10 dB impedance in 5.5 to greater than 10 THz frequency band as well as it is discussed the method to achieve better isolation, this design shows isolation parameter -66.27 dB (S12) and -69.6 dB (S21) at 8.19 THz. For the suitability of antenna for communication system CCL and TRAC is also calculated which are in acceptable limit.**

Keywords-THz, MIMO antenna, 0.1-10 THz, isolation technique,CCL, TRAC, Microstrip Patch Antenna.

I. INTRODUCTION

Unallocated frequency band of 0.1-10 THz has higher capacity of transferring data at high rate upto 10 Gbps, so the wireless application can accommodate THz technology for future communication systems[1]. Many materials shows the properties of absorption at THz frequencies so due to this feature THz frequencies can penetrates non-metallic and non-polar materials so THz technology helps in spectral analysis of material [2]. THz possess low photon energy so THz radiation may not be the cause of harmful ionization in living tissue so it can be a safe alternative to X ray [3,4].

For the application in the area of detection and identification of concealed weapons, explosives, illicit drugs [5-7]. video rate imaging system[8], homeland defence applications [9], THz frequency regime can be a interesting area to explore. Data transfer rate of communication systems can be increased with the help of THz frequency band but signals are affected by interference and multipath fading. To avoid such issue MIMO (Multiple input multiple output) configuration is used to design antennas, apart of improvement over fading issue, it provides good channel capacity as well [10].

In MIMO architecture multiple radiating elements are designed in compact area so it is required to put radiating elements close to each other now in this situation radiating elements are suffered from mutual coupling which affects antenna performance [11]. Increasing isolation between radiating elements are the solution for minimizing mutual coupling, orthogonally positioning, parasitic structures,

neutralisation-line, shorting pin, loading slots are some techniques which helps to reduce mutual coupling between radiating elements [12-15].

For the pattern diverstiy and high isolation, superwideband MIMO antenna was designed to cover 3.1 THz to more than 60 THz with high isolation of 30dB with four arm windmill shaped radiating structure and it was based on FR-4 epoxy substrate (ε_r=4.4, tan δ=0.02), for the pattern diversity and high isolation radiating elements were placed orthogonally [16]. To avoid the performance loss due to discontinuity at the joint of feed line and radiating patch THz MIMO antenna was designed using proximity coupling feed [17]. For the adjustable radiation pattern and increase channel capacity, Graphene superstrate layer was used as a radiating patch for THz antenna design[18]. For the directional radiation and WBAN application 2×2 MIMO THz antenna was designed in which rectangular patch was used to resonate at 8.8 THz with the bandwidth or 40 GHz and [19]. Tetradecagonal Ring Shaped radiating elements and semi-circular ground plane are used to design THz MIMO antenna which operated on 0.3-15.1 THz [20]. High Gain Super-Wideband THz antenna has reported in which elliptical shape radiating elements was used, for improvement in isolation L-shape stub was introduced in ground plane, this antenna was operated in 0.33-10 THz frequency band [21].

II. ANTENNA DESIGN

A MIMO antenna is proposed, which occupies the size of 133×255 μm^2 on Polyimide substrate (ε_r=3.5, tanδ=0.0027), antenna design is shown in figure 1(a). This antenna system is modification of SISO architecture where rectangular shape is applied for the antenna by whose length and width are find using equations (1) and (2) [22], where Graphene layer is sandwiched between two dielectric material first is Alumina and second is Silicon and for the excitation to radiating element proximity feed is used shown in figure 1(b). As SISO suffers from propagation fading, to overcome this issue antenna is modified in 2×2 MIMO configuration and a circular shape is cut from the radiating patch to achieve high bandwidth, this shape is selected by the given

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equation (5) [23], these elements are identical in shape and dimensions.

$$W = \frac{v_0}{2f_r}\sqrt{\frac{2}{\varepsilon_r+1}} \qquad (1)$$

where v_0 is free space velocity of light, ε_r dielectric constant, f_r is resonant frequency.

$$L = \frac{v_0}{2f_r\sqrt{\varepsilon_{reff}}} - 2\Delta L \qquad (2)$$

where ε_{reff} is effective dielectric constant, f_r is resonant frequency, ΔL is extension of length is given by equation (3)

$$\frac{\Delta L}{h} = 0.412\frac{(\varepsilon_r+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_r-0.258)\left(\frac{W}{h}+0.8\right)} \qquad (3)$$

h = height of substrate

$$\varepsilon_{reff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left[1+12\frac{h}{W}\right]^{-1/2} \qquad (4)$$

$$R = \frac{F}{\sqrt{1+\frac{2h}{\pi\varepsilon_r F\left[ln\left(\frac{F\pi}{2h}\right)+1.7726\right]}}} \qquad (5)$$

where

$$F = \frac{8.791\times10^9}{f\sqrt{\varepsilon_r}} \qquad (6)$$

All dimensional parameter are given in table I

(a)

(b)
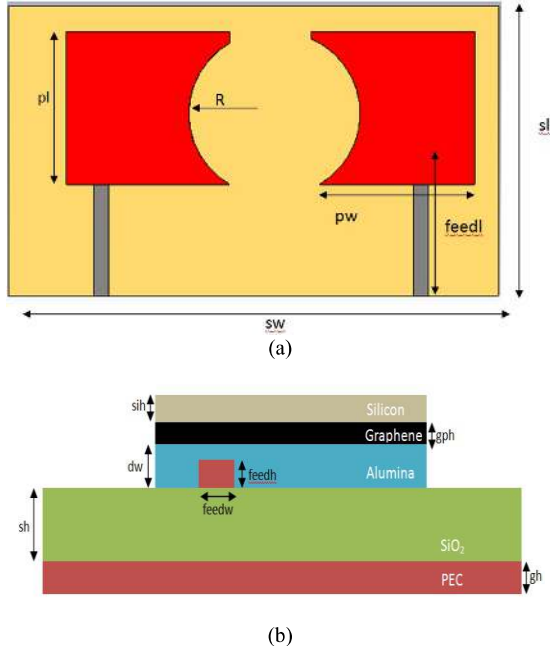
Fig. 1. Schematic views of the proposed design (a) Front view (b) cross sectional view

Parameter	Value (µm)	Parameter	Value (µm)
sl	133	sh	3.15
sw	255	gh	0.47
pl	70	gph	0.003
pw	70	feedh	0.47
feedl	69	dw	5.01
feedw	6.45	sih	0.19
R	37.5		

III.   RESULT AND DISCUSSION

A. Return loss and isolation

Proposed MIMO antenna is resonate in the frequency band 5.5 THz to greater than 10 THz, response of return loss S11 and S22 is shown in figure 2. When the antenna was designed as simple rectangular stack patch at this level return loss was not good but when patch is modified by circularly notch then it is found that S11 is -50.9 at 6.19 THz and S22 is -54.95 at 7.49 THz, overall return loss was better than -10 dB in whole band. As radiating elements are placed closely in compact area, so to reduce mutual coupling radiating patch are placed as opposite faced patch due to this technique isolation are -66.27 dB (S12) and -69.6 dB (S21) at 8.19 THz, overall isolation is achieved better than -25 dB in whole operating band, Isolation parameter S12 and S21 are shown in figure 3.

Fig. 2. S11 and S 22 parameter

TABLE-I
DIMENSION OF PROPOSED ANTENNA

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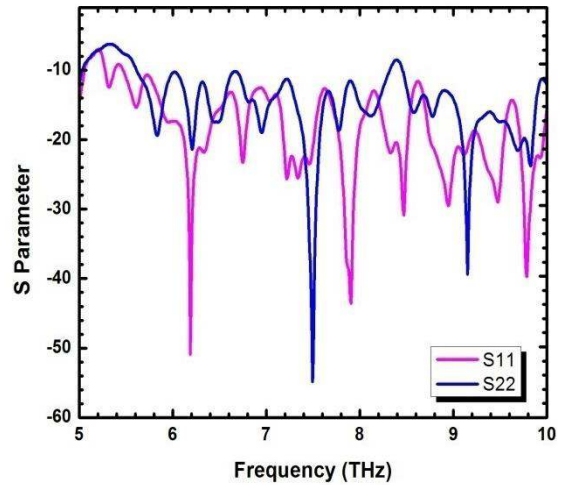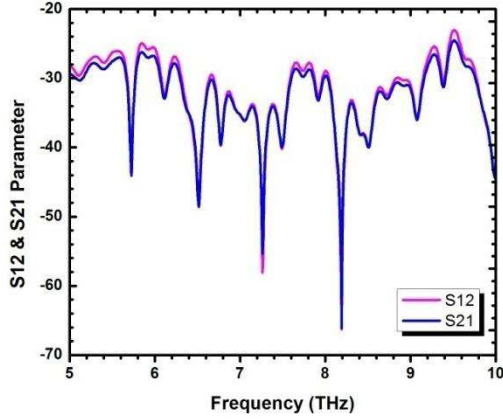
Fig. 3. *S*12 and S21 parameter

B. Gain and efficiency

Antenna provides better results in term of gain and efficiency, maximum gain is achieved 9.14 dBi at 6.25 THz and maximum efficiency is 88.7 % at 6.75 THz. Gain and efficiency is better than 5 dBi and 80 % respectively in whole band, parameters are shown in figure 4 and 5.
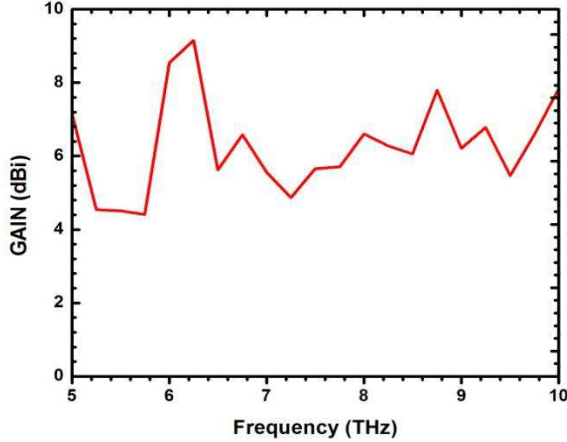
Fig. 4. Gain
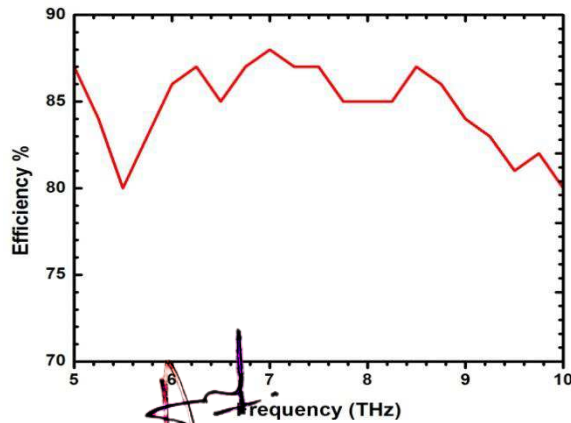
Fig. 5. Efficiency

C. Channle capacity loss (CCL)

CCL is a parameter which define the performance in term of that communication is being completed without any loss [19] and it is given by the equation (7)

$$CCL = -\log_2 \text{Det}(\phi^R) \qquad (7)$$

where

$$\phi^R = \begin{bmatrix} \phi_{11} & \phi_{12} \\ \phi_{21} & \phi_{22} \end{bmatrix}$$

$$\phi_{11} = 1 - (|s_{11}|^2 + |s_{21}|^2)$$

$$\phi_{22} = 1 - (|s_{22}|^2 + |s_{12}|^2)$$

$$\phi_{12} = s^*_{11} s_{12} + s^*_{21} s_{22}$$

$$\phi_{22} = s^*_{22} s_{21} + s^*_{12} s_{11}$$

Antenna shows minimum CCL 0.0072 bits/sec/Hz at 7.47 THz. CCL is maintained lesser than 0.2 bits/sec/Hz in whole operating band so this antenna can provide communication with maximum throughput, CCL is shown in figure 6.
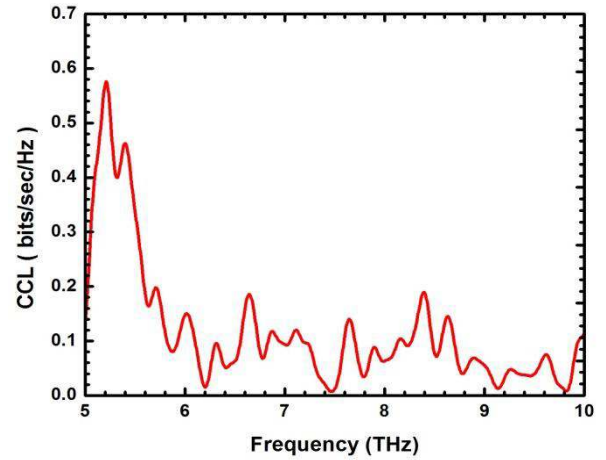
Fig. 6. Channel capacity loss

D. Total active reflection coefficient (TARC)

It is a degree of performance of antenna, it is defined as ratio between total incoming power to the total outgoing power, so for the better performance it should be zero or less than zero [19]. TRAC is given by equation (8) [24].

$$\Gamma_a^t = \frac{\sqrt{\sum_{i=1}^{N} |b_i|^2}}{\sqrt{\sum_{i=1}^{N} |a_i|^2}} \qquad (8)$$

where a_i is excitation vector, and b_i is scattering vector. further TRAC can be calculated by equation (9)

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$$\Gamma_a^t = \frac{\sqrt{|S_{ii}+S_{ij}*e^{i\theta}|^2+|S_{ji}+S_{jj}*e^{i\theta}|^2}}{\sqrt{N}} \qquad (9)$$

where θ is phase angle between two ports.

Proposed antenna design shows good performance in term of TRAC, and it is maintained below zero dB in whole operating band, response of TRAC is shown in figure 7. Therefore it is considered that this design has least amount of unwanted reflected power.

Experimental results are compared with the reference in the literature review as shown in table II
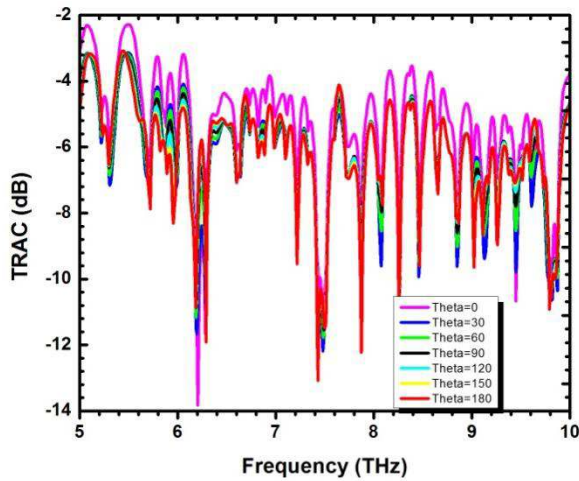
Fig. 7. Total active reflection coefficient

TABLE II
COMPARISON OF THE PROPOSED ANTENNA WITH
AVAILABLE REFERENCES

Ref.	Operating frequency (THz)	Antenna size (μm²)	Substrate	Gain (dBi)	CCL	TRAC (dB)
[16]	3.1 - More than 60 THz	110×155	FR-4	12	< 0.01	---
[17]	1.76 - 1.87	60×40	silicon dioxide	---	---	---
[18]	1.1	380×380	Pyrex	8.28	----	----
[19]	8.8 THZ	36× 35	RT/Duriod6010	8.2	0.2777	-13.8
[20]	0.3-15.1	800×1220	---	----	< 0.2	---
[21]	0.33-10	1000×1400	RT5880	19	0.25	< 30 dB
Proposed	5.5- more than 10 THz	133×255	Polyimide	9.14	0.0072	-13.82

IV. CONCLUSION

This antenna occupies the size of 133×255 μm² in MIMO configuration which provide a large bandwidth of 5.5 - greater than 10 THz. as large bandwidth can provide large amount of data rate as required in the communication system

CCL is a important parameter so this antenna provides less than 0.2 bits/s/Hz and TRAC better than 0 dB so this antenna is suitable for high speed communication systems.

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Graphnen based multiband stack patch THz antenna with proximity feed

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Abstract— **In this paper, antenna design of size 130 X 130 μm² is proposed for multiband THz applications, antenna is designed using two dielectric material and feed is used as proximity feed which results multiple resonant frequency in the frequency band 5-10 THz also it is analyzed impact of different substrate material on gain. This antenna achieves maximum gain of 9.19 dBi at 9.88 THz.**

Keywords—THz, proximity coupled feed, stack path, square shape patch

I. INTRODUCTION

As the demand of wireless communication system is increasing rapidly and it is affecting the life style in term of video calling, voice on demand (VOD), and internet of things (IOT). Current wireless communication technology suffers from low bandwidth inefficient spectrum utilization, interference and low data rate [1-2], to fulfill the quality of services in wireless communication THz communication technology is a promising candidate, as it has a potential of high bandwidth so it can transmit information at high data rate with low interference. The 0.1-10 THz electromagnetic spectrum has been allocated to THz communication [3-5]. Apart of these advantage, THz communication has non-ionic high frequency range [6] due to which human tissue does not suffers from chemical reactions and it can be utilized in medical application like detection of infected tissues [7].

The 0.1-10 THz frequency range has the capability to detect substances like 0.5-3 THz band identifies different chemical substances like aspirin soluble can be detected at 1.38/3.26 THz [8], same as aspirin caplets can be detected at 1.4/2.24 THz [9], as well as it is useful to detect the composition of explosives at 5-10 THz like Ammonium Nitrate (NH_4NO_3) at 4/7 THz respectively [10] and Trinitrotoluene (TNT) at 5.6/8.2/9.1/9.9 THz [11].

The copper is most versatile material as radiators in antenna structures but is has low electron mobility and it shows the ohmic losses at higher frequencies which results of low radiation efficiency, so it is required to choose right material for the antenna structure at THz frequency band.

The Graphene is a light weight and nano-film material but it has higher electron mobility 15,000 $cm^{-2}v^{-1}s^{-1}$, carrier density 2×10^{11}. Due higher electron mobility Graphene is considered as good conductor at THz frequency band, its surface conductivity can be find by the equation (2) [12].

$$\vec{J} = \sigma\,\vec{E} \qquad (1)$$

where J = current density, σ = surface conductivity, E = electric field intensity.

$$\sigma\left(i\omega, \Gamma, \mu_c, T\right) = -j\frac{q_e^2(w+j2\Gamma)}{\pi\,\hbar^2}\left[\frac{q_e^2}{(w+j2\hbar)}\int_0^\infty \varepsilon\left(\frac{\partial f_d(\varepsilon)}{\partial\varepsilon} - \right.\right.$$

$$\left.\left.\frac{\partial f_d(-\varepsilon)}{\partial\varepsilon}\right)d\varepsilon - \int_0^\infty \frac{f_d(-\varepsilon)-f_d(\varepsilon)}{(w+j2\Gamma)^2 - \left(\frac{4E}{h}\right)^2}d\varepsilon\right] \qquad (2)$$

where ω = Angular frequency, Γ = electron scattering rate; $\tau = relexation\ time = \frac{1}{2\Gamma}$, T = room temperature, f_d= Fermi - Dirac distribution function.

$$f_d(\varepsilon) = \left(1 + e^{\frac{\varepsilon+|\mu_c|}{K_B T}}\right)^{-1} \qquad (3)$$

where K_B = Boltzman constant, μ_c= Chemical potential, $\hbar$ = Reduced plank constant

The various antenna designs for THz frequency bands have been reported, An antenna system based on hexagonal patch and a pulse shape slot was discussed for 2.14 THz and 5.41 THz frequencies this antenna occupies size of 25.8 X 34 μm² [13]. With the -50.78 dB return loss an antenna was designed by using circular patch and triangular substrate which resonates at 7.32 THz [14], 85 X 120 μm² size Graphene sheet was used to construct antenna system to resonate at 1.24 THz, here combination of Copper and Graphene was used, to reduced cross polarization level Graphene layer was applied below the metal radiator and this antenna system achieve 69 % radiation efficiency [15].

A slot was made in Graphene patch antenna to achieve dual-bands characteristics at 1.96 THz and 4.83 THz for THz applications. It was constructed on Silicon-dioxide (ε_r = 3.9, tanδ = 0.001) thickness of 30 μm [16]. Gain of 7.79 dBi was reported in another Graphene based antenna in which an epsilon-near-zero (ENZ) metamaterial superstrate was

used. It was constructed using indium antimonide (InSb) and silicon dioxide multilayers [17]. For the frequency range of 0.42–0.48 THz, antenna was designed to achieve circular polarization characteristics two orthogonal arms in design, it was constructed on SiO_2 substrate with overall size 60×110 μm² [18]. Another antenna of size 150×150 μm² was designed using proximity feed technique on SiO_2 substrate, it operates in 3.25-6.20 THz frequency band [19].

A antenna was designed using slotted meander line with six SRRs and Gold as a patch on SiO_2 for multiband THz application in the frequency range of 3.77-6.60 THz [20]. Elliptical shape patch radiator was used with the partial ground plane on polyamide substrate, 12 dBi gain was reported in the frequency range of 0.46-5.46 THz [21].

II. ANTENNA DESIGN

Antenna design size of 130×130 μm² is proposed based on SiO_2 substrate ($\varepsilon_r = 3.9$, $\tan\delta = 0.001$), Graphen with thickness of 3 nm and chemical potential 0.2 eV is used to construct as a patch on Alumina ($\varepsilon_r = 9.4$, $\tan\delta = 0.0004$) and a thin layer of Silicon ($\varepsilon_r = 11.9$, $\tan\delta = 0.00025$) is place on Graphene patch to operate in the frequency band 5-10 THz, in this design feed is applied as proximity coupled feed between SiO_2 substrate and alumina as shown in fig.1 (a) Bottom view, fig.1 (b) Front view, for the designing a patch, square patch is selected, width (W) and length (L) can be calculated by equation (4) and equation (5) [22].

$$W = \frac{v_0}{2f_r} \sqrt{\frac{2}{\varepsilon_r+1}} \qquad (4)$$

where v_0 is free space velocity of light, ε_r dielectric constant, f_r is resonant frequency.

$$L = \frac{v_0}{2f_r\sqrt{\varepsilon_{reff}}} - 2\Delta L \qquad (5)$$

where ε_{reff} is effective dielectric constant, f_r is resonant frequency, ΔL is extension of length is given by equation (6).

$$\frac{\Delta L}{h} = 0.412 \frac{(\varepsilon_r+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_r-0.258)\left(\frac{W}{h}+0.8\right)} \qquad (6)$$

h = height of substrate

$$\varepsilon_{reff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left[1 + 12\frac{h}{W}\right]^{-1/2} \qquad (7)$$

All dimensional parameter are given in table I.

TABLE I DIMENSION OF PROPOSED ANTENNA

Parameter	Value (μm)	Parameter	Value (μm)
sl	130	sh	3
sw	130	gh	0.5
pl	70	gph	3×10^{-3}
pw	70	feedh	0.5
feedl	75	dw	5.5
feedw	7	sih	0.2

III. RESULT AND DISCUSSION

A. Return loss

Result is improved which is based on progress in antenna design, in first step shown in fig.2 (a) Bottom view, fig.2 (b) Front view, feed is selected in the middle location of patch the advantage of proximity coupled feed that if its location is tuned with the patch than expansion in bandwidth can be achieved with good return loss, but in this technique maximum return loss is obtained -35.44 dB at resonant frequency of 6.77 THz. In step 2, offset feed is selected shown in fig.1, this method shows better tuning with the patch so the multiple frequency bands is achieved which show better than -10 dB return loss, -60.38 dB return loss is obtained at 9.39 THz shown in fig.3.
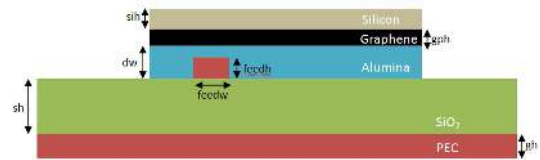
Fig.1 (a). Bottom view
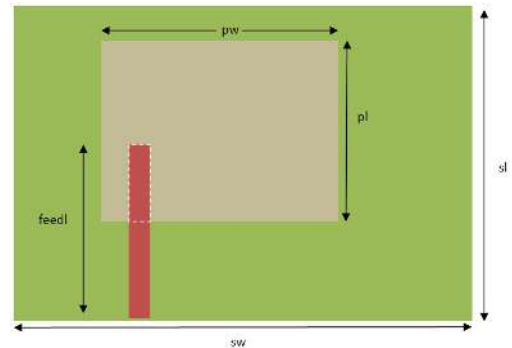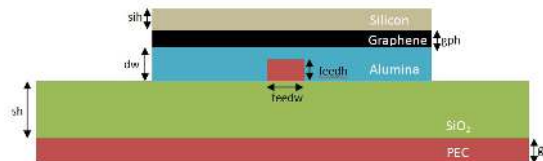
Fig.1 (b). Front view

Fig.2 (a). Bottom view
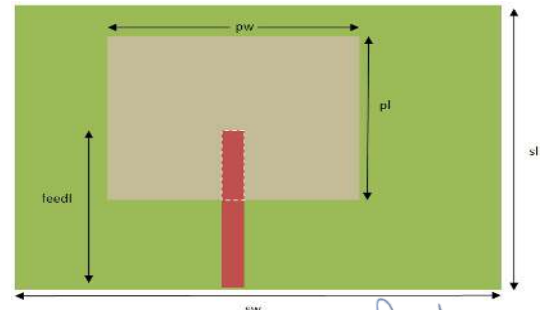
Fig.2 (b). Front view

B. Gain

In step 1, when the feed is applied in the middle location of patch gain is obtained 7.7 dBi at the resonant frequency of 6.77 THz for return loss of -35.44 dB but in second step gain is obtained 8.33 dBi at 9.39 THz resonant frequency for -60.38 dB return loss, variation of gain is shown in fig.4.
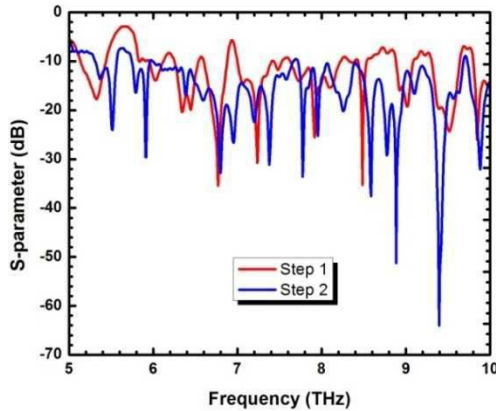
Fig.3. S11 Parameter

C. Radiation efficiency

In step 1, 96.6% efficiency is obtained at resonant frequency 6.77 THz for return loss of -35.44 dB and in step 2, 92.31% is obtained at 9.39 THz resonant frequency for -60.38 dB return loss, comparison of efficiency is shown in fig.5. When the antenna is simulated in both configuration, radiation efficiency is found above 75%.
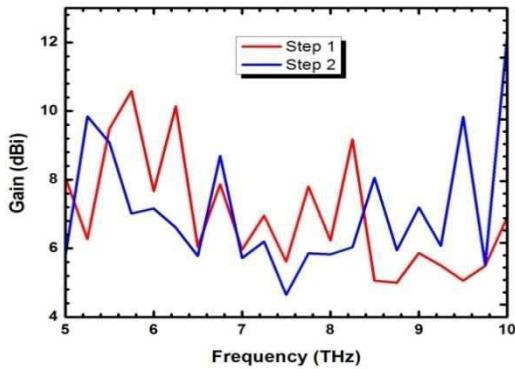
Fig.4. Gain
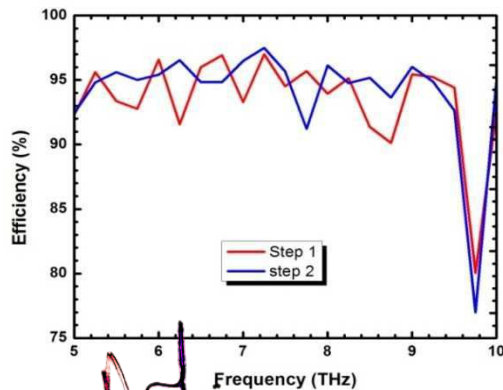
Fig.5. Radiation efficiency

Final antenna design is simulated and parameters, return loss, efficiency and gain, at multiple resonant frequencies are obtained which are included in table II.

TABLE II   SIMULATED PARAMETERS

Resonant Frequency (THz)	S11 (dB)	Efficiency (%)	Gain (dBi)
5.51	-22.01	94.38	9.07
5.91	-27.91	94.07	7.05
6.798	-30.89	93.9	8.18
6.95	-24.81	95.06	6.05
7.19	-21.13	96.1	5.92
7.37	-29.25	95.4	5.15
7.78	-25.81	90.5	5.65
7.9	-23.69	94.06	5.63
8.5	-33.88	93.4	7.34
8.7	-27.26	92.6	5.92
8.88	-46.27	93.7	6.5
9.39	-60.38	92.3	8.33
9.88	-30.26	84.94	9.19

D. Effect of different material of substrate on antenna.

Performance of antenna is analyzed for different substrate like FR-4 (ε_r = 4.3, tanδ = 0.025), Polymide (ε_r= 3.5, tanδ = 0.0027), Rogers RO4232 (ε_r = 3.2, tanδ=0.0018), and SiO2 (ε_r = 3.9, tanδ = 0.001) shown in fig.6. It is observed that in lower band RO4232 is showing good response for the gain and in higher band SiO$_2$ is good candidate for antenna gain
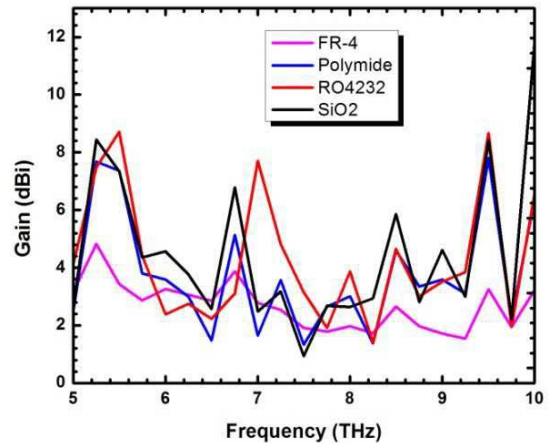
Fig.6. Gain of antenna at different substrate material

Experimental results are compared with the reference in the literature review as shown in table III

TABLE III   COMPARISON WITH REFERENCES

Reference	Operating frequency (THz)	Antenna size (µm²)	Substrate	Gain (dBi)
[16]	1.96 and 4.83	50 × 50	Silicon-di-oxide	4.75 and 4.3
[19]	3.25-6.20	150 × 150	Silicon-di-oxide	8.66

[20]	3.77-6.60	210×160	Silicon-di-oxide	7.54
[21]	0.46-5.46	600×800	polyamide	12
Proposed work	Table II	130×130	Silicon-di-oxide	5.15-9.19

IV. CONCLUSION

The proposed antenna with proximity coupling feed is designed for the THz applications which is based on the SiO_2 substrate of the size 130×130 μm^2, this design provides multiple resonant frequencies. It is observed that when feed is used as offset feed and layer of Alumina and Graphene is used as radiating element, this method improves the radiation efficiencies which are 94.38 % at lower THz frequency of 5.51 THz with the gain of 9.07 dBi and 84.94 % at higher THz frequency 9.88 THz with 9.19 dBi gain. As this antenna radiates in the frequency bands which are suitable for detecting chemical composition in explosive so application of this antenna is found suitable for detecting the chemical composition in explosives.

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28 GHz Inset Feed Circular Shaped Compact Patch Antenna Array for 5G Wireless Communication

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Abstract— **The fast-developing wireless devices at 5G band has made us to design an antenna array for energy radiation. In this paper, a new design for compact size antenna array for 5G communication system has been proposed. The proposed antenna array has been designed to operates in the frequency band of 27.089 - 28.856 GHz, which is part of millimeter wave. The design is compact in size and this antenna array occupies only 16 × 39 mm^2 and shaped as tree structure for gain improvement and for size reduction by using tilting method where branches are tilted at 30^0. At resonant frequency, proposed antenna array achieved 9.04 dBi gain and 76.01% radiation efficiency.**

Keywords-5G, Antenna Array, 28 GHz, Millimeter Wave, Microstrip Patch Antenna.

I. INTRODUCTION

In the current era of fast developing wireless communication technology the real time communication is becoming more prominent. For the real time applications, wireless consumer needs large speed and uninterrupted internet connectivity. As we are moving into real time data monitoring era so large number of devices are required to connect with the internet so it is mandatory to fulfill the criterion of large data rate. So large bandwidth is required by transmission systems to provide large data rate, for this purpose 5 G mobile network is the solution for day by day increasing demand of data and connectivity for mobile and wireless users with more efficiency and fidelity.

There is a problem with the current technology of wireless communication as it is not utilizing its allocated spectrum with full efficiency so it is losing its free space, 5G technology provide large bandwidth high data rate [1]. Due to shorter wavelength of 5G frequency, antenna structure occupies minimum space so large number of array and antenna element can be incorporated in a compact size of handset or the base station for the high gain and directivity so better connectivity can be provided [2]. FCC (Federal Communications Commission) has approved 28, 37, and 39 GHz, and an unlicensed spectrum of 64–71 GHz frequency band for the 5G communication network [3].

For the 5G application 28 GHz band has attracted the interest of researchers out of available bands for this purpose for which a compact patch antenna is one of the major

components to radiate the energy on this frequency band. Considering this a design has been investigated and implemented for 28 GHz band. In this category dual-band dual polarized patch antenna array for 24-28 GHz and 37-43 GHz has been proposed in which stack patch technique has been used [4]. Another MIMO antenna array of size 16.5 × 26 × 0.7 mm^3, was designed for 25.5 - 41 GHz frequency band with high isolation and achieved gain of 9.1 dB [5]. A technique has been proposed for thermal management, it was a cavity backed antenna twin arc slot with metal structure which operated on 28 GHz frequency band [6]. To make compact sized antenna, a common element is feed by two port, isolation should be sufficiently high to fulfill this criterion of dual-band dual-polarized proximity fed patch antenna was designed. In this antenna, to improve the isolation, feed line was placed orthogonally, it was suitable for 28/39 GHz band [7]. Small size design is desired for wireless and mobile devices as well as it is required that small size patch antenna should show the acceptable performance in terms of gain, radiation efficiency and total efficiency. For this purpose, MIMO antenna was designed for 28/38 GHz Dual band MIMO Applications.

For impedance matching at 28 GHz, inductive loading has been used. This antenna array has achieved gain of 9.0 dBi at 28 GHz and 5.9 dBi at 38 GHz [8]. An antenna was designed to improve isolation using meta surface corrugation on the size of 41 mm × 85 mm for the 27 - 32 GHz frequency band [9]. For the gain improvement and isolation enhancement, MIMO antenna was designed in which four port were used for 26 GHz - 31 GHz range [10]. A modified Franklin antenna was designed to achieve multiband characteristics in the range of 28 GHz - 39 GHz. It showed gain of 7.15 dBi at 28 GHz [11]. Looking into the various designs as have been discussed, it was realized that the compactness and other parameters are required to be improved; specially gain and directivity, which was hampered due to sidelobes in some designs.

For the side lobe level reduction at 28 GHz frequency band, antenna with Taylor feed network was designed. It occupied the size of 50 mm × 40 mm and achieved the gain of 11.5 dBi [12]. An antenna size of 55 × 110 mm^2 was designed for 28 GHz and 38 GHz bands, dual band

1

characteristics and showed the low mutual coupling. This design consisted of two rectangular patches with the inverted I shape slot, later it was modified in four element antenna system [13].

As providing services to multiple users simultaneously as well as higher spectrum utilization is a challenge. To overcome this issue beamforming technique is playing an important role in antenna designing [14]. To create four beams in four directions a patch antenna has been discussed which is based on 4×6 buttler matrix mictrostirp line, it operates in the band of 27.5 - 28.5 GHz [15]. Eight element linear arrays as a beamforming radiator were also used for the frequency range 26.5–38.2 GHz [16]. A compact size concept was given by authors in [17], which proved to be right and helped in our proposed design with reduction in size without compromising the efficiency and directivity. In [19] proximity fed design has been considered for better efficiency, which was tried on the present design but did not have better matching at this frequency range, which prompted us to go for inductive fed system for better impedance matching.

II. ANTENNA DESIGN

An antenna array is proposed in the tree shape which occupies the size of 16×39 mm^2 size on Rogers RT duroid 5880 dielectric having 0.79 mm thickness, and loss tangent of 0.0009. Antenna is based on inset feed circular patch for the proper impedance matching. The size of the shape is selected by the given equation (1) [18].

$$R = \frac{F}{\sqrt{1 + \frac{2h}{\pi \varepsilon_r F \left[ln\left(\frac{F\pi}{2h}\right) + 1.7726 \right]}}} \qquad (1)$$

where

$$F = \frac{8.791 \times 10^9}{f\sqrt{\varepsilon_r}}$$

where, R is the radius of the circular patch, h is the substrate height, ε_r is the effective permittivity of substrate, and f is the resonant frequency.

In the primary branch inset feed is used in circular patch for impedance matching at 28 GHz and sub branch is constructed to both side of primary branch as well as to reduce the size branch is tilted on 30^0 angles, all the parameter is given in table I. The schematic view of the proposed antenna design is shown in fig. no 1. The tilting angle has been set in such way by which we got optimized results at the proposed frequency range. The matching pattern has also been considered for the betterment of the design. It is also seen that spillover is also not of the range, which could affect the efficiency and the directivity of the antenna array design.

(a)   (b)
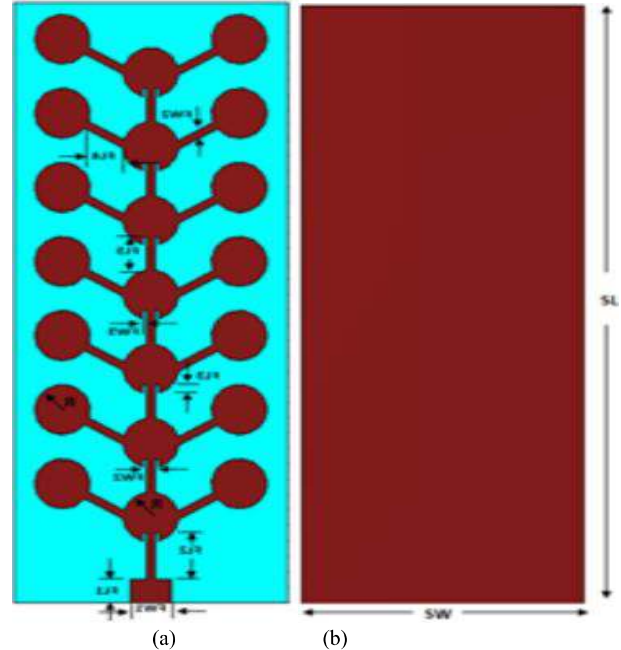
Fig. 1. Schematic views of the proposed design (a) Front view (b) Back view

TABLE-I
DIMENSION OF PROPOSED CIRCULAR PATCH ANTENNA

Parameter	Value (mm)
SL	39.0
FL1	1.50
FL2	3.00
FL3	0.54
FL4	2.57
FL5	2.17
SW	16
FW1	2.45
FW2	0.5
FW3	0.20
R	1.63

III. RESULT AND DISCUSSION

A. Resonant frequency

The Proposed antenna array design resonates at 28.028 GHz and covers 27.089 GHz - 28.856 GHz frequency band. It is seen from Figure 2 that the return loss at resonant frequency is -33.50 dB, which is considered quite good and will have better isolation and produce less spillover. The parameter S_{11} is always taken as major parameter to consider any design in microwave range of frequency.

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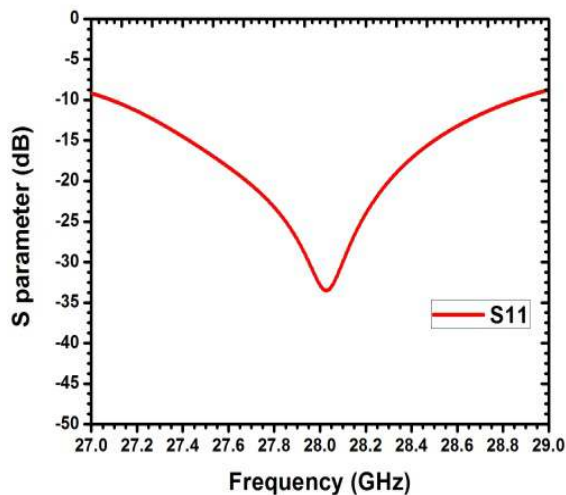
Fig. 2. *S*11 parameter

B. Gain and efficiency

Gain and efficiency of proposed antenna is shown in figure 3, gain varies from 9.49-7.37 dBi in the operating band with the peak gain 9.89 dBi and at resonant frequency it achieves the gain of 9.04dBi. Radiation efficiency in the operating band varies from 78.72 % - 76.24 % is shown in figure 4 and it show the radiation efficiency 76.01 % at resonant frequency.

C. Radiation pattern

E field pattern is shown in figure 4, at resonant frequency antenna shows the main lobe magnitude 16.3 dBv/m with main lobe direction 33^0 and angular width of 45.50^0. H field pattern is shown in figure 5, at resonant frequency antenna shown the main lob magnitude -32.4 dBA/m with main lobe direction 44^0 and angular width of 19.50^0. Experimental results is compared with the reference in the literature review as shown in table II
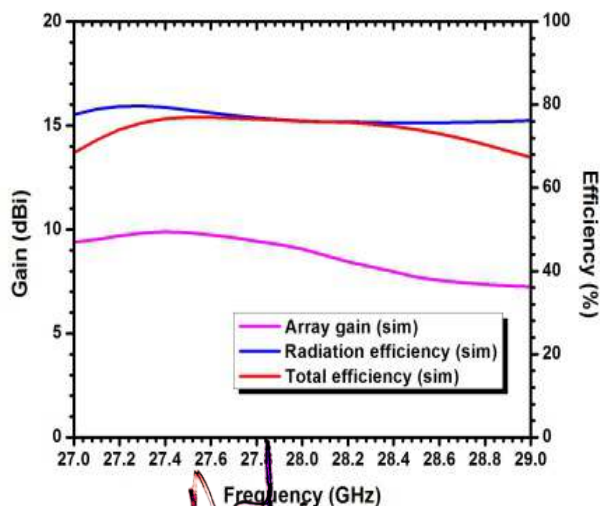
Fig. 3. Gain and efficiency of proposed array
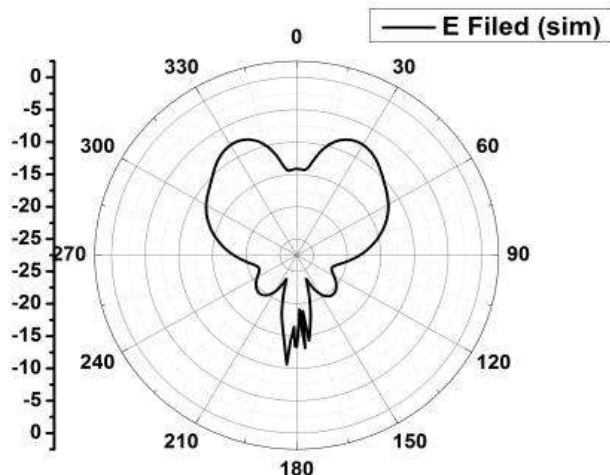
Fig. 4. E-field of proposed array antenna
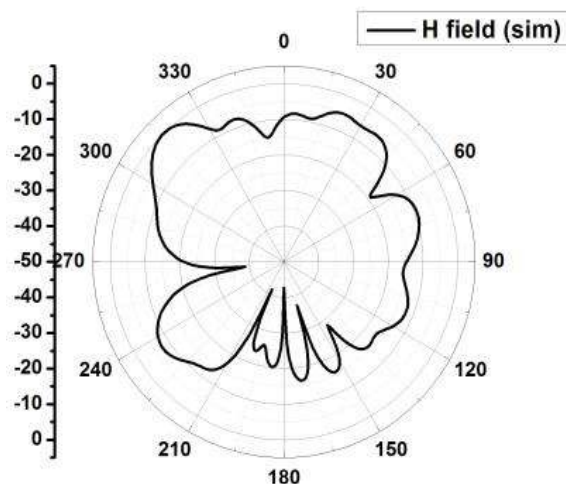
Fig. 5. H-field of proposed array antenna

TABLE II
COMPARISON OF THE PROPOSED CIRCULAR PATCH ANTENNA WITH AVAILABLE REFERENCES

Reference	Operating frequency (GHz)	Antenna size (mm²)	Substrate	Gain (dBi)
[9]	27-32	42 × 85	RO4003	17.9
[10]	26-31	48 × 31	Neltec	10
[11]	28-38	12.6 × 30	Rogers 5880	7.15
[12]	28	50 × 40	Rogers RT/duroid 5880	11.5
[13]	28 GHz and 38 GHz	55 × 110	Rogers RT/duroid 5880	7.95 and 8.27
Proposed work	27.08-28.85 GHz	16 × 39	Rogers RT/duroid 5880	9.04

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IV. CONCLUSION

The proposed array antenna with inset feed has been designed for the 5G application on the Rogers RT duroid substrate on 16×39 mm^2. The antenna was designed for 2:1 VSWR band of 27.089-28.856 GHz. Tilting the branches at 30^0 reduced the size of the proposed array antenna structure as well as improved antenna structure showed the gain of 9.04 dBi. The design radiation efficiency was 76.01 % at the resonating frequency of 28 GHz which makes this antenna suitable for the compact 5G wireless and mobile devices. The proposed design, which has been considered in this paper has been implemented with more care as the efficiency of the antenna plays major role in increasing the life of amplified devices also. The design has given satisfactory results in matching and losses as desired for the efficient communication.

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4

Microstrip Patch Antenna for Future 5G Applications

Nikhil Kalwit, Piyush Pawar, and Piyush Moghe

Abstract In this paper, a fifth-generation microstrip patch antenna has proposed. The proposed antenna design is working on 10.04 GHz with a return loss of −56.65 dB. The patch antenna has a compact structure of 18 mm × 18 mm with a FR4 glass epoxy substrate of 1.6 mm thickness. The results are simulated using Computer Simulation Technology Microwave Studio.

Keywords 5G · Patch antenna · Low return loss · High gain

1 Introduction

The speedy decrease in the dimensions of the mobile phone has led to the evolution of compact antenna structures. The conventional antennas are replaced by different antenna structure used in mobile communication [1–3]. The microstrip patch antenna has various advantages such as low cost, lightweight and easy to manufacture; despite various advantages, a major drawback that microstrip patch antenna is its narrow bandwidth.

The communication system moves on the next generation. In fifth-generation communication system, it has improved data rates and speed as compared to 4G. Various different fields have already adopted the 5G technology such as Internet of Things (IOT) and advance MIMI structure [4–6].

It has been discovered that millions of devices can be connected and operated using 5G technologies. Some 5G future systems are smart grids, smart cities, smart transportation, telemedicine and smart communication [7].

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Based on the requirements for 5G, antennas with lightweight, low profile, low-cost mass production, ease of installation, conformal to planar surface and also non-planar surface, mechanically robust when mounted on a rigid surface and compatible with monolithic integrated circuits are quite important [8, 9]. Despite its narrow bandwidth, microstrip patch antenna can be perfect coordinate to meet all the above requirements.

A microstrip patch antenna is proposed for 5G communication. The proposed antenna is designed to resonate at 10.04 GHZ and has a low profile structure with the dimensions of 18 mm × 18 mm × 1.6 mm.

2   Antenna Structure and Dimensions

The proposed small patch antenna using a microstrip line for feeding is given in Fig. 1. The patch antenna has rectangular patch of 10 mm × 6 mm with a rectangular slot on it. Various parameters, such as dielectric constant ($\varepsilon_r = 4.4$), resonant frequency ($f_r = 10.04$ GHz) and thickness of substrate ($h = 1.6$ mm), are considered while designing the proposed antenna. We have used FR4 substrate material for the design of the proposed antenna. In this structure, a waveguide port is used to excite the antenna. The precise dimensions of the proposed patch antenna are summarized in Table 1. The proposed structure works on one of the proposed frequency bands, i.e., 9.7–10.2 GHz for future 5G communication (Fig. 2).

Designing and simulation of the proposed patch antenna are performed using a commercially available simulation tool called Computer Simulation Technology (CST) Microwave Studio. The antenna is particularly designed for one of the frequency bands which may get considered for future 5G wireless communication.

Fig. 1 3D view of the proposed antenna in CST

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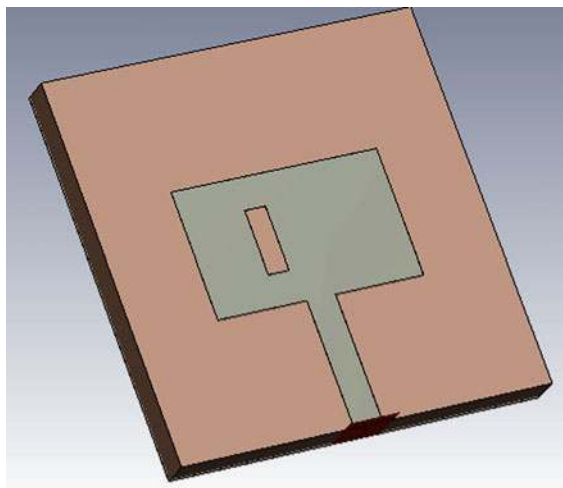
Table 1 Dimensions of the proposed antenna

Parameter	Value (in mm)
Ground plane length	18
Ground plane width	18
Patch length	10
Patch width	6
Feed line length	6
Feed line width	1.40
Substrate thickness	1.6
Patch slot length	3
Patch slot width	1

Fig. 2 Back view of the proposed antenna in CST
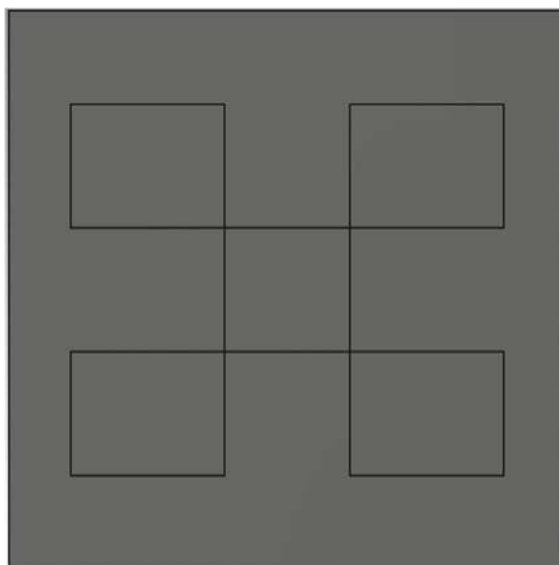
3 Simulation Results

3.1 Plot of Return Loss

Using wave port configuration, S11 parameters are obtained as antenna return loss. A value of −10 dB is taken as the base value which is considered fairly good in case of mobile communication. The proposed antenna works at the proposed band for 5G wireless standard. This antenna resonates at 10.044 GHz with a return loss of −56.65122 dB, covering a band from 9 to 12 GHz. Figure 3 represents return loss or S11 plot of the antenna.
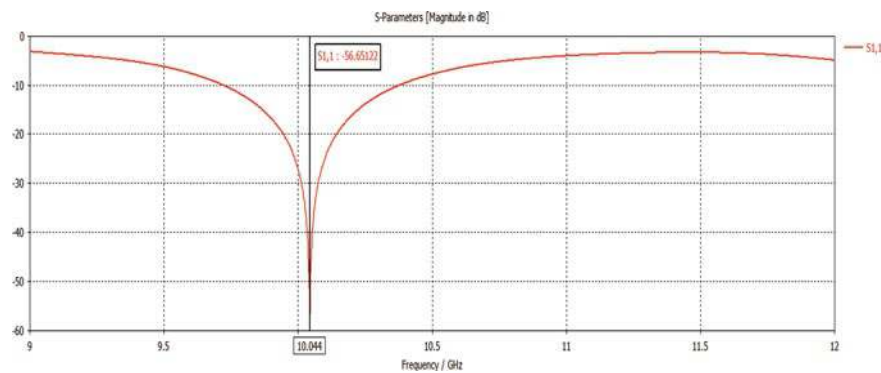
Fig. 3 Plot of return loss (in dB) of the proposed patch antenna
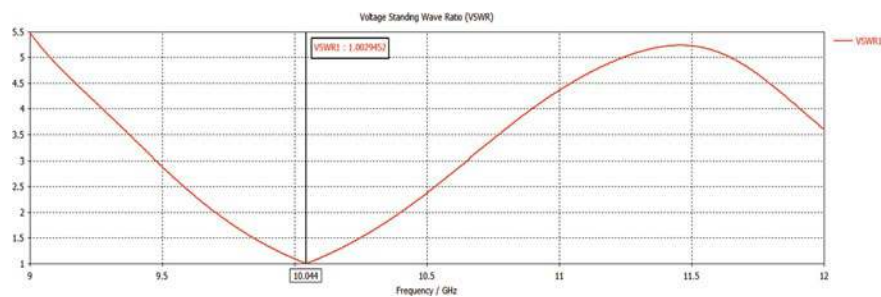
Fig. 4 Simulated VSWR plot of the proposed antenna

3.2 Plot of VSWR

The voltage standing wave ratio (VSWR) plot of the antenna is presented in Fig. 3. The consent level of VSWR for most of the wireless applications should not be more than 2.5 and it should be 1 ideally. As seen in Fig. 4, the VSWR value achieved at resonant frequency of 10.04 GHz is 1.0029 which is acceptable for its use in wireless applications.

3.3 Gain Plot

The 3D gain plot determines the antenna efficiency. The proposed patch antenna achieved moderate gain of 5.039 dB which is considered fairly well in terms of a compact antenna design. Figure 5 presents the 3D gain plot for the proposed antenna.

Fig. 5 3D gain plots
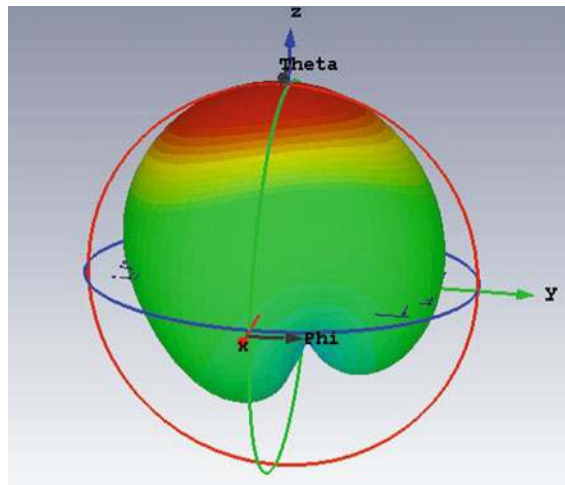
3.4 Radiation Pattern

Two-dimensional radiation pattern of the patch antenna is presented in Fig. 6. An omnidirectional pattern has been shown by the proposed antenna which is desirable for mobile communication.

Fig. 6 Radiation pattern

Farfield Gain Abs (Phi=90)

Theta / Degree vs. dB
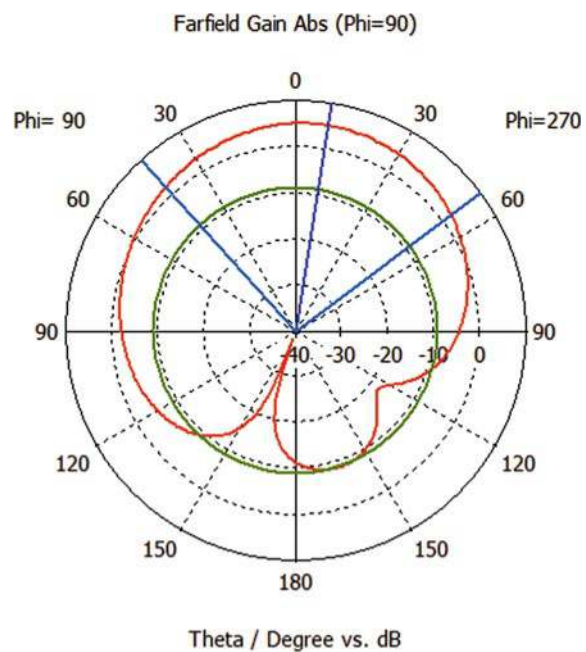
4 Conclusion

A small and compact microstrip patch antenna has been proposed for 5G wireless standard. The stupendous increase in mobile speed and technologies is approaching from fourth generation (4G) to fifth generation (5G). The antenna resonates at 10.04 GHz with a return loss of −56.65 dB and can be used in future 5G wireless devices. The proposed patch antenna shows the gain of 5.039 dB. The structure of the antenna is small and can be easily integrated in devices where space is a major issue.

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Contents

5G Inset Feed Antenna Array for 28 GHz Wireless Communication

Rohit Yadav, Leeladhar Malviya, and Dhiraj Nitnaware

Abstract Millimeter wave technology is the solution of the current generation of the mobile users to provide uninterrupted signaling and high data rate. In this paper, a compact 1×6 antenna array is designed at 28 GHz millimeter wave frequency application with 2:1 VSWR. For the impedance matching, inset feed is utilized with the circular patch. The proposed antenna occupies 37.60×8.45 mm^2 space on the Rogers RT/duroid 5880 dielectric substrate. The designed array antenna achieves 27.654–28.291 GHz bandwidth, 12 dBi gain, 88.04% radiation efficiency, at the resonant frequency.

Keywords 5G · Antenna array · 28 GHz · Millimeter wave · Microstrip patch antenna

1 Introduction

Present technology uses shared resources dynamically to support multiple users based on IP packet switching network [1]. Many researchers and scientists are trying their best to increase data rate and to reduce delays in worst conditions and to provide uninterrupted connectivity due to the increasing demand of wireless devices. The 4G has many of the limitations. Therefore, 5G has come in urgent need [2]. Also the bandwidth in 4G is limited and has only 20 MHz scalable bandwidth. This is also one of the reasons to use 5G millimeter wave (mmw) communication technology, which

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attracted researchers and industry to work over these bands for high data range, low latency, etc., for wireless communications systems [3].

The main goals of the 5G technology are to provide the solutions of the enhanced wireless services, coverage at low cost, high data rate, reuse/utilization of allotted frequency band, low power consumption, etc. Frequency bands of 28 and 43 GHz are being deployed in Korea, Japan and China, and 64 and 71 GHz are also proposed by FCC for 5G application [4]. For modern communication, low-cost microstrip antennas are the better choice. Taconic TLY-5, Rogers RT/duroid, FR-4 and polyimide, etc., are used to develop the 5G antennas [5].

Microstrip antenna is also known as the printed antenna because it is fabricated on printed circuit boards (PCBs). Bidirectional PCBs are used for the creation of ground and patch, where the substrate is sandwiched between these two layers. Varieties of shapes are available to create the ground and patches nowadays [6]. In the rectangular patch, the length is responsible for resonant frequency, and width is responsible for impedance matching at resonant frequency [7].

Various 5G antennas have been designed to achieve high data rate, high gain and high directivity, with different polarizations. A dual band antenna operated on 28 and 38 GHz was designed with such concept [8]. Similarly, a 15×15 mm^2 antenna was designed for 28 GHz using planar-inverted frequency antenna (PIFA) approach [9]. To cover the wide range from 26.6–40 GHz, a T-shaped antenna was designed [10]. In another design, an antenna was operated on 23.92–43.8 GHz frequency and occupied $10 \times 12 \times 1.48$ mm^3 size on AgHT-8 substrate [2]. To cover X band of 5G technology, an antenna was designed on polyethylene terephtalete substrate, which occupied 60.0×75.0 mm^2, and had average gain of 5.0 dBi [11]. An antenna covered frequency range from 27.5–28.25 GH and occupied 5 mm $\times$ 5 mm size on Rogers RT/duroid 6002 substrate [12]. A 28 GHz antenna was investigated with different orientation and excitation phases for the beamforming and beam steering operations [13]. An array antenna was designed with meta-material unit cell approach and occupied 11.3×31 mm^2 on Rogers RT/duroid 5880 dielectric substrate. The design had 10 dBi gain, better than 21 dB isolation [14]. Three antenna designs were investigated on the size of $55 \times 110 \times 0.508$ mm^3 and operated at 28/38 GHz. The maximum gain of 9.49 dBi was achieved with the designs [15].

2 Antenna Design

The proposed array antenna of 1×6 is designed on the Rogers RT/duroid 5880 dielectric substrate and occupied 37.60×8.45 mm^2 space. The Rogers RT/duroid has dielectric constant of 2.2, 0.0009 tangent loss and thickness 0.79 mm. An inset feed with circular patch is selected for design to proper impedance matching. The proposed array antenna resonates at 27.966 GHz frequency in 27.654–28.291 GHz frequency band. The circular patch has the freedom that only radius is required to control the frequency of operation [16]. The dimension of the circular patch is given by Eq. (1) [17].

$$R = \frac{F}{\sqrt{1 + \frac{2h}{\pi \varepsilon_r F\left[\ln\left(\frac{F\pi}{2h}\right)+1.7726\right]}}} \tag{1}$$

where

$$F = \frac{8.791 \times 10^9}{f \sqrt{\varepsilon_r}}$$

R is radius of circular patch, h is substrate height, ε_r is effective permittivity of substrate, and f is resonant frequency.

The design consists of two steps. In the first step, a circular patch with microstrip feed is designed, which resonates at 28.09 GHz frequency. In step two, an inset feed is selected with the circular patch. Each patch is connected to the independent feed with and feed lengths for the desired results. The schematic view of the proposed array antenna is shown in Fig. 1. All the optimized design parameters are given in Table 1.

3 Result and Discussion

3.1 Resonant Frequency

All the design steps are compared in Fig. 2. In design step 1 with 1×6 array, antenna resonates at 28.09 GHz and covers 27.73–28.46 GHz 10 dB return loss bandwidth. In design step 2, 1×6 array antenna with inset feed array antenna resonates at 27.966 GHz and occupies 27.654–28.291 GHz bandwidth in -10 dB return loss band. The inset feed with circular patch provides better impedance matching in comparison with the microstrip feed-based 1×6 array antenna.

3.2 Gain

The gain and efficiency of the proposed antenna array are shown in Fig. 3, and the 3D gain pattern is shown in Fig. 4. The proposed array antenna has 11.57–12.24 dBi gain in whole band. Also, the radiation efficiency in the band varies from 89.47–88.32%. The total efficiency in the band varies from 77.66–78.77%. At resonant, the gain is 12 dBi, and the radiation efficiency is 88.02%.

Fig. 1 Schematic views of the proposed design. **a** Front view. **b** Back view

(a)   (b)
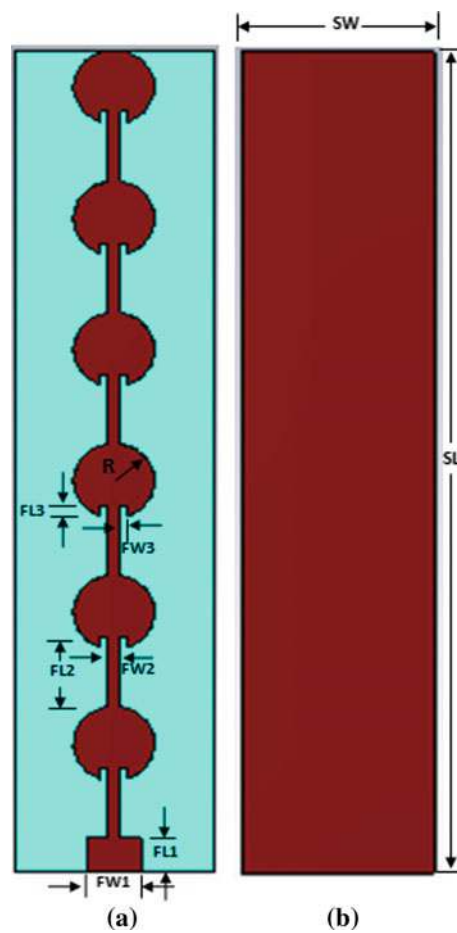
Table 1 Dimension of proposed circular patch antenna

Parameter	Value (mm)
SL	37.60
FL1	1.59
FL2	3.17
FL3	0.50
SW	8.45
FW1	2.28
FW2	0.52
FW3	0.33
R	1.72
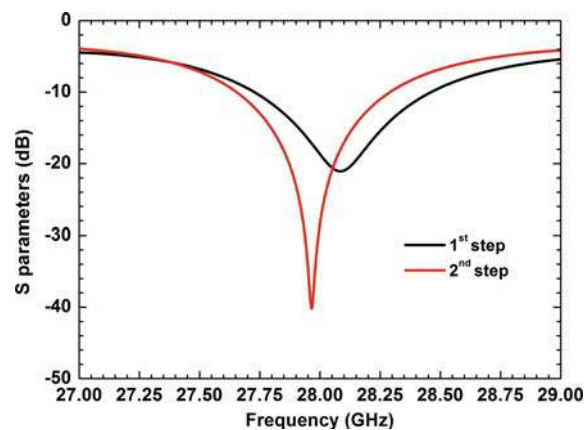
Fig. 2 S$_{11}$ parameter
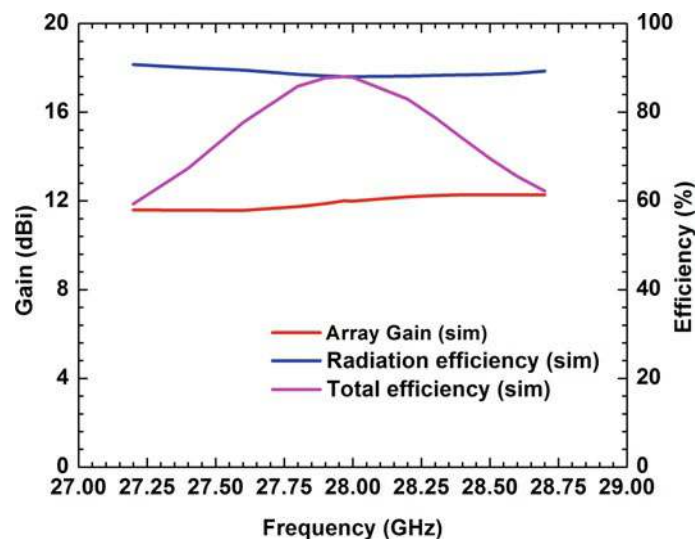
Fig. 3 Gain and efficiency

3.3 Radiation Pattern

The three-dimensional E-field and H-field radiation patterns are shown in Figs. 5 and 6. Similarly, the normalized E-field and H-field patterns are shown in Figs. 7 and 8. The proposed antenna array has 26.7 dBV/m value of E-field at resonant frequency and −24.8 dBA/m value of H-field. The antenna array has 62.8° beamwidth, and the main lobe directions of E-field is 0° and 340° for H-field.

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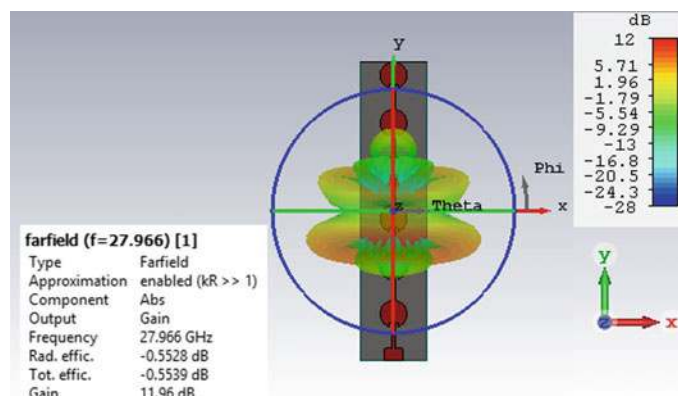
Fig. 4 3D gain pattern
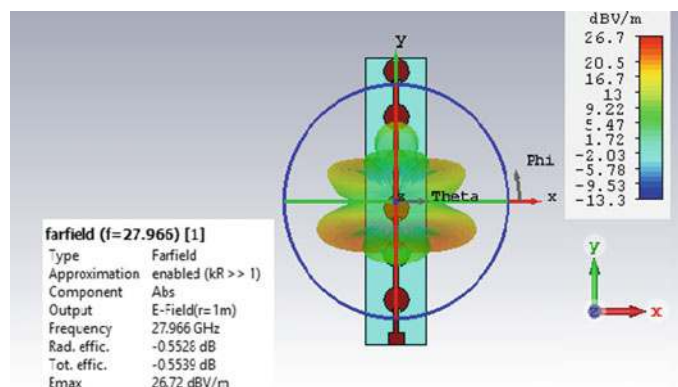
Fig. 5 3D E-field pattern

Fig. 6 3D H-field pattern

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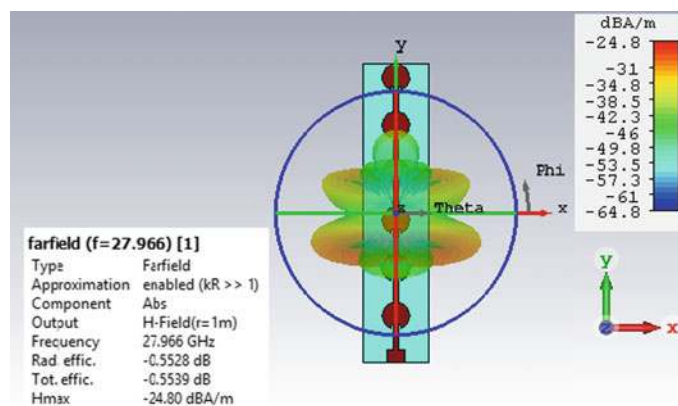
Fig. 7 Normalized E-field pattern
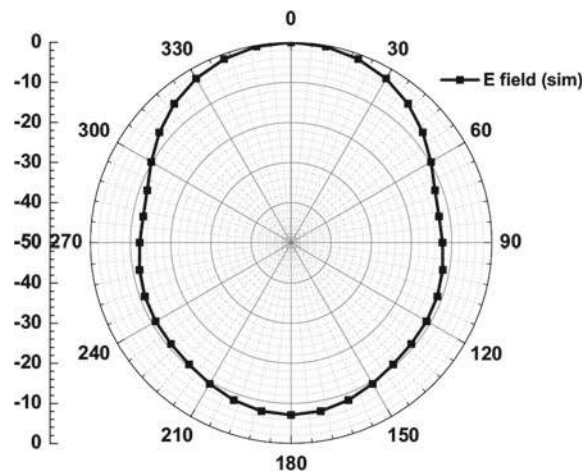
Fig. 8 Normalize H-field pattern
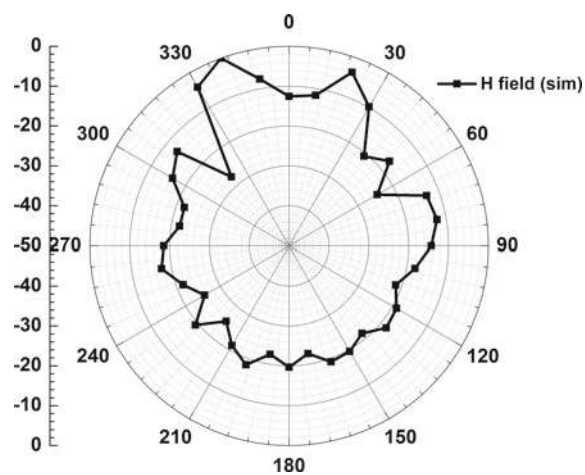
4 Conclusion

A 1 × 6 array antenna has been presented with inset feed and circular patch to resonate at 28 GHz millimeter wave wireless application. The design was fabricated on low loss tangent Rogers RT/duroid substrate. The design occupied the 37.60 × 8.45 mm^2 size on dielectric substrate. The bandwidth in 2:1 VSWR band is 27.654–28.291 GHz. The minimum gain in design is 11.57 dBi, and the radiation efficiency is 88.01%. The proposed array antenna is suitable for high data rate 5G technology.

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Security Assessment of SAODV Protocols in Mobile Ad hoc Networks

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Abstract The basic requirement in mobile ad hoc network (MANET) is to achieve Secure routing. Dynamic characteristics of MANET offers many challenges to achieve security parameters such as availability, integrity, confidentiality authentication, and non-repudiation. To hinder the normal routing operation malicious nodes make use of the vulnerable routing protocols. The real challenge to achieve secure routing as secure versions of the routing protocols is also vulnerable for routing attack. In this paper, We assess and compare the security of Ad hoc On demand Distance Vector routing protocol and Secure Ad hoc On demand Distance Vector routing protocol under different types of routing attack like blackhole and Replay attack.

Keywords MANET · Security parameters · AODV · SAODV blackhole attack Replay attack

1 Introduction

In MANET wireless medium used by randomly moving nodes to forward data packets for others nodes which are not within the range of direct broadcast. Ad hoc routing protocols adapted by network topology which undergoes quick and dynamically changing. This features is lacking in routing by wired networks. The salient features of MANETs are in auto-configure mode and the capability to work in an infrastructure less network. Above features of MANETs makes it advantageous in field like military

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operations, emergency rescue and disaster relief, etc., by providing cost effective fast installable and simply reusable solution.

The various routing protocols designed for MANETs [1] are focused at optimizing network routing performance. A protocol finds a route only when needed is named as reactive protocol. This is one of the MANET routing protocol which has achieved more attention as compared to other type of routing protocols. This feature allows the adhoc on demand protocols to perform better than the table driven routing protocols, which find and keep record of all feasible paths in the MANET even for those may not be utilized [2].

Emphasis on security must be given in real world MANETs [3]. Various attacks on routing in MANETs is interrupt the normal rote finding and set up process. These attacks can be brought by one or more malicious nodes. In recent literature several protocols on secure routing techniques have been proposed to protect from attacks. Cryptographic techniques based schemes are used to provide features like, authentication, message integrity and non repudiation.

The main focus of this paper is to analyze the security of a popular MANET on demand routing protocol, Ad hoc On demand Distance Vector (AODV) [2] and its secure version Secure Ad hoc On demand Distance Vector (SAODV) [4]. We describe how an attacker can be disrupt AODV routing by launching different routing attacks and find that the similar type of routing attacks are unsuccessful in SAODV because it uses asymmetric cryptography scheme. We showed that SAODV is also susceptible to certain kinds of replay attacks. A brief overview of AODV and SAODV routing protocols are discussed to assess their security by simulations of attack.

2   AODV and SAODV Working

AODV is an on demand reactive routing protocol that finds routes only when required. Sequence numbers are used to ensure that routes are fresh. A route request (RREQ) packet are broadcasted by a sending node to find a root to destination node. The RREQ contains the broadcast ID, current sequence number and IP address of node's. RREQ is received by the destination node and sends a route reply packet (RREP) on the same path which is setup during the process of route discovery. When failure in link occur a route error packet (RERR) is sent by intermediate node to the source and destination nodes [4].

SAODV added a feature of asymmetric or public key encryption to secure routing messages of AODV against different routing attacks. Hash chains and digital signatures are used by SAODV to secure both the mutable header field and non-mutable fields. These fields are hop count, source and destination addresses details, sequence number of all nodes. Calculation of hash chain by a source node are as follows: To sets the Max Hop Count to the Time To Live (IP header) first it creates a seed or random number. After that it calculates hash field by Max. Hop Count and seed and finally generates a digital signatures. This techniques makes it tough for a malicious node to change the routing messages since every node has a unique digital signature

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and it can only be generated by itself. When routing message processed for verification any decrement in the hop count field of RREQ packets or RREP packets by an attacker can be noticed, since hash field is checked by all the intermediate nodes.

To broadcast RERR, only signature of the packet is required to send. Before forwarding the RREQ, RREP and RERR packets, the destination nodes or intermediate nod authenticate the hash chain field and digital signatures of node.

3 Security Flaws in AODV and SAODV

The reasons of attacks on AODV protocol are:

- AODV is on demand reactive protocol.
- Message broadcasting is used in AODV Protocol.
- It is lacking in mobility management/flat routing.
- Shortest path algorithms is used AODV.
- No authentication process for non mutable field.
- It only maintain the record of neighborhood node.
- AODV is vulnerable to real time attack.
- AODV is not able to observe the next hop activities [5].
- The major factors which makes SAODV vulnerable to different attacks are:
- Partial authentication.
- No discrimination between old and new routing massage packets.
- A malicious node can easily spoof IP address of a node because IP header part is not secure.

4 Security Attacks on MANET

MANETs are not fully secured from various attacks. Attackers can drop of traffic network, modify control message or forward routing message to other node.

Goal of Attacker are:

- To decrease the overall throughput of network.
- To increase packets latency.
- To collapse link between two nodes.
- To change the packets root for increase link bandwidth.

The purpose of malicious node to lunch attacks in MANETs is to disrupt the normal operation of network or to take the routing information. Attacks can be generally defined into two category, Active attacks and Passive attacks. The purpose of launching an active attack in the network is to damage information and operation by inserting data or information in the network. Spoofing, and impersonation are examples of active attack. The aim of passive attack is to exchange data without

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Fig. 1 Network topology
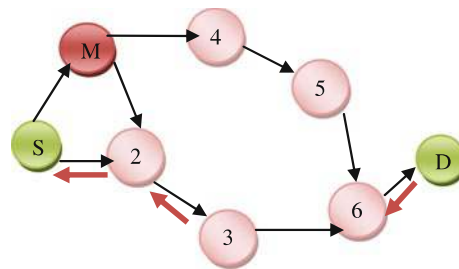
affecting the normal operation. It is hard to identify passive attack as compare to active attack.

Some of the most common attacks on MANET are:

Figure 1 shows the MANET topology in which S Node wants to send a data packets to D node. Node M is a malicious node.

A. *Route Disruption Attak*

An attacker initiates the route disruption attack in the MANET network by sending false or modified RREQ, RREP and RERR packets. AODV routing is interrupted while SAODV is able to defend the normal routing operation under attack condition [6].

B. *Route Invasion Attack*

To launch route invasion attack an attacker modifying and forging false RREQ and RREP packets in MANET. This attack can be successful against AODV but in SAODV a node is able to oppose this type of attack by identifying such packets and drop them.

C. *Blackhole Attack*

In blackhole attack, an attacker advertized that it has minimum path to the destination node and first sends false information of root to the source node, when root is established it can be receives the packets from source node [7].

The malicious Node A spoof IP address of destination nodes D from RREQ packets and launched blackhole attack. It sends fake RREPs which contents highest value of destination sequence numbers. AODV can be targeted by blackhole attack in two modes i.e., External blackhole attack in which a malicious node is not a part of network and Internal blackhole attack in which a malicious node is a part of network [8] but it was not successful in SAODV.

D. *Replay Attack*

A malicious node implements replay attack, by buffering the routing packets of one of the communicating parties and after some time replays those messages. By spoofing IP address and sending old RREQ packets, the attacker tries to misguided the destination node that the sending node wants to communicate again. In replay

mode, the destination node will send RREP packets to the malicious node. In this an attacker is able to established the connection with the destination node and can send its own interest data packets.

5 Security Threats in AODV and SAODV

AODV is more vulnerable to different routing attacks as it has not strong security features and it can be effortlessly targeted by a attacker. The purpose of design secure routing protocols are to achieve security parameters like authentication, availability, confidentiality, Integrity and non-repudiation and it is AODV can effortlessly be targeted by a attacker to interrupt its routing. To disrupt routing in AODV an malicious node can be adapt following techniques [8]:

- To degrade network performance and increase routing delay an attacker generate fake RERR packets.
- RREP and RREQ packets forge or modify by attacker.
- In blackhole attack malicious node sends fake RREPs of highest sequence numbers.
- To disrupt the normal routing operation attackers make a tunnel/wormhole.
- To receive or drop data packets it Spoof source or destination IP address and block legitimate network node.
- Attacker form routing loops and initiate sleep deprivation attack.
- A malicious node lunch resource consumption attack to exhaust node batteries.

SAODV protocol is designed to deal with only specific attack and it do not offer a complete secure routing solution, Likewise other secure routing protocols SAODV has some security limitations; Prevention from attacks like replay, wormhole or tunneling is not easy in SAODV.

6 Performance Parameter

To evaluate the MANET performance in normal and in presence of attack various parameter such as Energy per Data, Packet Delivery Ratio, throughput and end to end delay is usee [9].

A. *Throughput*

The relative amount of total number of packets delivered to total simulation time is defined as throughput.

B. *Packet Delivery Ratio* (*PDR*)

PDR is obtained in terms of total received packets at destination node and the total of transmitted packets by source node.

C. *Delay*

To pass a packet through the network the average time acquired by it, this time can be defined as delay.

D. *Energy per Data* (*EDR*)

Amount of energy consumed by the node to delivered per byte data is defined EDR.

7   Simulation

Performance of AODV and SAODV are analyzed in normal and presence of blackhole attacks condition.

Simulation shows that when the number of nodes was increases throughput and PDR is decreases in network AODV performs batter than SAODV protocol in throughput and PDR. Because control overhead is increases due to cryptographic security schemes.

Energy per Data and Packet delay are high if we increased the number of nodes in MANET. EPD and Packet delay is higher for SAODV as compare to AODV protocol because of the extra processing and verification of cryptographic schemes (Figs. 2, 3, 4 and Tables 1, 2, 3).
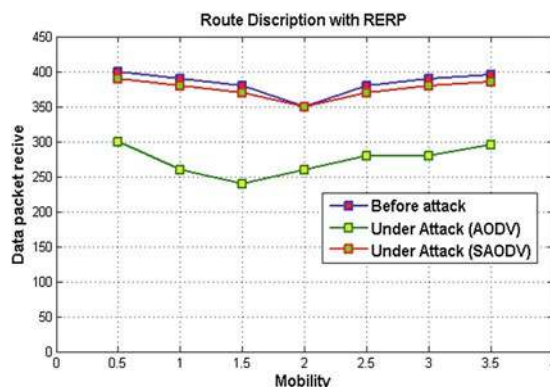

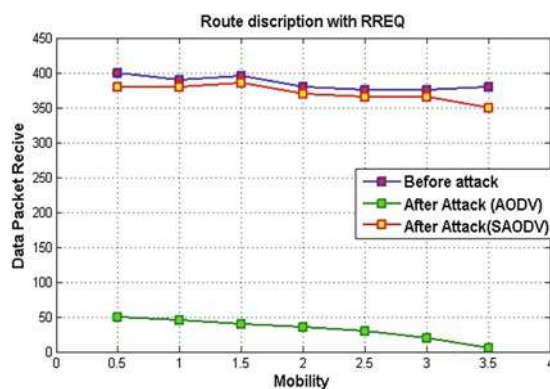**Fig. 2** Route discription with RREP on AODV and SAODV
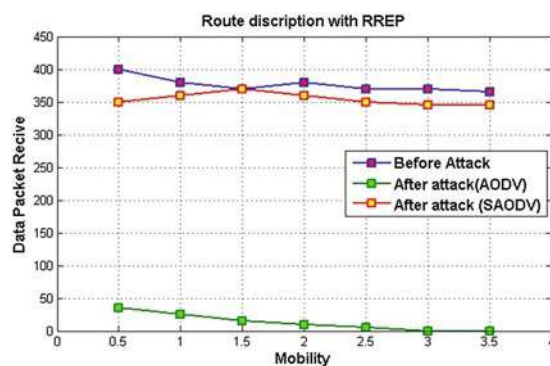
Fig. 3 Route discription with RREQ on AODV and SAODV

Fig. 4 Route discription with RERR on AODV and SAODV

Table 1 Performance parameter

S. no	Parameter	Value
1	Time of simulation	100 s
2	Name of protocol	AODV, SAODV
3	No. of malicious nodes	one
4	Number of nodes	20–100
5	Number of Max. connections	8, 16, 24, 32, 40
6	Pause time	25 s
7	Terrain area	700×700

Table 2 AODV performance

No. of nodes	Throughput	Delay	PDR	EDR
20	82	0.4	95	4
40	82	0.6	90	5.5
70	78	1.5	80	9.5
100	70	1.8	76	12

Table 3 SAODV performance

No. of nodes	Throughput	Delay	PDR	EDR
20	80	0.6	90	7.5
40	78	0.9	80	8
70	70	1.9	70	14
100	60	2.4	60	16

8　Conclusion

This paper paying attention on effects of attacks on security of SAODV and AODV protocols in MANETs based on the comparison on all mentioned parameters. We have observed the behavior of SAODV in presence of blackhole attack up to a defined level and it is found that blackhole attack is not successful in SAODV. AODV is more vulnerable for attacks due to modification of RREQ, RREP and RERR. To provide better security and stability in MANETs more secure routing and security mechanism is required to build up.

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