The effectiveness of cloud databases

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4 Author(s) Niraja Jain ; A V Deshpande ; B Raghu ; V Khanaa View All Authors

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Abstract:
"Utility computing" was the concept introduced by John McCarthy in 1961 in a speech given at MIT. He proposed that sharing the computing power on a time-sharing basis will help grow business of "providing computing power as an utility" and this was the inception of the cloud computing. Cloud computing can deliver the best to the end users either through the private, public or hybrid cloud infrastructures. As the databases are of significance importance, it is a mandate that they ought to be designed compatible to the rising cloud technology. Cloud computing has changed the face of the IT industry. But in the current scenario there are many database issues that are not addressed. With tremendous data growth, the need for the paradigm shift in the technology to be used to store, manage and retrieve data is awaited. Databases have changed from file storages to relational databases and further transformed to today's cloud databases. Still the need to process the query efficiently without losing the data privacy had been the topmost priority. The resource optimization and query dynamism are the major unchanged aspects in this changing scenario. The timing constraints on the query execution could be leisurely, indefinite, urgent or instantaneous. In almost all the scenarios, the effective storage, elastic manipulation and efficient data retrieval is the key.

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Contents

The future of database services: Cloud database

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Abstract:
Databases are the core of all the business services that are offered online. Cloud computing has drastically changed the way these online services are being offered. Hence it is of significance importance that the databases need to be compatible with cloud computing. The data is growing enormously with every passing day. With the paradigm shift in the technology used to store, manage and retrieve the data from file storage to relational databases to today's cloud databases, the need to process the query efficiently while preserving the privacy had always been the priority. The dynamism of the query and the optimization of the resources used for query execution are the aspects that doesn't change in any situation. The timing constraint on the query execution could be either instantaneous, urgent, leisurely or indefinite. But in almost all the scenarios the effective storage, manipulation and data retrieval is the key. While retrieving the data stored in cloud, privacy preservation is of utmost importance. To improve query efficiency in cloud with preserving the privacy can be achieved by introducing dataflow optimization techniques and defining data descriptor based algorithms.

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Contents

Cloud computing technology had changed the way the data is stored and processed. The multidimensional growth in computing systems and technologies have resulted into advanced scalable, portable and large scale integrated systems and technologies. Data centers, virtualization, cloud and WEB2 technologies are the leaders of this. Computing power was earlier based on the products used and usually upgrading was a costly affair. Advances in cloud computing technologies has changed the scene now and computing is being offered as a service over the internet. This has given the industry to enhance their flexibility to investment as well as ongoing cost. The private and public cloud platforms offer to deliver all the benefits of cloud computing technology to their customers. Databases had always been the critical part of this endeavour. E.F. Codd in 1970 proposed the rules for relational databases resulting into efficient and optimized query processing. To achieve such effectiveness todays cloud databases need to be made cloud computing compatible. Recent technologies are putting more demand on query optimization and data security with increasing scalability.

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DaaS (Database as a Service) in Cloud Computing

. Niraja Jain
PDEACOEM,
Bharath University, Chennai

Dr. B. Raghu
SVS Group of Institutes, Warangal
Bharath University, Chennai

Dr V. Kanna
Dean
Bharath University, Chennai

ABSTRACT:

Cloud computing technology had changed the way the data is stored and processed. The multidimensional growth in computing systems and technologies have resulted into advanced scalable, portable and large scale integrated systems and technologies. Data centres, virtualization, cloud and WEB2 technologies are frontiers of such growth. Computing has changed itself from being a product to a service that can be delivered to the consumers over internet through large scale data centres or cloud. the data centres used to create cloud services represents a significant investment in capital outlay and on-going cost. The private and public cloud platforms offer to deliver all the benefits of cloud computing technology to their customers. Databases had always been the critical part of this endeavour. E.F. Codd in 1970 proposed the rules for relational databases resulting into efficient and optimized query processing. To achieve such effectiveness, todays cloud databases need to be made cloud computing compatible. Recent technologies are putting more demand on query optimization and data security with increasing scalability.

The clouds provide on demand resources or services over the internet, usually at the scale and with the reliability of a data centre. The types of clouds can be categorized into architectural model, computing model, management model and payment model.

KEYWORDS:

Cloud computing, Database as a Service, Google Cloud

INTRODUCTION:

Over past few years there is an advent changes in the technology especially after the emergence and heavy use of Internet. Single System(Stand Alone) application are getting replaced by low cost, flexible and pay –as-you-go mechanism on distributed internet based applications. Here the public cloud system plays very important role. With the advent of Cloud platform where we are getting Software as a Service (SAAS), Infrastructure as a Service (IAAS) and platform as a service (PAAS) is getting popular day by day.

In this paper we are discussing about the SAAS where we are taking the Database as a service (DBaas) into consideration.

CLOUD COMPUTING DEFINITION:

The cloud computing industry represents a large ecosystem of many models, vendors, and market niches. The US National Institute of Standards and Technology (NIST) have published a cloud computing definition that attempts to encompass all the various cloud approaches. Cloud computing is the model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of:

Essential characteristics: On-demand service provisioning, access to network, Resource provisioning, instant scalability and on demand guaranteed service

Service models: Cloud Software as a Service, Cloud Platform as a Service, and Cloud Infrastructure as a Service

Deployment models: Private cloud, Community cloud, Public cloud and Hybrid cloud

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KEY BENEFITS OF CLOUD COMPUTING:

1. Virtualization: separating the business service from the infrastructure needed to run it.
2. Flexibility to choose multiple vendors that provide
   a. reliable and scalable business services
   b. development environments
   c. infrastructure that can be leveraged out of box
   d. billed on a metered basis
3. Flexibility of the infrastructure to instantly allocate and de-allocate massively scalable resources to business services on a demand basis.
4. Cost allocation flexibility for customers wanting to move CapEx(Capital Expenditure) into OpEx(Operational Expenditure)
5. Reduced costs due to operational efficiencies and more rapid deployment of new business services.

DATABASE AS A SERVICE:

When we are discussing about cloud databases, we mean and assume that it holds the information on distributed server in diverse areas as the information is kept on various cloud server around the globe. And because of this the cloud database structure will not remain same over the diverse database administration framework. On Cloud database platform there will be number of clients (hubs) which will able to handle multiple requests coming from multiple client. The connection of this system will be requiring convenient and full access to the databases on cloud environment. Many system over the cloud can get benefit the cloud database system, the user can connect to this by their own system or even through the handheld devices like mobile or tablet PC's. Following diagram will illustrate the flow of cloud database infrastructure.

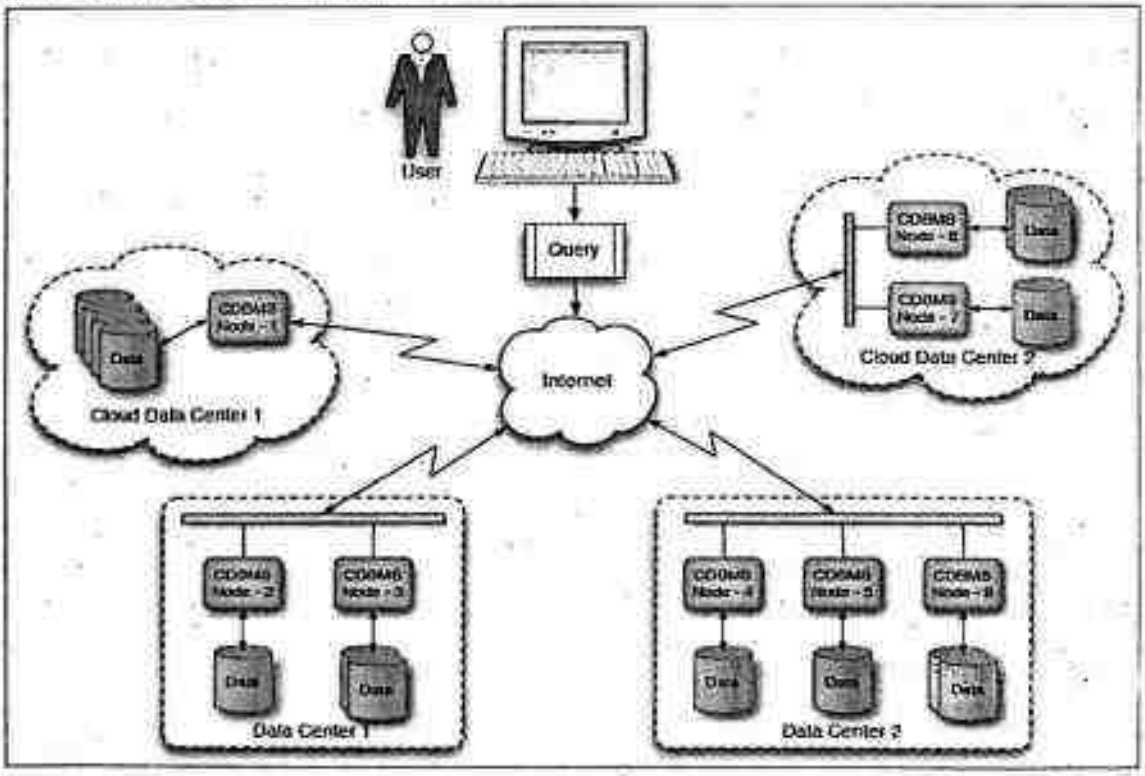

Fig. 1 Cloud Database Infrastructure

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CLOUD DBMS WISH LIST

1) *Efficiency:* 'Pay-as-you-go' model is structured such that the price increases linearly with the requisite storage, network bandwidth and compute power.

2) *Fault tolerance:* a fault tolerant transactional DBMS needs to recover from a failure without losing any data or updates from recently committed transactions; whereas a fault tolerant analytical DBMS wish it doesn't have to restart a query if one of the nodes involved in query processing fails. The long, complex queries are difficult to complete if it needs to restart each time of node failure. Business applications demand that the cloud database be ACID compliant.

3) *Ability to run in heterogeneous environment:* the degraded inconsistent performance of cloud compute nodes would have disproportionate effect on the query latency. This need to be taken proper care of while designing a system for heterogeneous environment.

4) *Ability to operate on encrypted data:* to prevent unauthorized access to the sensitive data on cloud application should have ability to decrypt the encrypted data before accessing it. The data analysis ability to work with encrypted data directly will need shipping of small amount of data in turn significantly improving the performance.

5) *Ability to interface with business intelligence products:* different customer-facing business

6) Intelligence tools working with database software to help in visualization, query generation, result dash-boarding and advanced data analysis typically interface with the database using JDBC or ODBC. So the database software that works with these products must accept SQL queries over these connections.

7) *Security while Create,* Write To and Query database like Amazon Web Services Relational Database (AWSRD) using CEP (Cloud Event Processing). Cloud-based Event Processing is where some event processing application is put into a closed / corporate, or public / distributed, cloud computing environment. Event latency and event store latency are major considerations.

Databases in Cloud Computing Environment:

At present the cloud database environment is supposed to be the best possible answer for most of the need of programming developers over the globe where they need to store the their data of their application in backend which can be accessed and adaptable to changes from even a single client. This Database as a service (DBaas) benefits over lot of traditional databases on local and server machine like MySQL, Oracle etc. The database which are classified over the traditional RDS (Relational data services where we get the data on organized way of SQL query writing. For such conventional databases on cloud are maintained by Amazon RDS, Google SQL and Microsoft Azure.

We have other side of cloud databases like Amazon Simple DB, Google Data store which are not a RDS but based on NoSQL Databases concepts, which are unstandardized and doesn't require traditional RDBMS queries to work with such databases

There are some most popular databases in cloud computing. They are mentioned below:

- StormDB
- MySQL
- PostgreSQL
- Google Cloud SQL
- MongoLab

As in this paper we are focussing on MySQL Google Databases on Cloud, we will be mentioning all the details about it.

MySQL

MySQL is an open-source social database administration framework. It is possessed by Oracle Corporation and can be utilized under either the GNU General Public License or a standard business permit acquired from Oracle. MySQL is a hearty, multi-strung, value-based DBMS. It is profoundly versatile and can be conveyed over numerous stages.

Google Cloud SQL is the services which one can hire on Google cloud which uses MySQL database internally. It provides all the features of the MySQL and it is equally useful the way it was useful on normal

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client server architecture. One can use MySQL Google Cloud services to support our database requirement of application from small to medium size applications.

MySQL databases sent in the cloud without an object. It is provided you by the Google Cloud Platform with effective databases that run quick, don't come up short on space and give your application the excess.

Following are some of the advantages of using MySQL Database in Cloud Computing.

1) Availability:

Most of the system which works on open source technology prefers the MySQL databases over the application development by the programmers. Hence it is available on large scale and programmers are comfortable using it.

2) Buy the database administration only:

Some cloud organizations just offer MySQL database facilitating through a cloud-based facilitating record. As of late, organizations began offering databases as an administration, permitting people to pay just for the databases and not for a facilitating record that there is no utilization for.

3) Versatility :

The versatility that originates from MySQL databases cannot be coordinated by individual or devoted devices. People would prefer not to ship in a bundle of database servers for trivial needs, however, cloud-based MySQL databases are ideal for such circumstance.

GOOGLE CLOUD MYSQL DATABASE ARCHITECTURE:

Following Figure 2 represents the overall architecture of how Google MySQL cloud services works. We had the database stored cluster wise/region wise on Google cloud. Whenever the request comes from users (clients) through internet it is passed to the Google Cloud platform. There is one compute engine that processes this request on cloud server where it will extract the SQL RDBMS query from the request and this query will get processed in Cloud SQL. This query upon the correctness of syntaxes will be executed on Cloud MySQL Database services and based on the query the result will be passed over internet to the user (Clients).

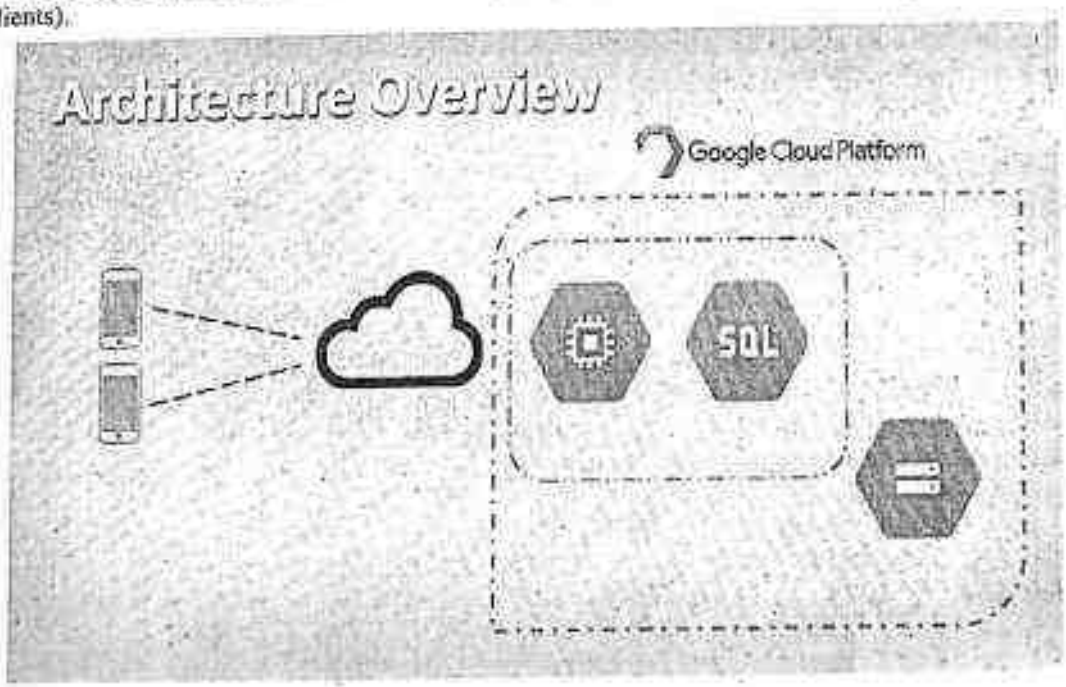

Fig. 2: Google MySQL Cloud Service

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CLOUD SECURITY:

Cloud Security Alliance identify seven threats to cloud computing that can be interpreted as a classification of security issues found within the cloud. They are:

1. Abuse and Nefarious Use of Cloud Computing
2. Insecure Application Programming Interfaces
3. Malicious Insiders
4. Shared Technology Vulnerabilities
5. Data Loss/Leakage
6. Account, Service and Traffic Hijacking
7. Unknown Risk Profile

Data loss / leakage stems from the disclosure of information that, though hidden, is deduced from freely available information. When users interact with a service they can leave a public trail, be it from status / update messages or through new postings. Unwelcome linkage occurs when new information is discerned about an individual through analysis of the individuals public trail i.e. links. This unwelcome linkage could be accidental or the result of the individual not covering their tracks. Social graph merging is similar to unwelcome linkage however the links formed occur through the aggregation of social graphs. A social graph is a graph describing a person's social information such as friends, groups and interests. Through combination of a person's social graph from separate social networking sites, or the social graphs of people from the same social network site, new information can be deduced.

Interdisciplinary relevance:

The rise of cloud computing as an universal platform for providing all kinds of services to users and organizations demands research and development in all levels of computing systems. Starting from the hardware level, we may highlight the continuous need for mechanisms that improve the support to virtualization, which also affects significantly the operating system architecture and the interfaces to hardware and functions provided to user level. One particular challenge is data management, since data have been generated at unseen rates, which not only overloads storage resources, but also demand scalable algorithms. In this scenario, desired applications must process distributed data, which should be moved the least, and, if migrating data is necessary, it should overlap with actual computation as much as possible. it is necessary to foster interdisciplinary research to enhance cloud-based platforms and services because isolated efforts in any context will be less effective for not considering their impact on other research areas. Such a need seems to be even more important considering that cloud platforms and their usage are a moving target which demands fast, versatile and integrated models, algorithms, mechanisms and techniques.

REVIEW OF RESEARCH AND DEVELOPMENT IN THE SUBJECT:

(a) International status:

Millions of people are unaware of and uninformed about how their personal information is being used, collected or shared in our digital society. Data Privacy Day aims to inspire dialogue and empower individuals and companies to take action. Data Privacy Day began in the United States and Canada in January 2008 as an extension of the Data Protection Day celebration in Europe. Data Protection Day commemorates the Jan. 28, 1981, signing of Convention 108, the first legally binding international treaty dealing with privacy and data protection. Data Privacy Day is observed annually on Jan. 28.

A popular class of computing clouds is Database Infrastructure as a Service (IaaS) clouds, exemplified by Amazon's Elastic Computing Cloud (EC2). In these clouds, users are given access to virtual machines (VM) on which they can install and run arbitrary software, including database systems. Users can also deploy database appliances on these clouds, which are virtual machines with pre-installed pre-configured database systems. Deploying database appliances on IaaS clouds and performance tuning and optimization in this

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environment introduce some interesting research challenges that include data security, database resource deployment on VM cloud optimization verses query optimization, applicability of Codd's query optimization.

Cloud services make easier for users to access their personal information from databases and make it available to services distributed across Internet getting exposed to challenges of privacy and security. Users have typically to establish their identity each time they use a new cloud service, usually by filling out an online form and providing sensitive personal information (e.g., name, home address, credit card number, phone number, etc.). This leaves a trail of personal information that, if not properly protected, may be misused.

(b) National status:

Protection of personal data is becoming a priority for the Indian Corporate sector, driven by stricter regulations on data privacy and increasing global business operations. Due to outsourced work, the Indian IT industry in particular has the additional responsibility to protect data of end-consumers from various countries, with exposure to much wider data protection regime. It is therefore imperative that the industry not only assign required focus to data privacy but may also use it as differentiator. While this importance cannot be undermined, privacy is not an absolute right and must data privacy regulations allow organizations to a reasonable extent, to balance it along with other conflicting interests such as security, need to comply with other laws or contracts, and business operations to some degree.

PRIVACY ISSUES IN CLOUD:

It is believed that information security policies cover the data privacy as well. Of course the two terms are interrelated. But in context of cloud computing, data privacy has its own concerns. The concept of privacy varies among countries, cultures, and jurisdiction as well as on the infrastructure of the organization. Privacy rights are related to the collection, use, disclosure, storage and destruction of personal data [9]. Privacy preservation should be managed as part of the data used by the organization.

IMPACT OF CLOUD ON DATA PRIVACY:

1. Generation of information
2. Use
3. Transfer
4. Transformation
5. Storage
6. Archival
7. Destruction

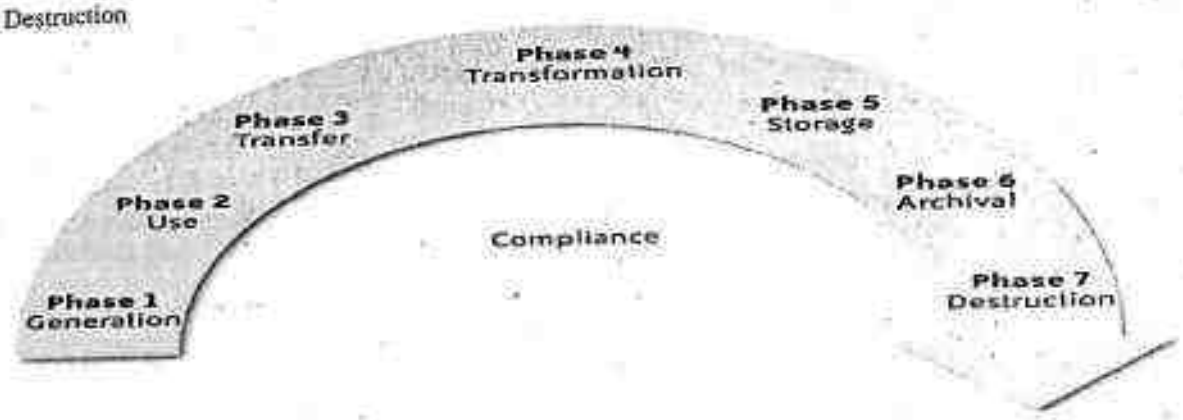

Fig. 3: Impact of Cloud of Data Privacy

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KEY PRIVACY CONCERNS IN CLOUD:

1. Organization's ability to provide the individual with access to all personal information and to comply with stated requests.
2. How the existing privacy compliance requirements are impacted by the move to the cloud?
3. Data transfer in cloud usually happens without the knowledge of organization resulting in potential violation of local law.
4. How long the personal information will be retained and who enforces this policy in cloud?
5. Does the destruction of data policy destroys data or just makes it inaccessible to the organization?

CHALLENGES IN EXISTING SYSTEM:

The existing Walrus storage provides the list of private data to the users. The request to access public or protected data can be satisfied on demand of the client. But client need to specify the bucket name or the access URL for the bucket in advance. Usually the time required to locate the private bucket is less than the time required to access public or protected bucket because access control list of the bucket needs to be searched to check whether or not the user can access it. And revoking the access policy to reduce the search time for the buckets may compromise the privacy of the buckets.

In a cloud scenario neither the data owner nor the cloud server can enforce the owner's access control policy. The reasons being maintaining the confidentiality and performance. The data owner instead needs to mediate every access request to filter the query result. This in turn nullifies the advantage of storing data at an external server. Therefore it is necessary to design a mechanism such that the data themselves enforce the restrictions on the set of users who can access it.

Both the privacy of the users accessing cloud services and of the data stored at cloud servers may be at risk since access requests could be exploited either by the cloud server or by a malicious observer to possibly infer the sensitive content of the accessed data. The query evaluation process is also at risk since the cloud server is not trusted and therefore can compromise the integrity of query results. Query results satisfy the integrity checks if they are correct (i.e. computed on genuine data), complete (i.e. computed over the whole data collection), and fresh (i.e. computed on the most recent version of the data). Correctness can be achieved by digital signatures. Defining authenticated data structures on the data may ensure completeness. However these data structures may be less flexible as they provide integrity guarantee only for queries operating on the attribute on which the structure has been defined. Freshness can be provided by making authenticated data structures dependent on a variable that changes over time.

SIGNIFICANCE OF THE STUDY IN THE CONTEXT OF CURRENT STATUS:

Data privacy is "the aspect of information technology that deals with the ability an organization or individual has to determine what data in a computer system can be shared with third parties." This allows an organization to protect data within and outside organization boundaries, reducing the amount of weak points hackers look for. Proper data security also protects data when it's shared with other users outside an organization's security system.

Privacy as a need in the society existed since centuries and laws on data privacy mostly started

getting enacted in several countries from late 1900s. But it is only with developments in the field of ICT and increasing digital convergence in the last few decades that introduced much greater opportunities for easy exploitation of personal data by corporates and government, for commercial or other unintended purposes without consent or knowledge of data owner.

OBJECTIVES:

The privacy issues differ according to different cloud scenarios and can be divided into following categories:

(i) how to enable users to have control over their data when the data are stored and processed in cloud and avoid theft, nefarious use, and unauthorized resale,

(ii) how to guarantee data replications in a jurisdiction and consistent state, where replicating user data to multiple suitable locations is an usual choice, and avoid data loss, leakage, and unauthorized modification or fabrication,

(iii which party is responsible for ensuring legal requirements for personal information,

(iv) to what extent cloud subcontractors are involved in processing which can be properly identified, checked, and ascertained.

CONCLUSION:

This paper surveys the different cloud computing paradigms and the database support in the cloud environment. we propose to use the Eucalyptus private cloud architecture as the experimental setup for testing the effectiveness of privacy preservation strategy in storage clouds. Storage clouds allow the client to upload the data to the servers. The data is available as and when required with the implemented security policies and reliability. The most difficult task for the storage clouds is to identify the authorized user for the requested data from the huge collection. Cloud providers allow for direct access to the private data. It is expected that only the authorized clients from the list provided to get access to the private data be allowed and others be denied the service by the data provider.

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ASAR Automatic PPT Generation Using Machine Learning

Shivam Kumar Singh[1], Rahul Sharma[1], Prof S.V Shinde[2]
[1]BE, Department of Computer Engineering, AISSMS College of Engineering, Pune, Maharashtra, India
[2]Assistant Professor, Department of Computer Engineering, AISSMS College of Engineering, Pune, Maharashtra, India

ABSTRACT

In most of the areas for sharing information, slide presentation plays an important role. The slides for the presentation are traditionally prepared using various tools. The traditional way of presenting slides is labor-intensive. Labor-intensive nature leaves scope for human-errors. In this paper, Research observation is, enforcing the automated PPT creation from multi-documents of different extensions based on input query or title that formulate extraction of valuable information source and model a presentation view to automating slide creation using integer linear programming (ILP) method to generate well-structured slides by selecting and aligning key phrases and sentences. This will eventually help in reducing a great amount of the presenters time and efforts. The proposed system works on natural language processing (NLP) rules to classify data for the desired slides. Preparing slides manually consume more time. The drawbacks of the traditional way lead to the need for an intelligent system. The intelligent system needs to be capeble of generating slides with minimum human interference. The existing automatic tools fail to fetch the graphical elements from a given input. Hence the paper proposed an Automatic Slide Generation System. The proposed system fetches the graphical elements as well as text from a document. The proposed system is more reliable than the existing system.

Keywords: Classification, NLP, Support Vector Regression (SVR), ILP, Slide Generation, Modules

I. INTRODUCTION

As one of the most important ways of transferring information and knowledge, presentations provide users to discuss and exchange ideas together. Presentations now play an important role to promote understanding of presenters ideas in many fields such as education, research and business. Many university lecturers use Web service to store, browse, and share presentation slides that are used in their lectures. Although powerful tools for Inserted: slide composition have been developed and Web service has been widely used to share slides, they have a problem with preparing many lecture slides to help their students understand the contents. Lecturers need to prepare slides that can promote understanding. But how to make the content of the slide fine-grained and highly structured is still a problem to address[4]. The traditional tools such as Microsoft PowerPoint and OpenOffice Impress fail to provide any functions of handling presenters' intentions. For example, the logical design of the slide structure and the interrelations between the objects. In presentation slides composition, it is necessary for presenters to consider topics, items, and their relations. Audiences cannot understand the presentation until they see the consistent discussion points in the slide structure. key idea is to construct a Language function from the objective function which is called as the primal objective function and the corresponding constraints, by introducing a dual set of variables. Automatic slides generation for

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A Review on Learning Based Automatic PPT Generation Using Machine Learning

Abhineet Ranjan[1], Akash Gangadhare[1], S. V. Shinde[2]
[1]BE, Department of Computer Engineering, AISSMS College of Engineering, Pune, Maharashtra, India
[2]Assistant Professor, Department of Computer Engineering, AISSMS College of Engineering, Pune, Maharashtra, India

ABSTRACT

Presentation slides are widely used to communicate information to the audience. There are various tools available in the market which only deals with the formatting of the slides but not the content. However, this traditional way of preparing slides is labor-intensive in nature and leaves scope for human errors. Also, for lengthy documents, there is a chance of some important information being missed out. The drawbacks of the traditional way lead to a need for an intelligent system. The intelligent system needs to be capable of generating slides with minimum human interference. In this paper, we are enforcing the automated PPT creation from multi-documents of different extensions based on input query or title that formulate extraction of valuable information source and model a presentation view to automating slide creation using integer linear programming (ILP) method to generate well-structured slides by selecting and aligning key phrases and sentences. This will eventually help in reducing a great amount of the presenter's time and efforts. The proposed system works on natural language processing (NLP) rules to classify data for the desired slides.

Keywords: Classification, NLP, Support Vector Regression (SVR), ILP, Slide Generation, NLTK, Feature extraction.

I. INTRODUCTION

Microsoft PowerPoint, virtual presentation software developed by Robert Gaskins and Dennis Austin for the American computer software company Forethought, Inc. PowerPoint was designed to facilitate visual demonstrations for group presentations in the business environment. Presentations are arranged as a series of individually designed slides that contain images, text, or other objects. The presenter has numerous programming tools to assist him in setting up the slides, including Microsoft Power-Point, Open Office, and Libre Office. Such tools are helpful in setting up the theme and outline of the presentation; however, they do not help presenters in selecting the content for the slides.

The traditional tools thus require a lot of investment, in terms of time and efforts. Collectively, a group of slides may be known as a slide deck [4]. The main focus of this project is to develop a system that helps to generate powerpoint presentation based on user query thus, preventing users time and increase performance. Support Vector Regression is used in maintaining all the main features which characterize the maximal margin of the algorithm. The Support Vector (SV) algorithm is a nonlinear generalization of the Generalized Portrait algorithm developed in Russia in.

Prof. R.B. Rathod

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Stolen Vehicle Detection and Automated Toll Collection System Using QR Code

Harshad Pampattiwar[1], Aishwarya Deshmukh[2], Pratik Sonawale[3], Kajal Jagtap[4], R.B. Rathod[5]
[1,2,3,4] BE, Student, PDEA, Pune, Maharashtra, India
[5] Prof., PDEA, Pune, Maharashtra, India

Abstract- Road transportation is the backbone of any country's economy. Improvement in transportation will lead to lifestyle characterized by extraordinary moments of people, Immense trade in manufactured of good. Developing countries like India needs a significant improvement in infrastructure such as Roads or Highways. Construction of these highways is a costly affair, which can't be invested by the government alone. Normally Public private partnerships are made to construct such a huge project. The money spent on these projects can be regained by collecting toll from the passengers who use the roads. The toll collection system, especially in India faces some problems such as long queue lines, escaping from toll plazas etc. These systems can service only 300 vehicles per hour, and if more than that number of vehicles arrives at that plaza, server traffic jams may occur. [1]

With the increase in the number of vehicles on road, there has been a marked increase in the number of crimes involving vehicle theft. In spite of several stringent laws being in place and security measures taken by car manufacturers, thieves still find a way to remain one step ahead and vehicle theft is still among one of the most reported crimes worldwide. Due to the expensive nature of motor vehicles, there is ample incentive for petty thieves to attempt thefts.[2]

Manual toll collection system contain many drawbacks, like it needs collector to collect the amount at a toll booth, delay in time, traffic congestion, more fuel consumption, longer queue of traffic. To solve these problems we propose QRCode base toll collection and stolen vehicle detection system. QRCode is generated at the time of registration of vehicle in our proposed system. On toll collection booth we collect toll as well as identify vehicle is stolen or not. Propose toll collection system is cost effective, it provides better experience to peoples, less delay of time, shorter queue of traffic, less fuel consumption.

Index Terms- QR-Code, Electronic toll collection, Toll Authorities , stolen vehicle detection.

I. INTRODUCTION

If you are driving an extended distance and try to induce there as quickly as potential, you may most likely move highways and interstates that permit you to travel quicker and have fewer, if any stops. Of course, sure varieties of roads have occasional stops wherever you have got to pay cash to travel on the road. These varieties of roads are referred to as toll roads. Generally they additionally blow over alternative names, like toll-way. To travel on a toll road, you have got to pay a fee — referred to as a toll. Generally you have got to prevent each therefore usually to pay extra tolls to stay traveling on the toll road. Most roads are engineered with native, state or national government cash raised from taxes. Tolls are sort of a tax that applies only to the users of the toll road. Toll roads permit new roads to be designed and maintained without raising taxes on the overall public. A toll road does not forever keep a toll road forever, though. Generally tolls are removed on roads once the price of construction has been recovered from the tolls collected. you may know you are on a toll road when you encounter a toll plaza. A toll plaza could be a gated space wherever you have got to slow down or stop to pay a toll to continue traveling on the road. There are typically many available lanes with toll booths to keep traffic moving as quickly as possible. Some lanes could have individuals working the toll booths, so you'll pay with modification or money. These lanes have gotten slower and slower day by day as a result of variety of vehicle get increase rapidly. To resolve this problem we are planning to use QR Code. [3]

QR is short for fast Response Codes. They're wont to take a bit of knowledge from a short-lived media and place it in to your telephone. You will before long see

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IFARMS: IOT BASED SMART DRIBBLE WATER SYSTEM AND INTERLOPER DETECTION SYSTEM ON CLOUD

Shembade Kalyani[1], Pisal Samata[2], Jadhav Priyanka[3], Budhwant Megha[4], Prof. R. B. Rathod[5]

[1,2,3,4]*Student, BE COMP, Manjari(BK), Pune*
[5]*Professor, P.D.E. A's COEM, Manjari(BK), Pune*

Abstract -*In India, the central calling is the cultivating. Almost the greater part of the cultivating is driven in the peaceful zones, however there is the insufficiency of the lodging and the carelessness about the different new innovations and the gadgets, because of which people groups are meandering towards developed territories. Thus, there is reprobate in horticulture. To overcome this issue, we go for splendid cultivating strategies using IOT. This endeavor fuses different features like GPS based remote checking, temperature identifying, clamminess distinguishing, appropriate usage of water in the residence. It makes usage of remote sensor frameworks for seeing the regular factors continually Various sensor center points are arranged at better places in the residence. Controlling these parameters with the assistance of any remote gadget or web administrations and the tasks are acknowledged by interfacing sensors, Wi-Fi, camera with microcontroller. The method, Image preparing is utilized for interloper's discovery perseverance. Gatecrasher recognition is finished by utilizing camera and additionally different calculations. After identification of interloper, the appropriate move is made by framework. General framework in the field can totally advance the yield of the harvests and general generation.*

Key Words: *IoT, Sensors, GPS, Microcontroller, Wi-Fi, Camera, etc.*

1. INTRODUCTION

Farming is the help of Indian economy. The key issue looked in numerous country territories is that absence of automation in agrarian exercises. Horticulture is considered as most key wellsprings of wage and sustenance generation around the world. India is the country of cultivating. Most of the overall public of India live in towns and are totally subject to agribusiness. The center of the cultivation is water framework. In India cultivating practices is finished by troublesome work, using common instruments, for instance, wrinkle, sickle et cetera. Our Smart Farming System lessens the manual work and mechanizes the horticultural exercises. Actually, the sensor hubs are conveyed into the farmland. They begin to gather ecological data and screen soil qualities. At that point, they coordinate as indicated by planned conventions to impart the gathered information to an overwhelming hub. Starting now and into the foreseeable future, this information is arranged and treated to settle on a conceivable decision. The security perspective is instance of by what means can the WSN improve the agricultural yield. All things considered, crops are antagonistically impacted by human or animal interlopers. Furthermore, the age system is still deficiently controlled which provoke a potential thing disaster. To overcome this point, the video surveillance centers can be used to perceive and recognize intruders and to better manage the creation method. The objective of this errand is to modernize the standard water framework structure. The standard target of this wander is to save work, diminishes misusing of water, from time to time the harvests may waste in light of over water framework, in like manner using a SMS based strategy to checking the method which is important for the digitalize the robotized technique.

Cultivating is standard wellspring of the all-inclusive community in current circumstance. It gives sustenance

and what's more tremendous work. Thusly, modernization of agribusiness is basic in light of the way that customary developing can't bolster up the collect yield. Subsequently, agriculturist start to use the diverse advancement to achieve better yield and decrease the required work.

In our endeavor, we are basically concentrating on following applications.

For an instance:

To reliably screen the soil sogginess.

To reliably screen the water level.

To check the temperature, stickiness.

To screen and control the whole structure.

Give the detail information about the field condition to the customer.

A) An Internet of Things:

The Internet of Things (IoT) is one system which contains physical items that are implanted with the electronic gadgets, software's, network and sensors to accomplish a higher esteem and give a few administrations in regards to trade of subtle elements with the item producer, administrator. Typically, it is relied upon to give present day and pushed relationship between the contraptions for its proper correspondence and handles a combination of traditions, applications and learning bases.

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Usage based Vehicle Insurance

H. Pakhale[1],S. Shahapure[2], S. Kamble[3], V. Tupe[4], Prof. B. S. Kankate[5]

[1,2,3,4]*Students, Department of Computer Engineering, PDEA College of Engineering, Pune*
[5] *Asst. Prof., Department of Computer Engineering, PDEA College of Engineering, Pune*

Abstract —Insurance On The Basis Of Driving Style (IOTBODS) which is an advanced product form in usage-based insurance (UBI) for a vehicle, takes driving style and behavior into consideration in its actuary process. IOTBODS insurance product is supported by refinement and analysis based on raw driving data of insured vehicles, and the very analysis process, which is based on accelerometer data, helps to recognize the risk level of each driving behavior by finding the relationship between them. Even if studies on risk level determination have been done adequately, research on feedback and presenting of risk evaluation results for the drivers of insured vehicles have not been reported much. In the proposed system, the user will get the insurance on the basis of their driving style. If the user is driving a vehicle without urgent braking, harsh braking, acceleration, rapid turn, sudden turn, cutting lane in speed i.e. rash driving; then the user will get more benefits. If the user does rash driving then the user will get lesser benefits of insurance.

Keywords- Usage Based Insurance, Driving Styles, Vehicle Insurance.

I. INTRODUCTION

The current pricing policy of automotive insurance companies around the world is based on traditional factors, such as age, location of residence, history of accidents and traffic violations. This means that all customers pay similar prices for similar factors, despite potentially large variations in their driving habits. The emerging telematics-based usage-based insurance (or pay-how-you-drive programs). Usage-based insurance (UBI) relies on the collection of each driver's data using various technologies (OBD-II, Smartphone, or Hybrid OBD-Smartphone) to calculate the risk score during a monitoring period, which can reflect the probability of getting involved in an accident.

UBI provides a promising way to differentiate safe drivers from risky ones, which forms the basis for risk categorization and, thus, for subsequent discounts or surcharges on premiums depending on driving behavior. The proposed system detects user location and the condition when an actual accident occurred. In propose system, the system can detect fraud insurance claim and authentic insurance claim. The authenticity of the accident identified by accelerometer reading. the system also poses the capability to categories user driving style.

II. EXISTING SYSTEM

In the existing system user claim insurance after an accident. As per repairing cost he/she get money. Disadvantages of the existing system are:

- Users can claim fraud insurances.
- Users who follow all rules and maintain their vehicle can't get proper benefits of the insurance

III. PROPOSED SYSTEM

Each driving data recorded and store to the database for evaluating and offering the exact amount of insurance policy driving data like harsh braking, accretion, lane cutting in speed will be collected using accelerometer and GPS location with incident date and time. This data is helpful to the insurance company to calculate the risk analysis and chances of getting accident recovery claims. It will be also useful to verify accident incident information explain by the consumer. Analysis data may be used for educating people about driving sense and analyzing the driving behavior of the people.

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IV. SYSTEM DESIGN

1. *Algorithm*

The Knuth Morris Pratt Algorithm is a string searching algorithm, that searches for the frequency of a "word" W within the main "text string" S so that when a mismatch occurs, the word embodies satisfactory details to determine where the next match could begin, thus bypassing re-matching of previously matched characters. This algorithm is used to match the driving styles of the user in an effective manner. The algorithm will give enhanced results for such large sets of data.

2. *Hardware Requirements*

i.	System	:	Intel I3 Processor and above.
ii.	Hard Disk	:	20 GB.
iii.	Monitor	:	15 VGA Color.
iv.	Ram	:	4 GB.
v.	Mobile	:	Android
vi.	Mouse	:	Logitech

3. *Software Requirements*

i.	Operating system	:	Windows 7 and above.
ii.	Coding Language	:	Java 1.8
iii.	Tool Kit	:	Android 2.3 and above
iv.	IDE	:	Android Studio
v.	Database	:	SQLite, MySQL

4. *Architecture*

The entire module would be based on the client-server architecture. It would have the android application deployed on the user's phone device which would have all the basic features including the status of the driving mode and also detection of an accident or rash driving using the KMP Algorithm. Whereas the Web would host the features attributed to the Insurance company which would provide all those conventional features along with the additional features regarding the objective of the proposed methodology.

The module is also adaptive to analyze the detection of rash driving or accidents from the inputs received from the devices deployed. The system continuously checks for any signs of driving patterns or accidents and if any discontinuous pattern is found then the user is alerted immediately. These records are not only helpful in detecting accidents but also in detecting rash driving or dynamic driving styles.

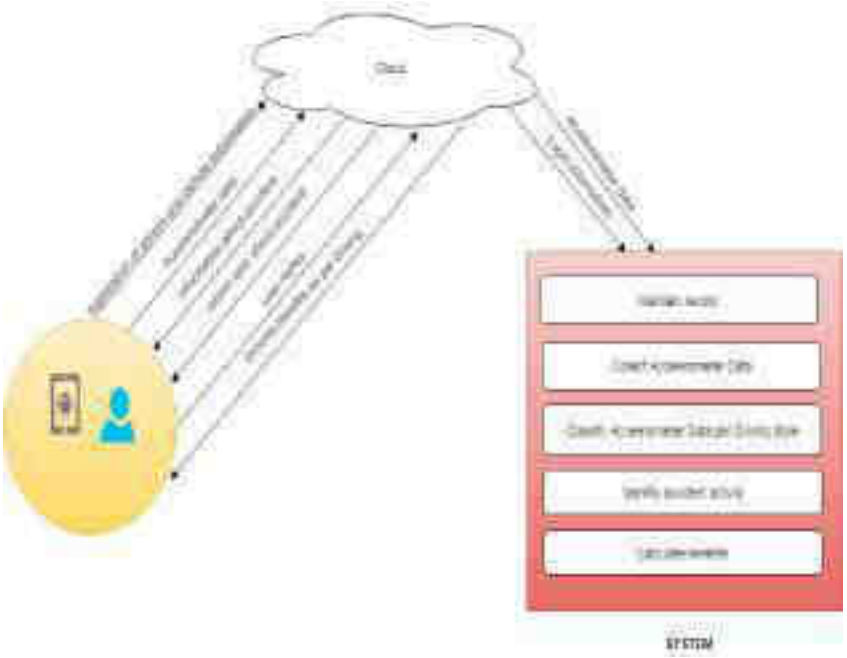

Figure. 1. Block Diagram

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V. MATHEMATICAL MODEL

Let *S* be the whole system which consists:

S= {*IP, Pro, OP*}. Where

A. *IP* is the input of the system.
B. *Pro* is the procedure applied to the system to process the given input.
C. *OP* is the output of the system.

A. Input:

IP = {I}. Where,

I is a set of data, provided as an input.

B. Procedure:

Step1: User has to do registration and login into the system.

Step 2: Verify the information into the database.

Step 3: Extract the data of the vehicle.

Step 4: Proposed work deals with accelerometer data, latitude-longitude (addressing data) using a haversine algorithm.

Step 5: The methodology comprised of three phases, firstly user registers and logins.

Step 6: Driving data or information of the user driving is updated on the server.

Step 7: If accidents are claimed it can be checked by the various authorities.

Step8: As per the detailed information or driving data of the user the relevant insurance policy is provided.

C. Output:

Detection of accidents and claiming the insurance policy as per the users driving data

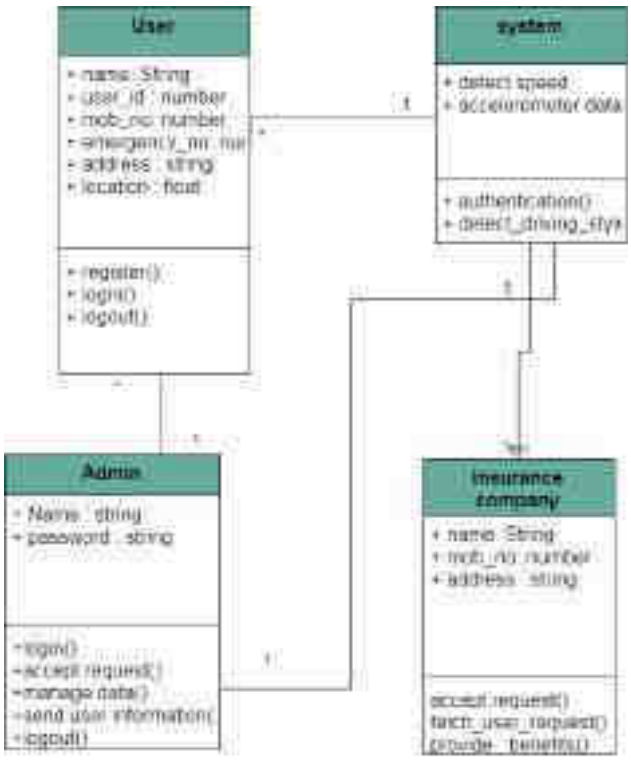

Figure. 2. Class Diagram

VI. CONCLUSION

The system can easily detect accidents and rash driving efficiently using the KMP Algorithm. Also, the location of the user can be traced in such critical times. The driving data gathered would be useful in policy-making for insurance companies and to give better options of various policies according to the user driving styles. This fulfills the objective of the Usage Based Insurance (UBI) successfully.

VII. FUTURE SCOPE

Although there are many people purchasing different types of insurance policies a few of them only fully aware of the benefits of these policies. Insurance covers are something that one should be fully aware. In general, the insurance policy provides protection against loss, threat and insecurity. The Indian insurance industry has changed speedily in the demanding economic environment throughout the world. In the current scenario, the insurance companies in India have become fiercer in nature and are allocating appropriate distribution channels to get the maximum profits and serve customers in manifold ways.

The future expansion of the insurance sector will depend on how effectively the insurers are able to come up with product designs suitable to our context and how successfully they are able to change the insights of the Indian consumers and make them aware of the insurable risks they might possess. The future growth of insurance also depends on how service-oriented insurers are going to be.

From the success of the project implementation, we can conclude that the software, when deployed in the Insurance Industry in India, would help them minimize their losses by eliminating fraud insurance claims by the customers along with discounting genuine customers in near future. Also, the data of the driving styles recorded would be beneficial in future policy-making or any such formulations. This system can also be standardized and synced with regulatory bodies such as the RTO, IRDA, etc. for better law enforcement and compliance purposes. The detection of an accident can be helpful in providing immediate support from the nearest Hospital or Health Care Centers. With such features, if introduced in the insurance industry, it would not only be beneficial for the industry but also for the genuine customers.

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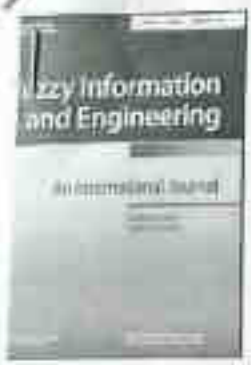

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Review on Reliable Pattern Recognition with Machine Learning Techniques

Devyani Bhamare & Poonam Suryawanshi

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Journal Européen des Systèmes Automatisés
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A Stereolithography System for 3D Low Cost Components

Criteria 3

Baban K. Suryatal[1,2*], Sunil S. Sarawade[3], Suhas P. Deshmukh[4]

[1] Mechanical Engineering Department, Sinhgad College of Engineering, Vadgaon Bk., Savitribai Phule Pune University, Pune, Maharashtra 411041, India
[2] Mechanical Engineering Department, PDEA's College of Engineering, Manjari Bk., Pune, Maharashtra 412307, India
[3] Mechanical Engineering Department, M.E.S. College of Engineering, Pune, Maharashtra 411001, India
[4] Mechanical Engineering Department, Government Engineering College, Karad, Maharashtra 415124, India

Corresponding Author Email: bksuryatal@gmail.com

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photo-polymer, stereolithography, rapid prototyping, ultra-violet light

ABSTRACT

The stereolithography (SL) process is one of the rapid prototyping technics and it is also known as additive layered manufacturing method. It is a chipless manufacturing method and the object is built layer by layer. A low cost stereolithography apparatus (SLA) is developed to produce highly precise, three-dimensional (3D) structures from broad selection of functional materials, especially photopolymer resin. The present SL systems available in the market are very expensive. The developed low cost SLA will be affordable to medium scale industries as well as customers. The developed SLA utilizes focused light beam of wavelength range of 300 nm – 700 nm from the DLP projector and passes through the objective lens over the surface of a photo-curable resin, which undergoes photo-polymerization and forms solid structures. The photopolymer used in this experimentation is polyethylene glycol di-acrylate and photo-initiator is Irgacure 784. The experiments are performed on objects with hexagonal cross-section and pyramid geometries and 0.1 mm curing depth along Z – axis. The trials are performed with different exposure and settling period. The 3D objects are successfully fabricated with high build speed and low cost. The pyramid object with maximum 120 numbers of layers with 12 mm dimension along Z-axis is built in 11.0 minutes. It is found that the optimum exposure time to cure a layer is two seconds. The maximum exposure area obtained in X-Y plane is 55 mm x 45 mm. The percentage dimensional error of the build objects is decreased as the curing time is reduced and the error is minimum for the two seconds curing period per layer. The obtained resolution of the build objects in X-Y plane is 23 microns and Z-stage resolution is 0.1 mm.

1. INTRODUCTION

There are a number of processes that can realize three-dimensional (3D) shapes such as those stored in the memory of a computer. An example is the use of holographic techniques [1], but these require many complex calculations to obtain the hologram and there is insufficient accuracy and clarity. A manual or a conventional mechanical process can also make a physical model, but such models require long fabricating times, high cost and excessive labour. To solve these kinds of problems, a new group of techniques called additive manufacturing (AM) technologies have been developed by a number of researchers group [2-5]. AM is a collection of processes in which physical objects are quickly created directly from computer generated models. The basic concept of rapid prototyping is where 3D structures are formed by laminating thin layers according to two-dimensional (2D) slice data, obtained from a 3D model created on a CAD/CAM system [2-5]. Stereolithography (SL) is one of the most popular AM process. It usually involves the curing or solidification of a liquid photosensitive polymer by focusing a light beam or laser beam of specific wavelength on the surface with liquid photopolymeric resin. The focused light beam supplies energy that induces a chemical reaction, bonding large number of small molecules and forming a highly cross-linked polymer [6]. Now a day, rapid prototypes of the different objects are required before their actual manufacturing because one can improve the design at the early stage of product development. The rapid prototyping or 3D printing field is very fast developing and this technology can applicable to all the fields i.e. engineering as well as non-engineering. The objective of this research work is to develop a low cost stereolithography apparatus (SLA) to produce highly precise, three-dimensional (3D) structures from broad selection of functional materials, especially photopolymer resin. The present SL systems available in the market are very expensive. The overall cost of the newly developed SLA is very low as compared to cost of SLA available in the market. The cost of photo-curable resin used is also low as compared to other available resins. Therefore, the developed low cost SLA will be affordable to medium scale industries and customers as the overall build cost of the objects is minimum.

A large number of researcher's groups have developed the SL systems out of which some of them are briefed in the following literature review.

Fujimasa [7] has been described the concepts of microplanes, microrobots, microcars and microsubmarines and MEMS which are systems that combine computers with

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tiny mechanical devices such as sensors, valves, gears, mirrors, and actuators embedded in semiconductor chips. Ventura et al. [8] developed a direct photo shaping process for the fabrication of functional ceramic components layer by layer and each layer is photo image or a digital light processing (DLP) projection system. Bertsch et al. [9] developed a micro stereolithography apparatus employing a pattern generator in which a UV laser and dynamic LCD pattern generator were used to generate the cross section of a 3D structure. While the substrate did not move in the x–y direction in the liquid photopolymer, an LCD pattern generation system was necessary and the resulting diffraction had to be considered. Maruo et al. [10] developed two-photon polymerization (TPP) which utilizes focused lasers to precisely polymerize small volumes resin and the volume is only polymerized if it is excited by two different photons within a very short time period. TPP is much slower than SL, but has successfully created components with 100 nm features. TPP is limited to polymers because it requires a clear resin to function; suspended particles would scatter the laser beams. Young et al. [11] have described a novel device for producing 3D objects that has been developed using an LCD as a programmable, dynamic mask and visible light to initiate photopolymerization. Ikuta et al. [12] introduced micro stereolithography technology and proposed a means of applying micro stereolithography in mass-production using an optical fiber array so that multiple microstructures could be fabricated in a single process. Monneret et al. [13] presented a new process of microstereolithography to manufacture freeform solid 3D micro-components with outer dimensions in the millimeter size range. Sun et al. [14] performed Monte Carlo simulations and experimental studies to understand the detailed microscale optical scattering, chemical reaction (polymerization), and their influence on critical fabrication parameters. It was found that due to the scattering, the fabricated line is wider in width and smaller in depth compared with polymeric fabrication at the same condition. The doping technique substantially reduced the light scattering, which in turn enhanced the fabrication precision and control. The experimental values of curing depth and radius agreed reasonably well with the theoretical modeling. Bertsch et al. [15] described new polymer/composite photosensitive resins that can be used in the microstereolithography process for manufacturing complex 3D components. Huang et al. [16] analyzed the shrinkage deformation of the mask type stereolithography process. Lee et al. [17] developed a micro stereolithography apparatus using a UV laser and a complex optical system. Jiang et al. [18] developed a Masked Photopolymerization Rapid Prototyping (MPRP) system using LCD panel as dynamic mask with an upper exposure skill. Dongkeon et al. [19] developed a liquid crystal display (LCD) based micro stereolithography process in order to fabricate microparts with superior mechanical properties (for e.g., micro gears) and investigates the fabrication process of micro bevel gears using photosensitive resins reinforced with ceramic nanoparticles. Deshmukh et al. [20] proposes and develops an offaxis lens scanning technique for MSL and carries out optical analysis to compare its performance with the existing techniques mentioned above. The comparison clearly demonstrates improved performance with the proposed offaxis lens scanning technique. Limaye [21] presented a more sophisticated process planning method to build a part with constraints on dimensions, surface finish and build time and formulated an adaptive slicing algorithm that slices a CAD model so as to obtain the required trade-off between build time and surface finish of up facing surfaces of the part. Hadipoespito et al. [22] developed DMD based UV micro – stereolithography system for fabricating 2D and 3D micro – parts. With the help of characterization experiments it was observed that the developed the DMD based imaging system irradiates an entire photopolymer layer at once, providing reasonable curing speed and good resolution at a low cost. Micro parts were also fabricated in nanocomposites, which were obtained by ultrasonic mixing of the transparent photopolymer and nano-sized ceramic particles. The micro models fabricated by this process could be used for micro scale investment casting, tooling, devices, and medical applications. In this method process optimization is needed to improve the quality of fabricated micro – parts. Singhal et al. [23] has presented a statistical surface roughness model for SLS prototypes as a key to slice the tessellated CAD model adaptively. The adaptive slicing system is implemented as Graphic User Interface in MATLAB-7.

Choi et al. [24] developed a more economical and simpler micro-stereolithography technology using a UV lamp as a light source and optical fiber as the light delivery system and photopolymer solidification experiments were conducted to examine the characteristics of the developed micro-stereolithography apparatus. Zhao et al. [25] developed a thick film mask projection stereolithography to fabricate films on fixed flat substrate and develop a column cure model in which a CAD model of part is discretized into vertical columns instead of being sliced into horizontal layers, and all columns get cured simultaneously till the desired heights. Vatani et al. [26] optimized the exiting slicing algorithms for reducing the size of the files and memory usage of computers to process them. In spite of type and extent of the errors in STL files, the tail-to-head searching method and analysis of the nearest distance between tails and heads techniques were used. As a result STL models sliced rapidly, and fully closed contours produced effectively and errorless. Deshmukh et al. [27] carried out analysis and experimental verification of optomechanical scanning systems for microstereolithography. Choi et al. [28] developed MSL system for tissue engineering using a Digital Micromirror Device (DMD) for dynamic pattern generation and an ultraviolet (UV) lamp filtered at 365 nm for crosslinking the photoreactive polymer solution. Gandhi et al. [29] proposes and analyses a 2D optomechanical-focused laser spot scanning system for microstereolithography which allows uniform intensity focused spot scanning with high speed and high resolution over a large range of scan. Higher speed and high resolution at the same time are achieved by use of two serial double parallelogram flexural mechanisms with mechatronics developed around them. Itoga et al. [30] developed maskless photolithography device by modifying Liquid Crystal Display (LCD) projector optics from magnified to reduced projection. The developed device produces a practical centimeter scale micro-pattern by dividing a large mask pattern and divisionally exposing it synchronized with an auto – XY stage, applying it to cell micro-pattern and microfluidic device production. But they arise problems in jagged pattern boundaries due to the liquid crystal panel structure and collapse pattern of the boundary divided on divisional exposure using the auto – XY stage. Zhou et al. [31] presented a novel AM process based on the mask video projection. For each layer, a set of mask images instead of a single image are planned based on the principle of optimized pixel blending. Experimental results show that the mask video

projection process can significantly improve the accuracy and resolution of built components. The disadvantage of this method is that it will require an additional linear stage with good accuracy and moving speed. In addition, the platform movement during the building process requires the designed hardware to ensure the repeatability between different layers which increases the overall cost of the system. Zabti [32] carried out Pareto based Multi-objective function based optimization of STL process which has three objective functions. The goal is to find the optimum exposure time value by minimizing the cure depth, surface roughness and maximizing the mechanical strength. Lehtinen [33] developed a DMD based projection stereolithography and a computer code is written to control the entire manufacturing process. Gandhi et al. [34] analyze various optical scanning schemes used for MSL systems along with the proposed scheme via optical simulations and experiments. The mechanical design of the scanning mechanism is carried out to meet requirements of high speed and resolution. The system integration and investigation in process parameters is carried out and fabrication of large micro-component with high resolution is demonstrated. Campaigne III [35] developed projection stereolithography and material characterization of nanocomposites photopolymers was carried out. Valentincic et al. [36] conclude that DLP based stereolithography is used to reduce the build time and to increase the manufacturing accuracy. Compared to fused deposition modeling (FDM) machines, machines for DLP stereolithography are expensive and thus not available to a broad range of users as it is the case with FDM 3D printers. Luo et al. [37] developed desktop manufacturing system which can produce RP parts with good machining efficiency, but the surface roughness should be further improved. Ibrahim et al. [38] investigate the influence of process parameters which are layer thickness and exposure time on physical and mechanical properties of DLP structure.

Thus, by going through the aforementioned literature on SL systems, it is observed that most of researchers develop microstereolithography systems. The developed SL systems are either LCD based or DMD based. The disadvantages of LCD based SL systems are low pixel filling ratio, print – through errors occurs due to light that penetrates into already cured layers, unnecessary wavelengths cause inaccurate dimensions in the cured part. The advantages of DMD based SL systems are availability of UV compatibility, high modulation efficiency, high light transmission, high optical fill factor, low pitch size and pixel size. Both the developed SL systems i.e. LCD as well as DMD based mentioned in above literature survey are very expensive, which are not affordable to common or medium sized industries or vendors who can build their prototypes with a cheaper cost. Therefore, development of a low cost SLA with better build speed is a goal of this research work.

The sub-section 2.1 of section 2 describes the developed low cost SLA in detail with specifications of the sub-systems, different softwares, photo-polymer and photo-initiator used in the apparatus. In sub-section 2.2 the absorbance spectrum of photo-curable resin and light beam spectrum of DLP projector are plotted. In sub-section 2.3 the slicing procedure of 3D CAD model into 2D slices is explained with the help of developed MATLAB code. The experimental results and discussions are given in section 3. Finally, the conclusions are drawn from experimental work in section 4.

2. EXPERIMENTAL SET UP

2.1 Stereolithography apparatus (SLA)

The stereolithography apparatus (SLA) is developed to produce highly precise, three-dimensional (3D) structures from broad selection of functional materials, especially photopolymer resin. The lay-out of the experimental set-up is shown in Figure 1 and the CAD model is shown in Figure 2. The developed stereolithography apparatus (SLA) utilizes focused light beam from DLP projector and then through the objective lens over the surface of a photo-curable resin, which undergoes photo-polymerization and forms solid structures. The lamp of the modified DLP projector works as light source and DMD chip in the DLP projector works as a dynamic pattern generator for this SLA. The colour wheel of the DLP projector is filtering most of the UV light out. But UV light is required for solidification of the photopolymer. Therefore, we had done changes in the colour wheel. The color wheel is a glass disc with several colored segments that spins while the projector is running to colorize the image. The projector actually requires it to run; when the color wheel is simply removed, the projector would not turn on the lamp. Therefore, only glass portion of the color wheel is removed so that maximum UV light should come out from the projector which is the requirement for solidification of liquid resin. After removing glass portion from the color wheel, the projector becomes black and white. Infocus make DLP projector with display resolution 1024×768 is used. The photograph of actual experimental set-up is shown in Figure 3.

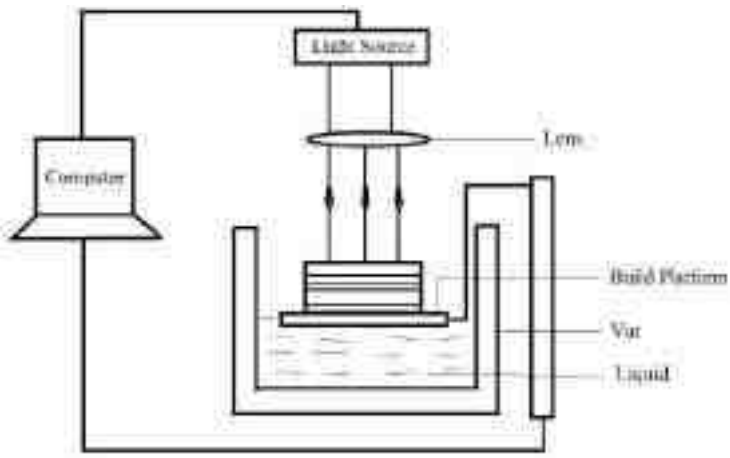

Figure 1. Lay-out of the experimental set –up

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1-Frame, 2-Ball Screw, 3-Guide rod, 4-Z stage, 5-Resin Tank, 6-Stepper motor

Figure 2. CAD model of experimental set-up without DLP projector

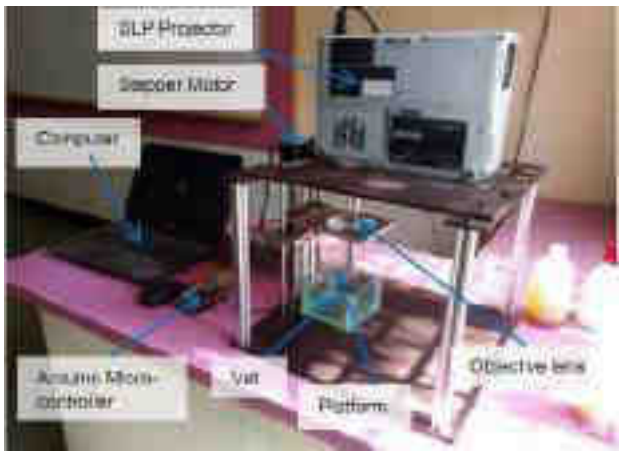


Figure 3. Experimental set-up

The photopolymer used in this experimentation is polyethylene glycol di-acrylate with 2% Irgacure 784 as photo-initiator. The absorbance spectrum of the photopolymer is plotted and the maximum absorbance observed is in the range of 315 nm to 480 nm. The peak absorbance of polyethylene glycol di-acrylate matches with the peak intensity of light beam of DLP projector which is in the range of 400 nm – 570 nm. Therefore, polyethylene glycol di-acrylate is selected as photo-curable resin and cost of the same resin is also low as compared to other resins. From this data it is concluded that maximum UV light is required for solidification of the photopolymer. The NEMA 17 bipolar stepper motor with 0.9˚ step angle, 5% step accuracy, 5 mm shaft diameter is used to rotate the ball screw. The ball screw with nominal diameter 12 mm, pitch 2.0 mm, core diameter 10.084 mm and lead angle 3.04˚ is used for up and down motion of the Z-stage. The maximum speed of the stepper motor is 2344 rpm and holding torque is 4.8 kg-cm. The Creo 3.0 software is used for modeling of 3D CAD model. The 3D CAD model and STL file format in Creo 3.0 software is more compatible with developed MATLAB code for slicing of 3D CAD model as compared to other modeling softwares. Therefore, Creo 3.0 software is selected for 3D CAD modeling. A special MATLAB code is developed for slicing of the 3D CAD model and this sliced 3D CAD model is imported into the Creation Workshop software version 1.0.0.75 which is used to control the focusing time period of sliced images through DLP projector and focusing lens. The make of focusing lens is Optics and Allied Engineering Private Limited, Bangalore with 100 mm diameter and 100 mm focal length.

The Creation Workshop software also controls the motion of the Z-stage through Arduino MEGA 2560 micro- controller and NEMA 17 bipolar stepper motor. It also controls input parameters, such as layer thickness, motor movement speed, exposure time and settling period. These parameters make the equipment versatile and suitable for a wide range of different tasks. Finally, the different shape objects are built by curing the aforementioned photo-curable resin. The photographs of the build components are taken by the Amp Cam digital microscope with optimum resolution 640×480 and 5X digital zoom. The FARO Edge 3D scanner with the specifications ±25µm accuracy, 25µm repeatability, 115 mm depth of field, 80 mm effective scan width for near field, 2,000 scanning points per line, 40µm minimum point spacing, 280 frames/second scan rate and Class 2M laser is used to measure the dimensions of the build objects. Thus, a low cost, high build speed SLA is developed to fabricate 3D components.

In the Z- Stage, we have to control the linear movement of the platform with the help of stepper motor and ball screw. The stepper motors rotational motion is transformed in to linear motion with help of ball screw coupled with motor shaft. Arduino microcontroller is used for precise and accurate control the movement of the motion stage. The rotational movement of the stepper motor is controlled with the help of special Arduino program. The program mainly consists of various commands and statements to control the various parameters such as speed, time delay etc. Figure 4 shows the window of Arduino software in which the uploaded program is shown. The Arduino Micro-controller with stepper motor is interfaced with Creation Workshop Software to obtain desired motion of Z-stage.

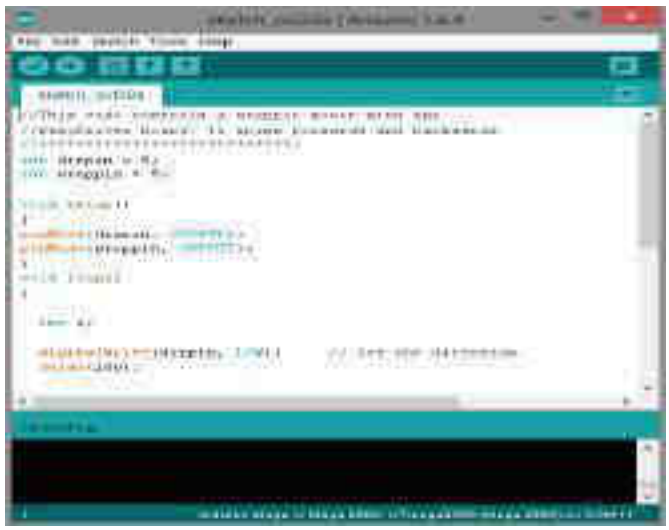


Figure 4. The program uploaded to the Arduino software

2.2 Spectrum study of photopolymer and DLP projector

The 3D object is built by focusing the light beam of DLP projector through objective lens on the z-stage platform. On the Z-stage platform a layer of liquid photopolymer of thickness equal to the slice thickness of CAD model is made available by lowering the platform with help of ball screw and stepper motor. Therefore, it is necessary to plot the absorbance spectrum of photopolymer from which we can conclude that what is value of wave length for peak absorbance. The Figure 5 shows the absorbance spectrum plot of photopolymer and it is observed that the peak absorbance is at wavelength 335 nm,

410 nm and 480 nm. Therefore, the focused light beam must have the peak wavelength in the range of 300 – 500 nm which is a UV light region.

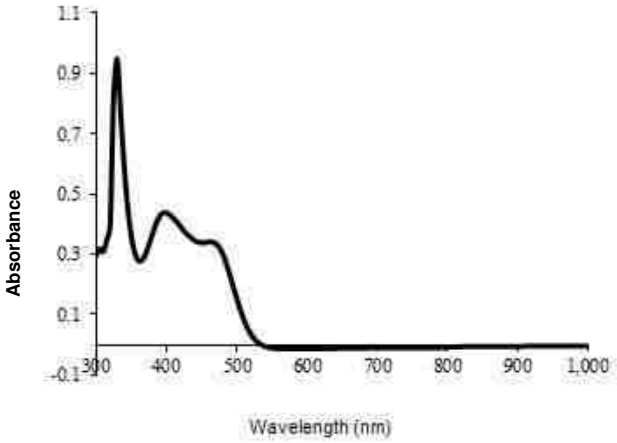


Figure 5. Absorbance spectrum of photopolymer

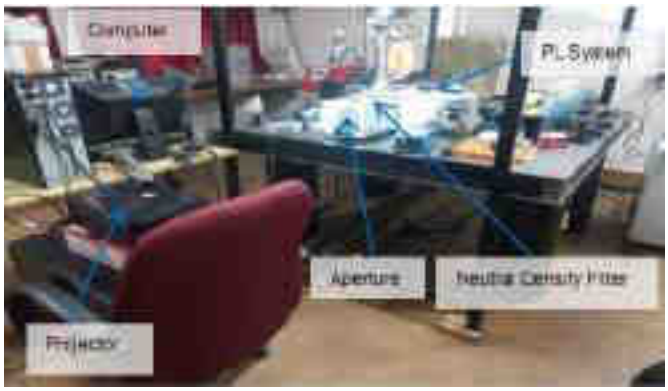


Figure 6. DLP projector light beam spectrum plotting set-up

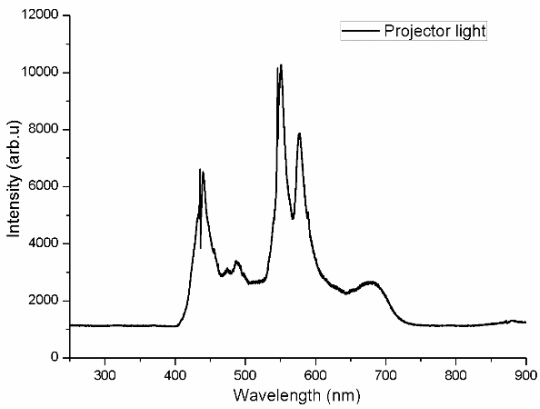


Figure 7. Light beam spectrum of DLP projector

The study of DLP light beam spectrum is done by using Horriba (model iHR320) light spectrometer. The Figure 6 shows the set-up for plotting the spectrum of DLP projector light beam. The light beam from the DLP projector is passes through the aperture then it passes through the neutral density filter. The neutral density filter removes the unwanted light rays. The spectrum is plotted for the light wavelength range of 250 – 900 nm. Finally, light beam passed into the photoluminescence (PL) system. The PL system consists of optical grating, mirror 1 and mirror 2 with CCD (closed circuit device) camera. The measured spectrum data by PL system is collected by the computer. The Figure 7 shows the light beam spectrum obtained by above mentioned spectrometer. From light beam spectrum it is observed that the peak values are in the wavelength range of 400 nm – 570 nm. Therefore, the light beam of DLP projector is useful to cure the selected photopolymer as peak wavelength range matches with each other.

2.3 Slicing of 3D CAD model

Basically, the stereolithography equipment consists of a DLP projector, focusing lens, resin vat, a linear translation stage with a platform and a computer. Before the manufacturing can begin, some preparations must be done. First, the CAD model is sliced into horizontal cross-section images. These black and white images will be projected one by one onto the platform with resin layer. As there are different methods available to slice a CAD model without tessellation but slicing a triangulated mesh model is still the commonly used method in 3D printing caused by its format (i.e. STL) is widely adopted in software and machine. These different methods of slicing a 3D CAD models are Contour, Voxelization and Ray tracing [39]. The contour method is the traditional slicing process that generates the cross-sectional information by intersecting the input model with a set of horizontal planes. As the input model is tessellated into faces (e.g. triangles defined in the STL), the slicing operation is actually a number of face-plane intersections, each of which is a segment. In a layer, the intersection between the model and a slicing plane is one or more polygons (contours), which are constituted by the segments. The voxelization method creates a 3D array of voxels that can cover the whole volume of the input model, and then decides whether each voxel is inside or outside the model. The in/out determination is challenging, because the mesh is just a set of faces in the 3D space without the information of inside or outside. In ray-tracing method, 2D image is used and in/out for every pixel in a slice is determined similar to point-in-polygon testing. In this method testing can be done by casting a ray from each pixel to intersect with the model, and finding out if the ray reaches the interior or exterior of the model at a particular height. Out of the above three slicing technologies, the ray-tracing method is the fastest in most cases and it needs a moderate amount of memory for computation. It maintains a good balance between computation time and memory space. It would be optimal if the intersection problem can be handled without creating other problems. Therefore, due to these advantages, the ray-tracing method is used for development of a special MATLAB code for slicing of 3D CAD model in this research work.

The STL file shown in Figure 8 was originally conceived by 3D Systems [40] and it opened the door for rapid prototyping and manufacturing market by allowing CAD data to be used in STL systems. The file consists of an unordered list of triangular facets that represent the outside skin of a part. The triangular facets are described by a unit normal vector and a set of X, Y, Z coordinates for each of the three vertices. The unit vectors indicate the outside of the part. Since the STL model consists of triangular facets, it is an approximate model of the accurate CAD data. Regardless of being an imprecise model, STL has become the standard used by most CAD and RP systems. STL is a simple solution for representing 3D CAD data and it provides small and accurate files for data transfer for specific shapes [41, 42]. There are two formats for STL file:

ASCI and Binary which are shown in Figure 9 and Figure 10 respectively. Binary files are smaller and more compact. Hence, they are more common. After generating the STL file of the 3D CAD model then it is necessary to slice the model into a number of horizontal cross-section images. The 3D CAD model of the object which is to be built by using stereolithography process is developed with the help of CREO 3.0 software. Then it is saved in STL file format using the same software. The Figure 11 shows the 3D CAD model in STL file format.

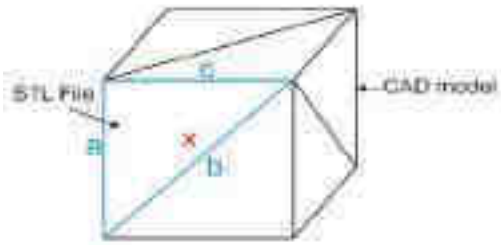


Figure 8. Standard Tessellation Language (STL) file and CAD model [42]

```
solid name

facet normal ni nj nk
    outer loop
        vertex v1x v1y v1z
        vertex v2x v2y v2z
        vertex v3x v3y v3z
    endloop
endfacet

endsolid name
```

Figure 9. ASCII STL file format [42]

```
UINT8[80] – Header
UINT32 – Number of triangles

foreach triangle
REAL32[3] – Normal vector
REAL32[3] – Vertex 1
REAL32[3] – Vertex 2
REAL32[3] – Vertex 3
UINT16 – Attribute byte count
end
```

Figure 10. Binary STL file format [42]

Figure 11. 3D CAD model in STL file format

Thus, a special MATLAB code is developed by using ray tracing method and by using this code, the 3D CAD model is sliced into a number of layers as shown in Figure 12. The Figure 13 (a) and (b) shows a single sliced layer in MATLAB software window. Then these sliced layers are imported in Creation Workshop software and focused one by one at required time interval with the help of DLP projector through objective lens on the Z- stage platform and finally the 3D object is built.

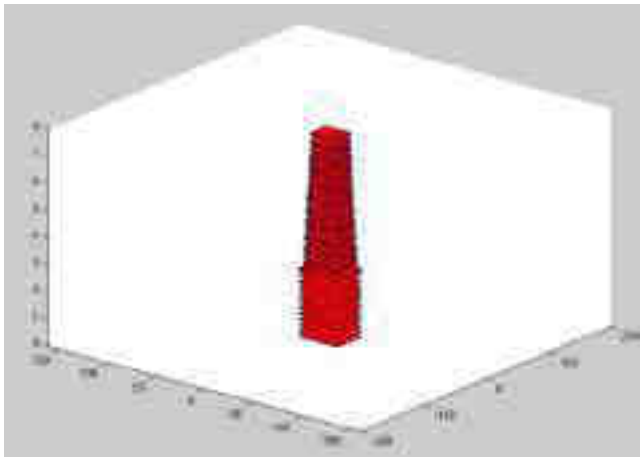
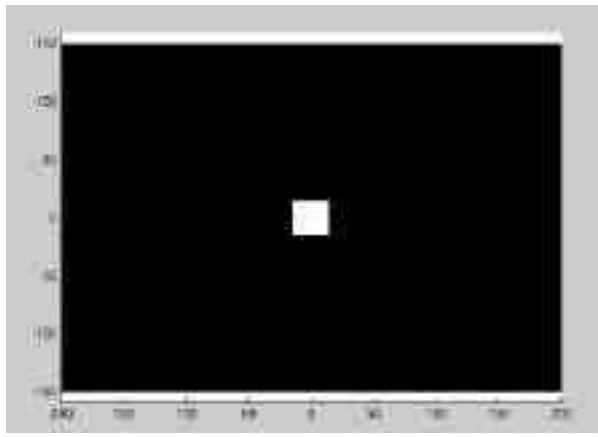
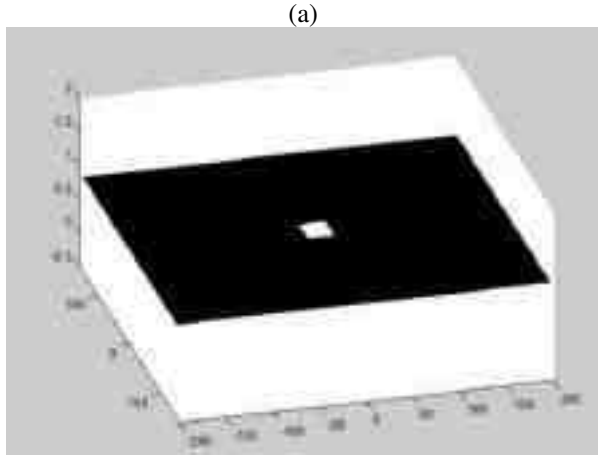


Figure 12. Sliced 3D CAD model



(a)



(b)

Figure 13. 2D Slices in MATLAB window

3. RESULTS AND DISCUSSIONS

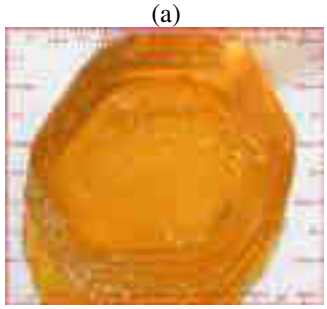
The experiments are performed with hexagonal cross-

section and pyramid objects with 0.1 mm curing depth along Z – axis. The trials are performed with different exposure time and settling period. The exposure time is varied from 10 seconds to 1 second and it is observed that the objects are best cured for 2 seconds curing period. The experimental test data for hexagonal cross-section and pyramid objects are given in Table 1 and Table 2 respectively. The CAD model of the hexagonal prism is shown in Figure 14 and scanned image of build hexagonal prism by FARO Edge 3D scanner is shown in Figure 15. The built hexagonal prism is shown in Figure 16 (a) and (b). The Figure 17 shows the measurements of dimensions of hexagonal prism by FARO Edge 3D scanner. The Figure 18 shows the CAD model of pyramid and Figure 19 shows the built pyramid. The scanned image of built pyramid by FARO Edge 3D scanner is shown in Figure 20 and the measurement of dimensions of pyramid by FARO Edge 3D scanner are shown in Figures 21-23. The pyramid object with 120 numbers of layers with 12 mm dimension along Z-axis is built. The maximum area 18 mm x 16 mm of pyramid object along X-Y plane is cured. For commercial SLA machines resolution in Z-axis is in between 0.01 to 0.25 mm. The resolution along Z-axis of 0.25mm creates a fairly coarse surface for medium sized parts, but for larger models, the layer steps are not too noticeable due to the relative size of larger parts. A resolution of 0.1mm provides a more favorable surface finish for medium and small parts. Therefore, experiments are performed with 0.1 mm curing depth along Z-axis. The maximum exposure area obtained is 55mm x 45mm. It is observed that as the curing time decreases the percentage error between the 3D CAD model dimensions and built dimensions are also decreases. The maximum and minimum percentage errors for hexagonal cross-section object are 9.43 and 2.0 respectively. The maximum and minimum percentage errors for pyramid object are 4.44 and 0.93 respectively. The minimum percentage error is observed for 2 seconds curing period. The dimensions of the built components are measured by FARO Edge 3D scanner with ±25µm accuracy. Creation Workshop software Version 1.0.0.75 is used: (i) to control the Z-stage motion, (ii) to control the focusing time of sliced images and settling time. The resolution of the built components depends upon Software Imposed Parameters (SIP) and SL Process Parameters (PP). The Software Imposed Parameters (SIP) are line width compensation, .stl file resolution, layer thickness, z compensation, and stereolithography grid. The SL Process Parameters (PP) consists of light beam size and intensity, light beam focus depth, and layer thickness [43].

Figure 14. CAD model of hexagonal prism

Figure 15. Scanned image of build hexagonal prism

(a)



(b)

Figure 16. Built hexagonal prism

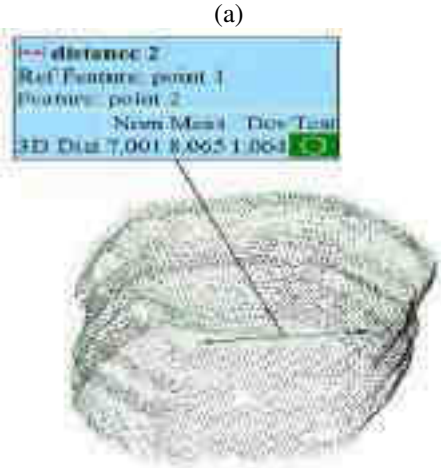
Table 1. Hexagonal prism experimentation data

Object Cross-section	Measuring Scale	Dimensions (mm) x	y	z	Layer thickness (mm)	No. of layers	Exposure time (sec.)	Settling Period (sec.)	Build time (sec.)
Hexagon (7 mm side)	CAD Model	14	14	10	0.1	100	2	3.5	546.5
	Built object	15.32	14.28	9.66					
	% Error	9.43	2.0	3.4					

Table 2. Pyramid experimentation data

Object Cross-section	Measuring Scale	Dimensions (mm) x	y	z	Layer thickness (mm)	No. of layers	Exposure time (sec.)	Settling Period (sec.)	Build time (sec.)
Pyramid	CAD Model	18	16	12	0.1	120	2	3.5	656.5
	Built object	17.20	16.15	10.85					
	% Error	4.44	0.93	2.33					

(a)



(b)

Figure 17. Measurement of height and side of hexagonal prism

Figure 18. CAD Model of pyramid

Figure 19. Built pyramid

Figure 20. Scanned Image of build pyramid

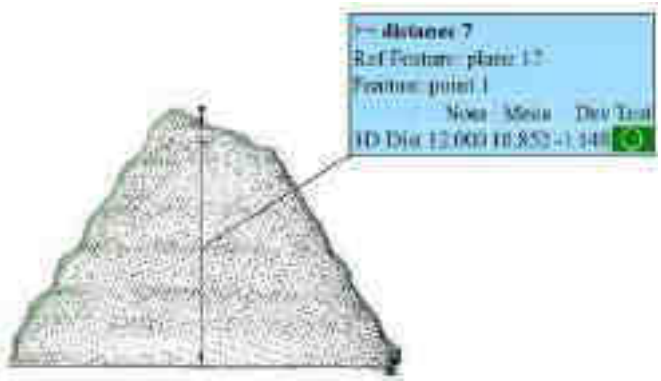


Figure 21. Height measurement of build pyramid

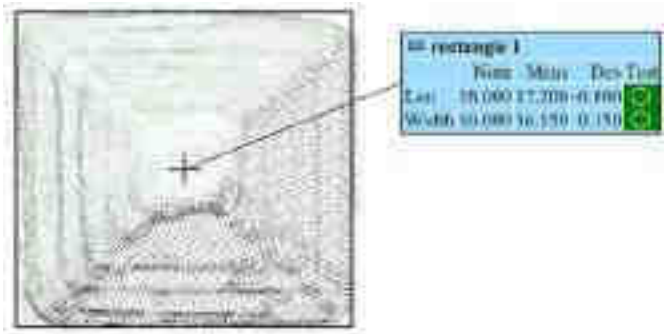


Figure 22. Base measurement of pyramid

Figure 23. Faro edge 3D scanner

4. CONCLUSIONS

A low cost stereolithography apparatus (SLA) has been developed with DLP projector as a UV light source. The overall cost of the developed SLA is very low as compared to the present commercial SLA available. Therefore, the build cost of the fabricated objects is reduced due to developed low

cost SLA. The optimum curing period per layer is two seconds per layer as the percentage error is minimum for two seconds curing period. Therefore, build speed obtained is two seconds per layer which is remarkable compared with present SLA. The dimensional accuracy of fabricated objects is also satisfactory as the maximum and minimum percentage error is 9.43 and 0.93 respectively which is acceptable comparing with the results available in the literature [33, 36]. The dimensional percentage error is decreased as the curing period or image focusing period is reduced. The pyramid object with maximum 120 numbers of layers with 12 mm dimension along Z-axis is built in 11 minutes. The maximum exposure area obtained which can be cured in X-Y plane is 55 mm x 45 mm. The resolution of the build objects in X-Y plane is 23 microns which is resolution of sliced image focused from DLP projector and Z-stage resolution is 0.1 mm. The advantages of the developed SLA are low build cost, high fabrication speed, excellent resolution in X-Y plane, low resin cost etc. The limitations are low dimensional accuracy, poor resolution of the fabricated objects along Z-stage. The future scope of the work is to introduce the dimensional error correction model in the experimentation to minimize the percentage errors of the build objects. Another future scope is to perform the experiments with values lower than 0.1 mm curing depth so that resolution of build objects along Z- stage will be improved.

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NOMENCLATURE

3D	three dimensional
AM	additive manufacturing
CAD	computer aided design
CAM	computer aided manufacturing
DLP	digital light processing
DMD	digital micro-mirror device
LCD	liquid crystal display
MEMS	micro-electro-mechanical systems
MSL	microstereolithography
PL	photoluminescence
RP	rapid prototyping
SL	stereolithography
SLA	stereolithography apparatus
STL	standard tessellation language
UV	ultra-violet

Parametric Optimization of Biodiesel Fuelled Engine Noise using the Taguchi Method

Satish A. Patil
Mechanical Engineering
Dr. D. Y. Patil Institute of Technology and
PDEA's College of Engineering
Pune, India
sapcoeh@rediffmail.com

R. R. Arakerimath
Mechanical Engineering
G H Raisoni College of Engineering and Management and
Savitribai Phule Pune University
Pune, India
rachayya.arakerimath@raisoni.net

***Abstract*—Biodiesel is a renewable, biodegradable, and efficient fuel that can be blended with petro-diesel in any proportion. The noise in the engine resulting from the combustion has a direct effect on the engine's performance. Many studies have examined the engines' vibration and noise when using diesel and biodiesel blends. This study examines the optimization of diesel blends, load, and compression ratio in the aspect of reducing noise on a Kirloskar single-cylinder diesel engine. Noise was measured at the engine and its exhaust on a computerized setup and for different loads. The experimental results showed that a blend with 15% biodiesel, at 7kg load, and 18 compression ratio produced the lowest noise. Moreover, the Taguchi method was utilized, and experimental results were validated by an ANN.**

Keywords-transesterification; biodiesel; noise; optimization

I. INTRODUCTION

Any alternative to diesel fuel should be replicable, economical, and technically acceptable [1]. Biodiesel is produced by the transesterification of renewable vegetable oils and animal fats with the use of alcohol. Biodiesel is highly degradable and nontoxic. Meanwhile, it has low emissions of carbon monoxide, particulate matter, and unburned hydrocarbons. Due to these properties, biodiesel has attracted wide attention as a replacement to diesel fuel [1, 2]. Biodiesel can be used without modifications in conventional compression ignition engines. Noise and vibrations are major issues of diesel engines [3, 4]. Engine body vibrations and noise are rich in information about the engine's operating parameters and physical condition [4, 5]. Excess noise and vibrations wear out components such as bearings, grouting, and couplings, increasing maintenance cost due to more component failures and unplanned operations. Due to noise and vibrations' importance, there is a need to study the effect of biodiesel and its blends on engine's life and performance [6-8]. Noise level depends on the load and the blending ratio of biodiesel [5]. As a result, it is necessary to extend an engine's life by using optimal blends, after analyzing their impact in noise [5-9].

II. EXPERIMENTAL PROCESS

A Kirloskar TV1 VCR single cylinder, four stroke, constant speed, water-cooled diesel engine, having 3.5HP at 1500rpm, was used on a computerized test bed equipped with measuring instruments such as thermocouples, dynamometer, tachometer and flow meters. The engine's specifications are shown in Table I.

TABLE I. ENGINE'S SPECIFICATIONS

Name	Kirloskar
No. of cylinders	1
No. of strokes	4
Type of cooling	Water cooled
Power developing capacity	3.5kW at 1500rpm
Compression ratio range	12-18
Stroke	110mm
Bore	87.5mm
Cylinder volume	661

Noise levels were measured by a noise meter for four different fuel blends on variable load conditions and compression ratios as per the Taguchi array. The study focused on the input parameters of biodiesel blends for examining the diesel engine's operating conditions. Noise was measured at the engine and its exhaust. A noise meter was placed at 0.5m distance from the engine for measuring its noise, and another was placed outside the room near the exhaust pipe end to measure the noise at the exhaust [3-5]. The noise meter and its specifications are shown in Figure 1 and Table II respectively.

TABLE II. NOISE METER'S SPECIFICATIONS

Display	14mm (0.55″) LCD with backlight
Parameter measurement	LP, Lmax, Leq, LN
Frequency range	31.5Hz~8kHz
Measurement range	LP: 30~130dB (A)
Resolution	0.1 dB
Accuracy	±1dB

Fig. 1. Noise meter.

Corresponding author: Satish A. Patil

Four fuel types were tested, namely: B0 consisting of 100% diesel, B15 consisting of 15% biodiesel and 85% diesel, B20 consisting of 20% biodiesel and 80% diesel, and B25 consisting of 25% biodiesel and 75% diesel [2, 3, 9]. Biodiesel blend, load on the engine, and compression ratio were the parameters whose effects on the engine's noise were studied. The parameters' levels are listed in Table III.

TABLE III. PARAMETRIC CONDITIONS

A: Blend	B: Load	C: Compression ratio
A1 = 0	B1 = 0	C1 = 16
A2 = 15	B2 = 4	C2 = 17
A3 = 20	B3 = 7	C3 = 17.5
A4 = 25	B4 = 10	C4 = 18

A. Noise Analysis

The orthogonal array of the input parameters indicates the number of combinations for the experiments. This selection of orthogonal array is based on three parameters and four levels for each parameter [2,5]. The array was obtained by Minitab using the following operating parameters:

Taguchi Design
Design Summary
Taguchi Array L16(4^3)
Factors: 3
Runs: 16
Columns of L16 (4^5) array: 1 2 3

TABLE IV. SAMPLE READINGS OF TAGUCHI ARRAY FOR PARAMETER OPTIMIZATION

Blend	Load	C.R.	Noise at the engine	Noise at the exhaust	Noise at the engine SNR	Noise at the exhaust SNR
0	0	16	92.75	108.9	-39.3463	-40.7406
0	4	17	93	109.25	-39.3697	-40.7684
15	4	16	93.75	112.15	-39.4394	-40.996
15	7	18	95	110.45	-39.5545	-40.8633
15	10	17.5	95.6	110.95	-39.6092	-40.9025
20	0	17.5	91.7	110.45	-39.2474	-40.8633
25	10	16	96.35	111.9	-39.677	-40.9766

The fourth row of Table IV gives the optimum values of input parameters for noise among the various blends. Signal-to-noise ratio (SNR) measures how the response varies relatively to the nominal or target value under different noise conditions. Depending on the goal, different SNRs may be chosen. In this experiment, lower SNRs are better. Optimal conditions were met with B15 blend, 7kg applied load, and 18 compression ratio, where the noise was 95dB at the engine and 110.45dB at the exhaust.

B. Taguchi Analysis: Noise versus Blend, Load, C.R.

Taguchi method analysis results for noise at the engine versus blend, load, and C.R are shown in Table V, while the regression's resulted equation is:

$$Noise\ at\ the\ engine = 96.6 - 0.0507 Blend + 0.371 Load - 0.255 C.R. \quad (1)$$

TABLE V. NOISE AT THE ENGINE MODEL SUMMARY

S	R-Sq	R-Sq(adj)
0.2196	76.30%	40.76%

Taguchi model's analysis results on noise at the exhaust versus blend, load, and C.R are shown in Table VI, and the regression's resulted equation is:

$$Noise\ at\ the\ exhaust = 107.89 + 0.0518 Blend + 0.1900 Loads + 0.044 C.R. \quad (2)$$

TABLE VI. NOISE AT THE EXHAUST MODEL SUMMARY

S	R-Sq	R-Sq(adj)
0.0658	86.48%	66.21%

C. Validation of Experimental Results by Artificial Neural Network (ANN)

The results of noise at the engine and the exhaust were validated by an ANN. An ANN script, shown in Table VII, was used for obtaining the output from the input parameters.

TABLE VII. ANN CONFIGURATION SCRIPT

```
clc; close all; clear all;
x = xlsread('Input1');
y = xlsread('Output2');
net = newff(minmax(x),[20,1],{'logsig','purelin','trainlm'});
net.trainparam.epochs = 1000;
net.trainparam.goal = 1e-15;   net.trainparam.lr = 0.01;
net = train(net, x, y);
y_net = net(x);
plot(y);hold on; plot(y_net, 'r');
error = (y - y_net);
```

III. RESULTS AND VALIDATION

A. Noise at the Engine

The experimental results for noise at the engine, the values calculated by the ANN, and the error between them are shown in Table VIII and a comparative graph of these values is shown in Figure 2. Apparently, there is a small difference, less than 1.2%, between the experimental and the ANN calculated values.

TABLE VIII. EXPERIMENTAL AND ANN RESULTS

Blend	Load	C.R.	Noise at the engine	Noise by ANN	Error	Error %
0	7	17.5	97	96	-1	-1.0%
0	10	18	95.2	96	0.8	0.8%
15	7	18	95	96	1	1.0%
20	10	17	95.9	95.5	0	0.0%
25	7	17	94.8	95.6	0.8	0.8%
25	10	16	96.35	95.2	-1.15	-1.2%

The regression plot obtained by the Taguchi model for the experimental results was compared with the ANN regression plot. The regressions' R-square value was around 80%. The straight line in these plots shows that the data fit a normal probability distribution. There are very low residual values, as

all residuals obtained are almost along the line in both plots. The similarity in these plots validates the results.

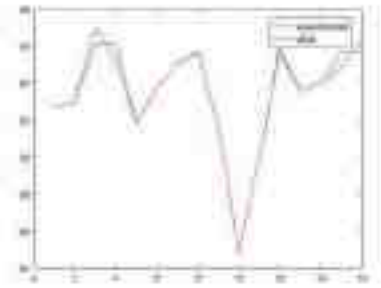
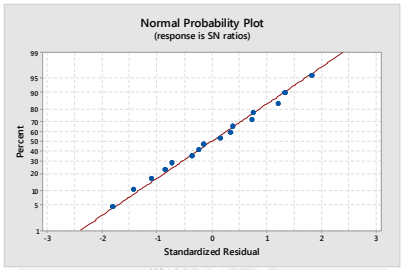


Fig. 2. Comparison of experimental and ANN noise values at the engine.

(a)



(b)

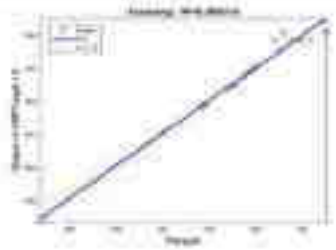


Fig. 3. Residual plot for noise at the engine by (a) Minitab, (b) ANN.

B. Noise at the Exhaust

The experimental results of noise at the exhaust, the values calculated by the ANN, and the error between them are given in Table IX. Moreover, a comparative graph of these values is shown in Figure 4. Apparently, there is a tiny difference between experimental and ANN results, less than 0.3%, for noise at the exhaust.

TABLE IX. EXPERIMENTAL AND ANN RESULTS

Blend	Load	C.R.	Noise at the exhaust	Noise byANN	Error	Error %
0	0	16	108.9	109.2	0.3	0.27%
0	4	17	109.25	109.1	-0.15	-0.14%
15	7	18	110.45	110.45	0	0.00%
15	10	17.5	110.95	110.95	0	0.00%
20	0	17.5	110.45	110.45	0	0.00%
25	10	16	111.9	111.9	0	0.00%

After comparing the regression plots of experimental and ANN results in Figures 3 and 5, we can see that there are very few residual values, and all values obtained are almost along the line indicating a normal probability distribution. The regression's R-square value was 86.48%. The similarity in these plots validates the results.

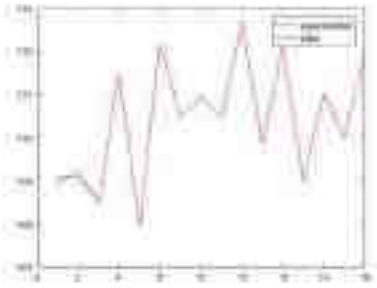
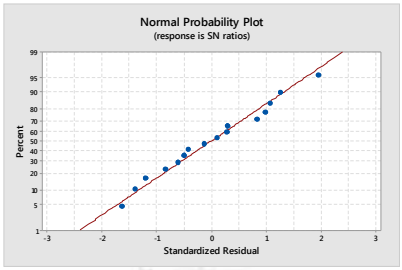


Fig. 4. Comparison of experimental and ANN noise at exhaust.

(a)



(b)

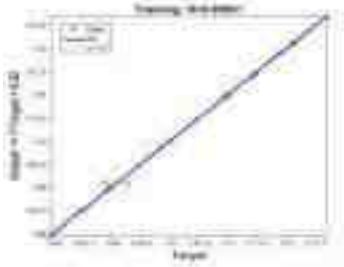


Fig. 5. Residual plot for noise at the exhaust by (a) Minitab, (b) ANN.

IV. CONCLUSION

This study examined the optimization of noise reduction at the engine and its exhaust with biodiesel blend, load, and compression ratio of the engine as input parameters. Analysis was carried out utilizing the Taguchi method, and optimization of the input parameters was performed by using SNR [10, 11]. The experimental results obtained by Minitab were validated by an ANN. The main conclusions of this study are:

- Optimal input parameters were: a blend with 15% biodiesel, applied load of 7kg, and compression ratio 18, resulting to 95dB noise at the engine and 110.45dB at its exhaust.
- R-square values obtained by regression analysis were around 80% and more, indicating that the obtained model fits to the actual data.
- There are small to tiny differences between the experimental and the ANN's noise values.
- All regression residuals of both Minitab and ANN were very low and almost along the line in both methods. The similarities in both plots validated the results.

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AUTHORS PROFILE

Satish A. Patil is a research Scholar at the Mechanical Engineering, Dr. D. Y. Patil Institute of Technology (DYPIT), Pune (MS), India, and a Assistant Professor in the Department of Mechanical Engineering, PDEAs College of Engineering, Manjari (Bk), Pune, India. Affiliated to Savitribai Phule Pune University, Pune.

Rachayya R. Arakerimath is a Professor and the Head of the Mechanical Engineering Department, Savitribai Phule Pune University, Pune G H Raisoni College of Engineering, Pune, India. He has 24 years of teaching experience and has worked at various levels. He is an approved Ph.D. guide under the Universities of Pune and Nagpur. He has published more than 100 papers in conferences and journals. He is also a reviewer for international journals.

Optimization of Biodiesel Synthesis using Heterogeneous Catalyst (SiO_2) from Karanja Oil by Taguchi Method

Satish A. Patil, R. R. Arakerimath

Abstract: ***Biodiesel is renewable and environmental friendly fuel which has the capable to gain comparable engine performance. In this experimental study, Karanja oil synthesized by using Transesterification process. Transesterification of Karanja oil to biodiesel using SiO_2 as a heterogeneous catalyst is studied using five different parameters and levels each. Minitab is used to fix the orthogonal arrays and Taguchi method is used to analyze the interaction effect for the transesterification reaction. The five different parameters responsible for biodiesel yield are molar ratio of methanol to oil, catalyst concentration, reaction temperature, reaction time and stirring speed. Effect of these parameters has studied on small scale. The biodiesel yield obtained experimentally at optimum conditions are 20% methanol to oil molar ratio, 3% SiO2 catalyst addition, 65ºC reaction temperature, 180 min reaction time and 500 rpm stirring speed is 77%.***

Index Terms -Transesterification, Biodiesel, SiO_2, Heterogeneous catalyst,

I. INTRODUCTION

The world today is getting evolved and needs are growing day by day about everything. The nature has a fixed stock of natural resources but human population is increasing at a tremendous rate. In various zones diesel fuels are utilized and have contribution for the economy of the nations. Due to the rise in environmental consciousness and decrease of petroleum reserves, there is needed to use of alternative fuels [3]. Because of increase in Global warming and more requirements of energy huge research and development is going on for renewable energies [3]. The properties like non-toxic, degradability, less carbon monoxide emission, particulate matter and unburned hydrocarbons, the biodiesel has gained an international focus as an alternative to diesel fuel [3]. The conventional compression engine does not require any modification to use the biodiesel as fuel.

The yields of Karanja oil biodiesel were obtained by 25 different sets of different experimental conditions and noted. All experiments were performed as per array obtained by Taguchi method under the different experimental conditions as mentioned here.

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Satish A. Patil , Research Scholar, Department of Mechanical Engineering, DYPIT, Pune (MS), India,

Assistant Professor, PDEA'S College of Engineering, Manjari (Bk), Pune. (sapcoeh@rediffmail.com)

Dr. R. R. Arakerimath, Professor and HOD, Department of Mechanical Engineering, G H Raisoni College of Engineering and Management, Wagholi, Pune, India (rachayya.arakerimath@raisoni.net)

The analysis of the results has done by Taguchi method using Minitab for optimization of input parameters. The different graphs have plotted here from results obtained during the analysis. The optimum conditions For different input parameters have identified for maximum yield of biodiesel production from Karanja oil using Heterogeneous catalyst.

II. OPERATING CONDITIONS

There the Transesterification process for biodiesel production from Karanja oil using heterogeneous catalyst.

Effect of different input parameters have studied as follows.

1) Variation of Molar Ratio in reaction.
2) Effect of amount of catalyst.
3) Effect of temperature on reaction.
4) Effect of stirring speed on reaction.
5) Effect of reaction time of reaction

The range of operating conditions for each parameter have as follows.

Table 1. Optimizing parameter conditions

A:Molar Ratio %	B: Catalyst %	C: Reaction Temp. ºC	D:Reaction Time	E: Reaction Speed
A1 = 5	B1 = 1.5	C1 = 55 ºC	D1 = 60 min.	E1 = 300rpm
A2 = 10	B2 = 2.0	C2 = 60 ºC	D2 = 90 min.	E2 = 400 rpm
A3 = 15	B3 = 2.5	C3 = 65 ºC	D3 = 120 min.	E3 = 500 rpm
A4 = 20	B4 = 3.0	C4 = 67 ºC	D4 = 150 min.	E4 = 600 rpm
A5 = 25	B5 = 3.5	C5 = 70 ºC	D5 = 180 min.	E5 = 700 rpm

III. EXPERIMENTAL RESULTS SIO2 AS A CATALYST

Initially the esterification process is done, the color of Karanja oil after esterification changed from deep brown to reddish yellow. The transesterification process produces methyl ester (Karanja oil biodiesel) and glycerol form upper and lower layers respectively. Due to more density of glycerin, it was settled at bottom. The catalysts and unused methanol were in the lower glycerol layer. The results shown that, using SiO_2 catalyst the biodiesel production is a considerable potential .

Twenty-five experiments for transesterification process were conducted using Karanja oil with methanol under different conditions of reactions to produce biodiesel. Input parameters and % of yields were noted. Sample readings are given below.

Taguchi Design

Design details

Array obtained by Taguchi Method L25 (5^5)
Factors: Five numbers
Runs: Twenty five
Columns of L25 (5^6) array: 1 2 3 4 5

Molar ratio	Catalyst %	Reaction temp	Reaction time	Reaction speed	Yield %	SNRA1	SRES
5	1.5	55	60	300	50	33.9794	-0.06531
5	2	60	90	400	52	34.3201	-1.24764
10	3.5	55	90	500	72	37.1466	1.83866
15	3	55	120	700	68	36.6502	-0.5516
15	3.5	60	150	300	73	37.2665	0.16741
20	2.5	55	150	400	67	36.5215	-0.94569
20	3	60	180	500	77	37.7298	1.62962
20	3.5	65	60	600	74	37.3846	-0.4575
25	1.5	70	150	500	68	36.6502	0.85144

In above table the row which is highlited by yellow colour gives the optimal values of input parameters for maximum biodiesel yield because of high value of SN ratio. The biodiesel yield obtained experimentally at optimum conditions are 20% methanol to oil molar ratio, 3% SiO2 catalyst addition, 65℃ reaction temperature, 180 min reaction time and 500 rpm stirring speed is 77%.

TAGUCHI ANALYSIS WITH SiO_2 CATALYST

Taguchi Analysis: yield % versus Molar Ratio %, Catalyst ... reaction Speed

Response Table for Signal to Noise Ratios

Larger is better

Table 3.Response Table for Signal to Noise Ratios

Level	Molar Ratio %	Catalyst %	Reaction Temp.°C	Reaction Time	Reaction Speed
1	35.18	35.34	36.24	36.17	36.26
2	36.06	35.75	36.31	36.24	36.06
3	36.39	36.42	36.20	36.13	36.50
4	36.72	36.80	36.12	36.31	36.35
5	37.12	37.17	36.60	36.62	36.31
Delta	1.93	1.82	0.47	0.49	0.44
Rank	1	2	4	3	5

Main Effects on yield by SN ratio for Individual Parameter: For examine differences between level for one or more factors the main effect plot is used. The graphs shows the response mean for each factor level. [1]

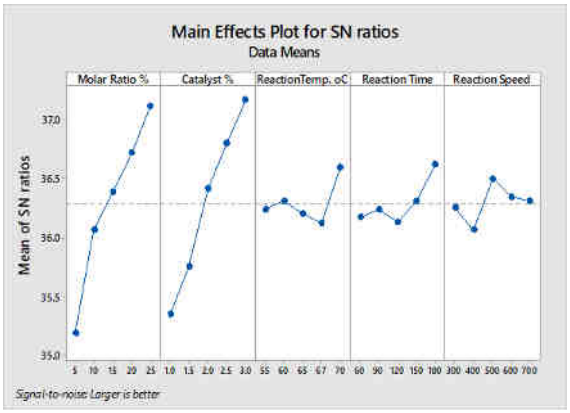

Fig. 1.Main Effects Plot for SN ratios

This figure shows that, the two graphs are steeper than others. First is the mean of S/N ratios vs molar ratio and second is the mean of S/N ratios vs. catalyst%. So, it is concluded that the two parameters affecting the yield mainly are the molar ratio and catalyst %. The effects of other three parameters can be neglected

IV. INTERACTION PLOT FOR PARAMETER A AND B (FOR MOLAR RATIO AND CATALYST %):

Analysis by Taguchi : % yield vs Molar Ratio, Catalyst %

Response Table for Signal to Noise Ratios

Larger is better

Table 4. Response Table for Signal to Noise Ratios

Level	Molar Ratio %	Catalyst %
1	35.18	35.34
2	36.06	35.75
3	36.39	36.42
4	36.72	36.80
5	37.12	37.17
Delta	1.93	1.82
Rank	1	2

Interaction Plot for SN ratios: Main effects were generally focused by Taguchi method, but suspected interactions are important to test. To measure whether the effect of one factor on response characteristic depends on the level of other the interaction plot is used. [1]

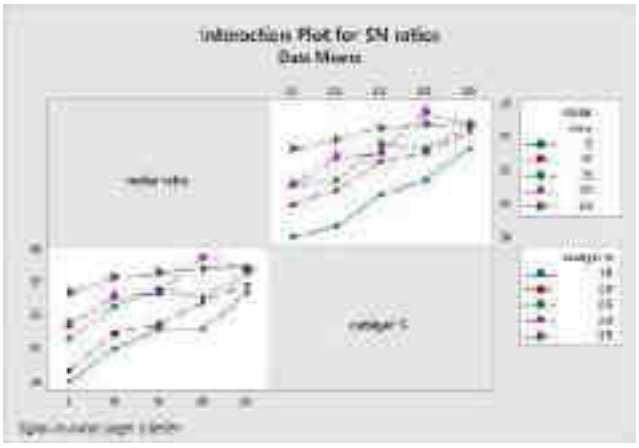

Fig.2. Interaction Plot for parameter A and B (For molar ratio and Catalyst %)

Simultaneously the interaction plots shows, the variation of yield with effect of molar ratio and catalysts are as shown in figure. This shows that the yield has maximum value for 20 % molar ratio and catalyst 3%.

V. REGRESSION ANALYSIS FOR SIO_2

Regression Analysis: yield % versus Molar Ratio %, ... , Reaction Speed Analysis of Variance.

Table 5. Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	5	1165.96	233.191	42.00	0.000
Molar Ratio %	1	544.50	544.500	98.08	0.000
Catalyst %	1	598.58	598.580	107.82	0.000
Reaction Temp. oC	1	1.66	1.657	0.30	0.591
Reaction Time	1	19.22	19.220	3.46	0.078
Reaction Speed	1	2.00	2.000	0.36	0.555
Error	19	105.48	5.552		
Total	24	1271.44			

Model Summary: R square value in model summary provides the measure of, how perfect the model is fitting with the actual data. R square value 91.70% shows that the obtained model is fitted to actual data.

Table 6. Summary of Model

S	R-sq	R-sq(adj)	R-sq(pred)
2.35622	91.70%	89.52%	86.30%

Regression Equation: It is a statistical model that determine the specific relationship between the input and output parameters. It gives the outcome with a relatively small amount of error.

yield % =35.39 + 0.6600 A + 6.920 B + 0.0484 C + 0.0207 D + 0.00200 E

Residuals Normal plot for Yield %: Graphical tool for comparing a data set with the normal distribution is the normal probability plot. The data fit in the normal probability distribution is shown by a straight line in this plot. All residuals obtained are almost along the line and very low residual values .

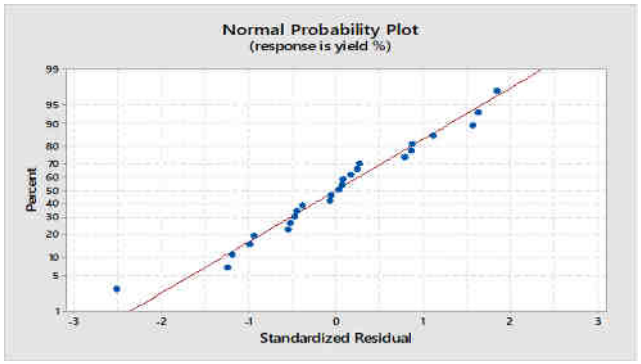

Fig.3. Normal Probability plot

VI. CONCLUSION

The analysis of optimizing the transesterification process has been carried out by Taguchi method for production of biodiesel from Karanja oil [1].

The different input parameters as in above table have been optimized using SNR , The conclusion are as follows;

1) The biodiesel yield obtained experimentally at optimum conditions are 20% methanol to oil molar ratio, 3% SiO2 catalyst addition, 65ºC reaction temperature, 180 min reaction time and 500 rpm stirring speed is 77%.

2) Main effective plot has concluded that the two parameters affecting the yield mainly are the molar ratio and catalyst %.

3) The interaction plot shows that the yield has maximum value for 20 % molar ratio and catalyst 3%.

4) R square value 91.70% shows that the obtained model is fitted to actual data.

5) The data fit in the normal probability distribution is shown by a straight line. All residuals obtained are almost along the line and very low residual values.

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AUTHORS PROFILE

Satish A. Patil, Research Scholar, Mechanical Engineering, DYPIT, Pune (MS), Working as Assistant Professor in Department of Mechanical Engineering, PDEAs College of Engineering Manjari (Bk), Pune. Affiliated to Savatribai Phule Pune University, Pune.

1.

Dr. Rachayya. R. Arakerimath. Professor & Head Mechanical Engineering, Savatribai Phule Pune University, Pune G H Raisoni College of Engineering, Pune, India. He has 24 year of teaching experience and worked at various levels. He is approved PhD Guide under university of Pune and Nagpur. He has published more than 100 papers in conferences and journals. And is reviewer for International journals also.

Experimental Analysis of Karanja Biodiesel blends to Study its effects on Engine Performance, Noise and Vibration Parameters

Satish A. Patil [1], Dr. R. R. Arakerimath [2]

[1] Research Scholar, Mechanical Engineering, DYPIT, Pune (MS), India,

[2] HOD Mechanical, G H Raisoni College of Engineering and Management, Wagholi, Pune, India.

Abstract: Biodiesel is renewable and environmental friendly fuel which has the potential to provide comparable performance of engine. In this experimental study biodiesel blends (B00 to B25) were used, which were synthesized using Transesterification process. Study of their effect on brake specific fuel consumption (BSFC), brake thermal efficiency (BTH), noise and vibration parameters have carried out. The output parameters were measured using vibrometer, noise meter and also other measuring instruments. The tests were carried out at different loads and plots are plotted here to study the effect of blends. It has been seen that for B25 the BSFC is considerably less as compared to the diesel. The brake thermal efficiency for biodiesel B10 and B25 is closer to the diesel fuel. For the blend B20 engine has less noise and B10 and B15 have the less engine vibrations. At heavy load it is found that the biodiesel blends have better BSFC, brake thermal efficiency and less noise values for the biodiesel blends compared to the pure diesel fuel.

Index Terms **- Transesterification, Biodiesel, BSFC, BTH, Noise, Vibration**

I. INTRODUCTION

Diesel fuels have significance for the economy of nations because they are utilized in various zones in daily life. The fuel which will be substitute to diesel fuel must be suitable, technically and economically acceptable [3]. Biodiesel is synthesized by transesterification from renewable sources such as vegetable oils and animal fats with alcohols. Because of properties like high degradability, no toxicity, low emission of carbon monoxide, particulate matter and unburned hydrocarbons, biodiesel has gained international attention as an alternative to diesel fuel[3] Biodiesel is an ecofriendly and provides complete combustion with less gaseous pollutant emission[3]. Biodiesel does not require any modification in conventional compression engine.

Engine body vibrations are rich in information about its operating parameters and physical condition and could be measured by attaching vibrometer to the engine block. Study is focused on ways to extract useful information about the diesel engine operating conditions. The diesel engine vibration parameters were studied. The three parameters used in vibration measurement are displacement, velocity and acceleration. Velocity and acceleration are the most important parameters depending on the frequency range [6]. A sensor was fixed on the engine head vertically with the help of magnet.

Excess vibrations wear out components such as bearings, grouting, couplings etc. eventually, damage of support structure can affect the balance, risk of fatigue of components, decreased equipment efficiency. Increased maintenance cost due to more component failures and unplanned operations [6].There is needed to study the effect of biodiesel and its blends on the engine life. Study of different parameters of vibrations is more important because they affect engine performance as well as engine life. It is necessary to enhance engine life by optimal use of blends by analysis of vibrations of the engine. And to find out the best biodiesel blends for better performance and enhanced engine life

II. EXPERIMENTAL SETUP

The setup comprises of four cylinders, four strokes diesel engine associated with hydraulic dynamometer. It has control panel with fuel tank, manometer, and fuel estimating unit, contactless speed indicator and temperature indicator. Temperature indicator is utilized to indicate the engine jacket cooling water inlet, outlet and calorimeter temperature. To analyze the effect of vibration and noise the vibrometer and noise meter were used. The vibrometer is having frequency range of 1 – 20 KHz. The noise meter is having accuracy of 1dB. It is used to record the unwanted noise at the time of engine running. The engine used for the experiment is of Mahindra 4 cylinder, 4 stroke diesel engines having 39 KW capacities at running speed of 5000 RPM and water was used to cool the engine.

Fig 1. Experimental Setup

III. RESULTS AND DISCUSSION

3.1) Brake specific fuel consumption and Brake thermal efficiency:

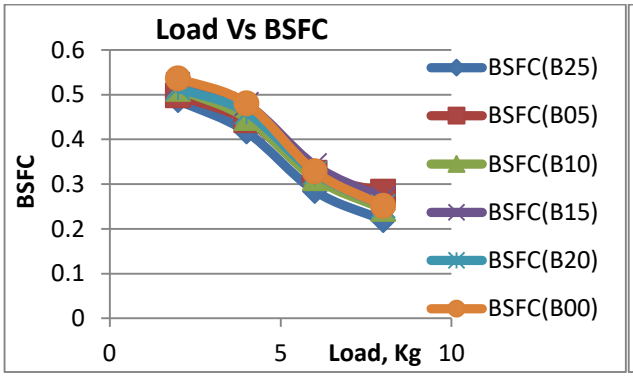

Fig 2. Load vs. BSFC

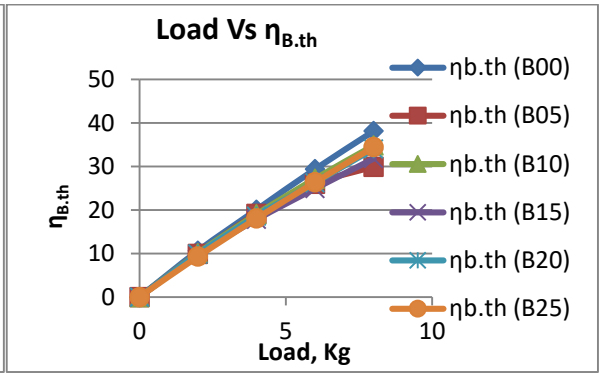

Fig 3. Load vs. BTE

From fig 2, it is observed that diesel has lower BSFC whereas biodiesel blends exhibits higher BSFC at all loads which is due to higher density, viscosity and lower heating value of biodiesel. Bsfc decreases with increasing load for various blends of biodiesel and diesel.

The percentage of energy present in the fuel that is converted into useful work is indicated by brake thermal efficiency. So, BTH is one of the main performance parameter. The comparison of BTE of the various blends of Karanja (B05, B10, B15, B20 and B25) with pure diesel is as shown in Fig 3. The BTE of Karanja blends are lower than diesel for the entire load. The decreasing trend in efficiency with increase in blend of biodiesel is because of lower calorific value of methyl esters than the diesel fuel. Due to its high viscosity the poor atomization may be caused.

3.2) NOISE:

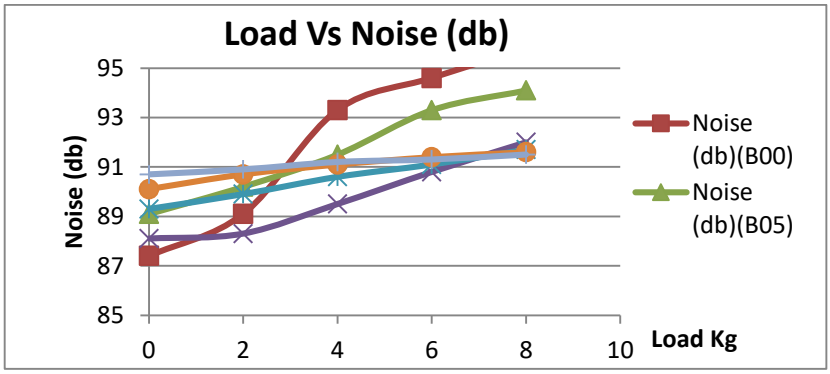

Fig 4. Load VS Noise

Statistical analysis of data and graph, It is cleared that the noise of engine measured at exhaust is lowest for B20 and increased as load increase. The noise of the diesel is less initially and also increases as load increases.

3.3) VIBRATION:

There are three important parameters of vibration viz displacement, velocity and acceleration. These are measured by using vibrometer for analysis.

a) Displacement:

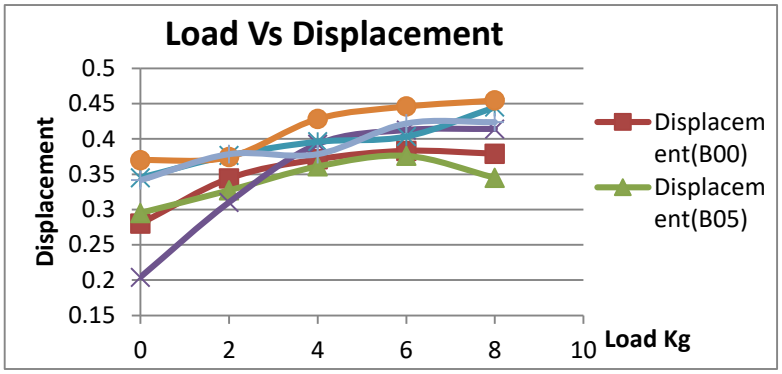

Fig 5. Load vs. Displacement

It is observed that the displacement for the biodiesel blend (B20) is higher at heavy load as compared to the pure diesel fuel. The displacement for B20 at load of 8 kg is near about 0.45mm. For B05 blend the displacement is much less near about 0.33mm compared to the pure diesel fuel.

b) Velocity:

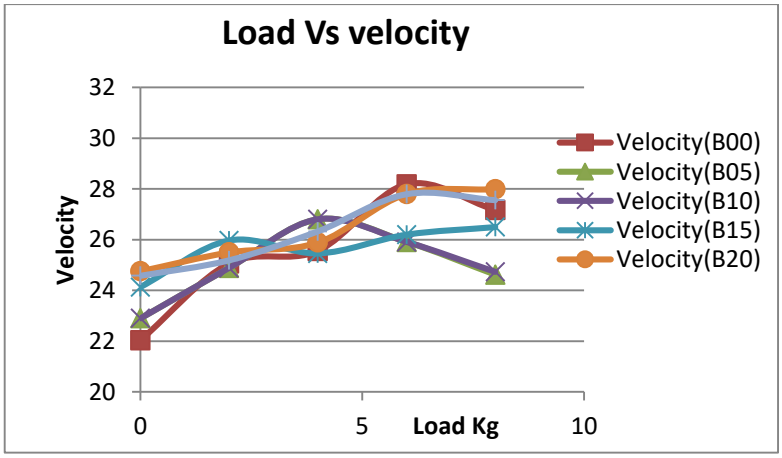

Fig 6. Load vs. Velocity

Statistical analysis of data it is observed that the velocity was lower for B10 and B15 as compared to diesel fuel. Velocity for all blends and also for diesel initially was low and increases with load.

c) Acceleration:

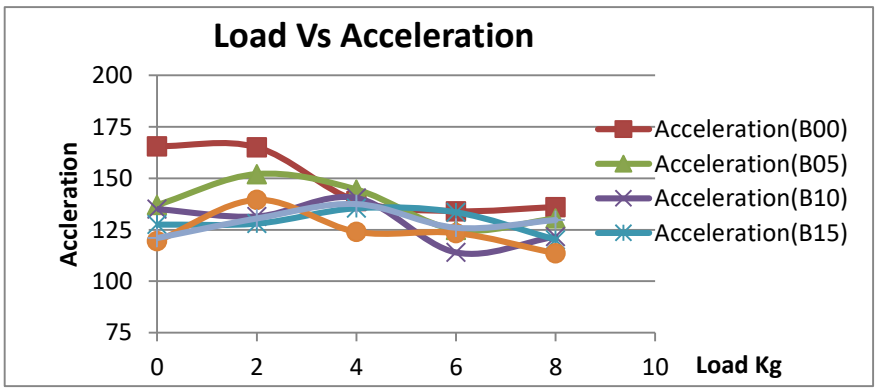

Fig 7. Load vs. Acceleration

From the statistical analysis of data it is observed that the acceleration was lowest for B10, B15 and B20. Diesel having higher acceleration values as compared to all blends. The acceleration values decreased as the load increase.

IV. CONCLUSION

In this experimental study biodiesel blends (B00 to B25) were used, which were synthesized using Transesterification process. Study of their effect on brake specific fuel consumption (BSFC), brake thermal efficiency (BTH), noise and vibration parameters have carried out. The observations and results have as follows.

a) It is observed that diesel has lower BSFC whereas biodiesel blends exhibits higher BSFC at all loads which is due to higher density, viscosity and lower heating value of biodiesel.

b) It has seen that the brake thermal efficiency for biodiesel B10 and B25 is closer to the diesel as fuel. The efficiency for blends also reaches up to 35%.

c) It is observed that the blend B20 is an optimal fuel for diesel engine which gives less noise.

d) Biodiesel blend B10 and B15 have shown the less vibration parameter values in four cylinder four stroke CI engine as compared to diesel.

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AUTHORS PROFILE

Satish A. Patil
Research Scholar, Mechanical Engineering, DYPIT, Pune (MS), Working as Assistant Professor in Department of Mechanical Engineering, PDEAs College of Engineering Manjari (Bk), Pune. affiliated to Savatribai Phule Pune University, Pune.

Dr. Rachayya. R. Arakerimath.
Professor & Head Mechanical Engineering, Savatribai Phule Pune University, Pune G H Raisoni College of Engineering, Pune, India. He has 24 year of teaching experience and worked at various levels. He is approved PhD Guide under university of Pune and Nagpur. He has published more than 100 papers in conferences and journals. And is reviewer for International journals also.

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CRITERIA 3

3.3.5 Biodiesel Production Optimization using Heterogeneous Catalyst (Al_2O_3) in Karanja oil by Taguchi Method

Satish A. Patil, R. R. Arakerimath

Abstract*: Biodiesel is renewable and environmental friendly fuel which has the potential to obtain considerable performance of engine. The aim of this work is to optimize the transesterification process for production of biodiesel using Taguchi method. In this experimental work, the Karanja oil transesterification is done to produce biodiesel using Al_2O_3 as a heterogeneous catalyst, using five parameters and five levels. Orthogonal array obtained by Minitab to analyze the interaction effect by using Taguchi method for the transesterification reaction. The parameters such as molar ratio of methanol to oil, catalyst concentration, reaction temperature, reaction time and stirring speed are effect on biodiesel yield. Effect of these parameters is investigated on small scale. Experimental yield obtained at optimal conditions i.e. are 20:1 molar ratio of methanol to oil, addition of 3% Al_2O_3 catalyst, reaction temperature 65ºC, reaction time 60 min and 600 rpm stirring speed is 80%.

Keywords: Biodiesel, Transesterification, Heterogeneous catalyst, Optimization

I. INTRODUCTION

Today the world's needs are growing day by day about everything. Nature has a fixed stock of natural resources but the population is increasing at a tremendous rate. Diesel fuels are used in various fields and have significance for the economy of nations. Rise in environmental consciousness and limited petroleum reserves, it is necessary to find out alternative fuels [3]. Biodiesel have the properties like no toxicity, high degradability, low emission of carbon monoxide, particulate matter and unburned hydrocarbons. It has an international attention as an alternative to diesel fuel [3]. Biodiesel does not require any modification in conventional compression engine.

The Karanja oil methyl ester yields, obtained by transesterification process. As per array developed by Taguchi method, there were 25 sets of experiments of transesterification process for production of biodiesel. Ratio of methanol to oil, catalyst concentration, reaction temperature, reaction time and stirring speed [2] were taken as per array obtained by Taguchi method.

A Operating conditions

Different Parameters affecting the Transesterification process

Effect of different parameters studied as follows.[2]

1) Variation of Molar Ratio in reaction.
2) Effect of amount of catalyst.
3) Effect of temperature on reaction.
4) Effect of reaction time of reaction
5) Effect of stirring speed on reaction.

The operating conditions for each parameter and levels are listed below:

For catalyst Al_2O_3

Table I. Optimizing parameter conditions

A:Molar Ratio %	B: Catalyst %	C: Reation Temp. ºC	D:Reaction Time min	E: Reaction Speed rpm
A1 = 5	B1 = 1.0	C1 = 55 ºC	D1 = 60 min.	E1 = 300 rpm
A2 = 10	B2 = 1.5	C2 = 60 ºC	D2 = 90 min.	E2 = 400 rpm
A3 = 15	B3 = 2.0	C3 = 65 ºC	D3 = 120 min.	E3 = 500 rpm
A4 = 20	B4 = 2.5	C4 = 67ºC	D4 = 150 min.	E4 = 600 rpm
A5 = 25	B5 = 3.0	C5 = 70 ºC	D5 = 180 min.	E5 = 700 rpm

II. EXPERIMENTAL ARRAY DEVELOPED BY TAGUCHI METHOD AND YIELD OBTAINED WITH SN RATIOS

Taguchi Design
Design Summary
Taguchi Array L25 (5^5)
Factors: 5
Runs: 25
Columns of L25 (5^6) array: 1 2 3 4 5

Revised Manuscript Received on November 15, 2019

Satish A. Patil, Research Scholar, Mechanical Engineering, DYPIT, Pune (MS), India,

Dr. R. R. Arakerimath, HOD Mechanical, G H Raisoni College of Engineering and Management, Wagholi, Pune, India.

Table II. Taguchi array for optimization of parameters (Sample readings)

MOLAR RATIO	CATA-LYST %	REACT TEMP.	REACT TIME	REACT SPEED	% YIELD	SNRA1	SRES
5	1	55	60	300	60	35.5630	0.231455
5	1.5	60	90	400	62	35.8478	-0.1543
10	3	55	90	500	70	36.9020	-1.31158
15	1	65	180	400	65	36.2583	0.231455
15	3	60	150	300	74	37.3846	-0.54006
20	2.5	60	180	500	72	37.1466	-0.54006
20	3	65	60	600	80	38.0618	2.160247
25	1	70	150	500	70	36.9020	0.617213
25	1.5	55	180	600	72	37.1466	0.231455

The highlighted row of above table gives the optimum values of input parameters for maximum yield, because of higher values of SN ratio.

III. ANALYSIS BY TAGUCHI METHOD

Taguchi Analysis: %YIELD versus Molar Ratio %, Catalyst ... tion Speed
Larger is better

Table III. Response Table for Signal to Noise Ratios

Level	Molar Ratio %	Catalyst %	React Temp. °C	React Time	React Speed
1	36.37	36.33	36.68	36.96	36.94
2	36.77	36.64	36.83	36.83	36.77
3	36.84	36.84	37.01	36.93	36.75
4	37.11	37.24	36.99	36.90	37.05
5	37.47	37.51	37.05	36.94	37.04
Delta	1.10	1.19	0.37	0.13	0.31
Rank	2	1	3	5	4

Main Effects Plot for SN ratios

Main effect plot is used to examine differences between level means for one or more factors. It graphs the response mean for each factor level. [1]

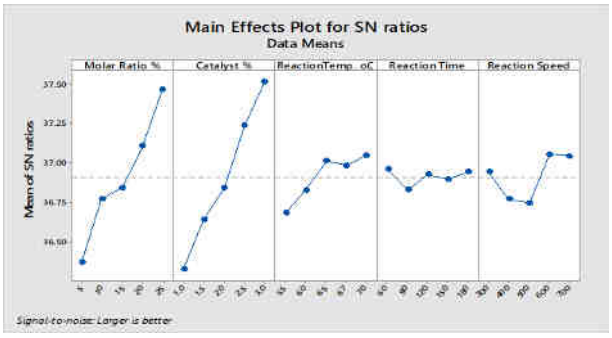

Fig.1. Main Effects Plot for SN ratios

From above graphs it is observed that graphs of mean of S/N ratios vs molar ratio and mean of S/N ratios vs catalyst% are steeper than others, so it is concluded that these two parameters i.e. molar ratio and catalyst % affects the yield mainly and effects of other three parameters can be neglected.

IV. INTERACTION PLOT FOR PARAMETER A AND B (FOR MOLAR RATIO AND CATALYST %) :

Taguchi Analysis: %YIELD versus Molar Ratio %, Catalyst %

Table IV. Response Table for Signal to Noise Ratios

Level	Molar Ratio %	Catalyst %
1	36.37	36.33
2	36.77	36.64
3	36.84	36.84
4	37.11	37.24
5	37.47	37.51
Delta	1.10	1.19
Rank	2	1

Interaction Plot for SN ratios:

Taguchi method generally focuses on main effects, but it is important to test suspected interactions. Interaction plot is used to measure whether the effect of one factor on response characteristic depends on the level of other.[1]

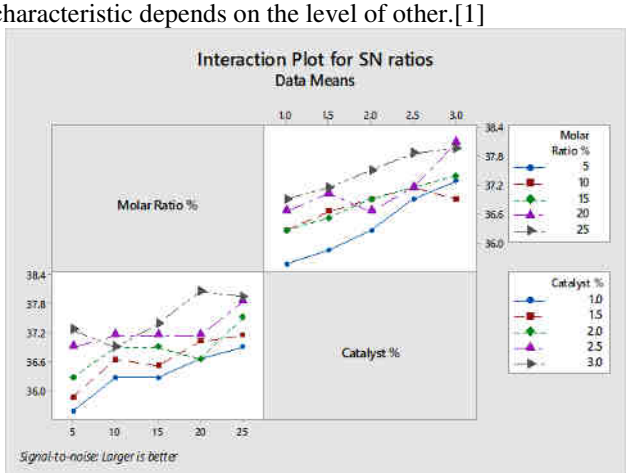

Fig.2.Interaction Plot for parameter A and B (For molar ratio and Catalyst %)

The above interaction plot shows that the maximum value of SNR at catalyst 3% and molar ratio 20 i.e. the maximum yield at this combination.

V. REGRESSION ANALYSIS:

Regression Analysis: %YIELD versus Molar Ratio %, ... , Reaction Speed

Table V. Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	5	528.758	105.752	48.07	0.000
Molar Ratio %	1	208.080	208.080	94.58	0.000
Catalyst %	1	288.000	288.000	130.90	0.000
ReactionTemp. °C	1	26.818	26.818	12.19	0.002
Reaction Time	1	0.080	0.080	0.04	0.851
Reaction Speed	1	5.780	5.780	2.63	0.122
Error	19	41.802	2.200		

Model Summary

In model summary R square value provides a measure of how well the model is fitting the actual data. Here R square value is 92.67%, this shows that the model obtained is fitted to actual data.

Table VI. Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
1.48327	92.67%	90.75%	87.90%

Regression Equation

Regression equation is statistical model that determine the specific relationship between the input parameters and output parameters. It gives the outcome with a relatively small amount of error.

%YIELD = 40.62 + 0.4080 Molar Ratio % + 4.800 Catalyst % + 0.1949 Reaction Temp. - 0.00133 Reaction Time + 0.00340 Reaction Speed

Normal Probability plot of Residuals for %YIELD

The normal probability plot is a graphical tool for comparing a data set with the normal distribution. A straight line in this plot shows the data fit a normal probability distribution. There are very low residual values and all residuals obtained are almost along the line.

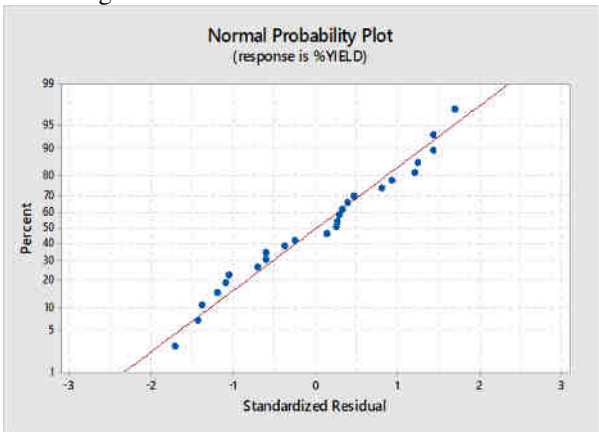

Fig.3. Normal Probability plot

VI. CONCLUSION

The analysis by Taguchi method has been carried out for optimizing the transesterification method for production of biodiesel from Karanja oil [1]. The various input parameters such as molar ratio, catalyst %, reaction temperature, reaction time and stirring speed have been optimized using SNR based on this study, it can be concluded that as follows;

1) Experimental yield obtained at optimal conditions i.e. are 20% molar ratio of methanol to oil, addition of 3% Al_2O_3 catalyst, reaction temperature 65ºC, reaction time 60 min and 600 rpm stirring speed is 80%.
2) From main effective plots, it is observed that graphs of mean of S/N ratios vs molar ratio and mean of S/N ratios vs catalyst % are steeper than others, so it is concluded that these two parameters i.e. molar ratio and catalyst % affects mainly on the yield.
3) The interaction plot proves that the maximum value of SNR at catalyst 3% and molar ratio 20% i.e. the maximum yield at this combination.
4) Here R square value is 92.67%, this shows that the model obtained is fitted to actual data.
5) A straight line in the normal probability plot shows the data fit a normal probability distribution. There are very low residual values and all residuals obtained are almost along the line.

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AUTHORS PROFILE

Satish A. Patil, Research Scholar, Mechanical Engineering, DYPIT, Pune (MS), working as Assistant Professor in Department of Mechanical Engineering, PDEAs College of Engineering Manjari (Bk), Pune affiliated to Savatribai Phule Pune University, Pune.

Dr. Rachayya. R. Arakerimath, Professor & Head Mechanical Engineering, Savatribai Phule Pune University, Pune G H Raisoni College of Engineering, Pune, India. He has 24 year of teaching experience and worked at various levels. He is approved PhD Guide under university of Pune and Nagpur. He has published more than 100 papers in conferences and journals. And is reviewer for international journals also.

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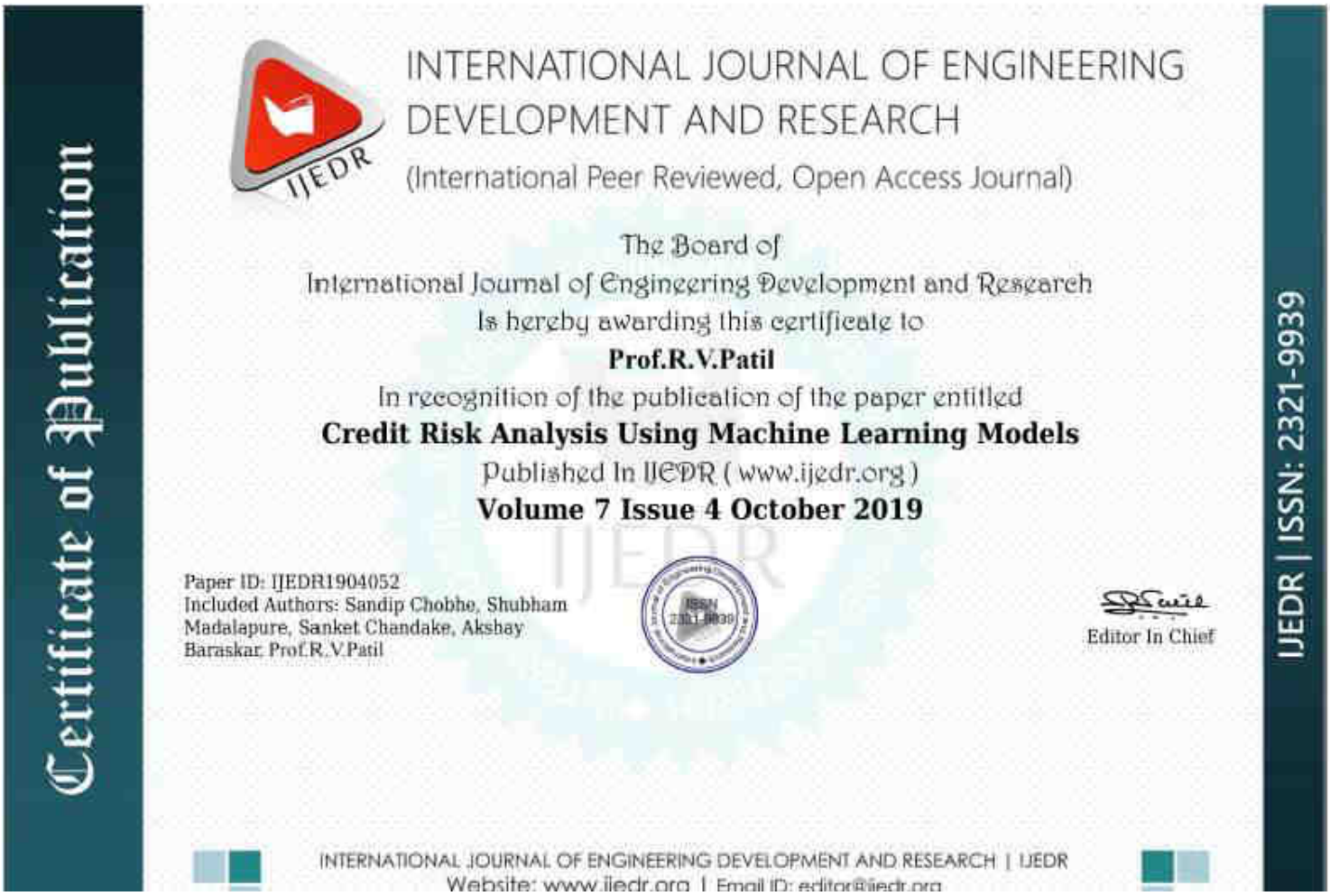

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Brain MR Imaging Tumor Detection Using Monogenic Signal Analysis-Based Invariant Texture Descriptors

Deepak O. Patil[1,2] · Satish T. Hamde[1]

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Abstract

Brain tumor is considered as a fatal disease with low survival rate and has the highest cost of care per patient. This article proposes a computer-assisted system for the recognition of brain tumor image through magnetic resonance imaging based on the monogenic signal analysis. From different monogenic components, textural descriptors are obtained using completed local binary pattern and gray-level co-occurrence matrix. In the pre-processing step, various filtering for noise removal and contrast enhancement techniques are implemented. Local phase, energy and orientation components originated from the monogenic signal analysis method are used for textural feature extraction. Fisher score-based filter approach for feature selection is then employed to derive the discriminating feature set. Finally, the acquired optimal feature set is classified using the support vector machine classifier. Two benchmark MR image datasets, e-health laboratory and Harvard medical laboratory, have been used to validate the system performance. Overall detection accuracy obtained was above 99%. The experimental results demonstrate the effectiveness of the proposed approach and the potential to assist the medical experts in enhancing the detection rate. Furthermore, the presented approach delivers superior performance in brain tumor image recognition as compared to existing techniques.

Keywords Monogenic signal analysis · GLCM · CLBP · Fisher score · MR images · Brain tumor detection · SVM classifier

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Cardiac Arrhythmia Detection on Electrocardiogram Beats based on KPCA and SVR

Criteria 3
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S.T. Sanamdikar[1], S.T. Hamde[2] and V.G. Asutkar[3]
[1]Ph. D. Student, Department of Instrumentation,
Shri Guru Govind Singhji Institute of Engineering and Technology Nanded (Maharashtra), India.
[2]Professor, Department of Instrumentation,
Shri Guru Govind Singhji Institute of Engineering and Technology Nanded (Maharashtra), India.
[3]Professor, Department of Instrumentation,
Shri Guru Govind Singhji Institute of Engineering and Technology Nanded (Maharashtra), India.

(Corresponding author: S.T. Sanamdikar)
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ABSTRACT: Patients suffer from various heart diseases may lead to sudden death. So that prior detection of arrhythmia is important to prevent the sudden deaths. Developing the methods of ECG signal features extraction is required to detect heart abnormalities and different kinds of diseases. This study shows the arrhythmia detection system based on kernel-PCA and support vector regression. Feature of ECG signal are the interval between the points such as RR interval, P, R, Q, S, and T beats having the specific magnitude. The several methods have been proposed to recognize and analyze the ECG signals. In this paper, we employ the combination of kernel-PCA and support vector regression classifier to recognize the ECG signal. The method consists of three steps; first, low pass filter removes the noise in ECG signal. Then Kernel-PCA and higher order statistics are derived for feature extraction of ECG signal. Finally, the obtained feature set is used as input to SVR classifier to classify the ECG signal. Most of the data comes from online MIT-BIH dataset to obtain the ECG records for evaluating the classification performance. The classification performance of the proposed model is also compared with the several conventional machine learning classifiers, which is better classification accuracy.

Keywords: ECG signal, feature extraction, Principal Component Analysis, Arrhythmia detection, Super vector machine and SVR (Super Vector Regression)

Abbreviations : CNN, Convolution Neural Network; ECG,- Electrograph; FFNN, Feed Forward Neural Network; FPN, Fusion of Paced and Normal Beat; PSO, Particle Swarm Optimization ;PVC, Premature Ventricular contraction; PCA, Principal Component Analysis; RMSE, Root Mean Square Error; SVM, Super Vector Machine; SVR, Super vector Regression.

I. INTRODUCTION

In recent year medical science technology has become widely increasing for automatic diagnosis of health problem. The electrocardiogram (ECG) plays a very significant role for diagnosing the health problem such as arrhythmia or other cardiac related issues. The purpose of ECG is to analyse and diagnoses the heart problem efficiently and accurately. The ECG receives the electrical signals from patient and obtains the arrhythmia signal information. In arrhythmia problem and genetic abnormalities change the contour of ECG signal; each portion of electrocardiogram beats contains information relevant to the doctor when a proper diagnosis is obtained.

The Fig. 1 shows the simple Electrocardiogram signal indicating the P, Q, R, S and T parameter [20]. The P beats occurs due to ventricular depolarization, the QRS are beats and the T beats due to ventricular depolarization. Volume of electrocardiogram ECG recorded in medical emergency is now increasing as heart disease patient are expanding at a disturbing rate.

The ECG signal contain various types of noise during the signal receives from patient such noise has some time high frequency or low frequency signal. It may affect the wrong diagnosis. So that noise removal is necessary.

As the technology changing researcher has been develop the many computational techniques or methods to extract the normal ECG signal from noisy data.

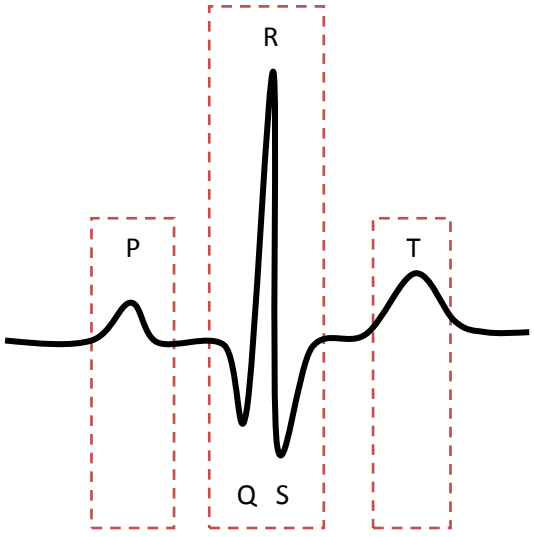

Fig. 1. Shows the simple Electrocardiogram signal.

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In previous studies have been accomplished the various model of different kinds of feature extraction from ECG signals and a classification technique has been proposed. Feature extraction may contain the non-linear, time, frequency domain and multi domain feature extraction [2, 3]. For the classification classical methods is used such as Artificial Network, Support Vector Machine (SVM), Super vector regression (SVR) etc. In the time domain the ECG signal can be easily figure out by the noise and has low accuracy level [4, 5]. Another approach for extracting the ECG feature based on convolutional neural network model. The model has two sections; the first part extract the feature from ECG signals and second part perform the classification of feature based on the first section. Feature extraction was discussed based on principle component analysis to reduce the multidimensional data and input is processed by three pooling layer approach [6]. These signals cannot be consider as the accurate parameter of ECG signals for accomplishing high arrangement correctness. There are various combination of methods have been proposed for ECG feature extraction classification. For the feature optimization the genetic algorithm and the SVM based classifier designated for classification of ECG waveforms [7, 22, 23]. The Extreme learning machine algorithm calculates the minimum weight Single Hidden Layer Feed forward Neural Network for classification [8]. The KNN based approach for cardiac arrhythmia classification. The model is one of the types of recurrent neural network for classification is based on the LSTM in time serious domain. In the recent study, echo state network was implemented based on the morphology for classifying the normal and abnormal ECG signals of heart. The classification is based on the two classes SVEB and VEB [10]. The feature extraction from non-linear process in time and space domain based on the T complexity is applied to the RR and for classification used 13 different classes [11, 12].

Although, all above mentioned classification techniques or methods have good result, they used a combined space, time, frequency, linear and non-linear domain for ECG beat classification. So that present research proposed ECG waveform detection model that extracting the features in multi domain based on the empirical mode decomposition with linear discriminate analysis [13]. The combined approach of polyhedral conic separation and k-means clustering was applied as classifier to differentiate the ECG waveforms with 5 different classes such as N for Normal, RBBB for Right Bundle Branch Block, LBBB for Left Bundle Branch Block, APC for Atrial Premature Contraction and VPC for Ventricular Premature Contraction [14-15]. Kutlua and Kuntalp proposed a new cloud based model for automatic classification of ECG beats with minimum processing of signals [16]. The proposed model is based on the compression based similarity (CSM) and classification is done by KNN with one Bayesian classifier for better accuracy. An effective method to classify the ECG signal based on the super vector regression analysis on 400 samples of data set of various arrhythmias was proposed [24]. Proposed Model is tested and compared with the various neural network classifiers techniques and observed that it gives better accuracy than existing system. The purpose of this research is to propose an efficient arrhythmia detection techniques based on the kernel principle component analysis and support vector regression methods. In this research select 5 classes; normal Beat (N), Aberrant atrial premature Beats (S), Ventricular Ectopic beats (V), Combination beat (F), Unclassifiable beats (Q). We used Support vector regression classifier to classify the instances of ECG beats. In section II brief description of proposed methodology gives the data handling and signal pre-processing procedures. In section III and IV discusses the evaluation, result analysis and discussion and in section V conclusions.

II. PROPOSED METHODOLOGY

The entire schematic diagram of recommended model as present in Fig. 2. The Model based on the Kernel-PCA and SVR classifier for feature extraction and classification of ECG signal to detect the arrhythmia. First raw ECG signal is pre-processed using low pass filter to remove the noise after that applied Kernel-PCA and Higher Order Statistics method for feature extraction from ECG. The extracted feature is further processed for classification using the SVR algorithm.

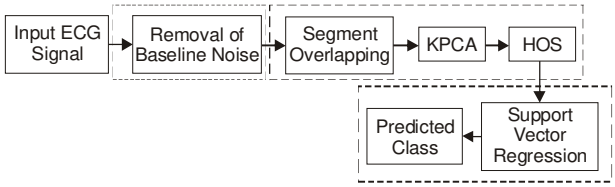

Fig. 2. Schematic diagram of Recommended Model for Classification of ECG signal.

Fig. 2 shows the proposed system can be categorized of three different sections such as pre-processing, obtaining feature and classification of beats. The working principle of proposed model as shown in following steps.

The raw ECG waveform are input to the system, and then pre-processed to remove the unwanted frequencies called as noise using the low pass filter.

Optimized the inputted ECG data by KPCA. KPCA is implemented to reduce the dimension and extract the ECG features. The wavelet transform techniques are used to extract the feature in frequency domain.

The KPCA are designated by non-linear and frequency domain parameter, which is useful for feature input to instruct and analyse the SVR classifier and finally predicted class of ECG signal, is classified from the MIT-BIH dataset.

A. ECG Signal pre-processing based on Low Pass Filter

The ECG beats are weak and it contains the noise so that pre-processing is required before the feature extraction [19]. Sometimes noise is distinct. We proposed the noise removal technique based on the low pass filter and pass the small frequency of ECG data and attenuates the high frequencies. Low pass filter function is proposed with cut-off frequency from 5 to 15Hz is used for noise removal is described below:

$$H(x_m, x_n) = \begin{cases} 1, & \sqrt{x_m^2 + x_n^2} \le X; \\ 0, & \sqrt{x_m^2 + x_n^2} > X. \end{cases} \quad (1)$$

where, X is the cut-off frequency

The Present techniques shows to verify the ECG Pre-processing. As adding the noisy data for pre-processing with the proposed techniques with 360 Hz interference.

$$RMSE = \left[\frac{1}{N}\sum_{i=0}^{n}(Y_i - \widehat{Y}_i)^2\right]^{\frac{1}{2}} \quad (2)$$

Where Y_i sample of ECG noisy signal, N is the sample length. ECG beat class from the dataset has been select for pre-processing by threshold.

B. Segmentation

The primary step is applied to show the lowest slope of ECG waveform such as goes down the waveform from R to S. and is also shows the higher slope of ECG waveform such as signal moving from lower Q to higher R.

$$y(x) = \frac{1}{2\Delta t}\big(y(x+1) - y(x-1)\big), \quad x = 0,\ 1,\ 2,\ 3 \ldots\ldots N-1 \quad (3)$$

Where, $2\Delta t$ for sample frequency and N for number of sample. Starting conditions are set to reduces error i.e., beginning condition is indicated for x = 0, and x - N-1.

C. KPCA for Feature Extraction

The ECG signal has uncertain amount of data and most of the significant data is incorporated into the nonlinear procedure. The non-linear process of feature extraction easier to finding out the normal ECG signals [20]. We present the KPCA method to extract the feature of ECG signals. The high-dimensional F-Space highlight (with measurement N) enables to acquire features (non-linear primary segments) with higher-request connections between information factors, and we can separate nonlinear segments up to n information point numbers (expecting n N). Portion PCA depends on standard direct PCA calculation in an element space where information x info is mapped by means of some non-linear capacity x [21]. Finally, we utilize part capacity to compute authorized location item in space.

First consider nonlinearly mapping all data points x to $f(x)$ in a higher dimensional feature space F. the covariance matrix can be estimated as

$$\sum f = \frac{1}{N}\sum_{n=1}^{N} f(X_n) f(X_n)^T \quad (4)$$

Plugging this into the eigen equation of the covariance matrix

$$\sum f\, \Phi_i = \lambda_i \Phi_i \quad (5)$$

Get the,

$$\left[\frac{1}{N}\sum_{n=1}^{N} f(X_n) f(X_n)^T\right]\Phi_i = \frac{1}{N}\sum_{n=1}^{N}(f(X_n)\,.\,\Phi_i) f(X_n) = \lambda_i \Phi_i \quad (6)$$

The eigen Φ_i vector is a linear combination of the N mapped data points

$$\Phi_i = \frac{1}{\lambda_i N}\sum_{n=1}^{N}(f(X_n)\,.\,\Phi_i) f(X_n) = \sum_{n=1}^{N} a_n^{(i)} f(X_n) \quad (7)$$

where, $a_n^{(i)} = \frac{1}{\lambda_i N}(f(X_n)\,.\,\Phi_i)$ (8)

Multiply $f(X_m)^T$ in equation 8 to both sides

$$(f(X_n)\,.\,\Phi_i) = \lambda_i N a_n^{(i)} = \sum_{n=1}^{N} a_n^{(i)} f(X_m)\,.\,f(X_n)) = \sum_{n=1}^{N} a_n^{(i)} k(X_m, X_n) \quad (9)$$

Where,

$$k(X_m, X_n) = ((X_m)\,.f(X_n)) \quad (m, n = 1 \ldots\ldots N) \quad (10)$$

Kernel representing a inner-product of two vectors in space F. If we consider $(m, n = 1 \ldots\ldots N)$

Equation 10 is scalar equation becomes the m-th component of the vector

$$\lambda_i N a_n^{(i)} = K a_i \quad (11)$$

Where, N is eigen vectors of K, which is obtained by solve the eigen value of K. The eigen value of K is proportional to eigen value of λ_i of the converiance matrix $\sum f$ for the feature selection of ECG beats in high dimensional space.

D. Higher Order System (HOS)

Depending upon the types of cardiac arrhythmia the ECG signals has some variation in shape. The proposed techniques should receive and eliminates these differences of signals. The cumulants are the good statistical function to eliminate the differences of ECG signals [18]. The normal signal amplitude varies from 1.15 to 1.36 which is same as the length of 0.39. The cumulant is a very powerful tool to reduce the error in ECG signals during the classification process [25]. The second, third and fourth order comulant are as follows:

$$\text{cumulant}(x_m,\ x_n) = E[x_m,\ x_n] \quad (12)$$

$$\text{cumulant}(x_m, x_n) = E[x_m, x_n, x_o] \quad (13)$$

$$\text{cumulant}(x_a, x_b, x_c, x_d) = E[x_m, x_n, x_o, x_p] - E[x_m, x_n]\,E[x_o, x_p] - E[x_m, x_o]\,E[x_n, x_p] - E[x_m, x_p]\,E[x_n, x_o] \quad (14)$$

Where, x_m, x_n, x_o, x_p is the Gaussian noise sequence independent from the data. Every order of function has certain feature. Where the second order function is signal variance, third order function is signal skewness and the fourth order function is signal kurtosis. These three functions disclose the HOS of ECG signals. This function can be used in combine the shows the classification result more accurately.

In our research, HOS gives the better result as compare the Gaussian noisy signal in ECG data. It is foreseen that higher order statistics could likewise eliminate the impact of other unwanted signals in cardiac arrhythmia dataset [25].

The length of the sample for feature extraction is the major problem in utilizing the higher order statistics. In our research, applied the KPCA model for sustain the shape of signals that shows the minimum length. So that by combining the HOS and KPCA to maintaining the morphology in proposed model.

E. SVR for Classification

After obtaining the feature of proposed model; each sample of ECG beats are classified individually based on the K-PCA and SVR. In this case each beat were not the same as the others, the most of the frequent output between the three component vectors as recent output.

Support Vector Regression (SVR): SVR is a Novel technique of learning system. This for solving supervised classification problems due to its generalization ability. In essence, SVM classifiers maximize the margin between training data and the decision boundary (optimal separating hyper plane), which can be formulated as a quadratic optimization problem in a feature space. The subset of patterns those are closest to the decision boundary are called as support vectors Regression. SVR uses undefined benchmarks from the SVM for gathering, with only two or three minor changes. As issue of first significance, since yield is a certified number it ends up being uncommonly difficult to foresee the present information, which has boundless possible results.

Because of backslide; an edge of obstruction (epsilon) is set in estimation to the SVM which would have adequately requested from the issue. However, other than this reality, there is in like manner an increasingly befuddled reason; the estimation is progressively tangled as such to be taken in thought.

Regardless, the rule thought is reliably the equivalent: to constrain botch, individualizing the hyper plane which enlarges the edge, recollecting that bit of the goof is persevered.

Kernel Function as

For Polynomial

$$k(x_m, x_n) = (x_{m,}, x_n)^d \quad (15)$$

Where m, n is constant term and d is for degree of kernel. In equation 5 calculate the dot product of two vector term by increasing the power of kernel.

For Gaussian RBF

$$k(x_m, x_n) = \exp\left(-\frac{|x_m - x_n|^2}{2\sigma^2}\right) \quad (16)$$

$|x_m - x_n|$ is for Euclidean distance between x_m and x_n.

To determine the performance of proposed model of SVR classifier six parameters are used which is Sensitivity, Specificity, Accuracy, false positive rate, false negative rate and precision. All the parameters are calculated as follows.

$$\text{Specificity} = \frac{T\_P}{(T\_P + F\_N)} \quad (17)$$

$$\text{Sensitivity} = \frac{T\_N}{(T\_P + T\_P)} \quad (18)$$

$$\text{Accuracy} = (T\_P + T\_N)/(T\_P + F\_P + T\_N + F\_N) \quad (19)$$

$$FAR = (F\_P)/(F\_P + T\_N) \quad (20)$$

$$FRR = (F\_N)/(T\_P + F\_N) \quad (21)$$

$$\text{Precision} = (T\_P)/(T\_P + F\_P) \quad (22)$$

Where, T_P is for the True Positive, T_N is for True Negative, F_N is for False Negative, F_P is for False positive, FAR is for false positive rate and FRR is for false negative rate.

III. EVALUATION AND RESULT ANALYSIS

The proposed method characterizes the five different classes

ECG beat annotations:

N - beats starting in the sinus hub
S - Aberrant atrial premature Beats
V - Ventricular Ectopic beats
F - Combination beat
Q - Unclassifiable beats

In this Experimental analysis, the MIT/BIH arrhythmia database dataset is utilized for validate the proposed Method. The database contains comment for both planning data and beat class data checked by free specialists. A total of 1800 samples from the MIT-BIH arrhythmia database are equally divided into training sets. A total of 400 samples of N are derived from records 100, 101, 103 and 105. Similarly, 400 samples of APC are derived from records 109, 111, 207 and 214, and 400 samples of VFN are derived from records 118, 124, 212 and 231. We also derive 400 samples of PVC from records 106, 119, 200 and 203 and 200 samples of FPN from records 209 and 222. A total of 1800 samples are used as ECG data after sampling and pre-processing the ECG signals. It is suggested that every ECG beat be ordered into the accompanying five heartbeats composes: N, S, V, F and Q beats.

N-Beat. Normal ECG sample from MIT/BIH dataset is shown Fig. 3.

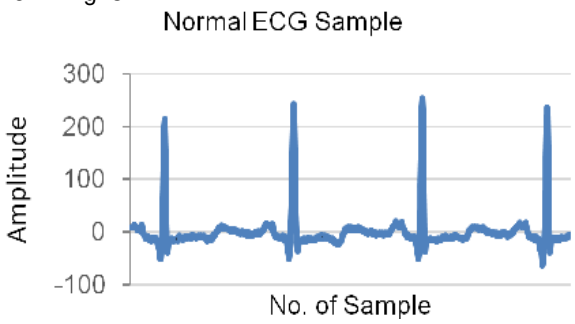

Fig. 3. N-beat ECG Sample.

Fig. 3 shows ECG signal to extract Time and Frequency based features. Those features are classified using SVR.

Table 1: Performance Analysis of Normal Class.

Parameter	Accuracy Level
Accuracy	0.9840
Sensitivity	0.92
Specificity	0.988571429
FAR	0.005747
FRR	0.148148
Precision	0.92

Table 1 shows the Performance Analysis of Normal Class. For Normal Class Total Accuracy for 100 randomly picked ECG sample of the MIT-BIH is 98.4 %. Below Figure shows the Accuracy, Sensitivity, Specificity, False Positive Rate, false Negative Rate and Precision.

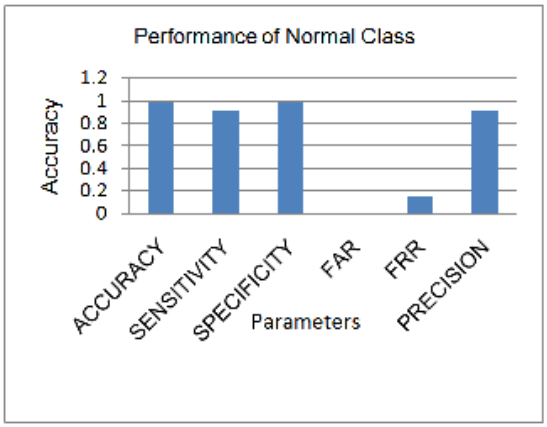

Fig. 4. Performance Analysis of N-beat Class.

S-Beat. Atrial premature complexes (APCs) are a common kind of heart arrhythmia characterized by premature heartbeats originating in the atria. Another name for atrial premature complexes is premature atrial contractions. When a premature beat occurs in the upper chambers of your heart, it's known as an atrial complex or contraction. Premature beats can also occur in the lower chambers of your heart. These are known as ventricular complexes or contractions. Causes and symptoms of both types of premature beats are similar.

Fig. 5 shows the Aberrant atrial premature signal to extract the Time and frequency based feature and classify those feature using SVR.

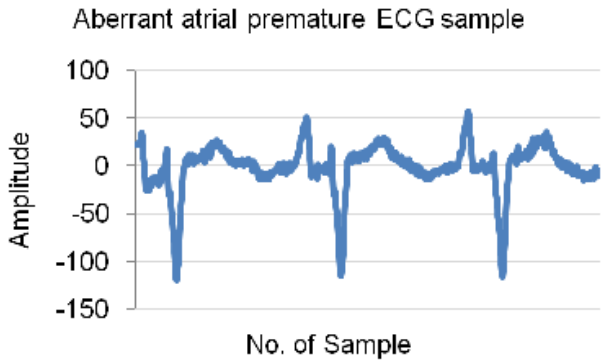

Fig. 5. Aberrant atrial premature ECG sample.

Table 2: Performance Analysis of Aberrant atrial premature Class.

Parameter	Accuracy Level
Accuracy	0.981333
Sensitivity	0.92
Specificity	0.985714
FAR	0.005764
FRR	0.178571
Precision	0.92

Table 2 shows Performance Analysis of Aberrant atrial premature Class. For Aberrant atrial premature Class Total Accuracy for 100 randomly picked ECG sample of the MIT-BIH dataset is 98.1 %.

Fig. 6 shows the performance analysis of S-beat with different parameter such as Accuracy, Sensitivity, Specificity, False Positive Rate, false Negative Rate and Precision.

V-Beat. Premature ventricular complexes/contractions (PVCs; also referred to a premature ventricular beats, premature ventricular depolarizations, or ventricular extra systoles) are triggered from the ventricular myocardium in a variety of situations. PVCs are common and occur in a broad spectrum of the population. Premature Ventricular Contraction ECG sample from combined dataset is shown Fig. 7.

Table 3 shows the Performance Analysis of Premature Ventricular Contraction Class. For Premature Ventricular Contraction Class Total Accuracy for 100 randomly picked ECG sample of the MIT-BIH data is 98.9 %.

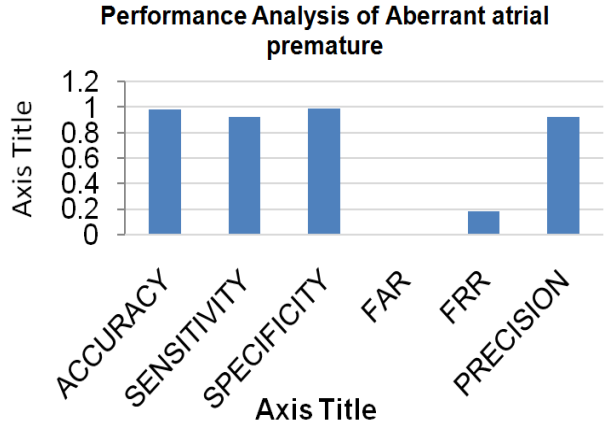

Fig. 6. Performance Analysis of S-Beat Class.

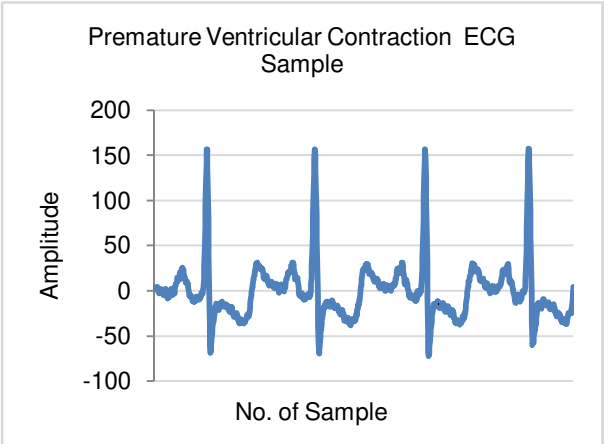

Fig. 7. V-beat class ECG Sample.

Table 3: Performance Analysis of Premature Ventricular Contraction Class.

Parameter	Accuracy Level
Accuracy	0.989333
Sensitivity	0.88
Specificity	0.997143
FAR	0.008523
FRR	0.043478
Precision	0.88

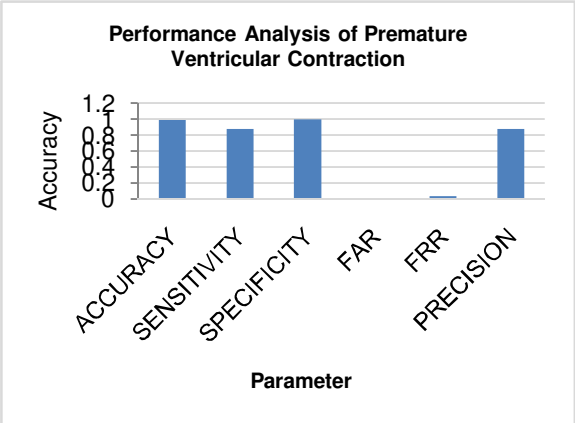

Fig. 8. Performance Analysis of V-beat class.

Fig. 8 shows the performance analysis of V-beat with different parameter such as Accuracy, Sensitivity, Specificity, False Positive Rate, false Negative Rate and Precision.

F-Beat. Combinational beat occurs when electrical impulses from different sources act upon the same region of the heart at the same time. If it acts upon the ventricular chambers it is called a ventricular combinational beat, whereas colliding currents in the atrial chambers produce atrial fusion beats. Ventricular combinational beats can occur when the heart's natural rhythm and the impulse from a pacemaker coincide to activate the same part of a ventricle at the same time, causing visible variation in configuration and height of the QRS complex of an electrocardiogram reading of the heart's activity. Combinational (Fusion) of ventricular and normal ECG sample from Combined dataset is shown Fig. 9.

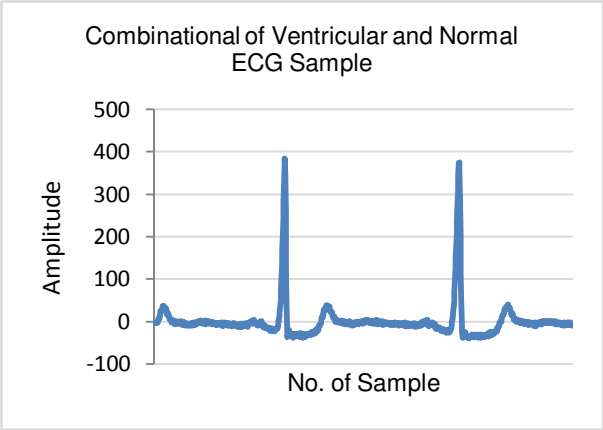

Fig. 9. Fusion of Ventricular and Normal ECG Sample.

Table 4: Performance Analysis of Fusion of Ventricular and Normal Class.

Parameter	Accuracy Level
Accuracy	0.986667
Sensitivity	0.88
Specificity	0.994286
FAR	0.008547
FRR	0.083333
Precision	0.88

Table 4 shows the Performance Analysis of Fusion of ventricular and normal Class. For Fusion of ventricular and normal Class Total Accuracy for 100 randomly picked ECG sample of the MIT-BIH data is 98.6 %.

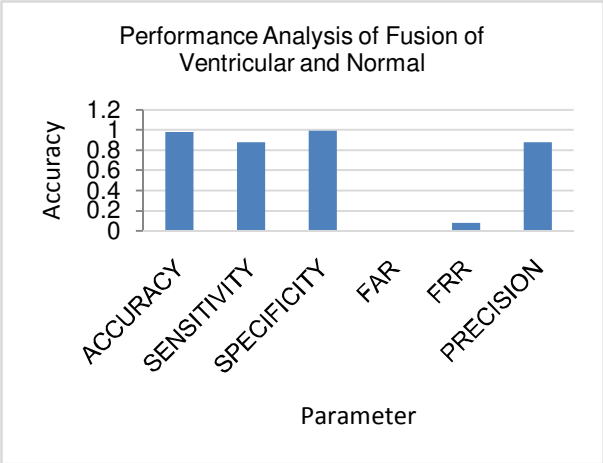

Fig. 10. Performance Analysis of F-Beat Class.

Fig. 10 shows the Performance Analysis of Fusion of ventricular and normal ECG beats such as Accuracy, Sensitivity, Specificity, False Positive Rate, false Negative Rate and Precision.

Q-Beats. Label that marks a segment of unreadable data. Unclassifiable ECG sample from combined dataset is shown in Fig. 11. Table 5 shows the Performance Analysis of Unclassifiable Class. For Unclassifiable Class Total Accuracy for 100 randomly picked ECG sample of the MIT-BIH data is 98.9 %.

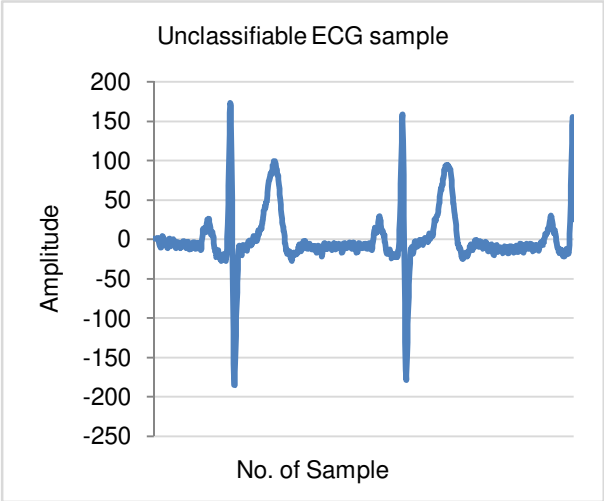

Fig. 11. Unclassifiable ECG sample.

Table 5: Performance Analysis of Unclassifiable Class.

Parameter	Accuracy Level
Accuracy	0.989333
Sensitivity	0.88
Specificity	0.997143
FAR	0.008523
FRR	0.043478
Precision	0.88

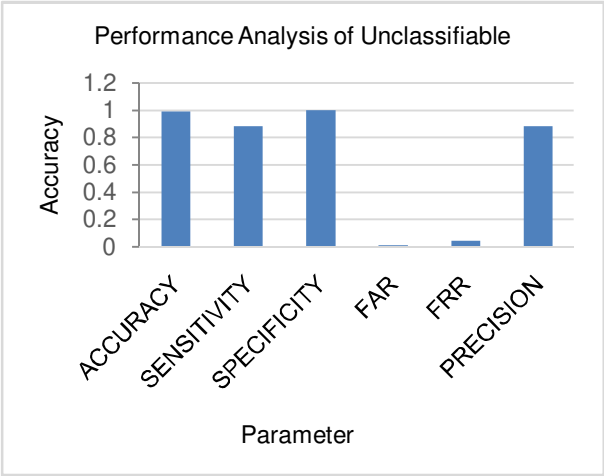

Fig. 12. Performance Analysis of Q-Beat Class.

Fig. 12 shows the Performance Analysis of Fusion of Unclassifiable ECG beats such as Accuracy, Sensitivity, Specificity, False Positive Rate, false Negative Rate and Precision. From Fig. 13 shows the comparing performance of several methods [1, 24, 26] with proposed KPCA-SVR method. It observed that specificity, sensitivity, positive prediction and false prediction rate of arrhythmia detection obtained by the suggested algorithm are better than the previous methods.

Table 6: Performance Evaluation of Several Methods and Proposed Methods.

Parameters	ANN	MD	SVM	KPCA-SVR
Sensitivity	0.93	0.98	0.94	0.98
Specificity	0.92	0.93	0.93	0.96
Positive Prediction	0.91	0.91	0.95	0.98
False Prediction	0.2	0.3	0.2	0.04

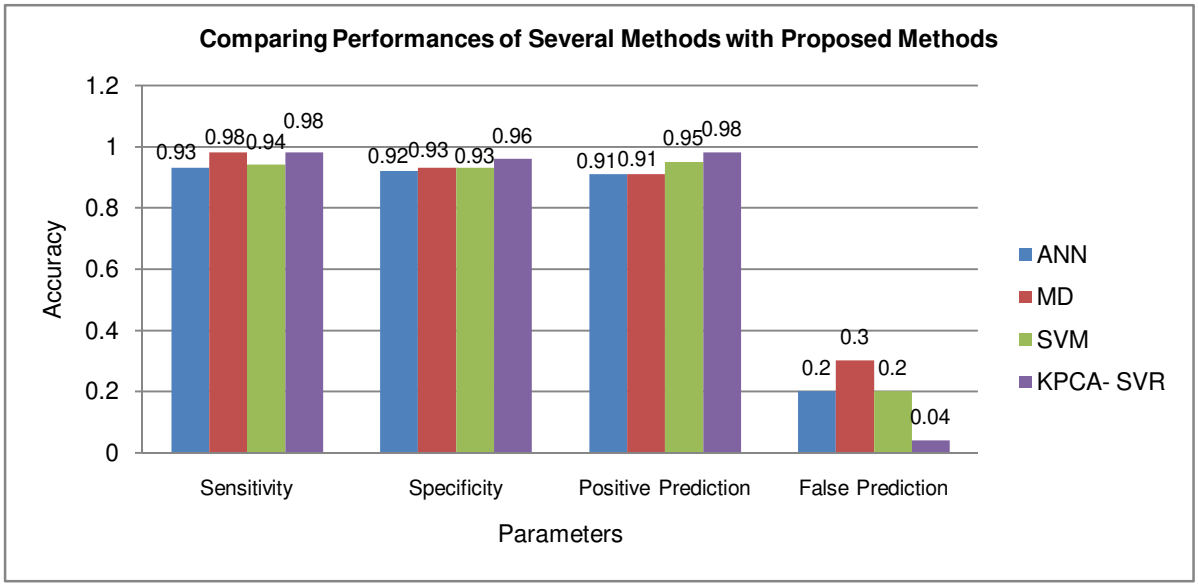

Fig. 13. Accuracy Comparisons of KPCA-SVR with other methods.

IV. RESULT AND DISCUSSION

Arrhythmia detection is an active research area in biomedical engineering with rapidly analysing the normalities and abnormalities of heart. The standard criteria for RR interval or ECG signal have number of limitations when discriminate the SVT from VT and alternative techniques have been suggested as the EGM width criterion which have the some limitation for QRS detection [10-13] and morphological techniques such as wavelet transform and Probability Density Function which do not have effective classification result [7, 22, 23]. The mechanism of feature extraction is proposed to extract the effective features for ECG recognition. The ECG data is sampled from MIT-BIH arrhythmia dataset and the data is pre-processed with low pass filter method with the 360 Hz interference. The various features have been proposed in the literature for classification of ECG beats. The classification performance of ECG beats is depends on feature extraction, feature reduction and classification algorithm. As the obtained results clearly indicate, ECG beats classification technique based on the combination of Kernel-PCA and SVR feature extraction to increase the accuracy, sensitivity, specificity and precision. This improvement can be caused by good performance of SVR classifier with reduced the number of ECG features.

V. CONCLUSION

In medical practices, computer based diagnosis of heart diseases or other kinds of heart problem can reduces the workload of medical practitioner and more concentrate on treatment rather than diagnosis. In this paper, an efficient Kernel-PCA and Support Vector Regression based ECG classification system is proposed to carry out automatic ECG arrhythmia detection by classify the patient's ECG into corresponding five kinds of cardiac arrhythmia condition such as Normal, Aberrant atrial premature, Ventricular Ectopic, Combination and Unclassifiable beats. Low pass filter method is used for pre-processing the ECG signal and removes the noise interference. The Proposed model uses the MIT-BIT cardiac arrhythmia dataset for ECG signal classification. The ECG signals have been classified into six common parameter are measure like Accuracy, sensitivity, specificity, False Positive Rate, false Negative Rate and Precision. The results show that the proposed algorithm is effective for prediction of cardiac arrhythmias, with an accuracy of 98%, sensitivity is 98%, Specificity is 96%, Positive Prediction is 98% and False Prediction is 0.4%. The proposed model can accomplish the better classification output so that diagnosis of cardiac arrhythmia effectively. The detection of arrhythmia by accuracy, specificity, sensitivity and prediction is superior to previous research because of the combination of KPCA and SVR in model. The higher order Statistics of cumulants are efficiently eliminates the variation in similar types of ECG signals so that easily classify the cardiac arrhythmia.

VI. FUTURE SCOPE

In our further research, we intend to focus on following points: (i) classification is performing on all the ECG beats of cardiac arrhythmia (ii) Optimal selection of feature sub-set to reduce the training time (computational requirements), (iii) achieving high classification accuracy with small sized input feature vector and limited training dataset.

Conflict of Interest. On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Dr.S.B.Zope
Principal
Sahyadri Valley College of Engineering & Technology, Rajuri

Parametric Optimization of Biodiesel Fuelled Engine Noise using the Taguchi Method

Satish A. Patil
Mechanical Engineering
Dr. D. Y. Patil Institute of Technology and
PDEA's College of Engineering
Pune, India
sapcoeh@rediffmail.com

R. R. Arakerimath
Mechanical Engineering
G H Raisoni College of Engineering and Management and
Savitribai Phule Pune University
Pune, India
rachayya.arakerimath@raisoni.net

***Abstract*—Biodiesel is a renewable, biodegradable, and efficient fuel that can be blended with petro-diesel in any proportion. The noise in the engine resulting from the combustion has a direct effect on the engine's performance. Many studies have examined the engines' vibration and noise when using diesel and biodiesel blends. This study examines the optimization of diesel blends, load, and compression ratio in the aspect of reducing noise on a Kirloskar single-cylinder diesel engine. Noise was measured at the engine and its exhaust on a computerized setup and for different loads. The experimental results showed that a blend with 15% biodiesel, at 7kg load, and 18 compression ratio produced the lowest noise. Moreover, the Taguchi method was utilized, and experimental results were validated by an ANN.**

Keywords-transesterification; biodiesel; noise; optimization

I. INTRODUCTION

Any alternative to diesel fuel should be replicable, economical, and technically acceptable [1]. Biodiesel is produced by the transesterification of renewable vegetable oils and animal fats with the use of alcohol. Biodiesel is highly degradable and nontoxic. Meanwhile, it has low emissions of carbon monoxide, particulate matter, and unburned hydrocarbons. Due to these properties, biodiesel has attracted wide attention as a replacement to diesel fuel [1, 2]. Biodiesel can be used without modifications in conventional compression ignition engines. Noise and vibrations are major issues of diesel engines [3, 4]. Engine body vibrations and noise are rich in information about the engine's operating parameters and physical condition [4, 5]. Excess noise and vibrations wear out components such as bearings, grouting, and couplings, increasing maintenance cost due to more component failures and unplanned operations. Due to noise and vibrations' importance, there is a need to study the effect of biodiesel and its blends on engine's life and performance [6-8]. Noise level depends on the load and the blending ratio of biodiesel [5]. As a result, it is necessary to extend an engine's life by using optimal blends, after analyzing their impact in noise [5-9].

II. EXPERIMENTAL PROCESS

A Kirloskar TV1 VCR single cylinder, four stroke, constant speed, water-cooled diesel engine, having 3.5HP at 1500rpm, was used on a computerized test bed equipped with measuring instruments such as thermocouples, dynamometer, tachometer and flow meters. The engine's specifications are shown in Table I.

TABLE I. ENGINE'S SPECIFICATIONS

Name	Kirloskar
No. of cylinders	1
No. of strokes	4
Type of cooling	Water cooled
Power developing capacity	3.5kW at 1500rpm
Compression ratio range	12-18
Stroke	110mm
Bore	87.5mm
Cylinder volume	661

Noise levels were measured by a noise meter for four different fuel blends on variable load conditions and compression ratios as per the Taguchi array. The study focused on the input parameters of biodiesel blends for examining the diesel engine's operating conditions. Noise was measured at the engine and its exhaust. A noise meter was placed at 0.5m distance from the engine for measuring its noise, and another was placed outside the room near the exhaust pipe end to measure the noise at the exhaust [3-5]. The noise meter and its specifications are shown in Figure 1 and Table II respectively.

TABLE II. NOISE METER'S SPECIFICATIONS

Display	14mm (0.55″) LCD with backlight
Parameter measurement	LP, Lmax, Leq, LN
Frequency range	31.5Hz~8kHz
Measurement range	LP: 30~130dB (A)
Resolution	0.1 dB
Accuracy	±1dB

Fig. 1. Noise meter.

Corresponding author: Satish A. Patil

Four fuel types were tested, namely: B0 consisting of 100% diesel, B15 consisting of 15% biodiesel and 85% diesel, B20 consisting of 20% biodiesel and 80% diesel, and B25 consisting of 25% biodiesel and 75% diesel [2, 3, 9]. Biodiesel blend, load on the engine, and compression ratio were the parameters whose effects on the engine's noise were studied. The parameters' levels are listed in Table III.

TABLE III. PARAMETRIC CONDITIONS

A: Blend	B: Load	C: Compression ratio
A1 = 0	B1 = 0	C1 = 16
A2 = 15	B2 = 4	C2 = 17
A3 = 20	B3 = 7	C3 = 17.5
A4 = 25	B4 = 10	C4 = 18

A. Noise Analysis

The orthogonal array of the input parameters indicates the number of combinations for the experiments. This selection of orthogonal array is based on three parameters and four levels for each parameter [2,5]. The array was obtained by Minitab using the following operating parameters:

Taguchi Design
Design Summary
Taguchi Array L16(4^3)
Factors: 3
Runs: 16
Columns of L16 (4^5) array: 1 2 3

TABLE IV. SAMPLE READINGS OF TAGUCHI ARRAY FOR PARAMETER OPTIMIZATION

Blend	Load	C.R.	Noise at the engine	Noise at the exhaust	Noise at the engine SNR	Noise at the exhaust SNR
0	0	16	92.75	108.9	-39.3463	-40.7406
0	4	17	93	109.25	-39.3697	-40.7684
15	4	16	93.75	112.15	-39.4394	-40.996
15	7	18	95	110.45	-39.5545	-40.8633
15	10	17.5	95.6	110.95	-39.6092	-40.9025
20	0	17.5	91.7	110.45	-39.2474	-40.8633
25	10	16	96.35	111.9	-39.677	-40.9766

The fourth row of Table IV gives the optimum values of input parameters for noise among the various blends. Signal-to-noise ratio (SNR) measures how the response varies relatively to the nominal or target value under different noise conditions. Depending on the goal, different SNRs may be chosen. In this experiment, lower SNRs are better. Optimal conditions were met with B15 blend, 7kg applied load, and 18 compression ratio, where the noise was 95dB at the engine and 110.45dB at the exhaust.

B. Taguchi Analysis: Noise versus Blend, Load, C.R.

Taguchi method analysis results for noise at the engine versus blend, load, and C.R are shown in Table V, while the regression's resulted equation is:

$$Noise\ at\ the\ engine = 96.6 - 0.0507 Blend + 0.371 Load - 0.255 C.R. \quad (1)$$

TABLE V. NOISE AT THE ENGINE MODEL SUMMARY

S	R-Sq	R-Sq(adj)
0.2196	76.30%	40.76%

Taguchi model's analysis results on noise at the exhaust versus blend, load, and C.R are shown in Table VI, and the regression's resulted equation is:

$$Noise\ at\ the\ exhaust = 107.89 + 0.0518 Blend + 0.1900 Loads + 0.044 C.R. \quad (2)$$

TABLE VI. NOISE AT THE EXHAUST MODEL SUMMARY

S	R-Sq	R-Sq(adj)
0.0658	86.48%	66.21%

C. Validation of Experimental Results by Artificial Neural Network (ANN)

The results of noise at the engine and the exhaust were validated by an ANN. An ANN script, shown in Table VII, was used for obtaining the output from the input parameters.

TABLE VII. ANN CONFIGURATION SCRIPT

```
clc; close all; clear all;
x = xlsread('Input1');
y = xlsread('Output2');
net = newff(minmax(x),[20,1],{'logsig','purelin','trainlm'});
net.trainparam.epochs = 1000;
net.trainparam.goal = 1e-15;   net.trainparam.lr = 0.01;
net = train(net, x, y);
y_net = net(x);
plot(y);hold on; plot(y_net, 'r');
error = (y - y_net);
```

III. RESULTS AND VALIDATION

A. Noise at the Engine

The experimental results for noise at the engine, the values calculated by the ANN, and the error between them are shown in Table VIII and a comparative graph of these values is shown in Figure 2. Apparently, there is a small difference, less than 1.2%, between the experimental and the ANN calculated values.

TABLE VIII. EXPERIMENTAL AND ANN RESULTS

Blend	Load	C.R.	Noise at the engine	Noise by ANN	Error	Error %
0	7	17.5	97	96	-1	-1.0%
0	10	18	95.2	96	0.8	0.8%
15	7	18	95	96	1	1.0%
20	10	17	95.9	95.5	0	0.0%
25	7	17	94.8	95.6	0.8	0.8%
25	10	16	96.35	95.2	-1.15	-1.2%

The regression plot obtained by the Taguchi model for the experimental results was compared with the ANN regression plot. The regressions' R-square value was around 80%. The straight line in these plots shows that the data fit a normal probability distribution. There are very low residual values, as

all residuals obtained are almost along the line in both plots. The similarity in these plots validates the results.

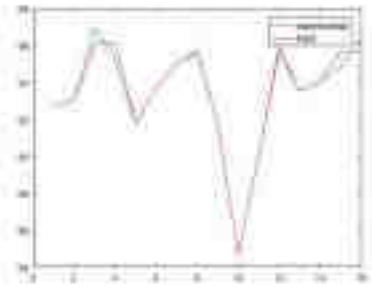
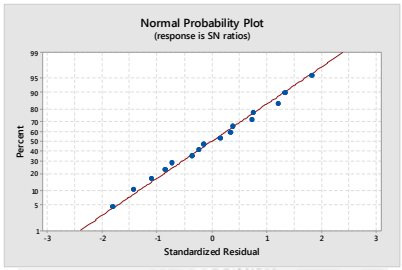


Fig. 2. Comparison of experimental and ANN noise values at the engine.

(a)



(b)

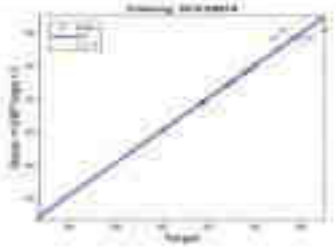


Fig. 3. Residual plot for noise at the engine by (a) Minitab, (b) ANN.

B. Noise at the Exhaust

The experimental results of noise at the exhaust, the values calculated by the ANN, and the error between them are given in Table IX. Moreover, a comparative graph of these values is shown in Figure 4. Apparently, there is a tiny difference between experimental and ANN results, less than 0.3%, for noise at the exhaust.

TABLE IX. EXPERIMENTAL AND ANN RESULTS

Blend	Load	C.R.	Noise at the exhaust	Noise byANN	Error	Error %
0	0	16	108.9	109.2	0.3	0.27%
0	4	17	109.25	109.1	-0.15	-0.14%
15	7	18	110.45	110.45	0	0.00%
15	10	17.5	110.95	110.95	0	0.00%
20	0	17.5	110.45	110.45	0	0.00%
25	10	16	111.9	111.9	0	0.00%

After comparing the regression plots of experimental and ANN results in Figures 3 and 5, we can see that there are very few residual values, and all values obtained are almost along the line indicating a normal probability distribution. The regression's R-square value was 86.48%. The similarity in these plots validates the results.

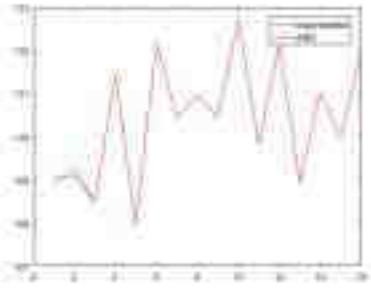
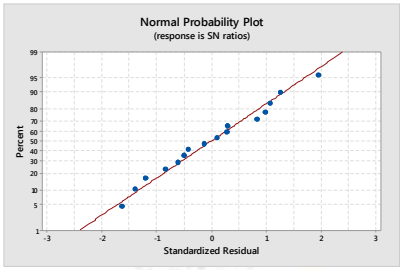


Fig. 4. Comparison of experimental and ANN noise at exhaust.

(a)



(b)

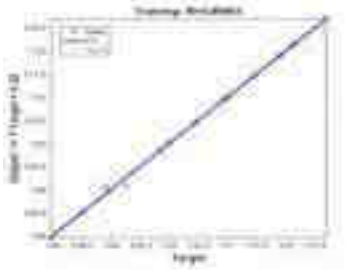


Fig. 5. Residual plot for noise at the exhaust by (a) Minitab, (b) ANN.

IV. CONCLUSION

This study examined the optimization of noise reduction at the engine and its exhaust with biodiesel blend, load, and compression ratio of the engine as input parameters. Analysis was carried out utilizing the Taguchi method, and optimization of the input parameters was performed by using SNR [10, 11]. The experimental results obtained by Minitab were validated by an ANN. The main conclusions of this study are:

- Optimal input parameters were: a blend with 15% biodiesel, applied load of 7kg, and compression ratio 18, resulting to 95dB noise at the engine and 110.45dB at its exhaust.
- R-square values obtained by regression analysis were around 80% and more, indicating that the obtained model fits to the actual data.
- There are small to tiny differences between the experimental and the ANN's noise values.
- All regression residuals of both Minitab and ANN were very low and almost along the line in both methods. The similarities in both plots validated the results.

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AUTHORS PROFILE

Satish A. Patil is a research Scholar at the Mechanical Engineering, Dr. D. Y. Patil Institute of Technology (DYPIT), Pune (MS), India, and a Assistant Professor in the Department of Mechanical Engineering, PDEAs College of Engineering, Manjari (Bk), Pune, India. Affiliated to Savitribai Phule Pune University, Pune.

Rachayya R. Arakerimath is a Professor and the Head of the Mechanical Engineering Department, Savitribai Phule Pune University, Pune G H Raisoni College of Engineering, Pune, India. He has 24 years of teaching experience and has worked at various levels. He is an approved Ph.D. guide under the Universities of Pune and Nagpur. He has published more than 100 papers in conferences and journals. He is also a reviewer for international journals.

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Original Article

BRAKE THERMAL EFFICIENCY ANALYSIS OF ENGINE FUELED KARANJA BIODIESEL USING TAGUCHI AND VALIDATION OF RESULTS

SATISH A. PATIL[1*] & DR. R. R. ARAKERIMATH[2]

[1]*Research Scholar, DYPatil Institute of Technology, Pune (MS), India*

[2]*HOD, Mechanical Engineering, G H Raisoni College of Engineering and Management, Wagholi, Pune, India*

ABSTRACT

Biodiesel is synthesized from oils produced from vegetables and fats of animals which have properties like renewability, biodegradability, and as an efficient fuel. It is easily blended with petro diesel at any proportion. Engine noise-generating due to combustion in engines has a direct effect on engine performance. Some researchers are working on the engine using petro diesel and different blends of biodiesel for performance characteristics over the world. This paper covers the study of input parameters optimization for BTH of the engine. The tests have carried out at different combinations as per the orthogonal array obtained by the Taguchi method. This selection of orthogonal array has based on three parameters along with four levels of all individual parameters. The experimental output BTH values calculated have noted by the computerized engine setup. The results obtained by Minitab software have compared with results obtained by ANN and validated.

KEYWORDS: Transesterification, Biodiesel, Brake Thermal Efficiency

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INTRODUCTION

Use of diesel fuels in many different areas and have importance for the wealth of the country, there should be an alternative to diesel. An alternative to diesel fuel should be replicable, economical, as well as technically acceptable [1]. Biodiesel is produced by the transesterification process from renewable oils obtained from vegetable and animal fats using alcohol. Highly degradable, nontoxic, particulate matters, less carbon monoxide emission, unburned hydrocarbons are some important properties of biodiesel. Because of these properties, biodiesel has acquired international focus as a replacement for diesel [2]. Biodiesel may be used without modifications in existing compression ignition engines.

Totally 16 numbers of experiments have done as per array prepared by Minitab software using different inputs such as Biodiesel Blends, Load on Engine, and Compression Ratio. The output BTH of the engine with Karanja oil biodiesel blends for different sets of experiments obtained have noted. For the optimization of input parameters, the results have analyzed using the Taguchi method [3]. The main effective plot and interaction plots have plotted. The input parameter optimal conditions based on SN ratio value have searched for the maximum BTH of the engine [4, 5]. The regression residual plot obtained by Minitab is compared with the regression residual plot by ANN [6]. The comparison of yield obtained by experimentation and ANN has also plotted together. There are very small differences between these values.

EXPERIMENTAL SETUP

In the experimental setup, Kirloskar makes TV1, Variable CR, and 3.5 HP @ 1500 RPM. The engine' specifications are as below. The computerized system testbed has equipped with all required measuring instruments such as thermocouples, dynamometer, tachometer, flow meters, etc

Table 1: Engine Specifications

Make	Kirloskar
No. of Cylinders	1
No. of Strokes	4
Type of Cooling	Water Cooling system
Power Developing Capacity	3.5 kW @ 1500 rpm.
Range of C. R.	12-18
Stroke length	110 mm
Bore dia.	87.5 mm
Cylinder Volume	661

In this work, four different fuels have tested such as B0 (diesel 100%), B15 (85% diesel with15%biodiesel), B20 (80% diesel with 20% biodiesel), and B25 (75% diesel with 25% biodiesel)

OPERATING PARAMETRIC CONDITIONS

The effects of different parameters affecting the Transesterification Process have studied as follows.[6]

- Blends of Biodiesel
- Applied load on Engine
- Compression Ratio of engine

The operating parameter values have given below:

Table 2: Optimizing Parameter Ranges

A: Blend	B: Load	C: Compression Ratio
A1 = 0	B1 = 0	C1 = 16
A2 = 15	B2 = 4	C2 = 17
A3 = 20	B3 = 7	C3 = 17.5
A4 = 25	B4 = 10	C4 = 18

ANALYSIS OF BRAKE THERMAL EFFICIENCY BY TAGUCHI METHOD: [6]

Orthogonal Array

The parametric design giving the number of conditions for all individual experiments in the orthogonal array. This orthogonal array selection has based on three parameters and four levels for the individual parameter as shown in above table number one.

Orthogonal array obtained by Minitab using operating parameters:

Summaryof Taguchi Design

Taguchi Array L 16 (4^3)

No. of factors: 3

No. of runs: 16

Columns of L16 (4^5) array: 1 2 3

Table 3: Sample Readings as per Obtained Taguchi Array

Blend	Load	C.R.	BTH	SNR_BTH
0	0	16	17.49	24.8558
15	4	16	22.33	26.97777
15	7	18	22.52	27.05137
20	0	17.5	15.16	23.61398
25	4	17.5	18.34	25.26799

In the above table 3, the yellowish row gives the higher value of the SN ratio which has indicated optimal input parameter values of engine for maximum BTH. For BTH the value of SN ratio, higher is better. The experimental maximum output value of BTH of the engine with input parameters blends B15, applied load 7 kg, compression ratio18 has 22.52 %.

TAGUCHI ANALYSIS: BTH VERSUS BLEND, LOAD, C.R.

Model Summary

S	R-Square value	R-Square. (adjusted)
0.6207	91.39%	78.47%

Regression Equation

BTH = 23.1 - 0.0872 Blend + 0.210 Load - 0.216 C.R……..(1)

Main Effective Plot for BTH

The Plots obtained by Minitab software have shown below

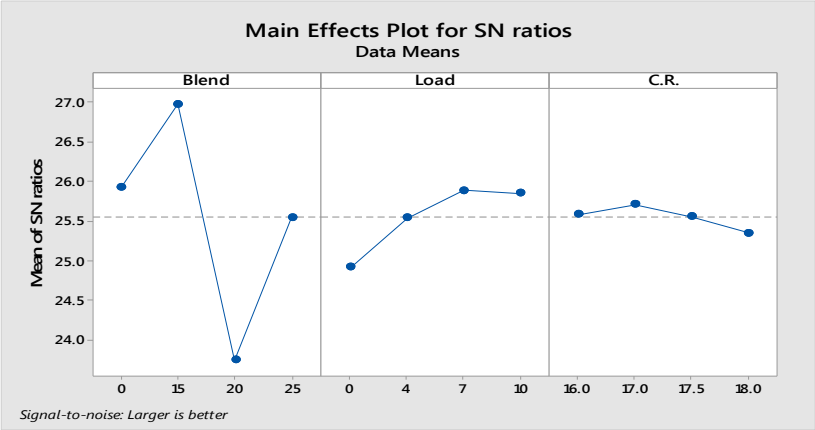

Figure 1: Main Effect Plot for BTH.

In the above main effect plots, S/N ratios vs blend, and S/N ratios vs load are comparatively steeper than CR plot. So, blend and load have affected more on the values of BTH. Therefore the effect of remaining one i.e. CR has neglected for further studies in the interaction plot.

INTERACTION PLOT FOR BTH: (6)

Generally, the Taguchi method concrete on the main effects and that's important to test the other interactions. The variations of BTH of engine separately with the effect of blend and load simultaneously have shown in these interaction plots. From this interaction plot, Blend 15 having a larger value of SN ratio at 7kg loads.

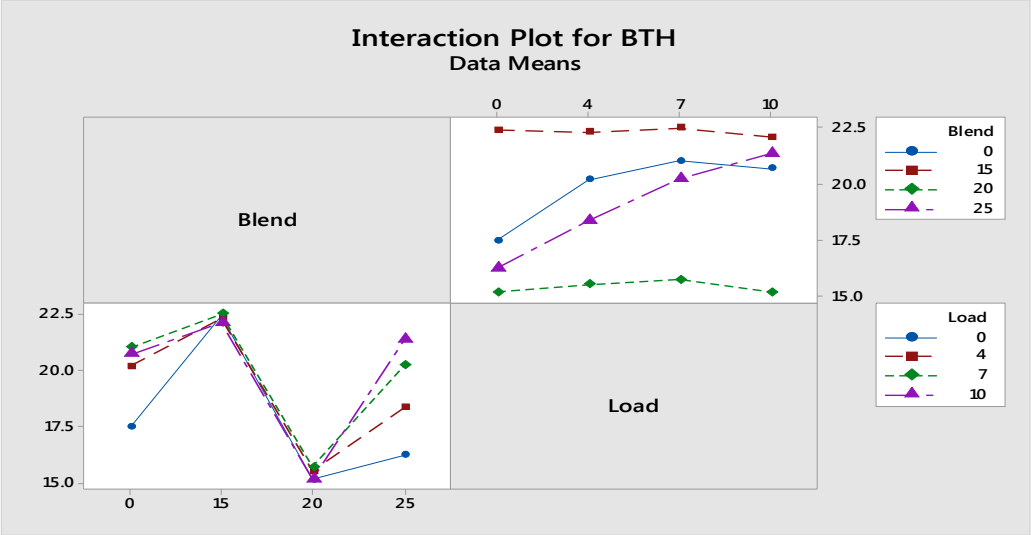

Figure 2: Interaction Plot for BTH.

VALIDATION OF EXPERIMENTAL RESULTS USING TAGUCHI FOR BTH OF ENGINE BY ARTIFICIAL NEURAL NETWORK (ANN)

Here the experimental results of BTH of the engine have validated by ANN (Artificial Neural Network).

ANN Script for the Analysis Performed

Script has written for obtaining the output by putting the values of input parameters

Table 3: ANN Script for the Analysis Performed

```
clc; close all; clear all;
x = xlsread('Input1');
y = xlsread('Output2');
net = newff(minmax(x),[20,1],{'logsig','purelin','trainlm'});
net.trainparam.epochs = 1000;
net.trainparam.goal = 1e-15;
net.trainparam.lr = 0.01;
net = train(net, x, y);
y_net = net(x);
plot(y);hold on; plot(y_net, 'r');
error = (y - y_net);
```

Comparison of BTH of Engine Obtained by Experimentation and ANN

Experimental values of BTH of engine and values calculated by ANN, error between them, and % error are given in table 4.

Table 4: Sample Readings by Experiment and ANN

Blend	Load	C.R.	BTH by Exp.	BTH by ANN	Error	Error %
0	0	16	17.49	17.49	0.00	0.00%
15	4	16	22.33	22.33	0.00	0.00%
15	7	18	22.52	22.52	0.00	0.00%
20	10	17	15.15	15.15	0.00	0.00%
25	0	18	16.23	16.23	0.00	0.00%

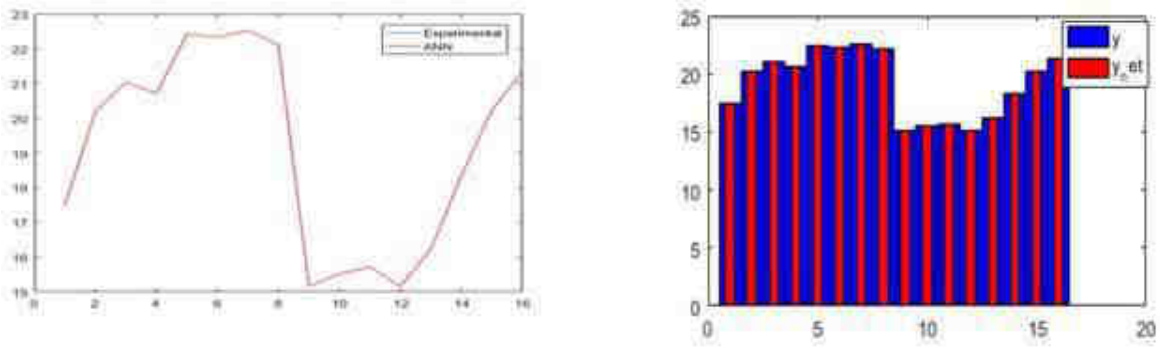

Figure 3: Comparison of BTH Obtained by Experimentation and ANN.

The comparative study of BTH of engine obtained by experimentation and ANN is as shown in Figure Fig. (3). There is a zero error in between these two values of BTH of the engine. In the table (3) the all values of BTH of engine obtained by experimentation and by ANN are given. There is no difference between these values and the % error is also zero.

Regression Plots: (6)

The regression plots obtained by Minitab software and ANN have shown below. The comparison has made between these plots.

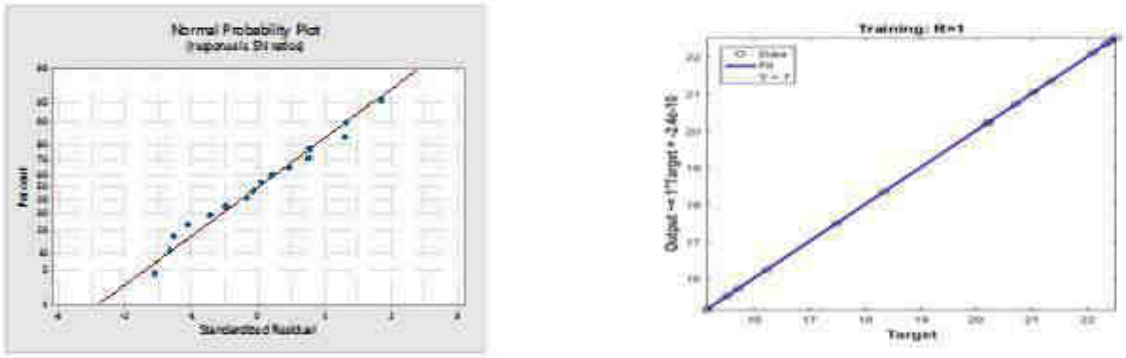

Figure 4: Comparison between Residual Plot for BTH by Minitaband by ANN.

There are very low residuals in the above both plots and all readings obtained are nearby or on the straight line. The R-square value for this regression has 91.39%.

CONCLUSIONS

This work has carried out for optimization of input parameters such as Biodiesel Blend, Load on Engine, and C R for output of BTH of the engine. The Taguchi method analysis using SNR base has performed for the optimization of input parameters. The results obtained by experimentation with Minitab are validated by ANN (Artificial Neural Network).The conclusions are as follows;

- The experimental output BTH of the engine has 22.52 % with optimal input parameters blend B15, applied load 7 kg, and compression ratio18.
- Interaction plots have shown the variation of BTH of the engine with the effect of blend and load simultaneously and also BTH of the engine has maximum value for blend15 and load 7 kg.
- The R square value obtained by analysis has 91.39%, shows generated model has fitted to actual given data.
- There have no differences between values of BTH of engine obtained by experimentation and by ANN.
- The regression residuals plot obtained by Minitab has similar to ANN regression plot. Hence results have validated.

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Classification and analysis of cardiac arrhythmia based on incremental support vector regression on IOT platform

S.T. Sanamdikar [a,b,c,d,*], S.T. Hamde [a,b], V.G. Asutkar [a,b]

[a] Department of Instrumentation Engineering, Shri Guru Gobind Singhji Institute of Engineering and Technology, Nanded, India
[b] Swami Ramanand Teerth Marathawada University, Nanded, Maharashtra, India
[c] Department of Instrumentation and Control, PDEA College of Engineering, Manjari Budruk, Pune, India
[d] Savitribai Phule Pune University, Pune, Maharashtra, India

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ABSTRACT

The electrocardiogram (ECG) is a diagnostic device capable of monitoring normal or irregular heart function. The entire ECG beat can be categorized into five different forms of beat arrhythmias (N, S, V, F, U). Quick and precise diagnosis of forms of arrhythmia is critical for identifying the heart problem and provides the proper treatment to the patient. In this paper, Discrete Wavelet Transform and Higher Order Statistics techniques has been used for analyzing and determining the ECG signals and implement it on an IOT-based platform. This system is based on three categories: The first approach involves inputting the ECG data; the second approach involves extracting the ECG beats with their respective amplitude from the base line. Wavelet transform function, and higher order statistics are used to eliminate noise and unwanted signal components and thus to extract ECG features. The third approach is to classify the ECG beats based on the Incremental Support vector regression classifier. After classification ECG beat is transmitted to the controller section for signal processing are given to controller section (Arduino Uno). The process can be implemented by employing the statistical feature for the feature extraction from the ECG signal. Compared to other approaches, the method provided by Incremental Support vector regression to identify the ECG beats and predict arrhythmia can provide successful detection of arrhythmias. The basic concept of the proposed system is to provide patients with reliable health care by using cloud data compliance to allow doctors to use this information and to provide a fast and feasible service. The findings show that the proposed algorithm is successful in predicting cardiac arrhythmias, with a 98% that is higher than other approaches.

1. Introduction

Recognition of the ECG signal is very crucial in understanding the functioning of the heart as well as the diagnosis of heart disease under different circumstances. The American Heart Association stated in 2006 that 70 million people around the world face the cardiovascular disease problem. The basic reasons for Cardiovascular Disease (CVD) are hypertension, lacking physical exercise, ineffectively adjusted eating regimen, smoking and unusual glucose levels. Because of the existence of noise and heartbeat abnormality, physicians face complications in the Arrhythmias analysis [1,2]. In addition, visual inspection alone can result in a misdiagnosis or irrelevant detection of arrhythmias. Therefore, the computer aided analysis of ECG data supports physicians to proficiently detect arrhythmia. Arrhythmia is a cardiovascular condition that is caused by abnormal heart activity; electrocardiogram (ECG) is used to detect heart defects. Feature Extraction, selection and classification Construction are the three main steps in the detection of arrhythmias. The ECG beat classification [3] as per ANSI/AAMI EC57:1998 standard database shown in Table 1. In Feature extraction process the input data is transform into different of features for detecting heart diseases. The Purpose of this study is to evaluate the ECG beats classification performance with integrating two methods for feature extraction and evaluation using wavelet transformation and higher order statistics. The evaluation of ECG beats classification performance can be improved by using the incremental support vector regression.

The numerous models of different kinds of feature extraction from ECG signals were achieved in previous studies, and a classification technique was proposed. Feature extraction may contain the non-linear,

* Corresponding author.
E-mail address: sanamdikar123@gmail.com (S.T. Sanamdikar).

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Table 1
MIT-BIH arrhythmia beats classification per ANSI/AAMI EC57:1998 standard database [21–41].

AAMI classes	MIT-BIH heartbeat classes
Non-Ectopic Beat (N)	Normal Beat (N)
	Left Bundle Branch Block (LBBB)
	Right Bundle Branch Block (RBBB)
	Nodal Escape (j)
	Atrial Escape Beat (e)
Supra-Ventricular ectopic Beat (S)	Aberrated Atrial Premature Beat (A)
	Atrial Premature (a)
	Supraventricular premature (S)
	Nodal premature (J)
Ventricular ectopic Beat (V)	Ventricular Escape (V)
	Premature ventricular contraction (E)
Fusion Beat (F)	Fusion of ventricular and normal (F)
Unknown Beat (U)	Unclassifiable (U)
	paced (p)
	Fusion of paced and normal (f)

time, frequency domain and multi domain feature extraction [3,4]. For the classification classical methods is used such as Artificial Network, Support Vector Machine (SVM), Super vector regression (SVR) etc. The ECG signal can be easily identified by the noise in the time domain and has a low accuracy level [5,6]. Another approach for extracting the ECG feature based on convolutional neural network model. The model has two sections; the first part extract the feature from ECG signals and second part perform the classification of feature based on the first section. Feature extraction was discussed based on principle component analysis to reduce the multidimensional data and input is processed by three pooling layer approach [7]. These signals cannot be considered as the accurate parameter of ECG signals for accomplishing high arrangement correctness. There are various combinations of methods proposed for classification of the ECG feature extraction. The genetic algorithm and SVM-based classifier designated for the classification of ECG waveforms [8–24] are used for the function optimization. The Extreme learning machine algorithm calculates the minimum weight Single Hidden Layer Feed Forward Neural Network for classification [9]. In the recent study, echo state network was implemented based on the morphology for classifying the normal and abnormal ECG signals of heart. The classification is based on the two classes SVEB and VEB [10]. The extraction of features from non-linear method in the time and space domain based on the T complexity is applied to the RR and 13 different classes are used for classification [11,12].

Although the above mentioned techniques or methods of classification have good results, they used a combined space, time, frequency, linear and non-linear domain for beat classification of the ECG. This research suggests an ECG waveform detection model that extracts multi-domain features based on empirical mode of decomposition with linear discriminatory analysis [13,14]. The combined approach of polyhedral conic separation and k-means clustering was applied as classifier to differentiate the ECG waveforms with 5 different classes such as N for Normal, RBBB for Right Bundle Branch Block, LBBB for Left Bundle Branch Block, APC for Atrial Premature Contraction and VPC for Ventricular Premature Contraction [15–18]. Ref [19] proposed a new cloud based model for automatic classification of ECG beats with minimum processing of signals. HOS and DWT is used for classify the ECG beats based on multivariate analysis [20–23]. The classification is performed based on feed forward neural network machine learning technique and particle swarm optimization [22] An effective method to classify the ECG signal based on the support vector regression analysis on 400 samples of data set of various arrhythmias was proposed [24,25]. The KPCA-SVR approach was used for detecting the cardiac arrhythmia [35]. The proposed model is evaluated and compared with the different techniques of neural network classifiers, and found that it offers better accuracy than the current method.

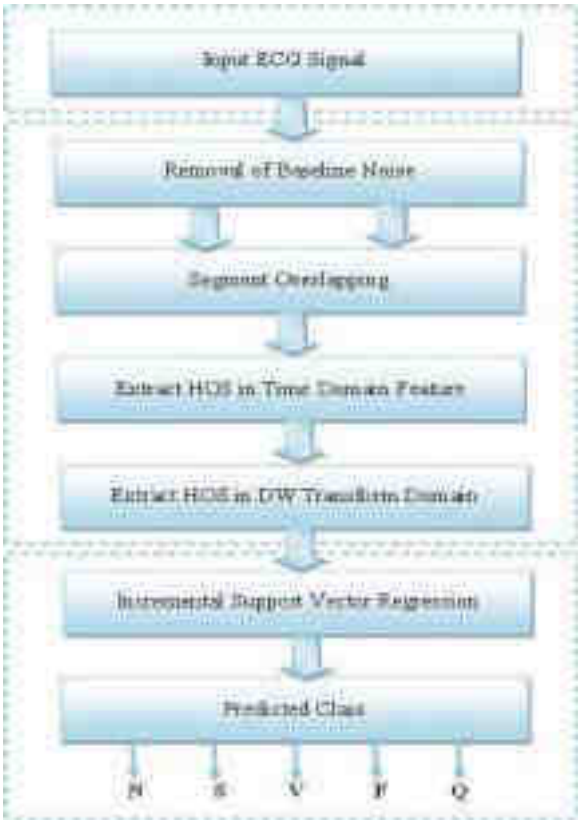

Fig. 1. The three tier architecture for recognition and classification of ECG signal for cardiac arrhythmia system.

2. Proposed methodology

Fig. 1 shows the three tier architecture of research work. The System consists of three sections such as input ECG signal, feature extraction and classification. The ECG beats are derived using the discrete wavelet transform and higher order statistics. These non-linear techniques have been used to extract the ECG beats better than others because of their versatility. In the Discrete Wavelet Transform and higher order statistics, the original ECG signal is decomposed in the time domain to remove the low-frequency component to eliminate the baseline and eliminate the high-frequency component to remove the noise and extract the function in the ECG signals. Sample frequency of ECG signal is 360 Hz. In the final step, classification is carried out on the extracted function of ECG beats and decides normal and abnormal arrhythmia activities. After classification of ECG beats sent to the IOT cloud. It is suitable for 24 × 7 monitoring of the patient. In almost all cases, the classification accuracy achieved is above 98%. The key purpose of the new scheme is to provide patients with safer and more effective services by creating a registry of collective records so that practitioners and physicians can use this database to provide evidence and an effective cure for arrhythmia. The execution times we acquired from actualizing the application on the ATMEGA328 P Microcontroller demonstrate that the ECG investigation and characterization can be performed progressively. TCP/IP protocol is used to transfer the data from controller section to remote hospital. Basically two steps for designing a programming logic one for receiving the signal and another is transmitting the signal using TCP/IP protocol. Set an integer number to packet data; be certain that the information is sent without misfortune of data. Heart beat is never transmitted to the base station (Controller) when heart beat is normal. Where the irregular condition is found. The transmitter is turned on and transmits data about heart beat to remote hospital.

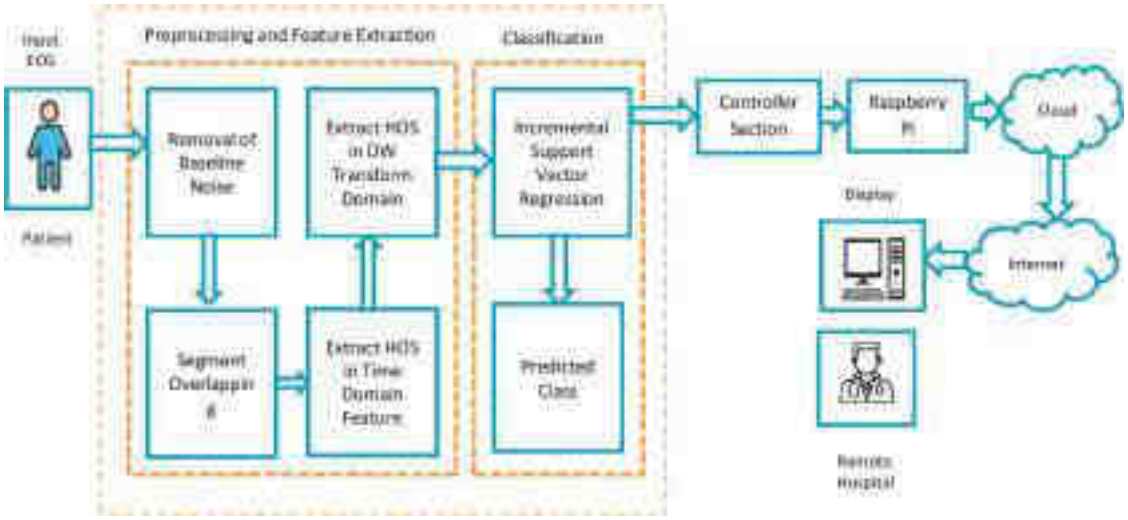

Fig. 2. Complete architecture of proposed model with IOT Platform.

2.1. Signal preprocessing

2.1.1. Removal of baseline noise

Baseline signal noise has an effect on normal ECG [2]. Noise frequency from around 0.5 to 0.6 Hz. Used high pass filter with the cut-off frequency 0.5 to 0.6 Hz [3,4] to eliminate such noise in signal. If the physical activity of the patient's body increases, then the frequency parameter of the baseline [26–28] increases such that the baseline noise signal is a low signal and a high pass filter with a cut-off frequency of 0.5 to 0.6 Hz is used to eliminate the baseline noise in the ECG signal.

2.1.2. Discrete wavelet transform function

In ECG signals consists of variety signals i.e. noise and it is required to remove the undesirable signals and extract useful feature from ECG. So many researchers have developed effective techniques for extracting the important feature for EEG and ECG signals based on the wavelet transform. In this section we will discuss the discrete wavelet transform function in time domain feature with the respective signal shape.

For the feature extraction, we acquire the concept of Yakup Kutlu and Damla Kuntalp [36] studied the wavelet and HOS techniques for noise removal. They proposed the good techniques for noise removal which gives the better result of noise removal as compare to others [27].

The signal is divided into the two parts High and Low frequencies.

The Low frequency again divided into two parts high and low frequency. This process is continued until the signal has been entirely decomposed.

$$y_{\text{high}}[n] = \sum_{k=-\infty}^{\infty} x[k]h[2n+1-k] \tag{1}$$

$$y_{low}[n] = \sum_{k=-\infty}^{\infty} x[k]g[2n-k] \tag{2}$$

Where,

x[k] is input ECG signal

g[n] and h[n] is Impulse response of high pass filter

There is n +1 possibility to encrypt ECG signal for the n level decomposition. Noise is removed from ECG signal using low and high pass filter. In wavelet transformation, approximate precise coefficient is just like binary tree. Such decomposition is applied on low and high frequencies. And again cerate next level of tree, make 2^{2n-1} in various way to encrypt the ECG signal. Each n level, there is 2^{n-1} nodes. The wavelet decomposition can be obtained at fourth level that means data in fourth level is used to extract the feature.

2.1.3. Higher order statistics

The higher order statistics (HOS) has importance in bio-medical signal processing field but first and second order statistics are not sufficient for all the representing it. So that we used third and fourth order statistics for analysis.

2.1.4. Statistical features

For evaluating the feature decomposition of signal is an important step in signal processing. In our proposed scheme we are evaluating some statistical feature such as energy, mean, median, entropy, standard deviation, skewness, kurtosis, covariance and to create feature set [29, 30]. The entire feature is evaluated in MATLAB software. Following are the standard equations used for evaluating feature based on C_{ab} at 4th level of decomposition

Following features are a set of statistical parameters to measure a distribution,

$$\textbf{\textit{Energy}} = \sum_{i=1}^{n} C_{ab}^2 \tag{3}$$

Standard Deviation

$$\sigma = \sqrt{\frac{1}{N}\sum_{i=1}^{N}(x_i-\mu)^2} \tag{4}$$

Mean

$$M = \frac{1}{N}\sum_{i=1}^{N-1} A_i \tag{5}$$

2.1.4.1. Kurtosis. used to measure the data sharpness is peaked from ECG signal. In data set A_1, A_2, A_n

$$KUR = \frac{\sum_{i=1}^{n}(A_i - \overline{A})}{N} / SD4 \tag{6}$$

Where, $\overline{A}$-mean, N-number of data points, SD-standard deviation

Skewness

$$SK = \frac{\varepsilon(C_{ab} - \mu a)^3}{\sigma_a^3} \tag{7}$$

The coefficients C_{ab} is the decomposition coefficient. Here i = 1, 2, …,i is the node number at 4th level of decomposition. N is the number of coefficients at the coefficients C_{ab} is the decomposition coefficient. Here i = 1,2,…,l is the node number at 4th level of decomposition. N is the

number of coefficients.

2.1.5. RR interval features

We have picked RR interim data as the main time space includes in our investigation. Two RR interims are figured straightforwardly from the R areas named as past RR and post RR interims. Past RR is characterized as the time remove among present and past R area while post RR is the time separate between current R area and the accompanying one [31].

- Past RR, (RR_i): The interval between *i*th R beat and past R beat.
- Post RR $RR_{(i+1)}$: interval between *i*th R beat to next R beat.
- Average of RR interval in 1-min, (RR_i): Averaged RR interval of 1-min of ECG
- Average 20-min RR interval, (RR_{20}): average RR interval of 20-min ECG

3. ECG beat classification model

This section describes the ISVR classifier used for the ECG beats classification.

3.1. ISVR classifier

The Incremental Support Vector Regression (ISVR) utilizes indistinguishable working standards from the SVM for grouping, with just a couple of minor contrasts. As a matter of first importance, since yield is a genuine number it turns out to be extremely hard to anticipate the current data, which has vast prospects. On account of relapse, an edge of resistance (epsilon) is set in estimate to the SVM which would have just mentioned from the issue. In any case, other than this reality, there is additionally an increasingly confused explanation; the calculation is progressively entangled subsequently to be taken in thought. In any case, the primary thought is consistently the equivalent: to limit mistake, individualizing the hyper plane which expands the edge, remembering that piece of the blunder is endured [32]. In this research Incremental SVR approach is used to develop the regression model. The training data are delivered to adjust the proposed model parameters, at the same time as the take a look at data are used to evaluating the prediction accuracy of the proposed model.

The complete description of ISVR techniques are given below.

(1) Load the data set.
(2) Data set can be placed in multi-dimensional function space and the data can be determined based on kernel function.
(3) To search the linear relationship of data in multi-dimensional space to find another hyper-plan with large vector.

Primarily, ISVR select the hyper-plan with maximum vector value between plan and both positive/negative points. Selection of Optimal hyper-plan is based on distance between data points and hyper-plan is maximum known as support vector.

Given training data set $(a_1, b_1), \ldots\ldots (a_n, b_n), p_i \in \{-11\}$ So we required to learn optimal hyper-plan $w.a + y = 0$, with max margin equivalent to decision function $f(x) = sign(w.a + y)$

The objective function,

Max

$$\varnothing(w) = \frac{1}{2}\|w\|^2 \rightarrow \dot{min} \tag{8}$$

ST constraint

$$p_i\ (w^t\ .\ a_i y) \geq 1,\ i = 1, 2, \ldots..N \tag{9}$$

The above Eq. (10) can be change into optimization problem so that can be solved by Lagrange multiplier technique.

$$\begin{cases} L(w,\ y, \alpha) = \frac{1}{2}\|w\|^2 - \sum_{i=1}^{N} \propto_i (p_i(w.a_i + y) - 1) \rightarrow \underset{w, y}{\min} \underset{\propto}{max} \\ \propto_i \geq 0,\ i = 1, 2, 3, \ldots\ldots N \end{cases} \tag{10}$$

Apply partial derivatives with respect to w and y and we will get,

$$\begin{cases} \frac{\partial}{\partial w} L(w, y, \propto) = 0 \Rightarrow w = \sum_{i=1}^{N} \propto_i,\ p_i,\ a_i \\ \frac{\partial}{\partial y} L(w, y, \propto) = 0 \Longrightarrow \sum_{i=1}^{N} \propto_i, p_i \end{cases} \tag{11}$$

Adding Eq. (12) into Eq. (11) and removes the variables w and y and we get dual optimization problem

$$\begin{cases} Q(\propto) = \sum_{i=1}^{N} \propto_i - \frac{1}{2} \sum_{i=1}^{N} \sum_{j=1}^{N} \propto_i \propto_j p_i p_j a_i a \underset{j \rightarrow}{} \underset{\propto}{max} \\ \propto_i \geq 0 \ \forall\ i = 1,\ \ldots\ldots..N \text{ and } \sum_{i=1}^{N} \propto_i p_i \end{cases} \tag{12}$$

If input data is not linearly distinguishable, to find min. value,

$$\varnothing(w) = \frac{1}{2}\ w^t.\ w + C \sum_{i=1}^{N} \xi_i \rightarrow \underset{w, y, \xi}{min} \tag{13}$$

ξ *is slack variable* It can be used for classification error and also minimized. C is user defined penalty variable. Final function is as follows;

$$w = \sum_{i=1}^{k} \propto_i p_i a_i \tag{14}$$

It also written as,

$$f(x) = sign\left(\sum_{i=0}^{N} \propto_i p_i (a^t.a_i) + y \right) \tag{15}$$

The Eq. (16) shows the dot product two variables known as training and testing data set. Presents the kernel function to integrate the sample data with proposed mapping function [39]. Final function can be written as,

$$f(x) = sign\left(\sum_{i=0}^{N} \propto_i p_i \varnothing(a^t)\ .\ \varnothing(a_i) + y \right)$$

$$= sign\left(\sum_{i=0}^{N} \propto_i y_i F(a^t a_i) + b \right) \tag{16}$$

The Eq. (17) shows the kernel function $F(a^t a_i)$. Our kernel function for proposed ISVR technique is as follows;

$$F(a^t a_i) = \exp(-\gamma\ \|a^t - a_i\|^2) \tag{17}$$

Above Eq. (17) will be used in proposed classification which has better classification accuracy.

To determine the performance of proposed model of ISVR classifier six parameters are used which is Sensitivity, Specificity, Accuracy, false positive rate, false negative rate and precision. All the parameters are calculated as follows.

$$Sensitivity = \frac{T\_P}{(T\_P + F\_N)} \tag{18}$$

Table 2
Classify the MIT/BIH arrhythmia dataset into training sets.

Beat	Class	Records	Total
N	N	100, 101, 103, 105	400
S	SVP	109, 111, 207, 214	400
V	PVC	118, 124, 212, 231	400
F	VFN	106, 119, 200, 203	400
Q	FPN	209, 222	200
Total			**1800**

$$Specificity = \frac{T\_N}{(T\_N + F\_P)} \tag{19}$$

$$Accuracy = (T\_P + T\_N)/(T\_P + F\_P + T\_N + F\_N) \tag{20}$$

$$FAR = (F\_P)/(F\_P + T\_N) \tag{21}$$

$$FRR = (F\_N)/(T\_P + F\_N) \tag{22}$$

$$Precision = (T\_P)/(T\_P + F\_P) \tag{23}$$

Where, T_P is for the True Positive, T_N is for True Negative, F_N is for False Negative, F_P is for False positive, FAR is for false positive rate and FRR is for false negative rate.

4. IOT platform

In Fig. 2, display the complete system architecture but in this section it presents the functioning of IOT in the framework proposed.

4.1. Hardware used

4.1.1. Data acquisition

The ECG signal is integrated with the circuit and used to amplify and filter ECG signal. CE 8232 is used for data acquisition connected to Arduino of ADC pins with 2.0 V to 3.5 V operational voltage.

4.1.2. Raspberry pi

The small sized raspberry pi is used with high specification in our proposed IOT based model. It has a core processor 32 bit 40 pin Quad with speed of 900 MHz. It has 4 USB port, 1 GB of memory (RAM), Ethernet port, and micro-SD port to store the OS and other files, and 5 V, 2A to run low power consumption.

4.1.3. Arduino uno

microcontroller with 16 MHz clock frequency, 14 I/O pins, USB Port, and power supply. It has 10-bit ADC to digitize the ECG signals and transfer to Raspberry pi with sample rate 860 sps (samples per second). The Inter-Integrated Circuit (I2C) protocol is used for data transfer.

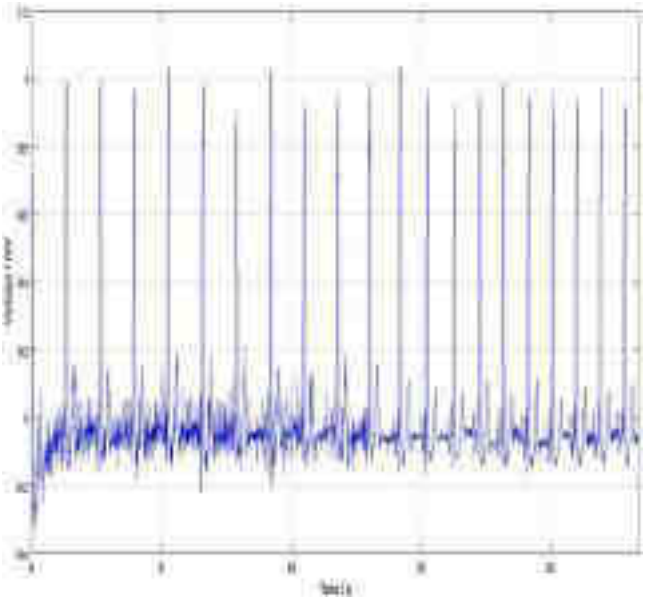

Fig. 4. Supra-ventricular premature ECG sample.

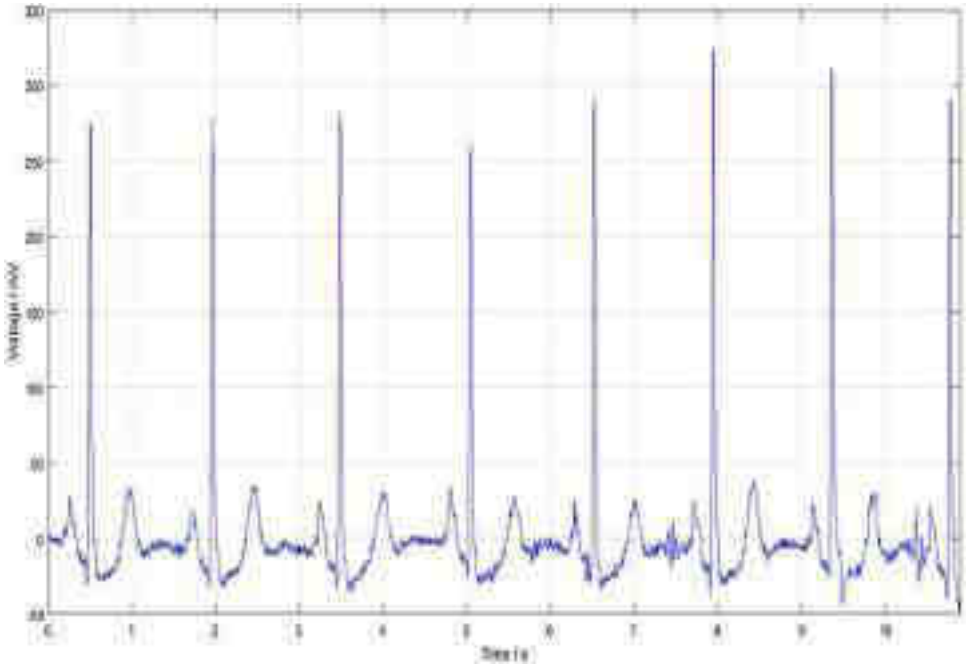

Fig. 3. Normal ECG sample.

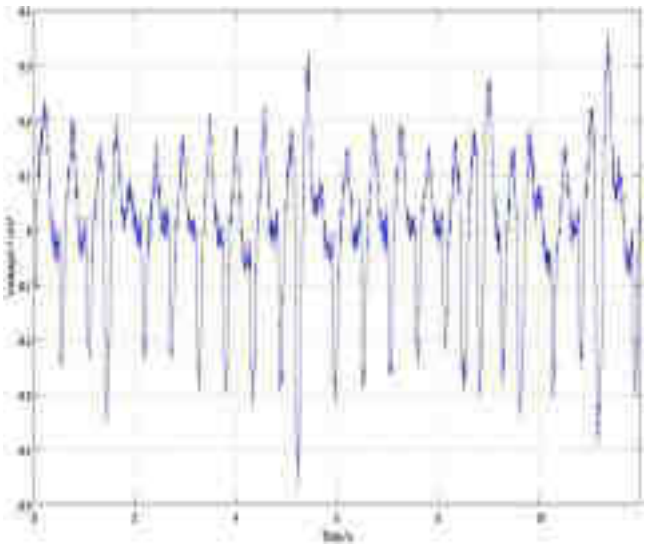

Fig. 5. Premature ventricular contraction ECG Sample.

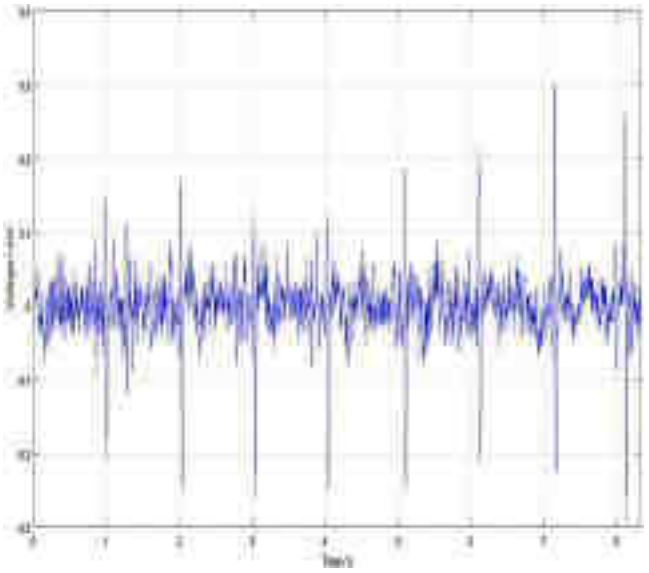

Fig. 6. Fusion of ventricular and normal ECG sample.

4.2. Controller section

In this section, the signals coming from the signal processing section are given to controller section (Arduino Uno). Arduino Uno has been used for converting analog signal to digital signal [33,34]. The data is coming from the sensor and sent to Raspberry from Arduino Uno. For the internet connectivity, Wi-Fi Modem is connected to the Raspberry Pi and data is stored to the cloud as the Raspberry Pi is registered to the cloud [36–38].

4.3. IOT cloud

The ECG signals are the transition of Wi-Fi linked to the Raspberry Pi from Raspberry Pi into the cloud. Data authorization, identity procedure has been ensured in such a way that the most effective authorized character would have access to the data of the person concerned [32]. ECG beats can be plotted for remote hospital doctor to view processing section.

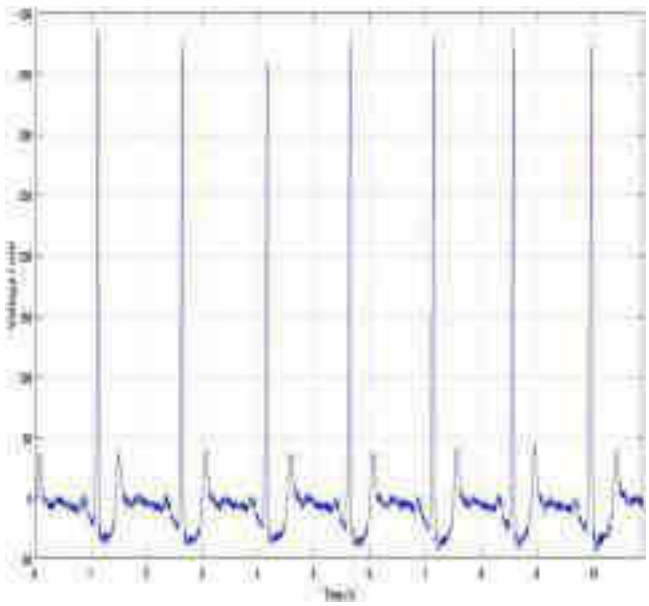

Fig. 7. Fusion of paced and normal ECG sample.

5. Result analysis

The proposed method characterizes the five different classes ECG beat annotations:
N - Normal
S - Supraventricular Ectopic Beats
V - Ventricular Ectopic beats
F - Fusion of ventricular and normal
Q - Fusion of Paced and Normal

In this Experimental analysis, the MIT/BIH arrhythmia dataset is utilized for validate the proposed Method. The database contains comment for both planning data and beat class data checked by free specialists. This dataset to create a five different beats categories in according to the Association for the advancement of Medical Instrumentation (AAMI) [21–41]. The Table 1 represents the summary of mapping beat classification per ANSI/AAMI EC57:1998 standard database. The Complete MIT-BIH arrhythmia dataset has been classified into 1800 samples of training sets as shown in Table 2.

Table 2 shows the record. Each record has unique number and this number shows the specific set of characteristics of ECG [40]. N class for 400 samples is obtained from 100, 101, 103 and 105 records. For APC class, 400 samples are obtained from 109, 111, 207 and 214 records. For VFN class, 400 samples of are obtained from 118, 124, 212 and 231 records. For PVC class, 400 samples are obtained from 106, 119, 200 and 203 records. Finally, for FPN class 200 samples are obtained from 209 and 222 records.

Following the sampling and pre-processing of ECG signals a complete of 1800 samples of ECG beats is needed. It is proposed that each ECG beat be grouped into the five heartbeats accompanying it composes: N S, V F, and Q beats.

5.1. N: normal

From Fig. 3, ECG signals we extract Time and Frequency based features. Those features are classified using ISVR.

5.1.1. S-Beat

Supraventricular untimely beats speak to untimely actuation of the atria from a site other than the sinus hub and can begin from the atria or the atrio ventricular hub (called junctional untimely beats), however by far most are atrial in cause.

Table 3
Performance analysis of ECG beats.

Class	Accuracy	Sensitivity	Specificity	FAR	FRR	Precision
N-Normal	0.984000	0.92	0.988571	0.005747	0.148148	0.92
S-SVP	0.986667	0.88	0.994286	0.008547	0.083333	0.88
V-PVC	0.989333	0.88	0.997143	0.008523	0.043478	0.88
F-VFN	0.986667	0.88	0.994286	0.008547	0.083333	0.88
Q-FPN	0.986667	0.88	0.994286	0.008547	0.083333	0.88

Table 4
Time domain feature.

Class	F1 Mean	F2 Variance	F3 Std. deviation	F4 Skewness	F5 Kurtosis	F6 Inst amplitude	F7 Range	F8 Modulated amplitude	F9 Max freq	F10 RR interval
N-Normal	0.00070	1283.5	35.826	5.0614	33.494	0.0290	777.01	4.17e+08	1189.10	257.87
S-SVP	0.00153	4458.62	66.772	3.4610	18.043	0.0237	624.14	1.45E+09	7635.45	344.37
V-PVC	0.00037	1080.72	32.874	1.7510	10.391	0.0062	354.19	3.51E+08	4162.32	260.62
F-VFN	4.7E-05	4072.35	63.814	4.0384	24.124	0.0059	985.05	1.32E+09	3688.40	270.00
Q-FPN	0.00120	10189.7	100.94	3.9727	22.174	0.2092	1333.90	3.31E+09	11400.3	259.62

Fig. 4 shows the Supra-Ventricular Premature signal to extract the Time and frequency based feature and classify those feature using ISVR.

5.1.2. V-Beat

Premature ventricular complexes/contractions (PVCs; also referred to a premature ventricular beats, premature ventricular depolarization, or ventricular extra systoles) are triggered from the ventricular myocardium in a variety of situations. PVCs are common and occur in a broad spectrum of the population. Premature Ventricular Contraction ECG sample from combined dataset is shown Fig. 5.

Fig. 5 shows the Premature ventricular contraction signal to extract the Time and frequency based feature and classify those feature using ISVR.

5.1.3. F: Fusion of ventricular and normal

A fusion beat occurs at the point when electrical driving forces from various sources follow up on a similar area of the heart simultaneously. In the event that it follows up on the ventricular chambers it is known as a ventricular combination beat, while impacting flows in the atrial chambers produce atrial combination beats.

Fig. 6 shows the Fusion of Ventricular and Normal signal to extract the Time and frequency based feature and classify those feature using ISVR.

5.1.4. Q: fusion of paced and normal

A pacemaker combination beat happens when the natural beat and pacemaker improvement beat somewhat depolarize the ventricles a hybrid QRS complex.

Fig. 7 shows the Fusion of Paced and Normal signal to extract the Time and frequency based feature and classify those feature using ISVR.

5.2. Performance analysis classes

Table 3 shows the comparing performance of ECG beats based on proposed ISVR method. The result shows that specificity, sensitivity, positive prediction and false prediction rate of arrhythmia detection obtained better results by the suggested method. While accuracy measures the overall system performance over the selected classes of beats, the other metrics are specific to each class and they measure the ability of the classification algorithm.

5.3. Time domain feature vector

Table 4 shows estimate the various feature of ECG beats in time domain vector.

5.4. Frequency domain feature vector

Table 5 shows estimate the various feature of ECG beats in frequency domain vector.

In this investigation observed in other useful fields i.e. Incremental SVR based on the Wavelet transform and HOS as compared to various classifiers that deal with feature space of large dimensionality. The Table 6 shows the various classifier accuracies result with the proposed ISVR classifier. The overall accuracies achieved with the proposed ISVR classifier are equal to 98%. This result is better than those achieved by the GSNN, KPCA-SVR and SVM. Comparison of the proposed systems built in this research with similar systems work in literature is a tedious task because each author used different methods of classification, types of arrhythmia, classification of arrhythmia, types of dataset and system performance. Fig. 8 demonstrates the comparative study of the method proposed with other classifier techniques. All the techniques for the classification were working well. The best performance of accuracy in classification is calculated using an ISVR method [35,42].

6. Discussion

A few investigations have tended to this issue by presenting various strategies. Berdakh Abibullaev et al. (2010) has recognized an approach for detection and classification of cardiac arrhythmias based on SVM but this research work has indicated less accuracy as compare to our proposed scheme with regards to the classification of cardiovascular arrhythmias except if they are constrained in light of the utilization of SVM. Miquel Alfaras et al. (2019) propose a technique for fast ECG arrhythmia classification based on machine learning from MIT-BIH database used for classification but has not applicable to real-time application. Yakup Kutlu et al. (2012) describes feature extraction based on the HOS and wavelet transforms techniques. The performance accuracy is measured based on the sensitivity, specificity and selectivity of 90%, 92% and 98% respectively. But the outcomes show up extremely constrained contrasted with the professional requirements for arrhythmia recognition. This Stage our work doesn't have impediments in examined information presented a statistical features and the created symptomatic methodology has a few favorable circumstances in contrast with past works.

The feature extraction mechanism is proposed to extract the effective features for ECG recognition and to implement for continuous patient monitoring on the IOT-based platform. The ECG data is sampled from the MIT-BIH arrhythmia dataset and the data is pre-processed with cut-off frequency using high pass filter. The various features for classifying ECG beats have been proposed in the literature. The classification

Table 5
Frequency domain feature.

Class	F11 Wavelet Mean	F12 Wavelet Variance	F13 Std. deviation	F14 Wavelet Skew	F15 Wavelet Kurtosis	F16 Inst amplitude	F17 Wave Range	F18 Modulated amplitude	F19 Max freq	F20 Wavelet Energy
N-Normal	0.1800	7924.70	89.020	0.9939	15.320	1.03e-06	1063.9	1.63e+08	330.71	3.7e+09
S-SVP	0.0015	4458.62	66.77295	3.4610	18.04385	0.02379	624.1	1.45E+09	7635.45	344.375
V-PVC	0.4413	5004.94	70.745	0.2638	12.098	2.18E-08	781.6	1.01E+08	329.30	2.2E+09
F-VFN	0.2552	11438.50	106.95	0.4824	17.456	3.83E-07	1404.4	2.34E+08	621.01	5.5E+09
Q-FPN	0.1998	41872.10	204.62	0.2503	16.141	5.42E-08	2360.8	8.41E+08	1860.10	2.2E+10

Table 6
Accuracy of different classifier.

Class	ISVR	SVM	GSNN	KPCA-SVR
N-Normal	98.4000	95.4167	98.2200	97.4000
S-SVP	98.6667	94.1667	96.3300	96.1300
V-PVC	98.9333	94.5833	98.2100	97.9300
F-VFN	98.6667	94.5833	97.2400	97.9600
Q-FPN	98.6667	94.5833	98.2300	93.9300

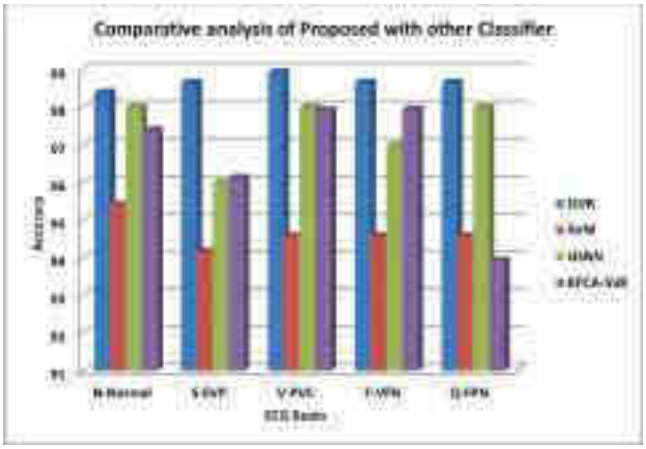

Fig. 8. Graphical representation of proposed ISVR classifier with other classifier.

performance of ECG beats depends on the extraction of features, the reduction of features and the algorithm for classification. As the results obtained clearly indicate, ECG beats classification technique based on Incremental SVR feature extraction to improve accuracy, sensitivity, specificity and precision. This improvement may be caused by good Incremental SVR classifier performance.

7. Conclusion

In this paper the Incremental support vector regression based on wavelet and HOS can be effectively applied and to achieve a reasonable degree of accuracy for the detection of cardiac arrhythmia. An efficient Incremental Support Vector Regression based ECG classification system is proposed to carry out automatic ECG arrhythmia detection by classify the patient's ECG into corresponding five kinds of cardiac arrhythmia condition such as Normal, Supraventricular Ectopic, Ventricular Ectopic, Fusion of ventricular and normal and Fusion of Paced and Normal beats and implement it on an IOT based embedded platform. For pre-processing the ECG signal, the high pass filter with the cut-off frequency 0.5 to 0.6 Hz is used and the noise interference is reduced. The proposed model uses the cardiac arrhythmia dataset MIT-BIT for the classification of the ECG signals. ISVR classifier efficiency is calculated by their accuracy, sensitivity, specificity, False Positive Rate, False Negative Rate and Precision. We also estimate some statistical feature in time and frequency domain. The findings show that the proposed algorithm is successful in predicting cardiac arrhythmias, with a 98% that is higher than other approaches. The basic idea of the proposed framework is to give patients better and better welfare administrations by executing cloud system data with the goal that the specialists use this information and provide a quick and productive solution.

Financial and ethical disclosures

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Credit author statement

This research paper is written, implemented, designed software and hardware etc are done by all three authors equally. we are all three responsible for this paper.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at https://doi.org/10.1016/j.bspc.2020.102324.

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Monogenic Wavelet Phase Encoded Descriptors for Brain Tumor Image Detection

Deepak O. Patil
Department of Instrumentation
SGGS Institute of Engineering and Technology
Nanded, Maharashtra, India
dopatil25@gmail.com

Satish T Hamde
Department of Instrumentation
SGGS Institute of Engineering and Technology
Nanded, Maharashtra, India
sthamde@sggs.ac.in

Abstract— **Brain tumor has a low survival rate and also affect a patient's social life. Early detection and further treatment of the abnormal growth of mass is a significant step during treatment to restrict the progression. MR image screening by the medical expert is a time-consuming and tedious task. This paper presents the development of computer-aided tool to detect brain tumor images. The proposed algorithm employs monogenic wavelet phase-encoded features for tumor detection. Phase component of the monogenic wavelet efficiently extracts the structural information from the input magnetic resonance images. The dimensionality of CLBP textural descriptors extracted from the phase component is further reduced using neighborhood component analysis feature selection. Finally, the support vector machine classifies the test magnetic resonance image as healthy or abnormal. The proposed approach is evaluated using two popular MR imaging databases and simulation results show enhanced performance compared to other existing algorithms.**

Keywords—– ***Brain tumor detection Monogenic wavelet phase encoding Neighborhood component analysis***, ***CLBP features.***

I. INTRODUCTION

Different medical imaging plays a significant role to detect and classify brain tumors. Magnetic resonance imaging (MRI) is a popular choice by the medical practitioners for identifying brain abnormalities. Although, other types of modalities are also available and used for a diagnosis like computer tomography (CT) and positron emission tomography (PET) imaging. Brain diagnosis problems are primarily addressed using the MR imaging type. Recent studies are focused on application image processing algorithms for automatic detection and classification of brain tumors in different categories like benign and malignant.

In India, 5 to 10 individuals out of 100,000 are suffering from CNS brain tumors and about 40% caners spread to the brain [1]. Brain tumor has a low survival rate and affects seriously on patients social and professional life. The Brain tumor is abnormal growth which creates a mass in the brain portion. Early detection of abnormal growth of a tissue mass is critical for the diagnosis and patient treatment. Manual analysis of magnetic resonance images is laborious and subjective. So, MR imaging-based computer based automatic detection and classification algorithms for tumor detection has been proposed [2].

In this paper, a monogenic wavelet phase-encoded texture descriptor-based technique for brain tumor image detection is proposed. The algorithm classifies an input magnetic resonance image as normal or cancerous. In the first step, the input MR image is pre-processed to remove the noise and further enhanced by applying filtering techniques before monogenic wavelet signal analysis. During the second step, filtered and enhanced image is applied to monogenic wavelet signal analysis and phase component is extracted. The third step involves the extraction of Completed local binary pattern (CLBP) texture descriptors from all the sub-bands of the monogenic wavelet phase component.

In the fourth step, neighbourhood component analysis (NCA) feature selection is employed to choose the most relevant and to discard redundant features thereby reducing the feature vector dimensionality. NCA is a filter technique to select the most powerful features from a large pool of input features. Finally, a healthy or abnormal MR image decision is done using the support vector machine (SVM) classifier. The algorithm is validated using two most widely used and publicly available databases: (a) e-health laboratory dataset and (b) Harvard medical laboratory dataset. The proposed algorithm evaluation is presented in terms of sensitivity, specificity, precision, accuracy, and F1-score.

The paper is organized as follows. Recent brain tumor detection in MR images techniques are briefed in section II. The proposed brain tumor detection method using monogenic wavelet phase encoding is presented in section III. Section IV explains monogenic wavelet analysis, CLBP descriptor and NCA feature selection approach in brief. Experimental results are presented in section V. Finally, section VI concludes the article.

II. PRIOR WORK

A variety of approaches are developed for abnormal brain tumor image detection by researchers in the last two decades. Multiresolution analysis methods using discrete wavelet transform (DWT), shearlet and curvelet transform for capturing abnormal signatures from the MR images are proposed in [3]. Particle swarm optimization (PSO) based feature selection approach is employed and the optimal feature set is classified by SVM classifier attaining 97.38% classification rate. The input image is first filtered using Weiner filter and local binary pattern (LBP), and Gabor wavelet transform (GWT) features are extracted in [4].

A generative progressive growing GAN along with the convolutional neural network (CNN) is combined for brain tumor image detection in [5]. Enhanced performance is obtained with data augmentation technique resulting in 91.08% detection accuracy using the deep learning framework. Geometrical and shape features like local ternary (LT) and quinary patterns (LQ) are extracted for brain tumor detection in [6]. SVM and k-nearest neighbor (KNN) classifiers achieved 97.5% detection accuracy using parabola descriptors. Distinct regions are obtained from the magnetic resonance images by utilizing k-means clustering technique and textural features are extracted in [7]. Finally, the artificial neural network (ANN) based classification

achieved 94.07% accuracy. Post-processing enhancement strategy is employed in the work to enhance the accuracy rate.

After segmenting the enhanced image by implementing binomial mean and other statistical parameters, geometric and textural descriptors are extracted from the input MR images for tumor detection is developed in [8]. The Genetic Algorithm (GA) based feature selection algorithm is used to select the discriminating features and fed to SVM classifier resulting in 90% classification rate. In [9], the input MR image is first decomposed using DWT and only high-energy sub-band is selected. High variance descriptors are then extracted from this sub-band and fed to ANN for the classification producing the detection rate of 99.7%.

Abnormal tissue detection and analysis algorithm using partial differential diffusion-filter (PDDF) and a combination of LBP and CLBP are illustrated in [10]. The proposed algorithm distinguishes tumor and healthy MR images with 96.6% accuracy. Input MR images are divided into various slices first, then Adaptive Convex-Region Contour (ACRC) algorithm and SVM classifier are employed for normal or abnormal brain image in [11]. 2D image slices are reconstructed into 3D form for better visualization in the work. The difficulty of low detection accuracy because of low contrast and non-illumination MR images is addressed in [12]. In the proposed method, input MR images are first enhanced and LBP features are extracted and fed to the IDSS classifier. The algorithm also compares different classifiers including k-NN, ANFIS, SVM, and ANN.

To segment and detect brain tumors from magnetic resonance images a deep learning algorithm is proposed in [13]. The method first pre-processes input images and a hybrid convolutional neural network (CNN) is employed. The algorithm effectively detects test images as healthy or containing tumor. GLCM and DWT features are extracted from the input image and classification of the tumor is done using CNN in [14]. A combination of the ANN and the c-means clustering model is developed for brain tumor detection [15]. GLRLM features are extracted after clustering operation for the classification task.

III. Proposed Approach for Brain Tumor Detection Using Monogenic Wavelet Phase-Encoded Features

Phase encoded discrimination details in the form of textural features are extracted after monogenic wavelet decomposition for the detection of tumor image. The detailed architecture of the proposed approach is shown in Fig. 1. Magnetic resonance images are first filtered to remove the noise and further enhanced in the pre-processing stage. Phase component of the enhanced MR image is acquired after the monogenic wavelet decomposition. All the phase components are employed for the feature extraction process. CLBP is a popular texture descriptor used in a variety of image processing applications. From each of the phase sub-band, CLBP features are extracted representing abnormalities and variations present in the abnormal tumor image.

To reduce the feature vector dimensionality and to choose the most relevant CLBP descriptors from a pool of large feature set, neighborhood component analysis based feature selection is employed in this work. The optimal feature set generated by NCA is then fed to support vector machine classifier. The SVM output is a binary decision assigning the label to the test image as healthy or abnormal containing the tumor. The proposed algorithm is validated using two widely used MR image databases: e-health laboratory and Harvard medical-laboratory.

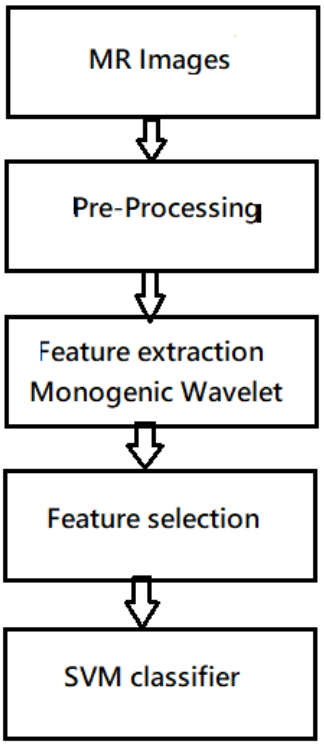

Fig. 1. Monogenic wavelet phase-encoded features based brain tumor image detection architecture.

IV. Feature Extraction and Selection

A. *Pre-processing*

MR imaging pre-processing is an influential task to minimize image degradation and in turn to enhance the classification accuracy. In this step, the input image is first resized into 256 × 256 spatial resolution. Resized samples are then converted into grayscale images before the feature extraction process. To remove the noise present in the image, the median filtering is applied. Finally, the filtered image contrast is enhanced using Contrast limited adaptive-histogram equalization (CLAHE).

B. *Monogenic wavelet based phase encoding*

Monogenic signal image analysis is based on the analytic signal concept and it generates rotation-invariant amplitude, phase, and orientation components [16]. A two-dimensional image is convolved with a quadrature filter creating the local phase, orientation, and energy components [17]. 2-D Riesz transform is defined as,

$$f_R(i) = \begin{Bmatrix} f_x(i) \\ f_y(i) \end{Bmatrix} = \begin{Bmatrix} k_x * f(i) \\ k_y * f(i) \end{Bmatrix} \quad (1)$$

Where $f(i)$ is the input signal and $i = (x, y)$, filter responses in 2 dimensions are represented as k_x and k_y.

Monogenic signal of an image *f(i)* is obtained from the Riesz transform as,

$$f_m(i) = f(i), f_x(i), f_y(i) \quad (2)$$

f(i) is the real component of the monogenic signal, and $f_x(i)$ and $f_y(i)$ are imagery parts. The input MR image can be decomposed into three components: (1) local phase (2) local amplitude and (3) local orientation, using these real and imaginary parts of the monogenic signal. Various monogenic components are computed as,

(1) Local amplitude $A_L = \sqrt{f + f_x^2 + f_y^2}$

(2) Local phase $\emptyset = -sign(f_x)atan2(\sqrt{f_x^2 + f_y^2}/f$

(3) Local orientation $\theta = \text{atan}\left(\frac{f_y}{f_x}\right)$

In the above equation, A_L represents the local energy contents, $\emptyset$ shows structural details and geometric information is contained in θ.

C. *Completed LBP descriptors*

In the next stage, CLBP textural features are extracted from all the phase components of the monogenic signal. CLBP is a powerful texture descriptor generated by combining sign, magnitude, and average components locally and used in a variety of image and signal processing applications [18]-[19]. The computation of sign and magnitude component contributes to additional local textural information as compared to the original LBP. The final coded CLBP histogram includes all three components. A detailed description of CLBP computation is described in [20].

D. Neighborhood component Analysis feature selection:

Feature selection is a principal step in machine learning algorithms to choose relevant features and to remove non-discriminating features. Feature selection approaches are divided into three types: (a) filter methods (b) wrapper methods and (c) hybrid methods [21]. The neighborhood component analysis (NCA) algorithm belongs to the filter method.

NCA is a feature weighting strategy for optimal feature subset selection. It uses objective function maximization criteria by evaluating overage classification accuracy over the training samples. Nearest neighbor classifier optimization generates the final weighting vector from the training data. The final weighting vector corresponding to the feature set is produced without any parametric assumption of the data under consideration and useful in multi-class problems. The objective function in NCA is defined as [22],

$$F = \sum_{i=1}^{m} O_i - \gamma \sum_{j=1}^{r} w_j^2 \quad (3)$$

Where γ is the regularization parameter, O_i is the probability of correct classification of *ith* sample, w_j is the weight vector. As the NCA assigns weight to each of the training samples, threshold *T* is set during the experiment to select the most relevant features.

V. EXPERIMENTAL RESULTS AND DISCUSSIONS

This section presents the simulation results and discussion. Experimental settings and dataset used are described first and later classification results with and without feature selection approach are presented. 50 healthy and 64 images with tumors are selected from the e-Health laboratory dataset [23] and Harvard medical laboratory [24]. Sample healthy and tumor images are shown in Fig. 2.

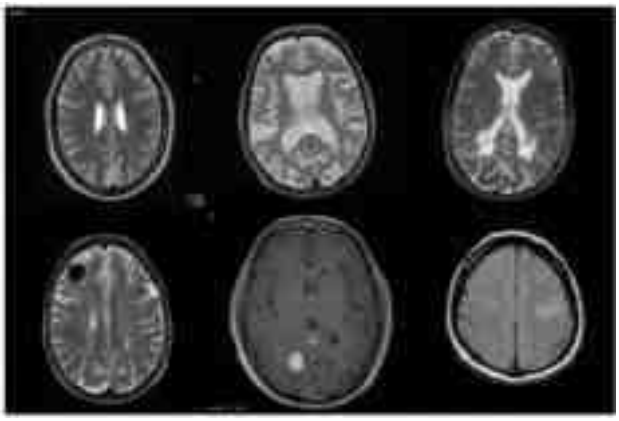

Fig. 2 Sample images from the database containing healthy and tumor samples.

As discussed in section III, selected MR images are pre-processed first. In the median filtering, neighborhood size is set to 3 × 3. Clip limit is selected as 0.001 while implementing the CLAHE algorithm. A lower clip limit is desirable to achieve better enhancement. Monogenic wavelets can be implemented using a variety of filters. In this work, the *log-Gabor* filter type is employed with a 0.55 shape parameter. Fig. 3 depicts even and odd parts of the frequency domain filters.

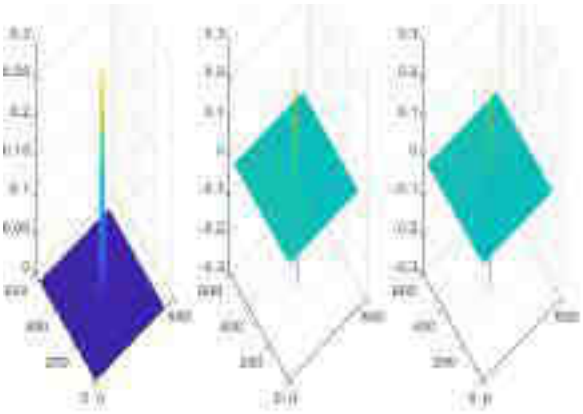

Fig. 3 Even and odd parts of the frequency domain filter.

The neighborhood component analysis approach is a weighting algorithm that assigns weight to an individual feature from the training data. Hence, a threshold-based approach is essential to extract relevant features. In this study, threshold *T* is selected experimentally. The support vector machine classifier is implemented using the Lib-SVM package [25]. Radial basis function (RBF) is used as a kernel function in SVM. Best values of cost parameter (C) and gamma ɤ are obtained using 5-fold cross-validation.

The first experiment involves individual phase-encoded feature evaluation using different sub-bands. Table I shows

sensitivity, specificity, precision, F1-score, and accuracy obtained using SVM classifier with and without NCA feature selection. RBF kernel function is used during SVM implementation. The first and third phase-encoded descriptors contribute higher as compared to the second descriptor. It is important to note that, in the first and second component the accuracy remained the same even after NCA feature selection. However, in the first case the feature vector dimension was reduced from 118 to 30 and in the second case to 72. So, NCA is a powerful feature selection algorithm that reduces the dimensionality of the feature set.

TABLE I
DIFFERENT PARAMETER EVALUATION USING INDIVIDUAL PHASE-ENCODED COMPONENT WITH AND WITHOUT FEATURE SELECTION.

Features	NCA	Sensitivity	Specificity	Precision	F1	Accuracy
Monogenic wavelet phase component 1	Yes	100	86.67	86.67	0.9267	93.33
	No	100	86.67	86.67	0.9267	93.33
Monogenic wavelet phase component 2	Yes	69.23	93.33	90	0.7826	92.82
	No	69.23	93.33	90	0.7826	92.82
Monogenic wavelet phase component 3	Yes	92.31	93.33	92.31	0.9231	92.82
	No	92.31	100	100	0.96	96.75

The second experiment involves the fusion of all the three phase components and evaluation of the parameters. Table II depicts various performance evaluation parameters obtained using RBF-SVM with and without feature selection technique. As it can be seen from table II that the highest accuracy is attained by applying neighbourhood component analysis feature selection. After NCA, the final feature vector length recorded was 54. Hence, the phase component of the monogenic wavelet efficiently extracts the structural information from the input magnetic resonance images useful for the classification task. It is interesting to note here that, this experiment uses only monogenic phase-encoded features without the inclusion of energy and orientation components.

TABLE II
DIFFERENT PARAMETER EVALUATION USING THE FUSION OF PHASE-ENCODED COMPONENTS WITH AND WITHOUT FEATURE SELECTION.

	NCA	Sensitivity	Specificity	Precision	F1	Accuracy
Fusion of monogenic wavelet phase component	Yes	100	100	100	1	100
	No	92.86	100	100	0.963	96.43

As discussed in section IV, the neighborhood component analysis approach is employed for feature selection. NCA is a feature weighting technique that assigns weight to an individual feature from the training data. The weighted features are ranked according to the individual weight in this study. Different threshold *T* is set and the accuracy rate is computed. Figure 4 illustrates different NCA thresholds $T_1 T_2 \ldots T_6$ and its corresponding classification accuracy. It is evident from figure 4 that the classification rate is significantly enhanced after the threshold value *T5*.

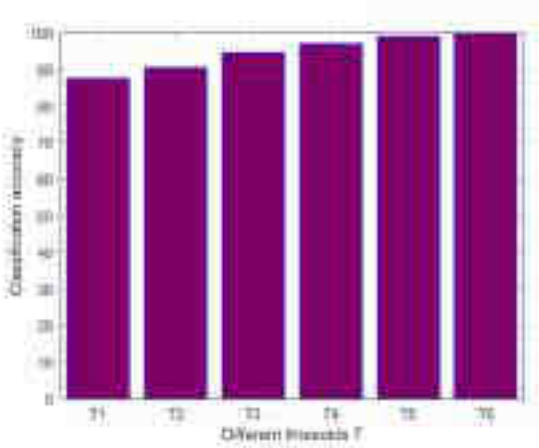

Fig. 4 Effect of feature selection using different threshold values on the classification accuracy.

The proposed monogenic wavelet phase-encoded MR brain tumor image detection algorithm is compared to other existing algorithms. Table III shows the comparison of various algorithms with the proposed monogenic wavelet phased encoding approach. It is clear from table III that, phase components accurately extracts abnormality details from the input image useful for the classification task. It is also interesting to note that transform domain feature extraction techniques perform better as compared to spatial domain features.

TABLE III
COMPARISON OF THE PROPOSED APPROACH WITH OTHER EXISTING ALGORITHMS.

Method	Features	Classifier	Accuracy (%)
[3]	Textural features from wavelet, curvelet and shearlet transform	PSO-SVM	97.38
[4]	LBP and Gabor wavelet function	KNN	98
[6]	Local Ternary Pattern (LTPs) and Local Quinary Patterns (LQPs)	SVM & KNN	97.5
[7]	k-means clustering	ANN	94.07
[8]	Geometric and four texture features	SVM	99.99
[9]	Energy and variance features from DWT sub-bands	ANN	99.7
Proposed	Monogenic wavelet phased encoded features	SVM	100

VI. CONCLUSION

The efficient extraction of structural information by the monogenic wavelet phase components is presented for brain tumor image detection. The proposed algorithm detects input test MR image as healthy or containing tumor with high accuracy evaluated using two popular magnetic resonance imaging datasets. Additionally, neighborhood component analysis reduces the feature vector

dimensionality with affecting the classification rate considerably. The method performs better as compared to other similar brain tumor detection algorithms. Future analysis includes effect of the monogenic wavelet energy and orientation components on the detection rate.

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Brain Tumor segmentation with Anti-Aliasing Impact filtration using Modified Finite Impulse Response Linear filter

Smita Kakade
Research Scholar
Computer Department
JJTU, Jhunjhunu
Rajasthan 333001

Dr.Vinod M. Vaze,
Rtd. MCA Coordinator., MU
Professor Computer Sc.
JJTU, Jhunjhunu
Rajasthan 333001

Dr.Pankaj Agarkar
D.Y.Patil COE
Lohagaon
Pune 411032
Maharashtra

Deepali Hirolikar
Research Scholar
Computer Department
JJTU, Jhunjhunu
Rajasthan 333001

Abstract:

The field of medical imaging advances so rapidly that all of those working in it, scientists, engineers, physicians, educators and others, need to frequently update their knowledge in order to stay abreast of developments. While computer engineering play a crucial role in this, more extensive, integrative research of image processing that connect fundamental principles and advances in algorithms and techniques to practical applications are essential.We focused on development of new medical imaging techniques which can serve the medical society.

Treatment protocols for malignant tumors generally call for surgical removal followed by tumor-bed irradiation. Irradiation ideally affects the tumor volume while limiting damage to surrounding normal tissues, this required accurate determination of 3-D treatment volumes.

Accurate tumor segmentation provides doctors with a basis for surgical planning. Moreover, brain tumor segmentation need to extract different tumor tissues from normal tissues which is a big challenge because tumor structures vary considerably across patients in terms of size, extension, and localization.

We need methodology to reconstruct image to refine boundary of objects present image. Proposed methodology shows clearvisibility of tumor growth along with anti-aliasing element which eliminates blood, plasma, fluid impurities and focuses over brain tumor affected area and assists the surgeon during actual surgery.

1. Background:

We will consider a base as a super sampling anti-aliasing (SSAA), also called full-scene anti-aliasing (FSAA), is used to avoid aliasing on full-screen images. Due to its tremendous computational cost and the advent of multi-sample anti-aliasing (MSAA) support on GPUs, it is no longer widely used in real time applications. MSAA provides somewhat lower graphic quality, but also tremendous savings in computational power.

The resulting image of SSAA may seem softer, and should also appear more realistic. However, while useful for photo-like images, a simple anti-aliasing approach may actually worsen the appearance of some types of line art or diagrams, especially where most lines are horizontal or vertical. In these cases, a prior grid-fitting step may be useful.

In general, super-sampling is a technique of collecting data points at a greater resolution (usually by a power of two) than the final data resolution. These data points are then combined (down-sampled) to the desired resolution, often just by a simple average. The combined

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data points have less visible aliasing artefacts.

Automated classification is encouraged by the need for high accuracy in dealing with a human life. Detection of brain tumor is a challenging problem due to the high diversity in tumor appearance and ambiguous tumor boundaries. MRI images are chosen for the detection of brain tumors as they are used in the determination of soft tissues.

The most precious field in digital image processing is diagnosing the internal activities of human body. Brain is one of the critical part in human body. In the current era cancer is a challenging in medical field. Identification of tumor in brain is very difficult. Segmentation is a kind of method in digital image processing used to divide the image into number of parts with specific regions.

Researches on classification for brain tumor from MRI image had been done extensively, yet there is still room for improvement. Anti-aliasing methods mentioned above will not work for medical imaging used for surgery. At first need to select features for pixel sampling. Many approaches had been focused on image segmentation and classification algorithm, yet little number of researches done on feature selection. Domain knowledge of medical science can be gained from medical practitioners to define characteristics of tissue of tumor and normal tissues. Images can be taken which don't have copyright.

In medical field, image fusion is a significant role analyzed the brain tumor which can able to get exact location and boundary of cancerous or noncancerous region. It is the method in which many images are integrated to a similar view into single fused image. This image is to decrease the uncertain and minimize the redundancy while extracting all the useful information through the input source images. The image fusion system is the combination of multi-images with relative data into single image. This method can be used to notice the brain tumor by combining T1 and T2 MRI slice images. Tumor segmentation is done using the level set segmentation method. Then the feature extraction is done with the complete local binary pattern approach and pyramid HOG approach. ART classifier can also used to classify the brain tumor to malignant or benign. Accurate and reliable brain tumor segmentation is a critical component in cancer diagnosis, treatment planning, and treatment outcome evaluation.

A variety of approaches exist for brain extraction from 3D medical images, but they are frequently only designed to perform brain extraction from images without strong pathologies. Extracting the brain from images exhibiting strong pathologies, for example, the presence of a brain tumor or of a traumatic brain injury (TBI) is challenging. In such cases, tissue appearance may substantially deviate from normal tissue appearance and hence violates algorithmic assumptions for standard approaches to brain extraction consequently

2. Motivation:

Computer processing and analysis of medical images covers a broad number of potential topic areas, including image acquisition,image formation/reconstruction, image enhancement, image compression and storage, image analysis, and image-based visualization. Furthermore, we need the research efforts related to these methodologies are the key elements of solutions to more systems-oriented problems. Such problems include image-guided surgery/intervention, atlas-based description of entire anatomical regions, deformation analysis based on biomechanical and other models, and

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visualization of anatomical and physiological processes.

Objectives of this research work are to image enhancement and segmentation for cancerous and normal medical image data, anti-aliasing framework will be designed and implemented.

3.Methodology:

Segmentation task is different from classification task because it requires predicting a class for each pixel of the input image, instead of only one class for the whole input. Fully Convolutional Networks (FCNs) owe their name to their architecture, which is built only from locally connected layers, such as convolution, pooling and up sampling. Note that no dense layer is used in this kind of architecture. This reduces the number of parameters and computation time.

The size of the images varies. We use data augmentation for training, as specified in the default arguments in the code given below. The data augmentation is necessary for training with batch size greater in order to have same image size with a random cropping. For validation and test sets with exact results, full dataset training is required for performance evaluation which takes many days to run and overshoots memory problems.

The proposed research intended for classification of different levels of tumor as T1, T2, T1ce and Fluid Attenuated Inversion Recovery (FLAIR). At the time of MRI accumulation, even though may differ by system to system, about 150 slices of 2D images are actually generated to symbolize the 3D brain volume level. The moment when the slices of the needed typical techniques are put together for analysis of the data becomes somewhat complex. T1 images are actually utilized for differentiating healthier cells, while T2 images are actually utilized to represent the edema area which in turn generates idealistic indication around the image. In T1ce graphics, the tumor boundary can simply be recognized through white-colour signal from the accrued distinction element inside the effective cell area of the tumor cells. As necrotic microscopic cells usually do not have interaction with the entire comparison agent, these may be noticed by extreme component of the tumor foremost developing it feasible to conveniently segment all of them by the productive cell areas within the comparable pattern. In FLAIR images, indication of water compounds are covered up which usually assists in differentiating edema area through the Cerebrospinal Fluid (CSF).

The proposed research methodology is a simulation development. Convolution Neural Networks (CNN) is amongst the alternatives of neural systems utilized intensely in the discipline of Computer system Vision. It was introduced their identity by the variation of obscured layers that is composed of the obscured layers of the CNN ordinarily comprise of convolution and pooling layers. Right here it basically suggests that rather of applying the typical initialization features described earlier, convolution and as well, pooling features are actually employed as acceleration operates.

Convolution works upon pair of images in case of 2D image where 1 considered as the “input” graphic and so the rest as a “filters” for the input image, generating a result graphic so convolution requires pair of images as input and so delivers a final as end result. Pooling is usually a group centred discretization procedure. The goal is always to reducing-group an input manifestation minimizing its proportions and enabling for presumptions to become relating to features comprised within the sub-areas. Therefore since one can easily observe Convolution Neural Networking i.e. CNN is fundamentally a deep neural networking which generally is composed of covered

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layers keeping convolution and so pooling capabilities in companion to theinitial function for producing nonlinear output.

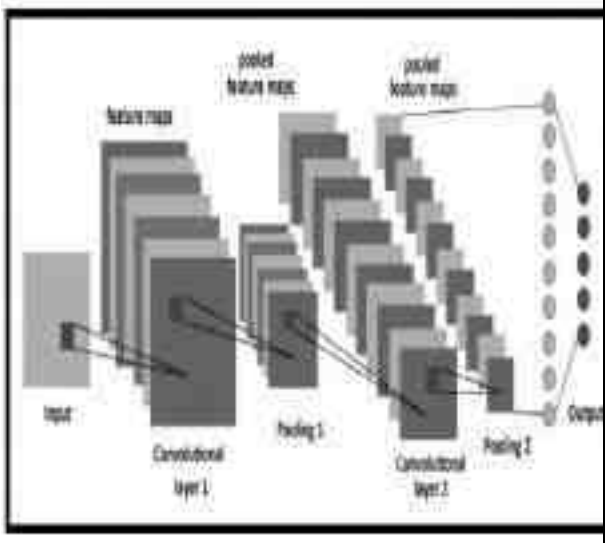
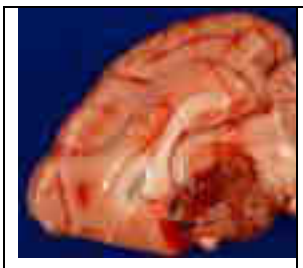


Figure 1–Block diagram of deep learning layers

4 Proposed Methodology

We shared our experimental results with team of ten medical professionals to validate present research, two radiologists, five surgeons and three anaesthetists studied and validated the usability of present research. Most of these team members have been in specialty practice and carried out processes at the hospital in Maharashtra State region in India.

Original Image	Output Image
	
(Source: Nature Medicine,2012)	



(Source: Online)

(Source: www.article.wn.com,2016)

Figure -2: Brain tumor surgical Image testing with DTR Adapter Module

The team tested real-time images and processed it with DTR with our assistance. The results are positive and can be recommended for medical imaging during surgical image captures. As of now, the output shows clear visibility of tumor growth, and surgeons can remove the tumor but, it is important to make sure that tumor is removed perfectly.

Considering that the studies are produced in a very organized structure, we used images captured during neuroendoscopy. The anti-aliasing element eliminates blood, plasma, fluid impurities and focuses over brain tumor affected area and assists the surgeon during actual surgery. Further, this defogged image output can be treated with “tumor routing” algorithm. We also analyzed offline method; the benefit of using defogged MR image instead of original MR image is that defogged image gives accurate positioning of tumor dimensions as shown using graphs in figure above.

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The graphical representation shows the vertical and horizontal position of the tumor. With knowledge of graphical representation, the surgeon can able to visualize live image during surgery. Also in the case of MRI, if further image streaming is developed, the surgeon may check how much tumor is removed, and by using graph location he/she can identify which part of the tumor needs to remove. When both points on each graph overlaps it means tumor removal is successful by tumor routing i.e. the process of step by step tumor removal.

Algorithm 1: Anti-Aliasing

1. Input MRI image which was captured before or after surgery to know the vertical state of tumor growth. We can use MRI image too, but the aim of the present module is to show the overall volume of the skeleton to identify the volumetric impact of the tumor.

2. Compute main pixel window (horizontal plane) for MRI image

3. Compute main pixel window (vertical plane) for MRI image.

4. Store horizontal and vertical window boundary pixels location in array-1 and array-2

5. Calculate high-intensity pixel for vertical count

6. Route through vertical pixels and Join high-intensity points

7. Stores it as a vertical shift tumor boundary location

8. Analyze 3D view for vertical shifting points and mark it.

9. If there are zero vertical shifts for low-intensity pixels, then consider end point of vertical shift.

10.Identify and compare highest intensity pixels in each tumor slice and connect initial pixel and final pixel.

This algorithm is intended for visual analysis for surgeons and can be used for pre and post surgical activities. The Tumor Removal Analyzer algorithm provides a 3D view which provides more clear visibility for tumor shift. Following figure-5 provides step by step analysis for brain tumor.

5. Results:

The proposed work considered an applied mathematics research. Proposed application oriented mathematical modelling flow is shown in figure below. Mathematical model is used to interact with each image pixel using set rules which can be used for the identification of tumor images pixels. The set rule will work on gray pixels and white pixels.

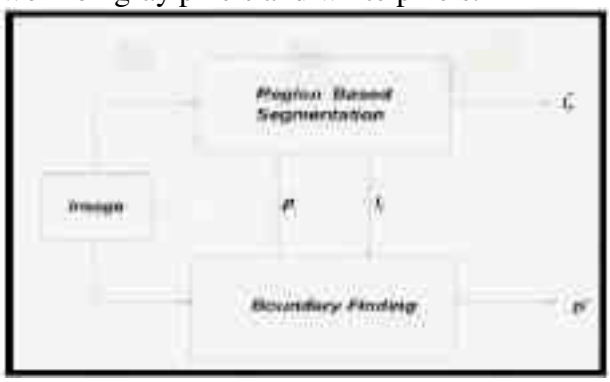

Figure 3- Flow Diagram for game theoretic image segmentation (Source: Online)

We developed modified Finite Impulse Response Linear filters for brain tumorgrey pixel identification. We considered FIR mathematical model as a reference model and this is further developed for MRI image pixel filtering. The game theory model will be applied for strategic pixel count calculation. We considered region growing problem for evaluation of proposed brain tumor image processing application as shown in figure below.

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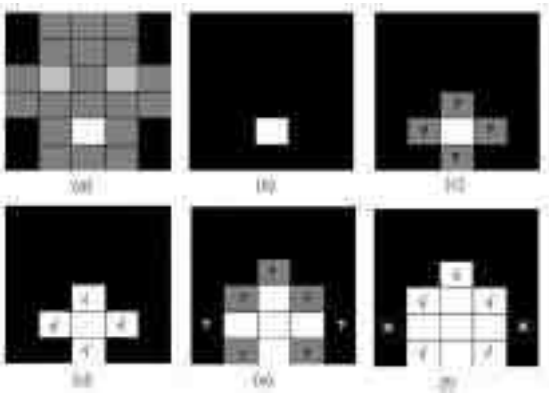

Figure 4- Region of Interest Pixel Clustering

The Modified Finite Impulse Response Linear filter (MFIR) further segregates the tumor tissue pixels and normal brain tissue pixels. In reference model only border of tumor is identified whereas in proposed mathematical model we can separately calculate the healthy tissues and tumor tissues accurately. Thus for MRI brain tumor image input proposed model gives more accuracy than existing model. We used images upload to Hadoop Server which is used as a medical image storage cluster.The mathematical model is converted to python for testing purpose. The following figure 3 shows the successful porting of mathematical model which further converted to algorithm by software professional for testing.

Figure 5 –Hadoop image storage cluster

The proposed game theory strategy for MFIR proved the better in terms of accuracy and feature extractions. For proposed model testing we used BRATS 2018 dataset images for 81 patients.

Table-1: Proposed Mathematical Model Performance Analysis

Model	**Pixel Accuracy**	**Feature Extraction**	**Application level usability**
MFIR (Proposed Model)	97%	Normal brain tissues, Tumor tissue	Yes
FIR	94%	Tumor tissue	Yes

Thus the MFRI and FRI outputs for same image are shown in figure 4.5 below:

(a)MFRI (b)FIR

The MFRI shoes the middle healthy tissues whereas FRI shows the middle bunch of pixels as a whole tumor. So, during surgery, whole part will be considered as a removal area in case of FRI but with MFRI, many tissues can be saved due to clear visibility of infected/tumor tissues.

Conclusion

Machine Learning (ML) and Artificial Intelligence (AI) have progressed rapidly in recent years. Techniques of ML and AI have played important role in medical field like medical image processing, computer-aided diagnosis, image interpretation, image fusion, image registration, image segmentation, ˙ image-guided therapy, image retrieval and analysis Techniques of ML extract information from the images and represents information effectively and efficiently. The ML and AI facilitate and

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assist doctors that they can diagnose and predict accurate and faster the risk of diseases and prevent them in time. These techniques enhance the abilities of doctors and researchers to understand that how to analyse the generic variations which will lead to disease.

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A Stereolithography System for 3D Low Cost Components

Baban K. Suryatal[1,2*], Sunil S. Sarawade[3], Suhas P. Deshmukh[4]

[1] Mechanical Engineering Department, Sinhgad College of Engineering, Vadgaon Bk., Savitribai Phule Pune University, Pune, Maharashtra 411041, India
[2] Mechanical Engineering Department, PDEA's College of Engineering, Manjari Bk., Pune, Maharashtra 412307, India
[3] Mechanical Engineering Department, M.E.S. College of Engineering, Pune, Maharashtra 411001, India
[4] Mechanical Engineering Department, Government Engineering College, Karad, Maharashtra 415124, India

Corresponding Author Email: bksuryatal@gmail.com

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ABSTRACT

The stereolithography (SL) process is one of the rapid prototyping technics and it is also known as additive layered manufacturing method. It is a chipless manufacturing method and the object is built layer by layer. A low cost stereolithography apparatus (SLA) is developed to produce highly precise, three-dimensional (3D) structures from broad selection of functional materials, especially photopolymer resin. The present SL systems available in the market are very expensive. The developed low cost SLA will be affordable to medium scale industries as well as customers. The developed SLA utilizes focused light beam of wavelength range of 300 nm – 700 nm from the DLP projector and passes through the objective lens over the surface of a photo-curable resin, which undergoes photo-polymerization and forms solid structures. The photopolymer used in this experimentation is polyethylene glycol di-acrylate and photo-initiator is Irgacure 784. The experiments are performed on objects with hexagonal cross-section and pyramid geometries and 0.1 mm curing depth along Z – axis. The trials are performed with different exposure and settling period. The 3D objects are successfully fabricated with high build speed and low cost. The pyramid object with maximum 120 numbers of layers with 12 mm dimension along Z-axis is built in 11.0 minutes. It is found that the optimum exposure time to cure a layer is two seconds. The maximum exposure area obtained in X-Y plane is 55 mm x 45 mm. The percentage dimensional error of the build objects is decreased as the curing time is reduced and the error is minimum for the two seconds curing period per layer. The obtained resolution of the build objects in X-Y plane is 23 microns and Z-stage resolution is 0.1 mm.

1. INTRODUCTION

There are a number of processes that can realize three-dimensional (3D) shapes such as those stored in the memory of a computer. An example is the use of holographic techniques [1], but these require many complex calculations to obtain the hologram and there is insufficient accuracy and clarity. A manual or a conventional mechanical process can also make a physical model, but such models require long fabricating times, high cost and excessive labour. To solve these kinds of problems, a new group of techniques called additive manufacturing (AM) technologies have been developed by a number of researchers group [2-5]. AM is a collection of processes in which physical objects are quickly created directly from computer generated models. The basic concept of rapid prototyping is where 3D structures are formed by laminating thin layers according to two-dimensional (2D) slice data, obtained from a 3D model created on a CAD/CAM system [2-5]. Stereolithography (SL) is one of the most popular AM process. It usually involves the curing or solidification of a liquid photosensitive polymer by focusing a light beam or laser beam of specific wavelength on the surface with liquid photopolymeric resin. The focused light beam supplies energy that induces a chemical reaction, bonding large number of small molecules and forming a highly cross-linked polymer [6]. Now a day, rapid prototypes of the different objects are required before their actual manufacturing because one can improve the design at the early stage of product development. The rapid prototyping or 3D printing field is very fast developing and this technology can applicable to all the fields i.e. engineering as well as non-engineering. The objective of this research work is to develop a low cost stereolithography apparatus (SLA) to produce highly precise, three-dimensional (3D) structures from broad selection of functional materials, especially photopolymer resin. The present SL systems available in the market are very expensive. The overall cost of the newly developed SLA is very low as compared to cost of SLA available in the market. The cost of photo-curable resin used is also low as compared to other available resins. Therefore, the developed low cost SLA will be affordable to medium scale industries and customers as the overall build cost of the objects is minimum.

A large number of researcher's groups have developed the SL systems out of which some of them are briefed in the following literature review.

Fujimasa [7] has been described the concepts of microplanes, microrobots, microcars and microsubmarines and MEMS which are systems that combine computers with

tiny mechanical devices such as sensors, valves, gears, mirrors, and actuators embedded in semiconductor chips. Ventura et al. [8] developed a direct photo shaping process for the fabrication of functional ceramic components layer by layer and each layer is photo image or a digital light processing (DLP) projection system. Bertsch et al. [9] developed a micro stereolithography apparatus employing a pattern generator in which a UV laser and dynamic LCD pattern generator were used to generate the cross section of a 3D structure. While the substrate did not move in the x–y direction in the liquid photopolymer, an LCD pattern generation system was necessary and the resulting diffraction had to be considered. Maruo et al. [10] developed two-photon polymerization (TPP) which utilizes focused lasers to precisely polymerize small volumes resin and the volume is only polymerized if it is excited by two different photons within a very short time period. TPP is much slower than SL, but has successfully created components with 100 nm features. TPP is limited to polymers because it requires a clear resin to function; suspended particles would scatter the laser beams. Young et al. [11] have described a novel device for producing 3D objects that has been developed using an LCD as a programmable, dynamic mask and visible light to initiate photopolymerization. Ikuta et al. [12] introduced micro stereolithography technology and proposed a means of applying micro stereolithography in mass-production using an optical fiber array so that multiple microstructures could be fabricated in a single process. Monneret et al. [13] presented a new process of microstereolithography to manufacture freeform solid 3D micro-components with outer dimensions in the millimeter size range. Sun et al. [14] performed Monte Carlo simulations and experimental studies to understand the detailed microscale optical scattering, chemical reaction (polymerization), and their influence on critical fabrication parameters. It was found that due to the scattering, the fabricated line is wider in width and smaller in depth compared with polymeric fabrication at the same condition. The doping technique substantially reduced the light scattering, which in turn enhanced the fabrication precision and control. The experimental values of curing depth and radius agreed reasonably well with the theoretical modeling. Bertsch et al. [15] described new polymer/composite photosensitive resins that can be used in the microstereolithography process for manufacturing complex 3D components. Huang et al. [16] analyzed the shrinkage deformation of the mask type stereolithography process. Lee et al. [17] developed a micro stereolithography apparatus using a UV laser and a complex optical system. Jiang et al. [18] developed a Masked Photopolymerization Rapid Prototyping (MPRP) system using LCD panel as dynamic mask with an upper exposure skill. Dongkeon et al. [19] developed a liquid crystal display (LCD) based micro stereolithography process in order to fabricate microparts with superior mechanical properties (for e.g., micro gears) and investigates the fabrication process of micro bevel gears using photosensitive resins reinforced with ceramic nanoparticles. Deshmukh et al. [20] proposes and develops an offaxis lens scanning technique for MSL and carries out optical analysis to compare its performance with the existing techniques mentioned above. The comparison clearly demonstrates improved performance with the proposed offaxis lens scanning technique. Limaye [21] presented a more sophisticated process planning method to build a part with constraints on dimensions, surface finish and build time and formulated an adaptive slicing algorithm that slices a CAD model so as to obtain the required trade-off between build time and surface finish of up facing surfaces of the part. Hadipoespito et al. [22] developed DMD based UV micro – stereolithography system for fabricating 2D and 3D micro – parts. With the help of characterization experiments it was observed that the developed the DMD based imaging system irradiates an entire photopolymer layer at once, providing reasonable curing speed and good resolution at a low cost. Micro parts were also fabricated in nanocomposites, which were obtained by ultrasonic mixing of the transparent photopolymer and nano-sized ceramic particles. The micro models fabricated by this process could be used for micro scale investment casting, tooling, devices, and medical applications. In this method process optimization is needed to improve the quality of fabricated micro – parts. Singhal et al. [23] has presented a statistical surface roughness model for SLS prototypes as a key to slice the tessellated CAD model adaptively. The adaptive slicing system is implemented as Graphic User Interface in MATLAB-7.

Choi et al. [24] developed a more economical and simpler micro-stereolithography technology using a UV lamp as a light source and optical fiber as the light delivery system and photopolymer solidification experiments were conducted to examine the characteristics of the developed micro-stereolithography apparatus. Zhao et al. [25] developed a thick film mask projection stereolithography to fabricate films on fixed flat substrate and develop a column cure model in which a CAD model of part is discretized into vertical columns instead of being sliced into horizontal layers, and all columns get cured simultaneously till the desired heights. Vatani et al. [26] optimized the exiting slicing algorithms for reducing the size of the files and memory usage of computers to process them. In spite of type and extent of the errors in STL files, the tail-to-head searching method and analysis of the nearest distance between tails and heads techniques were used. As a result STL models sliced rapidly, and fully closed contours produced effectively and errorless. Deshmukh et al. [27] carried out analysis and experimental verification of optomechanical scanning systems for microstereolithography. Choi et al. [28] developed MSL system for tissue engineering using a Digital Micromirror Device (DMD) for dynamic pattern generation and an ultraviolet (UV) lamp filtered at 365 nm for crosslinking the photoreactive polymer solution. Gandhi et al. [29] proposes and analyses a 2D optomechanical-focused laser spot scanning system for microstereolithography which allows uniform intensity focused spot scanning with high speed and high resolution over a large range of scan. Higher speed and high resolution at the same time are achieved by use of two serial double parallelogram flexural mechanisms with mechatronics developed around them. Itoga et al. [30] developed maskless photolithography device by modifying Liquid Crystal Display (LCD) projector optics from magnified to reduced projection. The developed device produces a practical centimeter scale micro-pattern by dividing a large mask pattern and divisionally exposing it synchronized with an auto – XY stage, applying it to cell micro-pattern and microfluidic device production. But they arise problems in jagged pattern boundaries due to the liquid crystal panel structure and collapse pattern of the boundary divided on divisional exposure using the auto – XY stage. Zhou et al. [31] presented a novel AM process based on the mask video projection. For each layer, a set of mask images instead of a single image are planned based on the principle of optimized pixel blending. Experimental results show that the mask video

projection process can significantly improve the accuracy and resolution of built components. The disadvantage of this method is that it will require an additional linear stage with good accuracy and moving speed. In addition, the platform movement during the building process requires the designed hardware to ensure the repeatability between different layers which increases the overall cost of the system. Zabti [32] carried out Pareto based Multi-objective function based optimization of STL process which has three objective functions. The goal is to find the optimum exposure time value by minimizing the cure depth, surface roughness and maximizing the mechanical strength. Lehtinen [33] developed a DMD based projection stereolithography and a computer code is written to control the entire manufacturing process. Gandhi et al. [34] analyze various optical scanning schemes used for MSL systems along with the proposed scheme via optical simulations and experiments. The mechanical design of the scanning mechanism is carried out to meet requirements of high speed and resolution. The system integration and investigation in process parameters is carried out and fabrication of large micro-component with high resolution is demonstrated. Campaigne III [35] developed projection stereolithography and material characterization of nanocomposites photopolymers was carried out. Valentincic et al. [36] conclude that DLP based stereolithography is used to reduce the build time and to increase the manufacturing accuracy. Compared to fused deposition modeling (FDM) machines, machines for DLP stereolithography are expensive and thus not available to a broad range of users as it is the case with FDM 3D printers. Luo et al. [37] developed desktop manufacturing system which can produce RP parts with good machining efficiency, but the surface roughness should be further improved. Ibrahim et al. [38] investigate the influence of process parameters which are layer thickness and exposure time on physical and mechanical properties of DLP structure.

Thus, by going through the aforementioned literature on SL systems, it is observed that most of researchers develop microstereolithography systems. The developed SL systems are either LCD based or DMD based. The disadvantages of LCD based SL systems are low pixel filling ratio, print – through errors occurs due to light that penetrates into already cured layers, unnecessary wavelengths cause inaccurate dimensions in the cured part. The advantages of DMD based SL systems are availability of UV compatibility, high modulation efficiency, high light transmission, high optical fill factor, low pitch size and pixel size. Both the developed SL systems i.e. LCD as well as DMD based mentioned in above literature survey are very expensive, which are not affordable to common or medium sized industries or vendors who can build their prototypes with a cheaper cost. Therefore, development of a low cost SLA with better build speed is a goal of this research work.

The sub-section 2.1 of section 2 describes the developed low cost SLA in detail with specifications of the sub-systems, different softwares, photo-polymer and photo-initiator used in the apparatus. In sub-section 2.2 the absorbance spectrum of photo-curable resin and light beam spectrum of DLP projector are plotted. In sub-section 2.3 the slicing procedure of 3D CAD model into 2D slices is explained with the help of developed MATLAB code. The experimental results and discussions are given in section 3. Finally, the conclusions are drawn from experimental work in section 4.

2. EXPERIMENTAL SET UP

2.1 Stereolithography apparatus (SLA)

The stereolithography apparatus (SLA) is developed to produce highly precise, three-dimensional (3D) structures from broad selection of functional materials, especially photopolymer resin. The lay-out of the experimental set-up is shown in Figure 1 and the CAD model is shown in Figure 2. The developed stereolithography apparatus (SLA) utilizes focused light beam from DLP projector and then through the objective lens over the surface of a photo-curable resin, which undergoes photo-polymerization and forms solid structures. The lamp of the modified DLP projector works as light source and DMD chip in the DLP projector works as a dynamic pattern generator for this SLA. The colour wheel of the DLP projector is filtering most of the UV light out. But UV light is required for solidification of the photopolymer. Therefore, we had done changes in the colour wheel. The color wheel is a glass disc with several colored segments that spins while the projector is running to colorize the image. The projector actually requires it to run; when the color wheel is simply removed, the projector would not turn on the lamp. Therefore, only glass portion of the color wheel is removed so that maximum UV light should come out from the projector which is the requirement for solidification of liquid resin. After removing glass portion from the color wheel, the projector becomes black and white. Infocus make DLP projector with display resolution 1024×768 is used. The photograph of actual experimental set-up is shown in Figure 3.

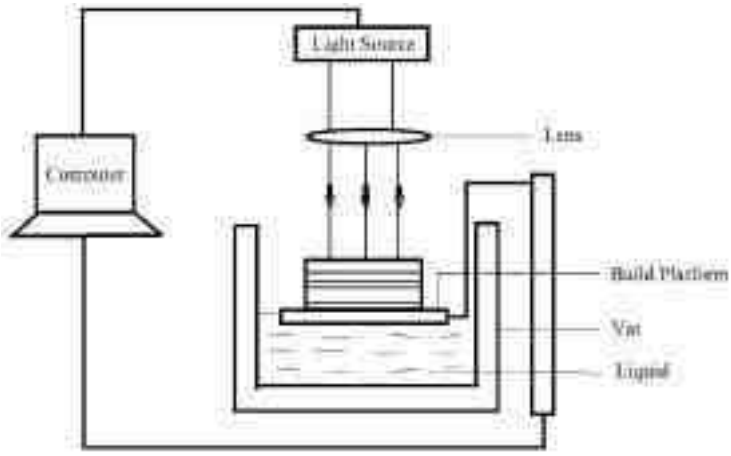


Figure 1. Lay-out of the experimental set –up

1-Frame, 2-Ball Screw, 3-Guide rod, 4-Z stage, 5-Resin Tank, 6-Stepper motor

Figure 2. CAD model of experimental set-up without DLP projector

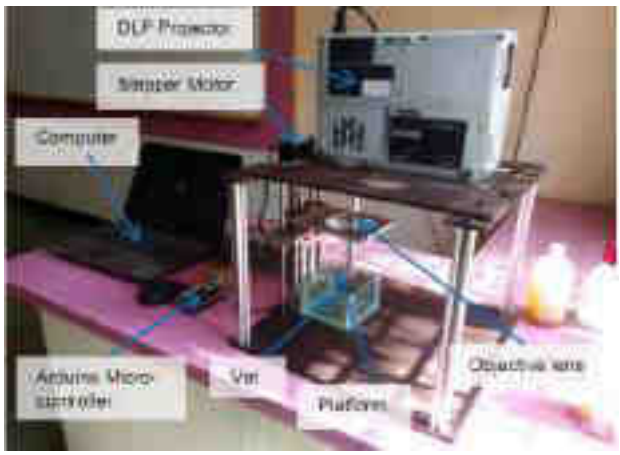


Figure 3. Experimental set-up

The photopolymer used in this experimentation is polyethylene glycol di-acrylate with 2% Irgacure 784 as photo-initiator. The absorbance spectrum of the photopolymer is plotted and the maximum absorbance observed is in the range of 315 nm to 480 nm. The peak absorbance of polyethylene glycol di-acrylate matches with the peak intensity of light beam of DLP projector which is in the range of 400 nm – 570 nm. Therefore, polyethylene glycol di-acrylate is selected as photo-curable resin and cost of the same resin is also low as compared to other resins. From this data it is concluded that maximum UV light is required for solidification of the photopolymer. The NEMA 17 bipolar stepper motor with 0.9˚ step angle, 5% step accuracy, 5 mm shaft diameter is used to rotate the ball screw. The ball screw with nominal diameter 12 mm, pitch 2.0 mm, core diameter 10.084 mm and lead angle 3.04˚ is used for up and down motion of the Z-stage. The maximum speed of the stepper motor is 2344 rpm and holding torque is 4.8 kg-cm. The Creo 3.0 software is used for modeling of 3D CAD model. The 3D CAD model and STL file format in Creo 3.0 software is more compatible with developed MATLAB code for slicing of 3D CAD model as compared to other modeling softwares. Therefore, Creo 3.0 software is selected for 3D CAD modeling. A special MATLAB code is developed for slicing of the 3D CAD model and this sliced 3D CAD model is imported into the Creation Workshop software version 1.0.0.75 which is used to control the focusing time period of sliced images through DLP projector and focusing lens. The make of focusing lens is Optics and Allied Engineering Private Limited, Bangalore with 100 mm diameter and 100 mm focal length. The Creation Workshop software also controls the motion of the Z-stage through Arduino MEGA 2560 micro- controller and NEMA 17 bipolar stepper motor. It also controls input parameters, such as layer thickness, motor movement speed, exposure time and settling period. These parameters make the equipment versatile and suitable for a wide range of different tasks. Finally, the different shape objects are built by curing the aforementioned photo-curable resin. The photographs of the build components are taken by the Amp Cam digital microscope with optimum resolution 640×480 and 5X digital zoom. The FARO Edge 3D scanner with the specifications ±25µm accuracy, 25µm repeatability, 115 mm depth of field, 80 mm effective scan width for near field, 2,000 scanning points per line, 40µm minimum point spacing, 280 frames/second scan rate and Class 2M laser is used to measure the dimensions of the build objects. Thus, a low cost, high build speed SLA is developed to fabricate 3D components.

In the Z- Stage, we have to control the linear movement of the platform with the help of stepper motor and ball screw. The stepper motors rotational motion is transformed in to linear motion with help of ball screw coupled with motor shaft. Arduino microcontroller is used for precise and accurate control the movement of the motion stage. The rotational movement of the stepper motor is controlled with the help of special Arduino program. The program mainly consists of various commands and statements to control the various parameters such as speed, time delay etc. Figure 4 shows the window of Arduino software in which the uploaded program is shown. The Arduino Micro-controller with stepper motor is interfaced with Creation Workshop Software to obtain desired motion of Z-stage.

Figure 4. The program uploaded to the Arduino software

2.2 Spectrum study of photopolymer and DLP projector

The 3D object is built by focusing the light beam of DLP projector through objective lens on the z-stage platform. On the Z-stage platform a layer of liquid photopolymer of thickness equal to the slice thickness of CAD model is made available by lowering the platform with help of ball screw and stepper motor. Therefore, it is necessary to plot the absorbance spectrum of photopolymer from which we can conclude that what is value of wave length for peak absorbance. The Figure 5 shows the absorbance spectrum plot of photopolymer and it is observed that the peak absorbance is at wavelength 335 nm,

410 nm and 480 nm. Therefore, the focused light beam must have the peak wavelength in the range of 300 – 500 nm which is a UV light region.

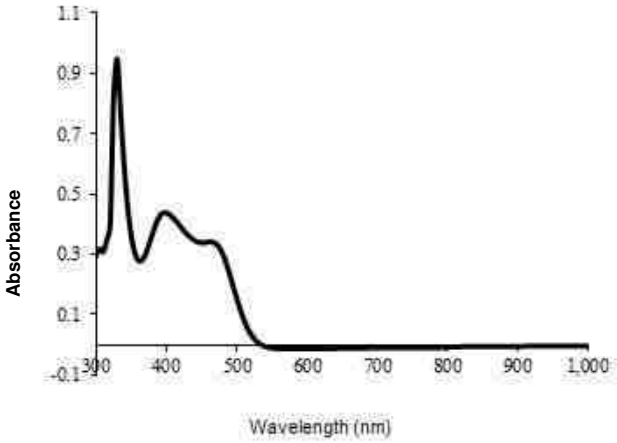


Figure 5. Absorbance spectrum of photopolymer

Figure 6. DLP projector light beam spectrum plotting set-up

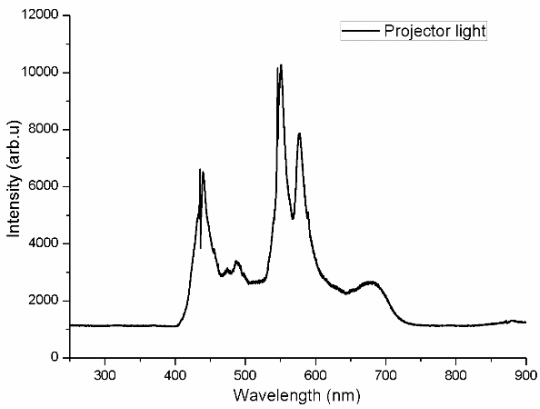


Figure 7. Light beam spectrum of DLP projector

The study of DLP light beam spectrum is done by using Horriba (model iHR320) light spectrometer. The Figure 6 shows the set-up for plotting the spectrum of DLP projector light beam. The light beam from the DLP projector is passes through the aperture then it passes through the neutral density filter. The neutral density filter removes the unwanted light rays. The spectrum is plotted for the light wavelength range of 250 – 900 nm. Finally, light beam passed into the photoluminescence (PL) system. The PL system consists of optical grating, mirror 1 and mirror 2 with CCD (closed circuit device) camera. The measured spectrum data by PL system is collected by the computer. The Figure 7 shows the light beam spectrum obtained by above mentioned spectrometer. From light beam spectrum it is observed that the peak values are in the wavelength range of 400 nm – 570 nm. Therefore, the light beam of DLP projector is useful to cure the selected photopolymer as peak wavelength range matches with each other.

2.3 Slicing of 3D CAD model

Basically, the stereolithography equipment consists of a DLP projector, focusing lens, resin vat, a linear translation stage with a platform and a computer. Before the manufacturing can begin, some preparations must be done. First, the CAD model is sliced into horizontal cross-section images. These black and white images will be projected one by one onto the platform with resin layer. As there are different methods available to slice a CAD model without tessellation but slicing a triangulated mesh model is still the commonly used method in 3D printing caused by its format (i.e. STL) is widely adopted in software and machine. These different methods of slicing a 3D CAD models are Contour, Voxelization and Ray tracing [39]. The contour method is the traditional slicing process that generates the cross-sectional information by intersecting the input model with a set of horizontal planes. As the input model is tessellated into faces (e.g. triangles defined in the STL), the slicing operation is actually a number of face-plane intersections, each of which is a segment. In a layer, the intersection between the model and a slicing plane is one or more polygons (contours), which are constituted by the segments. The voxelization method creates a 3D array of voxels that can cover the whole volume of the input model, and then decides whether each voxel is inside or outside the model. The in/out determination is challenging, because the mesh is just a set of faces in the 3D space without the information of inside or outside. In ray-tracing method, 2D image is used and in/out for every pixel in a slice is determined similar to point-in-polygon testing. In this method testing can be done by casting a ray from each pixel to intersect with the model, and finding out if the ray reaches the interior or exterior of the model at a particular height. Out of the above three slicing technologies, the ray-tracing method is the fastest in most cases and it needs a moderate amount of memory for computation. It maintains a good balance between computation time and memory space. It would be optimal if the intersection problem can be handled without creating other problems. Therefore, due to these advantages, the ray-tracing method is used for development of a special MATLAB code for slicing of 3D CAD model in this research work.

The STL file shown in Figure 8 was originally conceived by 3D Systems [40] and it opened the door for rapid prototyping and manufacturing market by allowing CAD data to be used in STL systems. The file consists of an unordered list of triangular facets that represent the outside skin of a part. The triangular facets are described by a unit normal vector and a set of X, Y, Z coordinates for each of the three vertices. The unit vectors indicate the outside of the part. Since the STL model consists of triangular facets, it is an approximate model of the accurate CAD data. Regardless of being an imprecise model, STL has become the standard used by most CAD and RP systems. STL is a simple solution for representing 3D CAD data and it provides small and accurate files for data transfer for specific shapes [41, 42]. There are two formats for STL file:

ASCI and Binary which are shown in Figure 9 and Figure 10 respectively. Binary files are smaller and more compact. Hence, they are more common. After generating the STL file of the 3D CAD model then it is necessary to slice the model into a number of horizontal cross-section images. The 3D CAD model of the object which is to be built by using stereolithography process is developed with the help of CREO 3.0 software. Then it is saved in STL file format using the same software. The Figure 11 shows the 3D CAD model in STL file format.

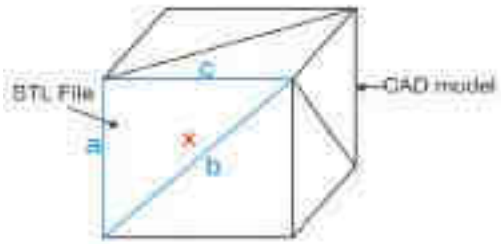


Figure 8. Standard Tessellation Language (STL) file and CAD model [42]

```
solid name

facet normal ni nj nk
    outer loop
        vertex v1x v1y v1z
        vertex v2x v2y v2z
        vertex v3x v3y v3z
    endloop
endfacet

endsolid name
```

Figure 9. ASCII STL file format [42]

```
UINT8[80] – Header
UINT32 – Number of triangles

foreach triangle
REAL32[3] – Normal vector
REAL32[3] – Vertex 1
REAL32[3] – Vertex 2
REAL32[3] – Vertex 3
UINT16 – Attribute byte count
end
```

Figure 10. Binary STL file format [42]

Figure 11. 3D CAD model in STL file format

Thus, a special MATLAB code is developed by using ray tracing method and by using this code, the 3D CAD model is sliced into a number of layers as shown in Figure 12. The Figure 13 (a) and (b) shows a single sliced layer in MATLAB software window. Then these sliced layers are imported in Creation Workshop software and focused one by one at required time interval with the help of DLP projector through objective lens on the Z- stage platform and finally the 3D object is built.

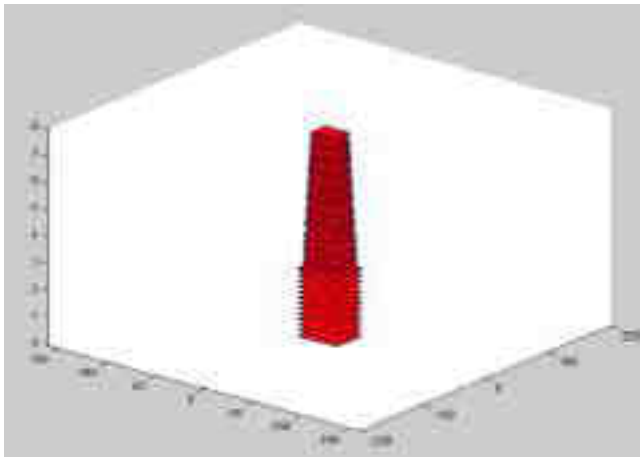
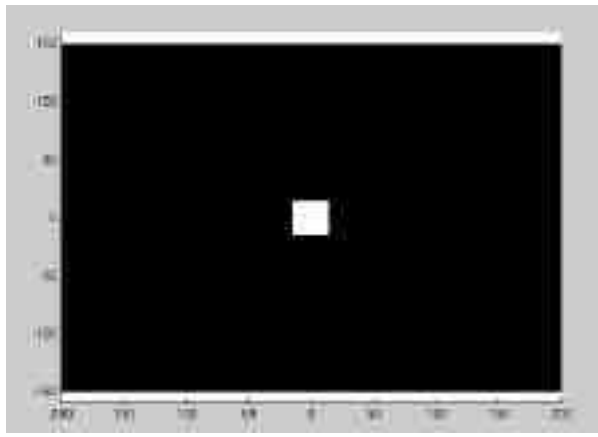
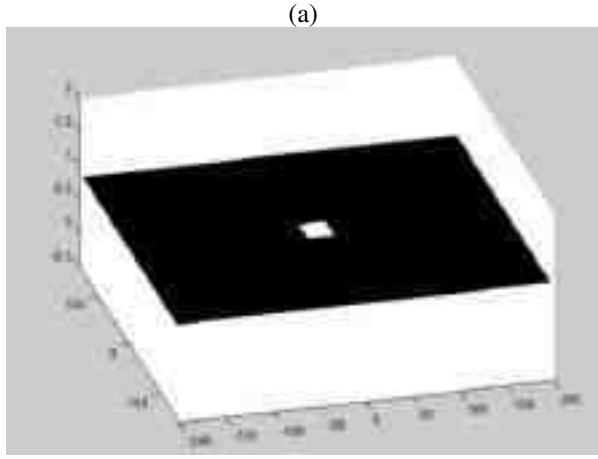


Figure 12. Sliced 3D CAD model



(a)



(b)

Figure 13. 2D Slices in MATLAB window

3. RESULTS AND DISCUSSIONS

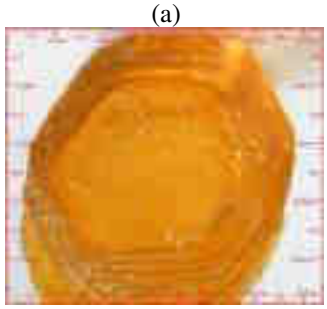
The experiments are performed with hexagonal cross-

section and pyramid objects with 0.1 mm curing depth along Z – axis. The trials are performed with different exposure time and settling period. The exposure time is varied from 10 seconds to 1 second and it is observed that the objects are best cured for 2 seconds curing period. The experimental test data for hexagonal cross-section and pyramid objects are given in Table 1 and Table 2 respectively. The CAD model of the hexagonal prism is shown in Figure 14 and scanned image of build hexagonal prism by FARO Edge 3D scanner is shown in Figure 15. The built hexagonal prism is shown in Figure 16 (a) and (b). The Figure 17 shows the measurements of dimensions of hexagonal prism by FARO Edge 3D scanner. The Figure 18 shows the CAD model of pyramid and Figure 19 shows the built pyramid. The scanned image of built pyramid by FARO Edge 3D scanner is shown in Figure 20 and the measurement of dimensions of pyramid by FARO Edge 3D scanner are shown in Figures 21-23. The pyramid object with 120 numbers of layers with 12 mm dimension along Z-axis is built. The maximum area 18 mm x 16 mm of pyramid object along X-Y plane is cured. For commercial SLA machines resolution in Z-axis is in between 0.01 to 0.25 mm. The resolution along Z-axis of 0.25mm creates a fairly coarse surface for medium sized parts, but for larger models, the layer steps are not too noticeable due to the relative size of larger parts. A resolution of 0.1mm provides a more favorable surface finish for medium and small parts. Therefore, experiments are performed with 0.1 mm curing depth along Z-axis. The maximum exposure area obtained is 55mm x 45mm. It is observed that as the curing time decreases the percentage error between the 3D CAD model dimensions and built dimensions are also decreases. The maximum and minimum percentage errors for hexagonal cross-section object are 9.43 and 2.0 respectively. The maximum and minimum percentage errors for pyramid object are 4.44 and 0.93 respectively. The minimum percentage error is observed for 2 seconds curing period. The dimensions of the built components are measured by FARO Edge 3D scanner with ±25µm accuracy. Creation Workshop software Version 1.0.0.75 is used: (i) to control the Z-stage motion, (ii) to control the focusing time of sliced images and settling time. The resolution of the built components depends upon Software Imposed Parameters (SIP) and SL Process Parameters (PP). The Software Imposed Parameters (SIP) are line width compensation, .stl file resolution, layer thickness, z compensation, and stereolithography grid. The SL Process Parameters (PP) consists of light beam size and intensity, light beam focus depth, and layer thickness [43].

Figure 14. CAD model of hexagonal prism

Figure 15. Scanned image of build hexagonal prism

(a)



(b)

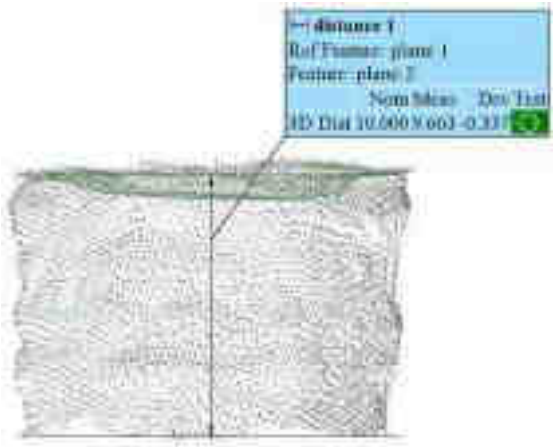
Figure 16. Built hexagonal prism

Table 1. Hexagonal prism experimentation data

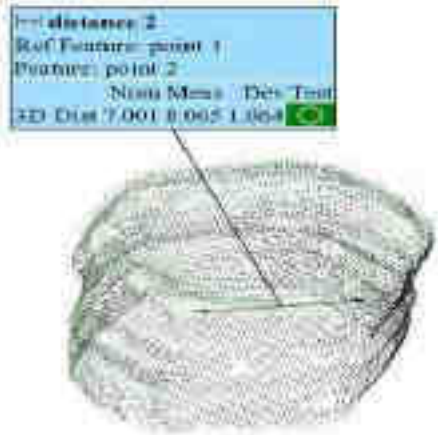
Object Cross-section	Measuring Scale	Dimensions (mm) x	y	z	Layer thickness (mm)	No. of layers	Exposure time (sec.)	Settling Period (sec.)	Build time (sec.)
Hexagon (7 mm side)	CAD Model	14	14	10	0.1	100	2	3.5	546.5
	Built object	15.32	14.28	9.66					
	% Error	9.43	2.0	3.4					

Table 2. Pyramid experimentation data

Object Cross-section	Measuring Scale	Dimensions (mm) x	y	z	Layer thickness (mm)	No. of layers	Exposure time (sec.)	Settling Period (sec.)	Build time (sec.)
Pyramid	CAD Model	18	16	12	0.1	120	2	3.5	656.5
	Built object	17.20	16.15	10.85					
	% Error	4.44	0.93	2.33					



(a)



(b)

Figure 17. Measurement of height and side of hexagonal prism

Figure 18. CAD Model of pyramid

Figure 19. Built pyramid

Figure 20. Scanned Image of build pyramid

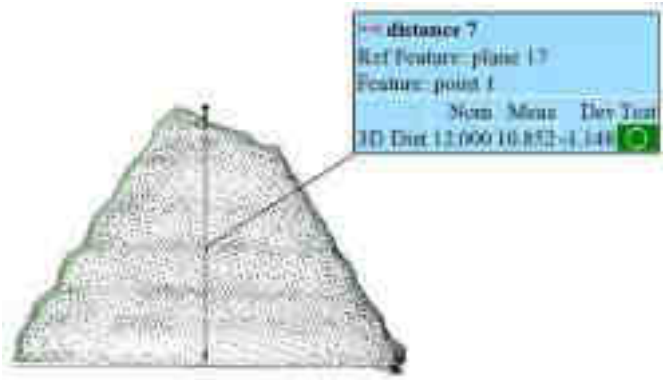


Figure 21. Height measurement of build pyramid

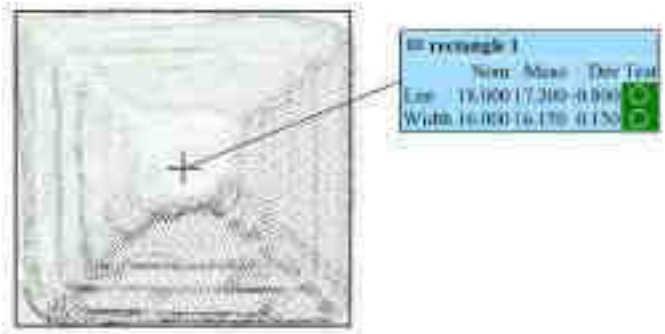


Figure 22. Base measurement of pyramid

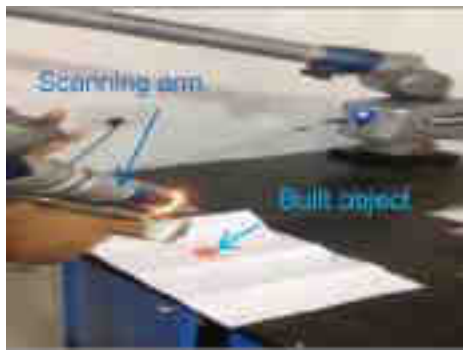


Figure 23. Faro edge 3D scanner

4. CONCLUSIONS

A low cost stereolithography apparatus (SLA) has been developed with DLP projector as a UV light source. The overall cost of the developed SLA is very low as compared to the present commercial SLA available. Therefore, the build cost of the fabricated objects is reduced due to developed low

cost SLA. The optimum curing period per layer is two seconds per layer as the percentage error is minimum for two seconds curing period. Therefore, build speed obtained is two seconds per layer which is remarkable compared with present SLA. The dimensional accuracy of fabricated objects is also satisfactory as the maximum and minimum percentage error is 9.43 and 0.93 respectively which is acceptable comparing with the results available in the literature [33, 36]. The dimensional percentage error is decreased as the curing period or image focusing period is reduced. The pyramid object with maximum 120 numbers of layers with 12 mm dimension along Z-axis is built in 11 minutes. The maximum exposure area obtained which can be cured in X-Y plane is 55 mm x 45 mm. The resolution of the build objects in X-Y plane is 23 microns which is resolution of sliced image focused from DLP projector and Z-stage resolution is 0.1 mm. The advantages of the developed SLA are low build cost, high fabrication speed, excellent resolution in X-Y plane, low resin cost etc. The limitations are low dimensional accuracy, poor resolution of the fabricated objects along Z-stage. The future scope of the work is to introduce the dimensional error correction model in the experimentation to minimize the percentage errors of the build objects. Another future scope is to perform the experiments with values lower than 0.1 mm curing depth so that resolution of build objects along Z- stage will be improved.

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NOMENCLATURE

3D	three dimensional
AM	additive manufacturing
CAD	computer aided design
CAM	computer aided manufacturing
DLP	digital light processing
DMD	digital micro-mirror device
LCD	liquid crystal display
MEMS	micro-electro-mechanical systems
MSL	microstereolithography
PL	photoluminescence
RP	rapid prototyping
SL	stereolithography
SLA	stereolithography apparatus
STL	standard tessellation language
UV	ultra-violet

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Research Article

Metaheuristic Methods for Efficiently Predicting and Classifying Real Life Heart Disease Data Using Machine Learning

Elia Ramirez-Asis,[1] **Magna Guzman-Avalos**,[2] **Bireshwar Dass Mazumdar**,[3] **D Lakshmi Padmaja**,[4] **Manmohan Mishra**,[5] **Deepali S Hirolikar**,[6] **and Karthikeyan Kaliyaperumal**[7]

[1]*Department of Education Administration, Universidad Cesar Vallejo, Huaraz, Peru*
[2]*Department of Management and Educational Sciences, Universidad Nacional Santiago Antúnez de Mayolo, Huaraz, Peru*
[3]*Department of Computer Science and Engineering, United University Prayagra, Prayagraj, India*
[4]*Department of Information Technology, Anurag University, Hyderabad, Telengana State, India*
[5]*United Institute of Management, Prayagraj, India*
[6]*Department of Information Technology, PDEA'S College of Engineering Manjari Bk, Savitribai Phule Pune University, Pune, India*
[7]*IT and IoT-HH Campus, Ambo University, Ambo, Ethiopia*

Correspondence should be addressed to Karthikeyan Kaliyaperumal; karthikeyan@ambou.edu.et

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The heart attack happens if the flow of blood leads to blocks in any of the blood veins and vessels liable for delivering blood into internal parts of the heart. In the modern life activities and habits, the males and females hold the same responsibility and burden of risk. The absence of understanding frequently leads to a postponement in dealing with the heart attack issues, which could worsen the injury and in most of the situations shown to be dead. Several researchers have applied data mining techniques to diagnose illnesses, and the results have been encouraging. Some methods forecast a specific illness, whereas others predict a wide spectrum of illnesses. In addition, the accuracy of sickness predictions can be improved. This post went into great length on the many approaches of data classification that are currently available. Algorithms primarily represent themselves through representations. Data classification is a typical but computationally intensive task in the area of information technology. A huge amount of data must be analysed in order to come up with an effective plan for fighting disease. Metaheuristics are frequently employed to tackle optimization issues. The accuracy of computing models can be improved by using metaheuristic techniques. Early disease diagnosis, severity evaluation, and prediction are all popular uses for artificial intelligence. For the sake of patients, health care costs, and slowed course of disease, this is a good idea. Machine learning approaches have been used to achieve this. Using machine learning and metaheuristics, this study attempts to classify and forecast human heart disease.

1. Introduction

Heart-related diseases [1, 2] consume around a million lives of peoples every year, creating this as the primary reason. In the year 2016, around 920,00 people had heart attacks and nearly half of them occurred suddenly without prior symptoms. Sudden death is the only symptom for heart disease. One death among five is due to heart problems in India. Heart disease has considerably become more when compared with past decades and has turned out to be the primary reason of death. It is highly challenging for healthcare professionals to identify quickly and precisely.

So, it is essential to implement computer expertise in this analysis to help healthcare professionals to detect in the early stages with enriched accuracy. The objective of this research is to precisely and proficiently evaluate

heart-related hospitalizations based on the offered medical account of the patient. The approaches of this research are innovative for this domain. This encourages the research to forecast heart-related hospitalization. To save the irreversible lives of human beings, early diagnosis and prediction of the disease is mandatory than any other business and profit. So, this research focuses on early and efficient detection of heart disease at higher accuracy levels using data mining algorithms and history of past patient records. The feature of classification algorithms in data mining is analysed in this research for effective prediction. The datasets used by the researcher and algorithms are naturally impure and contain missing, irrelevant, and outdated values with the system and human errors. Since, the efficiency of prediction algorithms completely depends on the input dataset, it is necessary to focus on data cleaning (preprocessing) process prior to the actual mining process. This will result in improved accuracy levels of prediction. Hence, this system focused on preprocessing, mining, and prediction of heart disease in earlier stages using the history of databases [3].

There are many different types of cardiac illness, each of which affects a different organ within the heart [4]. Cardiovascular illnesses include any form of cardiac disease, and the diseases associated with the heart are discussed in greater detail further down in this section. CAD, which is another term for coronary heart disease, is the most common type of heart disease in the world and is also known as coronary artery disease (CAD). Inflammation of the blood vessels and arteries, caused by fat accumulation, is a source of complaint.

The data confirm that the heart diseases are double that of the average ratio of neighboring countries of India in the world. Regardless of actuality a developing concern, many Indians are not conscious about the heart disease and its related preliminary indications. The disease history related to generations of the family is considered as the general and strong threat factors; most of heart-related diseases are because of well-known manageable reasons such as sugar level, cholesterol, abnormal blood pressure, unhealthy diet, habit of smoking, style of inactive life, stress, and abnormal weights. In current situation, the daily life style and habits have become the primary reason and risk factor for getting heart disease. Heart attack is the major reason for deaths, particularly amongst youngsters and teens in India. As per the Indian Heart Association, mostly 50 percent of heart issues are in men under the age of fifty years and 26 percent of every attack is below the age of 40 [5, 6].

The heart attack happens if the flow of blood leads to blocks in any of the blood veins and vessels liable for delivering blood into internal parts of the heart. In the modern life activities and habits, the males and females hold the same responsibility and burden of risk. The absence of understanding frequently leads to a postponement in dealing with the heart attack issues, which could worsen the injury and in most of the situations shown to be dead. September 29th of every year is renowned to be the World's Heart Day (WHD) to bring alertness of the heart-related issues. Different themes were introduced every year to tackle the many causes of heart-related diseases and to bring awareness among the public [7–10].

Machine learning models can solve highly critical issues by automatically detecting the characteristics of the input data, and deep learning models can adapt to changes in the problem that they are attempting to answer. Using the inferred data, machine learning models will be able to uncover and analyse characteristics in data patterns that have not yet been presented to the user. Because even low-computing models will be able to accomplish this, a significant amount of time will be saved [10].

Heart disease has considerably become more when compared with past decades and has turned out to be the primary reason of death. It is highly challenging for healthcare professionals to identify quickly and precisely. Using machine learning and metaheuristics, this study attempts to classify and forecast human heart disease.

2. Literature Survey

Cardiac disease and ECG datasets are back-eliminated from the classifier model built by the authors in [11]. The feature choices have improved categorization techniques and reduced the number of inputs, according to experience. Seventy eight percent increase in performance was achieved with just a 19% reduction in the size of the arrhythmia dataset that was utilized in this investigation. In comparison to the prior data, this new set is 85% better and has just four distinct features. In a previous research, redundant features were shown to improve the performance of classifiers.

A surge development approach-based fuzzy master system is outlined [12]. To handle UCI machinery cardiac datasets, this method was developed particularly for them. Decision tree algorithms are used to identify the most important qualities for optimal diagnosis and therapy. Fuzzy rules are used to generate the output data. Fuzzy approximation is used to get the outcome. An expert system based on the particle swarm optimization approach has a 93.27% accuracy rate. There is a huge advantage to this system when compared to other classification methods, which are difficult to understand the output model given by fuzzy expert systems.

A firefly-based method based on rough sets was proposed by authors in [13] as a foundation for an accurate prediction system. The high complexity and uncertainty associated with heart disease datasets may be reduced by including both fuzzy and rough theoretical notions. With the roughest-based fuzzy learning approach, it is feasible to find optimum answers while consuming minimal computer resources. Support vector machines and artificial neural networks cannot match these results when it comes to heart disease prediction and medication prescribing.

Scientists have devised a novel method for forecasting ventricular arrhythmia. An ECG signal processor that is completely integrated into the system is used in this work to construct a pain prediction system. A certain set of ECG parameters may be used to predict whether or not a person would have ventricular arrhythmia. To evaluate and monitor the sites, an ECG waveform is recognized and noted (PQRST). This procedure is carried out using real-time and flexible methods. Controlling the ECG signal fluctuations efficiently and accurately is the goal of these techniques. The

American Heart Association's collection of cardiovascular signals is utilized to assess the system's performance. It seems that the previous methods' accuracy metrics are comparable to the new ones, based on simulation findings. The system is simulated using an ASIC (application-specific integrated circuit) (ASIC). ESP-based ventricular arrhythmia forecasting is implemented for the first time on an ASIC.

A Naïve Bayes classification approach for heart disease detection was highlighted by researchers [14]. In today's society, heart illness has serious ramifications, as shown in this book. The Naive Bayes classifier is used in conjunction with statistical methods to accurately predict and diagnose cardiac disorders. It uses data preprocessing methods to handle the massive and complex gathering of medical data. Cardiac disease is classified using a discretization algorithm. In this case, directed variation with equal frequencies was used as the discretization approach. The stat log heart database contains datasets on heart disease that are used in this investigation. The findings show that this approach provides more accurate measurements than earlier techniques.

As mentioned in [15], the linear SVM classifier model works as follows. After isolating a hyperplane from a given dataset using categorized instructing tests, this difference classifier outputs an optimal hyperplane. Thus, the newly created instances of the input data model may be further classified in this manner. A hyperplane is a line that, in a two-dimensional space, splits the hyperplane into two parts. Both sides of the dividers include each class. In a nutshell, SVM separates classes.

Using deep learning and a linear SVM classification, the authors of [16] performed an original investigation. The softmax layer is replaced with a linear combinational machine in deep convolutional networks. Margin-based loss may be used to replace cross-entropy loss since it is more efficient. According to published studies, the SVM may be used to return various layers of a deep complex network. On the second layer, a deep convolution network replaces SVM. Ultimately, the goal of this study is to aid in the development of facial recognition software for use by humans.

Using logistic regression data analysis, the authors of [17] give an in-depth look at the statistical technique. Logistic degenerate is a statistical process for analysing dual dependent variables. An efficient method for regression analysis is logistic regression. The logistic model's parameters are estimated using logistic regression techniques. Logistic models use independent elements to calculate the probability of an event occurring.

Models of logistic regression provide the highest accurate classification results and are broadly used in a broad range of fields. Predictive models for heart disease are frequently evaluated using this technique. Overfitting is avoided with this method, which yields more precise findings. Nonlinear connections, on the contrary, make things more complicated and time intensive. In addition, this technique performs effectively as an evaluation tool for healthcare firms rather than a categorization model.

It was found that combining K-means and Apriori yielded the best results [18]. The dataset is first gathered using k-means gathering. The Apriori method is then used to determine the most often recurring item sets. A "bottom-up" approach is used by the Boolean association rule to get better results. Real-world scenarios in the heart disease prediction system provide a succession of challenging questions to patterns. Predictive analysis relies on categorization to ensure that the input data are accurately identified and mapped. There are two categories of data: those that have been tagged and those that have not. In addition to the single target quality, the labelled data include many predictive characteristics. Using all the target characteristics, the class label is denoted. Only those features that have been labelled have predictive properties that are not unlabeled. The basic goal of the classification process is to appropriately classify not labelled data using categorization models derived from labelled examples (historical data). The first step is to create a training model that already has the proper class (or goal values) to build it.

3. Methodology

Figure 1 illustrates an example of how heart disease can be predicted using genetics. This method is based on a database of heart disease cases. The extraction of features is accomplished through the use of a procedure known as PCA. For the purpose of categorising the data, a number of machine learning algorithms are used. The results of the testing can be used to improve disease prediction. Using machine learning in conjunction with metaheuristics is a lethal combination when it comes to accurate forecasting.

First ever developing conclusion tree-based approach is J. Ross Quinlan's ID-3 method. This strategy makes use of entropy and information gain measurements. The entropy of the functional characteristics is computed iteratively, starting with a nodule. Split attributes refer to the subsets of a dataset that have been divided based on the feature with the lowest error rate (entropy) and the greatest information gain. In the absence of an accurate categorization of its target classes, the algorithm repeats itself for each subset of data. The terminal nodes of a decision tree are defined as the final subset of the branch's nonterminal nodes. The split attribute specifies nonterminal nodes, whereas class labels are denoted by terminal nodes. An ID-3-based conclusion tree method developed in [19] allows for the early diagnosis of cardiac problems.

According to Peterson et al. [20], using a K-nearest neighbor strategy for pattern detection and data categorization is the most resilient method in the field. Distance functions or similarity measures are used in K-nearest neighbor algorithms. In order to classify freshly defined instances, a similarity measure is employed, and all instances are kept. In order to efficiently classify, it makes use of the instance-based learning approach. Based on the votes of the classes immediately adjacent to it, each new instance of the dataset is allocated a category. Both the training and testing datasets are used to calculate the distance metric. As soon as k has been chosen, the algorithm estimates how far apart the two instances are.

As a nonprobabilistic binary linear classification approach, PSO-SVM (particle swarm optimization) support vector machine is the best choice [21]. Using this method,

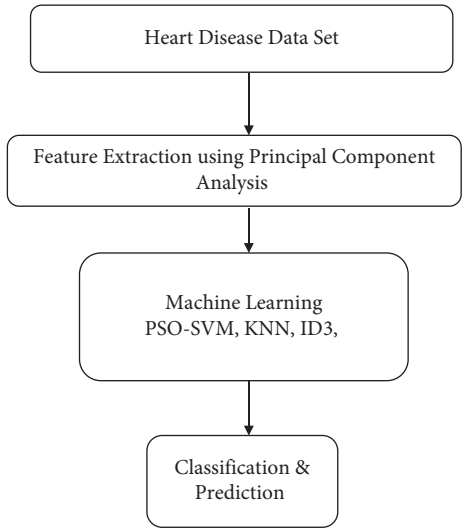

Figure 1: Machine learning and metaheuristics methods for classification and prediction of heart disease data.

samples may be divided into a single or several target classes. A single point is used to represent each piece of data. With each new group, it widens because of the clear divisions. The goal classes of the new occasions are remapped depending on which side of the space they fall. Nonlinear classification is possible if the input datasets are not tagged. The support vector machine employs an apart learning approach to classify the data because the instances cannot be allocated to target classes. More instances are added when the clusters based on functions have been formed. There is proof of a nonlinear support vector machine recommendation system. Nonlinear support vector machine approaches are the most often utilized way for dealing with unlabeled data.

4. Results and Analysis

Using data from the UCI machinery cardiac illness dataset [22], we conducted an analytical investigation. ID-3, C4.5, Random Forest, KNN, and SVM algorithms employ 303 entries from the Cleveland database as input. Weka is used to preprocess the incoming data set. The correctness of the data has been improved as a result of this preprocessing. Out of 303 instances, 240 instances were used for the training of machine learning predictors and remaining 63 instances were used for the testing of the machine learning predictors. Figures 2–4 show performance of machine learning predictors on the basis of different performance comparison parameters:

$$\text{Accuracy} = \frac{(\text{TP} + \text{TN})}{\text{TP} + \text{TN} + \text{FP} + \text{FN}},$$

$$\text{Sensitivity} = \frac{\text{TP}}{\text{TP} + \text{FN}}, \quad (1)$$

$$\text{Specificity} = \frac{\text{TN}}{\text{TN} + \text{FP}},$$

where TP = True Positive, TN = True Negative, FP = False Positive, and FN = False Negative.

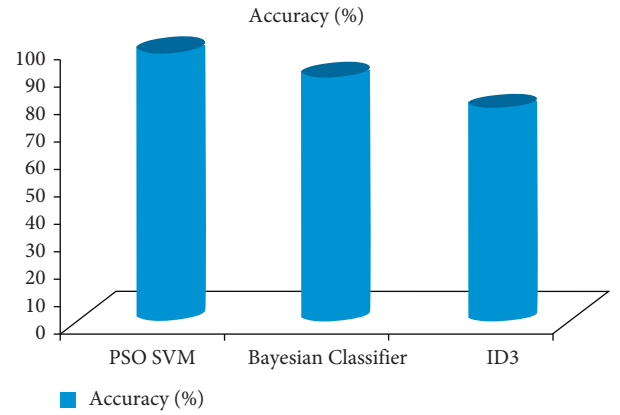

Figure 2: Accuracy of classifiers for heart disease dataset.

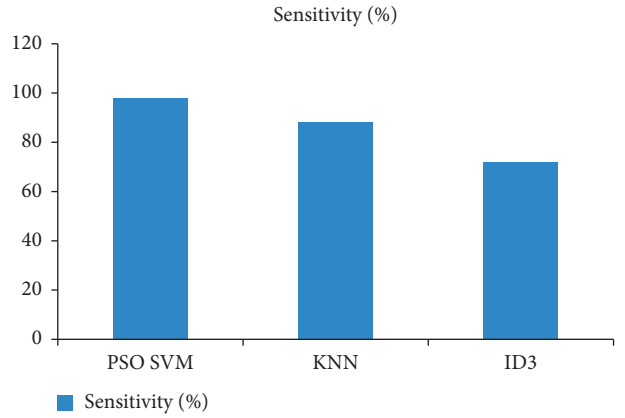

Figure 3: Sensitivity of classifiers for heart disease dataset.

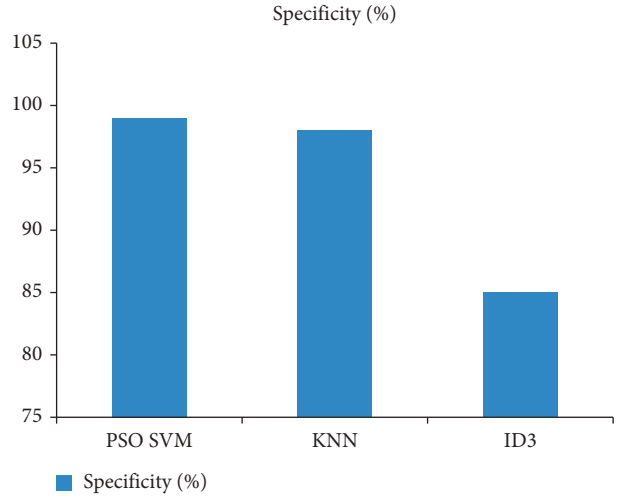

Figure 4: Specificity of classifiers for heart disease dataset.

5. Conclusion

The heart attack happens if the flow of blood leads to blocks in any of the blood veins and vessels liable for delivering blood into internal parts of the heart. In the modern life activities and habits, the males and females hold the same responsibility and burden of risk. The absence

of understanding frequently leads to a postponement in dealing with the heart attack issues, which could worsen the injury and in most of the situations shown to be dead. Metaheuristics are frequently employed to tackle optimization issues. The accuracy of computing models can be improved by using metaheuristic techniques. Early disease diagnosis, severity evaluation, and prediction are all popular uses for artificial intelligence. This study presented machine learning and metaheuristics methods for early and accurate detection of cardiac illness. Cleveland dataset is used for the innovative analysis. PSO-SVM algorithm is performing better than other machine learning predictors.

Data Availability

The data used to support the findings of the study can be obtained from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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INTELLIGENT MOVIE RECOMMENDATION SYSTEM USING AI AND ML

Ajinkya Satuse[1], Omkar Bhalerao[2], Pavan Pawar[3], Hrithik Thorat[4]

D.S. Hirolikar[5]

[1,2,3,4] Student, Department of Information Technology,

[5]Professor, Department of Information Technology

[1,2,3,4,5] Pune District Education Association's College of Engineering, Manjari Bk., Pune, India.

ABSTRACT

A recommendation system is a system that, depending on a data set, makes recommendations to users for specific resources such as books, movies, songs, and so on. Typically, movie recommendation systems anticipate what movies a user would enjoy based on the characteristics of the User and previously provided data. Such recommendation systems are useful for businesses that collect data from a big number of clients and want to deliver the best recommendations available. Many elements can be taken into account while creating a movie recommendation system, such as the film's genre, the actors, the story, and even the director. The systems can propose movies based on a single attribute or a combination of two or more. The recommendation system in this paper is based on the tags created by combining genre, actors and description that the user may choose to watch. We have adopted a Content-based filtering technique in our project. A recommendation engine uses several algorithms to filter data and then recommends the most relevant items to consumers. If a user visits a movie site for the first time, the site will have no previous history of that user. In such cases, the user can search for their favourite movie genre or director to get a similar recommendation.

KEYWORDS: Movie Recommendation Systems, Content-Based Filtering, Movie recommendation, machine learning project.

I.INTRODUCTION

With the ever-increasing demand for machine automated solutions, machine learning has become one of the rapidly increasing and evolving technology. In the era of the 21st century and increasing E-commerce over the Internet, online shopping and entertainment are on peak levels.

Online everything will be new normal in the upcoming decade. Imagine you are shopping online on websites like Amazon.com, they have a million products for sale and the same goes for Flipkart and other e-commerce websites. Entertainment websites like Netflix and Hotstar have over 10 million movies and series to be watched. If you want anything specific from Amazon you can search it, but what about the rest? If you want something similar or better than your search results, it will be like searching for a golden tree in the jungle of trees. You will be lost and will never find your way out of the jungle. That's where Recommendation systems can help you. Recommender system can become your ally in such platforms. Similarly, Recommendation System plays an important role in becoming your guide in the systems of Amazon, Netflix and other e-commerce websites. Without a recommendation system, they will be a database and you will need to be sure of what you're looking for. It will be great for Amazon and Netflix if people don't buy their products or don't watch any movie.

Therefore, companies need it more than anything in upcoming years. That is the reason we decided to learn recommender systems and take it to next level.

Recommendation Systems are mostly used to assist consumers in receiving customised results based on their choices. Recommendation Systems can also be used as a filtering strategy to select the best result from a set of anticipated results using a Machine Learning algorithm.

Movies can be segregated on basis of genres like thriller, animation, comedy, action, drama etc. Another way to categorize movies is based on some metadata such as cast, year of release, language or director. Nowadays, most online video-streaming platforms provide a number of similar types of tv shows and movies to the user by the help of utilizing users previous search keywords and previous watch history of the user. The main goal while building a Movie Recommendation System is to make it reliable and efficient to provide suggestions to users accurately what they are looking for. Normally, Recommendation Systems are divided into three different types – Collaborative or User Filtering, Content-Based Filtering and Hybrid filtering.

II.METHODOLOGY

1. **Requirement/Data Gathering**:

Data is the most important and foundation for machine learning projects. Gathering data from various datasets is key for a recommendation system. The more the data available the better the recommending results.

2. **Pre-processing**:

In the pre-processing stage, Filtering and making ready the data for the project, we will make some changes such as, we will build tags that will describe the data and help us to calculate its similarity with other data.

2.**1 System designing**:

In this system design phase, we design the system which is easily understood by the end-user i.e., user friendly.

We design some UML diagrams and data flow diagrams to understand the system flow and system module and sequence of execution.

3. **Model implementation and testing**:

We will create a framework of data that will coordinate with the code this phase involves the core part of our project that is coding and model designing. The model will make sure the project works well at the local level.

The different test cases are performed to test whether the project module is giving the expected outcome in the assumed time.

4. **Website designing**:

After we have created a working model, we will create the same into a website. This stage will involve designing an immersive UI.

5. **Deployment of System**:

Once the functional and non-functional testing is done, the product is deployed in the virtual environment or released into the local hosting like Heroku, over the internet.

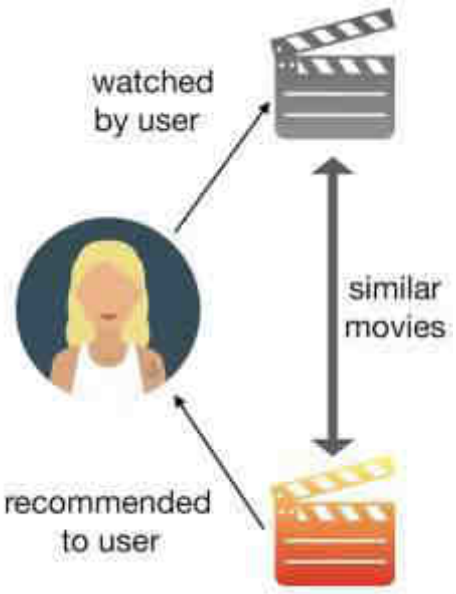
III.MODELLING AND ANALYSIS

Types of Recommendation System:

The recommendation system is usually classified on rating estimation

[1] Collaborative Filtering system
[2] Content-based system
[3] Hybrid system

Content-based Filtering Systems:
As the name suggests, a content-based recommender system recommends by the similarity of the content or the product. In a content-based recommender system, the similarity between the content or the product is calculated to find similar content.
For example: If you want to watch an action movie, The system will recommend and list the movies which are related to action.



We have used the cosine similarity method to calculate a numeric value, that calculates the similarity among other movies. The cosine similarity function calculates by independent of magnitude and it is easy to calculate. Mathematically, it is defined as follows:

$$\text{similarity} = \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|\|\mathbf{B}\|} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i^2}\sqrt{\sum_{i=1}^{n} B_i^2}}$$

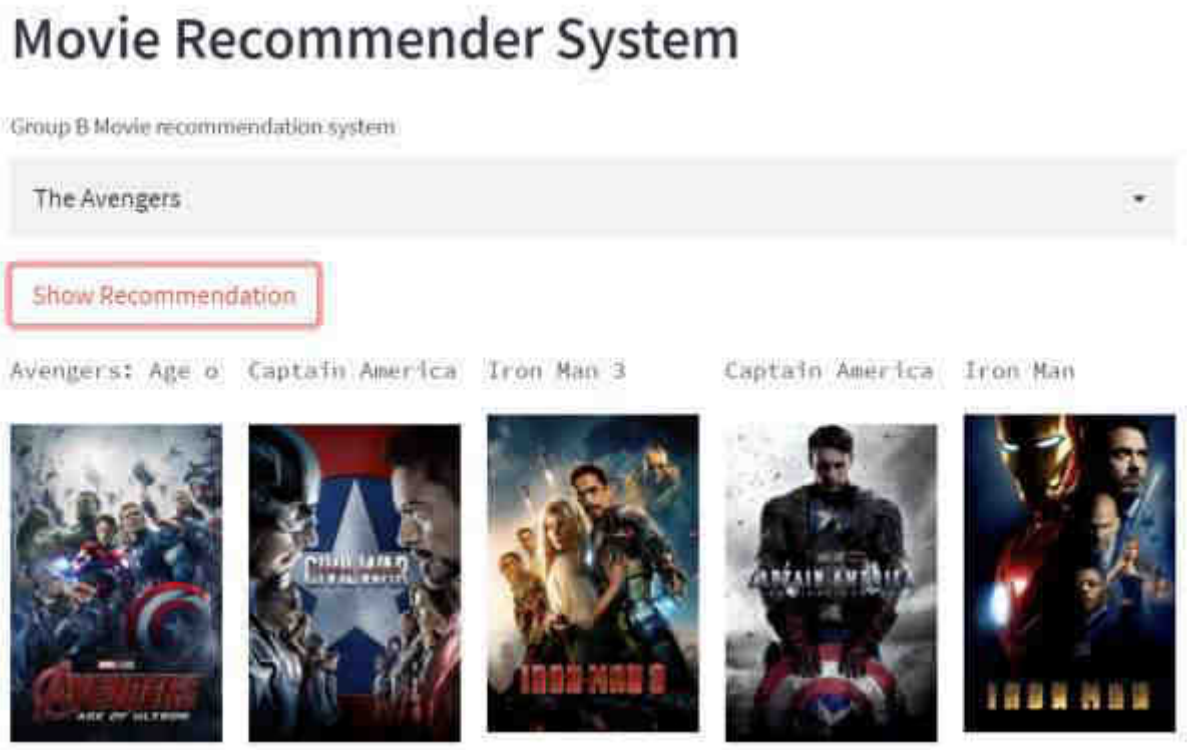
To implement the recommendation process these are the following steps,: -

- Get the movie's index based on its title.
- Get a list of cosine similarity ratings for that movie compared to all other movies.

Convert it to a tuple list, with the first member being the position and the second being the value. the score of similarity.
Get top 5 similar results and display.

As our project has done a fine job of verifying movies and recommending similar movies by calculating similarities between tags, this system is not strong enough to be recognised as a Perfect recommendation system. If a person searches for "The Avengers". The system returns all movies related to Avengers
movies while it is more likely that the people who liked that movie are more inclined to
enjoy other Marvel Movies. This is the result captured by our current system.

IV. RESULTS



V. CONCLUSION

[1] The recommendation systems can be enhanced for present and future requirements for increasing the quality and for better recommendation results.
[2] Recommendation system can become your virtual guide on E-Commerce platforms when powered with AI
[3] It will be a great loss for companies like Amazon and Netflix if people don't buy or don't watch their product
[4] With the ever-increasing demand for machine automated solutions 'ML' has become one of the rapidly evolving technologies along with AI and Data Science.
[5] Recommender systems will be used in the future to predict demand for products, connect buyers and sellers and eventually become the backbone for the supply chain.
[6] Mega companies like Amazon, Netflix and Facebook need recommendation systems now more than anything. With increasing products and users.

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COLLEGE MANAGEMENT WEB APPLICATION SYSTEM USING MEAN STACK

Ketaki Sonane *, Sakshi Naikwadi**, Mayuresh Koli*** , Harshal Sonawane****, Prof. S.V. Shinde*****

*(Computer engineering, PDEA College of Engineering , pune (India)
Ketakisonane21@gmail.com

**(Computer engineering, PDEA College of Engineering , pune (India)
Sakshinaikwadi15820@gmail.com

***(Computer engineering, PDEA College of Engineering , pune (India)
Mayureshkoli296@gmail.com

****(Computer engineering, PDEA College of Engineering , pune (India)
Harshalsonawane8888@gmail.com

*****(Computer engineering, PDEA College of Engineering , pune (India)
sashsir@gmail.com

Abstract :

The main goal of this project is to add mobility and automation to the process of managing student information in the laboratory. In real-world scenarios, for example, on a university campus, information is distributed to students in the form of notifications, handwritten manuals, and word-of-mouth messages. Today, it is important to communicate faster and easier between students using new formats such as mobile phone technology, as well as predictable forms of expression.The central idea of this project is the implementation of a web-based campus application for further development of educational institutions and educational systems. This application is used by students, teachers and parents. In previous systems, all information had to be displayed in a hard file or website. At the same time, searching for information is difficult to access and takes a long time to search existing websites. Therefore, to solve this problem, you can use a Web based application with MEAN Stack to make this process easier, more secure, and less error-prone. This system provides more efficient information.

Keywords: Mobility, Cryptography, Secure Random, Encryption.

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Music Recommender System Using ChatBot

Shivam Sakore[1], Pratik Jagdale[2], Mansi Borawake[3], Ankita Khandalkar[4]
[1,2,3,4]Dept. of Computer Engineering PDEA'S College of EngineeringPune, India

tract: *In this era of technological advances, text-based music recommendations are much needed as they will help humans eve stress with soothing music according to their moods. In this project, we have implemented a chatbot that recommends sic based on the user's text tone. By analyzing the tone of the text expressed by the user, we can identify the mood. Once the od is identified, the application will play songs in the form of a web page based on the user's choice as well as his current od. In our proposed system, themain goal is to reliably determine a user's mood based on their text tone with an application it can be installed on the user's desktop. In today's world, human computer interaction (HCI) plays a crucial role, and the st popular concept in HCI is recognition of emotion from text. As part of this process, the frontal view of the user's text is ed to determine the mood. The extraction of text tone from the user's text is another important aspect. We have used IBM nalyser to check the text tone of the user and to predict the mood based on the text of the user, and Last.FM API to recommend ngs based on themood of the user.*

ywords: *Introduction, Product-Architecture, Tone Analyzer, Music Classification Based on Mood, Acoustic Analysis, xperiment, Future/Current Use, Importance, Background, Literature Survey, Methodology, Equations, Planning, Tools and echnology, Conclusion.*

I. INTRODUCTION

Communication is the thing which we do in our daily life but having communication and getting to know the feeling through the music is a different level.To feel better and relaxing, people find music important in their lives. Why go over the music streaming which is not personalized to search the song that the user is feeling when the user gets a recommendation while based on the communication the user has with chatbot. In a typical conversation, about 93% of communication is determined by emotion being expressed. Humans are capable of detecting emotions, which is exceedingly important for successful communication.
Chatbots help business teams to scale their interactions with users. You could embed it in any major chat app, such as Facebook Messenger, Slack, Telegram, and Text Messages. Chatbots improve the user experience by facilitating interactions between users and services. Are you tired of all the weird chat bots out there that are designed primarily for business purposes? As part of this project, we will build a chatbot service to which you can talk. This wouldn't be a business-driven conversation. We would simply interact casually. Additionally, the chatbot would also recommend songs based on the tone of the user's voice. To implement the ong recommendation feature, Last.fm API will be used, a service very similar to Spotify API. Additionally, IBM Tone Analyzer PI will be used for the tone/emotion analysis of the conversation. API integration isvery important today as the popular chatbots much more than just have a data-driven conversation; they also offer more user-friendly features. In addition to offering a wide ray of open-source libraries for building chatbots, python also provides a wide array of open-source libraries for building chatbots, ch as scikit-learn and TensorFlow. For small data sets and simpler analyses, Python's libraries are more practical.

II. PRODUCT ARCHITECTURE

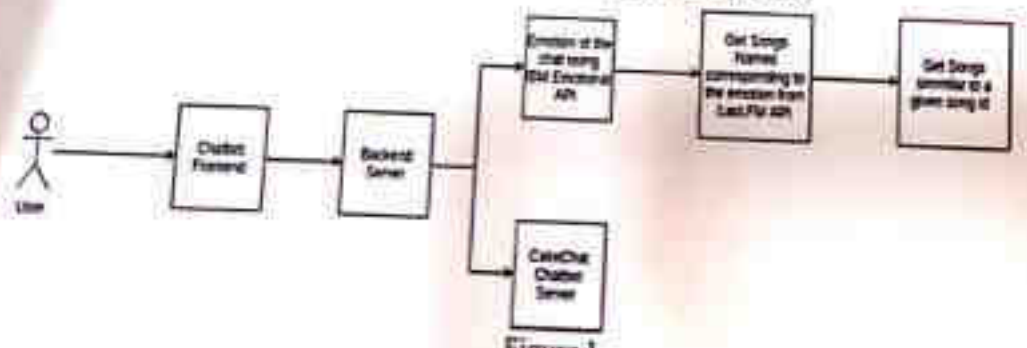

Figure 1
Product Architecture of Music Recommendation systemusing chatbot.

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Web Application for College using MERN stack

Vaishali Geetyal[1], Ritesh patil[2], Vaishnavi mudaliyar[3], Gauri kanpurne[4], Devyani ambi[5]
[1,2,3,4] Pdea's college of engineering manjari bk, Pune, India

Abstract— As digitization has evolved in every sector of the economy, many sectors are adopting this technology for their smooth functionality. Along with various other sectors, the education sector is also adopting this technology at a rapid pace.

Computerization and automated technology have made things much easier for schools, colleges, and universities. It has streamlined the whole administrative, academic, and financial day-to-day operations of educational institutions, also known as campus management solutions, has been developed for automating the daily operations of educational institutions.

The software meant to cater to the assorted needs of students, faculty members, and departmental staff. This software or system can be use to manage a variety of things.

In today's era, every education institution is in the race of proving themselves the best in offering education at every level. To draw more and more students into their institutions, these institutes are adapting all kinds of latest technologies.

One such technology called the MERN stack has been used to implement this project in order to keep the application at par with the latest technology.

Index Terms: Full-Stack Development, College Website, Web Design, Web Development, Reactjs, Nodejs, Express, MongoDB.

INTRODUCTION

The project "Web Application for College using MERN stack" aims at building a web application for college management using the robust technologies that constitute the MERN stack. These technologies include: Mongodb, Expressjs, Reactjs, Nodejs. MongoDB is a source-available cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas. Express.js, or simply Express, is a back end web application framework for Node.js, released as free and open-source software under the MIT License. It is designed for building web applications and APIs. It has been called the de facto standard server framework for Node.js. React is a free and open-source front-end JavaScript library for building user interfaces based on UI components. It is maintained by Meta and a community of individual developers and companies. Node.js is an open-source, cross-platform, back-end JavaScript runtime environment that runs on the V8 engine and executes JavaScript code outside a web browser.

SYSTEM ARCHITECTURE

The following modules have been implemented during the execution of this project:

1.Home Page: The home page is built using the powerful features of the Reactjs library and is attractive as well as fast. It provides the visitor of the website with the first impressive look and displays basic information about the college such as the name of the college, accreditation details, address of the college, courses offered and a contact us page. The Home page consists of a navigation bar to navigate to the different pages of the website.

2.Login Page : The login page first confirms if the visitor of the website is a student, teacher, or the admin himself. After confirmation, accordingly, access to the several pages of the website is provided after the credentials are verified. While the teachers and students can register themselves if new to the college, the credentials of the admin remain fixed in order to enhance the security.

3.Registration Page: New students and teachers can register themselves using the register portal. The passwords are hashed while storing to the MongoDB database using the node js implementation of Bcrypt.js. Bcrypt is one of the most used encryption libraries today. It incorporates hash encryption along with a work factor, which allows you to determine how expensive the hash function will be (i.e. how

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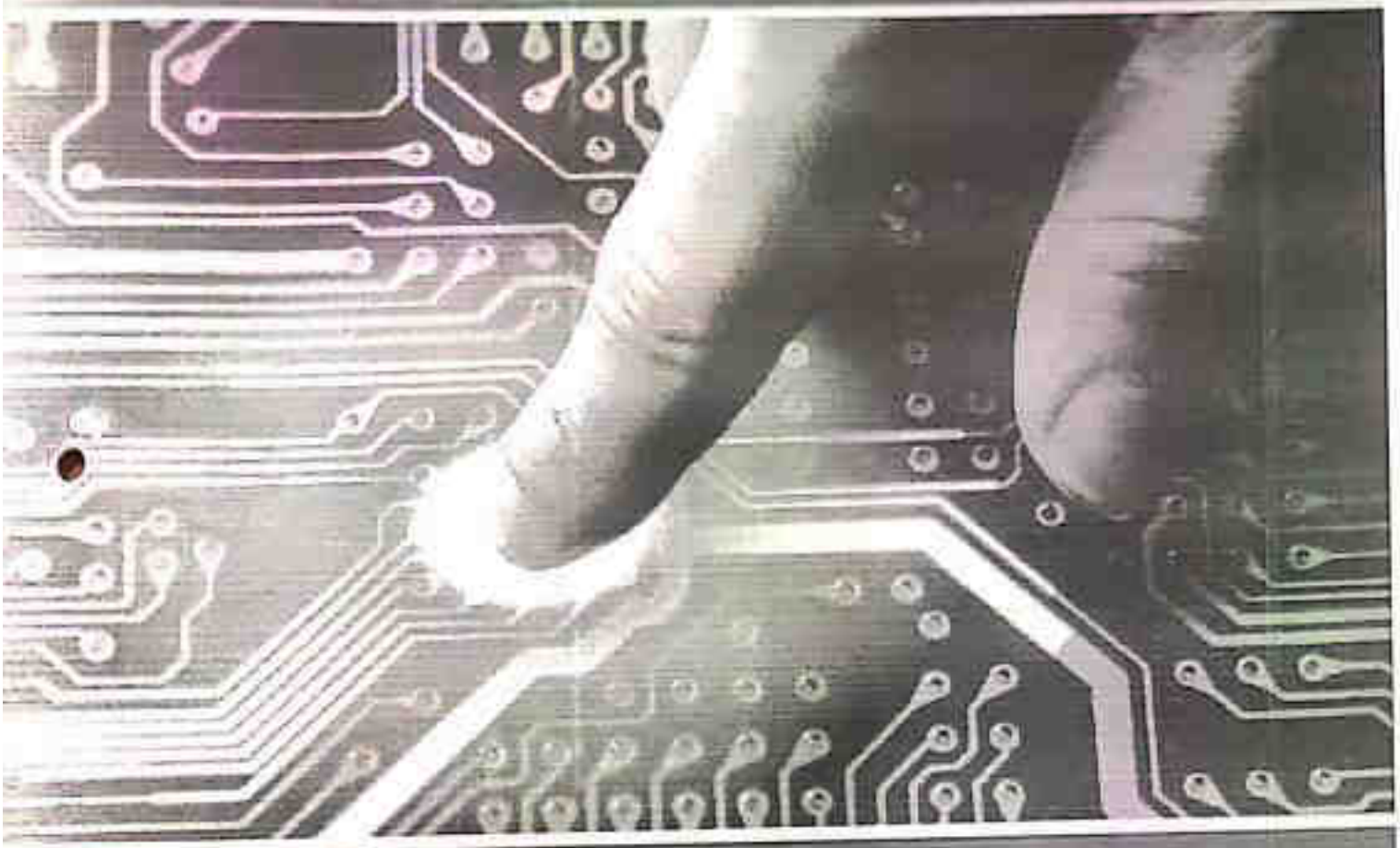

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Online VetMeds System

Prof. N.V. Gawali, Shaikh Abuosama Rizwan Ahmed, Attar Faiz Farid, Desale Vaibhav Rajendra

Department of Computer Engineering, PDEA's College of Engineering, Manjari Bk. Pune, India, India

B.E. Student, Department of Computer Engineering, PDEA's College of Engineering, Manjari Bk. Pune, India, India

ABSTRACT: Online VetMeds is web-based application. User can post requirement for medicine of their pets. User can purchase medicine online. Medicine delivery provided by the nearest associate pet store. Prescription is mandatory for ordering medicine. As per prescription user can search medicine and useful information to order. This application provides logins to the users. They can maintain their account. The main objective of this medical Booking Store system is to take the whole medical store online so that it is reachable to customers 24/7. Overall online medical booking store will become an efficient, highly responsive and an extremely accurate system.

KEYWORDS: pet, medicine, web application.

I. INTRODUCTION

There are more and more services being delivered through the Internet these days. Our shopping habits have changed a lot because of the Internet and Internet websites. As we know, a lot of things will be done on the internet. There has been a lot of medical information on the web for a long time. Recently, people have been using the web to buy medical products from home. Now, medicines can be ordered on a smartphone or through a website, and the seller will get them to you as soon as possible. They will also have a variety of payment options. When you buy something, you can pay with a credit card or debit card, and you can also pay with cash when you get it. In this paper, we look at the many benefits and drawbacks of buying medicines online and we can talk about them. This paper also talks about some important things to keep in mind when taking prescription drugs. To buy drugs online, this study is one of the first to do so. It helps people do this and encourages more people to do it.

Online Shopping has become very popular with young people because they don't have the time to go to the mall and buy things. This is because they don't have enough time to go to the mall and buy things. It also saves money. Once they have bought, the items they have bought will be sent to their home where they have told the Courier Company to send them. This is a modern way to shop because we can buy a lot of different things from different stores at different prices. This study looks into whether the quality of online shopping is a competitive advantage for Internet-based businesses that also cater to ecommerce customers.

II. RELATED WORK

This system solves this problem by conducting drug record transactions on a blockchain to create a smart healthcare ecosystem with a drug supply chain. A smart contract is launched to give time-limited access to electronic drug records and also patient electronic health records [1].

This system proposes a scenario-oriented blockchain system for drug traceability and regulation called Drug ledger, which reconstructs the whole service architecture by separating service provider into three independent service components and ensures the authenticity and privacy of traceability data [2].

In this paper, authors propose Blochian, a Blockchain-based platform for healthcare information exchange. First, analyse the different requirements for sharing healthcare data from different sources. Based on the analysis, we employ two loosely-coupled Blockchains to handle different kinds of healthcare data. Second, combine off-chain storage and on-chain verification to satisfy the requirements of both privacy and authentic ability. Third, propose two fairness-based packing algorithms to improve the system throughput and the fairness among users jointly [3].

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Online VetMeds System

Shaikh Abuwsama Rizwan Ahmed[1], Attar Faiz Farid[2], Desale Vaibhav Rajendra[3], Prof. N.V. Gawali[4]
[1, 2, 3, 4]PREC's College of Engineering, Manjari BK, Pune, India

Abstract: Online VetMeds is web based application. User can post requirement for medicine of their pets. User can purchase medicine online. Medicine delivery provided by the nearest associate pet store. Prescription is mandatory for ordering medicine. As per prescription user can search medicine and useful information to order. This application provides logins to the users. They can maintain their account. The main objective of this medical Booking Store system is to take the whole medical store online so that it is reachable to customers 24/7. Overall online medical booking store will become an efficient, highly responsive and an extremely accurate system.
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III. METHODOLOGY

A. Existing System

A lot of work has been done in this field thanks to its extensive use and applications. This section mentions some of the approaches that have been implemented to achieve the same purpose. These works are mainly differentiated from the techniques for vetmeds systems.

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Brain Machine Interface

Ajinkya Sasne[1], Ashutosh Banait[2], Apurva Raut[3], Vishal Raut[4]
Computer Science, Savitribai Phule Pune University

Abstract— *Brain Machine Interface is also known as 'A brain-computer inteface'.A brain-computer interface (BCI), sometimes called a direct neural interface or a brain-machine interface, is a direct communication pathway between a human or animal brain and an external device. In one-way BCIs, computers either accept commands from the brain or send signals to it (for example, to restore vision) but not both. Two-way BCIs would allow brains and external devices to exchange information in both directions but have yet to be successfully implanted in animals or humans. In this definition, the word brain means the brain or nervous system of an organic life form rather than the mind. Computer means any processing or computational device, from simple circuits to silicon chips. Research on BCIs began in the 1970s, but it wasn't until the mid-1990s that the first working experimental implants in humans appeared. Following years of animal experimentation, early working implants in humans now exist, designed to restore damaged hearing, sight and movement. With recent advances in technology and knowledge, pioneering researchers could now conceivably attempt to produce BCIs that augment human functions rather than simply restoring them, previously only a possibility in science fiction.*

I. INTRODUCTION

Man machine interface has been one of the growing fields of research and development in recent years. Most of the effort has been dedicated to the design of user friendly or ergonomic systems by means of innovative interfaces such as voice recognition, virtual reality. A direct brain-computer interface would add a new dimension to man-machine interaction. A brain-computer interface, sometimes called a direct neural interface or a brain machine interface, is a direct communication pathway between a human or animal brain(or brain cell culture) and an external device. In one BCIs, computers either accept commands from the brain or send signals to it but not both. Two way BCIs will allow brains and external devices to exchange information in both directions but have yet to be successfully implanted in animals or humans.

Brain-Computer interface is a staple of science fiction writing. In its earliest incarnations no mechanism was thought necessary, as the technology seemed so far fetched that no explanation was likely. As more became known about the brain however, the possibility has become more real and the science fiction more technically sophisticated. Recently, the cyberpunk movement has adopted the idea of 'jacking in', sliding 'biosoft' chips into slots implanted in the skull(Gibson, W.1984).Although such biosofts are still science fiction, there have been several recent steps toward interfacing the brain and computers. In this definition, the word brain means the brain or nervous system of an organic life form rather than the mind. Computer means any processing or computational device, from simple circuits to silicon chips (including hypothetical future technologies like quantum computing).

II. WORKING ARCHITECTURE

Before moving to real implications of BCI and its application let us first discuss the three types of BCI. These types are decided on the basis of the technique used for the interface. Each of these techniques has some advantages as well as some disadvantages. The three types of BCI are as follows with there features:

Dobelle's first prototype was implanted into Jerry, a man blinded in adulthood, in1978. A single-array BCI containing 68 electrodes was implanted onto Jerry's visual cortex and succeeded in producing phosphenes, the sensation of seeing light. The system included TV cameras mounted on glasses to send signals to the implant. Initially the implant allowed Jerry to see shades of grey in a limited field of vision and at a low frame-rate also requiring him to be hooked up to a two-ton mainframe. Shrinking electronics and faster computers made his artificial eye more portable and allowed him to perform simple tasks unassisted.

In 2002, Jens Naumann, also blinded in adulthood, became the first in a series of 16 paying patients to receive Dobelle's second generation implant, marking one of the earliest commercial uses of BCIs. The second generation device used a more sophisticated implant enabling better mapping of phosphenes into coherent vision. Phosphenes are spread out across the visual field in what researchers call the starry-night effect. Immediately after his implant, Jens was able to use imperfectly restored vision to drive slowly around the parking area of the research institute.

BCIs focusing on motor Neuroprosthetics aim to either restore movement in paralyzed individuals or provide devices to assist them, such as interfaces with computers or robot arms. Researchers at Emory University in Atlanta led by Philip Kennedy and Roy Bakay were first to install a brain implant in a human that produced signals of high enough quality to simulate movement. Their patient, Johnny Ray, suffered from 'locked-in syndrome' after suffering a brain-stem stroke. Ray's implant was installed in 1998 and he lived long enough to start working with the implant, eventually learning to control a computer cursor.

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SMART E-HEALTH SYSTEM: Machine learning based e-health system for diseases prediction

[1]Ankush Gadge, [2]Monika Biradar, [3]Vishal Awate, [4]Nisha Bankar, [5] Prof. S. V. Shinde
[1][2]Student of Computer Engineering Department, [5] Prof & Guide of Computer Engineering Department
[3][4] Department of Computer Engineering
[1][2][3][4][5] PDEA's College of Engineering Manjari Bk., Pune, Maharashtra, India
Savitribai Phule Pune University, Pune, Maharashtra, India

Abstract: Diabetes is a highly prevalent condition that affects people all around the globe. Long-term effects of diabetes include heart disease and renal failure, among other things. If this condition is discovered early, people may live longer and enjoy better lives. Nowadays, it seems that the healthcare business generates a large amount of data, which may be analyzed using proper machine learning algorithms and tools to deliver better insights. This kind of analysis aids in the early detection of rare and difficult-to-diagnose disorders, resulting in a higher cure success rate and lower medical costs. The goal of this study is to develop a model that will be able to predict the likelihood of diabetes in patients with the maximum accuracy. Three machine learning methods that may be utilized for data classification were selected for this research, and they are as follows: Multilayer Perceptron and Support Vector Machine On the diabetic data set, all Machine Learning Techniques were used to identify diabetes and detect stages of diabetes, and their results were analyzed using different metrics. In this study, an early-stage diabetes risk prediction dataset from the UCI machine learning repository was used. In a huge dataset, this research successfully demonstrated the capacity to detect individuals with early diabetes risks. Multilayer perceptron seems to categories the patient as diabetic or not with a better degree of accuracy than the other classification algorithms.

INTRODUCTION

Diabetes is a chronic condition that happens when the pancreas doesn't manufacture enough insulin or the body doesn't use it appropriately. Insulin regulates blood sugar. Type 1 diabetics have poor insulin production and must take insulin daily. There's no scientifically proven way to avoid type 1 diabetes. Type 1 diabetes symptoms include excessive urine excretion, thirst (polydipsia), continual starving, weight loss, visual abnormalities, and weariness [1]. Type 2 diabetes, also known as insulin-dependent or adult-onset diabetes, is the most common type of diabetes. Increased body weight and physical inactivity are mostly to blame for this kind of diabetes. The symptoms may resemble those of type 1 diabetes, although they are far less severe. Gestational diabetes is defined as hyperglycemia with a blood glucose level above normal but below the diabetes diagnostic threshold. Diabetes is a condition that develops during pregnancy. During and during pregnancy, women with gestational diabetes are more prone to problems. Women with gestational diabetes, as well as their children, have a higher chance of developing type 2 diabetes later in life. Prenatal screening, not reported symptoms, is used to identify gestational diabetes [2] [3].

Researchers such as [4] and [5] designed and proposed different kinds of machine learning based models to diagnose diabetes disease. However, only a few studies have concentrated on integrating the designed model into a user's app and designing a user interface so that consumers may monitor their health status on their smartphones. Furthermore, those models were trained using only one or two datasets, which does not guarantee that the model would perform as expected in real-world scenarios.

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Survey on Machine Learning based E-Health System for Disease Prediction

Ankush Gadge[1], Vishal Awate[2], Nisha Bankar[3], Monika Birudar[4], Prof. S. V. Shinde[5]
[1-4]Science and computer department, Savitribai Bai Phule Pune University, Pune, Maharashtra, India
[5]PDEA's College of Engineering, Manjari BK, Pune, Maharashtra, India

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ABSTRACT

The health reports of the people including diagnostics information and medical prescriptions are provided in the form of test-based case notes due to this the previous health conditions and the medicines used by the person are not known when they visit the hospital later. But storing all the health information of a person in the cloud as the soft copy reduces this problem. To achieve every hospital, dispensary, laboratory must have an internet connection for registration of patient's data, each patient will be identified by the unique Health ID and all the data of the patient will be stored in the cloud and the data can be accessed by only the particular patient. Accurate and on-time analysis of any health-related problem is important for the prevention and treatment of the illness. To diagnose the disease by accessing all information from linked Health ID with Machine Learning algorithm will boost the system in detection of diseases. Here the work presents review of previous researcher's techniques used for the prediction of diseases and number of parameters used.

Keywords : Cloud Computing, Disease Prediction, Health Id Generation, Machine Learning Algorithm.

I. INTRODUCTION

For the prevention and treatment of health problems, accurate and timely investigation of any health-related issue is critical. In the event of a critical illness, the standard method of diagnosis may not be adequate. The development of a medical diagnostic system based on machine learning (ML) algorithms for illness prediction may aid in a more accurate diagnosis than the current technique.

To create and build a specific framework for a smart health system based on the Internet of Things. The framework takes a tiered approach to addressing critical difficulties with IoT-based smart health systems, including a comprehensive data gathering method from the patient to cloud storage that can be accessed remotely. The numerous illnesses and the factors that are utilised to forecast diseases are described in Section A. Section B describes

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WATER LEVEL MONITORING SYSTEM

Prof. A.A Bamnikar*1, Mr. Kale Swapnil Baba*2, Miss. Patil Shivani Adesh*3, Mr. Vhankade Rajesh Narendra*4, Mr. Pawar Vikrant Subhash*5

*1,2,3,4 Computer Engineering, Pdea's College Of Engineering ,Manjri ,Pune, India.

*5Guide, Computer Engineering, Pdea's College Of Engineering ,Manjri ,Pune,India.

ABSTRACT

To demonstrate this the system makes use of containers, where the ultrasonic sensors placed over the containers to detect the liquid level and compare it with the container's depth. The system makes use of an AVR family microcontroller, Raspberry Pi, LCD screen, Wi-Fi modem for sending data and a buzzer. A 12 V transformer is used for power supply in this system. The LCD screen is used to display the status of the level of liquid in the containers. The liquid level is highlighted as colored to show the level of liquid present in the container with the help of a web page to the user. The buzzer starts ringing when the set limit of the liquid is crossed. Thus this system helps to prevent the wastage of water by informing about the liquid levels of the containers.One of the major problems faced by most of the countries is the issue of water scarcity in the world and wastage during transmission has been identified as a major culprit; this is one of the motivations for this research, to deploy computing techniques in creating a barrier to wastage in order to not only provide more financial gains and help the environment as well as the water cycle which in turn ensures that we save water for our future. The IOT based Water Level Monitoring system is an innovative system which will inform the users about the level of liquid and will prevent it from overflowing.

I. INTRODUCTION

Water is a universal solvent which plays an important role in everyday life. The total amount of water available on earth has been estimated at 1.4 billion cubic kilometers, enough to cover the planet with a layer of about 3km. About 95% of the Earth's water is unfit for human consumption. About 4% is locked in the polar ice caps, and the rest 1% constitutes all fresh water found in rivers, streams and lakes which is suitable for our consumption. A study estimated that a person in India consumes an average of 135 liters per day. This consumption would rise by 40% by the year 2025. This signifies the need to preserve our freshwater resources. Many houses make use of supplementary water tanks to store water that is collected from rain water or water pumped from wells or underground. At present, water meters are used to calculate the amount of water used at homes. This doesn't provide an efficient method of monitoring the water usage. The water is wasted at each and every outlet knowingly or unknowingly which adds up to huge amounts in the end. Efficient management of the water used at homes is very much necessary as about 50% of water supplied to the cities gets wasted through improper usage. Water management is only possible, if the user is aware of the quantity of water he uses and the quantity available to him. Water is essential in every hour of our lives. Hardly anyone keeps in track of the level of water in the overhead tanks. Consequently, automatic control involves designing a control system to function with minimal or no human interference. The idea can be implicitly used to ascertain and control the level of water in overhead tanks and prevent the wastage. In this Arduino based automatic water level indicator and controller project, the water level is being measured by using ultrasonic sensors.

II. OBJECTIVES

1. To learn the working of a water indicator.
2. Measure the water level when the circuits indicate when the tank is half and full.
3. To learn how to build simple circuits.
4. To check the level of water in the tank. Depending on the water level, the motor switches ON when the water level goes below a predetermined level or the motor switches OFF when the tank is full.
5. To display the water level and other important data on a 7-Segment Display.

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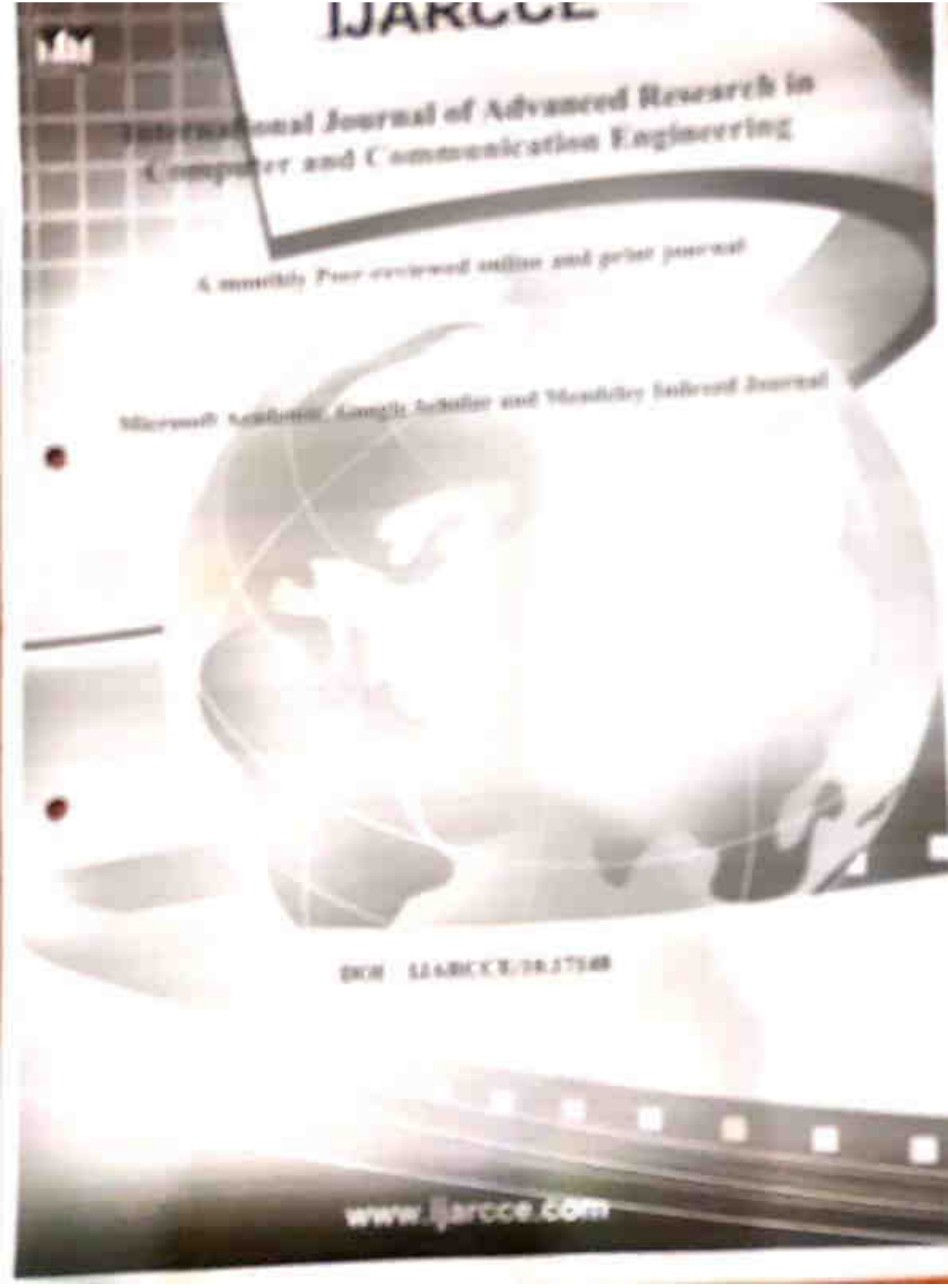

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Water Requirement Forecasting System

Prof. N.V. Gawali[1], Omkar Botre[2], Harshal Ghavate[3], Pooja Hake[4], Ganesh Wakchaure[5]

Assistant Professor, Dept. of Computer Engineering, PDEA's College of Engineering, Manjari Bk Pune, Maharashtra, India[1]

Student, Dept. of Computer Engineering, PDEA's College of Engineering, Manjari Bk, Pune, Maharashtra, India[2,3,4,5]

Abstract: Water is essential for the survival of life on Earth. Both natural and manmade factors contribute to water scarcity. The amount of freshwater on Earth has stayed constant over time, but the human population has exploded. As a result, the search for freshwater becomes more intense every day. For improved and more effective water usage planning, proper management and forecasting are essential. The main parameters for an Urban Water Management are water demand and population forecasting. Machine learning is one of the most well-known forecasting approaches. Machine learning is a data analytics technology that allows machines to learn without having to be fully programmed. Machine learning, unlike previous demand forecasting approaches that were not ideal for historical unstructured and semi-structured data, takes into consideration or has the capability of assessing such data.

Keywords: water demand, forecasting, machine learning.

I. INTRODUCTION

Water is both a vital source of life and a valuable natural resource. Water covers nearly 70% of the earth's surface, and it is assumed that it will always be there for us; however, water shortages are already affecting multiple areas across continents. According to a recent UNESCO study, by 2025, 1.8 billion people living in multiple areas will face severe water shortages, and approximately 33% of the world's population will be under water stress conditions.

Desalination has become a major option for water delivery in recent decades, opening the door to tackling unconventional water resources with great promise for providing sustainable water supply. Desalination provides only around 1% of the world's drinking water, but it is increasing year after year.

Kuwait has a total area of 17,818 km2, a population of 4.62 million (2018), 98 percent of the Kuwait Metropolitan Area, 810 km2 or 4.5 percent of the total area, Kuwait is one of the few countries in the world without rivers or natural lakes, and Kuwait was entirely reliant on distillation plants for its freshwater supplies. Kuwait has been successfully using multi-stage flash distillation units for over 30 years. Kuwait has the greatest global water use per capita, with 500 gallons per person per day.

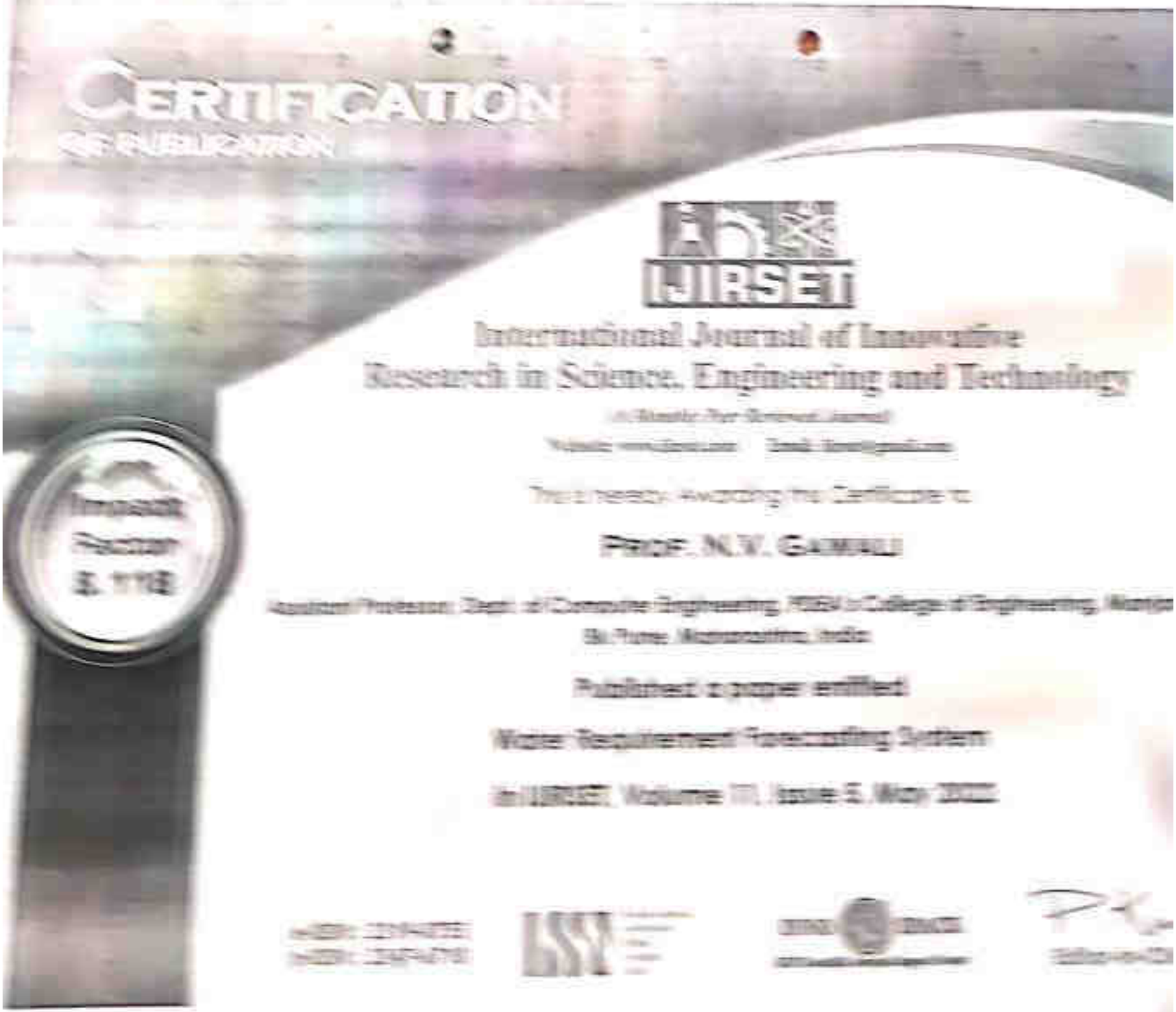
Desalinating seawater is more expensive than other natural resources such as groundwater or rivers because it requires a lot of energy; on the other hand, water recycling and conservation costs $1.09 to $2.49 per thousand gallons [4], with water demand forecasting lowering capture, treatment, storage, and distribution costs. The Water Distribution Network was able to reduce energy expenses by 5.2 percent while reducing energy consumption by 3.1 percent thanks to water demand projections.

The sustainability of economy & society development is to a large extent depending on rationalizing the utilization of water resources, for the last couple of decades desalination has become a vital alternative for water supply. It opens the door to tackle unconventional water resources that has great potentiality to provide sustainable water supply. Desalination offers just about 1% of the world's drinking water, but this amount is rising year-on-year.

State of Kuwait has a total area of 17,818 km2. Kuwait has a population of 4.62 million, roughly 98 percent of Kuwait Metropolitan Area, 810 km2 or 4.5 percent of the total area. Kuwait is one of few countries in the world without rivers or natural lakes, Kuwait was entirely dependent on distillation plants for its freshwater supplies. For about 30 years multi-stage flash distillation plants have been used successfully in Kuwait. The highest global water consumption per capita was recorded in Kuwait at 500 liters per person per day.

II. LITERATURE REVIEW

Shabani et al. [1] suggested a two-stage learning system that combines Gene Expression Programming (GEP) and time-series clustering to anticipate short-term water demand. The technique was put to the test in Milan, Italy, using real-world water demand data. Multi-scale modelling was done using lead intervals of 3, 6, 12, and 24 hours to rearrange hourly



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Assistant Professor, Dept. of Computer Engineering, PDEA's College of Engineering, Manjari Bk Pune, Maharashtra, India

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Student, Dept. of Computer Engineering, PDEA's College of Engineering, Manjari Bk, Pune, Maharashtra, India

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Student, Dept. of Computer Engineering, PDEA's College of Engineering, Manjari Bk, Pune, Maharashtra, India

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DIGITAL CERTIFICATE SYSTEM FOR VERIFICATION OF EDUCATIONAL CERTIFICATES USING BLOCKCHAIN

M. C. Hingane*, Sangram Ranaware**, Ketan More***, Najim Attar****, Kajal Kumari*****

*(Computer engineering, PDEA College of Engineering , pune (India)

**(Computer engineering, PDEA College of Engineering , pune (India)

***(Computer engineering, PDEA College of Engineering , pune (India)

****(Computer engineering, PDEA College of Engineering , pune (India)

*****(Computer engineering, PDEA College of Engineering , pune (India)

Abstract:

While the number of universities, tertiary education students and number of graduates per year constantly increase, the need to easily verify degree certificates generates new business opportunities. In this paper we project two financial models balancing where the price for the service is balanced between the graduate and the employer as the main stakeholders of that service. Students demand a proof-of-certification at low cost and easy to check, employers also demand quick and trustable verification of degrees when recruiting. According to the researches done till date millions of students graduate every year. The problem of fake certificates is a big issue. Getting fake educational certificates in India is not that difficult. Companies hiring thousands of fresher spend large amount of money to get the educational certificates and transcripts verified of applicants. A Digital Certificate using blockchain technology can address this problem. Blockchain is a decentralized distributed digital ledger collectively maintained by a network of computers, called nodes. The data in the blockchain cannot be modified by a person without the consent of everyone else who maintains the records. This makes the data secure.

Keywords: Blockchain, Document Verification, Digital Certificate, distributed, Preprocessing, etc.

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DIGITAL CERTIFICATE SYSTEM FOR VERIFICATION OF EDUCATIONAL CERTIFICATES USING BLOCKCHAIN

M. C. Hingane*, Sangram Rananaware, Ketan More***, Najim Attar****, Kajal Kumari*****

*(Computer engineering, PDEA College of Engineering , pune (India)

Madhuri.borawake@gmail.com

**(Computer engineering, PDEA College of Engineering , pune (India)

Sangram.rananware2001@gmail.com

***(Computer engineering, PDEA College of Engineering , pune (India)

Ketanmore1137@gmail.com

****(Computer engineering, PDEA College of Engineering , pune (India)

Najimattar313@gmai.com

*****(Computer engineering, PDEA College of Engineering , pune (India)

kajalkumarikkv@gmail.com

Abstract:

According to studies conducted so far, millions of students graduate each year. Fake certificates are a significant problem. Fake educational certificates are not difficult to obtain in India. Companies that hire thousands of freshmen pay a lot of money to get candidates' educational certificates and transcripts confirmed. This problem can be solved with a Digital Certificate based on blockchain technology. Blockchain is a distributed, decentralised digital ledger that is maintained by a network of computers known as nodes. A person cannot change the data on the blockchain without the permission of everyone else who maintains the records. This ensures the data's safety.

Keywords: Blockchain, QR code , Student, Public key , Digital Certificates.

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Data Security of Dynamic and Robust Role Based Access Control from Multiple Authorities in Cloud Environment

Vikas Nagrale *, Ashutosh Kumar **, Mayur Yalij***, Prof S.V. Shinde****

*(Computer engineering, PDEA College of Engineering , Pune (India)
Vickynagrale1210@gmail.com

**(Computer engineering, PDEA College of Engineering , Pune (India)
Ashutosh081097@gmail.com

***(Computer engineering, PDEA College of Engineering , Pune (India)
yalijmayur@gmail.com

****(Computer engineering, PDEA College of Engineering , Pune (India)
sashsir@gmail.com

Abstract:

Data integrity maintenance is that the major objective in cloud storage. It includes audition using TTP for unauthorized access. This work implements protecting the information and regeneration of information if someone mishandles it. This job are going to be assigned to a Proxy server. the info of the users are going to be stored publicly and personal area of the cloud. so only public cloud data are going to be accessed by user and personal cloud will remain more secured. Once any unauthorized modification is formed, the first data within the private cloud are going to be retrieved by the Proxy server and can be returned to the user. Cloud storage generally provides different redundancy configuration to users so as to take care of the specified balance between performance and fault tolerance. Data availability is critical in distributed storage systems, mostly when node failures are prevalent in real world. This research work explores about secure data storage and sharing using proposed AES 128 encryption algorithm and Role Base Access Control (RBAC) for secure data access scheme for user. This work also dispensed backup server approach it works like proxy storage server for spontaneous data recovery for all distributed data servers. The experiment analysis has proposed publicly similarly as private cloud environment.

Keywords: RBAC, El Gamal encryption scheme, Secure user access policy, Proxy Key Generation Role Base Access Control (RBAC), Advanced encryption standard (AES), TPA (Third Party Auditor), TMACS: Threshold Multi-Authority Access Control System

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FARMERS AGRICULTURAL PORTAL

Akshaya Mahadik[1], Jay Katre[2], Hritik Rasal[3], Harshal Awate[4], Prof. A.A. Bamanikar[5]*

[1,2,3,4] *Department of computer engineering, Pune district education association college of engineering, Pune, Maharashtra, India.*

**Guide*

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Abstract: *For many years, farmers in India have had a little freedom to choose markets and buyers for their products. All states in the country require that all farm products be sold and marketed through their jurisdiction Farmers can increase margins by selling their products in owned markets without the involvement of middlemen. Agricultural Marketing in India has evolved from catering to local demand through market yards within the range of farm stones to having interconnectivity between markets to spread the value among farmers and consumers. A number of changes in the field of agriculture marketing of the country, such as electronic market, online warehousing, loans, contract farming and others, are creating opportunities for new formats of market which are more efficient at meeting market demand and supply. Infrastructure, technology, and capacity-building will be needed to implement these changes. This system also includes an interactive chatbot. The platform provides general queries for users, such as any questions regarding products or tracking packages. The website includes a live weather broadcast service for its visitors to see the latest weather conditions.*

Key Word: *: Middleman, Agriculture Marketing, Electronic Market, Chat Bot, Weather Broadcast*

I. INTRODUCTION

Portal for farmers to sell products at better rates the aim of this system is to help farmers update farm product related information in the website. Farmer product management website application that helps farmers to get the best price for farming products. Farmers can also improve their profit margins. Farmers can sell their products directly to customers or deliver their products to the seller. Farmers can view the profiles of their workers and direct them as needed. Farmers can find information about agriculture on the Farmers Portal of the Department of Agriculture & Co-operation. A website that provides information on agricultural storage, crops, extension activities, selling the product, and interaction with the you can also reach out to a Buy from a wholesaler for a better price. Let's build a 'CHATBOT' Communication with the customer. Additionally, we are adding a weather broadcast report to this portal for farmer use. Direct contact between the farmer and the customer will result in the price of the products being affordable for the customer. Both the farmer and the customer will benefit, as the customer will save some money and the farmer will gain additional profit.

II. IMPORTANCE

A-With the project, farmer will be offered a better rate from a whole seller or from any user. Moreover, the most significant aspect of the project is that the farmer can sell his own product without the need of a middleman. The farmer can also deliver the product himself for more profit than by using an agent to deliver the product.

A "Chat Bot" is also integrated within the application for communications purposes between the user and the entire sales team.

B-Consumer: In our system, we call 'Consumer' to those people who take production of farmers as their input for their business or personal use, like hotels. In this system, there is login for these people, which is compulsory. After login, they will find list of available items they can buy from farmers like milk, green vegetables, flowers and many more things. They can give orders from

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FARMERS AGRICULTURAL PORTAL

Prof. A. A. Bumanikar[1] Harshal Awate[2] Jay Katre[3] Hritik Rasal[4] Akshaya Mahadik[5]
Department of Computer Science and Engineering,
PDEA's College of Engineering Manjari Pune 411038
harshalawate4042@gmail.com

Abstract — **Agriculture is the world's leading source of food items. All the food substances that are essential viz. Agriculture produces vegetables, proteins, and oils. The carbohydrates provide all living beings with energy. Farmers have great importance in our society. They are the ones who provide us food. Presence of Too Many Intermediates/Middlemen results in the exploitation of both farmers and consumers with the middlemen offering lower prices to farmers and charging higher prices from the consumers. The portal is envisaged to make available relevant information and services to the farming community and private sector through the use of information and communication technologies, to supplement the existing delivery channels provided for by the department. The farmers can gain more profit using this portal and by connecting directly with the customers. Avoiding interference of a middleman. The information obtained can help farmers identify efficiencies that lead to higher productivity and profitability, lower input costs, and optimized fertilizer use. The more a farmer knows about his or her farm, the better their opportunities to strengthen supply chain relationships. This portal will help farmers to get a clear idea about customer requirements and it will also provide information about how to grow required crop and what it will cost. The max-prior algorithm used helps in allocating the highest requirement customer to the farmers to gain better profit. It also helps the farmers in selling their produce quicker. Thus, by this portal the farmers gain more profit hence increasing the country's economy.**

Keywords— Agriculture; Middleman; Products; Chatbot; Weather Report

INTRODUCTION

Agriculture contributes significantly to a country's GDP that is the Gross Domestic Production of a country. By the passing of time, there are a number of revolutions that take place in order to improve agriculture throughout the world or a country. If we talk about agriculture, India has witnessed a number of revolutions, that is, the green revolution, yellow revolution, blue revolution, agriculture. Agriculture affects the biodiversity of a country depending upon agricultural activities. Portal for farmers to sell products at better rates The aim of this system is to help farmers update farm product related information in the website. Farmer product management website application that helps farmers to get the best price for farming products. Farmers can also improve their profit margins. Farmers can sell their products directly to customers or deliver their products to the seller. Farmers can view the profiles of their workers and direct them as needed. Farmers can find information about agriculture on the Farmers Portal of the Department of Agriculture & Co-operation. The crops that are grown should be directly sold to the customers without any middleman so all the profits can directly gain by the farmer himself also customers can have fresh products directly from the farmer. Since the farmer will be dealing with the customer directly, prices of the products offered by the farmer to the customer will also be affordable to the customer. This supports both farmers and the customer where the consumer can reduce their expenses and the producer can gain more profit.

The main objective of this project is to ensure a direct line of communication between the User and the farmer. A farmer can also sell his product directly to the customer and he will get the profit. Also, weather information is available to the farmer so he knows in what weather to grow the particular crop. As the farmers are less aware of the current requirements and technologies, this portal would be very helpful and effective to know the information about crops in whole India. Since farmers don't know about current trends and technologies, they ask for help from middleman and middleman takes advantage of this and farmers couldn't get all the profit. To avoid these situations, proper awareness and use of current technologies must be given to the farmers. As the technologies develop very rapidly, this awareness can have a major impact on future generations and it will contribute a large amount of growth to the nation's economy. The paper consists of the following subdivisions. Section II represents the research gaps containing various models of E-trading systems that benefit the producers and the consumers. Section III discusses the proposed web application along with the algorithm designed to maximize profit for the farmers. Section IV shows the screenshots of the web application along with the price and profit comparison of traditional method and the spry farm application. Finally, the conclusion and future enhancement are mentioned in the last section.

I. RELATED WORK

In order to solve the unfair conflicts of wages to the farmers, a web portal for trading has been designed by (Raghu Raman D) which is based on providing details of seeds and fertilizers of produce at fair prices and would bridge up all the unfair means of crop produce, procurement and sales [1]. (Venkateswarao) has designed an E-application System which allows farmers to set their own price to their products and allows buyers for e-auction. Farmers can set the initial bid amount based on the quality [2]. Due to development of this system, direct profit amount is provided to the farmer directly and advancement to this system will bring more communication about requirements between farmers and customers without a middleman.

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Spoilage detection and shelf life prediction of food using Internet of Things and Machine Learning

Madhuri Borawake, Aradhana Sharma, Ulfat Shaikh, Sejal Barkade, Rutuja Paturkar

Department of Computer Engineering

Pune District Education Association's College of Engineering, Pune, Maharashtra, India

Abstract:

Food spoilage is a crucial problem everyone is facing in the world. Every year about 48 million cases of food-borne illness are reported across the world. This is due to the consumption of spoiled food. Spoiled food contains several volatile organic compounds which are harmful to health. So, it is necessary to develop a system that can detect food spoilage before even the signs of spoilage are visible. The system aims at detecting spoiled food using appropriate sensors and by monitoring gases released from food. Different sensors are used to detect different parameters of food such as pH, moisture, oxygen level, ammonia gas, methane, and ethylene. The microcontroller takes readings from sensors. These readings are used as input to the machine learning model which will determine whether food is spoiled or not. If food is not spoiled, then the ML model will also predict the lifespan of food. This would help consumers to consume fresh food and avoid food-borne illnesses. With the help of this gadget, human mistakes that occur during the inspection can also be avoided. As in this system, the work of humans has been taken by the sensor, due to which there is no chance of human errors. That's why its accuracy has increased. The device gets the accurate results while detecting food spoilage. Time and money consumption can be reduced due to the high efficiency of the system, which will be profitable for large industries.

IndexTerms - **Arduino Uno, Internet of Things, Machine Learning, Sensors, Spoilage detection.**

I. INTRODUCTION

In today's world, food spoilage is crucial problem in food industry as consuming spoiled food is harmful for human's health. About 351,000 people die of food poisoning globally every year. The freshness of food can be detected manually but manual detection in a large scale industry is almost impossible and also may led to human error and environmental defects. So it is necessary to develop a device that can detect the freshness of food and also the lifespan. Proposed system will detect the spoiled food using biosensors[7] which is used to monitors the gases released by particular food items and ML technologies such as KNN[6] algorithm. Biosensor plays a vital role to detect the food spoilage. Based on the combination of the sensors outputs of the food items should be detected.

II. LITERATURE SURVEY

Food spoilage can be detected manually by checking color, tasting it or by smelling it. But manual checking is time consuming, less efficient and expensive due to human errors, environmental defects as checking color or taking smell sometimes gives wrong results. Various food quality monitoring systems and food spoilage detection systems are made using various technologies.

To analyze the images of food item, image processing[3] technique is used. The color, texture and shape are analyzed using computer vision algorithms in order to classify the food based on the color, size, maturity, defects etc. Fuzzy Logic is used to handle the fuzzy information and rule-based inference to construct decision support in real life applications. To estimate the expiration of food commodities, fuzzy set theory is used [5].

eFresh[7] is a device developed with biosensors that measures pH, moisture, and ethanol level of food item. The user can input the food to be checked from Android mobile application, the selection of food item from application gives command to Arduino Uno with communicating through Bluetooth module and microcontroller takes the reading from sensor and decision is made based on predefined algorithm and output is displayed on LCD.

A unique method is introduced for detecting food deterioration by combining picture classification with machine learning techniques and artificial intelligence [1]. They have used AI, deep CNN networks, computer vision, and ML

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E-Gadget to Detect Food Freshness using IoT and ML

Dr. M. P. Borawake[1], Aradhana Sharma[2], Ulfat Shaikh[3], Sejal Barkade[4], Renuja Paturkar[5]
[1]Professor, Computer Department, PDEA's College Of Engineering, Manjari, Pune
[2,3,4,5]Student, Computer Department, PDEA's College Of Engineering, Manjari, Pune

Abstract: *The food we consume plays an important role in our daily life. It provides us energy which is needed to work, grow, be active, and to learn and think. The healthy food is essential for good health and nutrition. Light, oxygen, heat, humidity, temperature and spoilage bacteria can all affect both safety and quality of perishable foods. Food kept at room temperature undergoes some chemical reactions after certain period of time, which affects the taste, texture and smell of a food. Consuming spoiled food is harmful for consumers as it can lead to foodborne diseases. This project aims at detecting spoiled food using appropriate sensors and monitoring gases released by the particular food item. Sensors will measure the different parameters of food such as pH, ammonia gas, oxygen level, moisture, etc. The microcontroller takes the readings from sensors and these readings then given as an input to a machine learning model which can decide whether the food is spoilt or not based on training data set. Also, we plan to implement a machine learning model which can calculate the lifespan of that food item.*
Index Terms: *Arduino Uno, Food spoilage, IoT, Machine Learning, Sensors.*

I. INTRODUCTION

In today's world, food spoilage is a crucial problem as consuming spoiled food is harmful for consumers. In India, food commodities are wasted due to spoilage. Various factors cause food spoilage, making items unsuitable for consumption. Factors like humidity, moisture, temperature, light intensity, etc. causes food decay. Consuming spoiled food can cause illness commonly known as food poisoning and hence detection of freshness of food or food quality is needed. Also, preservatives used to increase lifespan of food causes people illness and reduces food quality. The freshness of food can be detected manually by smelling it, tasting it or by observing color changes or state of fruits, vegetables or food item. But manual detection is time consuming, also it may have human errors or environmental defects. Therefore, it is important to create device which can determine food spoilage without human interference. This project aims at detecting spoiled food using appropriate sensors and monitoring gases released by the food item. The parameters like pH, humidity, oxygen gas are tested, as increase or decrease in these parameters may reduce the quality of food. Biosensors play a vital role to detect the bacterial contamination in food sample. Based on the combination of the sensor outputs quality of the food should be detected. Our system proposes a device which contains gas sensors, pH sensors, moisture sensor for real time monitoring. These values are communicated to laptop and ml model using esp8366 wifi module. The values extracted are then fed as an input or test data to ml model and tested against trained model. The machine learning model tells the user, what is the current state of food, good to eat or ready for bin. Also, we plan to implement a machine learning model which can calculate the lifespan of that food item.

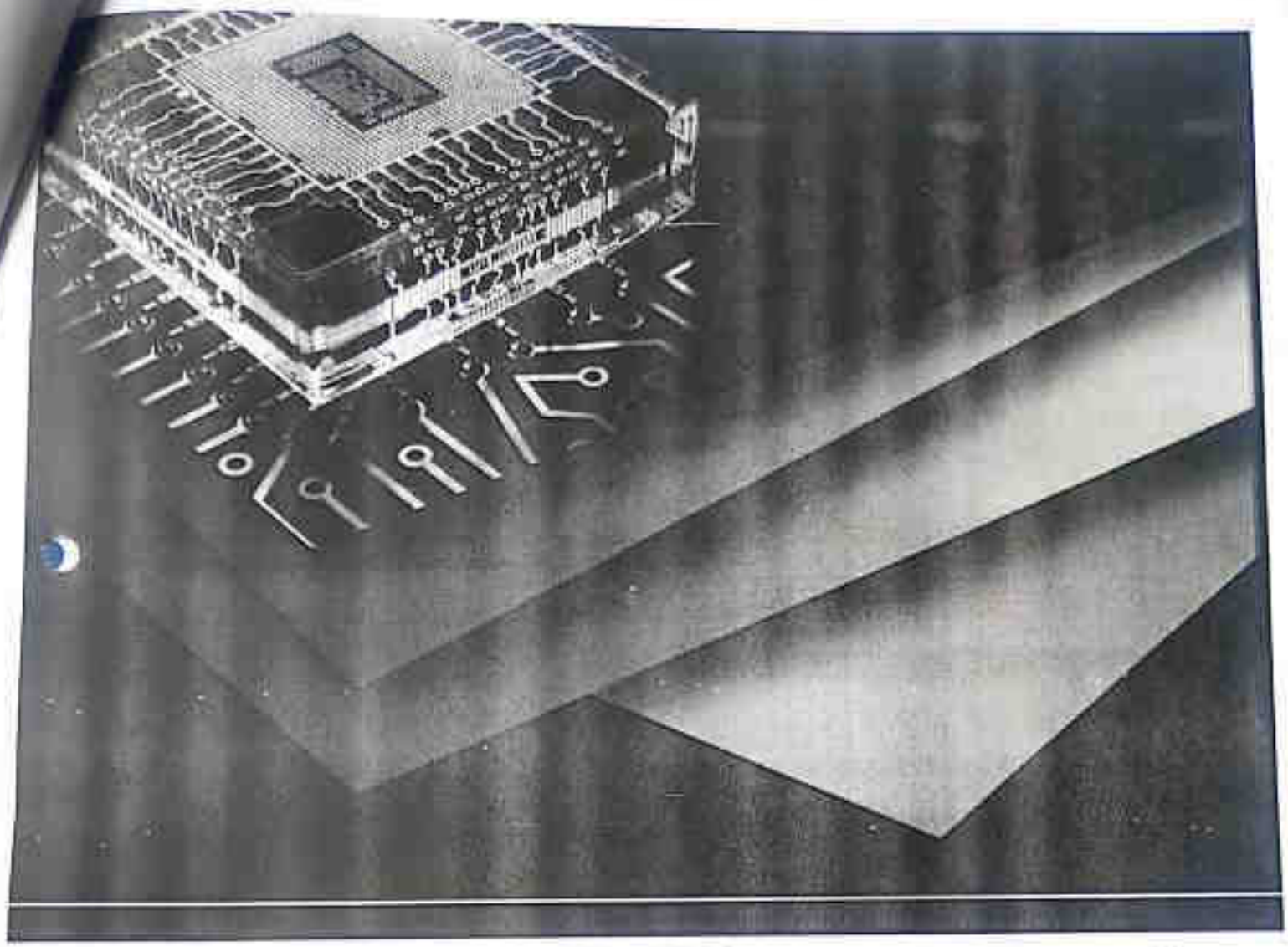
II. LITERATURE REVIEW

Food spoilage can be detected manually by checking color, tasting it or by smelling it. But manual checking is time consuming, less efficient and expensive due to human errors, environmental defects as checking color or taking smell sometimes gives wrong results. Various food quality monitoring systems and food spoilage detection systems are made using various technologies.

Image processing technique is used to analyze the images of food item using computer vision algorithms. The color, texture and shape are analyzed in order to sort the food, specifically vegetables and fruits, based on the color, size, maturity, defects etc. Fuzzy Logic is used to handle the fuzzy information and rule-based inference to construct decision support in real life applications. To estimate the expiration of food commodities, fuzzy set theory is used [1].

Machine learning uses the sample datasets (known as training datasets) to train the model in order to make decisions, in this case, to determine whether the food is spoilt or not. In [2], machine learning algorithms PCA and KNN are used to determine the food spoilage. The information from MQ gas sensors is fed to PCA to reduce the data and KNN is used for classification of food.

Deep learning works with artificial neural networks, which are designed to imitate how humans think and learn and make machine behave like human brain. In [3], the fruit type and quality is determined using convolutional neural networks.



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COLLEGE MANAGEMENT WEB APPLICATION SYSTEM USING MEAN STACK

Ketaki Sonane *, Sakshi Naikwadi**, Mayuresh Koli*** , Harshal Sonawane****, Prof. S.V. Shinde*****

*(Computer engineering, PDEA College of Engineering , pune (India)
Ketakisonane21@gmail.com

**(Computer engineering, PDEA College of Engineering , pune (India)
Sakshinaikwadi15820@gmail.com

***(Computer engineering, PDEA College of Engineering , pune (India)
Mayureshkoli296@gmail.com

****(Computer engineering, PDEA College of Engineering , pune (India)
Harshalsonawane8888@gmail.com

*****(Computer engineering, PDEA College of Engineering , pune (India)
sashsir@gmail.com

Abstract :

The main goal of this project is to add mobility and automation to the process of managing student information in the laboratory. In real-world scenarios, for example, on a university campus, information is distributed to students in the form of notifications, handwritten manuals, and word-of-mouth messages. Today, it is important to communicate faster and easier between students using new formats such as mobile phone technology, as well as predictable forms of expression.The central idea of this project is the implementation of a web-based campus application for further development of educational institutions and educational systems. This application is used by students, teachers and parents. In previous systems, all information had to be displayed in a hard file or website. At the same time, searching for information is difficult to access and takes a long time to search existing websites. Therefore, to solve this problem, you can use a Web based application with MEAN Stack to make this process easier, more secure, and less error-prone. This system provides more efficient information.

Keywords: Mobility, Cryptography, Secure Random, Encryption.

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Academia: Web Platform for E-learning.

Kishor Naykodi[1], Abhishek Lavale[2], Abhishek Raut[3], Prajwal Gadekar[4]

And Prof. S.V.Phulari[5]

[1,2,3,4]Student of Bachelor of Engineering, Dept. of Computer Engineering, Pune District Education Association's College of Engineering, Pune, Maharashtra, India

[5]Professor, Dept. of Computer Engineering, Pune District Education Association's College of Engineering, Pune, Maharashtra, India

ABSTRACT

— This paper shows how an E-learning management system may be used to improve an existing manual method. The technique seeks to create an E-learning web application with a better and safer user experience for students and teachers, as well as an interactive teaching-learning platform. E-learning systems can lead to a management system that is error-free, secure, dependable, and quick. It can let the user focus on learning rather than record-keeping and other administrative tasks. It will assist the organisation in making better use of its resources.

Keywords: Research Paper, Technical Writing, Science, Engineering and Technology

I. INTRODUCTION

Innovation has changed such a great amount over the most recent couple of years that everybody ought to be exceptional. Training, medication, person-to-person communication, and an assortment of different fields have all been influenced by innovation. Everybody tries to be quicker and more shrewd in the realm of innovation. We are endeavoring to fix the issue of the school system in this paper with the goal that it turns out to be more compelling and fascinating. The E-learning Management System works on the effectiveness of the instructing educational experience. It is more well known and broadly used these days. E-learning is a stage for discovering that consolidates data with electronic media and correspondence advances. Different expressions for E-learning incorporate PC based preparing, online training, and innovation improved learning, among others. Our e-learning stage incorporates highlights like reinforcing and advancing students' associations with teachers, merging all usefulness into one stage for a superior client experience, and making task booking straightforward. We additionally give elements like client execution, conversation discussions, courses, and asset sharing, among others.

We might utilize these elements to work out client execution, share concentrate on materials, transfer tasks, talk with different students and teachers, sign up for courses, and gain new advanced abilities. Learning is more powerful and agreeable when you utilize an E-learning stage.

1. Literature Survey

Internet learning has become more well known among students as of late. E-learning has turned into a well known issue in the field of Artificial Intelligence and is perhaps the most famous instructive turn of events. E-learning is one of the main impacts of the web upheaval. In spite of the fact that it can't deal with all elements of the organization, for example, a few courses that require down to earth abilities and management, it increments students connection with addresses, which prompts the accomplishment of the gaining objective since students can get to data from anyplace and whenever.

Florentina Magda Enescu, Gheorghe Urban, and Mariana Jurian introduced the examination at the Romania 2019 on Electronics, Computers, and Artificial Intelligence(ECAI) International Conference eleventh Edition 2019. The PHP programming language was picked after a few investigations of the most modern web programming dialects for carrying out the application for the E-Learning module, and the structure made depends on the programming language, PHP, Laravel, which was the latest rendition delivered. The MySQL data set was decided to store the data.

Vaishnavi Agarwal, Nandita Pandey, KM Anjali, Anandhan K, Damodharan D Noida2021 distributed a paper on the specialized parts of learning frameworks (ICACITE). Fostering an instructive site seems OK since we can do a ton with it to guarantee its prosperity. Assuming it gives exact and opportune data, an instructive site can assist with laying out brand validity.

Prof. Smita Deshmukh, Mr Deepak Mane, and Mr Abhijeet Retawade distributed their examination on specialized parts of single site page applications in the Proceedings of the Third International Conference on Computing Methodologies and Communication in Mumbai in 2019. (ICCMC 2019). A solitary page application or site doesn't continually reload pages from the server and on second thought associates with the client by powerfully changing the ongoing page. While visiting resulting pages, the client experience isn't disturbed along these lines, causing the program to work like a work area. In single-page applications, the source code is put away with a solitary page burden, or specific assets are stacked and added to the page

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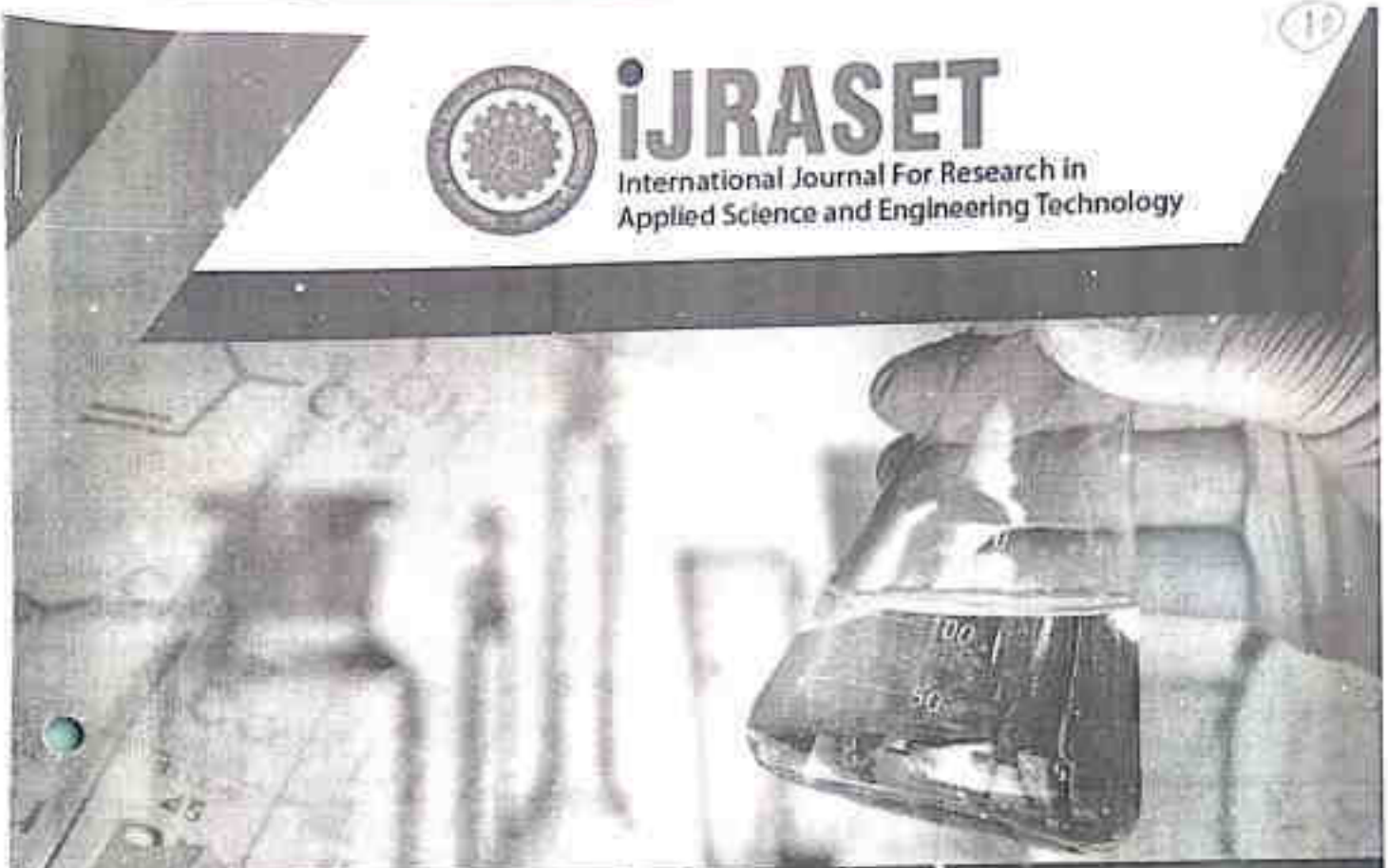

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S. V. Phulari[1], Abhishek Lavale[2], Abhishek Raut[3], Kishor Naykodi[4], Prajwal Gadekar[5]
[1, 2, 3, 4, 5]Dept.Computer, PDEA'S College Of Engineering Manjari (BK), Pune, India

Abstract: *This paper illustrates how we can improve the existing manual system with the help of E-learning management system. The method aims to build an E-learning web application having better and safer user experience and provides an interactive teaching-learning platform for students and teachers. E-learning Management System is way of solving the educational problems using the modern technologies. It gives an error free, secure, reliable and fast management system. It can assist the user to concentrate on learning rather to concentrate on the record keeping and other stuff. It will help organization in better utilization of resources.*

Keywords: *Web application, Database, backend, frontend, platform, E-learning, Frameworks.*

I. INTRODUCTION

In past few years' technology get changed in way that everyone should be up to date. Technology affected every sector such as education, medication, social networking and lot more. In the world of technology everyone wants to be a faster and smarter. In this paper we are trying to solve the problem of educational system so it gets effective and entertaining.

The E-learning Management System makes teaching-learning process effective. It is mostly being used nowadays and is gaining popularity. E-learning provides a learning platform by using information with electronic medium and technologies for communication. We can use E-learning use as other alternative terms such as computer-based training, online education or technology-enhanced learning and others. E-learning platform made by us provides a features like improving and facilitating the students' relationship with the teaching staff, placed all the functionality in one platform so that user gets the better experience, task scheduling has been made easy. Also, we are giving functionalities like user performance, discussion forums, courses, resource sharing etc. Using these functionalities, we can calculate user performance, share study material, upload assignments, chat with fellow students and teachers, also enroll for courses and learn new skills in the field of technology. Overall using E-learning platform makes learning effective and entertaining. The aim of creating an E-Learning Web Application is to use the latest web technologies to develop a solution for educational system and provide error free, reliable, secure and interactive self-learning online platform for enthusiastic learner.

II. LITERATURE SURVEY

E-learning can be described as the utilization of modern technologies and Internet to make education effective. In recent years E-learning is one of the major trends in education. E-learning is among the most important explosion propelled by the internet transformation. Although it has the inability to handle all functions of the institution such as some courses that require practical skills and supervision but it also increases the interaction among students and lectures which in turn will lead to achieve the learning goal as students are able to access anywhere and anytime

The study was presented by Florentina Magda Enescu, Gheorghe Şerban, Mariana Jurian Romania 2019 on Electronics, Computers and Artificial Intelligence (ECAI) International Conference 11th Edition published in year 2019. After several analyzes of the most sophisticated web programming language for implementing the application for the E-Learning module, the PHP programming language was chosen and the framework created is based on the programming language that is PHP, Laravel which was latest version released. For storing the data, it was chosen to use the MySQL database.

Keeping the technical aspects of the elearning system in mind research conducted by Vaishnavi Agarwal, Nandita Pandey, KM Anjali, Anandhan K, Damodharan D Noida2021 published on International Conference on advance computing and Innovative Technologies in Engineering (ICACITE). Creating an educational website creates a lot of business sense as we can do a lot of things with it, to ensure its success. An educational website, if it provides accurate and much-needed information, can help build brand credibility.

In the technical aspects of Single Web Page Application research conducted by Prof. Smita Deshmukh, Mr. Deepak Mane, Mr. Abhijeet Retawade Mumbai 2019 in Proceedings of the Third International Conference on Computing Methodologies and Communication (ICCMC 2019). A single-page application is a web application or web site that does not reload the page always from the server and interaction with the user is done by dynamically changing the current page. The user experience is not interrupted in this way while accessing successive pages and makes the application behave like a desktop.

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Driver Drowsiness Detection Using Machine Learning

Prof. Swati Gade[1], Kahtija Kamble[2], Aishwarya Sheth[3], Sakshi Patil[4], Siddhi Potdar[5]
[2,3,4,5]Computer Engineering Department, PDEA'S College of Engineering Manjari(bk) ,Pune-412307, India
[1]Savitribai Phule Pune University

Abstract: *This document is a review report on the research conducted and the project made in the field of computer engineering to develop a system for driver drowsiness detection to prevent accidents from happening because of driver fatigue and sleeping. The report proposed the results and solutions on the limited implementation of the various techniques that are introduced in the project. Whereas the implementation of the project gives the real world idea of how the system works and what changes can be done in order to improve the utility of the overall system.*

Furthermore, the paper states the overall of the observation made by the authors in order to help further optimization in the mentioned field to achieve the utility at a better efficiency for a safer road.

Keywords: *Driver drowsiness, eye detection, yawn detection, blink pattern.*

I. INTRODUCTION

Humans have always invented machines and devised techniques to ease and protect their lives, for mundane activities like traveling to work, or for more interesting purposes like aircraft travel. With the advancement in technology, modes of transportation kept on advancing and our dependency on it started increasing exponentially. It has greatly affected our lives as we know it. Now, we can travel to places at a pace that even our grandparents wouldn't have thought possible. In modern times, almost everyone in this world uses some sort of transportation every day. Some people are rich enough to have their own vehicles while others use public transportation. However, there are some rules and codes of conduct for those who drive irrespective of their social status.

One of them is staying alert and active while driving. Neglecting our duties towards safer travel has enabled hundreds of thousands of tragedies to get associated with this wonderful invention every year. It may seem like a trivial thing to most folks but following rules and regulations on the road is of utmost importance. While on road, an automobile wields the most power and in irresponsible hands, it can be destructive and sometimes, that carelessness can harm lives even of the people on the road. One kind of carelessness is not admitting when we are too tired to drive. In order to monitor and prevent a destructive outcome from such negligence, many researchers have written research papers on driver drowsiness detection systems. But at times, some of the points and observations made by the system are not accurate enough. Hence, to provide data and another perspective on the problem at hand, in order to improve their implementations and to further optimize the solution, this project has been done.

A. Motivation

Now-a-days, there is huge increase

in private transportation day by day in this modernize world. It will be tedious and bored for driving when it is for long time distance. One of the main causes behind the driver's lack of alertness is due to long time travelling without sleep and rest. Tired driver can get drowsy while driving.

Every fraction of seconds drowsiness can turn into dangerous and life- threatening accidents may lead to death also. To prevent this type of incidents, it is required to monitor driver's alertness continuously and when it detects drowsiness, the driver should be alerted. Through this we can reduce significant number of accidentsand can savelives of people.

II. LITERATURE SURVEY

A. System Review

This survey is done to comprehend the need and prerequisite of the general population, and to do as such, we went through different sites and applications and looked for the fundamental data. Based on these data, we made an audit that helped us get new thoughts and make different arrangements for our task. We reached the decision thatthere is a need of such application and felt that there is a decent extent of progress inthis field too.

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AN INTERACTIVE WEB BASED GAME

Prof. N.V. Gawali [1], Ayush Bhat [2], Ajit Tarade [3], Devashish Maharaul Baker [4], Hrithikesh Kishor Chavan [5]
[1] Professor, Department of Computer Engineering, PDEA's College of Engineering, Manjari Bk. Pune, Maharashtra, India
[2] [3] [4] [5] UG Students, Department of Computer Engineering, PDEA's College of Engineering, Manjari Bk. Pune, Maharashtra, India

Abstract: This project aims to develop an internet web browser based strategy game application. Strategy games engage the player for a long time and improve cognitive skills. Various web platform games are available on the internet, and our game is also inspired from them. We have tried to keep the user interaction simple and easy to understand as one has not to go many steps to accomplish a task in the game. A thorough study has been done and results from various paper related to web game user interaction has been included in our game. This is just the first model of the game, various possibilities exist for the future where we can extend the game. We have also planned to develop this application into an internet business where upgraded users have to pay real money to play the game and we'll provide attractive incentives to the winner of the game. This game will also be integrated with various social networking websites such as Facebook, so that we can attract a large number of players across the world. The main purpose of the game is to provide entertainment along with improving different cognitive skills. Such games attract a lot of consumers, who are eager to test their planning and decision based skills. Target users of the game are mainly school and college students along with interested adults.

Keywords: Games, Automation, Image Recognition, Image Resolution, Mobile communication, online game, Strategy.

I. INTRODUCTION

An online browser game is a game which is played on internet using browsers. These browser games run using standard web technologies or browser plug-ins, such games usually involves use of standard web technologies as a front end and other technologies as a back end. Browser games include all video game genres and can be single player or multiplayer. Browser games are also portable and can be played on multiple different devices, web browsers and operating systems. Standard web technologies such as HTML, CSS, PHP, and JavaScript can be used to make browser games, but these have had limited success because of issue with browser compatibility and quality. These technologies collectively termed dynamic HTML, allow for games that can be run in all standard compliant browser. As we advance in information technology, number of internet users are increasing day by day. In last few years, this number has increased significantly as people are being aware of the use of internet. Internet users like to gain information as well as keep them entertained by listening online music, playing online games, etc. A large section of the internet users like to play variety of online games. These games do not require any special requirement, any user can play such games using their internet browser. Internet browser games have an advantage over Standaloce games as they do not require any setup or special requirement on the players system. Browser games are easy to access and made short to provide entertainment and challenge to the user in as easy way as possible. There is a large variation present in online games. Few examples can be shooting games, mathematical games, action games, puzzle games, strategy games, etc. But most of these games are developed by foreign countries' developers. The lack of Indian based online games which lead us to take this project of developing an Indian theme game. Games to which users can relate, are more attractive and people like to play such games often. This project aims to fulfill such gap by developing an Indian theme based online game.

II. LITERATURE REVIEW

Earliest online gaming started around 1969. In 1970s and 80s when Dial up bulletin boards became popular it gained more attention. At that this Dial up method was used by players to play online games. Commercial online service was introduced in 1980s and interactive online games were introduced after that. In the 1990s, with the introduction of Java and Flash technology, several online games were introduced based on these technologies. This gave a great boom to the online games.

We started the project by referring to various online games and research papers on interaction design and game development. The results of the study is discussed as below.

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Multi Images Steganography using Neural Network

Gayatri Ulhas Kadam[1], Purva Ignathi Jadhav[2], Trupti Shahaji Chandanshive[3], Kajal Vilas Shinde[4], Mrs. Ashwini Hemantkar[5]
[1, 2, 3, 4, 5] Computer Engineering, PDEA College of Engineering, Pune (India)

Abstract: Currently, the most successful approach to steganography is empirical objects, such as digital media, is to embed the payload while minimizing a suitably defined distortion function. The design of the distortion is essentially the only task left to the steganographer since efficient practical codes exist that embed near the payload-distortion bound. The practitioner goal is to design the distortion to obtain a scheme with a high empirical statistical detectability.

In this paper, we propose a universal distortion design called universal wavelet relative distortion (UNIWARD) that can be applied for embedding in an arbitrary domain. The embedding distortion is computed as a sum of relative changes of coefficients in a directional filter bank decomposition of the cover image. The directionality forces the embedding changes to such parts of the cover object that are difficult to model in multiple directions, such as textures or noisy regions, while avoiding smooth regions or clean edges. We demonstrate experimentally using rich models as well as targeted attacks that steganographic methods built using UNIWARD match or outperform the current state of the art in the spatial domain, JPEG domain, and side-informed JPEG domain.

I. INTRODUCTION

Steganography is an algorithm to conceal information within an object while keeping the object containing the hidden information indistinguishable from the original one.

The main purpose of steganography is to grant access to the hidden information only to the authorized clients while keeping its content and its presence unrevealed to the others. Encryption Standard image steganography methods usually aim at hiding secret image within a cover image.

To this end, various studies including spatial domain-based methods and frequency domain-based methods have been actively conducted, and remarkable results have been achieved. The hiding network takes a cover image and a secret image as inputs then creates a container image by hiding the secret image into the cover image. The revealing network extracts a hidden secret image from the container image.

A. Motivation

In this project we primarily concentrated on the data security issues when sending the data over the network using stenographic techniques. The main objectives of our project are to product security tool based on steganography techniques to hider message carried by stego-media which should not be sensible to human beings and avoid drawing suspicion to the existence of hidden message. We aim to make an effort in a similar direction, by utilizing the ideas from the aforementioned papers to encode multiple images into the single cover image. Unlike traditional methods, we use the same resolution cover and secret images and we aim to keep the changes to the encoded cover image unnoticeable to human perception and statistical analysis, while at the same time keeping the decoded images highly intelligible.

B. Problem Statement

This project addresses the security problem of transmitting the data over internet network, the main idea coming when we start asking that how can we send a message secretly to t destination? The science of steganography answers this question. Using steganography, information can be hidden in carriers such as images, audio files, text files, videos and data transmissions. In this document, we proposed some methods and algorithms of a multi-image steganography system to hide an images of a secret message. We aim to hide multiple images (2 or more) in one not-so-secret cover images. The embedded secret images must be removable with minimum loss. The encoded cover images must look like the original cover images.

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College Website Using MERN Stack

Dr. Ritesh Patil[1], Vaishali Gentyal[2], Vaishnavi Mudaliar[4], Gauri Kanpurne[5], Devyani Ambi[6]
[1,2,3,4,5]Pune District Education Association's College of Engineering Manjari (BK), Pune 412307 (Maharashtra) India

Abstract: College Website is that the Growing significance of internet sites for various organizations is well known. Today, a well-planned digital strategy plays a significant role in an institution's marketing strategies — especially considering younger generations' growing dependence on technology. Put simply, a well-designed website will facilitate you're engaging, current students, connect with prospective ones, and inform parents all without delay. It encompasses promoting school events, displaying course offerings, and showcasing campus life, etc. during this paper, we discuss the models submitted by our team, login, Admin panel, Instructor, Fees payment, and About us page. For these modules, we've used technical stacks ReactJs, Bootstrap (Front-end), NodeJs, ExpressJs, and MongoDB for Database.
Keywords: Full-Stack Development, College Website, Web Design, Web Development, Reactjs, Nodejs, Express, MongoDB.

I. INTRODUCTION

The College Website is developed to disallow the issues that are common in the institution's manual system. This software is carried out to get rid of and in some instances decrease the affliction faced by this current system. Moreover, this system is designed for the particular need of the company to carry out operations in a smooth and effective manner.

HTML, CSS, and Javascript are the foundation of Web development but are not long-lasting sufficient to carry out all the modern challenges. So we will be using MERN Stack to develop the website. MERN Stack: MERN Stack is a Javascript software Stack that is used for better and easier, faster deployment of full-stack web applications. MERN Stack comprises four key technologies namely: MongoDB, Express, React, and Node. js. It is designed to make the development process Effortless and trouble-free. it is cost-effective, UI rendering and performance are much more efficient than basic stacks, open-source, and Easy to switch between client and server.

This page accommodates information about Management, Campus, Facilities, Departments, Admission, fees payment, etc. The student login module helps the student to log in to the site and easily download documents. For that student must type the username and password correctly. Users can through our site and access the services offered by the Admin. Through the student panel student can access the fees payment model, online attendance, etc.

II. OBJECTIVE OF PROJECT

The key function of the project is to adapt the previous technical stacks (Html, CSS) into the modern technical stacks (MERN). All the elements of the MERN stack are open source, and thus you can bring them into use to create powerfully built web apps. Free templates are available online, which will save you tons of time. It would have taken at least three times as long to customize a theme compared to downloading a template solution.

This stack is completely dependent upon open-source technology so that the developer's team can utilize it freely, which means you don't have to make each component from the beginning. The underlying technology gets so well documented that you can deploy it with ease.

Most intrinsic is that MERN is a full-stack development technique that means you're liable for constructing an application's frontend and backend components. This technique extracts principles from both UI design and software engineering.

The objective of our project is to design, publish and maintain a website for our college which consists of all the information regarding the college like infrastructure, faculty, transport facilities, etc.

Our project is completely web-oriented application software that enables us to access the absolute extraction about the college, staff, students, facilities, etc. this website shows a virtual view of the Campus. On this website, we will find the latest data about the students and staff.

This generic application is designed for assisting the students of an institute regarding the information on the courses, subjects, classes, assignments, grades, and timetable. It also provides support that a faculty can also check about his daily schedule, can upload assignments, and notices to the students. Here the executive admin will be controls the accounts of the student and faculties, makes the timetable, and upload the latest information about the campus events at the site.

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Online Child Predator Detection Using Ml

**Prof. Swati Gade[1], *Utkarsha Bhadre, *Tabbasum Shaikh, *Sarika Waghmode, *Mahesh Bangar.

**Professor, Computer department, Pune district education association's college of engineering, Manjari, Pune.

*Student Computer Department, Pune district education association's college of engineering, Manjari, Pune.

ABSTRACT Proficient analysis should aid the more completely comprehend the risks of online sexual sites and manners by which to shield youth from sexual stalkers who utilize the Internet. Albeit the Internet has numerous positive angles, quite possibly the most malicious aspect is its expected use for online sexual predation. The Internet addresses a medium that permits sexual stalkers admittance to innumerable kids in a moderately mysterious climate. The primary goal of our task is to distinguish kid hunter base on remarks and post of web-based media account and send hunter record to digital cell admin. A late public review demonstrated that around one out of five youth are requested for sex over the Internet yearly (Finkelhor, Mitchell, and Wolak, 2000; Mitchell, Finkelhor, and Wolak, 2001). This task report presents our present advancement to empower the formation of the framework. Thus, with the created framework, youngster hunter accounts recognition any report to administrator for additional activity.

INDEX TERMS ML, dataset, Training Module, Predator.

I. INTRODUCTION

The online exposure of children to pedophiles is one of the fastest growing issues on social media. As of March 2014, the National Society for the Prevention of Cruelty to Children (NSPCC) reported that i) 12% of 11-16 year olds in the UK have received unwanted sexual messages, and ii) 8% of 11-16 year olds in the UK have received requests to send or respond to a sexual message [16]. The detection of children cyber-sexual-offenders is therefore a critical issue which needs to be addressed. Children in their teens have started to use social media as their main means of com-munication [20]. Moreover, a recent study of cognition, adolescents and mobile phones (SCAMP) has revealed that 70% of 11-12 year olds in the UK now own a mobile phone rising to 90% by age 14 [78]. While social media outlets (e.g., chat rooms, images and video sharing sites, microblogs) serve as contact points for pedophiles (predators) to potentially exploit children to achieve the automatic detection of child abuse on the Web is still an open question. A common attack from paedophiles is the so-called online child grooming, where adults engage with minors via social media outlets to eventually exchange sexually explicit content. Such grooming consists of building a trust relationship with a minor, which finally leads into convincing a child to meet them in person [19].

Previous research on detecting cyberpaedophilia online, including the efforts of the first international sexual predator identification competition (PAN-12) [11], has focused on the automatic identification of predators in chat-room logs. However little has been done on understanding predators behaviour patterns at the various stages of online child grooming, which include Deceptive Trust Development, Grooming, and Seeking for Physical Approach (Section 2). Characterising such stages is a critical issue since most of the sexually abused children have been driven to voluntarily agree to physically ap-proach the predator [36]. This suggests that understanding the different strategies a predator uses to manipulate children behaviour could help in educating children on how to react when expose to such situations. Moreover the early detection of such stages could facilitate the detection of malicious conversations on the Web. We believe that a deeper characterisation of predator behaviour patterns in such stages could aid in the development of more robust surveillance systems which could potentially reduce the number of abused children. This pa-per advances the state of the art on predator detection by proposing a more fine-grained characterisation of predators' behaviour in each of the online child grooming stages [21]. The main contributions of this paper can be summarized as follows: (1) We propose an approach to automatically identify grooming stages in an online conversation based on multiple features of lexical, (i) syntactical, (ii) [illegible] content, (iii) psycho-linguistic, and (iv) discourse patterns. (2) We provide classification models for each stage using single and multiple features. Our findings demonstrate that

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Human Activity Recognition System Using Smartphone Data Sensors with Python and Machine Learning

Prof. Swati Gade[1], Shubham Lokare[2], Tushar Gaikar[3], Ezaz Khan[4]
[1]Assistant Professor, Dept. Of Computer Engineering, Pune District Education Association's College of [illegible], Maharashtra, India
[2,3,4]Student of Bachelor of Engineering, Dept. of Computer, Pune District Education Association's College of [illegible], Maharashtra, India

Abstract: ***This project depicts recognition Human activity Using data generated from user Smartphones [illegible] repository to recognize six human activities. These activities are standing, sitting, laying, walking, upstairs and walking downstairs. Data is collected from embedded accelerometer, gyroscope and other sensor. Data is randomly divided into [illegible] ratios to From training and testing data set respectively. Activity Classification done using Machine Learning models Namely Random Forest, support vector machine, Neural Network and k-Nearest Neighbor. We have compared accuracy and performance of these model using confusion matrix and random simulation. Human Activity recognition(HAR) is classifying activity of person using responsive sensor that are affected from human movement. Both users and capabilities of smartphone With them. These facts makes HAR more important and Popular. This work focuses on recognition of Human activity using smartphone sensor different machine learning classification approaches. Data retrieved from smartphones accelerometer and gyroscope sensor are classified On order to recognize human activity. Results of the approaches used compared in terms of efficiency and precision.***

Keywords: ***CNN, Accelerometer and gyroscope LSTM Model, Machine Learning, SVM etc***

I. INTRODUCTION

This project uses low-cost and commercially available smartphone as sensor to identify human activity. [illegible] and computational power of smartphone makes it an ideal candidate for non-intrusive body-attached sensing. According to the statistic of us mobile subscribers around 44% of mobile subscribers in 2011 own smartphone and 90% of these smartphones have built-in inertial sensor such as accelerometer or gyroscope.

Research has shown that gyroscope can help activity recognition even though its contribution alone is not as good as accelerometer. Because gyroscope is not so easily accessed in cellphones as accelerometer our system only uses readings from accelerometer.

Unlike many other works before we relaxed the constraints of attaching sensor to fixed body position with desired orientation in our design, the phone can be placed at any position around waist such as jacket pocket and pants pocket with arbitrary orientation. These are the most common positions where people carry mobile phone.

Training process is always required when a new activity is added to the system. Parameter of the same algorithm may need to be trained and adjusted when the algorithm runs on different devices due to the variance of sensors.

A. Motivation

Human Recognition system have various approaches, such as vision based and sensor based, which further categorized into wearable, object-tagged, dense sensing etc. Before moving further there are also exist some design issues in HAR system such as selection of different types of sensors, data collection related set of rules, recognition performances how much energy is consumed, processing capacity and flexibility keeping all these parameters in mind it is important to design an efficient and lightweight Human activity recognition model. A network for mobile human activity recognition has been proposed using long-short term memory approach for human activity recognition using triaxial accelerometer data.

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Music Recommendation System Using Chatbot.

Mansi Borawake[1], Pratik Jagdale[2], Ankita Khandalkar[3], Shivam Sakore[4]

And Dr. R.V. Patil[5]

[1,2,3,4]Student of Bachelor of Engineering, Dept. of Computer Engineering, Pune District Education Association's College of Engineering, Pune, Maharashtra, India

[5]Professor, Dept. of Computer Engineering, Pune District Education Association's College of Engineering, Pune, Maharashtra, India

ABSTRACT

—The proposed research work develops a personalized system, where the person's present day emotion is analysed with the assist of the chatbot. The chatbot identifies the person's sentiment by means of asking a few popular questions. Based totally on the enter provided by way of the user, present day emotion or mood is analysed by using the chatbot and it'll generate the playlist. The proposed recommendation device utilises the APIs for the playlist era and advice.

The text-primarily based recommendation of song might be of significant use in this technological era, as humans may want to discover comfort from stress through being attentive to soothing tracks adjusted to their mood. On this assignment, we are building a chatbot that recommends music based totally at the consumer's textual content tone.chatbot that recommends tune in keeping with the tone of the text expressed by means of the user, we can become aware of the temper.as soon as the mood is diagnosed, the application will play songs within the focus of an internet page primarily based on the person's desire in addition to his modern mood. In our proposed system, the primary purpose is to reliably decide a user's temper based on their textual content tone with a software that may be set up at the user's laptop. In the modern world, human pc interplay (HCI) performs a crucial function, and the most famous idea in HCI is the reputation of emotion from the text.

Keywords—INTRODUCTION,PRODUCT-ARCHITECTURE, TONE ANALYZER,MUSIC CLASSIFICATION BASED ON MOOD,ACOUSTIC ANALYSIS,EXPERIMENT,FUTURE/CURRENT USE,IMPORTANCE,BACKGROUND,LITERATURE SURVEY,METHODOLOGY,EQUATIONS,PLANNING ,TOOLS AND TECHNOLOGY,CONCLUSION.

I INTRODUCTION

Communication is the factor which we do in our daily life however having communication and studying the feeling through the music is an exclusive stage.To experience higher and more enjoyment, people discover music critical of their lives. Why go over the music streaming which isn't customised to search the song that the person is feeling when the user gets a recommendation while based on the conversation the user has with chatbot. In an average conversation, approximately 93% of communication is decided with the aid of emotion being expressed. People are able to detect emotions,which is fantastically vital for success.

Chatbots help enterprise groups to scale their interactions with users, you may embed it in any important chat app, such as facebook Messenger, Slack, Telegram, and textual content.Messages. Chatbots enhance the person's enjoyment by facilitating interactions among users and services. Are you bored with all the weird chat bots out there which might be designed typically for enterprise purposes? As a part of this project, we will build a chatbot carrier to which you may communicate. This wouldn't be an enterprise-driven communique: we might really have interaction casually. Moreover, the chatbot could also suggest songs based on the tone of the person's voice.To enforce the tune advice characteristic, Last.fmAPI could be used, a service very much like Spotify API. Moreover, IBM Tone Analyzer API will be used for the tone/emotion evaluation of the communication. API integration is very critical today because the famous chatbots do plenty more than simply have information-pushed communication; in addition they offer greater person-friendly capabilities. In addition to offering a wide array of open-source libraries for building chatbots, python also offers a big selection of open-supply libraries for constructing chatbots, along with scikit-analyse and TensorFlow. For small records sets and less difficult analyses, Python's libraries are more sensible.

Normal, every and absolutely everyone undergoes a lot of issues and the reliever of all the stress that is encountered is music. If it's so, the essential part of listening to the song needs to be in a facilitated manner, that is a player capable of playing the track in accordance to the man or woman's temper. The paper proposes such a player and as a result named Emotion based totally music participant. spotting the human emotions is considered to be a worldwide consistency however depict variability a number of the humans on the idea in their capabilities. The different methods being the category of emotions which might be existing are depicted as information-based, statistical and hybrid strategies. However, there are several difficulties

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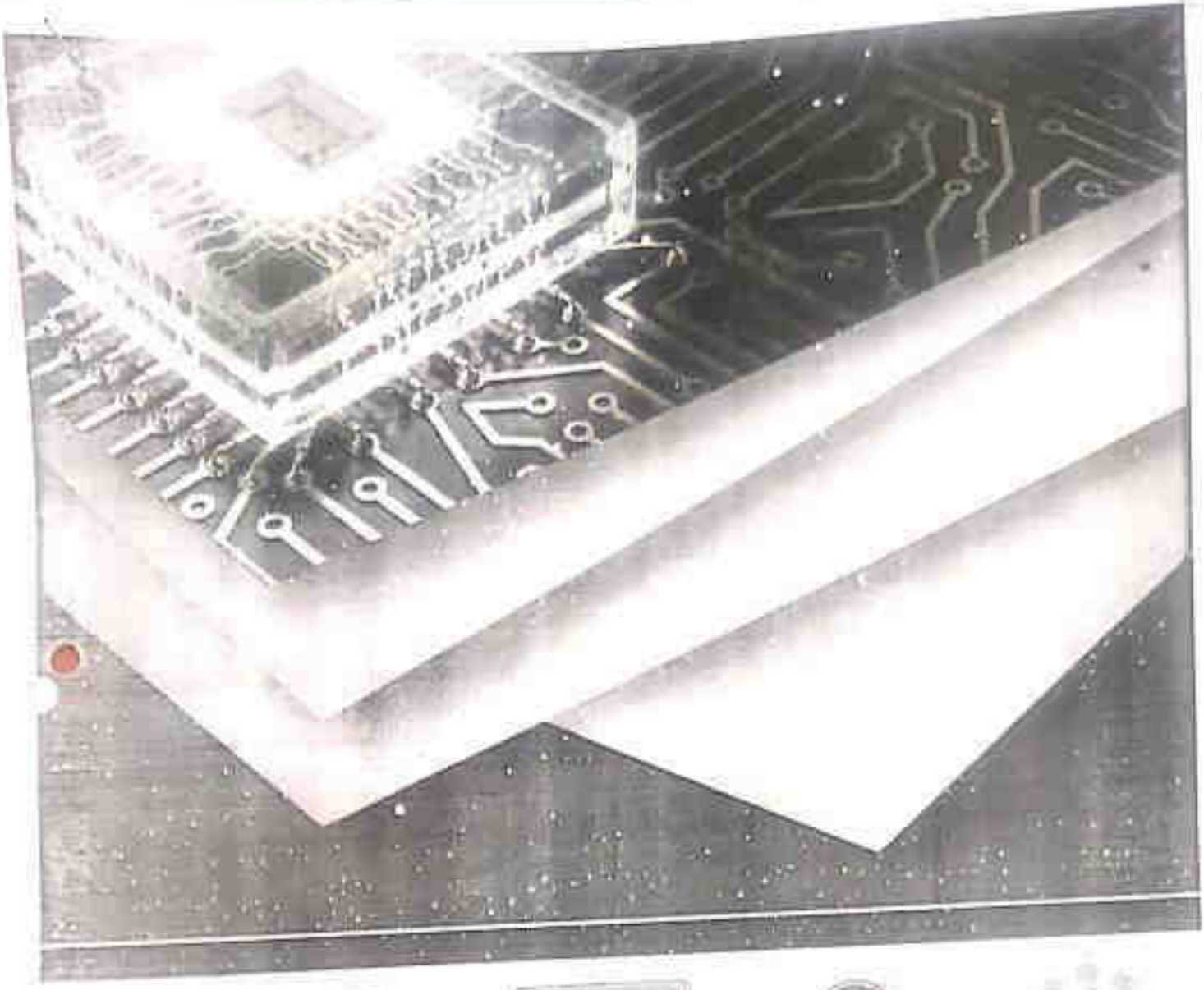

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FACE DETECTION SYSTEM

Miss. Sale Suraj Vadke*1, Miss. Natasha Anil Jangale*2, Miss. Pallavi Bhaskarao Sabale*3, Prof. S. V. Phulari*4

*1,2,3Student, Department of Computer Engineering, Pune District Education Association College of Engineering Manjari Hadapsar Pune.

*4Guide, Department of Computer Engineering, Pune District Education Association College of Engineering Manjari Hadapsar Pune.

ABSTRACT

Face (facial) recognition is the identification of humans by the unique characteristics of their Faces.Face recognition technology is the least intrusive and fastest biometric technology. It works with the most obvious individual identifier, the human face. With increasing security needs and with advancement in technology extracting information has become much simpler. This project aims on building an application based on face recognition using different algorithms and comparing the results. The basic purpose being to identify the face and retrieve information stored in the database. It involves two main steps. First to identify the distinguishing factors in image n storing them and Second step to compare it with the existing images and returning the data related to that image.

I. INTRODUCTION

There have been many attempts to solve the human face detection problem. The early approaches are aimed for gray level images only, and image pyramid schemes are necessary to scale with unknown face sizes. View-based detectors are popular in this category, including Rowley's neural networks classifier, Sung and Poggio's correlation templates matching scheme based on image invariants and Eigen-face decomposition. Model based detection is another category of face detectors. For color images, various literatures have shown that it is possible to separate human skin regions from complex backgrounds based on either YCbCr or HSV color space. The face candidates can be generated from the identified skin regions. Numerous approaches can be applied to classify face and non-face from the face candidates, such as wavelet packet analysis, template matching for faces, eyes and mouths, feature extraction using watersheds and projections. In this project, a new face detector for color images is developed. The objective of this project is to develop a very efficient algorithm, in terms of low computational complexity, with the maximum number of face detections and the minimum number of false alarms. To achieve these objectives first, the image is transformed to HSV color space, where the skin pixels are determined. The skin regions in HSV space are described by crossing regions of several 3D linear equations, which are found using training data. Also, the median luminance condition Y value of the image is determined. For high luminance images, the chances that more non-skin pixels are set to skin regions are high, thus an additional but simple classification on YCbCr space is performed to remove hair pixels. Hence, a binary mask of the original image can be obtained. This binary mask is then filtered with some image morphology processing to break connections between faces and remove scattered noise. A connected component analysis is followed to determine the face candidates. The final step is to determine real faces from the face candidates using a multi-layer classification scheme. The application of this project justifies an assumption that the faces will have approximately the same size.

The face detection system can be divided into the following steps:-

1. Pre-Processing: To reduce the variability in the faces, the images are processed before they are fed into the network. All positive examples, that is the face images are obtained by cropping images with frontal faces to include only the front view. All the cropped images are then corrected for lighting through standard algorithms.

2. Classification: Neural networks are implemented to classify the images as faces or non faced by training on these examples. We use both our implementation of the neural network and the Matlab neural network toolbox for this task. Different network configurations are experimented with to optimize the results.

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ERP Application for Education Industry with Django REST Framework

Department of Computer Engineering PDEA'S College of Engineering Manjari BK. Pune

Author : Prof. S.V.Phulari
(svphulari666@gmail.com)

Manasi Shivarkar(manishivarkar@gmail.com)
Samruddhi Jawalkar(samruddhi2309@gmail.com)
Ravisha Bansode(ravishabansode25@gmail.com)
Usha Guvala (ushaguvala@gmail.com)

ABSTRACT

Online Educational System provides a simple interface for maintenance of student information as well as all the operations related to college. It can be used by educational institutes or colleges to maintain the records of any college operation. The creation and management of accurate, up-to-date information regarding a college academic career is critically important in the university as well as colleges. ERP System for Educational system deals with all kind of student details, academic related reports, Promotional things, college details, course details, curriculum, batch details, placement details and other resource related details too. It will also have faculty details, batch execution details, students' details in all aspects, the various academic notifications to the staff and students updated by the college administration. It also facilitate us explore all the activities happening in the college. Different reports and Queries can be generated based on various options related to students, batch, course, faculty, exams, semesters, certification and even for the entire college The placement officer is responsible for updating the placement related information like eligible criteria for a particular company, arriving date for the company which is coming for recruitment, the list of students who are eligible for attending the recruit.

KEYWORDS

Enterprise Resource Planning, Python, Django, REST Framework, Application Programming Interface, Web APIs, MVC, JWT, MD5, Educational Management Module, LMS.

INTRODUCTION

ERP Educational Module Management Module which is used by Schools as well as Colleges to manage their daily activities which include the management of Employees, Students, Books and Library Records, Parents details, Assignments, Admission Process, Results and Reports, Exams, Events, Attendance, Timetable, Fees and Other Reports , marketing activities ,placements, etc. It provides one-point access to manage this wide range of activities both effectively and efficiently.

The system will be used by four people, which are super users, college and all branches details, owner details, Admin, Teacher, Librarian and Student, Principal, etc. Admin can login using valid credentials and perform various task such as Adding a Teacher/Professor, Student and Librarian and other employees and also can manage them. Super User can also add all employees and assign roles to them. We are adding developer who will manage all technical things i.e adding course modules, design new course, create new test ,challenges ,etc. Teacher/Professor can login and perform various task such as add assignment, mark attendance, upload result and view event. Librarian can login and perform task such as adding a single or multiple books, view added books, request a book, issue a book to students, return issued book from student and view event. Student can access the system by providing valid credentials access modules such as viewing their own profile, view books,

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MULTI-IMAGE STEGANOGRAPHY USING DEEP NEURAL NETWORKS

[1]Gayatri Ulhas Kadam, [2]Purva Iganti Jadhav, [3]Trupti Shahaji Chandanshive, [4]Kajal Vilas Shinde, [5]Ashwini Bhamnikar

[1]Student, [2]Student, [3]Student, [4]Student, [5]Teacher
Computer Engineering,
PDEA's College of Engineering, Pune, India

Abstract: Currently, the most successful approach to steganography in empirical objects, such as digital media, is to embed the payload while minimizing a suitably defined distortion function. The design of the distortion is essentially the only task left to the steganographer since efficient practical codes exist that pecheme with a high empirical statistical detectability. In this paper, we propose a universal distortion design called universal wavelet relative distortion (UNIWARD) that can be applied for embedding in an arbitrary domain. The embedding distortion is computed as a sum of relative changes of coefficients in a directional filter bank decomposition of the cover image. The directionality forces the embedding changes to such parts of the cover object that are difficult to model in multiple directions, such as textures or noisy regions, while avoiding smooth regions or clean edges. We demonstrate experimentally using rich models as well as targeted attacks that steganographic methods built using UNIWARD match or outperform the current state of the art in the spatial domain, JPEG domain, and side-informed JPEG domain.

Introduction: Stegano graphy is an algorithm to conceal information within an object while keeping the object containing the hidden information indistinguishable from the original one. The main purpose of steganography is to grant access to the hidden information only to the authorized clients while keeping its content and its presence unrevealed to the others. Various kinds of carriers such as physical objects, texts, sounds, and network packets have been utilized to safely conceal and deliver confifidential data. Among them, a digital image is one of the widely used carriers in recent digital steganographic algorithms Various kinds of carriers such as physical objects, texts, sounds, and network packets have been utilized to safely conceal and deliver confifidential data. Among them, a digital image is one of the widely used carriers in recent digital steganographic algorithms (i.e., image steganography). Advanced Encryption Standard image steganography methods usually aim at hiding secret image within a cover image. To this end, various studies including spatial domain-based methods [1,2] and frequency domain-based methods [3–7] have been actively conducted, and remarkable results have been achieved. Although there has been tremendous progress in image steganography, there is still a limitation in hiding a large amount of data. Recently, several studies have tried to hide fullsize secret images inside a cover image using Advanced Encryption Standard[8–10]. These methods are completely different from the conventional image steganography approaches, the Advanced Encryption Standard-based steganography method usually consists of a hiding network and a revealing network. The hiding network takes a cover image and a secret image as inputs then creates a container image by hiding the secret image into the cover image. The revealing network extracts a hidden secret image from the container image.

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ERP APPLICATION FOR EDUCATION INDUSTRY WITH DJANGO REST FRAMEWORK

Prof. S. V. Phulari*1, Mansi Shivarkar*2, Ravisha Bansode*3, Usha Guvala*4, Samruddhi Jawalkar*5

*1Computer Science & Engineering, PDEA'S College Of Engineering Manjari Pune, India.

ABSTRACT

Online College Management System provides a simple interface for maintenance of student information as well as all the operations related to college. It can be used by educational institutes or colleges to maintain the records of any college operation. The creation and management of accurate, up-to-date information regarding a college academic career is critically important in the university as well as colleges. ERP System for College management system deals with all kind of student details, academic related reports, Promotional things, college details, course details, curriculum, batch details, placement details and other resource related details too. It will also have faculty details, batch execution details, students' details in all aspects, the various academic notifications to the staff and students updated by the college administration. It also facilitate us explore all the activities happening in the college, Different reports and Queries can be generated based on various options related to students, batch, course, faculty, exams, semesters, certification and even for the entire college The placement officer is responsible for updating the placement related information like eligible criteria for a particular company, arriving date for the company which is coming for recruitment, the list of students who are eligible for attending the recruit.

Keywords: Enterprise Resource Planning, Python, Django, REST Framework, Application Programming Interface, Web APIs, MVC, JWT, MD5, College Management, LMS.

I. INTRODUCTION

ERP School/college/university Management Module which is used by Schools as well as Colleges to manage their daily activities which include the management of Employees, Students, Books and Library Records, Parents details, Assignments, Admission Process, Results and Reports, Exams, Events, Attendance, Timetable, Fees and Other Reports , marketing activities ,placements, etc. It provides one point access to manage this wide range of activities both effectively and efficiently. The system will be used by four people, which are super users, college and all branches details, owner details, Admin, Teacher, Librarian and Student, Principal, etc. Admin can login using valid credentials and perform various task such as Adding a Teacher/Professor, Student and Librarian and other employees and also can manage them. Super User can also add all employees and assign roles to them. We are adding developer who will manage all technical things i.e adding course modules, design new course, create new test ,challenges ,etc. Teacher/Professor can login and perform various task such as add assignment, mark attendance, upload result and view event. Librarian can login and perform task such as adding a single or multiple books, view added books, request a book, issue a book to students, return issued book from student and view event. Student can access the system by providing valid credentials access modules such as viewing their own profile, view books, view time-table, assignments, result, attendance and events, give exams, and solve challenges given by professors. Super user is the root node who adds the colleges into the system with their details. Also can view/delete a college from the system. Super user is also adding different branches of the college and also adds the whole management and director detail. In this project we are adding technical support module for whole college administrative work such as computer or any other machine repairing Proposed system is easy to understand and user friendly too. Managing a school, university, college or any educational institution without a perfect software solution in the present times is painful, same in the case of any enterprises or business. Hence an appropriate solution is required which can ensure the smooth functioning of the organization as a whole, and with ERP college Management Module, this problem can simply be solved.

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Web Application for College using MERN stack

Vaishali Gentyal*, Ritesh patil*, Vaishnavi modaliyar*, Gauri kanpurne*, Devyani ambi*
*Pillai's college of engineering mumbai hk, Pune, India

Abstract— As digitization has evolved in every sector of the economy, many sectors are adopting this technology for their smooth functionality. Along with various other sectors, the education sector is also adopting this technology at a rapid pace.

Computerization and automated technology have made things much easier for schools, colleges, and universities. It has streamlined the whole administrative, academic, and financial day-to-day operations of educational institutions, also known as campus management solutions, has been developed by automating the daily operations of educational institutions.

The software meant to cater to the assorted needs of students, faculty members, and departmental staff. This software or system can be use to manage a variety of things.

In today's era, every education institution is in the race of proving themselves the best in offering education at every level. To draw more and more students into their institutions, these institutes are adapting all kinds of latest technologies.

One such technology called the MERN stack has been used to implement this project in order to keep the application at par with the latest technology.

Index Terms: Full-Stack Development, College Website, Web Design, Web Development, Reactjs, Nodejs, Express, MongoDB.

INTRODUCTION

The project "Web Application for College using MERN stack" aims at building a web application for college management using the robust technologies that constitute the MERN stack. These technologies include: Mongodb, Expressjs, Reactjs, Nodejs. MongoDB is a source-available cross-platform document-oriented database program. Classified as a NoSQL database program, MongoDB uses JSON-like documents with optional schemas. Express.js, or simply Express, is a back end web application framework for Node.js, released as free and open-source software under the MIT Licence. It is designed for building web applications and APIs. It has been called the de facto standard server framework for Node.js. React is a free and open-source front-end JavaScript library for building user interfaces based on UI components. It is maintained by Meta and a community of individual developers and companies. Node.js is an open-source, cross-platform, back-end JavaScript runtime environment that runs on the V8 engine and executes JavaScript code outside a web browser.

SYSTEM ARCHITECTURE

The following modules have been implemented during the execution of this project.

1.Home Page: The home page is built using the powerful features of the Reactjs library and is attractive as well as fast. It provides the visitor of the website with the first impressive look and displays basic information about the college such as the name of the college, accreditation details, address of the college, courses offered and a contact us page. The Home page consists of a navigation bar to navigate to the different pages of the website.

2.Login Page: The login page first confirms if the visitor of the website is a student, teacher, or the admin himself. After confirmation, accordingly, access to the several pages of the website is provided after the credentials are verified. While the teachers and students can register themselves if new to the college, the credentials of the admin remain fixed in order to enhance the security.

3.Registration Page: New students and teachers can register themselves using the register portal. The passwords are hashed while storing to the MongoDB database using the node js implementation of Bcrypt.js. Bcrypt is one of the most used encryption libraries today. It incorporates hash encryption along with a work factor, which allows you to determine how expensive the hash function will be (i.e. how

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Online Child Predator Detection Using ML (Research Paper)

Prof. Swati Gode[1], Utkarsha Bhudee[2], Tabbasum Shaikh[3], Mahesh Hongar[4], Sarika Waghmode[5]
[1]Professor, Computer Department, PDEA's College of Engineering, Manjari, Pune
[2,3,4,5]Student, Computer Department, PDEA's College of Engineering, Manjari, Pune

Abstract: Proficient analysts should all the more completely comprehend the risks of online sexual sales and manners by which to shield youth from sexual stalkers who utilize the Internet. While the Internet has numerous positive angles, quite possibly the most malicious aspect is its expected use for online sexual predation. The Internet addresses a medium that permits sexual stalkers admittance to innumerable kids in a moderately mysterious climate. The primary goal of our task is to distinguish kid hunter base on remarks and post of web-based media account and send hunter record to digital cell admin. A late public review demonstrated that around one out of five youth are requested for sex over the Internet yearly (Finkelhor, Mitchell, and Wolak, 2000; Mitchell, Finkelhor, and Wolak, 2001). This task report presents our present advancement to empower the formation of the framework. Thus, with the created framework, youngster hunter accounts recognition any report to administrator for additional activity.

Index Terms: ML, dataset, Training Module, Predator.

I. INTRODUCTION

The online exposure of children to pedophiles is one of the fastest growing issues on social media. As of March 2018, the National Society for the Prevention of Cruelty to Children (NSPCC), reported that i) 12% of 11-16 year olds in the UK have received unwanted sexual messages; and ii) 8% of 11-16 year olds in the UK have received requests to send or respond to a sexual message [16]. The detection of children cyber-sexual-offenders is therefore a critical issue which needs to be addressed. Children in their teens have started to use social media as their main means of communication [20].Moreover a recent study of cognition, adolescents and mobile phones(SCAMP) has revealed that 70% of 11-12 year olds in the UK now own a mobile phone rising to 90% by age 14 [28]. While social media outlets (e.g., chat-rooms, images and videosharing sites, microblogs) serve as contact points for paedophile (predators) to potentially exploit children (victims),the automatic detection of children abuse on the Web is still an open question. A common attack from paedophiles is the so-called online child grooming, where adults engage with minors via social media outlets to eventually exchange sexually explicit content. Such grooming consists of building a trust-relationship with a minor, which finally leads into convincing a child to meet them in person [19]

Previous research on detecting cyber paedophilia online, including the efforts of the first international sexual predator identification competition (PAN'12)[11], has focused on the automatic identification of predators in chat-room logs. However little has been done on understanding predatory behaviour patterns at the various stages of online child grooming, which include Deceptive Trust Development, Grooming, and Seeking for Physical Approach (Section 2). Characterising such stages is a critical issue since most of the sexually abused children have been driven to voluntarily agree to physically approach the predator [36]. This suggests that understanding the different strategies a predator uses to manipulate children behaviour could help in educating children on how to react when expose to such situations. Moreover the early detection of such stages could facilitate the detection of malicious conversations on the Web. We believe that a deeper characterisation of predator behaviour patterns in such stages could aid in the development of more robust surveil-lance systems which could potentially reduce the number of abused children. This pa-per advances the state of the art on predator detection by proposing a more fine-grained characterisation of predators' behaviour in each of the online child grooming stages[21]. The main contributions of this paper can be summarised as follows:(1) We propose an approach to automatically identify grooming stages in an online conversation based on multiple features: i) lexical; ii) syntactical; iii) sentiment;iv) content; v)psycho-linguistic; and vi) discourse patterns.(2) We generate classification models for each stage, using single and multiple features. Our findings demonstrate that the use of Label discourse pattern features alone can achieve on average a gain in precision (P) of 4.63% over lexical features. While the use of combined features in classifiers consistently boost performance in P with again of 7.6% in all grooming stages.(3) We present a feature analysis to identify the most discriminative features that characterise each online grooming stage. The rest of the paper is organised as follows: Section 2 introduces Olson's theory of luring communication which characterises predator's child grooming stages. Sec-tion3 presents related work regarding detection of online predator-victim conversations as well as previous work in online child grooming. Section 4 presents the set of features selected to characterised the language used by predators.