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A Deep Learning based Web Security Mechanism for Detection of Web Application Attacks and Phishing URLs

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Abstract— As the number of people using the internet grows, so does the need for the secure transmission of confidential & vital data. Web apps security methods must be used in building an online web application since it has been exposed to many different types of cyberattacks. To obtain access or corrupt a legitimate online application, hackers may employ a variety of methods, including phishing sites that mislead users into providing important & private data. Due to this, the necessity to take appropriate steps to identify the risks and be informed of vulnerabilities that could impact the website and therefore the regular business flow is raised as a reaction. As a result of this research, mitigations against the most frequent web application assaults have been implemented, & web administrators now have better tools to identify assaults like phishing links the research also shows how to generate web application logs which make it easier to identify anomalous customers & determine whether their activity is out of limits, out of scope, or otherwise against the regulations. Secure coding techniques are used for mitigation, and a variety of categorization algorithms are used to identify phishing links. The created app was tested & assessed using the suggested BiLSTM against numerous assault situations, and the results demonstrate that the site had effectively mitigated these dangerous web app assaults and for detecting of phishing connections component, a contrast was made among distinct methods to determine the better ones, and superior framework gave 99.06 percent precision.

Keywords—Web security, Web service application, Web attacks, Phishing detection, Classification algorithms, BiLSTM.

I. INTRODUCTION

With the fast growth of Internet technology apps [1], particularly driven by broad adoption & application of novel technologies like mobile Internet, cloud computing, & large data, network info technology has been profoundly incorporated into all areas of social operations, commercial operations, & everyday life. Because of the present cyberspace era, that reliance on network info technology, cyberspace is subject to a growing number of security concerns & threats. The study of how to conduct a fast & scientific & precise risk evaluation of present network or network service, and also create effective predictions about potential risks by developing a credible evaluation framework, has been a study hotspot in current years.

Institutions, businesses, & people alike have been more concerned about web security in the last several decades. Attackers may search a web system's assault surface for flaws & exploit them to gain access to systems. The assault surface of a system is the subset of resources that an assailant may utilize to assault the system, showing the security of a system. The assault surface in web security [2], refers to the possible exploitable key characteristics of an online system, like dangerous inherent functions or code statements, that are linked to vulnerabilities. Even though conventional security measures (like anomaly detecting, access control, & authenticating) may improve online security, these static & passive defenses are incapable to withstand unexpected assaults, like zero-day threats. Web security risks are much too critical to overlook. Based on OWASP (Open Web Appl Security Project) whitepaper, the highest 10 most frequent risks are all included. is generally used in the categorization of vulnerabilities while not being an official standard. [3][4].

Because of growth in online app development and use, the quantity & intensity of web assaults has risen as well. Statistics show that in 2018, 953,000 online assaults were prevented daily, up from 611 000 blocked assaults per day the prior year, according to Statista [5]. With regards to injection vulnerabilities, OWASP [6], reports that they are still the most common. The quantity & intensity of assaults on web applications is constantly rising. Hackers are increasingly turning to new types of assaults in light of the internet's vast store of data. This is the environment in which extensive web application security work has been carried out [7].

Researchers are working hard to find new ways to protect against web-based assaults using both supervised & unsupervised machine learning techniques. The extraction of feature sets, which is necessary for the construction of machine learning identification prototypes, is a major problem in web-based attack detection. There is no comprehensive characteristic set for detecting the assaults effectively. Deep learning as a method for improving web-based assault detection is presented in this article as a solution to fill the resulting void.

The article is organized as follows: Section II covers a literature review on web security, Section III outlines typical Web Application Attacks, & mitigations are addressed, as well as some research issues & their answers in Section III. Section IV describes the issue, shows access logs, & explains the identification of phishing URLs utilizing deep learning BiLSTM. Section V discusses the findings. section VI, the last section, contains the conclusion & recommendations for further research.

II. LITERATURE REVIEW

The assault on the online service will unquestionably have an adverse effect on an ongoing system's stability. Data thievery, data manipulation, & service interruption are all possible outcomes. In the case that assaults on the system's online services are not avoided or at least minimized, substantial losses may result. System growth will be cheaper if a security feature is included from start rather than after an assault has already happened. The research which has addressed web service must

Network Attack Detection System Based on Hybrid Deep Learning Technique in Cyber Security Application

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Abstract- Technology, procedures, & controls used in cyber security are aimed at preventing cyber-attacks on systems, networks, programs, devices, & data. Its goal is to safeguard systems, networks, & technology against unauthorized use and cyber-attacks. Using a Network Attack Detection System, network security breaches may be detected & contained in companies. Creating a flexible & effective network intrusion detection system (NIDS) for unexpected & unanticipated assaults, on the other hand, poses numerous difficulties. A hybrid ID architecture built on DL-based prediction & classification of destructive network cyberattacks & protection of security is developed in this article using an AlexNet. The CNN pretrained Alexnet uses convolution to collect local features, while the recurrent neural network (RNN) catches temporal data to enhance the efficiency & predictions of the ID system. The hybrid method HARNN ensures that no intrusive packets transmit thru and enter our systems by using a combination of techniques. The hybrid convolution RNN intrusion detection system was tested using publicly accessible ID data, including the contemporary & realistic CSE-CIC-DS2018 data. Using 10-fold cross-validation, the simulation outcomes indicate that the suggested network attack detecting system surpasses existing ID methods in terms of malicious assault identification rate accuracy using CSE-CIC-IDS2018 data.

Keywords: Cyber Security; Recurrent neural network; deep learning; AlexNet; intrusion detection system; machine learning.

1. INTRODUCTION

Avoiding damaging attacks on computers, servers, smartphones, and other mobile devices are referred to as "cyber security." Security of electronic data or security of information technology is some terms that are used to describe it. Physical-layer wireless communication technology's fast advancement also introduces new security concerns. Wi-Fi eavesdropping, spoofing identities, & tampering with data are just a few of the security problems that plague those who use wireless communication networks. Many more physical devices are now linked to a network due to the advancement of Internet technologies. When devices are connected, a big no. of data is produced & stored. Over time, the 'big data' age will arrive [2]. Network assaults are common due to the system's complexity and the wide range of assault techniques available. There are two types of network attacks: active and passive. A malevolent party gains access to networks, monitors them, & steals sensitive data while creating no changes. This is called a passive network assault. Active network assaults alter, encrypt, or corrupt data. Since hackers' technology is improving all the time, network assault detecting systems must be more sophisticated & effective than ever before if they are to be effective. A robust, dependable, & precise intrusion detection model offers wide application possibilities for enhancing network security, given the constraints of conventional network security protection technologies.

Keeping an eye on one's cyber security condition is a new priority for information security professionals nowadays. Cyberspace security status identification & comprehension of possible incursion activities are two of its primary tasks. The prediction of specific network assaults has received a lot of attention to better comprehend possible incursion activity. The motives for network assaults, on the other hand, are much more significant [3]. The term can be used in a variety of contexts, from business to mobile computing, or it can be divided into a few broad groups. [4].

- **Network security** is a computer network against intruders, like targeted assailants or opportunist viruses, is the technique of network security.
- **Application security** is concerned with preventing malicious code from running on a computer's software or hardware. A compromised program may provide hackers access to information that was supposed to be secure. Before deploying software or device, successful security must be designed.
- **Information security** storage & transmission of data are safeguarded by information security, which keeps the data's integrity & privacy intact.
- **Operational security** process & decision making for managing & safeguarding digital assets are part of operational security. There are many rights consumers have when using a network, and procedures that regulate how and

A SURVEY ON MRI BRAIN CANCER CLASSIFICATION TECHNIQUE

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***Abstract*— Brain tumor is an abnormal growth of brain cells within the brain. Brain tumor detection and segmentation and is one of the most challenging and time consuming task in medical image processing. MRI (Magnetic Resonance Imaging) is a visualization medical technique, which provides plentiful information about the human soft tissue, which helps in the diagnosis of brain tumor. MRI is an imperative technique used for brain tumor detection and verdict. Study of medical MRI images by the radiologist is very difficult and time overwhelming task and correctness depending upon their experience. To overcome this problem, the automatic computer aided system becomes very obligatory. The brain tumors are classified into malignant and benign using SVM and KNN classifiers. The odds of survival can be expanded in the event that the tumor is identified effectively at its initial stage. In this paper highlight study of different techniques on brain cancer classification. In Proposed system we will use computer based procedures to detect tumor blocks or lesions and classify the type of tumor using Artificial Neural Network (ANN) in MRI images of different patients with Astrocytoma type of brain tumors. The image processing techniques such as histogram equalization, image segmentation, image enhancement, morphological operations and feature extraction have been developed for detection of the brain tumor in the MRI images of the cancer affected patients.**

***Keywords*—Classification, MRI, SVM, KNN, PCA, Skull masking, ANN.**

I. INTRODUCTION

Brain is the center of human central nervous system. The brain is a complex organ as it contains 50-100 billion neurons forming a gigantic network. A brain tumor is a mass of unnecessary and abnormal cell growing in the brain or it can be defined as an intracranial lesion which occupies space within the skull and tends to cause a rise in intracranial pressure. Brain tumors are mainly classified into two i.e. Benign and Malignant. Benign tumors are non-cancerous and they seldom grow back where as malignant tumors are cancerous and they rapidly grow and invade to the surrounding healthy brain tissue. MRI is an indispensable contrivance in the clinical and surgical environment due to superior soft tissue differentiation, high spatial resolution, contrast and it does not use any harmful ionizing radiation which may have an effect on patients.

The MRI is the most regularly utilized methodology for imaging brain tumors and recognition of its territory. The customary strategy for CT and MRI brain images grouping and tumor recognition are still for the most part in light of an immediate human investigation of those images, in spite their being various other diverse techniques have just been proposed [2,3]. MRI is a non-destructive and non-invasive strategy in nature. It gives high-resolution images which are generally utilized as a part of brain scanning reason. There are many image processing method, for example, histogram equalization, picture segmentation, image enhancement, morphological operation, feature choice and obtaining the features, and order.

The MRI image may contain both normal and abnormal images. Feature extraction refers to various quantitative measurement of medical images typically used for decision making regarding the pathology of a structure or tissue. In image processing, feature extraction is a special form of dimensionality diminution. When the input data to an algorithm is too large to be processed and it is assumed to be disgracefully unnecessary, then the input data will be transformed into a compact representation set of features. Brain tumors are abnormal masses in or on the brain.

A. Background

Previously clustering approach was being used for biomedical area which focuses on MRI brain image segmentation process with modified fuzzy clustering. This work has not considered the noise removal and can be have better segmentation based on quantization. Segmented image will detect the brain tumor. Also, we are going to detect the size and stage of the tumor. To provide an optimized solution for highlighting the affected area of the brain with segmentation in color images. To detect the size and stage of Brain tumor. a strategy that accomplishes tumor stage by utilizing ANN. In the pre-processing stage, three distinctive differentiation upgrade plans have been connected; i) adjusted ii) adaptive threshold and iii) histogram imaging. The TKFCM calculation which is basically a combined approach of the K-implies and Fuzzy C-implies plans has been embraced with specific alterations for actualizing the division organize. In the feature extraction the property based measurement features have been inferred. At long last, the SVM conspire characterizes the brain MRI picture either into the normal or having tumor classes.

B. Motivation

In medical practices, the early detection and recognition of brain tumors accurately is very vital. In literature, there are many techniques has been proposed by different researchers for the accurate segmentation of brain tumor. Some discoveries such as X-rays, ultrasound, radioactivity, magnetic resonance imaging (MRI) or computed tomography and the development of tools that can generate medical images have facilitated the development of some of the most efficient exploration tools in medicine [10].

MRI Image segmentation is based on set of process of brain tumor detection; pixel intensity based features are extracted. Image Segmentation group pixels into regions and hence defines the object regions. Segmentation uses the features extracted from image. Classification is the last step in process of brain tumor image into normal or abnormal and classifies the abnormality type whether it is benign or malignant. This study evaluates various techniques which are used in tumor detection from brain

Prediction of gainer & looser of Stocks using machine learning techniques

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Abstract—Investors in stock market want to maximize their profits, it would be beneficial for them if the market movement can be predicted beforehand. Machine learning approaches such as ANN, PSO algorithm has been used herein to predict the gainer and looser shares of the market. In this paperwe used ANN algorithm is implemented for prediction purpose and finally result is compared for all these algorithms. This prediction model is used with some common indicators to maximize the return and minimize the risk for the stock market. Historical data of the some stocks has been used for building and training the models. Later, testing file is generated with the real data to ascertain the accuracy of the model and to predict the gainer and looser share of the market.

Keywords—*ANN, Stock market prediction, machine learning, historical data. formatting;*

I. INTRODUCTION

Stock markets are trading institutions where stocks (equity) and other financial instruments such as bonds are offered for trade. For stocks, the market generally operates a 'willing-buyer, willing-seller' trade, where buyers and sellers prices are matched for a fit. If there is no match, then no trade takes place and waits for a future match or expires. In most stock exchanges, the common and easily accessible market is the equity market (stocks), where the entry investment can be as low as USD1. The equity market is therefore more active, having many players and hence a segment worthy of further study. The performance of stock markets is measured on a daily basis by some key indicators such as 'share index', which is a measure of the performance of some stocks picked from the different sectors of the market. Such an index is important in not only gauging the performance of trades in the stock exchange but also the economic performance of the particular country as a whole.

Shareholders however do not directly execute the trade, nor is there any meeting between buyers and sellers for negotiations. Shareholders trade by giving instructions to their Stockbrokers, who in turn execute the orders. Stockbrokers usually also advise clients on where to trade. In their advisory role, some Stockbrokers base their advice on the fundamentals of the various stocks or undertake technical analysis. However, none of these predictive methods have assurance of profit as they usually just indicate a future trend and a likely up or down price movement and not the real expected future stock price. Stockbrokers need to be empowered, through better predictive tools, to enable them have some capability to provide the best advice to their clients. A predictive tool that Stockbrokers can use to guide on exact price movements, as a basis of investment, is therefore desirable. This can be an artificial intelligence (AI) system based on neural networks. Complex relationships between inputs and outputs may not always allow us to find patters. ANN is gaining much attention these days because of its capability of solving such problems. It has robust ability to discover relationship in the input data set without a priori assumption of the knowledge of relation between the input and the output data. It can be used to build model that identify unknown hidden patterns in data which can be further used for prediction purposes. Neural Network has already been successfully applied in the fields related to finance, econometrics, medicine and engineering. In the chaotic system, like stock market, in which many known as well as unknown factors affect the stock price, there is no significant mathematical relation between the factors and the price can be found. There is no law exists which governs the stock prices using the underlying factors. Taking this into consideration, application of neural networks would be very beneficial in predicting stock market.In this paper, multilayer perceptron algorithm is used for the prediction(gainer/looser).

II. LITERATURE REVIEW

In [1] proposes the utilization of Artificial Neural Network that is feedforward multi layer perceptron with error backpropagation and builds up a model of setup 5:21:21:1 with 80% training information in 130,000 cycles. The examination builds up a model and tests it on 2008-2012 data from stock exchanges e.g. Nairobi Securities Exchange and New York Stock Exchange, where prediction comes about show MAPE of between 0.71% and 2.77%. Approval finished with Encog and Neuroph acknowledged comparable outcomes.

In [2] show an Artificial Neural Network way to deal with anticipate stock exchange files. They layout the outline of the Neural Network model with its saliant highlights and

adjustable parameters. Number of activation capacities are actualized alongside with option for cross approval sets. They finally test their algorithm on the Nifty stock file dataset where they anticipate the qualities based on values from the past n days.

In [3] feed forward neural system is actualized for prediction purpose. It has been seen that aftereffects of neural system is more encouraging in predicting stock value that actually isn't surely predictable.

In [4] proposes a stock value forecast demonstrate, which extracts features from time series information and social organizations for prediction of stock costs and evaluates its execution. In this system, they utilize the features for example, numerical dynamics of news and remarks, overall senitment analysis of news and remarks, and technical examination of historic cost and volume. They demonstrate the stock value movements as a component of these information includes and tackle it as a regression issue in a Multiple Kernel Learning regression system.

In [5] build up a two-stage multiple kernel learning algorithm by incorporating sequential minimal optimization and the gradient projection strategy. By this calculation, advantages from various hyperparameter settings can be joined and general framework execution can be made improved. Additionally, the client require not indicate the hyperparameter settings in advance, and experimentation for deciding suitable hyperparameter settings can then be avoided.

In [6] artificial neural system is utilized alongside windowing administrator; which is very effective for working with time series information for predicting stock exchange cost and pattern. This examination is done on Wal-Mart Stores Inc. (WMT) a recorded organization of New York Stock Exchange. Five years authentic dataset (2010-2015) is utilized to attempt the analyses of this investigation. As indicated by the aftereffect of this examination Artificial Neural Network (ANN) can create a balanced outcome with a little mistake.

In [7] set forward another technique called HLP as data preprocessing to process the stock information. By HLP technique we can get the stock high low point with various recurrence and amplitude. The extracted information depicts the feature of stock value development. After that they build ANN models to forecast the stock development direction and cost. The HLP strategy and ANN models offer help to financial specialists.

In [8] introduce the accessible capacity calculation display in light of the artificial neural network for lead acid batteries in an electric vehicle. Contrasting and the techniques based on the Peukert condition, which is regularly utilized for the computation of the accessible limit with regards to lead acid batteries in EVs, this model is more exact.

In [9] proposes genetic algorithm way to deal with feature discretization and the assurance of association weights for artificial neural network to anticipate the stock value record. Past research proposed numerous hybrid models of ANN and GA for the technique for training the system, feature subset selection, and topology optimizations. In the vast majority of these examinations, in any case, GA is just used to enhance the learning algorithm.

III. PROPOSED APPROACH

A. Proposed System overview

The main goal of the proposed system is to predict the gainer or looser shares. Initially online data about share market is extracted. Preprocessing is done on the extracted data and old dataset of the shares. In preprocessing process, similar attributes are check, in this process we keep the similar attributes and remove all the attributes. Training file is generated from the preprocessing method, the details about the dataset is discussed in the next section. After generating training file classification process is done.

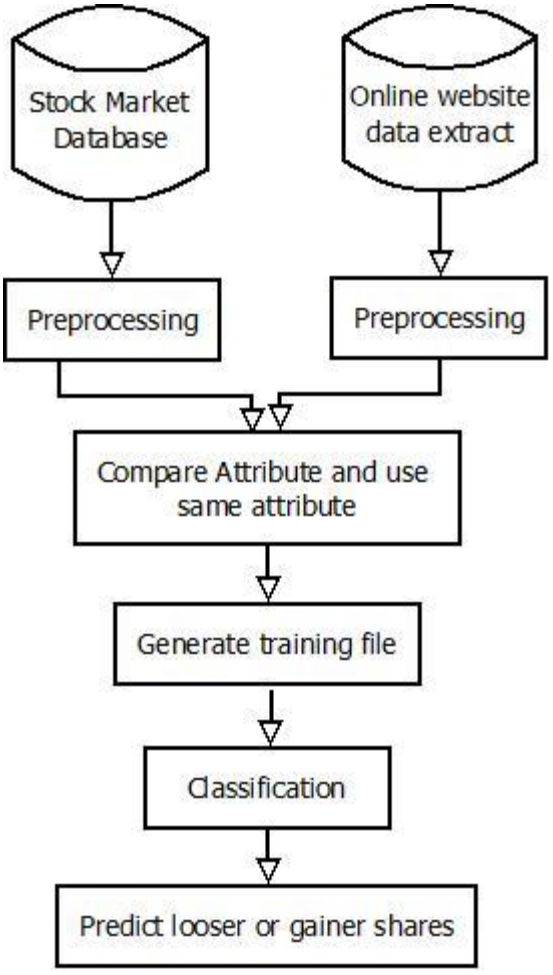

Figure 1.Proposed System Architecture

B. Algorithm

Process:

1) Create test file using dataset.
2) Take query as input & creating training file related to query.
3) Pass training & testing file to multilayer perceptron.
4) Matching query on test data & assigning class
5) If query match then
6) class =1(Gainer)
7) else
8) class =0 (Looser)
9) Predict looser share= 1 training file
10) End

C. Data Set Used

In this system we used stock market dataset and online web stock dataset, after the preprocessing process the training file is generated, the attributes of the training files are:

1. Previousclose
2. Open
3. Currentclose
4. High
5. Low
6. Change

and the classes are:

1. Gainer
2. Looser

Total records are: 250

IV. CONCLUSION AND FUTURE SCOPE

In this paper, proposed the method which predict the gainer/looser shares. We use stock market dataset and online website data as an input dataset. For the classification, multilayer perception algorithm is used for classification process. Finally system will predict the looser or gainer shares

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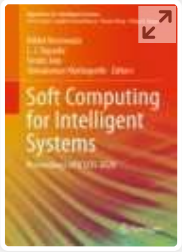

Soft Computing for Intelligent Systems pp 167–175

Extracting Knowledge in Large Synthetic Datasets Using Educational Data Mining and Machine Learning Models

Jaikumar M. Patil & Sunil R. Gupta

Conference paper | First Online: 23 June 2021

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Abstract

Educational Data Mining (EDM) and Learning Analytics (LA) investigation has emerged as an attractive domain of study. The valuable unfolding experience from institutional databases for several determinations such as prophesying learners achievement rate, enforcement, coordination and

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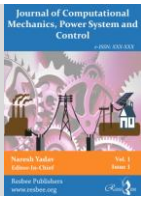

HPSOSSA: Enhancement of Dynamic Stability by Optimal Placement of UPFC

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Abstract: This paper proposes a hybrid approach on the basis of the Optimal Positioning and Sizing (OPAS) to enhance the dynamic stability for Unified Power Flow Controller (UPFC). Moreover, the maximum power loss bus is recognized during the optimum positioning by putting the UPFC, as the generator outage have effects on the power flow constraints namely voltage, real and reactive power flow, and loss of power. By exploiting the Particle Swarm Optimization (PSO) method, the optimum position is determined. According to violated power flow quantities, the Salp Swarm Algorithm (SSA) optimizes, which is necessary for UPFC quantity in order to get better initial operating circumstance. Subsequently, the proposed and conventional methods are simulated in the MATLAB platform and the performance of the proposed approach is examined by comparing conventional approaches like Genetic Algorithm (GA), PSO, and Artificial Bee Colony (ABC). Finally, the results revealed that the performance of the proposed approach is enhanced and validate it's possible to resolve the crisis.

Keywords: optimal location; sizing; UPFC; power system; voltage

Nomenclature

Abbreviations	Descriptions
DS	Distribution System
OPAS	Optimal Positioning and Sizing
DG	Distributed Generation
MFA	Moth–Flame Algorithm
LSF	Loss Sensitivity Factors
RDS	Radial Distribution system
ABC	Artificial Bee Colony
UPFC	Unified Power Flow Controller
DFO	Dragonfly Optimization
SOO	Single-Objective Optimization
PSO	Particle Swarm Optimization
APL	Active Power Loss
BFOA	Bacterial Foraging Optimization Algorithm
SVC	Static Var Compensator
GWO	Grey Wolf Optimization
MOO	Multi-Objective Optimization
TCSC	Thyristor-Controlled Series Compensation
MBA	Mine Blast Algorithm

1. Introduction

Nowadays, power systems restructuring have foisted profitable competition between electric usage, generating extremely stressed operating circumstances. This shows the minimized operating margins, patterns, and overloading transmission line congestion that conduct the power system almost voltage instability. Further distribution companies wish to exploit the conventional transmission system to its utmost, hence circumventing the additional construction cost of new power transfer passages. So, there is a maximized requirement to gaze into the safe level for operations of the power system [18].

During the contingency, the risk index is a phrase, which considers the probability of the incident of a contingency as well as the seriousness of the system state [19]. The result of the contingency and the

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operating circumstance, when compared with the divergence of the nominal voltage of each system bus, are the main aspects, which creates the severity function. As a numerical value, the clear quantification of the system risk offers a superior comprehension of the system condition, as the pre-defined operating process might be set only for standard contingencies, as well as not present for undermined occurrence.

Voltage Stability is predominately associated with the reactive power planning issue, which contains the analysis of the contingency, whereas appropriate circumstances of reactive power reserves are vital for the stable operation of the power system [20] [21]. By installing the FACTS devices reactive power supports enhances, which is a restorative for eluding voltage instability. The optimal positioning of the FACTS device and the optimal number of MVAR generated/absorbed using the device has an intense effect on the Voltage Stability of the system for real-time security evaluation. The SVC represents a shunt connected device and is frequently exploited for Voltage Profile enhancement, due to its low-cost while comparing with the STATCOM [22].

In [9], by the variable susceptance approach the modeling of the SVC was done and the firing angle technique was also dealt. The SVC positioning and N−2 contingencies were considered to augment the loadability margin and also Bender's decomposition approach was also exploited in [10]. The SVC compensator for voltage stability enhancement was presented in [11]. To discover the optimal positioning and rating of the TCSC and SVC, a bifurcation analysis was exploited in [12]. The positioning for SVC is to conserve the bus voltage as constant, as a result of that maximize the Voltage Stability on the basis of the sensitivity method was presented in [13]. In [14] [15], for the best positioning of FACTS devices, the analysis of the stability index was also presented to manage voltage and reactive power.

The UPFC is considered as the trendy FACTS devices, its major power reclines in its ability to manage reactive and active power concurrently. Theoretically, a UPFC can carry out power flow control, voltage support, and dynamic stability enhancement in a similar device. In order to attain such functionality, it is uniformly significant to resolve a suitable position for installation of UPFC. The efficiency of UPFC differs while it is installed in different positions. The positioning of UPFC in the best possible position is determined on the basis of several performance indices. Because of the high UPFC cost, it is significant to determine their optimal location to convene the preferred objective.

During the past decade, various optimization methods were exploited to determine the best position for UPFC to maximize/minimize several objectives when gratifying several constraints. Several models of UPFC namely voltage source model, uncoupled model, transformer model, and current injection model are exploited in simulation experiments.

The main objective of this paper is to develop a hybrid technique on the basis of the OPAS of UPFC for dynamic stability enhancement. Moreover, the huge amount of power loss bus is recognized at the supportive position in order to fix the UPFC; due to the outage of the generator, the UPFC has effects on the power flow constraints namely voltage, power loss, and real as well as reactive power flow. Using the PSO algorithm the optimum position is examined. On the basis of the violated power flow quantities, the Salp Swarm approach optimizes the necessary UPFC quantity to convalesce the first operating circumstance.

The rest of the paper is organized as follows: Section 2 describes the literature review, and section 3 defines the problem formulation. Section 4 defines the proposed hybrid PSOSSA for optimal placement of UPFC. Section 5 describes the results and discussions of the paper. Section 6 states the conclusion of the paper.

2. Literature Review

In 2018, Mohammad Jafar Hadidian-Moghaddam et al [1] presented a novel optimization technique to resolve the OPAS issue of DG in a DS. A new ALO was exploited with different objectives to resolve the optimization issue. These objectives were the minimization of acquired cost of energy from the upstream network because of a generation of DGs' power, consistency enhancement, and minimization of DGs' cost application, minimization for losses of DS and minimization of buses voltage deviation. This issue was resolved as a MOO besides an SOO.

In 2018, T.C. Subramanyam et al [2] addressed the problems in determining and localizing the positioning for fuel cells to join to DG systems. Here, the dual-phase intelligent technique was exploited to handle the problem. Initially, the neural network was used for the determination of optimal positioning, while in the next phase the optimal positioning of fuel cells was determined using the ABC method. An enhanced version of ABC was presented to evaluate the optimal sizing. The proposed approach was implemented with four IEEE bus systems and analyzed with five existing methods. The outcomes show a better performance of the presented technique. At last, the simulation outcome exposed that the proposed technique performs superior to conventional techniques.

In 2016, Somasundaram Alamelu et al [3] addressed an application of evolutionary methods to OPAS of UPFC that are formulated as multi and single-objective optimization issues. In the optimization process, the decision variables namely optimal positioning, both distance and line of UPFC from the transmitting end; and system reactive power reserves control parameters of UPFC were considered. Reduction of total costs with a UPFC installation cost as well as improvement of the loadability limit was contemplated as objectives. For optimal sizing and siting of UPFC, the CMAES and NSGA-II methods were exploited on IEEE 30 and 14 bus test systems.

In 2017, S. M. Abd Elazim and E. S. Ali [4] presented an MBA for OPAS of capacitors in several DS. Initially, the majority candidate buses for installing capacitors were recommended exploiting LSF. After that, the presented method was used to infer the capacitors size and their positions from the selected buses. Here, the objective model was framed to minimize the total cost and, as a result, to augment the net saving per year. The presented method was examined on 85 and 10 bus RDS. The attained outcomes by means of the proposed method were compared with others to emphasize their advantages. In addition, the outcomes were initiated to confirm the efficiency of the recommended method to reduce the losses and total cost.

In 2016, S. P. Mangaiyarkarasi and T. Sree Renga Raja [5] presented a novel modified severity index while accounted with the incidence of a contingency probability, enumerates the risk, which numerically explains how close the system is to voltage instability. It was chiefly exploited because of the inadequate reactive power maintained. To enhance the Voltage Profile of the system, the FACTS devices were used during line outages. Here, the SVC was contemplated, as the compensating device.

In 2017, Mohammad Mohammadi et al [6] developed a fuzzy based technique for DS feeder reconfiguration with respect to the DSTATCOM with an objective of reducing real operating cost and power loss. The DS tie switches, DSTATCOM position, and size was optimally decided to attain a suitable operational state. In the proposed method, the fuzzy membership function for loss sensitivity was exploited.

In 2017, K.R. Devabalaji and K. Ravi [7] presented a novel method to decide the optimal sizing and positioning of DG and DSTATCOM was examined, and the objective model was designed for reducing operational costs, loss of power, and Voltage Profile enhancement of the system subjected to equality and inequality constraints. LSF was exploited to pre-determine the optimal position of DSTATCOM and DG. To determine the optimal size of the DSTATCOM and DG, the BFOA was presented. Here, the DSTATCOM and DG were concurrently allocated in the RDS and it was examined with various load models.

In 2018, Ahmed A. Zaki Diab and Hegazy Rezk [8] presented applications of DFO, GWO, and MFA optimization approaches for the capacitors optimum sitting in several RDSs. To determine the majority candidate buses, the loss sensitivity factor was applied. Subsequently, each optimization approach was used to locate optimum positioning as well as capacitors sizes for determining buses. Here, 69-, 33- and 118-bus RDSs were represented for examining the efficiency and effectiveness of examined methods. The convergence performance was validated for examined RDSs.

3. Problem Formulation

The UPFC is considered as the FACTS devices that offer independent control of the reactive as well as voltage magnitude, real power flows, and improves the dynamic stability of the system. Moreover, the UPFC comprises of dual switching converters such as shunt and series converter, and it starts working from a general DC link. Through coupling transformers, the converters are connected to the power system. The shunt converter is connected to the transmitting end node while the series converter is connected among the receiving and transmitting end. Moreover, it inserts an AC voltage with a controllable magnitude as well as in series manner the phase angle is connected with the transmission line. While the APL is abandoned, the UPFC can't able to produce or soak up the active power in two converters, and it needs to balance using the DC link. Conversely, the converters create or soak up the reactive power as well as the self-governing shunt reactive compensation for the line. Fig 1 demonstrates the basic model of the UPFC.

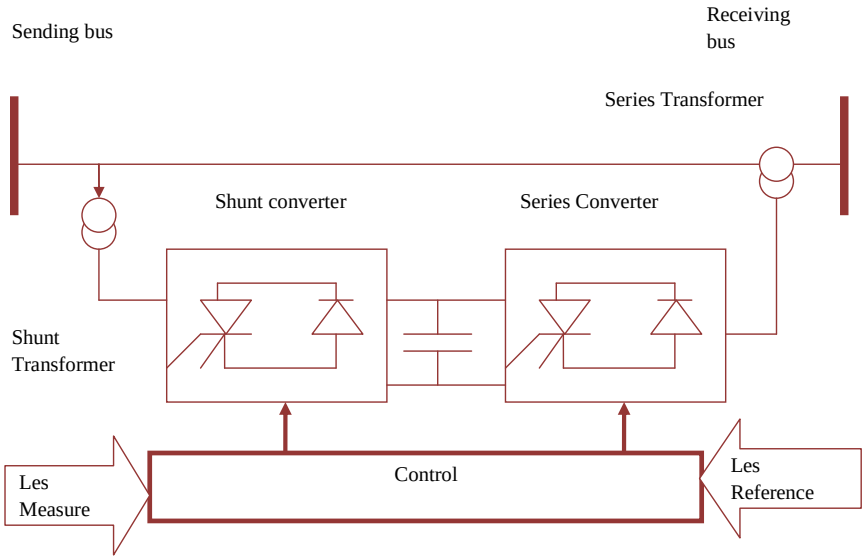

Fig. 1. *Schematic diagram of UPFC*

Here, the generator is related with the transmitting and receiving buses. The converters are related using the transformer. It comprises the converter impedances like shunt and series impedance. The converters are associated with the capacitor of DC link with the capacity of voltage. It is included in the UPFC power flow equation that is necessary to solve the power system pretentious quantities similar to equality and inequality constraints. It can happen because of the generators outage existing in the power system due to the exploitation side requirements insist contentment at all times.

Generally, the power system adds to the contentment for a total demand for the usage. Moreover, the system generators need to assure the total demand of the clients and the transmission lines power loss. Here, it is represented as the power balance or equality constraints circumstance of the power system. The generators contained in the system acquire outage; it might add to the loss of power and have an effect on the dynamic stability environment. In eq. (1), the necessary power balance condition is denoted.

$$\sum_{m=1}^{N_G} P_C^m = D + \sum_{n=1}^{N_G} \left(R_L^m + RP_L^m \right) \tag{1}$$

where D refers to the demand, P_C^m indicates the power generated in the m^{th} bus, RP_L^m and R_L^m represents the reactive and real power losses of the n^{th} bus that are computed using eq. (2) and (3).

$$R_L^m = |V_m||V_n||Z_{mn}| \sum_{n=1}^{N} \cos(\beta_{mn} - \delta_m - \delta_n) \tag{2}$$

$$RP_L^m = |V_m||V_n||Z_{mn}| \sum_{n=1}^{N} \sin(\beta_{mn} - \delta_m - \delta_n) \tag{3}$$

Where V_m and V_n indicate the m^{th} and n^{th} bus voltage, Z_{mn} indicates matrix of bus admittance, β_{mn} represent the angle connecting the buses m^{th} and n^{th}, δ_m and δ_n represent the load angles of m^{th} and n^{th}

Moreover, the inequality constraints such as real, voltage, and reactive power flow that is affected because of the dispute of the generation unit. The power system dynamic stability primarily regarded as the VOLTAGE STABILITY of each node. At each bus at the range [0.95 to 1.05] pu the stable power flow requires the voltage. Eq. (4) states the change in voltage.

$$\Delta V_m = \frac{1}{\sqrt{1}} \sqrt{\sum_{m=1}^{1} \left(V_m^k \right)^2} \tag{4}$$

$$\Delta V_m^k = V_{slack} - \sum_{m=1}^{n} X_m \left(\frac{R_L^m - nRP_L^m}{V_m} \right) \tag{5}$$

By means of V_{slack} indicates the voltage of the slack bus, V_m indicates the bus voltage, ΔV_m^k indicates the voltage stability index of the bus m. Here, $m = 1,2,3,4 \ldots n$ X_m indicates the impedance of the m^{th} bus, PR_L^m and R_L^m indicates the reactive and real powers of the bus m and n. The voltage of the bus lies among the limits that are $V_m^{min} \le V_m \le V_m^{max}$. In eq. (6) and (7), the reactive and real powers of the particular bus are denoted.

$$R_L^m = |V_m||V_n|\sum_{n=1}^{N_T} C_{mn}\cos\delta_{mn} + S_{mn}\sin\delta_{mn} \quad (6)$$

$$RP_L^m = |V_m||V_n|\sum_{n=1}^{N_T} C_{mn}\sin\delta_{mn} - S_{mn}\cos\delta_{mn} \quad (7)$$

Where V_m and V_n represent the voltage of m and n buses correspondingly, N^T indicates the total number of buses, δ_{mn} indicates the angle among m and n buses correspondingly, C_{mn} and S_{mn} represents the susceptance and conductance values correspondingly. Based on these constraints, exploiting the proposed hybrid technique the optimum position and the UPFC is evaluated.

4. Proposed Hybrid PSOSSA for optimal placement of UPFC

4.1 Conventional SSA Algorithm

In 2017, Mirjalili introduced SSA [16], which is a novel optimization method created to resolve many types of optimization issues. It imitates the Salps behavior in nature; it is a class from the Salpidae's species, and that are barrel-shaped planktonic tunicate. Additionally, they are alike to jellyfishes in tissues, as well as stirring behavior and their weights possess a maximum water percentage.

Initially, SSA divides the population into two sets such as the followers and the leader. Here, the front salp of the chain is represented as the leader, and the other salps are represented as the followers. In n - dimensions, the location of the salps is identified that symbolize the problem search space and n signifies the problem's variables. These salps explore for a source of food that denotes the objective of the Swarm. The location needs to update often, hence the eq. (8) is exploited to do this deed to the salp leader.

$$y_q^1 = \begin{cases} S_q + r_1\left(\left(u_q - l_q\right)\times r_2 + l_q\right) r_3 \le 0 \\ S_q - r_1\left(\left(u_q - l_q\right)\times r_2 + l_q\right) r_3 \le 0 \end{cases} \quad (8)$$

Where y_q^1 indicates the leader position within q^{th} dimension, where the source of food in this dimension is S_q, the lower and the upper bounds are l_q and u_q, respectively. r_2 and r_3 are produced arbitrarily in the range [0, 1] to preserve the search space. In addition, the parameter r_1 represents the significant coefficient of this technique, because of its part in the balancing among the exploitation stage and the exploration stage and it is computed by using eq. (9).

$$r_1 = 2e^{-\left(\frac{\Delta t}{t_{max}}\right)^2} \quad (9)$$

Where, t and t_{max} designate the current and the max iterations' number, correspondingly. Subsequently, in order to update the positions of leader's, the SSA initiates to update the followers' location by eq. (10).

$$y_p^q = \frac{1}{2}\left(y_q^p + y_q^{p-1}\right) \quad (10)$$

y_p^q is the p^{th} position of the follower within q^{th} dimension and p is superior to 1.

4.2 Conventional PSO Algorithm

PSO [17] imitates the evolvement of the information on social behavior and creates group communication behavior while sharing confidential information regarding migrating, hunting, or flocking. This group and its members signify a result and that is referred to as particles and swarm, correspondingly.

For updating the location, a particle depends on its knowledge and neighbors. The swarm initiates by producing a set of arbitrary particles and creating their positions y_p and velocity u_p in a dimension p^{th}. Subsequently, PSO initiates its major loop to calculate every particle by calculating a fitness function; the outcome is analyzed with its global and optimal values. The eq. (11) and (12) indicates the technique, which is exploited for updating the locations of particles.

$$y_{pq}^{(t+1)} = y_{pq}^t + u_{pq}^{(t+1)} \quad (11)$$

$$u_{pq}^{t+1} = w u_{pq}^t + c_1 r_1\left(y_{pq}^{p(t)} - y_{pq}^{(t)}\right) + c_2 r_2\left(y_{pq}^{g(t)} - y_{pq}^{(t)}\right) \quad (12)$$

where y_{pq} represents the p^{th} particle location in the q^{th} dimension, u_{pq} indicates the p^{th} velocity in the q^{th} dimension, t indicates the current iteration, w represents an inertia weight as well as used to enhance the speed of the population convergence. The constants c_1 and c_2 are acceleration coefficients. $y_{pq}^{p(t)}$ Indicates the optimal previous location of a particle p in q^{th} dimension; $y_{pq}^{g(t)}$ indicates the global optimal position in q^{th} dimension. r_1 and r_2 are arbitrary parameters $p \in [0, 1]$. This series will be repeated until meeting the stopping criteria.

4.3 Proposed HPSOSSA Algorithm

This section clearly describes the organization of the proposed Hybridization of PSOSSA method. It is the combination of the PSO [23] and the SSA methods. The fundamental organization of the SSA method is modified by enhancing the updating stage of the position of population's. This modification combines the update method of the PSO into the foremost method of the SSA.

This combination includes additional suppleness to the SSA in discovering the population and assures the variety of method and attains the best value rapidly. Generally, the major organization of the proposed PSOSSA method is demonstrated in fig. 2. The initial step in the proposed PSOSSA is to describe the parameters and produce the population that indicates a set of the result is to determine the optimum position. After that, each result performance is validated by calculating the fitness function for each one and determines the optimal of them. Subsequently step in the proposed PSOSSA method is for the current population updation exploiting either the PSO or SSA method that depends on the fitness function quality. Here, if the fitness function probability, for the current solution, is higher than 0.5 subsequently the SSA, if not, the PSO is exploited. Afterward, the fitness function for each solution is calculated as well as the optimal result is determined following by population updation. After that step is to ensure if the stop circumstances are contented next return by the optimal result, or else, do again the preceding steps from calculating the probability to the conclusion.

The proposed method initiates by defining the primary values of the PSO and the SSA after that SSA produces an arbitrary population Y of size N in D dimension, subsequently, SSA computes the food fitness for each outcome y_p, $p = 1,2,.....N$. On the other hand, before calculating the objective model, each solution y_p is rehabilitated to a binary vector (so as to comprises only 1's and 0's) along with the value of an arbitrary threshold $\in [0, 1]$ exploiting eq. (13).

$$y_p(t+1) = \begin{cases} 1 \text{ if } \dfrac{1}{1+e^{-y_p(t)}} > \mu \\ 0 \quad \text{otherwise} \end{cases} \tag{13}$$

So, only the y_p elements that are equivalent to 1's are selected to indicate the power loss. The subsequent step is to calculate the objective model for each y_p stated in eq. (14).

$$f(y_p(t)) = \xi E_{yp(t)} + (1-\xi)\left(\left|\frac{y_p(t)}{C}\right|\right) \tag{14}$$

where $E_{y_p(t)}$ indicates the minimization of the voltage deviation; while the next term indicates the minimization of power loss. So as to calculate the power loss and voltage deviation, the parameter $\in [0, 1]$ is exploited. Subsequently, the probability of every fitness function is calculated using eq. (14).

$$Prob = \frac{f_p}{\sum_{p=1}^{N} f_p} \tag{15}$$

In accordance with the $Prob$ value, the current solution y_i is updated exploiting the PSO or the SSA. For instance, $Prob > 0.5$, subsequently the SSA is exploited as shown in eq. (8) to (10), otherwise, the PSO method as shown in eq. (11) and (12).

For each updated solution, the fitness function is calculated and updated the optimal solution. This progression is iterated until it meets the stop state (the proposed PSOSSA method pertained for the maximum iteration's number as a stop state).

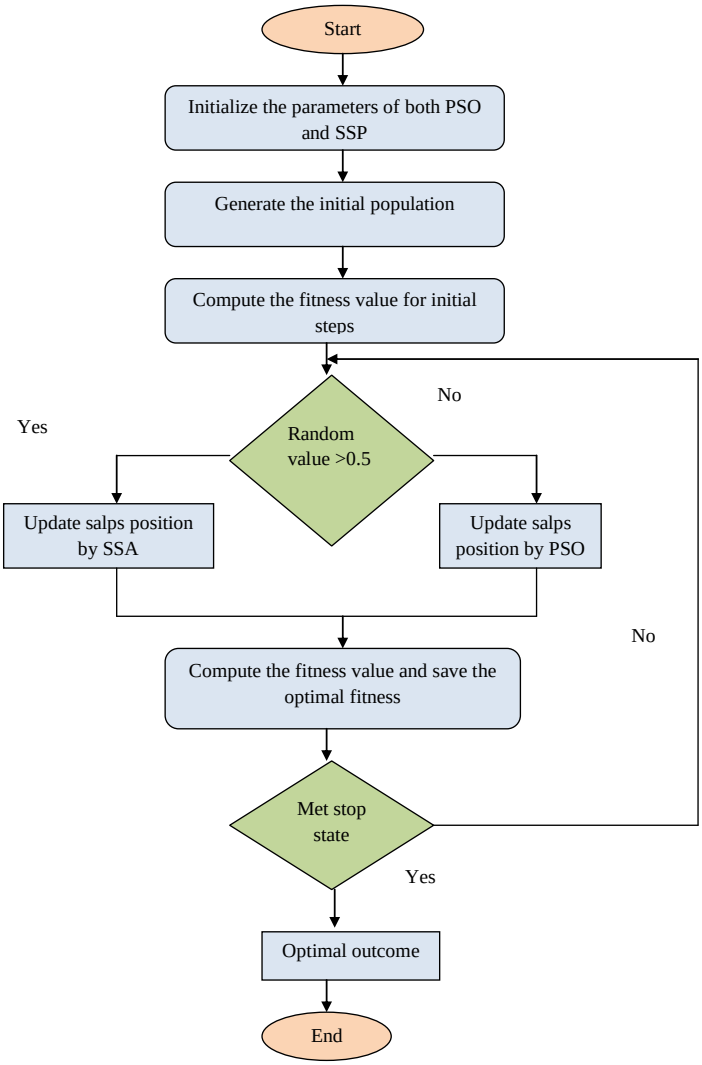

Fig. 2. *Flowchart of Proposed PSOSSA*

5. Results and Discussions

5.1 Simulation Procedure

The proposed technique is simulated in the MATLAB. In this section, the numerical outcomes of the proposed technique were shown and examined. The attained outcomes were compared with several operating environments. Here, the proposed method was tested in the IEEE bench mark systems such as IEEE 30 and 14 bus systems.

5.2 IEEE 30 Bus System

In this section, the dynamic stability of the IEEE 30 bus system is demonstrated. Here, the information regarding the power loss at normal circumstance also provided, for the single and double generator of the proposed hybrid approach and conventional approaches in IEEE 30 Bus system. Table 1 summarizes the comparative analysis of the proposed approach with different conventional methods such as PSO ABC, and GA for single generator problem is shown. Here, the obtained outcomes exposed the performance of the proposed technique, which outperforms existing techniques in terms of power loss in the IEEE 30 bus system.The performance analysis of the proposed method with different conventional methods like PSO ABC and GA for double generator problem is demonstrated in Table 2. Here, the attained result exhibits the proposed technique performance, and it outperforms the traditional approaches regarding the power loss in the IEEE 30 bus system.

In Fig 3, the graphical representation of Voltage Profile for both the conventional and proposed methods for IEEE 30 Bus system is shown. The Voltage Profile is recognized for the conventional approach and proposed an approach, during the generator off time. The Voltage Profile at each bus is

distorted at the generator shutdown period from the Voltage Profile analysis. However, the proposed approach is exploited to improve the VP normal condition by the UPFC.

Table 1. *Comparision of proposed and Conventional methods of Power loss in IEEE 30 Bus System for single generator Problem*

Methods	Fault generator in bus	Power loss (MW)
PSO	2	12.32
GA	2	11.45
ABC	2	13.42
Proposed	2	10.78

Table 2. *Comparision of proposed and Conventional methods of Power loss in IEEE 30 Bus System for Double generator Problem*

Methods	PSO		GA		ABC		Proposed	
Fault generator	22	27	22	27	22	27	22	27
Power loss (MW)	10.92	11.23	10.23	11.89	10.67	10.98	9.08	10.02

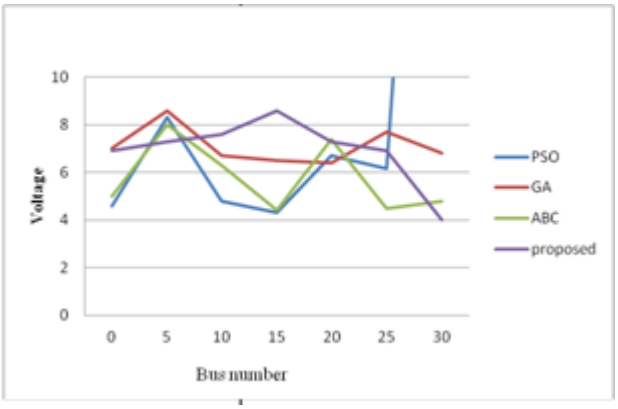

Fig. 3. *Graphical Representation of voltage profile for both the conventional and proposed method in IEEE 30 Bus system*

5.3 IEEE 14 Bus system

In this section, the dynamic stability of the IEEE 14 bus system is demonstrated. In Table 3, the performance analysis of the proposed technique with different conventional methods for single generator problem is demonstrated in the IEEE 14 Bus system. Here, the attained results exposed the performance of the proposed approach, which outperforms traditional approaches regarding power loss in the IEEE 14 bus system.

The performance analysis of the proposed method with different conventional methods like PSO ABC and GA for double generator problem is shown in Table 4. Here, the attained result exhibits the proposed technique performance, and it outperforms the traditional approaches regarding the power loss in the IEEE 14 bus system.

In Fig 4, the graphical representation of Voltage Profile for both the existing and proposed methods for IEEE 14 Bus system is revealed. From the analysis, it is clearly shown that the proposed approach improves the Voltage Profile than the conventional methods.

Table 3. *Comparison of proposed and Conventional methods of Power loss in IEEE 14 Bus System for Single generator Problem*

Methods	Fault generator in bus	Power loss (MW)
PSO	2	8.12
GA	2	8.48
ABC	2	9.14
Proposed	2	7.62

Table 4. *Comparison of proposed and Conventional methods of Power loss in IEEE 14 Bus System for Double generator Problem*

Methods	PSO		GA		ABC		Proposed	
Fault generator	22	27	22	27	22	27	22	27
Power loss (MW)	9.12	9.13	11.29	12.19	9.17	9.18	8.18	9.12

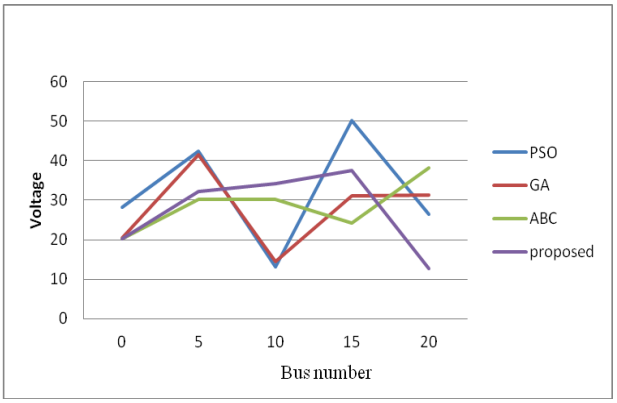

Fig. 4. *Graphical Representation of voltage profile for both the conventional and proposed method in IEEE 14 bus system*

6. Conclusion

The efficiency of the OPAS for UPFC in order to improve the dynamic stability was developed in this paper. The main benefit of the proposed approach, it has high efficiency in searching capability to discover the optimum solutions and correctness. Moreover, the proposed approach was evaluated in the IEEE 14 and 30 benchmark system as well as the efficiency was tested over various generator faults. At first, the single generator issue was carried out in different manners in the bus system and later double generator problem was established. In these circumstances, the power loss and the voltage profile was evaluated at normal circumstance, for both the proposed and conventional methods. Finally, the performance analysis shows that the proposed method efficiently improves the dynamic stability of the system because of the choice of optimum position and UPFC quantity was capable against the conventional methods.

Compliance with Ethical Standards

Conflicts of interest: Authors declared that they have no conflict of interest.

Human participants: The conducted research follows the ethical standards and the authors ensured that they have not conducted any studies with human participants or animals.

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3.3.2 - Number of research papers per teachers in the Journals notified on UGC website during the year **2019-20.**

Sr. No.	Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal /Digital Object Identifier (doi) number		
							Link to website of the Journal	Link to article / paper / abstract of the article	Is it listed in UGC Care list
1.	Automated e-billing and power control system through power line communicatio	D.L. Bhombe & Dr. D.D. Nawgaje	Electronics and Tel comm	Global Journal Of Engineering Science And Researches,	2019	2348–8034	https://www.gjesr.com/	https://zenodo.org/record/1548587/files/26.docx?download=1	NO
2.	Explore the Effect of Om Mantra Meditation on Brain with Wavelet Analysis	Bhavna Harne	Electronics and Tel comm	WSEAS TRANSACTIONS on SIGNAL PROCESSING	2019	1790-5052	https://wseas.org/cms.action?id=4062	https://www.wseas.org/multimedia/journals/signal/2019/a105114-685.pdf	YES
3.	Design of Vehicle Protection and Tracking System Using Face Recognition	Dr. S. B. Patil, P. R. Wankhede	Electronics and Tel comm	International Journal of Technical Innovation in Modern Engineering& Science (IJTIMES)	2019	2455-2585	https://www.ijtimes.com/	https://www.ijtimes.com/IJTIMES/index.php/ijtimes/article/view/2124/2061	NO
4.	Design of Anti-Theft and Tracking System For Vehicle Protection By Biometric	Dr. S. B. Patil, P. R. Wankhede	Electronics and Tel comm	International Journal of Advance Research in Engineeri	2019	2393-9877	https://www.ijaret.org/	http://www.ijarest.com/papers/finished_papers/150722140918_.pdf	NO

	Authentication			ng, Science & Technology (IJARET)					
5.	Automated Micro-aneurysms Detection using Pixel Intensity Rank Transform	Pravin Wankhede and Kamlesh Khanchandani	Electronics and Tel comm	Biomedical and Pharmacology Journal, Vol 13, Issue 1, Scopus	2020	0974-6242	https://biomedpharmajournal.org/	https://biomedpharmajournal.org/vol13no1/automated-microaneurysms-detection-from-retinal-fundus-images-using-pixel-intensity-rank-transform/	YES
6.	Feature Extraction in Retinal Images using Automated Methods	Pravin Wankhede and Kamlesh Khanchandani,	Electronics and Tel comm	International Journal of Scientific & Technology, Vol 9, Issue 3 Scopus	2020	2277-8616	https://www.ijstr.org/	http://www.ijstr.org/final-print/mar2020/Feature-Extraction-In-Retinal-Images-Using-Automated-Methods.pdf	YES
7.	200W Ku band GaN HEMT Power Amplifier for Satellite Communication	Vivek V. Ratnaparkhi	Electronics and Tel comm	International Journal of Scientific & Technology Research Scopus Vol. 08	2019	2277-8616	https://www.ijstr.org/	http://www.ijstr.org/final-print/sep2019/200w-Ku-band-Gan-Hemt-Power-Amplifier-For-Satellite-Communication.pdf	YES
8.	Review of GaN HEMT High Power Amplifiers for Microwave Applications	Vivek V. Ratnaparkhi	Electronics and Tel comm	International Journal of Advanced Science and Technology Scopus	2019	2005-4238	https://www.scopus.com/sourceid/21100829147	https://www.researchgate.net/profile/Vivek-Ratnaparkhi/publication/342513679_Review_of_GaN_HEMT_High_Power_Amplifiers_for_Microwave_Applications/links/61163ac40c2bfa282a3f75c7/Review-of-GaN-HEMT-High-Power-	YES

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9.	Creation of Dashboard for Financial Accounting in SAP	T. P. Marode	Electronics and Telecomm	International Journal of Advanced Innovative techniques in Engineering	2020	2455-6491	https://ijaite.co.in/	https://drive.google.com/file/d/1jMI8CPKR3M3-cN5PhA5FqP5J2zMgiq4e/view	NO
10	A novel hybrid atlas-free hierarchical graph-based segmentation of newborn brain MRI using wavelet filter banks	Kamlesh Khanchandani	Electronics and Telecommunication Engineering	INTERNATIONAL JOURNAL OF NEUROSCIENCE	2019	0020-7454	https://www.tandfonline.com/action/journalInformation?journalCode=ines20	https://escipub.com/international-journal-of-neuroscience-research/	YES

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GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

AUTOMATED E-BILLING AND POWER CONTROL SYSTEM THROUGH POWER LINE COMMUNICATION

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ABSTRACT

Now a days electricity is very important to carry out various work which need electricity. And because of that, proper utilization of this commodity is of immense important to us. That's why, it is required to measure power consumption. Previous system require an individual and agent to physically come and take down the readings and report to house hold or office the amount one has to pay. The objective of this paper is to measure and monitor the electricity consumed by consumers in a locality and transmitting the measured reading between the consumer and utility. The concept of Power Line Communication is used for the transfer of data between consumer and utility. Power Line Communication uses the high power line for the communication. The vital merit of this system is that no additional transmission line is needed for the transmission of data. It gives the useful functionality of switching the power ON or OFF to the user based on the signal sends to it from the controller.

Keyword: *PLCC:Power Line CarrierCommunicationmodem , EB: Electricity Billing , AMR: Automatic meter reading*

I. INTRODUCTION

A. Power line communication

Here the power line carrier communication modemis useful to send and receive serial data over existing AC power lines of the building. It has large immunity to electrical noise patience in the power line and built in error checking therefore it cannot give out corrupt data. The modem is in the form of a ready to use circuit module. It is capable of providing 9600 baud rate less rate bi-directional data communication. Due to small size it can be integrated and become part of the consumer's power line data communication system.

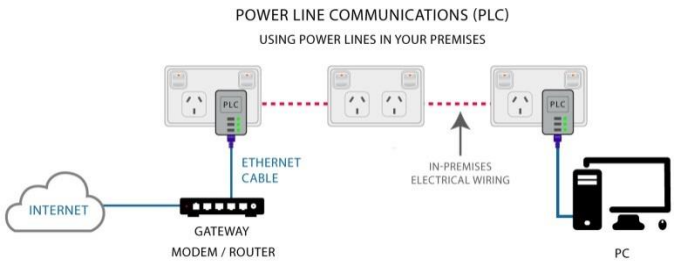

Figure1.PLC

B. Hardware required

1) Digital energy meter:
The Digital energymeter is a high-accuracy, fault-tolerant electrical energy measurement IC that is intended for use with 2-wire distribution systems. It is electrically fed and calm of electronic controllers. It assemble an interface for the data to be transmitted from the remote terminal to the isolator block.

2) Optocoupler:
In this project, an electrical isolation between energy meter and power line modem is very important. For this purpose an optocoupler is used.

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3)Microcontroller:
Then the microcontroller which has been used in project is AT mega 328, Flash, EEPROM, and SRAM are all integrated onto a single chip, removing the need for external memory in most applications. Some devices have a parallel external bus option to allow adding additional data memory. Almost all devices have serial interfaces, which can be used to connect larger serial EEPROMs or flash chips.

4) LCD:
LCD stands for Liquid Crystal Display. It is a display device which display the information provided to it. Its shape and size varies for different applications.

5) PLC modem:
Power line modem is useful to send andreceive serial data over AC mains power lines of the building.[1]

II. LITERATURE REVIEW

Inthe previous technologies for the automatic meter reading there are many factors which are missing that is speed and also due to the use of GSM the interference problem can be there .When there is the use of android technology for the automatic meter reading there is less memory storage. Also if the network connection is week then there may be the loss of data connection. Now the power line carrier communicationhas also been used as a technology but still there is only the advancement in automatic meter reading of each house from EB office.And the automatic power controlling is not present there so it is less advantageous than the system which has been proposed in this paper.

So here in our project the power line communication modem is used but for automatic meter reading as well as for the power supply controlling through GUI , if the bill has not been paid by the customer in time. And after the payment of bill automatically the power supply connection will be ON of that customer's house by the EB officer.

III. PROPOSED SYSTEM

C. System Description:

The customer section consists of digital energy meter. The output of the processor is a digital pulse which depends upon the load used. These digital pulses are given to the input of second section through the optocoupler. Hence the energy consumed by the consumer is measured digitally. The control section in customer section is the heart of the system which consists of the micro controller. For every 3200 pulse the micro controller receives it increases the number of units consumed by the consumer by 1 which is stored in the EEPROM. The vendor section consists of the PLC MODEM which is a transceiver i.e. it can receive as well as transmit data. The PLC modem receives the input from the microcontroller and transmits it to the EB office. These are received by the modem placed in the EB office.[1]

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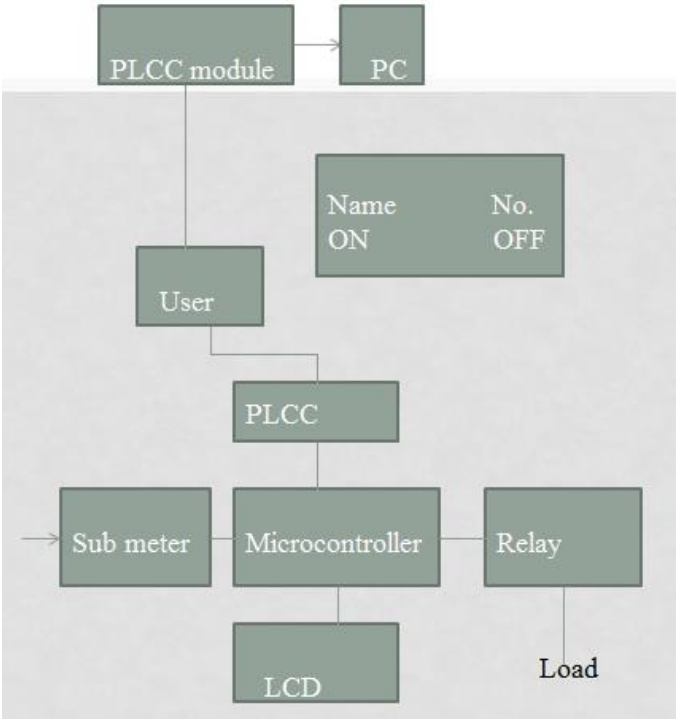

Figure2: Practical implementation of automatic meter reading

In the above system the microcontroller will first read the data ih the form of units present on the sub meter. Then the readings will get send in the forward direction towards the PLCC. In this project we required total two PLC modem. One for transmitter and another for receiver to decode the data. Afterwards the EB officer will save all the data in the PC of each house and accordingly he will send the amount of bill customer has to pay.

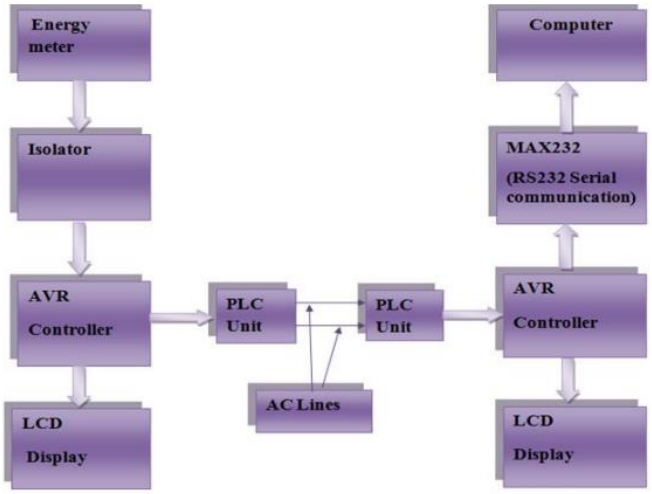

Figure3.Alternative diagram of Automatic meter reading

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D. AMR (Automatic Meter Reading)

Basically the AMR is apower measuring device , generally it is being used in measuring electricity , gas , water consumption in many countries on the world since it has a lot of advantages that the old analog meters doesn't have. It has advantages in safety , real time measuring and time save as well as it has a better user interface and digital data analysis . AMR appears in several types depends on measured data type and data transfer technologies . We can say that AMR is the best solution to measure,collect and analyze data for the big networks like the electricity transmission and distribution network in Egypt . In the year 1886 , the first AC transmission line was installed . Since this age , it was very important to measure the energy that consumers pay for . Hence , the first generation of power meters was found which we know as (Watt-Hour meter) . As most of us know , the first generation(traditional meter reading devices) is being used tell now in many places .It has a lot oflimitations that we will mention later . To overcome this limitation we have to modify a newreading system that provides remote reading, safety , on-time readings and a simple user interface . That is what AMR provides successfully.[2]

E. Description of customer and vendor unit

The first one is the customer section consists of digital energy meter and control system. The current transformer (CT) and voltage transformer (VT) of the specified rating are used. The output of the processor IC is a digital pulse, which depends upon the load used. These digital pulses are given as an input to the second section through the optocoupler. And that's why the energy consumed by the consumer is calculated digitally. The control system in customer section is the heart of the system which consists of the micro controller(ATMEGA328). For every specified number of pulse the micro controller receives it increases the number of units consumed by the consumer by 1, which is stored in the EEPROM. This is then displayed onLCD. The vendor unit consists of the MODEM which is a transceiver i.e. it can receive as well as transmit data. The modem receives the input from the microcontroller and transmits it to the EB side. These are received by the modem placed in the electricity billing side and sent to the PC. The tariffs are calculated using VB software by the PC and sent to the micro controller through the same pair of MODEM. Hence the number of units consumed andthe amount is displayed on the LCD panel.[3]

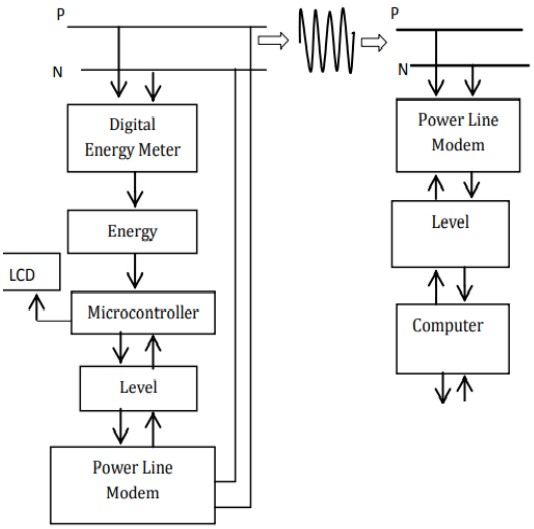

Figure 4. Customer and vendor unit

Though many technological innovations are taking place in this world, existing electricity consumption billing process seems in India to be very obsolete and does not meet the latest technology available. In this paper, the above said process is totally automated and the communication is made possible entirely through the power line. Not only the billing, even the control of system is fully automated by this technique i.e. when a consumer fails to pay his bill consumption within a given period of time the supply automatically gets cut off to his house and the

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restoration is done only when the bill is cleared. The currently usedsystem involves the user to go up to the EB office to manually pay his bills. The readings are taken using the analog meter present in the customer's house. The readings are taken using an employee working at the EB office. This system is having some of limitations like erroneous readings, easy manipulation, manual labor and time consuming. In the proposed system, the analog energy meters are replaced by digital meters which is advanced . The meter readings in the form of digital data are transferred from the customer end to the Electricity billing office through power line. [4]

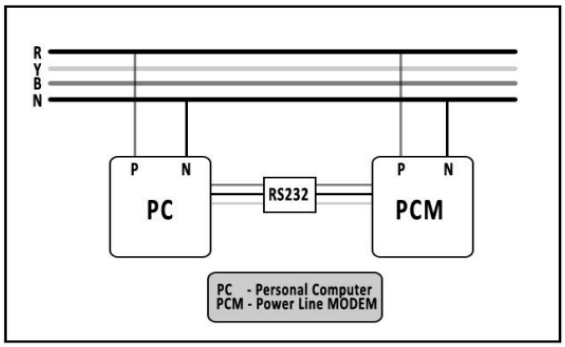

Figure 5: Connection between PLC and PC

F. Power line communication and computer connection

There is a cable which is used for serial data transmission. Thus the connection between the computer and the PLM is in the form of serial data transmission with a start byte and end byte attached to the data. In the prototype software a specially designed binary enables the power line modem to get the KWh readings from each energy meter on the consumer end. A protocol is sent from the PC to the meter requesting the meter reading. The meter in turn sends back the meter reading value. A data base management system is maintained in the PC to store the power consumption details of the customers. These details are processed to obtain the bill that is to be paid by the customers. As soon as the bill is generated the grace time for the consumer is given for paying the bill. The computer continuously monitors, whether the bill is cleared in time. If not, the PC sends the trip signal via concentrator, through the power line, to the node at the consumer end. The supply is again restored back only when the bill is cleared .[5]

We propose to create such energy meters, which will have the de multiplexer or decoder circuits to decode this information. This data will then be read by an AVR microcontroller circuit also built in the energy meter.

Based on the information, which is nothing but the billing status of the consumer, indicating whether he has paid his bill or not, the microcontroller circuit will trigger a relay based switching circuit, which controls the power supply to the customer.The information will source, or at the distributing local substation, by the electric company officials, by an encoding/multiplexing circuit. It will contain the information of all consumers, being retransmitted periodically. We will demonstrate this system with a single energy meter, due to budget constraints.[6]

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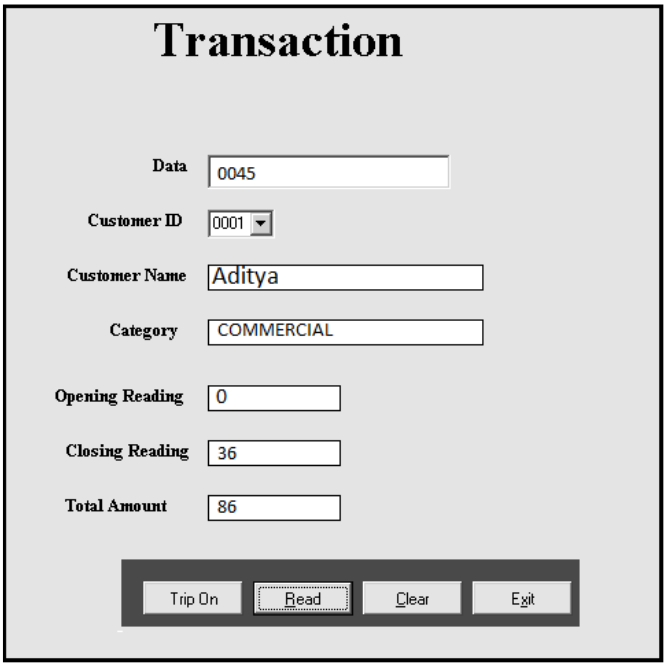

Figure 6: Billing form

Above figure is showing the billing form on which the amount which should be paid by the user is also shown. Many problems had encountered during implementation but finally design had been successfully implemented, simulated, and results are taken. It is also researched several ways to improve the system. The GUI could be used which is in built in the matlabto communicate with the low level instructions in the Power PC micro-controller to give a user-friendly interface for both transmitter and receiver.

IV. CONCLUSION

The system which has been proposed saves time and money, increases customer satisfaction, reduces complaints and worker injuries and can pay for itself in a handful of years. Utilities should look beyond basic meter reading expenses to determine how an automated system will drive efficiencies and savings throughout many departments in the organization. This proposed Automated EB model includes an office module which has a PC with its back end connected to a database. The other module is the customer home module which is present at the home this module is used to make note of the amount of power consumed by the customer and after a period of 1 month it sends to the PC in the EB office. This EB office module calculates the data and sends it to the customer along with the due date. The customer also gets details of the bill on his mobile phone through which he can pay the bill. If the customer fails to pay the bill the automated system, cut OFF the customer‟s supply and the restoration takes place only after the bill is cleared. Even though there are new modern methods of communication of billing data, the use of existing power line seems to be the most economically efficient.

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Explore the effect of Om mantra meditation on brain with wavelet analysis

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Abstract: - This study uses a discrete wavelet transform based feature extraction method to examine the effect of Om meditation on the brain. With twenty-three healthy engineering college students between the age group of twenty to twenty-two chosen as subjects for the study, EEG signals were obtained before performing Om meditation as well as after performing Om meditation. EEG signals were classified into Gamma, Beta, Alpha, Theta and Delta bands by using detailed coefficients and approximate coefficient obtained by five level wavelet transform. Feature such as relative power using the Welch method was extracted from each band and was analyzed using two way repeated analysis of variance. Findings reveal increased theta power and higher theta amplitude in after condition at all regions in comparison to the before the condition of meditation but results were not significant. No significant results were found in any other band. As described in other studies, increased theta power is a sign of relaxation. Results revealed through the study were promising results for single day testing and immediate effect of Om meditation. The study emphasizes the importance of Om meditation which could work wonders for people under stress if adopted as a daily routine. As Om meditation is simple and easy to practice, it could open a new horizon for naïve meditators.

Key-Words: - Mantra meditation, EEG, Om.

1 Introduction

Meditation is one of the aspects of yoga that can be stated as consciously and voluntarily guiding self-attention for relaxation or for seeking oneself or for personal improvement. Meditation can be categorized into two types: the first type involves focusing attention on a particular object and second being a mental or loud repetition of a chant called mantra meditation [2]. Varieties of mantras can be chosen for meditation. Mantra repetition is a simple method to implement in order to attain meditation [3]. The appearance of the Om syllable in Upanishads, Bhagvat Gita, and Vedas make it holy and sacred [4], thus making it the highest sacred symbol in Hinduism. Om, considered as the name of God, is a sacred syllable in Hinduism from which all other sound came into existence [4].

Many benefits of Om meditation have been revealed from studies conducted using sophisticated mathematics and medical tests to analyze its effect on the human body. Many researchers have found the effects of Om meditation on human by analyzing various parameters such as functional Magnetic Resonance Imaging (fMRI) [5], Evoked Potentials [6-7], Electroencephalograph [8-9] and other variables [10-11]. fMRI study has been conducted on the listening of the Om mantra [12].Even wavelet analysis of uttered Om sound has been done [13]. All analysis shows the positive effect of Om mantra meditation on the human body.

There are mainly two studies based on EEG on loud Om mantra meditation. The first study [8] is the time domain analysis of the EEG signal before and after Om chanting. The second study [9] is based on power spectral analysis which employed a fast Fourier transform (FFT) to examine oscillatory changes in the standard frequency bands (delta, theta, alpha, and beta) after OM chanting. Most of the studies [14-20] related to different meditations used the concept of FFT to explore neural concomitants. Wavelet and FFT are two tools of spectral analysis [21]. Wavelets are localized in both time and frequency whereas the standard FFT is only localized in frequency. Wavelet is proved to be better in detecting brain diseases [21]. In the existing literature on meditation, many studies used wavelet analysis and features from it to classify the EEG patterns [22-26]. A few works of literature have addressed the use of wavelet for power spectral analysis of the EEG signal. In the present study, in contrast to Fourier analysis, wavelet analysis has

been used for spectral analysis of the EEG signal before and after OM chanting. The aim is to compare oscillatory changes in the standard frequency bands (delta, theta, alpha, beta, and gamma) before and after OM chanting. In all studies related to different meditations [14-20] examining EEG measures reported an increase in theta power. Since other meditations have shown modulation in the theta band, it has been therefore hypothesized that like other meditation OM chanting would result in changes in theta activity [9].

In order to find the effect of Om mantra meditation on human beings, subjects with no prior experience of meditation were chosen. Students of Shri Sant Gajanan Maharaj College of engineering were selected as subjects for conducting the study.

This study is an attempt to evaluate the trait changes in EEG pattern due to Om meditation outside meditation, unlike other studies where states are evaluated during meditation. The rest of the paper is organized as follows: at the first section, materials and methods are discussed followed by experimental results. The discussion part is covered in the third section. The last section concluded the study.

2 Materials and methods

2.1 Subjects

A total of 23 naive meditators with a mean age of 20.99 years, between the age group of 18–22 years were assessed. Subjects chosen had no meditation training referred to as naïve meditators. They were chosen from a Shri Sant Gajanan Maharaj College of engineering randomly. Subjects were informed to practice Om mantra meditation and that their brain activity would be recorded before and after OM chanting. Nonsmokers, not frequent drinkers and right-handed subjects with sound mind state were chosen with the explicit consent of each subject. This study is presented and applied to the concerned ethical committee of Government Medical College, Akola, Maharashtra, India [9].

2.2 Design of study

The study was conducted in two sessions with repeated measures: the first session involves EEG assessments before Om meditation and the second involves EEG assessments after Om meditation. Subjects were asked to perform OM chanting for a duration of 30 minutes.

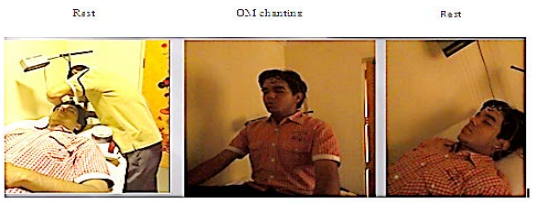

Fig. 1 Experimental setup

The experimental setup for the study is
"Rest →OM chanting →Rest"
as shown in the figure below (Fig. 1). The recording was done in a peaceful and quiet place in order to help the subject to concentrate more effectively. The subject was asked to relax by laying down on a cot with closed eyes. In this relaxing mode, EEG was recorded termed as "EEG before meditation". After recording EEG data, the subject was instructed to sit in an erect position and perform Om chanting for about 30 minutes. During the Om chanting subject was asked to breathe smoothly. During meditation, subjects were asked to inhale for a longer time and exhale with chanting Om. The room of the recording was kept dark for better concentration. Following meditation, the subject was again asked to relax by laying down on a cot with eyes closed. And, again EEG was recorded for more than two minutes which is termed as "EEG after meditation". The subject provided with their detailed experience after experiment [9].

2.3 EEG recording before and after Om mantra meditation

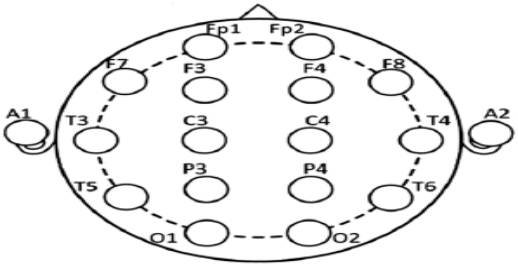

Fig. 2 Electrodes placement

In an electrically shield room of Bilala Hospital, Akola, EEG recording was performed under the guidance of Dr. Saurabh Bilala. EEG signals were recorded using monopolar montages, according to international standard 10-20 from 16 channels using the RMS India system with a 256 Hz sampling frequency. The electrodes and their placement are as shown in fig. 2. The electrodes in the left hemisphere were referred to the left earlobe (A1) with the ground at the forehead [9]. Electrodes placed on the right hemisphere are numbered evenly, whereas those on the left hemisphere are numbered oddly. Electrodes used are prefrontal

electrodes Fp (1,2), frontal electrodes F(7,3,4,8), temporal electrodes T(3,4,5,6) Central C(3,4), Parietal P(3,4), Occipital O(1,2) and reference earlobe A(1,2).

2.4 Discrete wavelet analysis

Out of the two types of wavelet transform: Continuous and Discrete, Discrete wavelet transform (DWT) is used widely in biomedical applications [27]. DWT is a time-frequency analysis technique suitable for analyzing non-stationary signals. EEG signals contain non-stationary characteristics [26], hence DWT is the well-suited technique for analyzing EEG [27-28]. DWT decomposes signal by passing it through a pair of high pass and low pass filter having mirror characteristics. By using a filter bank tree diagram DWT decomposition is shown in the diagram below (fig.3). Using quadrature mirror filters (QMF), DWT split the signal into two equal components: Detail and Approximate. 'Detailed coefficients' (D) are obtained by passing the signal through high pass filter whereas 'approximation coefficients' (A) are obtained by passing through low pass filter. The filtered signal out of low pass filter is again split into two components D2 and A2 corresponding to level 2. Again the low pass filter components of level 2 are split into two coefficients D3 and A3 and so on. As the level goes on, low pass filter components are split further and in this way, DWT decomposition takes place thus forming a bank of continuous bandpass filters spread logarithmically over frequency [27-28].

Scaling function dependent on low pass filter $\Phi_j,k(n)$ is given by

$$\Phi_j,k(n) = 2^{\frac{j}{2}} h(2^j n - k) \quad (1)$$

and the wavelet function dependent on high pass filter $\Psi_j,k(n)$ is given by

$$\Psi_j,k(n) = 2^{\frac{j}{2}} g(2^j n - k) \quad (2)$$

where $n = 0,1,2,.....,M-1$; j represents resolution

$j = 0,1,2,....,2j-1$; k represents sampling ratio

$J=\log_2(M)$ M is the legth of the signal[29]

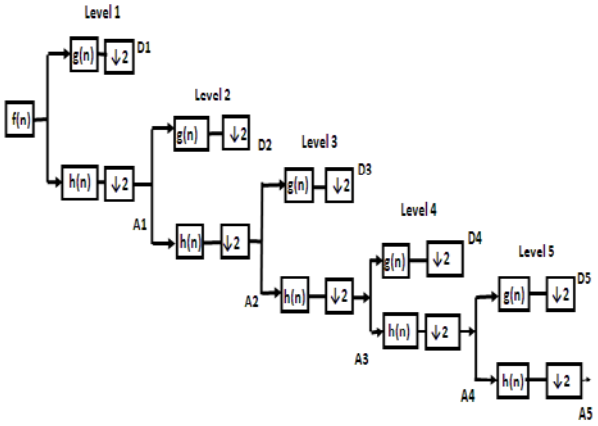

Fig. 3 DWT sub-band decomposition

Approximation coefficients in the ith level is given by:

$$A_i = \frac{1}{\sqrt{M}} \sum_n f(n)\Phi_j,k(n) \quad (3)$$

Detail coefficients in the ith level is given by:

$$D_i = \frac{1}{\sqrt{M}} \sum_n f(n)\Psi_j,k(n) \quad (4)$$

With the sampling frequency of 256 Hz, the maximum level L chosen for decomposition is 5. In this study, DWT has been carried out using various mother wavelets namely:

Daubechies db2, db3, db4, db5, db6, db7, db8, db9, db10.

Coiflets coif1, coif2, coif3, coif4, coif5

Symlets sym1, sym2, sym3, sym4, sym5, sym6, sym7, sym8.

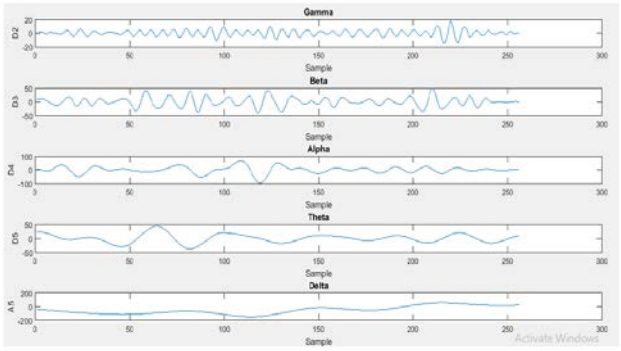

Fig. 4 Approximate and detailed coefficients of one second EEG using db4 wavelet taken from a subject before Om meditation

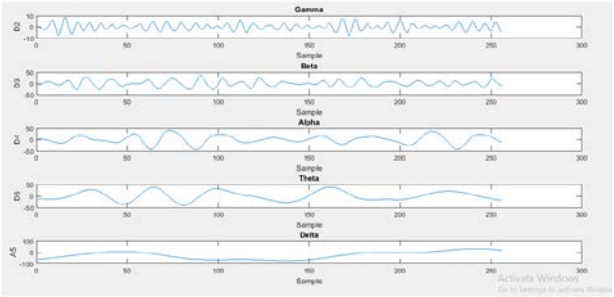

Fig. 5. Approximate and detailed coefficients of one second EEG using db4 wavelet taken from a subject after Om meditation

Table 1 Bands with five level DWT

Level	Wavelets coefficients	Frequency bands (Hz)	Correspondi ng Band
2	Detail coefficient D2	32-64	Gamma
3	Detail coefficient D3	16-32	Beta
4	Detail coefficient D4	8-16	Alpha
5	Detail coefficient D5	4-8	Theta
5	Approximate coefficient A5	0-4	Delta

Analyzing the coefficients in sub-bands yields classified signal into five bands namely Gamma (32 – 64 Hz), Beta (16-32 Hz), Alpha (8-16 Hz), theta (4-8 Hz) and delta (0 - 4 Hz) (table 1).Fig.4 and fig 5 show the approximate and detailed coefficients for one second EEG.

2.5 Feature extraction using DWT

Since the purpose was to explore brain dynamics as a result of OM chanting, the EEG data of the first one minute before OM chanting was used to assess the control state and the first one minute data after OM chanting to assess state achieved after meditation [9]. One minute data should be used for trustworthy spectral analysis [30]. 256 data points epoch was selected. The DWT was then performed to the selected data. The power spectral density (PSD) of delta (0.3–4 Hz), theta (4.1–8.0Hz), alpha (8.1–16.0 Hz), and beta (16.1–32.0 Hz) and gamma (36.1-64.0) frequency band were obtained by using Welch technique, Hanning windowing function. The resulting values were afterward normalized into a relative power [31-32] as follows:

$$\text{relative power} = \frac{\int_{f_L}^{f_H} S_b(f)df}{\int_0^{f_{\max}} S_T(f)df} \times 100 \qquad (5)$$

Where
f_L - lower frequency of particular band,
f_H - lower frequency of particular band,
f_{max} =55 Hz,
S_b – EEG signal of particular band,
S_T – EEG signal of particular band

Finally, the mean relative power was computed for every electrode. For statistical analysis, all 16 electrodes were divided into 8 brain regions which are as follows: right partial occipital (P4, O2), left partial occipital (P3, O1) right central (C4), left central (C3), right frontal (F8, F4and Fp2), left frontal (F7, F3 and Fp1), right temporal (T4 and T8) and left temporal (T3 and T7). Under each region, the power values of the constituent electrodes were averaged, and the procedure was repeated for all the frequency bands. The descriptive representation of the proposed feature extraction scheme is presented in Fig. 6.

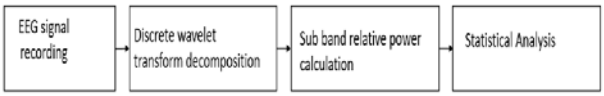

Fig. 6. Flow diagram of proposed approach to qualify the changes in spectral power of each band

2.6 Statistical analysis

For statistical analysis, IBM SPSS software version 2 was used. In order to find the normality of the relative power data distribution, a Kolmogorov–Smirnov test was preliminarily tested. It revealed a normal distribution of the data, justifying the subsequent use of ANOVA analysis. Two-way analyses of variance (ANOVAs) were performed on the relative power values obtained. In order to verify the specificity of a band involved into the OM chanting effect, two way repeated ANOVA was carried out with factor bands namely, delta, theta, alpha, beta, and gamma also considering two conditions namely before and after. In order to analyze the specificity of location involved into the OM chanting effect, each frequency band was submitted to a within-subjects design, analysis of variance (ANOVA) over the factors of condition (before and after) and region (8). A statistically significant value of p is 0.05. Greenhouse-geisser corrected values were reported.

3 Experimental results

Meditation features were quantified by discrete wavelet transform using different mother wavelets namely Daubechies (db2 to db8), Symlets (sym1 to sym8). The result turns out from all different wavelets that are almost the same.
The first two-way ANOVA analysis is conducted to check the involvement of a particular band in OM

meditation on relative power obtained by different mother wavelets. All reveals only band significant results, not any interaction (band x condition) or condition effect.Fig.5 shows relative power in the band before and after condition with the db4 mother wavelet. Research results are the opposite of what was expected. No specific band involved in the OM chanting effect.

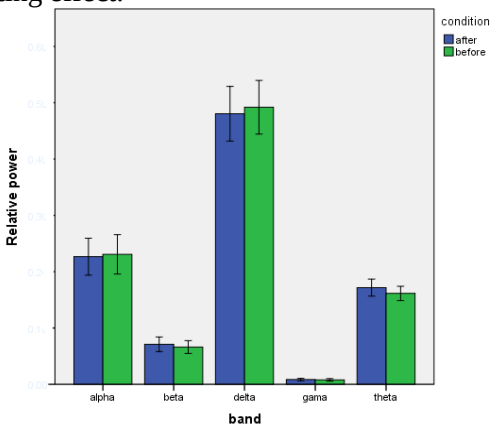

Fig.5 Relative power with DWT (db4 mother wavelet) before and after OM mantra meditation (N=23). No any band exhibited a significant effect.

Secondly two -way repeated ANOVA with region [8] and condition [2] as factors were performed for relative power values obtained by different wavelet separately for all the five types of bands (delta, theta, alpha, gamma, and beta) to assess the association between region and condition after OM chanting. Main effects (conditions and regions) and interaction effect for each frequency band with db4 wavelet are given in table 2.Repeated-measures ANOVA demonstrated insignificant main effects for condition and interaction effect for all bands (table.2).

Fig.6, fig7, fig.8, fig.9, fig.10 show mean relative power with symlet2, db8, db7, db6, and db4 mother wavelet. But closer examination shows an increase in theta power in all regions in after condition with all wavelets. These results are very promising and enhanced theta is noticeable with the db4 mother wavelet only.

Table 2 ANOVA results (n=23)

Frequency band	Condition main effect	Region main effect	Condition × region interaction effect
Alpha	F (1, 22) = 0.045 P = 0.835	F(7,154)= 18.796 P = 0.00	F(7, 154) = 1.196 P = 0.308
Beta	F(1,22) = 0.533 P = 0.473	F(7,154)= 15.242 P = 0.000	F(7,154) = 0.608 P = 0.748
Delta	F(1,22) = 0.533 P = 0.473	F(7,154)= 15.242 P = 0.000	F(7,154) = 0.608 P = 0.748
Gamma	F(1,22) = 0.198 P = 0.660	F(7,154) = 7.915 P = 0.000	F(7,154) = 0.848 P = 0.550
Theta	F(1,22) = 1.185 P = 0.288	F(7,154)= 48.064 P = 0.000	F(7, 154) = 0.454 P = 0.866

*significant (p<0.05)

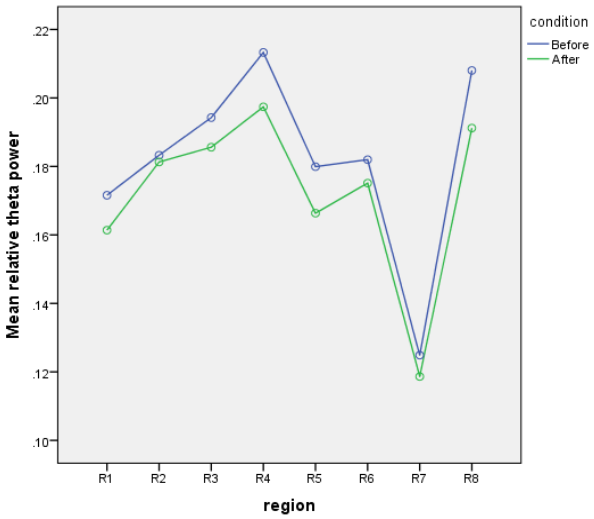

Fig. 6 Profile graph showing changes in relative power in theta band in all eight regions at before and after conditions with symlet2 mother wavelet: Region: R1: Left Frontal; R2: Left temporal R3: Left partial occipital R4: Left central; R5: Right frontal; R6: Right temporal; R7: Right partial occipital R8: Right central

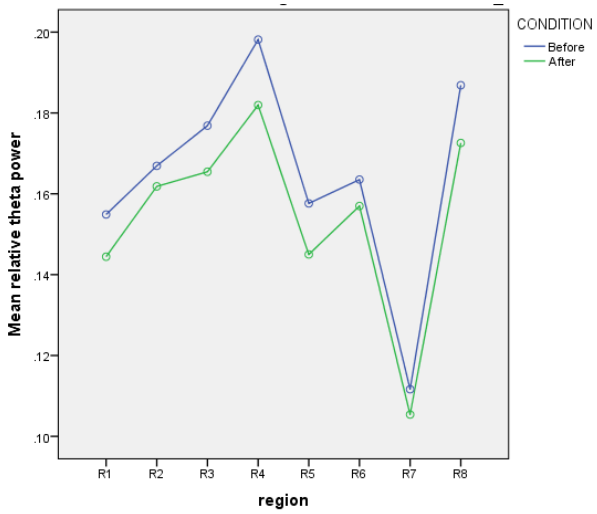

Fig. 7 Profile graph showing changes in relative power in theta band in all eight regions at before and after conditions with db8 mother wavelet

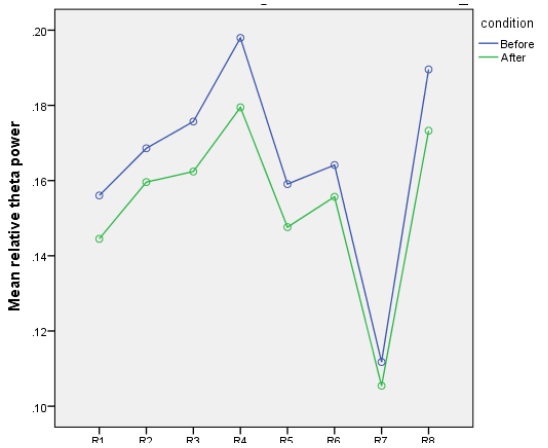

Fig. 8 Profile graph showing changes in relative power in theta band in all eight regions at before and after conditions with db7 mother wavelet

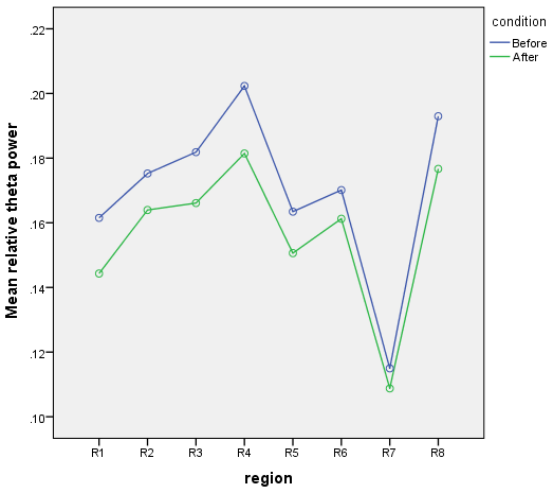

Fig. 9 Profile graph showing changes in relative power in theta band in all eight regions at before and after conditions with db6 mother wavelet

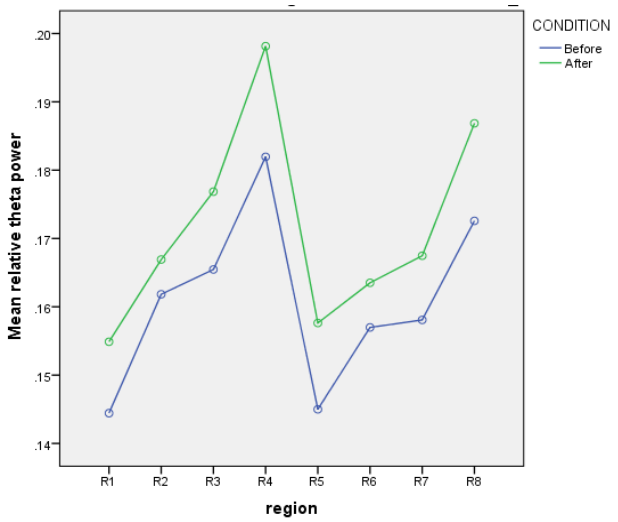

Fig. 10 Profile graph showing changes in relative power in theta band in all eight regions at before and after conditions with db4 mother wavelet

4 Discussion

The focal objective of this study was to explore the effect of Om mantra meditation on the brain through information rendered by the relative discrete wavelet power of all bands of EEG. Any band oscillations as an attribute of 30 minutes OM chanting was not observed with wavelet analysis. But an increase in theta power in all regions of the brain has been observed. Raised theta denote a reduction in cortical arousal [33-36]. The condition of deep relaxation is correlated with a decrement in cortical arousal [37]. Earlier studies have presented the significance of Om mantra meditation in offering relaxation [5, 9]. Thus on the basis of previous literature and our study, OM chanting can be proposed as an effective measure for offering relaxation.

There are many previous reports [14-20] on mediation in which theta power increases during meditation. But these studies usually performed a FFT spectrum analysis of the EEG signal. In our knowledge, only one study on Sudarshan Kriya yoga [38] has been conducted using a similar feature to analyze its effect on brain signals during a working memory task. This is the second effort to use this feature to investigate the effect of meditation on the brain and thus producing promising results with naïve mediators and only thirty minutes Om chanting. The syllable of 'Om' consists of three sound A U M [4] "A" represents the physical plane. "U" represents the mental and astral plane, the world of intelligent spirits, and all the heavens. "M" shows the deep-sleep state [39]. In this study, while recording EEG, subjects were not abided by the time constraints for the recitation of 'A',' U', 'M 'sound of Om mantra. A detailed study can be carried out by keeping fixed time for 'A',' U', 'M 'recitation or with experienced meditators or with a bigger sample size or with control groups. Our study on naïve meditators with immediate effects of loud Om mediation can work as an impetus for naïve meditators to practice Om meditation on a daily basis and may provide solace to people under stress.

5 Conclusion

Power spectral density extracted from DWT transform were calculated to quantify the differences in the various brain areas at varied bands of frequency. For analysis, two way repeated

ANOVA measures were employed which reveals the relaxing effects of Om meditators. This EEG study on naïve meditators for just 30 minutes results in increased theta power which is a sign of relief and relaxation. The study suggests that if such a small duration of Om meditation has such a relaxing effect then it could be used as a stress reliever if adopted as a daily routine. Further research studies with a larger sample size and using advanced signal processing techniques are recommended.

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Design of Vehicle Protection and Tracking System Using Face Recognition

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***Abstract*— Now a day there may be a speedy growth inside the automobile robbery. The protection of car from theft turns out to be critical due to insecure surroundings. Actual time car protection system is the solution for this hassle. The proposed vehicle security machine performs picture processing based totally real time person authentication using face detection. The gadget described on this paper robotically takes images of driver and compares his or her face with database to test whether he is an authenticated motive force or now not. The face detection system utilized in proposed system primarily based on HAAR classifier set of rules. The other modules transmit necessary records to users and assist to preserve vehicle secure. This machine prototype is constructed on Raspberry pi 3, controls all of the strategies. The GPS module within the car detects the vicinity of the automobile. The photo of thief or unknown man or woman is send to the owner via using mail. So via this device the identification of the thief and the vicinity of the auto are really smarter and less expensive than conventional one.**

Keywords*— *Face Recognition, Face Detection, GPS (Global Positioning System)

I. INTRODUCTION

In automobile security gadget, the objective is to save you the robbery of automobile and make certain safety of automobile by means of avoiding the way of theft. the security degree of the gadget need to be increases by using supplying driver verification the usage of face recognition device that confirms a consumer being a certified character to have get right of entry to the ignition system. The raspberry pi based totally manipulate machine fixed inside the vehicle uses GPS receiver and captures photograph from the digital camera on detection of person in front of the digital camera in the automobile. Face is detected and recognized using algorithm overcoming the pose and illumination constraints. The recognized photo is compared with the authorized image of users within the database. If matched, the machine lets in running the automobile. If no longer matched, it sends photograph of the person and GPS values to the owner. For face detection the Haar classifier algorithm is used and for face reputation the SVM is used. The SVM educated to recognise whether or not the consumer's image matched with the image from database or now not. Essentially this research is aimed for imposing a machine this is able to figuring out the proprietor. Therefore face reputation is used to set off the ignition of vehicle. The vehicle safety gadget using Face reputation provides flexibility to pick out proprietor and to prompt the vehicle. To growth the accuracy, performance and reliability of the face recognition, algorithms are needed. Principle Component Analysis (PCA) and Haar cascade are used for face popularity motive.

II. ALGORITHM FOR FACE RECOGNITION

A. Face Detection Using Haar Classifier Algorithm

The face discovery calculation proposed by Viola and Jones is utilized as the premise of our plan. Its epic methodology expanded exactness yet in particular speed, taking into consideration ongoing applications that at the time could process 15 pictures for every second. It utilizes a preparation technique called boosting, where a course of feeble classifiers (numerous classifiers set after one another) is prepared utilizing a huge arrangement of basic yet computationally efficient highlights, with the goal that simply the best hopefuls figure out how to go through the entire course of classifiers. Advances have been made since, particularly on account of unconstrained face location. The calculation utilizes a necessary picture so as to process Haar highlights of a face hopeful in consistent time. It utilizes a course of stages which is utilized to dispense with non-face hopefuls rapidly. Each stage comprises of various Haar highlights. Each element is arranged by a Haar include classifier. The Haar include classifiers create a yield which would then be able to be given to the stage comparator. The stage comparator wholes the yields of the Haar include classifiers and contrast this worth and a phase limit to decide whether the stage ought to be passed. On the off chance that all stages are passed the face applicant is closed to be a face. These terms will be talked about in more detail in the accompanying areas.

B. Integral Image

The basic picture, otherwise called a summed territory table, is a method that empowers quick and basic calculations of wholes over rectangular zones in a picture. Every pixel (x, y) in the fundamental picture is equivalent to the entirety of pixels above and to one side of (x, y) in the first picture, as appeared in Equation (1).

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Design of Anti-Theft and Tracking System for Vehicle Protection by Biometric Authentication

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ABSTRACT

This paper displays a framework that adequately and proficiently gives an utilization of biometric validation in vehicle security. In biometric validation based vehicle insurance and following framework, the biometric verification assumes a significant job to give high security to the vehicles. The principle point of this task is to shield the vehicle from unapproved individuals by utilizing the one of a kind id that is unique mark validation and face acknowledgment. The proposed framework incorporates two security modules one is to give security to the entryways and another is to give security to start. The unique mark scanner is set to open the entryways and the face location framework is utilized to enact the start of vehicle. So in this framework just approved people who enrolled their unique mark and face picture in the framework can get to the vehicle. Additionally The GPS module is utilized to follow the vehicle and to get the continuous area of vehicle. The continuous area of vehicle is send to the client as URL connects by utilizing SMS.

Keywords- Fingerprint Module, Raspberry Pi 3, Web camera, GPS (Global Positioning System) and Relay

I. INTRODUCTION

In recent years, vehicle robberies are expanding at a disturbing rate far and wide. Individuals have begun to utilize the robbery control frameworks introduced in their vehicles. So in this framework we are endeavoring to improve the security highlights of the vehicle. The utilization of biometric based frameworks has seen an exponential development. This is a direct result of colossal advancement in this field making it conceivable to cut down their costs. Biometrics is turning into another best in class technique for security frameworks. Biometrics are utilized to give tied down access to real working frameworks like ATM, mobile phones, vehicles, workstations, workplaces, and different things that need approved access. Biometric have rolled out huge improvements in security frameworks making them more secure than previously, effective and shabby. Not at all like different methods which utilize passwords and numbers, that are should have been recollected, biometric procedures utilize human body parts like fingerprints, face or even iris of your eyes and as we realize that these things are exceptional to all, consequently it makes biometric frameworks the best over others. In our venture unique finger impression check is utilized, where we can contrast the unique finger impression of the driver and the predefined finger impression. In the event that the unique mark of the driver does not coordinate with the put away finger impression of the proprietor of vehicle then the entryways of vehicle not opened and the proprietor of vehicle gets message as unapproved individual attempting to open the entryways of vehicle. The face location strategy is utilized to initiate the start of vehicle. In the event that the essence of driver coordinated with the put away picture, at that point start will enact generally proprietor will gets the picture of cheat. Additionally the following of vehicle should be possible by utilizing GPS. We can get the accurate area of vehicle utilizing GPS framework. The location of the area of our vehicle is sent as URL interface.

II. LITERATURE REVIEW

In structure and improvement of a GSM based vehicle burglary control framework for a car which is being utilized to counteract/control the robbery of a vehicle. The created framework utilizes an installed framework dependent on GSM innovation. The planned and created framework is introduced in the vehicle. An interfacing portable is likewise associated with the microcontroller, which is thus, associated with the motor. Once, the vehicle is being stolen, the data is being utilized by the vehicle proprietor for further preparing. The data is passed onto the focal preparing protection framework, where by

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Automated Microaneurysms Detection from Retinal Fundus Images using Pixel Intensity Rank Transform

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Computer aided design is in demand for diabetic retinopathy screening systems. Microaneurysms are the first observations as sign of Non-prolific diabetic retinopathy. Number of microaneurysms in retinal image helps to find severity of diabetic retinopathy. This paper presents a method to detect microaneurysms in retinal fundus images. Non illuminated and varying field of view images preprocess initially, so that non lesion and lesion features can be clearly visible for proper detection. Then negative pixel intensity rank transform (PIRT) is used to find smooth regions and edges in retinal images. In next step, optic disc and blood vessels are subtracted from rank transform image. Finally true microneurysms candidates are selected using histogram thresholding. The proposed method is evaluated on publicly available datasets DIARETDB1 and E-optha MA. The performance parameters sensitivity, specificity, and accuracy achieved are 98.79%, 83.33%, and 97.75% respectively for DIARETDB1 database and 94.59%, 96.56% and 95.80% respectively for E-optha MA database. The results show that proposed method is able to detect microaneurysms efficiently in retinal images for diagnosis of diabetic retinopathy.

Keywords: Computer Aided Diagnosis, Image Enhancement, Image Segmentation, Microaneurysm, Rank Transform, Retinal Image.

Diabetic retinopathy (DR) is one of the ocular diseases with highest number of patients. As per the report[1] of Indian Optometry Federation (IOF) published in the year 2010, an estimated 500 million people of India's population of 1.25 billion require vision correction through spectacles, contact lenses or refractive surgery to be able to perform and functioning normal in their routine life. More than 26 million people are blind or vision impaired due to different ocular diseases. It is painful to note that 133 million people, including 11 million children, are blind or vision impaired simply due to lack of an eye examination facilities. The main reason is inadequate number of professionally trained optometrists in India. Only less than 50% of current requirement of optometrists are available to provide necessary vision care to all the people of the country.

Screening is an effective way for early detection of ocular diseases. Fundus cameras are used to acquire retinal image for detection and assessment of ocular diseases. These retinal images contain normal (optic disc, blood vessels and fovea) and pathological features (microaneurysms and exudates). Microaneurysms are the first sign of presence of proliferative diabetic retinopathy

Feature Extraction In Retinal Images Using Automated Methods

P. R. Wankhede, K. B. Khanchandani

Abstract— Accurate information of retinal features such as blood vessels, optic disc, and macula helps ophthalmologists for early detection of ocular diseases like diabetic retinopathy and diabetic maculopathy. In this paper, we presented computer aided automated methods for feature extraction in retinal images. Proposed automated methods consist of pre-processing, blood vessels extraction, optic disc segmentation and macula region segmentation. Initially, pre-processing is performed using shade correction and top-hat transformation for enhancement of dark anatomical structures such as blood vessels and macula/fovea region. A novel graph cut method is used to extract blood vessels. Then template based matching and morphological operations are used for detection and extraction of optic disc. Finally, post processing is used for detection of macula in retinal images. Publically available datasets are used for evaluation of proposed automated methods. Experimental results are compared with state-of-art results. Performance analysis of automated methods show that accurate extraction is done by proposed methods. The proposed automated methods will help in finding lesion features and early diagnosis of retinal diseases.

Index Terms— Computer aided diagnosis, blood vessels segmentation, optic disc detection, diabetic retinopathy, graph cut analysis, template matching, Feature extraction.

1 INTRODUCTION

Diabetic retinopathy (DR) is a frequent microvascular complication of diabetes mellitus. DR is rare in children in their teenage years. In study 0**Error! Reference source not found.** observed that DR may develop in almost 85% of patients with diabetes for more than 25 years whereas Diabetic maculopathy is present in 15% of patients with diabetes for more than 15 years. When diabetes detected in patients one third of them are diagnosed with mild retinopathy and diabetic maculopathy can occur in nearly 25% of patients. DR can develop in 80% patients with type II diabetes after 15 to 20 years [2]. Screening is an effective way for early detection of ocular diseases. Automated ophthalmic screening programs can save national health care budget by few hundred millions of dollar. In US, automated screening programs can save 400 million USD per year [3]. In developing countries like India, this huge amount of budget savings will have significant impact on national economy and development of country [4]. Digital screening of DR results in generation of large number of retinal images to be manually analyzed by an ophthalmologist. Sometime these images are unevenly or non-uniformly illuminated. This often leads to observer fatigue and increase in the time taken for diagnosis. In automatic eye screening programs, the localization and segmentation of anatomical landmarks (Fig.1) such as blood vessels, OD, fovea and macula in retinal images help to detect the presence of diseases [5]. Blood vessels usually have small curvatures and look like anti-parallel pairs. Since the vessels have lower reflectance compared to the other retinal surfaces, they appear darker relative to the background [6]. The blood vessels information can be used in grading severity of disease or as a part of the process of automated diagnosis of diseases like age related macular degeneration and glaucoma [7] and diabetic retinopathy [8]. Blood vessels act as a landmark for localizing other features of retinal images as optic disc [9], [10][11] and the fovea [12]. The blood vessels also used for benchmark for feature point selection for retinal image registration.

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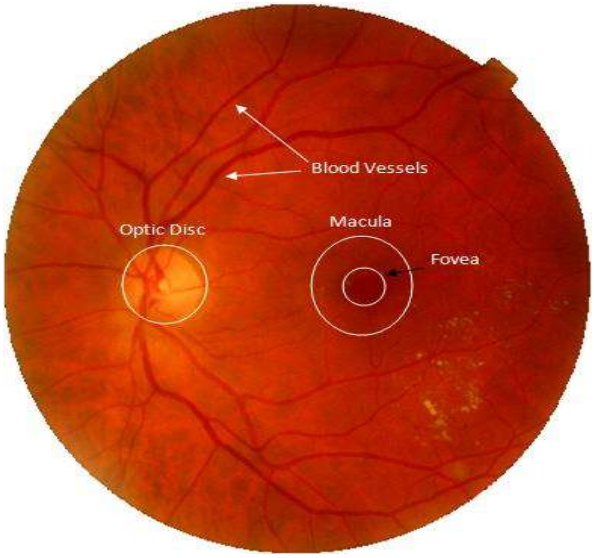

Fig 1 Retinal image with anatomical features such as blood vessels, optic disc, macula and fovea

The OD in a healthy retinal image usually appears as a bright yellowish and elliptical object marked by dark surface vessels. In the presence of diseases in OD, neovascularization occurs from DR or cup size change due to glaucoma. Automated detection of optic disc (OD) is important for early detection of glaucoma. Disc size, neuro-retinal rim and cup area features are used for the assessment of glaucoma [13]. OD consist of cup and vessel origin (VO). The VO position is an important reference point for detecting the macula, and thereby grading macular pathologies such as diabetic maculopathy, macular edema and macular ischemia [14]. Also, automated OD detection plays an important role in developing automated "diagnosis expert systems" for diabetic retinopathy (DR), as its segmentation is a key component to correctly identify other bright features in the images such as the bright lesions (hard exudates or cotton-wool spots). Besides the position of the OD, the VO seed point is another important feature of a fundus image that is needed for vessel tracking methods to

200W Ku-Band Gan HEMT Power Amplifier For Satellite Communication

Vivek V. Ratnaparkhi, Anil S. Hiwale

Abstract: Design of 200W Ku band GaN HEMT power amplifier is presented. A balanced configuration using 20 mm bare die packaged GaN HEMT device is discussed. Branch line coupler is used to parallel cascade two single stage power amplifiers. Inductor based equivalent bondwire array model is used for this design. Simulated performance of power amplifier (PA) shows 200W output power with drain efficiency of 68% and power added efficiency (PAE) of 53% at design frequency of 11.10 GHz. Less than 0.5 dB variation in large signal gain is observed between 11.07-11.20 GHz band of frequency. Proposed GaN HEMT power amplifier can be used to replace conventional travelling wave tube amplifiers (TWTAs) used in Ku-band satellite communication.

Index Terms: GaN, Ku band, PAE, Satellite Communication, TWTA.

1 Introduction

TRAVELLING wave tube amplifiers (TWTAs) are used for high power amplification in satellites. For Ku-band satellite applications TWTAs are widely used due to its high output power and high efficiency compared with GaAs solid state power amplifiers (SSPAs) [1]. However, TWTAs need very high applied voltages and have limited lifetime. They also require large amount of time to start transmitting full output powers. These limitations are not convenient for broadcasting and news gathering systems using Ku-band satellite communications. On the other hand, SSPAs need lower applied voltages, have longer lifetime and require shorter preparation time than the TWTAs [3]. Hence, SSPAs are expected to replace conventional TWTAs used in satellite communications. Since last decade potential consideration is given to GaN HEMT based SSPAs for satellite as well as terrestrial communications. High operating voltage, higher power density, and higher thermal conductivity are major advantages which lead to extensive use of GaN devices in high power amplifiers [4]. There are various high power amplifiers presented in literature [5, 6, 7, 8] using GaN HEMTs. Discrete GaN HEMTs can work for extremely wide bandwidth from DC-26 GHz. In comparison to MMIC power amplifier, discrete GaN transistor PA can obtain higher output power in a specific band, and has a greater tuning flexibility and lower cost [9]. In this paper, parallel cascaded balanced configuration 200W high power amplifier is designed and simulated which produces 68% of drain efficiency and 53% of power added efficiency for Ku-band Indian satellite applications. To the best of authors' knowledge this is the highest output power and PAE reported at Ku band using balanced configuration. Qorvo's TGF2023-2-20 GaN HEMT device is used to design proposed power amplifier [10]. Due to its better thermal conductivity we have preferred alumina substrate for our design [11]. Alumina has dielectric constant of 9.8, thickness of 25 mil, and 0.0002 loss tangent is used for this design.

2 Circuit Design

A hybrid approach using bare-die transistor is preferred for considerable reduction in PA cost. There are two major challenges for hybrid PA design at microwave frequency. First, huge parasitic will be introduced by assembling and requirement of bondwires to connect device with microstrip substrate. Second, tolerances due to manufacturing constraints which may result into bandwidth limited matching networks [12]. Power amplifier design is started with obtaining accurate non-linear model from the device manufacturer. TGF 2023-2-20 is die packaged GaN HEMT device which requires bond wire arrays to connect it with microstrip. To model bond wire array we have used equivalent inductors in our design. The value of inductor is calculated theoretically as well as using EDA tool. At the beginning, DC analysis is carried out to fix proper bias point of amplifier. Class AB mode of operation is selected to achieve good compromise between efficiency and linearity. Device is biased at 28V VDS and 954mA of drain current. Since, device is unstable at lower frequencies stabilization network is used at input side. Parallel combination of resistor and capacitor in series with gate and series resistor in gate bias line is used for stability improvement. Load pull analysis is performed to find out value of load impedance which can produce maximum output power. Load impedance ZL= 2.33-j17.2 Ω and source impedance ZS=31.53-j97.019 Ω which are obtained after load pull need to be matched with 50 Ω impedance. Generally, higher order matching networks are used to improve bandwidth performance which can be achieved at the cost of higher insertion losses. To obtain reasonable bandwidth with minimum insertion losses a novel and simple matching networks are designed. Multiple transmission line sections with variable length and width are used to design matching networks. Fig.1 shows complete amplifier circuit which is ready for EM-Circuit cosimulation.

3 Simulation Results

In this section, simulation results of proposed power amplifier are presented and discussed. According to the design specifications, the power amplifier should provide at least 7

dB gain and PAE more than 45 %. The output power should be more than 150 W.

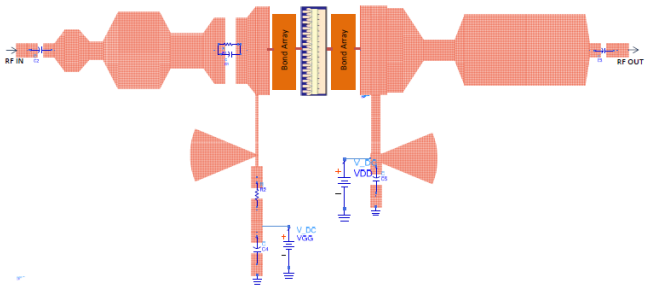

Fig.1. Single stage Ku band GaN SSPA

The complete amplifier is designed and simulated using Keysight's Advanced Design System (ADS) software. Different characteristic parameters of designed SSPA are simulated and shown in this section. Fig.2 shows output power and large signal gain of proposed high power amplifier. It is seen that, output power is more than 90W and large signal gain is higher than 7 dB. Fig.3 shows drain efficiency is more than 60%, power added efficiency is greater than 50% in the range of 11.025-11.170 GHz. At design frequency of 11.10 GHz output power is found to be 105.11W, PAE found to be 59.18% and large signal gain is 7.5dB. Drain efficiency at design frequency is 70.63%. Power amplifier performance with input power sweep is shown in Fig.4, which shows the PAE and drain efficiency performance of designed PA with input power sweep. Generally GaN based PAs are designed and operate at 2-3 dB compression level to get maximum output power. To obtain 105W of output power we have driven our PA at 3 dB compression. The obtained results of TGF 2023-2-20 die packaged GaN HEMT device are very much closer to the performance specified in device datasheet. The stability of amplifier is also checked and it is found that designed PA is stable from DC-15 GHz. Fig.5 shows return loss performance of single stage Ku-band SSPA. Return loss performance is just acceptable and can be further improved by using balanced configuration. Ideally, this results in the same gain and twice the output power as the input signal.

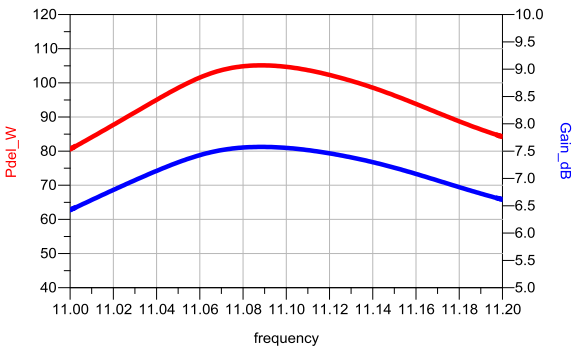

Fig.2. Output power and gain of single stage PA

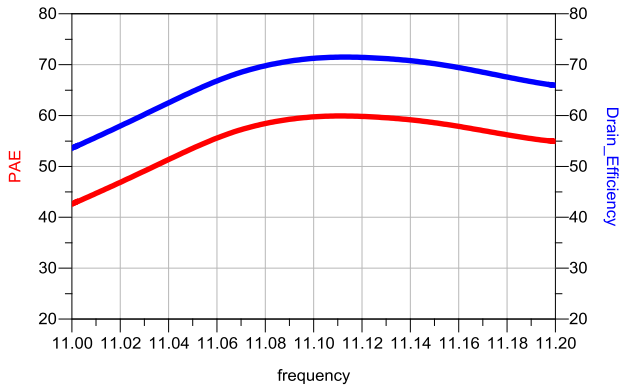

Fig.3. PAE and drain efficiency of single stage PA

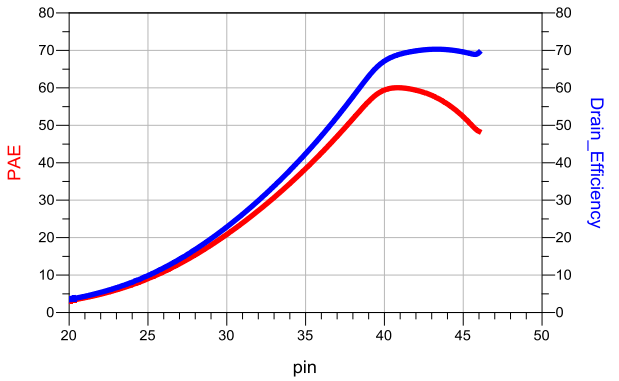

Fig.4. Efficiency over input power sweep of single stage PA

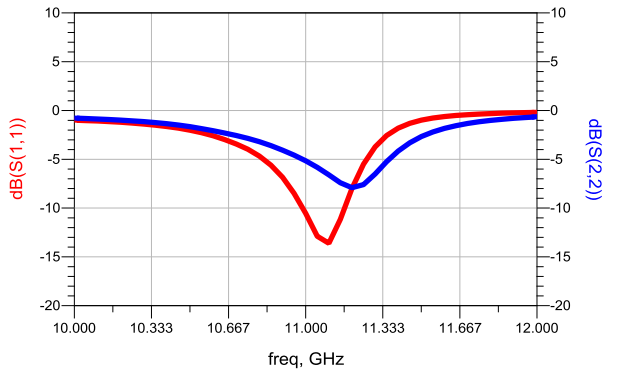

Fig.5. Return loss of single stage PA

Two single stage amplifiers are parallel cascaded to improve output performance. It is necessary to maintain amplifier efficiency and bandwidth while improving output power performance. Balanced configuration as shown in Fig.6 is used to combine two single stage amplifiers [9]. It consists of 3 dB quadrature hybrid coupler used to split the input signal into two components with a 90^0 phase difference between them. The signals are then fed to two paired amplifiers and then combined together by another 3 dB quadrature hybrid coupler at the output of the PAs. Branch line couplers are used in balanced configuration. Since, fourth port is terminated with 50 Ω this will always result into better VSWR performance.

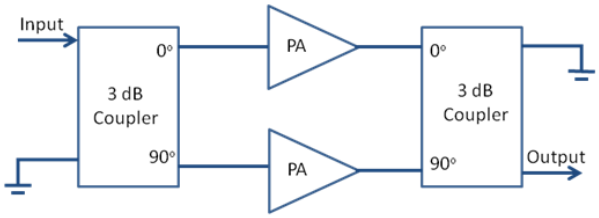

Fig.6. Typical balanced configuration

Length and width of this branch coupler is calculated and optimized to some extent for better response using Keysight's ADS. The amplitude and return loss response of branch line coupler is shown in Fig.7.

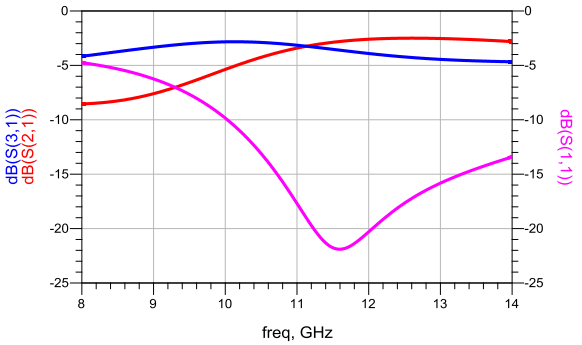

Fig.7. BL coupler response

Two single stage PA as shown in Fig.1 are parallel cascaded by using above discussed branch line couplers. Branch line couplers are designed and optimized in such a way that, they should offer minimum insertion loss. It can be seen from Fig.7, BL coupler offer 0.25 dB of insertion loss. Amplitude and phase imbalance of BL coupler is also maintained over desired frequency range. Frequency response of parallel cascaded balanced PA is plotted in Fig. 8 which shows output power and gain response over the frequency sweep. It is observed that, almost 200W of output power is obtained at design frequency of 11.10 GHz. Large signal gain is also more than 7 dB at design frequency. The PAE and drain efficiency is plotted in Fig.9, and it is found that PAE is more than 53% and drain efficiency is about 70%. Two stage power amplifier performance with input power sweep is shown in Fig.10. The Most importantly, the return loss improvement can be seen in Fig.11, which is due to use of branch line coupler.

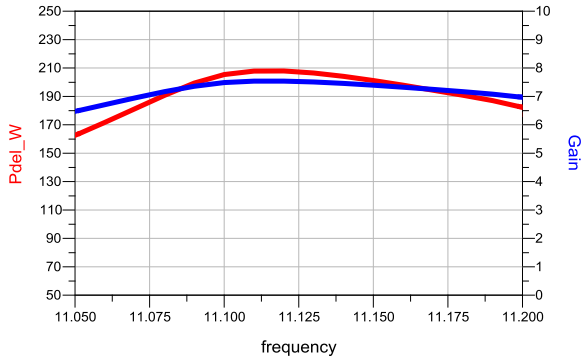

Fig. 8. Output power and gain of two stage PA

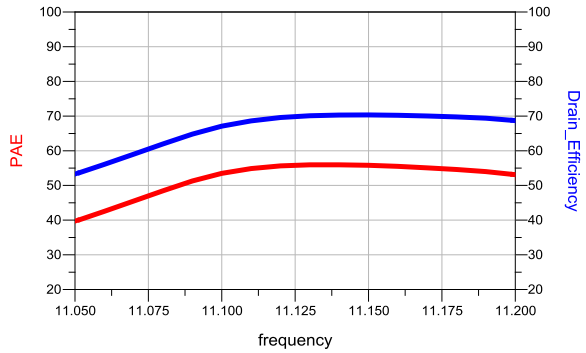

Fig. 9. PAE and drain efficiency of two stage PA

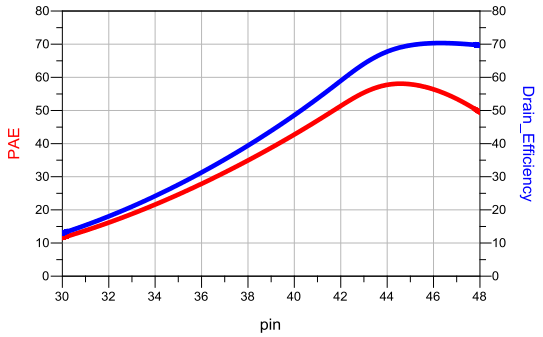

Fig. 10. Efficiency over input power sweep of of two stage PA

The reasonable improvement in return loss bandwidth is obtained by using BL couplers. The input and output return losses S11 and S22 are well below -15 dB during 11-12 GHz. However, the complete response of two stage parallel cascaded PA is slight shifted towards higher frequency.

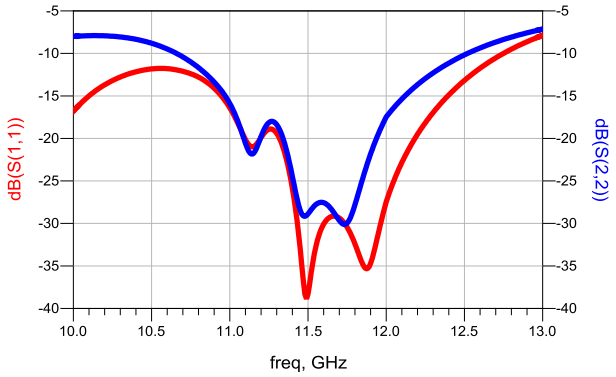

Fig.11 Input and Output return losses of two stage PA

Table 1 compares state-of –the art Ku band PAs, and it is seen that proposed PA produce highest output power and efficiency reported ever.

Table 1*Comparison of State-of-the art Ku band Pas*

Reference	Bandwidth (GHz)	Pout (W)	Gain (dB)	PAE (%)
2011[2]	14.75-15.25	62	8.9	45
2009[3]	14-14.5	120	27	9
2014[9]	13.3-13.7	33.8	7.3	30
2016[12]	13.75-14.5	12	6	23
2014[13]	13.75-14.5	80	--	22
This Paper	**11.05-11.20**	**200**	**7.5**	**53**

4 CONCLUSION

In this paper 200W high power amplifier with 53% power added efficiency for Ku band Indian satellite applications is presented. TGF2023-2-20 bare die GaN HEMT is used for this design. Novel matching network topologies have designed to achieve optimum bandwidth with minimum insertion loss. Table I shows comparison of state-of-the-art Ku band power amplifiers. Proposed power amplifier has highest output power and efficiency reported by the time for Ku-band applications.

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Review of GaN HEMT High Power Amplifiers for Microwave Applications

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Abstract

Gallium Nitride (GaN) high power amplifiers become very popular in recent years for RF and microwave applications. There is huge interest in design and development of GaN high power amplifiers. In certain microwave applications GaN power amplifiers have already replaced conventional travelling wave tube amplifiers (TWTAs). This paper summarizes about different power devices and semiconductor technologies used for power amplification with emphasis on GaN technology. Various advantages of GaN power amplifiers with other power amplifier technologies are addressed. Often used performance improvement techniques in solid state power amplifiers (SSPAs) for microwave applications are discussed. This paper also describes some examples of GaN high electron mobility transistor (HEMT) power amplifier for microwave applications.

Keywords: *Gallium Nitride (GaN); Radar, Solid State Power Amplifier (SSPA), Travelling Wave Tube (TWT).*

1. Introduction

Rapid advancements in the semiconductor device technology since last few decades is playing important role in high power amplifier (HPA) design for microwave applications. Moreover, recently developed Gallium nitride (GaN) semiconductor devices are widely used for design of HPAs at microwave frequencies. Conventional microwave tubes used have certain limitations. Travelling wave tube tubes (TWT), klystrons and magnetrons were traditionally used for microwave applications. When used at microwave frequencies TWTAs shows certain limitations such as shorter life span, high noise, wide bandwidth which may cause interference with an adjacent band of other wireless communication systems. To overcome these limitations solid-state power amplifiers (SSPA) using GaN based devices are widely used at microwave frequencies.

In this paper we have focussed on microwave amplification using GaN transistors. However, entire family of power of devices including the travelling wave tube amplifiers are also considered for performance wise comparison with GaN SSPA. Table 1 depicts different power devices families comparison. It can be seen from Table 1 that, solid state semiconductor power devices (SSPDs) are having capacity to generate about 1KW of output power with efficiency of 65%. If number of stages of SSPAs are cascaded properly very high output power may be in the range of few tens of kilowatts can be produced. Life time of power amplifiers using SSPDs is large when compared with the other members of power device family including power grid tubes (PGTs) and electron beam devices (EBDs) such as TWTs and klystrons. SSPDs are highly reliable than PGTs and EBDs.
GaN transistors certainly have the potential to disrupt Vacuum Electron Devices (VEDs) market and will replace certain VEDs used at high frequency microwave applications. There is huge interest and requirement for GaN SSPAs for various wireless applications including space and radar.

Table 1. Comparison of Power Devices

Device Type	P_{max} (kW)	Drain Eff. %	Gain (dB)	Operating voltage (kV)	Life time (hours)
SSPDs	0.8	50-65	10-17	0.025-0.1	$50x10^3$
PGTs	0.5-10	50-60	10-13	0.5-10	$(3-10)x10^3$
EBDs	0.1-2000	25-60	20-40	25-100	$(10-20)x10^3$

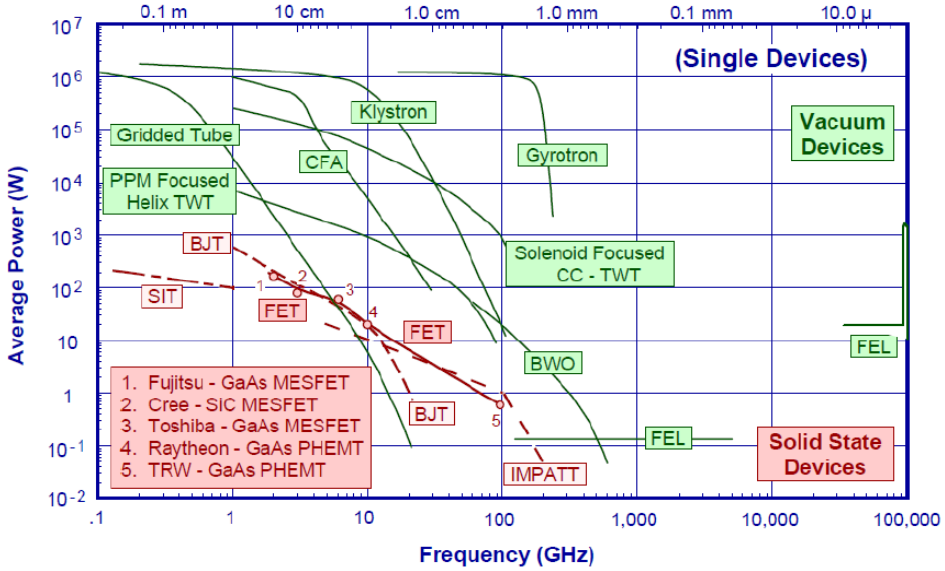


Figure 1. Technology Status

Fig. 1 shows technology status of different power devices with respect to frequency. Conventional microwave tubes and various solid state devices including BJTs, FETs, HEMTs and IMPATT diodes are compared for their output power performance over the frequency. The output power of solid-state devices for a given frequency is lower than that conventional microwave tubes [1]. Lower bias voltages, reduced electron velocity and semiconductor thermal impedance, are major factors which limits the output power produced by solid state devices.

In space applications, the vacuum tube based TWTA is still used, due to its high output power capability with wider bandwidth and higher Power Added Efficiency (PAE). Since TWTA uses the filament in electron gun, which is subject to wearing out over the operating time and requires an extremely high bias voltage results into less reliability when compared with solid state devices. Since last two decades GaN semiconductor based HPAs are developed for various microwave applications which may become a substitute to conventional TWTAs used in many space and radar applications. With efficient power combiner/dividers GaN based HPAs are now able to produce several 100's of watt level output power in the microwave band [1].

2. Semiconductor Technologies

Various types of semiconductor technologies have been used for RF power transistors. These technologies include SiGe HBT, Si LDMOS FET, GaAs MESFET, AlGaAs pHEMT, InGaP HBT, SiC MESFET and AlGaN/GaN HEMT. Table 2 shows comparison of these technologies in brief. It is seen from Table 2; GaN HEMT is the best choice for high power RF and Microwave amplifiers.

Table 2. Solid State RF Power Transistor Technologies

Technology	Supply Voltage	Linearity	Power Density	PAE
Si BJT	26 V	Poor	Medium	Low
SiGe BJT	< 20 V	Good	Medium	High
Si LDMOS	26 V	Very Good	Low	Medium
GaAs MESFET	12 V	Good	Medium	Medium
GaAs pHEMT	8-12 V	Very Good	Medium	High
GaAs HBT	8-26 V	Good	High	High
SiC MESFET	48 V	Good	Very High	Medium
GaN HEMT	48 V	Promising	Very High	High

3. GaN Technology

Transistors using GaN semiconductors invented in 1990s and its use in various applications is started since last few years [2].

There are various advantages of GaN semiconductor based transistors in comparison to other competing semiconductors viz. Si, SiC, and GaAs. Table 3 gives comparison of different material characteristics of Si, GaAs, SiC and GaN. GaN semiconductor has highest breakdown voltage due to which GaN transistors can operate over higher bias voltage around $60V_{DC}$. Higher drain voltage lead into higher output impedance per wattage of RF output power and requires simpler impedance matching network designs. Moreover higher impedance of GaN HEMT devices help to design HPAs with higher PAE and wider bandwidth. Higher saturation drift velocity results into higher saturation current densities and wattages per unit periphery. This produces smaller capacitance per wattage of RF output power. Smaller capacitance of output and smaller drain-to-source resistance per wattage make GaN transistors useful in switched-mode power amplifiers [3].

If compared with silicon semiconductor devices in same applications GaAs HPAs offers high efficiency. GaN devices provide higher efficiencies than GaAs HPAs. Due to these high efficiency capabilities GaN SSPAs are being used in microwave applications where they have not probably used earlier. GaN based semiconductor device operates at high voltages and have higher saturation velocity which makes GaN devices to produce more power in less space—higher-power density. So, small size HPAs may be built with GaN based semiconductor devices, as long as a proper heat removal is provided.

4. GaN Device Overview

GaN material is a binary III-V direct band gap semiconductor. GaN based semiconductor devices are quite similar to that of lateral N-channel FETs of silicon. GaN transistors can be fabricated in both enhancement mode as well as depletion mode. Due to poor performance of P-channel GaN FETs, they are not popular. Fabrication of GaN based devices has to be done with some type of substrate at the base, Generally silicon and silicon carbide are used for this [4].

Table 3. Material Parameters Comparison

Property	Si	GaAs	SiC	GaN
Band gap energy (eV)	1.11	1.43	3.2	3.4
Critical breakdown field (MV/cm)	0.3	0.4	3.0	3.0
Thermal Conductance (W/cm.K)	1.5	0.5	4.9	1.5
Mobility(cm2 /V.s)	1300	6000	600	1500
Saturated Velocity (× 107 cm/s)	1.0	1.3	2.0	2.7
JFOM versus Si	1.0	1.7	20	27

Certainly, the GaN substrates are the best way to grow GaN transistors, due to its similar structure of crystal lattice; but it is quite time consuming as well as expensive process. In recent years, unmatched lattice substrates have been created and now generally preferred. Silicon carbide is another choice due to its excellent thermal conductivity but at the same time it is more expensive than silicon. There are various processes adopted for fabrication of GaN semiconductor based devices. Most commonly used process using GaN and/or AlGaN on to the different base substrates, is shown in Fig. 2.

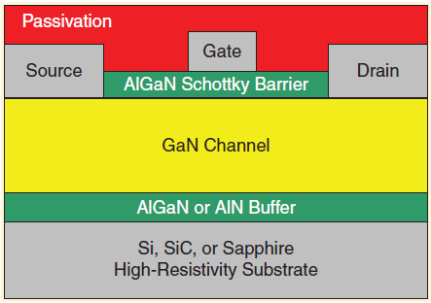


Figure 2. Basic structure of N-channel GaN FET

Generally, 3 to 4 months of time is required to make a batch of GaN based devices, and there is strong possibility of contamination, structural mismatch, crystal strain, or other fabrication related issues. If these fabrication issues with passivation layers at surface have not addressed with proper care, it may result into the deterioration of fabricated GaN based device.

However, significant progress is made during last decade, some more attention and careful study is expected for GaN semiconductor based HEMTs. Reduction of trapping effects in GaN devices is one of the active areas for research in the field of semiconductor devices. Since inception of GaN based devices have shown certain trapping effects. Gate- and drain-lag transients, light sensitivity, transconductance frequency-dispersion, current collapse of the drain characteristics, and restricted microwave power output are some of these effects [5-9].

5. Power Amplifier Classes

GaN based HEMT technology has not only insisted researchers to re-investigate upon different classes of PAs including D, E, and F, but also discover new modes of PA such as Class J [10,11]. It is apparent that efficiency increases from class A to higher classes. But, it should be noted that, higher classes like C, D, E, F, are having less linearity. Although, class A, B and AB are less efficient they are having higher linearity and can easily produce large amount of output power.

Table 4. Theoretical maximum efficiencies of various class PAs

Class	A	B	AB	C/D/E/F	J
Efficiency, %	50	78.5	50-78.5	100	78.5

Generally, the practical efficiency of a particular class of PA will be lower because of a various of reasons including V_{KNEE} losses, passive component losses, conductance losses, and discharge losses [12].

The selection of class of PA is dependent on application. For satellite and radar applications where high output power is required class AB is suitable choice. Class AB provides high output power and good linearity at the cost of lesser efficiency. For mobile applications class E and F are more popular because of their highest efficiency.

6. Performance Based Survey of GaN HPAs

In this section survey of GaN HPAs is presented. Extensive literature survey in the field of GaN HPA for various microwave applications is carried out. Various publications during time period of 2001-2016 in the area of GaN HPA design are chosen for this study. The comprehensive results of this survey are shown in fig. 3 (a)-(f).

In fig. 3(a) the number of papers published in the time span of five years is being categorized and it is observed that number of publications reported have been increased over the time. It is apparent to say that many people have shown their interest in the design of GaN based HPAs for various microwave applications. It can be seen from fig. 3(b), (c) and (d), that majority of GaN HPAs are designed below C-band and are capable of generating output power in the range of few 10's of watts. There are very less publications beyond 6 GHz. However, some authors have reported higher frequency GaN HPAs which are capable of producing very less output power and at the same time their efficiency is much lower. From fig. 3 (e) it is clear that, however, various PA classes are available class AB is still popular choice in many microwave applications.

GaN HEMT technology has various advantages over other competing semiconductor technologies which are discussed in previous sections of this paper. The linearity of class E and class F power amplifiers can be further improved by using different linearity improvement techniques. Recently developed class-J power amplifiers are indeed overdriven class-A biased with improved PAE performance. Suitable choice of microstrip substrate is one of the important factors while designing HPAs. The Average Power Handling Capacity of particular microstrip substrate has to be calculated prior to start of PA design. Choice of proper Microstrip substrate is also crucial factor in the design of HPAs. Generally, high thermal conductivity substrates are preferred for HPAs. Many researchers have preferred to use Roger's Microstrip substrates for design and development of GaN based HPAs which can be seen from fig. 3 (f). Basically, the choice of microstrip substrate is depends upon the Average Power Handling Capacity (APHC) of the substrate. This is mainly decided by the thermal conductivity of the material being used to fabricate the substrate. RT/ duroid 6035HTC laminates of Roger's Corporation is suitable choice for high power microstrip boards [13].

7. Power Amplifier Examples

Kazuhisa Yamauchi *et al* [14] have demonstrated a 60W output power GaN based HPA for Ku-band applications. To obtain the high efficiency, novel matching circuit topology is proposed which can control the reflection phase at the 2nd harmonic frequency ($2f_o$). Fig.4 shows the schematic diagram of the power amplifier.

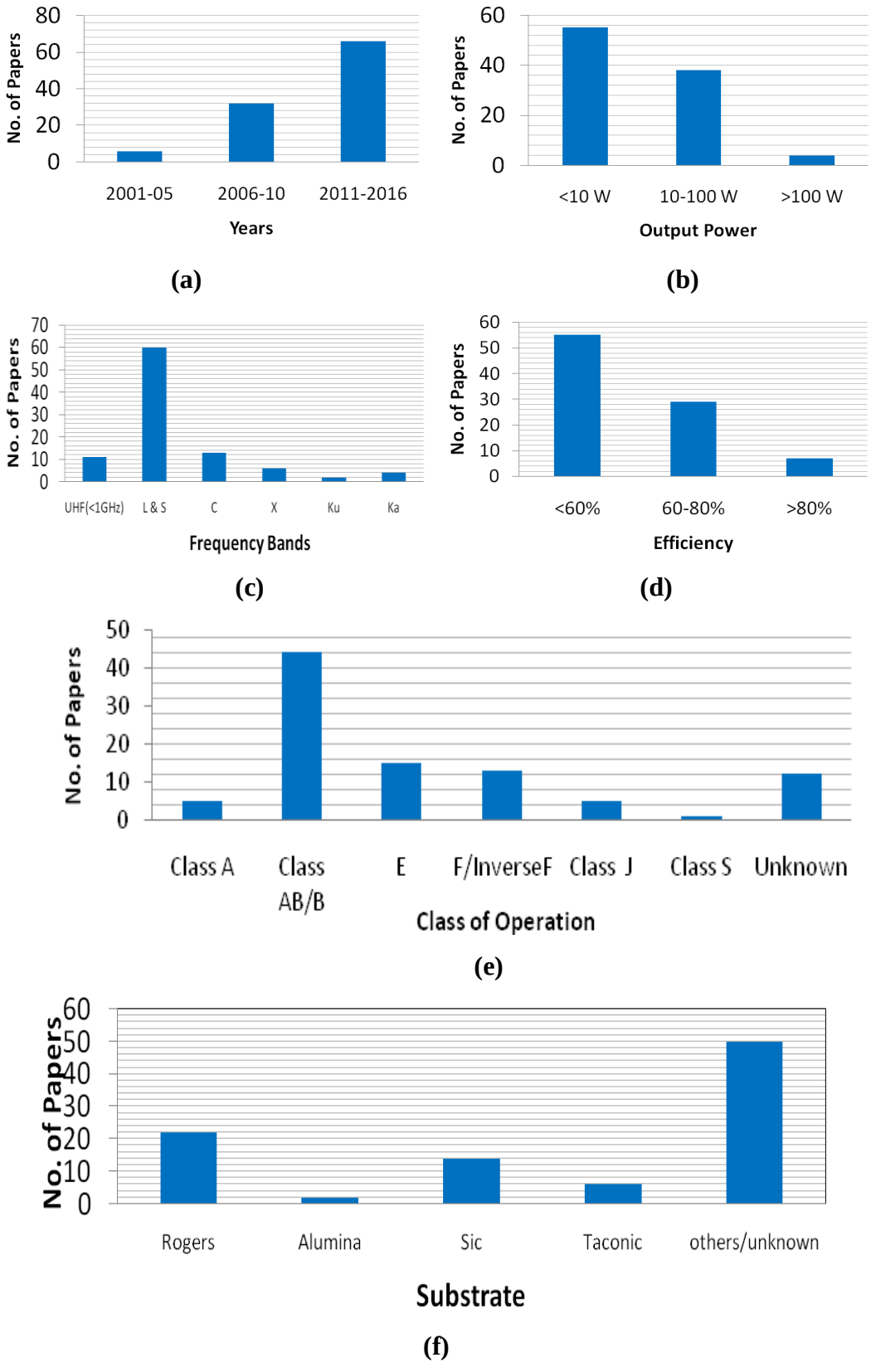


Figure 3. (a)-(f) Survey of GaN HPA publications

To obtain highest PAE impedance matching networks are designed with special care. Novel and simple impedance matching technique to tune out reflection phase at $2f_o$ is used to the proposed power amplifier to obtain higher PAE. The reflection phase at second harmonic frequency is controlled by varying the length of the microstrip sections. In the proposed circuit, the reflection phase at $2f_o$ is tuned around 45deg. Fig.5 (a) and (b) shows the output power, gain and PAE response over input power and frequency sweep.

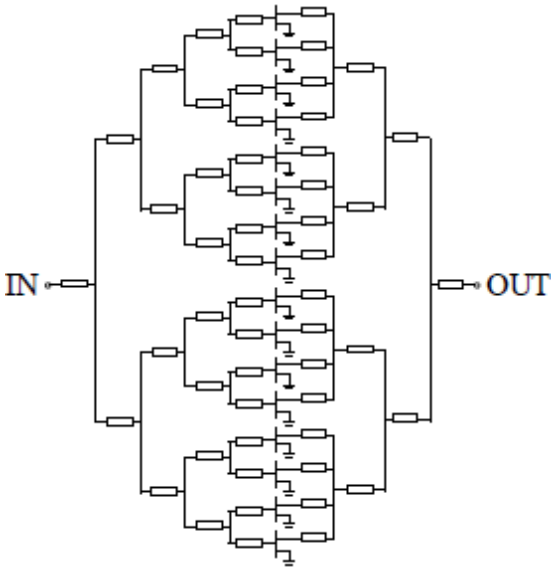


Figure 4. 60W Ku-band GaN HPA

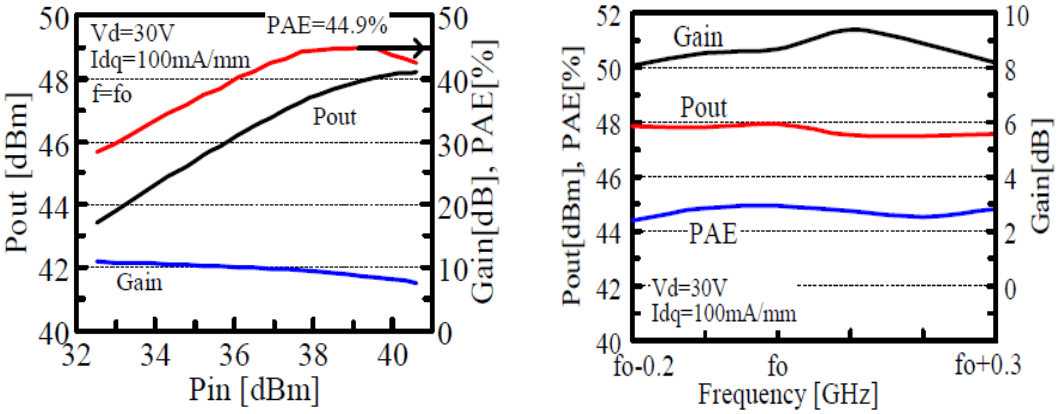


Figure 5. Output power, gain, and PAE versus (a) input power (b) frequency

Hitoshi Sumi *et al* [15] reported a 120-W HPA for Ku-band microwave applications. Proposed HPA is realized by efficiently combining eight GaN FETs. The important part of this circuit power divider and combiner is designed for minimum insertion loss. Suspended line type combiner is used which has offered minimum insertion loss. To improve linearity performance linearization technique at the driver and final output stage is applied. Authors of this paper have claimed this is the first PA generated output power more than 100W using GaN FETs at Ku-band. Fig.6 shows block diagram of proposed 120W GaN SSPA. Fig.7 (a) shows large signal gain and efficiency variations with output power variation and fig.7 (b) shows large signal gain and IM3 as a function of output power.

Kenle Chen *et al* [16] have presented high-frequency high-efficiency Class-F PA using GaN transistors. Output matching network in this PA is three-stage, low-pass network

which is used to overcome harmonic manipulation problems. Proposed class-F PA is designed at 3.1GHz of centre frequency and resulting PAE of 82%, 15 dB gain, and 10W output power [16]. Fig. 8 shows circuit schematic of proposed PA.

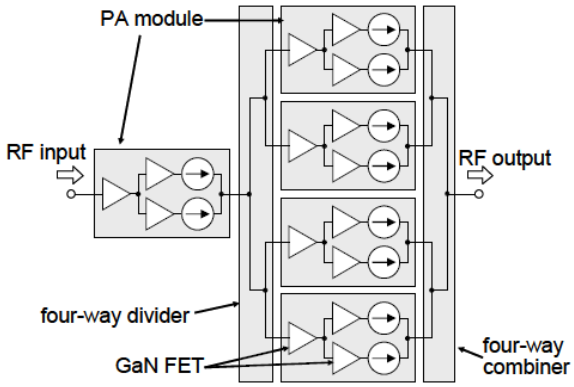
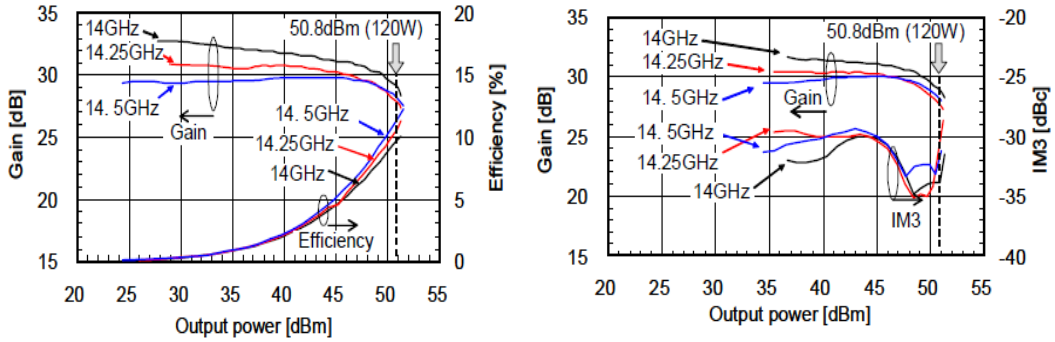


Figure 6. 120 W SSPA block diagram



(a) **(b)**

Figure 7. (a) Gain and Efficency (b) Gain and IM3 over output power sweep

PA performance including output power, gain, efficiency, and PAE with respect to input power is shown in fig. 9. It is apparent that gain started to compress around 23dBm input power. The highest PAE of 82% is achieved Pin of around 25dBm. At this input power Pout of 40 dBm, gain of 15 dB, and drain efficiency of 85% is achieved.

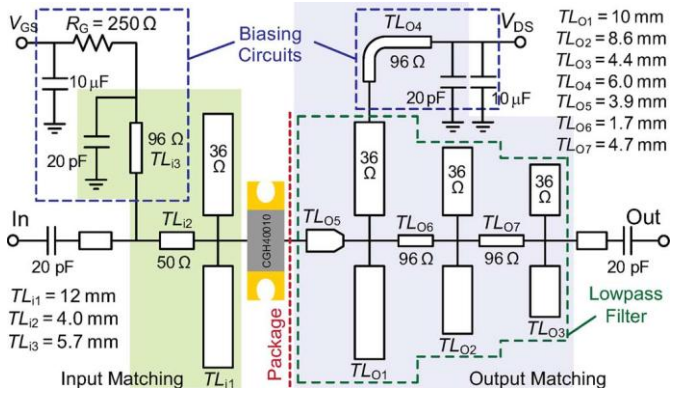


Figure 8. Circuit of the Class-F PA with dimensions

The simulated and measured results over input power sweep are plotted in fig. 9(a). The measured PA performance over frequency sweep is shown in fig. 9(b). It is seen that >70% PAE can be maintained from 3–3.2 GHz and 3 dB bandwidth is around 350 MHz is achieved.

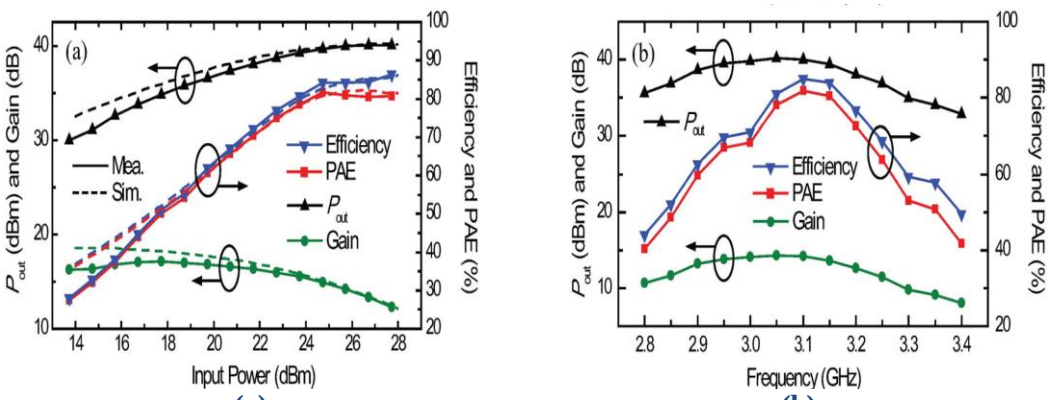


Figure 9. (a) Measured and simulated performance of PA over input power sweep at 3.1 GHz. (b) Measured performance of PA with frequency variation

Ramadan et al. [17] have presented a double-stage GaN HEMT HPA operating at 2GHz and having 15W output power and 70% of PAE. This is basically a two stage PA in which the main PA is biased in class F mode of operation. The driver stage of this PA is biased and designed for class F^{-1} mode and used to feed the main PA. An inter-stage impedance matching network is designed to obtain broadband PAE performance improvement.

The proposed two-stage amplifier is shown in fig. 10. CGH60015D GaN HEMT die from Wolfspeed is used in driver stage (transistor Q_1) as well as in power stage (transistor Q_2).

Fig. 11 depicts PAE performance of these two PAs over frequency sweep. There is significant improvement in frequency bandwidth corresponding to a PAE higher than 60%.

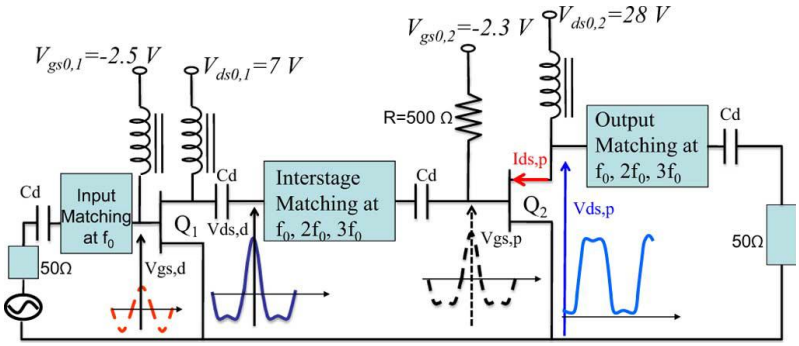


Figure 10. Two-stage PA principle

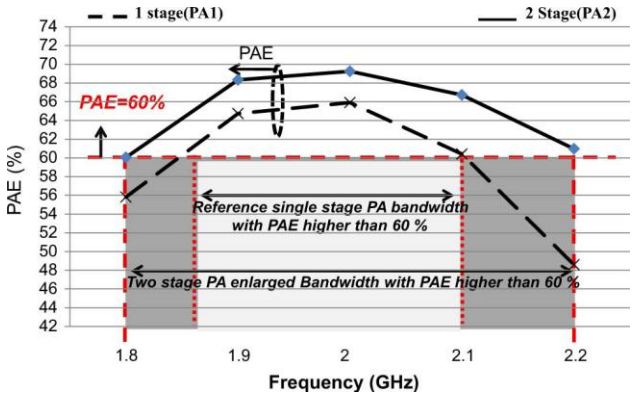


Figure 11. PAE performances of the two PAs

8. Conclusion

This paper has reviewed different power devices available for power amplification at microwave frequencies. Different competing semiconductor technologies for high power amplification are also addressed. The importance of GaN devices in high power amplifier design at microwave frequencies is discussed. There is huge interest by various research groups around the world in the field of GaN HEMT SSPA design. The use of promising GaN devices in design of high power amplifier allows achieving maximum output power, high efficiency and improved linearity. Some examples of GaN based HPAs are also discussed. It is predicted that, the GaN high power amplifiers will be designed and used in certain military, radar and Satellite applications in near future with improved efficiency and linearity.

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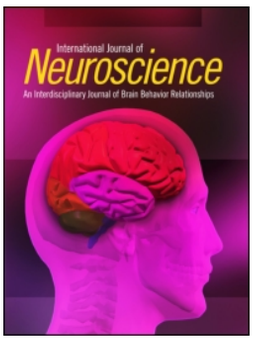

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A novel hybrid atlas-free hierarchical graph-based segmentation of newborn brain MRI using wavelet filter banks

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A novel hybrid atlas-free hierarchical graph-based segmentation of newborn brain MRI using wavelet filter banks

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ABSTRACT

Objective: The newborn brain MRI (magnetic resonance imaging) tissue segmentation plays a vital part in assessment of primary brain growth. In the newborn stage (nearly less than 28 days old), in T1- as well as T2-weighted MR images similar levels of intensity are exhibited by WM and GM, makes segmentation of the tissue extremely challenging. In this newborn stage for tissue segmentation, very few methods are developed. Hence the development of accurate brain tissue segmentation of neonate is prime objective of this paper.

Methods: In this research work, we propose a novel hybrid atlas-free hierarchical graph-based tissue segmentation method for newborn infants. Wavelet filter banks are a class of deep models wherein filters and local neighborhood processes are used alternately for efficient segmentation on the raw input images, and fuzzy-based SVM (support vector machine) is used for precise tissue classification.

Results: Specifically, from T1, T2 images multimodality information are used as inputs and then as outputs the segmentation maps are generated. The proposed approach considerably outperforms preceding methods of tissue segmentation as reflected in results. With this approach, the newborn MRI images that are even suffered from noise, poor resolution or the low contrasted images are also segmented more effectively with precision of 90% and sensitivity 98%.

Conclusion: In addition, our findings indicate that the incorporation of multi-modality image led to significant improvements in performance. Thus, the proposed work effectively tackles the unreliability as well as the other issues faced with the prior methodologies with an interactive accurate segmentation outline.

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1. Introduction

In pediatric neuroimaging, MRI (magnetic resonance imaging) is proving to be revolutionized tool as it does not use ionizing radiations and provides non-invasive way of imaging brain structure [1]. Infant brain MRI identifies peculiarities, for example, hydrocephalus, congenital malformations, hypoxic-ischemic encephalopathy, infarction and infections. In neuro-radiology diagnosis, especially in the neonatal stage, a fundamental part is formed by brain MRI [2]. Clinical analysis of brain scans and tissue segmentation is primarily the responsibility of neuro-radiologists who only use software to improve visualization. As MR data are voluminous, whole manual analysis is cumbersome and time-consuming, it's also quite subjective and vulnerable to variation of users [1,3].

Neonatal phase is a critical time in the development of the brain. Research on brain development is not only clinically important but also crucial in the development of prevention strategies and therapies for at-risk babies [4,5]. Neonatal brain MRI segmentation is a major component in the study of neonatal brain development, opening the way to cortical folding analysis, tissue volume testing and connectivity [6–9]. The aim of brain tissue segmentation is to identify all large brain regions, such as brainstem, cerebellum and soft tissues like white matter [10], gray matter and CSF [11,12]. For adults' brain MRI segmentation, numerous methods have been developed. However, it remains challenging for neonatal brain images due to the low contrast of brain tissue and impoverished spatial resolution compared to adult brain images. In fact, the tissue intensity trend changes dramatically with age in the neonatal brain due to the complex WM myelination cycle [13].

More comprehensive segmentation of a large number of brain regions was needed to measure increases in local brain volume over time [14]. The MR images of manually segmented atlas are recorded in atlas-

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based segmentation systems to the MR object of the subject and its labels are propagated back to measured transformations. Multiple atlas propagated labels can then be fused to yield probabilistic spatial priors or to yield the final result of segmentation [11,15,16]. A probabilistic atlas propagated temporal tissue priors. One downside is that the atlas is produced by a typical semi-automatic segmentation of three subjects and cannot thus catch the large differences in the neonatal population [17].

Conventional atlas-based methods are generally constructed by equally averaging all the aligned template images from a population. Nonetheless, these population-based atlases may not be representative of a test subject in regions with high inter-subject heterogeneity and therefore often contribute to low capacity in those regions to direct segmentation. To address this issue, a patch-driven level set approach is used to segment neonatal brain MR images using sparse representation techniques. However, Wang et al. [18] segment a brain structure into GM, WM, and CSF, along with WM is further segmented into myelinated and unmyelinated WM. Gui and Wang [9,19] make use of a basic framework which uses sparse representation to combine data on the multi-modality picture and also integrates anatomical restrictions for tissue segmentation. Yet, the method does not determine the different weights of different modalities in different brain regions.

Multi-source learning application system is utilized by Wang et al. [20] to classify brain tissues. But, to perform segmentation based on feature But, to perform segmentation same type of features are extracted, which would not considered as an optimal choice." By "To perform segmentation based on features of same type are extracted, which would not considered as an optimal choice. To overwhelm the issues faced with compact multi-scale structure tensor (MSST), the multivariate mixed student's *t*-distribution (MMST) has been deployed in Yang et al. [21]. However, it exhibits poor reliability and accuracy, while performing color texture segmentation.

Wang and Zhou [19,22] enhance graph cut-based algorithms by combining color and texture information for graph cutting, including structure tensors in the graph cut model, incorporating active contours in the segmentation process, and using a soft brush tool to impose soft limitations to refine problem boundaries. Integrating these elements provides an immersive segmentation approach that overcomes the difficulty of previous segmentation algorithms in managing images with textures and low contrast boundaries and produces a smooth and precise segmentation boundary. The problem of tissue segmentation was formulated as a patch classification task by Zhang et al. [23] in which the patch relationship was ignored. The computing cost of 3D CNNs is higher as compared to 2D CNNs, since these networks use 3D convolutions.

In the present research work, we propose a novel atlas-free hierarchical graph-based segmentation method using wavelet filter banks for the subdivision of the whole newborn brain. The method proposed improves the accuracy and outperforms present state-of-the-art segmentation techniques.

2. Materials and methods – hierarchical graph-based segmentation of newborn brain MRI using wavelet filter banks

This framework considers the input data comprises of T1- and T2-weighted newborn brain MR images. In initial stage, the preprocessing performs affine registration, inhomogeneity correction, radiological alignment [9] and two-stage image de-noising to reduce noise and partial volume effect with preserving edges. Similarly, after the de-noising process, there is a need to efficiently separate the myelin contents which can aids in efficient segmentation in the MRI images by utilizing wavelet filter banks and after that a fuzzy-based SVM is utilized for tissue classification. As explained above, the proposed flow of framework is given diagrammatically in Figure 1.

$\Delta I \in \{I_1, I_2, I_3, \ldots I_n\}$, ΔI represents the database of MR images of newborn infants, and 'n' is the number of MR.

2.1. Pre-processing of newborn brain MRI

Newborn MRIs were impaired during the imaging process because of noise and digitization of images and the presence of extra-crane tissues in MRIs such as brain, hair, bone, muscles, wind and fat [24]. Eliminating these noises and extra-crane tissues from the preprocessing of the brain MRI is a method that modifies the heterogeneous image into a homogeneous image. Although lots of filters have been used to filter the images, some of the filters corrupt the minute details of the image, and some conventional filters incessantly process the image (smoothing), thus hardening the edges of the image. Henceforth, the inhomogeneity correction is the proposed preprocessing step, better image clarity is provided by de-noising and skull stripping.

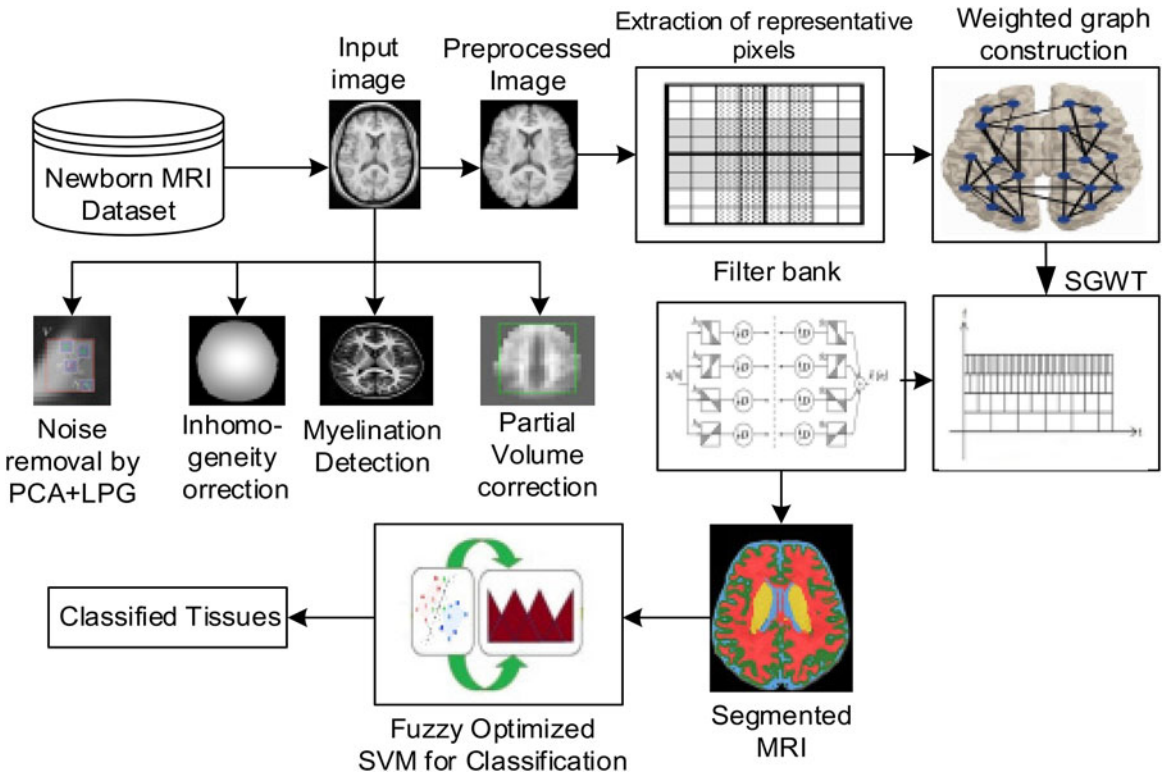

Figure 1. Proposed architecture of hierarchical graph-based segmentation of newborn MRI.

2.1.1. De-noising

The pixel surge model processes the kind of smoothing filter with PCA (principal component analysis) with LPG (local pixel grouping) [25] and it will never influence the lower dimensions. For improved conservation of local object structures, a pixel and its nearest neighbors are shown as a vector factor, whose learning samples are selected from the local window using LPG-based block matching. This LPG method includes the use of only instances obstructing the identical material as part of the local statistics measurement for PCA transform estimation. So that local image characteristics can be preserved to a great extent after the PCA domain coefficient reduction to eliminate noise. In order to further enhance the de-noising performance, the LPG–PCA denoising process is rehabilitated and the noise level in the second stage is adaptively balanced.

Assume '*I*' to be an image of size *i***j*. Initially, the difference is computed for neighbors using threshold values and value of neighbors is updated. Pixel surge model works by altering the value of pixels and calculating the variance between the closest neighbors [26]. The process will end once the eligibility criterion is met. The steps involved in the pixel surge model are as follows:

- The pixel value is determined using the difference between the neighbors. The difference of the adjacent neighbors is computed using the formula that is given in Equation (1).

$$\text{Difference of adjacent neighbours} = \text{nearest neighbour 1} - \text{nearest neighbour 2} \quad (1)$$

- Once the pixel values are calculated, the pixel value is updated by setting a threshold. Here, the threshold value is assumed to be greater than or less than 1. The pixel intensity values can be achieved by calculating the difference between the closest neighbors and finding the pixel value.
- Later on, a threshold is set to update the intensity value of the pixels. Now, the threshold that is set lies greater than or less than 0.5. Upgrade the count values in a pixel's specific intensity value and plot the histogram.
- Calculate the difference between the intensity value of neighbors and pixel intensity. For the computation of the pixel intensity, threshold is a set.

$$Pixel\ value = \begin{cases} 2\ if\ pixel\ difference > 1 \\ 0\ otherwise \end{cases}$$

- When the eligibility criterion has been reached the process is stopped. Totally, 200 iterations are taken by our process for completion. Resulting from each of the iterations, the image 'I' is denoted as *I*′ and *I*″, and so on.

Let S be the n shape. The key concept in PCA is that a projection of a low-dimensional latent space plus some additional noise may clarify the high-dimensional findings. Let γ be a latent variable of dimensional d.

$$I(\gamma) = N(0,1) \tag{2}$$

The shape vector s is observed using the model of distribution and given as

$$s = W_\gamma + \mu + \varepsilon \tag{3}$$

where W – linear mapping, μ – shape

The shape s is specified by mapping W of the latent variable γ with additive noise $\varepsilon \approx N(0, \sigma^2 I)$.

The maximum likelihood solution for the parameters μ, W, σ^2 is

$$\begin{gathered} \mu = \mu_{ML} \\ W = W_{ML} \\ p(s/\gamma) = N(W_\gamma + \mu, \sigma^2 I) \\ \sigma^2 = \sigma^2_{ML} = \frac{1}{q-d}\sum_{i=d+1}^{q} \lambda_i \end{gathered} \tag{4}$$

A threshold value supports the retrieval of edge detected image from the gradient. If the gradient value is found to be smaller than the threshold value, the threshold value would then replace it.

Algorithm for Noise Removal

Input: *Noisy Image*
Output: *Noisy Removed Image*
Step 1: Acquire a set of image data and calculate the pixel difference.
Step 2: Apply PCA to the input image.
Step 3: Apply local pixel grouping and the gradient.
Step 4: Results are merged to obtain the absolute magnitude of the gradient.
Step 5: The absolute magnitude represents the output edges and applies inverse PCA.
Step 6: Calculate the value of PSNR for evaluating the algorithm.

Here, If $f <$threshold value then, $f =$ threshold value.

2.1.2. Inhomogeneity correction

MRI intensity non-uniformities induce bias fields during image acquirement and magnetic vulnerability differences in the scanned samples, which prevent classification of voxel tissue content based solely on image strength. Consequently, these non-uniformities require reimbursement for qualitative and segmentation studies of MRI. The non-uniform image improvement is modeled as a region of multiplicative bias that varies gradually in space.

The differences in the bias area are determined within the stripped MRI volume by correcting a parametric tissue quantity exemplary to small neighborhood histograms. Tissue class means is used by measurement model and from the global image noise variance is estimated, as well as likelihood of every tissue class and parameters for local multiplicative bias within the neighborhood. During the histogram fitting procedure, the local parameters are assessed. We using a regularized tri-cubic B-spline these values are smoothed and interpolated, where the non-uniformity field of our estimate is provided.

The proposed model comprises of a spatially variant multiplicative concept of bias b_k defining the effect of non-uniformity in the kth voxel. The measurement process of the proposed model is given in the following equation:

$$X_k = b_k y_k + n_k \;\; k \in \Omega \tag{5}$$

where $x_k =$ calculated value of the present voxel non-uniformity, $y_k =$ measured quality without distortion or discrimination, and $h_k =$ additive spatially white Gaussian noise.

The underlying function of the probability distribution is

$$p(x_k|b_k, y_k) = g(x_k; b_k y_k, \sigma) \;\; k \in \Omega \tag{6}$$

where $g(x; \mu, \sigma) =$ function of Gaussian density, $m =$ mean and $\sigma^2 =$ variance.

This is a measurement system with a non-stationary mean, controlled by the tissue and bias present in the image, at that location within a single voxel. We have to consider that the volume changes steadily with b_k.

2.2. Effective separation of myelin content

2.2.1. Initialization of ROI

Starting with a seed voxel manually picked within the WM, create a sphere-shaped permissive ROI, wide enough to accommodate voxels around the WM [27]. For both the left and right WM, this step was accomplished, which results in two spherical ROIs potentially overlapping.

2.2.2. Histogram-based thresholding

Histogram-based thresholding of intensity was applied to limit the initial ROIs to surround the WM more closely. From MRI, T1w and T2w newborn brain images due to heterogeneous tissue components intensity histograms usually follow a multimodal distribution [27]. Hyper-intensity in T1w and hypo-intensity in T2w images are due to increasing myelin content of the WM, the most prominent peaks of the Gaussian curves of T1w and T2w intensity. In general, these peak intensity ranges are described as:

$$\begin{gathered} \left[\frac{\text{mode}_{T_1W} - (\max_{T_1W} - \text{mode}_{T_1W})}{2}, \max_{T_1W}\right] \textit{and} \\ \left[0, \frac{\text{mode}_{T_2W} - (\max_{T_2W} - \text{mode}_{T_2W})}{2}\right] \end{gathered} \tag{7}$$

For histograms of T1- and T2-weighted brain MR images, correspondingly. By means of Gaussian fitting, voxels of initial ROIs do not encounter the thresholding conditions specified in Equation (1).

$$I_{T_1W} > \mu_{T_1W} - 2\sigma_{T_1W} \text{and} I_{T_1W} < \mu_{T_1W} + 2\sigma_{T_1W} \quad (8)$$

This meant that most of the voxels were removed from CSF. Upon adding this first-pass threshold, the intensity histograms of T1w and T2w image of the remaining voxels are connected to $\mu'_{T_1W}, \sigma'_{T_1W}$, μ'_{T_2W}, and σ'_{T_2W}. Similar to the thresholding of the first-pass, voxels do not follow the threshold criteria set out in Equation (2) were removed:

$$I_{T_1W} > \mu'_{T_1W}, I_{T_2W} < \mu'_{T_2W}, \text{and} I_{Myelin} > \frac{\mu'_{T_1W} + \alpha\sigma'_{T_1W}}{\mu'_{T_2W} - \alpha\sigma'_{T_2W}} \quad (9)$$

where α is a constant. This second-pass threshold refines the results by applying more progressive T1w and T2w thresholds from the first step, and adding a myelin profound intensity thresholding the resultant WM voxels are further restricted. The most prominent of these second-pass threshold parameters is myelin profound image brightness threshold. Since it relies on α value, for a range of α values the WM segmentation results are systematically evaluated. For all other tests, a value of 0.9 is chosen after heuristic experimentation for this proposed article.

The initial ROI and frequency thresholding are heavily dependent on the position of the manually chosen WM seed voxels. Based on WM ROI revised, left and right ROIs were developed to minimize this vulnerability and increase the robustness as new seed voxels left and right center of mass voxels arising from preceding two procedures were utilized. Using these new WM ROIs, the thresholding steps were repeated. In the following sections, the resultant voxels are referred to as thresholded WM regions.

2.2.3. Region growing

Region growing approach is employed in order to diminish the inter-image bias of α. The optimum value can vary across subjects [27] because the intensity variations between WM and CSF voxels are usually high and not dependent on α values. This procedure was carried out only between the thresholded WM voxels and the thalamus voxels accompanying them. The values for the left and right WM regions are determined separately. The distance $d_1(v, R)$ between the intensity I_v of a voxel v and a region R is defined as:

$$d_1(v, R) = \frac{|I_v - \mu_R|}{\sigma_R} \quad (10)$$

In the above equation, μ_R = mean and σ_R = SD of intensities $Range \in R$. The ROI of thalamus is described as voxels with a defined distance (i.e. rectilinear distance) within the modified WM shaped ROI. For this, the range between L_1 and any thresholded WM voxel should be less than three voxels and meet the intensity threshold criteria of the T1w and T2w as presented in Equation (1). Consider that as a result, the thalamus ROI varies each time the WM area changes. From the previous step starting with the thresholded WM regions, only if $d_1(v, WM) < d_1(v, Thal)$ every edge voxel in *WM* or *Thal* is allocated to WM. Each step has been repeated a total of 10 iterations or until convergence.

2.2.4. Geometric restraints

To control and correct the over-estimation of WM region segmentation, geometric restraints are introduced. The over-estimation raised due to vagueness of WM boundary adjoining the thalamus region [27].

2.2.5. Partial volume estimation

Typically, more than two-thirds boundary voxels of the WM voxels were from preceding steps. Therefore, partial volume approximation was applied to provide an improved segmentation of WM. Because of CNR benefit above T1- or T2-weighted MRI images, the partial volume of each voxel was determined internally and externally of WM boundary using myelin profound images [27]. Evaluation was on the basis of difference in voxel's intensity at each boundary voxel with its adjacent voxel, which comprises of boundaries, vertices along with faces providing 26 adjacent voxels (maximum).

Considering inside and outside the WM each boundary voxel essentially had neighboring voxels. $\frac{I_v - M_{out}}{M_{in} - M_{out}}$ is the partial volume of a boundary voxel where it is the myelin sensitive image intensity of the boundary voxel, while mean myelin sensitive image intensities are M_{min} and M_{out} of the adjacent voxels internal and external to the WM, correspondingly. Both boundary voxels are given partial volume values and total volumes are assigned to all internal voxels. Partial volume correction for WM segmentation is defined as combined WM segmentation along with boundary voxels.

2.2.6. CNR for thalamus and WM

WM-thalamus CNRs are evaluated with and without bias field rectification between T1w, T2w and myelin profound images [27]. The mean intensity of WM

segmentation prior to partial volume approximation was used to measure CNR.

The mean intensity of any voxels was the thalamus signal intensity that was within two voxels of any *WM* voxels, by applying Equation (2), CSF voxels were excluded. In the calculations of CNR, contrast and absolute intensity difference between thalamus and WM was used. The SD for thalamus voxel intensities is used in noise estimation.

2.2.7. Gamma dissemination

To explore the variability of myelin profound intensities of the WM, we match the gamma dissemination with the myelin profound intensity histograms:

$$\frac{(x-x_0)^{k-1}e^{-(x-x_0)/\theta}}{\theta^k\Gamma(k)} \tag{11}$$

where $\Gamma(k)$ = gamma function of myelin profound image intensities, k = shape parameter and θ = scale parameter to be estimated [27]. In fitting, these parameters are determined by setting $x_0 = x_0|_{\min}$ in histogram and employing a least-squares module of curve-fitting.

2.3. Hierarchical graph-based segmentation using wavelet filter banks

2.3.1. Representative pixel removal

In this research, we are using wavelet filter banks for segmentation of all possible tissues present in newborn MR images using hierarchical graph-based approach. This means that an image information is represented by collection of pixels of interest as a substitute to all object pixels. The main advantage of the graph of the sparse image representation is to increase the processing speed of segmentation, which is very important while working with high contrast in newborn MR brain images [28].

For segmentation purposes, the textural characteristics could be sparsely represented from image in terms of intensities by local peak and minimal pixels. In a search window of $w \times w$, set of highest and lowest level of pixels is denoted by $S_w^{\max}$ and $S_w^{\min}$, respectively, and calculated using Equation (12).

$$\begin{aligned}(i,j) \in S_w^{\max} &\Longleftrightarrow \left\{ I(i,j) = \max_{(k,l)\in N_{w(i,j)}} I(k,l) \right\} \\ (i,j) \in S_w^{\min} &\Longleftrightarrow \left\{ I(i,j) = \min_{(k,l)\in N_{w(i,j)}} I(k,l) \right\}\end{aligned} \tag{12}$$

Here, the value of intensity of pixel (i,j) is denoted by $I(i,j)$ and neighboring pixels of (i,j) are given by $N_{w(i,j)}$ in the search window having size of $w \times w$. These expressions are utilized to extract the set of interest of pixels from preprocessed newborn brain MRI.

2.3.2. Development of weighted graph

A key stage in segmentation algorithm is the development of weighted graph. Weighted graph $G = \{V, E, W\}$ is having $|V| = N$ vertices linked to the similarities between vertices by collection of edges E through corresponding weights W [28]. Representative pixels extracted from preprocessed brain MRI images are used as graph vertices in proposed research work, i.e. $V = S_w^{\max}$. To construct graph edges and related weights, in order to define local properties of each vertex signature vector is created then edges are created on the basis of similarity measures among the vectors.

According to its closest local limit and K closest local minimum neighbors nearer it, the definition vector is optimized for each vertex. The procedure is to describe the distribution of the local minima and maxima around each one in the region. Different measures like distance, direction and intensity $\Omega_{p,K} = \{p_k(x_k, y_k, v_k); k = 1, \ldots..., K\}$, are employed for p and $\Omega_{p,K}$. Where, $p = (x, y, v)$ are vertex for (x, y) position in an image with intensity of v and closest extremity set K. Following expressions are utilized to calculate intensity mean and SD.

$$\mu_v = \frac{1}{K}\sum_{k=1}^{K} v_k, \tag{13}$$

$$\sigma_v^2 = \frac{1}{K}\sum_{k=1}^{K} (v_k - \mu_v)^2, \tag{14}$$

Following expressions are used to calculate distance mean and SD:

$$\mu_d = \frac{1}{K}\sum_{k=1}^{K} d_k, \tag{15a}$$

$$\sigma_d^2 = \frac{1}{K}\sum_{k=1}^{K} (d_k - \mu_d)^2 \tag{15b}$$

2.3.3. Spectral graph wavelet transform (SGWT)

The transformation of spectral graph wavelet [28] is carried out in the spectral domain through decomposition of Laplacian graph matrix $L = D - W$ where D is graph degree matrix using $D_{ij} = \sum_j W_{ij}$.

The set of positive $\{\lambda_k\}_{k=0,\ldots..,N-1}$ and orthogonal $\{X_k\}_{k=0,\ldots...,N-1}$ Eigenvectors are produced due to symmetric, semi-definite and positive nature of L.

The graph Fourier transform is defined for a function on vertices f as $\hat{f}(k) = <f, X_k> = \sum_{n=1}^{N} f(n)X_k^*(h)$. The kernel filter g is used to generate SGWT for spectral domain and is indicated by Equation (16).

$$W_f(t,n) = \sum_{k=0}^{N-1} g(t\lambda_k)\hat{f}(k)X_k(n) \tag{16}$$

Now, for the implementation of SGWT, the following steps are activated from graphs developed using previous discussion for a scale of J.

1. Matrix L is calculated and estimated maximum value of λ_{max}.
2. Computed set of scales $\{t_j\}_{j=1,\ldots,J}$ on frequency domain $[0, \lambda_{max}]$ that decides different levels of stretching filter kernels. Then, set of filters is designed encompassing one band-pass $g(t_j.)$ and one low-pass $(h.)$ filter conforming to respective scale t_j.
3. The truncated Chebyshev polynomial approximation is computed.
4. All SGWT coefficients are determined by assuming that the feature on vertex $f(n)$ is the magnitude value at vertex n.

The sets of coefficients are created by SGWT from a collection of *N*-extracted descriptive pixels connected by weighted graph $(J+1)$. It encapsulates similarities at different scales between graph vertices as well as the conceptions of regional characteristics. For segmentation purposes, these coefficients will be engaged in the final stage.

2.3.4. Two-phase separable wavelet filter banks for newborn tissue segmentation

A separate sampling and filtering technique were suggested to apply two-step wavelet filter bank architecture to an arbitrary-weighted graph $G = (V, E)$. Here a 'cascaded' manner two-phase filter banks are utilized, along with a sequence of bipartite sub-graphs of the original graph as demonstrated in Figure 2. In the proposed segmentation methodology, filtering stage along one dimension resembles to filtering employing edges which belong to the corresponding bipartite sub-graph is employed. After filtering along a sub-graph as shown in Figure 2, the outcomes are preserved in vertices [29]. A new transformation is implemented following edges of the next stage bipartite sub-graph to the resulting network signals.

$B_i = (L_i, H_i, E_i)$, $i = 1 \ldots\ldots K$ is a series of K bipartite sub-graphs resulted after decomposition. Bipartite sub-graphs include the identical vertex set: $L_i \cup H_i = V, i = 1, 2 \ldots . K$. Each edge in belongs to exactly one E_i, i.e. $E_i \cap E_j = \varphi, i \neq j, \cup_i E_j = E$. We have to decide on the two-coloring (H_i, L_i) and the classification of the edges in each bipartition. To ensure invertibility of systems as shown in Figure 2, the edge classification must be carried out iteratively depending on the order of the sub-graphs, provided the two-coloring chosen. The edges are chosen sub-graph wise [29]. The core idea is to include all the edges *i* between vertices of different colors that have not yet been allocated in E_i at each point.

Generally, at stage *i* having sets H_i and L_i, E_i includes all the connections of $E - \cup_{k=1}^{i-1} E_k$ which links vertices in L_i to vertices in set H_i. E_1 will therefore contain all the edges between H_1 and L_1. All the links between nodes in H_2 and L_2, which are not included in E_1 will be assigned to E_2 as depicted in Figure 3.

Since all edges between L_1 and H_1 have been allocated to E_1, the structure $G_1 = G - B_1 = (V, E - E_1)$ also includes two disjoint graphs. So, in the second stage of Figure 4, B_2 consists of two separate graphs $B_2(L_1)$ and $B_2(H_1)$, each of which will be independently processed by one of the two filter banks. Obviously, it ensures the invertibility of the decomposition of Figure 2, since it is easy to do so.

The bank of the two-channel graph filter, where *f* and $\tilde{f}$ are the input and remodeled graph signals.β_L, β_H are the defined decimation blocks. The graph filters H_0, H_1, G_0, G_1 are expressed as:

$$H_i = \sum_{\lambda \in \sigma(G)} h_i(\lambda) P_\lambda, G_i = \sum_{\lambda \in \sigma(G)} g_i(\lambda) P_\lambda, i = 0, 1 \qquad (17)$$

where σ (G) = Eigenvalues of the Laplacian matrix of G

$P_y, \lambda \in \sigma(G)$ = Eigenspace projection matrices [30].

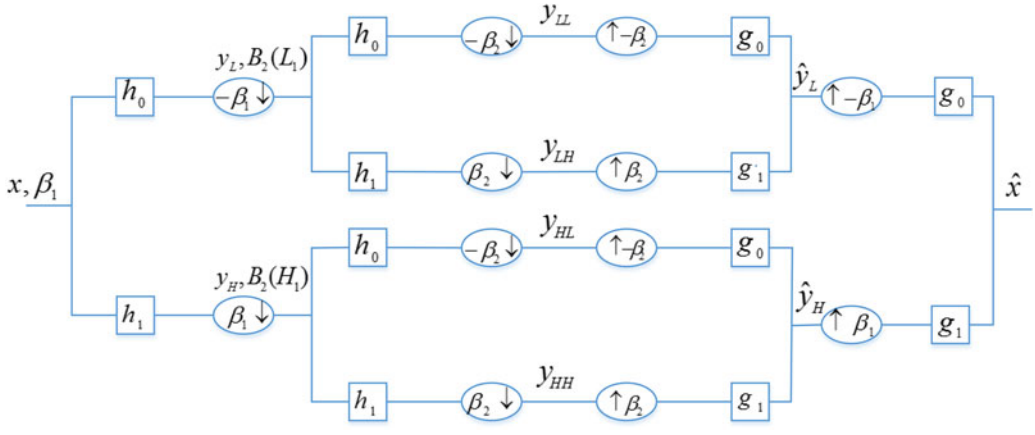

Figure 2. Block diagram of a 2D separable two-channel filter bank.

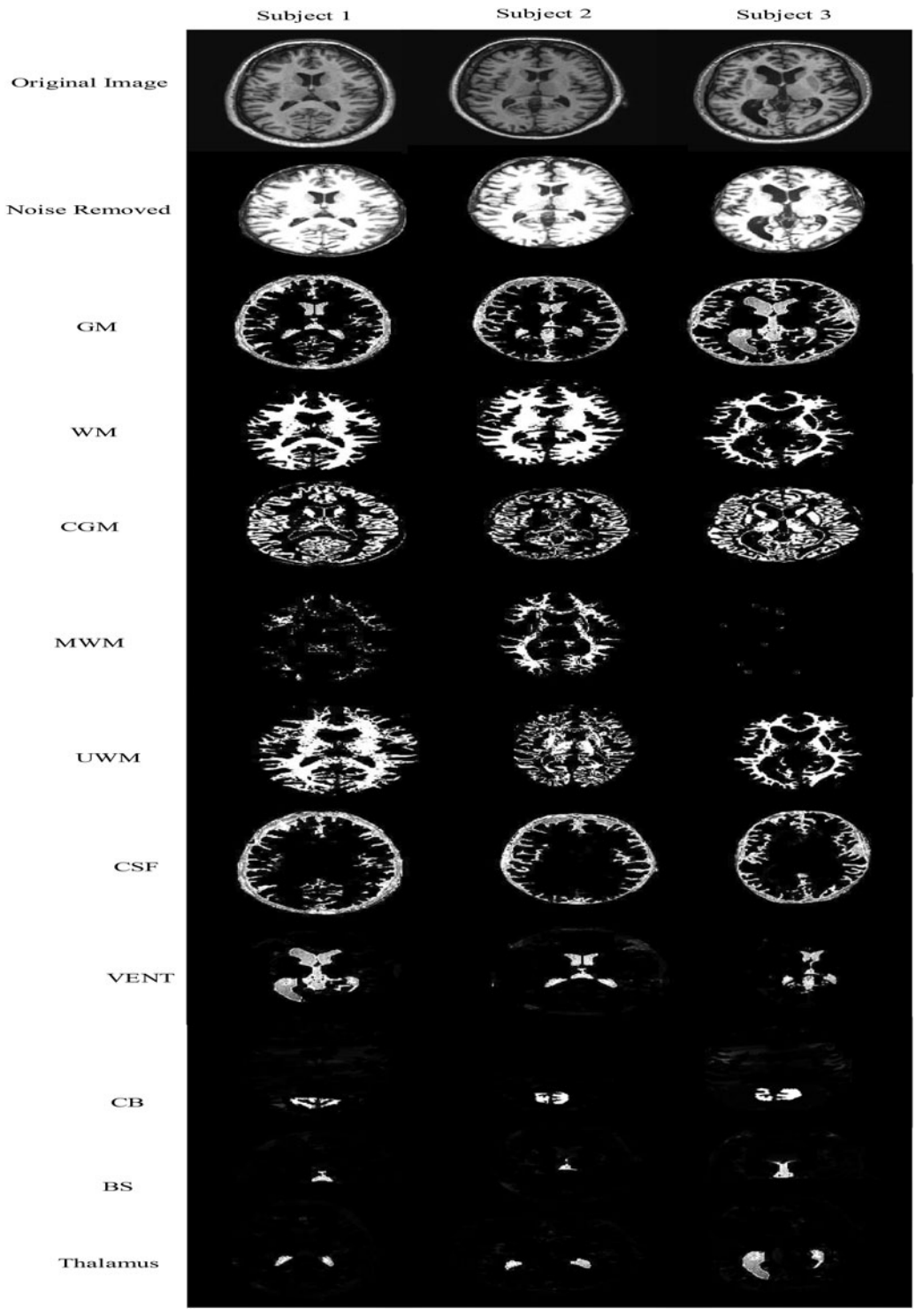

Figure 3. Comparison with existing methods based on performance parameters.

The filters for interpretation and synthesis are graph spectral transformations represented respectively by the $h_i(\lambda), g_i(\lambda)$ spectral kernels. If $h_1(\lambda) = g_0(2-\lambda), g_1(\lambda) = h_0(2-\lambda)$, then filter bank is bi-orthogonal. We reflect on the development of the nonzero graph filter bank used without lack of generality. The filter bank's input–output interaction is

$$\hat{f} = Tf$$
$$T = \frac{1}{2}(G_0H_0 + G_1H_1) + \frac{1}{2}(G_0J_\beta H_0 - G_1J_\beta H_1) \quad (18)$$

where J_β = diagonal matrix.

The necessary and adequate condition is $\lambda \in \sigma(G)$, for all filter banks

Figure 4. Segmented simulated results of T1w and T2w neonatal brain MRI segmentation.

$$h_0(\lambda)g_0(\lambda) + h_0(2-\lambda)g_0(2-\lambda) = 2 \qquad (19)$$

The kernel design is modeled as continuous functions of $\lambda[0, 2]$ to enable the kernel model independent of the graph structure.

2.4. Fuzzy-based SVM for tissue classification

The proposed FO-SVM classifier is a computationally efficient technique that transforms each group of the SVM scores into fuzzy sequence membership degrees. We constructed a series of M binary SVM classifiers f_q, each distinguishing a particular class w_q from the other. In addition, fuzzy-based SVM is a voting system in which each classifier votes according to the value of the decision obtained [31]. The judgment values are then blurred using a properly designed membership feature, to indicate fuzzy grading of patterns representing group membership. Then appropriate

membership function $\mu_k(x_i) \in [0,1]$ is developed and used to fuzzify the decision values. The devised membership function indicates the class w_k to which particular pattern x_i fits.

Through evaluating the difference between the decision output $f_k(x_i)$ and the maximally competing (MC) classifier $m_k(x_i)$, the fuzzy degree $\mu_k(x_i)$ of x_i to a specific interest class w_k is calculated. The classifier f_k is assumed to be primary voter as it resolves the $w_k v_s\{\Omega - w_k\}$ problem, in which its assumed that $x_i \in w_k, f_k(x_i)$. Problems $w_l v_s\{\Omega - w_l\}$ and voting class w_l having weight $f_l(x_i)$ are resolved by $(M-1)$ classifiers. Maximally Competing classifier from this set is the one having the highest judgment cost.

1. Membership $\mu_k(x_i)$ is directly proportional to the difference $\{f_k(x_i) - m_k(x_i)\}$.
   The difference's positive (negative) values contributing to fuzzy scales of higher (lower). Sigmoid function is centered at $m_k(x_i)$ with an acceptable scale variable, therefore, $\mu_k x_i$ can be viewed as a decision function extended to the boundary $f_k(x_i)$. Based on the magnitude of $f_k(x_i)$ relative to $m_k(x_i)$, the value of $\mu_k(x_i)$ will be higher or lower.
2. Patterns satisfying $L_1 : \{f_k(x_i) - m_k(x_i)\} = 1$ uses higher threshold value as $\mu_k(x_i) = 0.8$ in w_k, whereas others $L_3 : \{f_k(x_i) - m_k(x_i)\} = -1$ take a lower grade as $\mu_k(x_i) = 0.2$. Ultimately, when a match arises, there is considerable uncertainty, and therefore a value of $\mu_k(x_i) = 0.5$ is applied to these patterns.
3. The above lines split the domain of decision $f_k(x) \times m_k(x)$ into three areas of interest, viz. A, B, and C. Region A includes patterns fulfilling $\{f_k(x_i) - m_k(x_i)\} \geq 1$ criteria. These are very confident class patterns w_k (gray matter), where $f_k(x_i)$ dominates significantly $m_k(x_i)$, and therefore, they are a high membership value in $w_k(\mu_k(x_i) \in [0.8, 1]$. Region B includes patterns fulfilling $-1 < \{f_k(x_i) - m_k(x_i)\} < 1$ criteria. These are ambiguous patterns (white matter) with comparable values of $f_k(x_i)$ and $m_k(x_i)$, thus accomplishing adequate membership grades within the range from 0.5 to 0.8. Lastly, region C comprises patterns fulfilling the criteria $\{f_k(x_i) - m_k(x_i)\} \leq -1$. The $m_k(x_i)$ controls $f_k(x_i)$, where $m_k(x_i)$ are the patterns indicated by maximally competing classifier and belong to the aforementioned classes. We thus obtain a sufficiently low level of membership degree $\mu_k(x_i) \in [0, 0.2]$ in the w_k class.

3. Results

In this paper, we choose to use T1 images and T2 images for neonatal brain segmentation since they have better intensity contrast. Standard preprocessing steps such as de-noising, inhomogeneity correction and partial volume correction were performed.

To measure the overlap rate between two segmentations, we employ dice ratio (DR), which is defined as:

$$\mathrm{DR} = |\mathrm{A} \cap \mathrm{B}| / (|\mathrm{A}| + |\mathrm{B}|).$$

DR ranges from 0 to 1, corresponding to the worst and the best agreement between labels of two segmentations.

After applying segmentation algorithm on the original image, edge points are extracted which belong to object of interest. In the proposed research work, we used modified Hausdorff distance (MHD) for object matching as distance measure and given as

$$d(A,B) = \frac{1}{N_a} \sum_{a \in A} d(a,B)$$

For justification of our process, images obtained from MR brain's evaluation framework [32] which contains three newborn MRI datasets with T1 and T2 slices. Figure 4 shows the original MR T1 and T2 slices, with the corresponding segmentation results of our wavelet filter bank-based newborn MR image segmentation method shown segmented tissues: WM – white matter, GM – gray matter, MWM – myelinated white matter, UWM – unmyelinated white matter, CGM – cortical gray matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus.

3.1. Parameter description

3.1.1. Sensitivity

A statistical measure for measuring the performance of a method of classification is sensitivity. The sensitivity is the ability to deliver a positive outcome when the event under consideration is definitely positive. It is also defined as the rate of properly classified events among all identified events and is indicated as in

$$\text{Sensitivity} = \frac{TP}{TP + FN}$$

The sensitivity of the proposed methodology is obtained to be as 98.7683.

3.1.2. Specificity

It is the responsibility of the specificity to measure the accuracy if a specific class is set. The specificity is the

chance of having a negative outcome when the attack is really negative and given as

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

The specificity of the proposed methodology is obtained to be as 79.999.

3.1.3. Precision

Precision is measured as the relationship between positive prediction and all prediction and is given as in

$$\text{Precision} = \frac{TP}{TP + FP}$$

Precision value of the proposed work is obtained to be as 90.0024.

3.1.4. Recall

Recall is the proportion of correctly expected positive observations to all actual class observations

$$\text{Recall} = \frac{TP}{TP + FN}$$

Recall value of the proposed methodology is stated to be as 98.7963.

3.1.5. F-measure

F1 score might be a better measure to use if we need to seek a balance between Precision and Recall and there is an uneven class distribution (large number of actual negatives).

$$f1 = 2 \times \frac{\text{precision} \times \text{recall}}{\text{precision} + \text{recall}}$$

The F-measure value of the proposed work is obtained to be as 94.1496.

4. Discussion

In our framework the dataset used for input includes T1- and T2-weighted brain MR images of newborn infants. In initial stage, the preprocessing stage utilizes affine registration, inhomogeneity correction, radiological alignment. Two-stage image de-noising by PCA with LPG is used to reduce noise and partial volume effect while preserving edges. For an improved preservation of image local structures, a pixel and its nearest neighbors are demonstrated as a vector variable, whose training samples are designated from the local window by using LPG-based block matching. This LPG method includes the use of only instances obstructing the identical material as part of the local statistics measurement for PCA transform estimation. So that local image characteristics can be preserved to a great extent after the PCA domain coefficient reduction to eliminate noise. In order to further enhance the de-noising performance, the LPG–PCA de-noising process is rehabilitated and the noise level in the second stage is adaptively balanced.

After preprocessing and de-noising stage achieve a sparse graph-model image representation and then wavelet transformation is performed for segmentation of the newborn MR image.

In this research, we are using wavelet filter banks for segmentation of all possible tissues present in newborn MR images using hierarchical graph-based approach. This means that an image information is represented by collection of pixels of interest as a substitute to all object pixels. The main advantage of the graph of the sparse image representation is to increase the processing speed of segmentation, which is very important while working with high contrast in newborn MR brain images [28].

In pattern recognition, hierarchical tree classifiers were recently suggested, incorporating the strengths of SVMs (support vector machines) and DTs (decision trees). In this research, classification process is performed by fuzzy-based support vector machine (fuzzy

Table 1. Performance metrics of fuzzy SVM classifier with existing methods.

Classifier	Sensitivity	Specificity	Precision	Recall	F-measure
Fuzzy SVM	98.7963	79.999	90.0024	98.7963	94.1946

Table 2. Dice similarity coefficient of proposed method.

Subject	GM	WM	CGM	MWM	UWM	CSF	VENT	CB	BS	Thalamus
Image 1	0.94	0.96	0.9	0.85	0.92	0.91	0.94	0.87	0.89	0.92
Image 2	0.94	0.95	0.97	0.89	0.95	0.92	0.94	0.90	0.91	0.91
Image 3	0.93	0.91	0.91	0.75	0.89	0.88	0.93	0.93	0.93	0.88
Image 4	0.93	0.96	0.88	0.83	0.89	0.89	0.91	0.89	0.91	0.87
Image 5	0.92	0.97	0.94	0.77	0.95	0.76	0.88	0.94	0.88	0.90
Mean	0.92	0.95	0.92	0.81	0.92	0.87	0.92	0.91	0.90	0.90

SVM) classifier. Table 1 represents the performance parameters of fuzzy SVM classifier. Discrimination of nodes is introduced by binary SVMs. The tree structure is calculated by means of a category grouping algorithm, which determines the class groups to be divided at each inner node, depending on the degree of fuzzy ambiguity between classes. Thus, the following comparative results are discussed, thus the proposed framework is proved better segmentation than that of other existing techniques the discussed results are depicted below.

Table 2 represents the dice similarity coefficient of the proposed dataset. Most recent line contains the mean of the dice values for the five subjects. GM – gray matter, WM – white matter, CGM – cortical gray matter, MWM – myelinated white matter, UWM – unmyelinated white matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus.

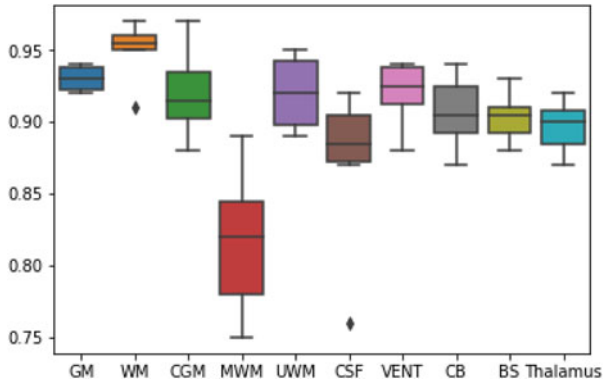

Figure 5. Dice coefficient of proposed method.

Figure 5 shows the dice coefficient value representation graph of the proposed dataset, from that the dice coefficient value of GM – gray matter, WM – white matter, CGM – cortical gray matter, MWM – myelinated white matter, UWM – unmyelinated white matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus are reasonably higher than the other techniques listed in the above existing works.

Table 3 represents the MHD values of GM – gray matter, WM – white matter, CGM – cortical gray matter, MWM – myelinated white matter, UWM – unmyelinated white matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus form MRI dataset. Most recent line contains the mean of the MHD values for the five subjects.

Figure 6 shows the MHD value representation graph of the proposed dataset, from that the MHD value of GM – gray matter, WM – white matter, CGM – cortical gray matter, MWM – myelinated white matter, UWM – unmyelinated white matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus are reasonably lower than the other techniques listed in the above existing works.

Table 4 represents the absolute volume difference (AVD) values of the proposed dataset. Most recent line contains the mean of the MHD values for the five subjects.

Figure 7 shows the AVD values representation graph of the proposed dataset, from that the MHD

Table 3. Modified Hausdorff distance (mm) of proposed method.

Subject	GM	WM	CGM	MWM	UWM	CSF	VENT	CB	BS	Thalamus
Image 1	1.58	2	1.58	2.01	2.58	2.98	1.88	1.68	1.74	1.84
Image 2	1.57	2.01	1.6	2	2.78	2.8	1.84	1.65	1.71	1.86
Image 3	1.6	2.02	1.58	1.96	2.7	2.94	1.92	1.66	1.73	1.87
Image 4	1.56	2.04	1.6	2.02	2.65	2.93	1.85	1.67	1.69	1.88
Image 5	1.59	2	1.63	2.03	2.7	2.82	1.9	1.70	1.72	1.89
Mean	1.58	2.01	1.59	2	2.68	2.89	1.87	1.67	1.72	1.86

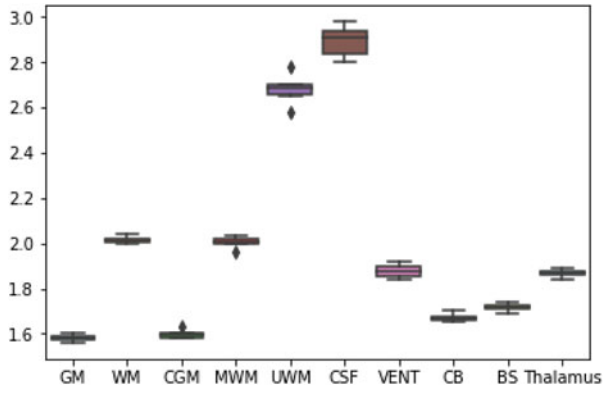

Figure 6. Modified Hausdorff distance (MHD) of proposed method.

Table 4. Absolute volume difference (AVD) of proposed method.

Subject	GM	WM	CGM	MWM	UWM	CSF	VENT	CB	BS	Thalamus
Image 1	6.65	6.69	6.94	6.71	3.94	9.75	6.61	6.74	6.84	8.74
Image 2	6.64	7.00	6.98	6.70	3.96	9.79	6.62	6.76	6.87	8.76
Image 3	6.62	6.98	6.92	6.76	3.92	9.78	6.60	6.73	6.83	8.79
Image 4	6.68	6.97	6.89	6.84	3.91	9.76	6.66	6.79	6.85	8.72
Image 5	6.67	6.96	6.95	6.78	3.95	9.77	6.63	6.75	6.86	8.75
Mean	6.65	6.98	6.93	6.70	3.93	9.78	6.63	6.75	6.85	8.75

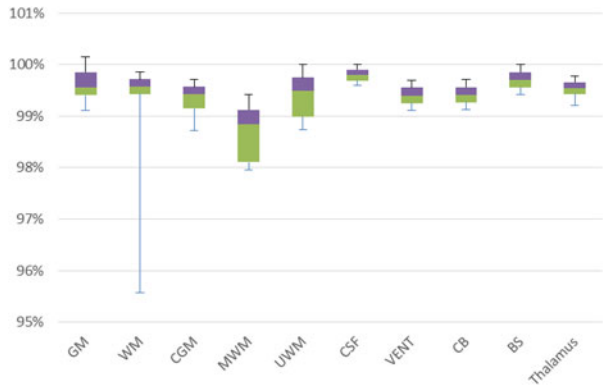

Figure 7. Absolute volume difference (AVD) values of proposed method.

Table 5. Jaccard similarity coefficient (JSC) of proposed method.

Subject	GM	WM	CGM	MWM	UWM	CSF	VENT	CB	BS	Thalamus
Image 1	0.90	0.79	0.95	0.44	0.91	0.78	0.88	0.79	0.75	0.81
Image 2	0.88	0.82	0.90	0.68	0.94	0.77	0.86	0.81	0.77	0.83
Image 3	0.92	0.75	0.92	0.74	0.88	0.76	0.84	0.83	0.74	0.85
Image 4	0.94	0.80	0.87	0.82	0.88	0.74	0.90	0.80	0.78	0.86
Image 5	0.86	0.77	0.93	0.76	0.93	0.75	0.92	0.82	0.76	0.84
Mean	0.90	0.78	0.91	0.68	0.90	0.76	0.88	0.80	0.76	0.84

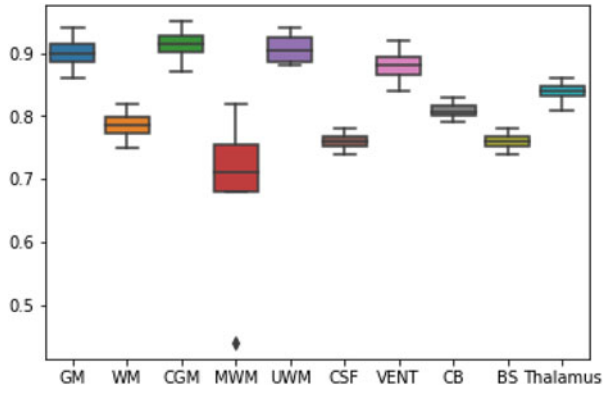

Figure 8. Jaccard similarity coefficient (JSC) values of proposed method.

value of GM – gray matter, WM – white matter, CGM – cortical gray matter, MWM – myelinated white matter, UWM – unmyelinated white matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus reasonably lower than the other techniques listed in the above existing works.

Table 5 represents the Jaccard similarity coefficient (JSC) values of proposed dataset. Most recent line contains the mean of the MHD values for the five subjects, say: 0.90, 0.78, 0.91, 0.68, 0.9, 0.76, 0.88, 0.80, 0.76 and 0.84 for GM, WM, CGM, UWM, MWM, CSF, VENT, CB, BS and thalamus, respectively.

Figure 8 shows the JSC values representation graph of the proposed dataset, from that the MHD values of GM – gray matter, WM – white matter, CGM – cortical gray matter, MWM – myelinated white matter, UWM –

Table 6. Mean surface distance (MSD) of proposed method.

Subject	GM	WM	CGM	UWM	MWM	CSF	VENT	CB	BS	Thalamus
Image 1	0.92	0.81	0.97	0.46	0.93	0.79	0.90	0.85	0.84	0.74
Image 2	0.90	0.84	0.92	0.70	0.96	0.78	0.88	0.89	0.80	0.78
Image 3	0.94	0.77	0.94	0.76	0.90	0.79	0.86	0.87	0.82	0.75
Image 4	0.96	0.82	0.89	0.84	0.90	0.76	0.92	0.86	0.81	0.76
Image 5	0.88	0.79	0.94	0.78	0.95	0.77	0.94	0.88	0.83	0.73
Mean	0.92	0.80	0.93	0.70	0.92	0.78	0.90	0.87	0.82	0.75

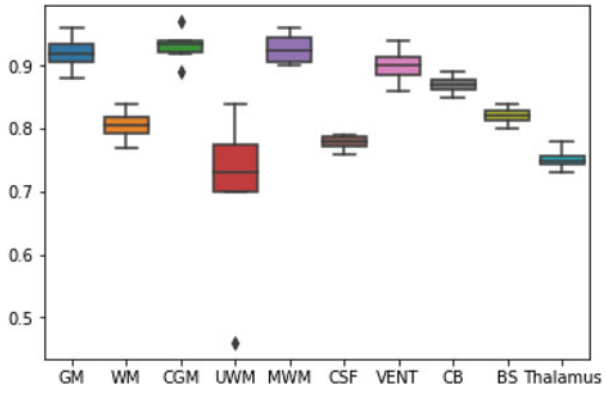

Figure 9. Mean surface distance values of proposed method.

Table 7. Comparison with existing methods based on dice coefficient and MHD.

Methods for classification	Dice (%)	MHD (mm)
Proposed method	93	2.5
Vedran et al. [33]	90	3.1
Wang et al. [20]	91	3.5

unmyelinated white matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus are reasonably lower than the other techniques listed in the above existing works.

Table 6 represents the mean surface distance (MSD) values of the proposed dataset. Most recent line contains the mean of the MSD values for the five subjects say, images 1–5. Here, the mean values achieved by our proposed for our dataset includes: 0.92, 0.80, 0.93, 0.70, 0.92, 0.78, 0.90, 0.87, 0.82 and 0.75 for GM, WM, CGM, UWM, MWM, CSF, VENT, CB, BS and thalamus, respectively.

Figure 9 shows the MSD values representation graph of the proposed dataset, from that the MSD value of GM – gray matter, WM – white matter, CGM – cortical gray matter, MWM – myelinated white matter, UWM – unmyelinated white matter, CSF – cerebrospinal fluid, BS – brainstem, CB – cerebellum, VENT – ventricle and thalamus are reasonably lower than the other techniques listed in the above existing works.

The comparative analysis of the proposed system and the existing algorithms are shown in Table 7. From the data, the dice and MHD values are reasonably higher than the comparison technique. The proposed

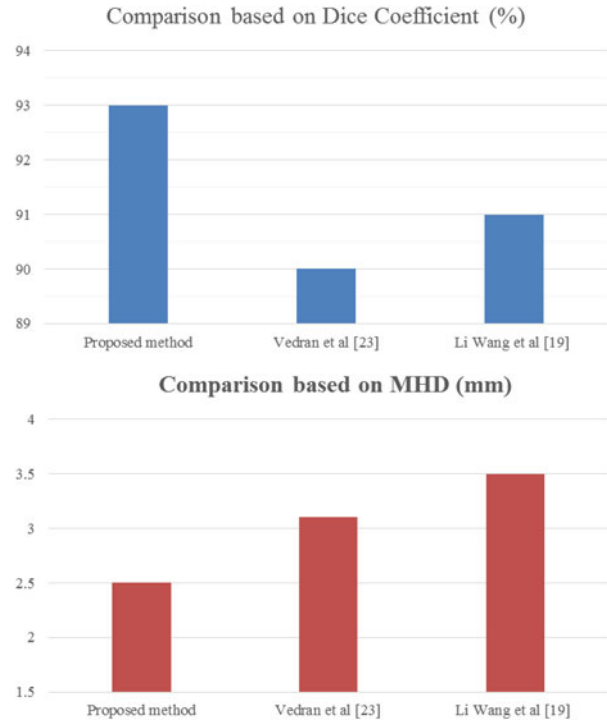

Figure 10. Comparison with existing method based on dice coefficient and MHD.

Table 8. Comparison of proposed method based on performance parameters.

Classifier	Sensitivity	Specificity	Precision	Recall	F-measure
SVM	89.25	69.23	79.231	88.321	85.321
LS-SVM	92.12	71.234	82.351	91.632	89.456
Alex Net	96.876	74.651	87.654	95.712	91.1876
Fuzzy SVM	98.7963	79.999	90.0024	98.7963	94.1946

method of wavelet filter bank-based segmentation gives better DC, MHD, AVD, JSD, MSD when compare to other segmentation methods. It has been clearly shown with the aid of Figure 10 having 93% dice and 2.5 mm MHD for proposed work, whereas [20] exhibits 91% dice and 3.5 mm MHD as well as 90% and 3.1 mm for the method referred in [33].

Table 8 compares our proposed methodology with the existing classifiers such as SVM, LS-SVM and Alex Net. It reveals the effective performance of our proposed work by analyzing the parametric measures such as sensitivity, specificity, precision, recall and

F-measure. Here, SVM exhibits 89.25% sensitivity, 69.23% specificity, 79.231% precision, 88.321% recall and 85.321% F-measure, respectively. Moreover, LS-SVM exhibits 92.12% sensitivity, 71.234% specificity, 82.351% precision, 91.632% recall and 89.456% F-measure, respectively. But comparing all these results with our proposed classifier, it exhibits better performance in terms of sensitivity, specificity, precision, recall and F-measure such as 98.79%, 79.99%, 90.0024%, 98.7963 and 94.1946%, respectively.

Thus, form the above results, it is clear that the proposed method exhibits better performance while on performing segmentation of MRI images, which are highly affected with noise, poor resolutions, etc. that makes the system unreliable. Hence, with our proposed work, it is possible to achieve précised segmentation result of newborn brain MRI images; thereby, it enhances the reliability as well as the accuracy by providing better differentiation of cerebrospinal fluid from thalamus, GM, WM, CGM, MWM, UWM, CSF, BS, CB and VENT.

5. Conclusion

In this proposed work, a hierarchical graph exhibiting clear segmentation results of newborn brain MRI images are successfully obtained. That is, it accurately segments the cerebrospinal fluid from the region of white matter along with ten tissues including thalamus. This, in turn, increases the performance of our proposed work, which enhances the reliability and accuracy of the proposed segmentation method. With this, the newborn MRI images that are even suffered from noise, poor resolution or the low contrasted images are also segmented more precisely; say 90% and sensitivity 98%. Thus, the proposed work effectively tackles the unreliability as well as the other issues faced with the prior methodologies with an interactive accurate segmentation outline.

Disclosure statement

No potential conflict of interest was reported by the authors.

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ABSTRACT: *Chatbots are used widely for interactive communication between machine and humans from a very long time. Although the technology and application of Chatbot has changed with time. Chatbot is generally a virtual person or assistant who can effectively talk to any human being using interactive textual skills provided to it. The motivation behind writing down this paper is that it will be helpful for both Professors, visitors and students to ask any sort of questions related with the Shri Sant Gajanan Maharaj College of Engineering and to comprehend rationale behind this. Our special importance is actually based on accuracy of determining chatbot system. However, the technology enables people for dealing with machine in their language by means of a machine interface is picking up prominence in an assortment of questions mainly for benefit of user. The complete model of an algorithm trained with wide dataset, with interactive UI's which are responsive to various classified actions make the experience of users amazing. The chatbot system will be built using tools from Keras library of Python. The response principle matches the input sentences from a user. The User can enter their queries and doubts in the textbox of chatbot to get an appropriate output. Thus user can get their queries solved virtually without visiting the enquiry counter. The System analyses the query and then provide a response to the user.*

Keywords: Chatbot, NLP (Natural Language Processing), NLTK(Natural Language toolkit), Pattern matching approach

1. INTRODUCTION

Chatbots are conversational interfaces as they are additionally known, provide a new way for people to collaborate with machine frameworks. Generally for getting an query replied by a software program included utilization of an internet searcher, or filling out a form. A chatbot system enables a person to ask queries in the similar manner that they would address a human being. The most surely understood chatbots as of now are voice chatbot system: Alexa and Siri. In any of the case, chatbots are right now being embraced at a high rate on machine visit stages. Later In machine learning have significant enhanced the precision and maintain adequacy of Natural Language Processing by making the chatbots a practical alternative for numerous associations. This improvement in Natural Language Processing is initiating a lot of extra research which should proceeded with a difference in the viability of chatbot system in the years to come. The chatbot replies using an effective GUI (Graphical User Interface) providing a real experience as such as someone is really listening and responding humanly.

In this project, we created a chatbot which will provide all the information regarding Shri Sant Gajanan Maharaj College of Engineering through the web interface using Deep Learning and NLP techniques. Thus, our bot will act as a person at enquiry office whom they can ask any questions regarding admission and college environment at any time in more interactive way. Thus, reducing workload of the admission cell personnel. This system can be integrated on college website and thus students who desire to get admission in the college can clear their doubts from their home. We have provided a feedback mechanism through which user can rate bot's responses and thus bot can respond more accurately next time. The KNN algorithm is used to solve the classification model problems and basically creates an imaginary boundary to classify the data. When every new data points come in, the suitable algorithm will definitely try to predict that to the nearer of the boundary line. This bot can maintain context and can give responses based on the context by operating according to the algorithm. Thus, this paper focuses on the sample bot which can be used as a reference for creating chatbots for many other purposes. We used the Tokenization process of replacing sensitive data with unique identification symbols that retain all the essential information about the data with more security which converts the normal strings of text into a list of tokens i.e. words that we actually want. Sentence tokenizer will be used here to find the list of sentences and we used tokenizer called as Word tokenizer which will be used to find the list of words in strings. The paper by explaining the working of this sample chatbot explains the proposed methodology of developing similar purpose chatbot.

"A COMPARATIVE ANALYSIS OF LOAD BALANCING ALGORITHMS WITH CLOUDSIM"

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ABSTRACT: *Cloud load balancing helps to manage workload demands by distributing resources among various computers or servers in a cloud computing environment. There are many challenges in terms of performance and efficiency in the cloud environment. The aim of the paper is to address the issue of distribution of cloudlets over virtual machine with maximum efficiency and throughput. The prime goal is to address the load distribution in multiple Virtual Machines and to propose an algorithm which has minimum response time and minimum power consumption using CloudSim.*

Keywords: Cloud Computing, load balancing, Virtual Machines (VM's), CloudSim

1. INDRODUCTION

Cloud Computing is an emerging technology in IT environment having large requirement of resource and infrastructure. Load balancing in the cloud environment can be defined as the process of distributing or sharing the workload amongst various computer resources (servers, computers etc.). In respect to cloud computing, load balancing is a very vital task.

With an efficient load balancing techniques, the throughput can be increased and response time can be minimized. With the increase in number of users on cloud, there is a decrease in the number of resources that gives rise to the time delay in providing service to the users. In such a situation there may arise the problem of underload and overload which can be dealt with the efficient load balancing algorithm. A load balancing algorithm which is dynamic in nature does not consider the previous state of the system, that is it considers the present state of the system.

In this paper, a comparative analysis between various load balancing algorithms like First Come First Serve (FCFS), General Prioritized Load balancing algorithm and A Priority Based Dynamic Resource Mapping Algorithm is presented. The performance of the mentioned algorithm is studied and checked through the overall execution time taken by each algorithm to complete the task using CloudSim (version 3.0)

2. LITERATURE REVIEW

Authors described about an improved algorithm of dynamic resource allocation [1] in cloud computing considering tasks' priority and balancing load by sorting the virtual machines on the basis of the processing power, job requests on the basis of the number of instructions and priority and then assigning group of cloudlets to the corresponding virtual machine.

The proposed algorithm et al. [2] proposed an approach for Dynamic Load Balancing in Cloud Computing uses agents. It has been observed that performance of the existing load balancing algorithms can be improved with the help of mobile agents. Mobile agents can be defined as composition of data and software which can drift from one machine to another. The total task is completed using agents i.e Regular and Mobile. Mobile agents can be defined as a constitution of Computer data and software which can drift from one

"CREATION OF DASHBORAD FOR FINANCIAL ACCOUNTING IN SAP"

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ABSTRACT: *In today's global and competitor business Enterprises Resource Planning plays a vital role and it is becoming one of the important tools to achieve competitiveness in business. ERP becomes a powerful solution for SMEs (Small and Medium-scale Enterprises) in India. There are various ERP applications which are available in the market via SAP Oracle applications, Microsoft, Peoplesoft, etc. SAP is one of the proven and widely used ERP application which can integrate multiple business modules and each module performing a specific business function. In SAP ERP There are various modules available Example FI, MM, SD, etc. FI (Financial Accounting) is one of the main modules which collects and stores business transactions in a way that satisfies the external reporting requirements. Our project objective is to prepare daily cashbook for the financial status of a charitable organization. To prepare a financial statement for an organization quarterly, half-yearly and yearly as per BPT and to save the cost by in house development. The Dashboard prepared in our project can be used by any other non-profit making organization to analyze and make a top-level financial decision with very ease.*

***Keywords*:** SAP, ERP, ABAP, Financial Accounting, Daily Cashbook, Charitable organization, Trial Balance, SAP DDIC, ORACLE, SQL Databases

1. INTRODUCTION

SAP (Systems Applications and Products in Data Processing) systems provides control over various business processes, it increases productivity, better inventory management, promotes quality, reduced material cost, effective human resource management, boosts profits, reduced overheads, better customer interaction and increased throughput. It also improves customer services. SAP ERP has various modules and one of the modules is SAP FI stands for Financial Accounting and it is one of the important modules of SAP ERP. It helps to store the financial data of an organization. SAP FI helps to analyse the financial conditions of the company in the market. It can comprise other SAP modules like SAP SD, SAP PP, SAP MM, etc.ABAP stands for– Advanced Business Application Programming. It is a programming language to develop applications for the SAP R/3 system. The new version of ABAP is called ABAP Objects and which include object-oriented programming also. SAP will run applications written using ABAP/4, the latest ABAP version and applications using ABAP Objects.

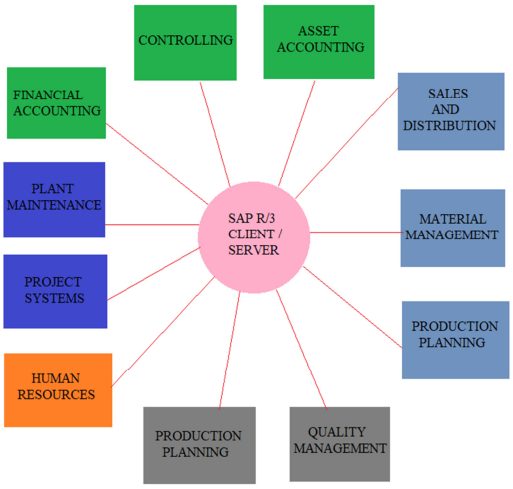

Figure 1: SAP R/3 – Modules & Integration

SAP Financial Accounting (FI) collects and stores business transaction in a way that satisfies external reporting requirements. Due to online integration within itself and with other modules, it allows managers to access the financial position of the company in real-time. It manages financial relationships with customers and vendors like booking payables and receivable, sending and collecting payments,

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"STUDY ON SYSTEM APPLICATION PRODUCT"

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ABSTRACT: *Enterprise Resource Planning Systems enable their users to work in several functional areas, industry solutions. SAP, the leading ERP System in the World, delivers the newest standard information technology, architecture and methodology when introducing its new product. New features of the introduced product gradually replace the old techniques and approaches. Present paper demonstrates that how SAP evolves and its different versions. This paper provides the advantages, disadvantages of SAP by comparing its versions; also SAP is compared to other ERP software's.*

***Keywords*:** SAP, ERP, SAP VERSIONS, SAP MODULES**.**

1. INTRODUCTION

SAP has started its own success story with introducing SAP R/1 System from 40 years. A financial Accounting system named R/1 was the 1st version of SAP's enterprise software. R/1 was replaced by R/2 at the end of the 1970s. SAP R/2 was business application software suite that was very successful in 1980s and early 1990s[13]. SAP AG brought out a client–server version of the software called SAP R/3 with the advent of distributed client–server computing (The "R" was for "Real-time data processing" and 3 was for 3-tier). Such as Microsoft Windows or UNIX, new architecture is compatible with multiple platforms and operating systems. On 6 July 1992SAP R/3 was officially launched. SAP R/3 was renamed SAP ERP and later again renamed ECC (ERP Central Component). Over the next 10 years, SAP came to dominate the large business applications market. SAP R/3 4.70's successor is SAP ECC 5.0 ERP. In 2006the latest version, SAP ERP 6.0, was released. SAP ERP 6.0 has then been updated through SAP enhancement packs. The most recent is SAP enhancement package 8 for SAP ERP 6.0 in 2016[5].

Figure 1: SAP as ERP

Many companies find that there were many problems with their end-to-end processes. To sharpen their core function with the end-to-end process that is where they can implement SAP ERP. To automate their enterprise and they will be able to keep their operational processes up to date with the ever-growing industry it will help them. In various areas of industry, SAP can help to execute ERP solutions. It is used around the world, in more than 100 countries, which turns out to be more than 50000 clients worldwide. Those numbers are expected to grow as more and more enterprises use the SAP ERP. Companies love the fact that they get real time updated information so they can keep their edge and stay ahead of the game[9].

Figure 2: Components of ERP

- Customer Relationship Management (CRM) - Quoting and Estimating, Order Entry, Sales Force Automation.
- Manufacturing - Shop Floor Control, Routings, Capacity Planning and Scheduling, Purchasing, Forecasting, Material and Production Planning, Lot/Serial Control, Inventory, Workflow.
- Supply Chain - Supplier Management, Purchasing to Jobs/Projects, Demand Planning, Purchasing.

of deliveries, packing, picking, shipment of products to customers, delivery of products and billings.

Various modules are involved in all these process such as Finance Accounting, Controlling, Material Management, Logistics Execution, etc., which shows the complexity of the involved integration [10].

4.4. Material Management(MM)

It deals with movement of materials via other modules like supply chain management, logistics, sales and delivery, production and planning , warehouse management..

4.5. Logistic Execution(LE)

Logistic Execution can be divided into two sub-modules, i.e., shipment of goods and warehouse. These two modules are integrated with SD, material management, and production and planning[8][9].

4.6. Supplier Relationship Management(SRM)

This module deals with the efficient and effective transition of products and services between an organization and its suppliers. This module can be effectively integrated with planning, accounting, and inventory system.

4.7. Customer Relationship Management(CRM)

CRM deals with end-to-end customer related processes. CRM centralizes the data related to all the customers associated with an organization.

4.8. Human Resources(HR)

The most important objective data administration in HR is to enter employee-related data for administrative, time-recording, and payroll purposes [9].

5. BENEFITS OF THE ERP SYSTEM

Customized solutions

As the needs of every company are different, each gets a customized system. It considers operational and departmental needs. As all the ERP systems are adaptable and flexible to work. It means it is easy and handy for every employee to use it. The reason behind the flexibility of it as there are various system modules for various departments. Like finance, product management, sales and distribution, and personnel management modules. It is adaptable because the system is available via mobile [3]. Hence, anyone can use the software from anywhere.

Increased Productivity and Efficiency

With the help of real-time information, all the employees can do more work and handle customer queries faster. Different departments communicate effectively since all the information is up-to-date [3]. As customers can make orders, pay, and track their goods, they are able to relate to the company. The company can improve its customer services ensuring by the customer service relationship system. To monitor the inventory, employees use the *supply chain management system*. They track transactions between the business, the suppliers, and the customers [3].

Cost Efficient Use

This system can operates in each department only on a cost of one. It helps to reduce the cost of labor by making sure each and every labor is working. It also helps to reduce administration costs. There are various controls available on replenishing the supply and this also helps to reduce the cost of inventory. It prevents overstocking unnecessary goods. Aside from reducing the compliance costs, the software assures there is incoming revenue. This happens because customers are using a seamless system for ordering and paying for goods [3]

Data Analysis and Reporting

It is very difficult to rely on people to provide accurate data analysis and reports. Error occurred due to humans can cost your business a lot of money. It takes the risk out since there is no data duplication in the ERP system. The system provides real-time reports of everything happening in the business. It delivers risk analysis and performance reports. An ERP system updates transactions and inventory changes as they are occurring. The old data of the company can help to determine the future of the business and industry.

Maintain consistent operations

With the help of SAP ERP system, managers direct all departments to achieve the same goals. This accelerates the decision-making process. You can make system updates and it applies to every department. The system manages a global business[3]. It solves foreign exchange rates and allows the group of companies to communicate. It becomes very easy to spot operational risks as well.

6. DISADVANTAGES

Expensive

This entails software, hardware, implementation, consultants, training, etc. Or you can hire a programmer or two as an employee andonly buy business consulting from an outside source, do all customization and end-user training inside. That can be cost-effective[4].

Not much flexible

It is flexible but it depends. It can be configured to almost anything. In Navision one can develop almost anything in days[4]. While other software may not be flexible.

7. DIFFERENCE BETWEEN SAP ERP AND OTHER ERP SYSTEMS

List of top 10 ERP system is as follows[6]:

1. SAP
2. ORACLE and NetSuite
3. Microsoft
4. Infor
5. IFS
6. Workday
7. Epicor
8. abas
9. Deltek
10. Sage

Below are the points that explain the key differences between SAP and Oracle:

- SAP ERP is a known solution for Enterprise Resource Planning whereas Oracle is the most famous technology provider, especially for relational database management system[7].
- SAP ERP deals with business functional areas like Finance, Material Management, Sales & Distribution, Accounting, etc. whereas Oracle Relational Database Management System deals with key data areas like Data warehousing.
- SAP ERP has been synonymous with large corporations like Microsoft whereas Oracle Relational Database Management System is available from simple versions that can be quite well employed for personal to enterprise-level solutions[7].
- SAP system breaks the traditional information system management which acknowledges processes independently whereas Oracle deals with RDBMS which can work on the multi-model scheme, to make the database design process easier.
- SAP R/3 is one of the classical examples of SAP ERP whereas Oracle Database 18c is the latest Relational Database Management System released by Oracle Corporation.
- SAP ERP employ ABAP as a standard language whereas Oracle RDBMS can be accessed by virtue of a standard language called SQL.
- SAP ERP is an asset in the sense that it operates in real-time not alike traditional systems although Oracle RDBMS can be termed an asset in a sense that it can be scaled down to personal use from the confines of enterprise firms.
- SAP ERP domain lies in real-time business management systems whereas Oracle strength lies in Database Management[12].
- SAP ERP integrates business applications whereas Oracle relational database management system is utilized in enterprise environments for data-level functionality [7].

8. CONCLUSION

This study shows the evolution of SAP versions and their different functions. In this paper, the basic modules of SAP are listed and studied. Also benefits of SAP are discussed which shows the advantages of this system over the other systems. With these benefits of SAP, disadvantages are also discussed. SAP is one of the top ERP systems in all over the world but for the comparison, top 10 ERP systems in the world are listed with the comparison/difference between Oracle and SAP. In this way we studied SAP and its functionalities.

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A COMPARATIVE STUDY ON WEB FRAMEWORK TECHNOLOGY

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ABSTRACT: *Nowadays World Wide Web has turned into a whole new level of marketplace. The websites give a business strong online presence. The WWW is now a dynamic medium exposing a plethora of on-line services for every user. The web technologies are rapidly changing and developed new. This makes the decision of choosing one technology hard for the developer. That is why developer needs to keep up with latest trends. The comparison of dynamic Web programming framework technologies is the main goal of this paper. There are many web development frameworks available; choosing the one that suit our need is the hard part. In particular, this paper examines difference between asp.net, Django, code igniter, cake php, angular js. The comparison is based on the many factors like System architecture, performance, speed, API support, Cost estimation, etc.*

***Keywords*: frameworks, System architecture, Performance, API Support.**

1. INTRODUCTION

A web application is a software application which runs on one or more than one computer or a machine. A web application communicates through a network or a server. In most cases, web browsers as a client are used to access web applications over a network, such as Internet. This provides the ability to update and maintain a program without deploying and installing software on client machines. Web applications are utilized in intranets, in many companies and schools, for instance. They are used for web mail, online retail sales, discussion boards, weblogs, online banking among others. Web applications are different from other applications because they do not need to be installed and hence have an advantage that it can be accessed and used by millions of people at the same time [1].

Because most computer operating systems have web browsers web applications are popular. Programmers can easily change a web application. Users don't go to install new software to ascertain these changes. As web applications run on Internet or Intranet, they have become an essential and important part of business recently. More sophisticated Internet and web application have been emerged as the number of users of Internet and World Wide Web is increasing day by day.

Dynamic elements such as event handling, processing of forms, performing of calculations have been included in order to extend the functionality of Internet browsers. VBScript or mostly used JavaScript are the script languages introduced to enhance the mostly static content of web pages with dynamic elements.

In order to provide interactivity to web applications, Dynamic HTML (DHTML), extensible HTML (EHTML) and XML are some of the technologies that are part of today's browsers. Web servers have become more flexible while responding to client that presenting the same content to all users. Server side scripting use in order to process the incoming requests by the server.

With the help of server side scripting considering the client's request web pages are prepared by application on the server. In HTML format, the information is submitted to the client which is the Internet's basic standardized language of communication. Several server side technologies exits today, example are ASP or ASP.Net, Java Servlets and JSP, PHP, Perl, Python. A web framework may is a software framework that's designed to support the event of web applications including web services, web resources and web APIs [7]. They provide a standard way to build and deploy web application on World Wide Web. They aim to automate the overhead associated with common activities performed in web development.

Comparing various web development tools and technologies is an important idea consideration for many web application developers. This in turn helps to decide which technologies and tools to adopt in developing new frameworks to simplify the web application development process[2] [3]

The comparison of dynamic Web programming framework technologies is the main goal of this paper. There are many web development frameworks available; choosing the one that suit our need is the hard part. In particular, this paper examines difference between asp.net, Django, code igniter, cake php, angular js. The comparison is based on the many

factors like System architecture, performance, speed, API support, Cost estimation etc.

2. LITERATURE SURVEY

Comparison is based on system architecture and implementation, orm techniques, performance.
System architecture (Model View Controller (MVC)Model View Controller (MVC) is the type of design pattern. Most of the PHP frameworks and content management systems are based on MVC design pattern. MVC separates the application into three different layers, Model, View and Controller which makes the application very light. New features can easily be added in MVC based application. The layout of application can be easily changed.

2.1 Cake PHP

2.1.1. System Architecture

Cake PHP is a MVC based framework and was released in 2005, it is written in PHP but inspired by Ruby on Rails. Ruby is a cross-platform interpreted language. Rails is a web development framework which runs on the Ruby programming language. Ruby on rails also uses MVC design pattern. Cake PHP uses documented software engineering concepts and software design patterns as convention over configuration, Model View Controller, active records, association data mapping and front controller

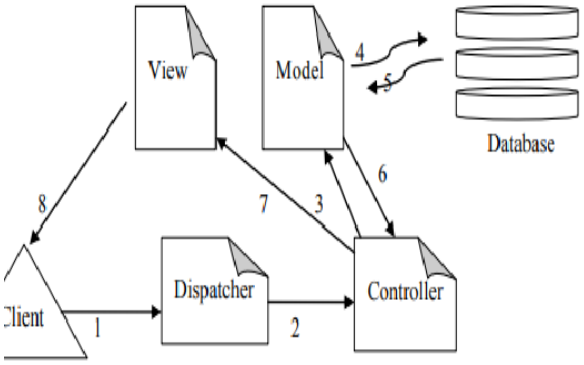

Figure 1: System Architecture of Cake PHP

2.1.2. Orm technique

Cake PHP follows ORM technique wherein object relational mapping programming that turns the info of various type systems in the database.

2.1.3. Performance

It provides much faster performance in case of small data sets and small projects but for larger projects it is not that much preferred as it does not perform data binding process

2.1.4. API Support

APIs are handled well in Cake PHP due to its code structure and most things implemented the right way. However, implementing APIs and frankly the Cake routing itself has been made unnecessarily difficult and people tend to stay away from Cake PHP due to this reason. [4]

2.2 Codeigniter

2.2.1. System Architecture

CodeIgniter is also MVC based PHP framework, was written by Rick Ellis. CodeIgniter framework has some distinct features i.e. no restrictive coding rules, no need to learn template language, small but comprehensive libraries and thorough documentation. These features are suitable for small and medium sized application. In CodeIgniter, there is no database abstraction layer like object-relational mapping (ORM) in CAKEPHP. Due to absence of ORM in CodeIgniter framework, the database communication becomes complex and insecure.

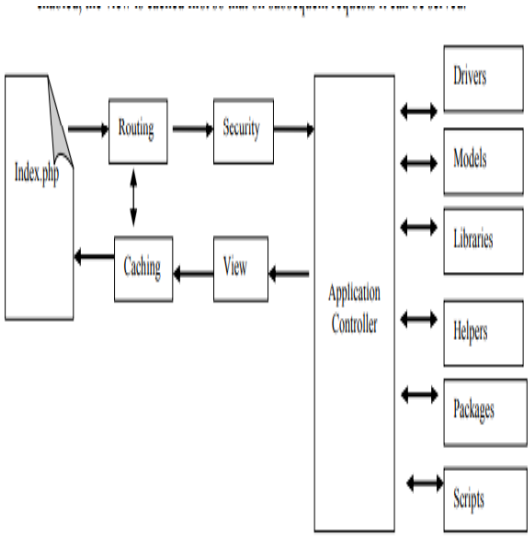

Figure 2: System architecture of CodeIgniter

2.2.2 Orm technique

CodeIgniter doesn't accompany ORM, so for the conversion, developers need to believe the third parties

.

2.2.3 Performance

It offers enhanced stability and support, it offers simple routing methods it allows you to cached website for improved performance and loading times.

2.2.4. API support

There was no built-in API support in 2.0. CI provided new base controller called Rest Controller. There is still no concept of middleware in CodeIgniter hence the application will not be based on latest programming practices on other accomplished frameworks. [5]

2.3. AngularJS

AngularJS may be a popular JavaScript framework for creating front-end single page web applications. It's designed to support dynamic views which makes browsing the page smooth like that during a native application. Important features are:

.NET has a facility of Garbage Collector which can handle large size of data. Performance can be increase by avoiding use of sessions or application variable, Avoid bulk data store on client side etc.

2.5.3. API Support

The ASP.NET Web API is an extensible framework for building HTTP based services that can be accessed in different applications on different platforms such as web, windows, mobile etc. It only supports HTTP protocol. It supports different forms of data response. ASP.NET Web API framework includes new Http Client to communicate with Web API server.

	System Architecture	**ORM technique**	**Performance**	**API support**
Cake PHP	MVC based RUBY framework	Yes	Faster for small project, No data binding process	Implementation is difficult
CodeIgniter	MVC based PHP framework	No	Enhanced stability and support	No built in support
Angular JS	Component-oriented +(MVC and MVVM	Yes	Best for single page web application	Fully extensible and supports
Django	MTV based python framework	Yes	Great performance	Built in API support with great community support
ASP.net	Three tier architecture	Yes	High performance	Various and latest API support

Figure 4: .net framework layers

3. CONCLUSION

The choice of one web development technology is always be hard for a web application developer. The developer has to consider many factors for useful, attractive and efficient development process. The research paper compares the prominent and popular web development technologies; to get the best technology around for web application development. We compared various research done previously on ASP.net, Codeigniter, Angular JS, Cake PHP, Django. On the basis of this literature survey we compared these tech nologies based on System architecture, ORM technique, performance, API support. The comparative study is represented in table.

Table 1: Comparative study results

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"AUTOMOBILE BILLING AND MANAGEMENT SYSTEM"

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ABSTRACT: *Proposed project is aimed to develop a web based software for managing the automobile service centers, which is helpful in maintaining automobile customers in effective manner and thus helps to establish good relations between customers, staff and automobile organization. It consist of various custom modules for maintaining automobiles and stock information perfectly and safely .The main module in proposed project is login, customer management , staff management, automobile management and billing of reports. This software helps in inventory management, stock management etc.*

Keywords: Reports, Stock Management, Admin Module, Staff Module, Bill Printing, Products Management.

1. INTRODUCTION

In manual system we have to maintain accounting Books, bills etc. We make entries for every service done in different books then we prepare the cash book. There are many Advantage and disadvantage of manual system such as there is no power requirement(advantage) but on other side it gets Difficult to maintain transaction and accounting books, Difficulty in generation of a report, It is much time consuming, Difficulty in searching a record, due to human errors data may not be perfect. So in order to overcome these manual errors we proposed a computerized system. It is very helpful for maintaining Automobile Customers, Staff, Stock and helps for establishing good relation between staff, customers and automobile organization. This will save the time and also provide accuracy and reliability.

The proposed project is developed to manage the automobiles and their parts in the automobile service center. The main module in this project are Login, Stock Management, Customer Management, Staff Management, Sales and Reports. The first module is the login. The automobile owner must have to login to the system for usage. The username and password are verified and if it is correct, next form opens. If the username and password are not correct, it gives the error message. When a user search for a automobile parts, if it is available, system will show quantity, price etc. "Automobile Billing and Management System" is useful for maintaining automobiles, their parts and thus customers accurately and thus helps in maintaining good relation between customers, staff and automobile organization.

It contains various modules for effectively maintaining automobiles and stock information perfectly and safely. When a particular part of automobile is sold to the customer, stock is reduced by user. When a new item purchase is done, stock is increased by user. When the user tries to sale items that are not in stock, the system will prompt the user that the stock is not enough i.e. Out of stock. On other side the stock of automobile's parts can be maintained perfectly by the automobile shop owner by overcoming existing system drawbacks. This software can be used by a automobile repair shops and service centers for keeping all the records of items which is to be purchased and sell. It helps to maintain a record of all entries done by user, transactions done, record of staffs along with their attendance etc.

The rest of this paper, Literature Review is discussed in Section 2 Methodology in Section 3 Results in section 4 and finally concludes the paper in Section 5.

"DESIGN AND IMPLEMENTATION OF COMPLETE BUSINESS MODEL"

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ABSTRACT: *The underlying principle is the WordPress design and android studio, which will combine forms to make a solution for the problem faced by an architecture firm. WordPress is used to create some beautiful and attractive websites, and the android studio is a platform made by google by using it we can make an android app. In that the languages are used like JAVA and XML, therefore, we can do a complete business model project by using these two platforms.*

***Keywords*:** WordPress, Android App, Java, XML.

1. INTRODUCTION

In this project, we had developed a business model that will help the Architecture to generate more revenue and make their customers happy. In this business module there are two modules:

- Website
- Android Application

1.1 Website

The main aim of this project is to increase the revenue generation of the firm. For this, this project is consists of a website. The website is mainly for attracting customers to the firm. And as this is an Architecture firm which is whole revolves around simplicity and attractiveness this website is also simple to understand and attractive. This website has pictures of the project completed by the firm along with a living project so that the customer can have a real idea about the work of the firm. This website gives the overall taste of the work of Firm to the customers. Along with this website also have some personal information about the Architecture and his team so that they can contact them.

1.2 Android Application:

This is the second module of the website an Android Application. Nowadays the client himself personally has to visit the site to know the status of the work i.e. how t is going on. For this, the client has to make some free time and travel to the site to see towards this which will consume time and it is sometimes a haptic task too. So that to avoid the time consumption of the client to visit the actual site this application is useful. In this application, the architecture will send the picture of the site that will be visible to the particular client. The client can also give some feedback over it in the comment section present below the picture.

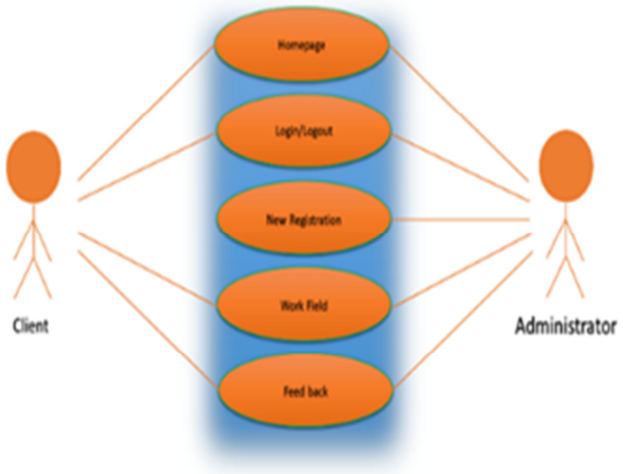

Figure 1: Use Case Diagram

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Android Application with Platform Based On Voice Recognition For Competitive Exam

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Abstract: This paper comprises a description of the project develops a platform based on voice-recognition for MCQ of competitive exams. It is observed that the existing platforms are static, inconvenient for users, and not eye protected. To overcome these issues, we are introducing a platform for users which will be more sophisticated for users. This Platform is more Featurable because which is more in demand because this feature called voice recognition will grab all the display model up to 2030, all the display gets vanish. Everyone needs his/her assistant who will listen to a voice or ask a question, and correct him at a movement. We are creating a platform for student/user which more flexible i.e it has features like voice recognition in this feature platform will ask a question and the user will have to answer. User will have this like a test, but this test will have like display based, display and voice-based (In this feature user will see the question on display and user can answer by giving in his/her voice and clicking on screen also) and voice-based(In this mode user can give a test within a specific time by connecting earphone and give an answer by speaking in the microphone, and give result at end of test). This platform also performs the user according to his/her giving time for attempting a question. For improving his/her performance platform will also give tips according to his convenience

Keywords: Text-To-Speech, Blind Peoples, Mobile Devices, Voice-Based application, Speech-To-Text, Flutter, Firebase

I. INTRODUCTION

The modern-day world can be labeled as a data-driven world. With the invention of mobile devices and advancements in networking technology, there is an exponential growth in data being generated by a single device in the network. The internet currently has over 3.8 billion connected devices across the globe. With an enormous number of devices connected to the internet, the amount of data being exchanged is huge. Along with these largely generated data many advantages and features over that data can be expected at the user side so it can give the opportunity as well as challenge for manipulation of that each data.

In recent years blind mobility has become an important issue since a large number of people are visually impaired and partially sighted. According to the World Health Organization (WHO), approximately 0.4% of the population is blind in industrialized countries while the percentage is rising to 1% in developing countries [1, 2]. There were 285 million people who were visually impaired of which 246 million had low vision and 39 million were blind [3]. Along with blind people, more and more non-blind people are having eye problems due to excessive use of smartphones and laptops or can say due to more use display that directly or indirectly affects human health as well as causes a lot of issues to the human's eyesight.

The blind people face challenges daily in communicating with the world around them. They have to depend on their sighted colleagues for making a phone call and accessing other mobile functionalities. But latest technology these problems are overcome and due to these. There are most of the blind user uses the

"MACHINE LEARNING APPROACH TO GENERATE ARTISTIC CAPTIONS BY USING NEURAL NETWORK FOR VISUALLY IMPAIRED PEOPLE"

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ABSTRACT: *Captioning an image involves generating a human readable textual description given an image, such as a photograph. It is an easy task for humans, but very challenging for a machine as it involves both understanding the content of an image and how to translate this understanding into natural language. This project aims to identify the purpose behind a visual depiction of an image captured, analyze the context behind a visual image and generate an artistic caption for the same. The resulting caption will not necessarily be descriptive but rather contextual and creative. There doesn't exist a direct mapping between image and its corresponding description generated but an abstract mapping that denotes the image into sentences which is very much artistic and aiming to exhibit a kind of computational creativity. A user interface is built for users to upload images or paste a remote image URL or image can be captured directly through a real time camera. Further this text can be converted to speech which will help visually impaired people to depict contents in an image which is otherwise impossible for them without any assistance. A neural network is trained using a dataset so that this pre-trained model can be used to predict the context of an image in a text format which is then converted to speech.*

Keywords: Convolution neural network, Recurrent neural network, model, dataset, deep learning

1. INTRODUCTION

In this era of automation, various technologies are being used to overcome the existing social, economic and health related problems. One such example of technology due to which automation is increasing day by day is Machine Learning. Using this technology, there have been various drastic changes in the past few years and many more changes are predicted to occur in the coming years in terms of the tools being used in the industry and in various other sectors. This technology is used in the areas where it is difficult to develop an algorithm for performing the task constructively. In this technology, the machine is trained on a given set of data in which it learns to detect patterns and features present in the input data. Numbers of inputs are required to train the machine precisely. Once it is trained, it is able to recognize the patterns present in the data fed and it can make predictions effectively. There are various subsets of machine learning which are based on the similar concept. One such subset is deep learning which is based on the concept of neural networks. This consists of artificially developed neurons which resemble the brain cells. As the humans get the sense of perception through the brain cells which are known as neurons in the same manner this artificially developed neurons can be trained and used in image recognition. The neurons are gathered together to form a network of neurons which is called a layer. There are various layers present in a neural network such as the input layer and the output layer. Information can be transmitted through these layers. This similar approach is employed in this project which makes use of neural networks. The data set that is used to train the model is Flickr-8k which consists of 8,000 Images and a text file containing relevant description for each image. Five descriptions are provided for each Image. All this input data is fed for the training purpose. Once the model is trained, it can be used for generating captions of various objects. Furthermore, the generated in the textual format are converted to speech using Google text to speech API

"KCV-A MODERN APPROACH TOWARDS BETTERMENT OF VILLAGERS"

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ABSTRACT: *Nowadays rural stakeholders have to manage heterogeneous and complex information ranging from selling techniques to product prices, this study investigates the potential of mobile apps to support them by providing detailed information of policies given by the Government. Moreover, android as operating system, most of its applications are freely available. The use of a Smartphone is an increase in every sector of business, education, etc. It is observed that the Indian Government provides lots of schemes to villagers for their development, but all schemes do not reach every villager. So to bridge this gap this system will help us. This system can provide information using an android Smartphone from anywhere and anytime in online mode. The application will available in English, Hindi and Marathi Language. The study proposes that the development of mobile apps should support village activities by providing information about all policies and scheme given by the Government to villagers.*

***Keywords*:** Android, Survey, KCV, Villager

1. INTRODUCTION

The active growth of mobile communications combined with the global use of all types of mobile devices has changed citizen's daily life and firm practice. There are various Village scheme App that are available for villagers. Agriculture profession, business profession, health profession, education profession are working. There is possibly a no better example of a smart village than with the mobile app. Mobile apps enable villagers to perform crucial tasks wherever and whenever they need it. From accessing scheme information and managing all data and getting surveys, there is practically no job that a village app can't do. To meet this growing demand, apps need to be launched that are useful, user friendly, and simple to use. The agricultural sector in particular constitutes an essential pillar of the marketplace and as a business division covers the food needs of the society. The term "mobile agricultural apps" is used to distinguish any mobile app targeting the needs of the agricultural division and its stakeholders, such as farmers, agricultural firms and co-operations. These apps cover a spectrum of ventures from the field to the agricultural market (e.g. buying and selling goods and products). More particularly, mobile applications allows various varieties of services, such as weather forecasting for farmers, agricultural related news, management of the agricultural commodity, dairy farming, management of irrigation systems, management of crop sensor, yield forecasting, and monitoring, registration of soil types, and calculation. Mobile apps can also be use for taking surveys. This study aims to reveal the information about KCV (Knowledge College Village), which is survey-based app for villagers. Firstly, this paper explains Background of KCV, KCV analysis, Design and implementation, Related work, Limitations of this app. Finally, we summarize the study, form conclusion.

2. BACKGROUND

In India there are 6 lakh villages out of them 1.25 lakh villages are backward so there is a need for designing and building the village as a smart village. Village is main criteria for development of nation. So, to develop the village in such a way that it is self-dependent in providing the facilities to its villager and well connected to the rest of the world i.e. smart village. [1]

Sustainable development is generally discussed in terms of environmental considerations, but from a rural community perspective, sustainable development must address how the people of the community generate the income to maintain their

"ONLINE E-COMMERCE BUSINESSES RELATED TO FOOD AND PRODUCT SERVICES"

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ABSTRACT: *This Research Paper is based on Online Ecommerce Businesses Related to Food and Services. The mobile application era has thrown open a new pathway for Current marketing scheme. Mobile application is a combination of marketing awareness and the technology uses Internet as a medium to advertise and sell services and goods. The purpose of these is to know what are the influencing factors, positioning of various attributes of different online portals in their mind and overall satisfaction towards online food delivery services their perceptions and needs.*

Keywords: Consumer Preferences, current customer feedback, online food delivery service, consumer perception, expectations of consumers, mobile application

1. INTRODUCTION

This research paper is aimed to look into consumers views about the Resource they receive from various portals. This paper will help the service providers to understand the consumer's perception, needs and views on the basis of the overall result of a survey. The popularity of online food ordering and delivering services is regularly growing and also expectations of the users are getting enlarge. Food delivery which is online can be define as a process of delivery of food or take out from a restaurant or a local food joint through a web page or mobile App. The customers can order food from anywhere such as their favourite Hotels, their choice of cooking, can decide whether to get it delivered to improve from the restaurant and can choose to pay from various payment modes such as cash on delivery, debit card, credit card, or UPI (Phone Pay, Google Pay). All of such led to massive competition among the food producers. Producers are competing by price cutting, cost-cutting, improvement in food quality, better atmosphere, Affordable and better service. Price Cutting is important to increase demand of a particular product against its competitor product. Cost cutting is done through the methodical use of raw material and decreasing production and transportation cost. Need for good service has led to the formation of an upcoming service industry known as food delivery. It gives advantages such as lighter wallet, safe and secure, easier to use, and paper-saving, affordable also. Food delivery and picking up is a very hard problem with different aspects such as cost-effective routing, cost-effective delivery and pickup nodes, Decay of food, Fixed transport services and not only there is a need to identify practicable but also systematic way to solve them.

2. LITERATURE SURVEY

Food which is pre-cooked leads to wastage of food if less customer visited instead of visiting more. When customer visits to restaurants they have to wait for 15-20 min to get their orders or more than that. Sometimes food quality and taste may do not match with requirement of customers but they take orders from restaurants because of no previous idea for e.g. food panda [3].

There are many applications like Zomato, Swiggy are already exist but they are providing home delivery services from nearby restaurants and food courts only for that particular area [4].

In order to lower service cost and amplify customer experiences, few restaurants have look into the service automation system.
The number of grow in online food ordering is because of satisfaction and control [2].

Almost more than half of the people around the earth has ordered food online. Personal interaction with restaurant

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Dashboard for Materials Management in SAP

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Abstract – *In 1972 four former IBM employees founded SAP AG, Since its inception, SAP has made significant development and marketing efforts on standard application software, including the R/2 system for mainframe application and the global market with R/3 system for open client/server technology. The company name SAP that is Systems, Applications and Products in Data Processing is a standard software package that can be configured in multiple areas and adapted to specific needs of company. To meet those needs, SAP includes a large number of business tasks, leaving room for further enhancements or adapting to business practice changes. SAP itself is providing thousands of standard reports, thereafter to meet the business process of client, client (Student Consumer Co-operative Store) require few of the customized reports in Materials Management module in their required format.*

Index Terms- *System application product, Enterprise resource planning tool, materials management, ALV.*

1.INTRODUCTION

1.1 SAP

SAP is an acronym for Systems, Applications and Products in Data Processing. It is a standard software package that can be configured in multiple areas and adapted to specific needs of company. To support those needs, SAP includes large number of business functions, leaving room for further enhancements or adaptability to business practice changes.

SAP itself provides thousands of standard reports for any business process, commonly required by the profit making industries. SAP ERP does not contain generalized reports for non-profit organization client needs to customize these reports in SAP ERP. The MATERIALS MANAGEMENT reports used by the client of SAP are in different standards from SAP standard. Hence there is need to develop such reports which will be helpful to reduce cost of SAP implementation. thereafter to meet the business process of client, client require few of the customized reports in Materials Management module in their required format.

1.2 ERP systems

An ERP system is made up of enterprise resource planning applications that share databases and interact with each other, which means it can remove data from departments and give everyone a single source of information. This system can automate key business processes and help reduce risk, ensure regulatory compliance and speedy reporting. [1]

ERP systems must be replaced by Internet applications and separate systems that can communicate together. But over time, organizations are forced to control IT budgets, and the complexity, transparency and cost of ownership have become crucial. Thus organizations have begun to focus on modern ERP systems and aim to create added value by reducing the cost of it. [2]

The Ground Foundation of ERP Systems is a general database that provides the possibility to include all the processes required for a given company. These processes are usually in the areas of finance, control, product planning, logistics, sales, materials management and human resources. [3]

General and integrated databases can be used by various SAP modules. For example, an employee with data in an HR module is working as a product supervisor. Data about him is simultaneously accessible to the production planning module as well as the human resources module. Thanks to deep integration of applications it is possible to use only one database without any other interface and data can be inserted into the system only once.

1.3 Brief History

SAP Company was founded in 1972 by five former IBM employees in Germany. SAP stands for Abbreviations of the Software, Envaldungen und Products. It translates into English as Software, and Applications and Products. The founders wanted to develop a product that would cover all the processes and manage the entire economics of the organization.

In 1972 the first standard software for financial accounting was released. This product was the foundation of the SAP R/1 system, not yet fully featured with the ERP system. Letter R refers to real-time processing.

SAP R/2 was released in 1979. and was the first real ERP system. In 1992, SAP R/3 was a breakthrough, based on the

"REAL TIME BUS TRACKING SYSTEM BASED ON GPS USING ANDROID APPLICATION"

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ABSTRACT: *In today's running life, anyone does not want to waste their single minute. People are always in hurry. But, while travelling from one place to another through public transport, passengers have to face lot of problems because of spending much time on the bus stops. It is not always feasible to wait for longer time. Moreover, they do not know that the bus will come or not. There are many people who are mainly dependent on public transport. So, keeping their problems in mind, we have developed real time bus tracking system to help the passengers to locate the exact position of the bus on the Google Maps that is pre-installed into their android device. Also, there is no need to install a GPS device in the bus, which will save the installation and the maintenance cost. The system is designed in such a way that the driver or conductor of the bus just have to enter the source and destination stops and press a allow location button to share the live location of bus. The android app, with the help of GPS service, automatically sends driver or conductors location to the server continuously in interval of five minutes. The location details are then shown on Google Map to the passenger. This application thus enable passenger to find exact position of public transport bus and save the time spent in waiting at bus stops and thus will not get late or arrive early at stops. Also, it helps in finding his distance from bus stop, time required for the bus to reach the stop. Here, a web-application has been developed in order to maintain all records such as bus details, driver and conductor details of the bus, managing routes, etc. For this, MySQL database along with Php PDO has been used.*

Keywords: Android, GPS, Google Map Api, Bus Tracking, MySQL, Php PDO, Tracking unit, Monitoring Unit.

1. INTRODUCTON

Today, the fastest developing industry is the mobile industry. Mobile phones now as smart phones have become most essential part of human life. These are getting integrated with various and multiple features that help in communicating with others, throughout the world in seconds, organize our lives and document events. One of the most important features provided by these smart phones is the location based services. One of them is GPS .The GPS uses satellites for getting exact position of the smart phone in terms of latitude and longitude. With the help of these longitudes and latitudes, the position can be seen on the map. The applications in android have the facility to navigate through the maps. Tracking buses is always been a problem for all. The GPS device is costly, complicated and requires maintenance. The application need to be developed in such a way that it resolves all of these issues.

Buses are one of the most used ways of public transport used by the people. Various organizations like schools, companies, universities, companies, business firms, banks, etc. use them as main medium of transportation. Because of the increase in population, the number of vehicles have also increased which cause traffic on roads, due to the bus arrives late at the stops. There might be some other reasons as well. The people have to wait for longer period of time on bus stops due to this and thus suffer problems. Thus, an effective transportation system with tracking mechanism can solve this problem and lead to better life of people and society. Hence, the developed real time bus tracking system will be helpful for the people that will provide the exact location of the bus on the Google Map API and also let them know in how much time the bus will arrive to the stop so that they do not have to spend much time in waiting on stops.

For building such application, we have used android based GPS and GSM service to continuously send the

"REAL TIME BUS TRACKING SYSTEM USING SMARTPHONE"

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ABSTRACT: *In this dynamic life where everyone is in a hurry to reach their destinations, waiting for bus is hectic and even many of us are unaware of the bus timing. To overcome this difficulty, an easy system is proposed in this paper to aid tracking real time bus location. The proposed solution takes advantages of the two main features in mobile platform nowadays which are location services, mainly GPS based and Google map services. Basically there are two sides of application client side and server side. Exact location of bus is tracked using smart phones held by driver as well as conductor in every bus. If clients' device is an android based smart phone, he can install our application to track bus location using internet service. The application is proposed considering a low budget mechanism for real time bus tracking including every possible road.*

***Keywords*:** Android, GPS based location, Google Map, Real time vehicle tracking

1. INTRODUCTION

Today mobile phones are becoming more technologically advanced and offer more features. One of them is the remarkable features and capabilities that new smart phones offer especially Android based smart phones. Android is becoming very popular in embedded market for two mainstream reasons. First, source code is completely free; moreover there are no royalty fees for Java VM (Virtual Machine). Second, Android is highly suitable for expansion as the developer see fit. With that many features, the need for resourceful applications rises. Vehicle tracking systems combine the use of automatic vehicle location in individual vehicles with software that collects these fleet data for a comprehensive picture of vehicle locations. Vehicle information can be viewed on maps via the internet or specialized software. Some related works where formerly done but there is a fact of high cost and there is more complexity. Fetching location using GPS from bus driver and conductor and displaying it directly to user is a solution.

The application is basically designed for local as well as private buses that are used for long distance travelling. Every bus has a driver and conductor (optional) .In today's scenario most of the people use android phones. Hence real time location of bus is calculated from values that are fetched by GPS in smart phones of driver and conductor.

2. LITERATURE SURVEY

A system was developed in [1], using GPS and GSM technologies. The system is micro-controller based that consists of GPS, GSM, Atmega microcontroller MAX 232, 16x2 LCD and software part is used for interfacing all the required modules and a web application is also developed at the client side. The GPS satellite gives the exact position of the device which is situated in the vehicle. This device is in turn which is connected to the local GSM service provider via a GSM network as it has SIM card present in it thus the GPS parameters which the device has are send to the tracking server. There is a fact of high cost as the devices they use are costly and there is more complexity in integration of those devices in a simple box.

A. Al-Mazloum et al. [2] developed an SMS based tracking system for tracking children's location. Parent's phone sends SMS to child's phone requesting a location information. Then child's phone replies with GPS data and after receiving the data, the parent's phone shows the location on map. Although the system was good for SMS based tracking, it does not provide online location tracking system using application software because it did not use any dedicated server. There is a system architecture as in [3], designed based on client-server. In server side, it contains a GPRS, a web and an SMS server along with database to store user details and

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QUALITATIVE AND QUANTITATIVE ANALYSIS OF FRICTION STIR WELDING OF 6111-T4 ALLOY JOINT WITH PREHEATING

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ABSTRACT

The rising industrial requirement for lighter, multi-material components supports the development of new joining processes. Friction Stir Welding (FSW) is one process which has the fast development in several industries. The high strength AA6111-T4 aluminum alloy is commonly used in the aerospace components due to its special mechanical properties like lightweight and high strength. This alloy cannot be welded by fusion welding techniques due to solidification cracking which severely degrade the mechanical properties of the joint. In contrast, through Friction Stir Welding (FSW) process solidification relate defects can be eliminated. An investigation includes external heat addition through preheating the metal before weld. This preheating temperature effects on microstructure and overall mechanical properties of the goof quality joints were investigated by using qualitative and quantitative approaches. Factorial design, ANOVA and empirical regression models were used to analyze samples without preheating and with preheating. From this study, the following conclusions are derived. Sufficient heat input should be given to obtain defect free and quality joint. The results showed that preheating the base metal to 100 -150°C prior to welding improved the tensile strength and joint efficiency compared to the joints made without preheating.

KEYWORDS: ANOVA, Preheating, Factorial Design, FSW & Aluminium Alloy

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Original Article

Design and Development of Low Cost Orange Sorter

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Abstract— The present review provides brief information about various types of innovations done in orange grading equipment's. The basic objective of grading operation is to grade oranges into different sizes as per the requirement. The farm and food industries were using manual sorting to grades the fruits based on their sizes and colour quality but this method was time consuming, laborious and suffers from the problem of inconsistency and inaccuracy due to involvement of huge human worker. Now a days huge machine are too costly, because of this many small scale industries cannot afford them and also these machines require large space. Thus at present, sorting of the fruits become very difficult industrial process and issues of concern. The main objective of this project is to design a system for grading orange. To design such a system fruits weight, sizes and surface area need to be found. In this project we are using mechanical sorter to grade the oranges. By using this system we completely eliminate manual sorting work and reduce cost and also increases production rate.

Keywords: Design, Development, Low Cost, Orange Sorter

I. INTRODUCTION

Naturally orange occurs in various sizes, so there is a need to grade the orange on the basis of its size as per the company requirement. Now a days, most farms & food industries use manual experts for sorting of the fruits which is time consuming, laborious, and suffers from the problem of inconsistency and inaccuracy in judgment by different human experts. Maharashtra owns 2nd rank in the country for production of oranges, Yet, no any automated sorting machine is developed for this. In this project, we developed the orange grading machine which grades the oranges on the basis of size.

Previously the work was done manually but continuous sorting causes fatigue to the worker. Due to inaccuracy and less efficiency there is a need to develop a machine to sort oranges. Although the solutions are available, these solutions are not feasible for small scale industries. The production of orange is in the higher rate. So for quality sorting, this product sorter is a requirement as per the market survey. For sorting, there is a requirement of intelligent machine in agricultural sector to raise the quality and to lower the sorting costs and to reduce the manual labor. This innovation tends to decrease sampling time and costs of the task as well as increase its accuracy.

II. MECHANICAL DESIGN

A. Material Consideration:

The knowledge of material and their properties is of great significance. The machine elements should be made of such material which has properties suitable for the consideration of operation. The choice of material, for our project depends on following factors:

- Availability of materials.
- Suitability of materials for working condition in service.
- The cost of material.
- Low weight of material.

B. Design of system:

The main channel is fixed on table using helical springs in between. For free fall of oranges over the main channel, the table must be inclined. For this the slope is required to be calculated. We have to find the slope of machine such that the orange will fall freely. The slope should not be large enough that it will create difficulty in sorting.

We are using mild steel cold rolled (CR) sheet for main channel.

Its coefficient of friction is 0.4

Length of main channel is 1m.

For calculating the slope, consider orange is rolling freely over the main channel.

Let "m" be the average mass of orange,

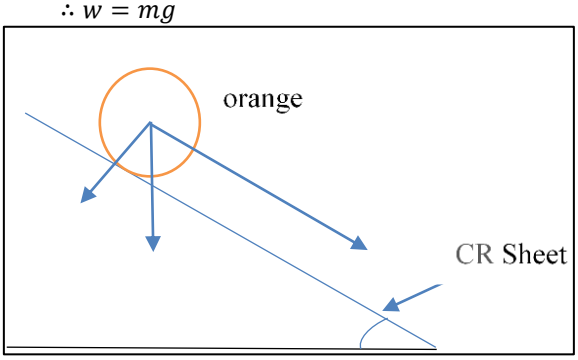
g = acceleration due to gravity,

μ = coefficient of friction between orange and CR sheet,

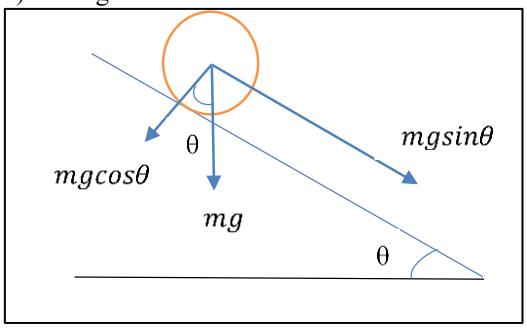
θ = angle of inclination.

Let w be the weight of orange,

$\therefore w = mg$



We consider that the angle between horizontal and surface of main channel (where the oranges make surface contact) i.e. angle of inclination be θ.



Therefore, the angle between vertical and perpendicular to CR sheet will also be θ.

Hence the component of weight perpendicular to CR sheet is $mgcos\theta$ and the

Component of weight parallel to CR sheet is $mgsin\theta$ which will made the
Orange roll freely on sheet.

We know that μ is the coefficient of friction which is opposing this motion.

∴ Net force acting on orange = $mgsin\theta - \mu.N$
Here N is the normal reaction which is $mgcos\theta$
∴ Net force = $mgsin\theta - \mu.mgcos\theta$
∴ $m.a = mg[sin\theta - \mu.cos\theta]$
∴ $a = g[sin\theta - \mu.cos\theta]$
∴ $a = 9.81*[sin12 - 0.4 * cos12]$
By trial and error our angle is found to be 12°.
∴ a = 1.79 m/s^2
From above, as the orange is stationary initially consider μ=0.
Also, s = 1m length of CR sheet
Now we have μ, a & s.
So, we can find the time to sort 1 orange by using formula

∴ $s = ut + \frac{1}{2}at^2$

∴ $1 = 0 * t + \frac{1}{2} * (1.79) * t^2$

∴ $1 = \frac{1}{2} * (1.79) * t^2$

∴ t = 1.05sec

In 1.05 sec, 1 orange gets sorted.
∴ Our Machine capacity = 3780 orange/hr.
Let average weight of orange is 140gms.
Sorting takes placed on both sides of system hence,
Then capacity of complete system = 2*(3780*0.140) kg/hr.
= 1058.4 kg/hr
≈ 1058 kg/hrs.

C. Component used:

The system consist of following components,

1) Table:

The component over which the mainframe channel is fixed. It is designed with 12^0 of inclination with base.

Fig.1 Table

Dimension:
- Length = 1225mm
- Width = 570mm
- Height = 710mm
- Inclination = 12^0

Operation:
- Cutting
- Welding
- Grinding

2) Mainframe channel:

This is the main area of the system. Mainframe channel has 2 inclination for easy sorting of oranges, one with base and another with vertical plane.

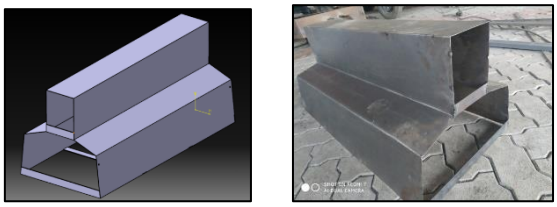


Fig. 2: Mainframe channel

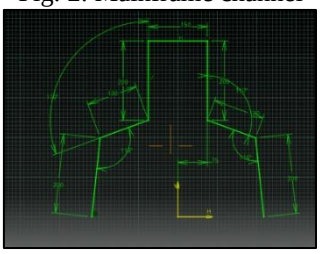


Fig.3: Dimensions for mainframe channel

Dimension:
- Length = 1000mm,
- Thickness = 1mm

Operation:
- Cutting
- Press breaking

Machine used:
- Pressing machine

3) Hopper:

Hopper is connected to the mainframe channel in inclined position. The oranges from previous line, supply the oranges continuously to it. Hopper is design by considering the capacity of the system.

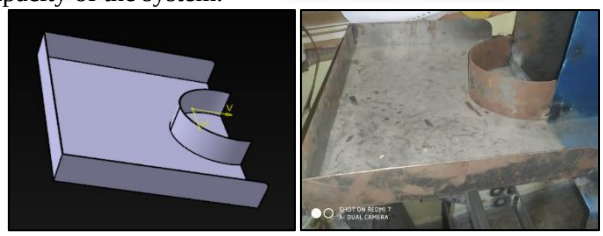


Fig. 4: Hopper

Dimension:
- Length = 380mm
- Width = 300mm
- Height = 50mm

Operation:
- Cutting
- Welding
- Bending

4) Helical spring:

A spring is defined as an elastic body, whose function is to distort when loaded and to recover its original shape when the load is removed. The helical springs are made up of a wire coiled in the form of a helix and are primarily intended for compressive or tensile loads. The cross-section of the wire from which the spring is made may be circular, square or rectangular.

Fig. 5: Helical spring

Dimension:

- Coil Diameter = 5mm
- Outside diameter = 40
- Pitch = 8mm
- Free Length = 60mm
- Number of coil = 8

Operation:

- Welding.

5) Adjusting strip :

The main function of this strip is to sort the orange of different size. Adjustable strip can provide the size variation by adjusting slot.

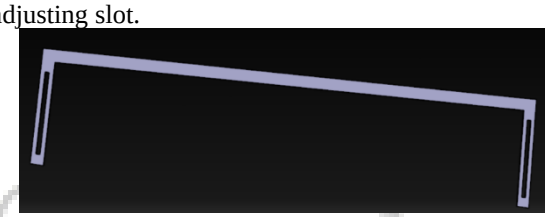


Fig. 6: Adjustable strip

Dimension:

- Length = 1000mm
- Thickness = 2mm
- Width = 25 mm
- Height = 200mm

Operation:

- Cutting
- Welding

a) Fixed strip:

The main function of this strip is to sort the orange of different size.

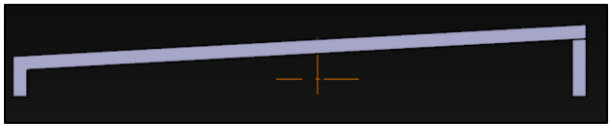


Fig. 7: Fixed strip

Dimension:

- Length = 1000mm
- Thickness = 2mm
- Width = 25 mm
- Height = 45 (left side) and 100mm (right side)

Operation:

- Cutting
- Welding

D. Auxillary component :

1) Washer:

It is a thin plate with a hole that is normally used to distribute the load of a threaded fastener, such as a screw or nut.

2) Nut and bolt:

These are tightened so that some axial force present in that will prevent movement of the connected members in the axial direction of the bolt. Proper tightening also prevents loosening of the nut.

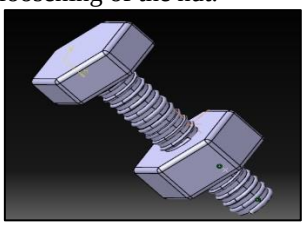


Fig. 8: Washer

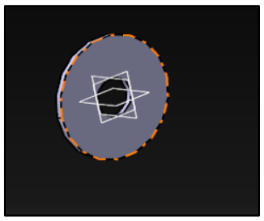


Fig. 9: Nut and bolt

E. Project Assembly:

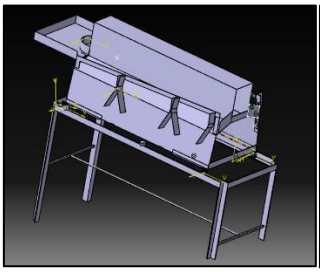


Fig. 10: CATIA View of assembled system

Fig. 11: Assembly of complete system

III. METHODOLOGY

A. Fabrication:

Fabrication is the process in which finished and assembled product is obtained from raw materials by doing some manufacturing processes. For fabrication we have selected the standard cold rolled sheet available in market having thickness of 1mm.Then as per our project concept, we are required to bend the sheet by press brake forming process. The obtained component is rest on table with 4 helical springs in between. The strip is attached on both sides of component and divided into 3 parts as per the size requirement. The 3 collection boxes are provided on both sides. The motor is installed inside the main component with small mass attached to it for producing vibration in system.

The main processes used for the fabrication are:

1) Cutting
2) Welding
3) Drilling
4) Grinding

1) Cutting:

This process is used for the cutting of sheets, angles as per our dimensions.

2) Welding:

In this process, we have welded the angles, strips to main component of machine, helical spring in between main component and table which acts as support for mechanism. The process used for welding was arc welding because it is economical and also results in good weld.

3) Drilling:

This operation is used to make drill on so as to adjust size as per requirement. For this operation, we have used vertical drilling machine.

Fig. 12: Welding of the strip

Fig. 13: Welding of the helical spring

4) Grinding:

The sharp edges of the metal were smoothed with the help of grinder. Also welded joints were smoothen by grinder

5) Assembling:

All the components after the various processes were assembled to obtain the finished mechanism.

B. Methodology:

Manufacturing Stages:

Following are the different stages of the project:

1) Recognition of need of mechanism.
2) Design of the components.
3) Selection of the material.
4) Fabrication and assembly.
5) Trial.

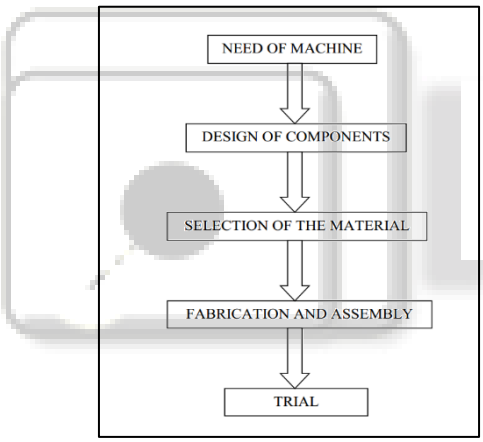


Fig. 14: Manufacturing Stages.

C. Working:

This device came to actualization from interconnecting various components, frames together using appropriate tools and equipment. By switching on the motor, the vibration is produced due to eccentric loading of mass attached to the motor shaft. Also excess vibration is provided with the help of helical spring. As soon as the motor started the shaft rotates and the oranges available in the hopper automatically dropped over the mainframe channel of system.

The oranges move forward and due to 12 degrees of inclination of base on which the oranges are dropped, they make contact with strip which is connected on both sides. The strip is connected to machine part in such a way that it can sort smallest size of orange i.e. 40mm (which we had taken in our project) at beginning and largest size of 110mm sort at the end portion. And accordingly 3 different sizes of oranges get sorted in ascending order and collected in boxes.

D. Motion Flow diagram

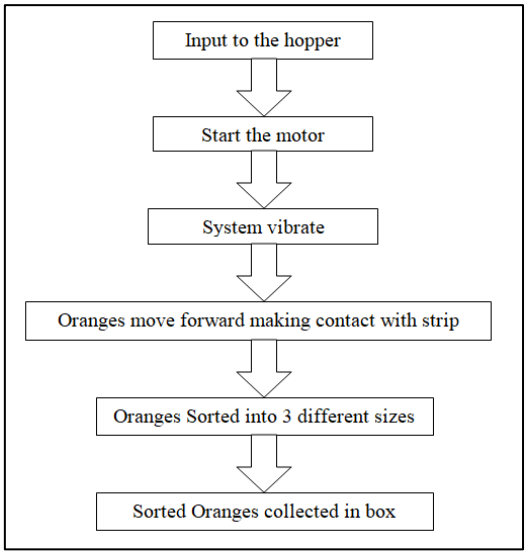


Fig. 15: Motion flow diagram

IV. Result and Discussion

From the trial taken on fabricated mechanism we come to know that the orange sorting machine can work efficiently with the help of our mechanism. Although the machine has the ability to grade more than 20 oranges per minute based on the requirement as the machine is built with high feed rate but were not loaded beyond 15 pieces since it was under test run.

Fig. 16: Front view of sorter

For each test, number of different size fruits was recorded and machine performance evaluated by comparing with the number of fruits identified and sorted by the machine. Machine performance determines how much it closes or deviates from the set standard criteria. Thus, a maximum of 87% accuracy was achieved for small and medium size oranges and 100% for large size oranges with less than 0.2 error margins.

Sr. no.	Fruit size	Number Of fruits before sorting	Number of fruits after sorting	Error	Accuracy (%)
1.	Small	15	13	0.13	87
2.	Medium	10	12	0.2	80
3.	Large	10	10	0	100

Table 1: Results obtained from testing the mechanical fruit sorting machine.

V. CONCLUSION AND FUTURE SCOPE

A. Conclusion

The objective of our project is to design a low cost machine that will sort orange on the basis of its size. An effective solution is provided that sorts orange into three categories via –small, medium and large without damaging it. The whole system has an advantage of small volume and high reliability.

The system has relatively low cost of around Rs.15000/- and can be purchased by a small trader. The input is given to the hopper from the caret of mixed oranges .The machine is being started. The orange passes through the main part of machine and as per their size they get collected into the caret and thus sorted. The operation is quite easy and the power consumption of the system is also very low.

This system brings innovation in the existing technology of sorting and also replaces the tedious job of manual sorting by machine and thus provides an effective solution.

B. Future Scope

We done this uptill now. In the future, we will,

1) Provide some adjustment in the machine so that it can sort some other citrus fruits such as sweet lemon, lemon etc.
2) Do some arrangement for washing of fruits.
3) Make machine more reliable so that we may be able to set the size of sorting manually. Like now our machine sorts orange in the size of 4 cm, 7cm and 11cm. We will be able to change the size of sorting to 3cm, 5cm, 7cm. Different size of orange grows in different geographic location. So in order to cope with this we will provide some arrangement which will allow us to decide the size of sorted orange as per our requirement.
4) Try to reduce the noise of the system.
5) Increase the productivity and accuracy of the machine.
6) Try to increase the operation time of machine so that it can be operating continuously without stopping the machine.
7) Provide wheels to the machine so that it can be shifted from one location to another location easily.

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Low Temperature Hydrogen Gas Sensing Performance of Fe-doped SnO_2 Nanostructured Thin Films

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ABSTRACT

Fe doped tin oxide was prepared by hydrothermal method and the same has been used to fabricate a thin film for sensing. Fe doped tin oxide was prepared by sol–gel dip-coating technique on the glass substrates for hydrogen sensing. The microstructure and morphology of the prepared materials were analysed by XRD and SEM analysis. The SEM images clearly show that doping can clamp down the growth of the large crystallites and can lead to large agglomeration spheres. Thin film gas sensors were formed from undoped pure SnO_2 and Fe doped SnO_2. The sensors were exposed to ammonia and ethanol gases. The responses of the sensors to 1000 ppm of hydrogen gas at different operating temperatures (25 °C – 100 °C) were studied. Results show that a good sensitivity towards hydrogen gas was obtained with Fe doped SnO_2 thin film sensor at an optimal operating temperature of 75 °C. Response time of the sensor and its stability were also studied.

1. Introduction

Tin oxide (SnO_2) is a wide band-gap (~3.5 eV) compounds with metal-like conductivity and widely studied due to its potential applications as: conventional gas sensor due to its high reactivity with environmental gases [1]; catalyst for hydrocarbons oxidation [2], and an excellent optical transparency and high chemical stability have been recognized as very promising materials with widespread technological applications [3,4].

SnO_2 has been established as the predominant sensing material for the gases like CO, C_2H_5OH, NO etc. The basic sensing principle behind metal oxide based thin or thick film is that there will be a change in the electrical resistance due to gas reacting with negatively charged oxygen that is adsorbed on the surface of the metal oxide nanoparticles [5–10]. It is generally accepted that increasing the surface/bulk ratio by decreasing the grain size of rutile SnO_2 nanoparticles is crucial for achieving high-sensitivity in gas sensors. One of the other most common ways to modify the characteristics of the material is introducing dopants into the structure. Many results have shown that several additives (cations: Fe, Cu, Co, Cr, Al, Mn, Mg; anions: P, S) can lead to an increase of the surface area of SnO_2 sensors.

Doped SnO_2 thin films are extensively studied in the recent times due to its crystallinity, tetragonal rutile structure and gas sensing application. SnO_2 thin films are prepared by the various techniques such as reactive sputtering, spray pyrolysis, chemical vapour deposition, laser ablation and sol-gel having its own importance [11-14]. Sol gels have been used extensively as. Among these techniques, as it is economical, simple and energy saving method to deposit high quality films, simple experimental arrangement, easy control on film thickness with a high porosity area which can improve the efficiency of the sensors, greater homogeneity and more purity.

In this study, Fe-doped SnO_2 thin films with varying concentrations of iron were grown by sol–gel dip-coating technique on the glass substrates. H_2 gas-sensing properties of the as-grown Fe-doped SnO_2 thin films with varying concentrations of Fe were investigated.

2. Experimental Methods

2.1 Sol-Gel Synthesis of SnO_2 Nanocrystalline Thin Films

SnO_2 semiconductor thin film coating on the Pyrex glass (silica) slides (substrate) was conducted via sol–gel dip-coating technique. Tin-isopropoxide (10% w/v) in *iso*-propanol and toluene was purchased from Aldrich chemicals and used as-received. Pyrex glass slides, with roughness of ±10 nm, were received from Fisher Scientific. Small glass substrates (1 cm×1 cm), were cut from the glass slides for the dip-coating experiments. The glass substrates were ultrasonically cleaned, first in acetone and then in *iso*-propanol. The pre-cleaned substrates were dipped in the solution of tin-isopropoxide in *iso*-propanol and toluene, corresponding to the concentration 0.25 M of tin-isopropoxide, using a dip-coater with a withdrawal speed of 150 cm/min. The gel films were dried at 200 °C for 1 h in air. The substrates were dip-coated again using the same solution under similar conditions and then dried again at 200 °C for 1 h in air. The dried gel films were fired at 450 °C in air. The samples were heated at a rate of 30 °C/min upto 450 °C, held at that temperature for 2 h, and then cooled to room temperature inside the furnace. Finally, a thin layer of Pt was sputtered for 10 s on some of the semiconductor thin films using a sputter coater.

Table 1 Details of the deposition parameters of Fe-doped SnO_2 thin films

Parameters	Particulars
Concentration of tin-isopropoxide solution	0.25 M
Temperature at which films dried	200 °C
Time for films drying	1 h
Annealing temperature	450 °C
Film thickness	500 mm

2.2 Characterization

All the characterization techniques described below were employed after firing the sol–gel dip-coated Fe-doped SnO_2 thin films at 450 °C for 2 h. X-Ray power diffraction (XRD) analysis conducted on a Rigaku MiniFlex 600 X-Ray diffractometer with Cu-Kα radiation (λ = 1.5418 Å) as X-Ray source (at 20kV and 20 mA) in the scanning angle (2θ) range from 20° to 80°. The mean crystallite size calculated using Debye-Scherer formula,

$$D = \frac{0.95\lambda}{\beta Cos\theta} \quad (1)$$

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where, λ is the X-ray wavelength, θ is the Bragg diffraction angle and (in radians) is the full width at half maximum. The morphological analysis is done by field emission scanning electron microscopy (FESEM). The high-resolution transmission electron microscopy measurements are obtained on JEOL JEM-2100 microscope operated at 200 kV.

2.3 Gas Sensitivity Measurement

Gas response measurements of the samples are carried out as follows: The films are loaded in the sensing chamber with four probe leads attached. The film is heated in the chamber with atmospheric air as ambient and then in the ambience of H_2 gas. Resistance measurement and gas sensing response of the samples are carried out at different temperatures using Keithley 2400 source meter. The sensor response to a particular gas concentration is defined as,

$$S\% = \frac{R_a - R_g}{R_a} \times 100 \quad (2)$$

where, R_a and R_g are the resistances of the sample in the absence and presence of the test gas respectively.

3. Results and Discussion

Typical XRD patterns of the as-prepared SnO_2 samples are shown in Fig. 1 where one can see that they are identically similar except in peak intensities. The cassiterite phase of SnO_2 is identified, having no evidence of impurity regardless of dopant concentration. The diffraction peaks corresponding to Fe_2O_3 cannot be seen in XRD patterns, in the studied Fe concentration range less than 4 wt.%. It can be seen that the diffraction peaks become weaker and broader with the increasing amount of dopant, which indicate that Fe^{3+} doping suppress the growth of large SnO_2 crystallites.

Table 2 Crystallite size, lattice parameters of undoped and Fe doped SnO_2 Thin Films

Sample	Crystallite size (nm)	Cell volume (Å³)	a/c (Å)
SF	24.3	71.7522	1.4891
SF-1	23.7	71.7687	1.4878
SF-2	16.4	71.7734	1.4876
SF-3	12.6	71.4211	1.4870

Table 1 gives the information about lattice related parameters of pure and Fe-doped SnO_2 obtained from XRD data, where the crystallite size calculated from using the Scherrer formula. It is observed that the crystallite size decreases with increasing Fe-doping concentrations. This may be because of the fact that the dopant atoms exert a drag force on boundary motion and grain growth [15]. Hence addition of Fe element decreases the particle mobility on formation and thereby inhibits the growing-up of SnO_2 crystallites. When on the addition of dopant, crystallite size becomes less in the range of nano-scale, it is likely that the defects get introduced is found to be more in undoped films. Crystallite size is calculated from Scherrer formula, for undoped and doped SnO_2 films (Table 2) agree nearly with the values calculated from Williamson-Hall method.

To understand how the doping affects the morphology of the SnO_2 active layers, a morphological characterization based on scanning electron microscopy analysis was performed. Fig. 2 depicts the morphology of Fe-doped SnO_2 films at different concentrations, deposited at a substrate temperature 450 °C.

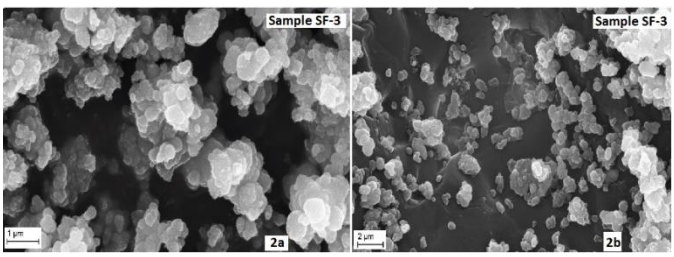

Fig. 2 SEM images of Fe doped SnO_2 thin films

The SEM images for lower Fe concentration (sample SF-3 at different magnifications) show that the distribution of smaller grains is not uniform but at higher levels (3 wt.% Fe), the smaller grains are more uniform and regular in size as shown in Fig. 2. It was observed that micrograph of sample SF-2 consist of mixed sized, less densely packed and polygon shaped grains. The films deposited at higher deposition temperatures have more uniform grains of larger size. The micrographs recorded for the different samples show that the films are essentially homogeneous, and made up of grains and voids. The voids within the film structure provide conduction paths for gas molecules to flow in from the environment. Conductivity of the films is due to the flow of current along the conducting paths of the constituents of the film that are formed randomly by connecting the grains together. As the concentration of Fe is increased to 3 wt.% (sample SF-3), the films become denser and closely packed (Fig. 2). In addition, the SEM picture indicates that the surface of the sample is porous. This clearly indicates that the metal dopant together with deposition temperature modifies the morphology and the sensing action.

The structural properties of doped and undoped SnO_2 films have a significant effect on the electrical and gas sensing property and for this reason structure and grain size measurements on the films were carried out. The relation between dopant weight percentage and crystallite size is plotted in Fig. 3. From the Fig. 3, it can be seen that as the crystallite size decreases with increase in the dopant weight percentage.

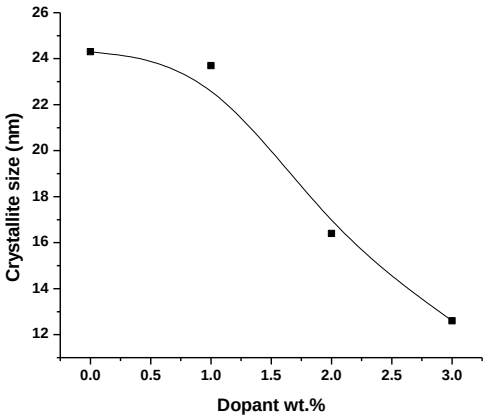

Fig. 3 Effect of dopant wt.% on crystallite size doped and undoped SnO_2 sensors

To investigate the gas sensing properties of Fe doped SnO_2 samples the fabricated films are loaded into the conductivity chamber. For measurements, the sample is kept inside the sensing chamber to attain the desired operating temperature under a pressure of 10^{-1} Torr. The surface resistance is allowed to equilibrate at the operating temperature for a reasonably long time prior to gas exposure. This value of resistance is defined as the initial equilibrium resistance in the absence of the test gas (Ra). Hydrogen gas was injected into the chamber roughly for 60 seconds to create a concentration of 1000 ppm and the resistance of the gas sensor (R_g) was continuously recorded for 10 minutes starting from the gas injection moment and is compared with the initial resistance. The exposure time to target gas was 10 minutes.

While gas sensitivity measurement, initially, the electrical resistances of the Fe doped SnO_2 films were high and on exposure to H_2 gas, an abrupt fall of the film resistance was observed. It is also observed that the electrical resistance gets saturated in less than 2 minutes. Fe-doped SnO_2 samples were found to be more sensitive to H_2 gas than undoped SnO_2 sample. Sensitivity heavily depends on the operating temperature of the sensors. The measurements are repeated at different operating temperatures as 25, 50, 75 and 100 °C to study the variation. The sensors reach the maximum sensitivity to H_2 gas at the operating temperature of 75 °C which is much lesser than our previous results [16].

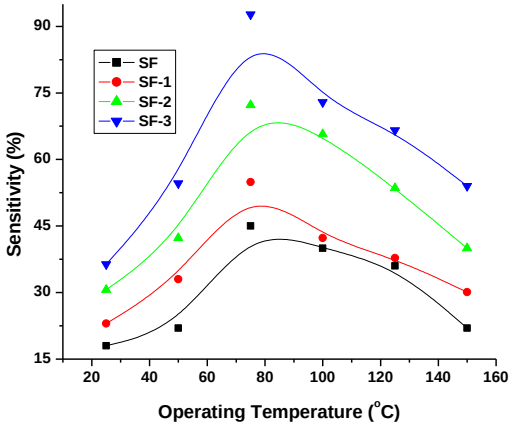

Fig. 4 Effect of operating temperature on sensitivity (%) of undoped and Fe-doped SnO_2 samples

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Fig. 4 shows the variation of sensitivity to 1000 ppm of H_2 gas with the operating temperature for undoped and Fe-doped SnO_2 samples. The sensitivity is found to increase with increase in operating temperature, attains a maximum at 75 °C followed by the decrease with further increase in the operating temperature. Also, with an increase in deposition temperature, the grain size increases causing a decrease in grain boundary potential and hence an increase in mobility. The decrease in grain boundary potential is also responsible for an increase in carrier concentration with deposition temperature, which results a decrease in resistance.

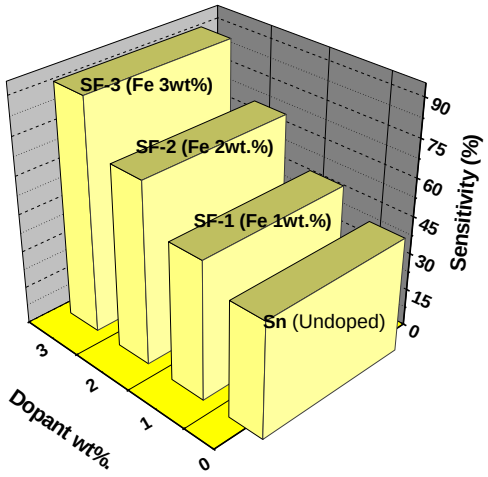

Fig. 5 Effect of dopant wt.% on sensitivity of SnO_2 samples at 75 °C

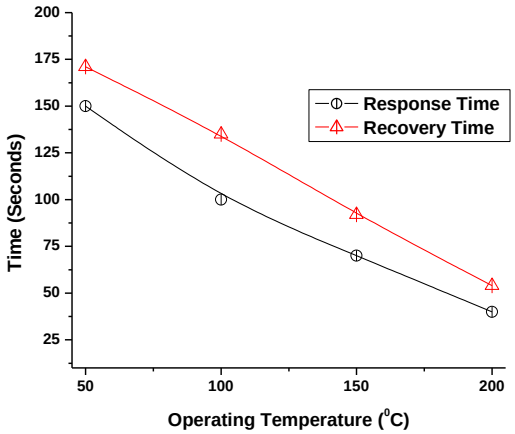

Fig. 6 The response and recovery times of the 3 wt.% Fe doped SnO_2 towards 1000 ppm hydrogen as a function of operating temperature

Fig. 5 shows the dependence of the sensitivity to the amount of Fe in SnO_2 for 1000 ppm of H_2 gas at 75 °C. The sensitivity of the Fe-doped SnO_2 increases when the amount of Fe is 3 wt.%. The enhanced sensitivity is due to the amount and distribution of the dopant. These results proved that a homogeneous distribution of the higher concentration of Fe in SnO_2 is advantageous to enhance sensitivity to H_2 gas.

Response and recovery times of the 3 wt.% Fe doped SnO_2 for 1000 ppm hydrogen are presented in Fig. 6. It presents a decaying behavior with considerable fast response and recovery times at high temperatures (200 °C). At low working temperature the response time is higher due to slow desorption of the formed water molecules on the surface especially at temperatures below 75 °C. Our results demonstrated faster response and recovery times in the order of 150–170 s for low temperature sensing which so considerable compare to 40 min recovery time is. It can be attributed to the facilitate occupancy and desorption of H_2 molecules at grain boundaries on the large surface area of prepared samples. However, the obtained results of the response magnitudes and the working temperature are not as good as our previous work on thin film sensors.

4. Conclusion

In this study, Fe-doped SnO_2 nanostructured thin films with different dopant amounts were synthesized by sol–gel dip-coating technique. By using X-ray diffraction and electron microscopy studies, it is found that Fe^{3+} doping can suppress the growth of large SnO_2 crystallites and assist in a uniform growth of agglomerated grains. The gas sensing properties to H_2 is tested and found that 3 wt. % Fe-doped SnO_2 exhibit the best gas sensing properties which can be attributable to enhanced capability of adsorbing oxygen by Fe on the surface. This implies a good potential of the Fe-dopant in SnO_2 films, for practical H_2 gas sensing applications at 75 °C.

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Nanocrystalline Pure and Modified $ZnSnO_3$ Perovskite: A Novel Material for Gas Sensing

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ABSTRACT: Nanocrystalline powder of pure $ZnSnO_3$ structure and average crystallite size 11.3 nm was synthesized by co-precipitation method. The as-prepared powder sample was characterized by using X-ray diffraction (XRD) and transmission electron microscopy (TEM). Thick films of $ZnSnO_3$ were fabricated by using screen printing technique. Surface modified $ZnSnO_3$ based thick films were fabricated by dipping method which was followed by firing. Surface morphology and elemental analysis of pure and surface modified nanocrystalline $ZnSnO_3$ thick films was studied by using FESEM with EDAX respectively. The response of pure $ZnSnO_3$ and surface modified $ZnSnO_3$ to different oxidizing gases like Cl_2, NO_2, H_2S, SO_2 and CO was investigated. The pure $ZnSnO_3$ exhibited high response response to 100 ppm towards nitrogen dioxide (NO_2) gas at an operating temperature 200^0C. MgO modified $ZnSnO_3$ (5 min), as compared to pure $ZnSnO_3$, demonstrated enhanced response towards NO_2 gas at an operating temperature 200^0C. The selectivity of the sensor elements for various target gases was studied.

KEYWORDS: Nanocrystalline, $ZnSnO_3$, Thick film, X-ray diffraction, Sensor response.

I. INTRODUCTION

Due to the emission of various toxic and hazardous gases, human body suffer from different diseases like lowering of haemoglobin levels, affects the nervous system and may cause mental retardation, headaches, blindness and hypertension. In day today modern life detection of different gases plays a vital role. Gas sensing has become a significant area of research that leads to the development of extremely reactive gas sensing devices able to detect various toxic and hazardous gases. It is supposed that the demand for toxic and deleterious gases is urgent to change human nose. A lot of gas detecting systems have recently been used in process control and laboratory analytics [1-4].

On solid-state gas sensor many types review papers have been published [5-9]. Nitrogen dioxide (NO_2) exposure is now essential target for different crucial processes in an environment. This gas can be very dangerous for human bodies when its concentration in an environment increases hence now a day NO_2 monitoring and controlling is essential. Semiconductor gas sensors (SMO) in the type of thin or thick films, based on metal-oxides like p–n heterojunctions, have been usually reported in the literature for NO_2 detection [10-16]. Basic characteristics of SMO gas sensor are sensitivity, selectivity and durability. In sort to achieve high sensor response and good selectivity, various factors such as nanostructure control, addition of dopant, operating temperature, gas concentration, etc. have been adopted to enhanced the gas sensing properties of SMO gas sensors. In nanostructure particles, a huge portion of the atoms exist at the surface, and therefore, the surface properties exposed to be foremost. The use of nanostructure particles in SMO gas sensors is touching interest in the scientific area [17-20]. Zinc Stannate ($ZnSnO_3$) perovskite has received interest for a variety of applications due to its scientific properties. $ZnSnO_3$ has a perovskite structure of the general formula ABO_3. $ZnSnO_3$ in recent times drawn attention in the research area due to its potential applications in gas sensors, electronic devices, solar cells, plating additives, optoelectronics, etc. [21-25].

In this paper, preparation of pure $ZnSnO_3$ nanocrystalline powder by a simple chemical route, fabrication of $ZnSnO_3$ based thick films and it surface modification by dipping method has been reported. Their gas sensing properties to carbon dioxide (CO_2), carbon-monoxide (CO), nitrogen-dioxide (NO_2), sulphur dioxide (SO_2), chlorine (Cl_2) and hydrogen sulfide (H_2S) were investigated.

II. EXPERIMENTAL DETAILS

2.1. Preparation of nanosized pure $ZnSnO_3$

The synthesis of $ZnSnO_3$ was done by using stoichiometric molar amount of analytically pure grade [$ZnSO_4.7H_2O$] and [$SnCl_4.5H_2O$] aqueous NaOH. The solution was continuously stirred by magnetic stirrer for 1h to obtain a

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homogeneous clear solution. Then aqueous NaOH was added drop wise at room temperature under rapid stirring till pH becomes 9. This precipitate was filtered and followed by washing with ethanol and distilled water for several times then precipitate were dried at 120°C in oven. The dried sample was calcined at 800°C for 6 h in muffle furnace to obtain nanoparticles of $ZnSnO_3$.

2.2. Fabrication pure and surface modified $ZnSnO_3$ thick films

$ZnSnO_3$ thick films were fabricated on glass substrate by using screen printing technique. The details of fabrication of thick films by using screen printing techniques are already published in our earlier publications [26].

Pure $ZnSnO_3$ thick film was modified by dipping them into a 0.01 M aqueous solution of magnesium chloride ($MgCl_2.6H_2O$) for different intervals of time (5 min). Surface activated films are termed as MgO modified $ZnSnO_3$ thick films. Silver contacts were made for electrical measurements.

2.2. Materials characterization

The XRD patterns were recorded on X-ray diffractometer (PANanalytical X' Pert-Pro) using a Cu-K_α mono chromatized radiation source and filtered in the range $2\theta = 10^o - 90^o$. The average crystalline size (D) was calculated according to the Debye-sheerer equation: $D=K\lambda/B\cos\theta$; where B is the full width at half-maximum intensity of a peak at an angle θ, K is a constant, λ is the wavelength of the X-ray source.

In this investigation FESEM has been done with JEOL JSM -7610F which is operated at 30 kV. The images obtained were used to analysis the particle morphology, film surface topography and grain size etc. In this study, the TEM was recorded by using Hitachi (H-7500) 120 kV is equipped with CCD camera. This instrument has the resolution of 0.36 nm with 40-120 kV operating voltage.

2.3. Test system and gas sensing measurement

To test the gas sensing response, the sensor was loaded into a gas sensing chamber. The concentration within the chamber was increased by adding a particular quantity of gas. Gas mixing is performed via a volumetric method. For designing a gas sensor a variety of factors must be focussed such as the materials sensitivity and material sensitivity. The sensing parameters of the sensor were analysed at different concentrations (ppm) and temperature. The sensing response is given as,

$$S\ (\%) = R_g\text{-}R_a/R_a \times 100$$

Where, R_g is the sensor resistance in the gas, R_a is the sensor resistance in the air.

By using gas sensing setup the fabricated sensors were tested. For absorption of the moisture of material, preheating is necessary condition which gives the stable data collection. The concentration of test gases sensor was tested for the nitrogen dioxide (NO_2), chlorine (Cl_2) carbon mono oxide (CO), hydrogen sulfide (H_2S), sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) gases.

III. RESULTS AND DISCUSSION

3.1. Materials characterization

Figure 1 depicts XRD pattern of nanocrystalline $ZnSnO_3$ powder synthesis by co precipitation method. XRD pattern shows the rhombohedral perovskite structure in accordance with JCPDS card no. 00-052-1381. For $ZnSnO_3$ the characteristic peaks for rhombohedral perovskite structure. XRD pattern of $ZnSnO_3$ shows that all the diffraction peaks can be assigned to rhombohedral $ZnSnO_3$ with lattice parameters a=b=5.283(4) Å and C=14.091(4) Å and $\alpha=\beta=90^o$, $\gamma=120^o$ and volume of cell is 340.66$Å^3$.

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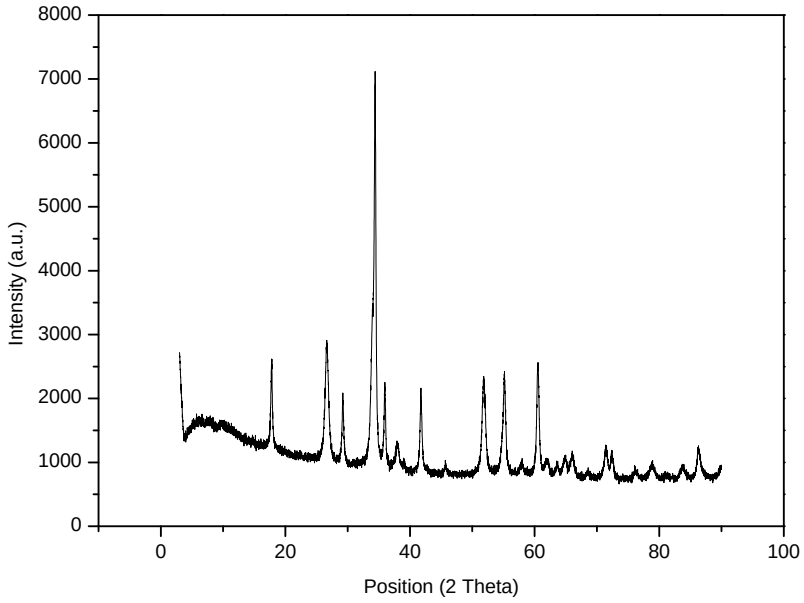

Fig. 1 : X-ray diffraction pattern of $ZnSnO_3$ powder calcinated at 800°C.

The morphology of synthesized $ZnSnO_3$ nanopowder was examined with the help of transmission electron microscopy (TEM). TEM images of nanocrystalline $ZnSnO_3$ powder calcined at 800°C is shown in figure 2 crystalline size can be revealed 13 nm to 18 nm. The average crystalline size calculated from the XRD data agrees with the TEM results. The small amount of agglomerations is observed in the micrograph.

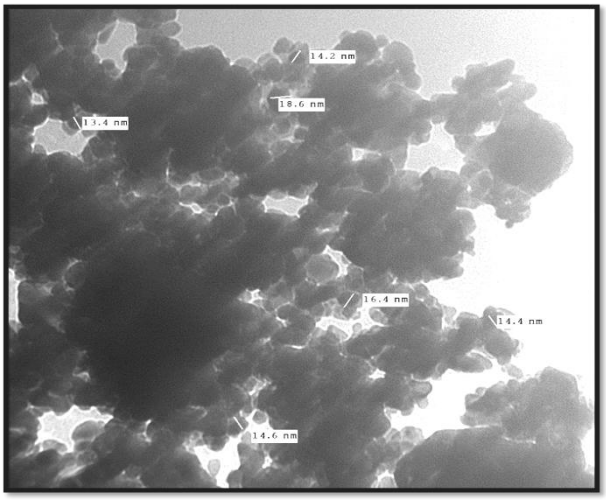

Fig. 2: TEM image of pure $ZnSnO_3$ calcinated at 800°C.

Figure 3 shows the field emission scanning electron microscope (FESEM) images of nanostructured pure $ZnSnO_3$ and MgO modified $ZnSnO_3$ (5 min). FESEM analysed the surface morphology of thick film. Figure 3 shows a few particles are in the range of 22 nm - 32 nm, 36nm - 37 nm and 39 nm - 40 nm could be clearly seen and some agglomerates are formed. Nanostructure and surface area are most main factor that affects the sensor characteristics. High porosity increase surface to volume ratio thus help in getting excellent sensitivity.

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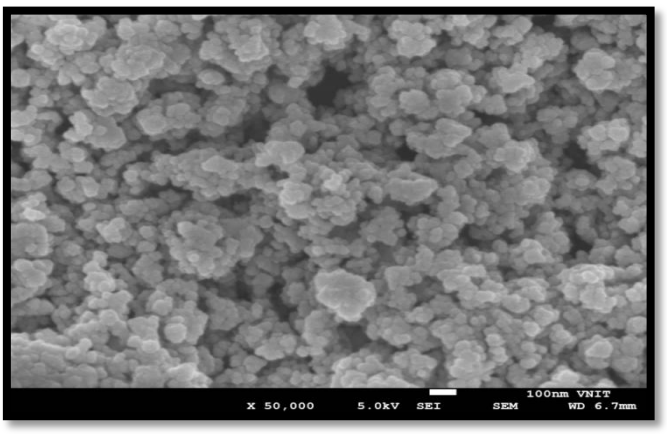
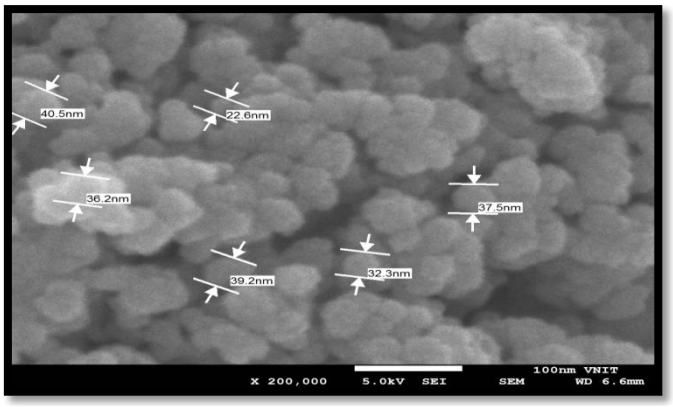


(a)



(b)

Fig.3 : FESEM images of nanocrystalline (a) pure $ZnSnO_3$ (g) MgO modified $ZnSnO_3$ (5min) based thick films.

3.2. Gas sensing properties

The gas sensing properties of pure and modified $ZnSnO_3$have been studied towards CO, Cl_2, SO_2, H_2S and NO_2. The gas sensing property studied for various concentration of NO_2 gas at operating temperature 200^oC. Both adsorption and combustion of the oxidizing gases occur on the surface of the sensors.

The response of the $ZnSnO_3$ film towards NO_2 was measured at different operating temperature and results are shown in figure 4. From figure it is clearly seen that the sensor response of $ZnSnO_3$ towards NO_2 gas increase with the increasing temperature and reaches to a maximum value. And thereafter it decreases with the increasing operating temperature. From figure, it can be observed that $ZnSnO_3$ exhibited maximum response 25 to 100 ppm NO_2 at 200^oC.

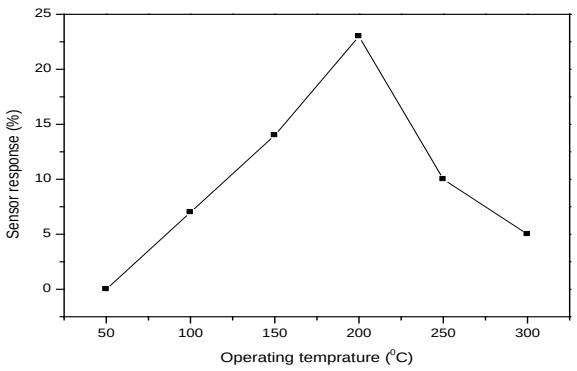


Fig. 4: Sensor response of $ZnSnO_3$ based thick film sensor towards NO_2 gas.

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Sensor response of pure $ZnSnO_3$ to different oxidizing gases like nitrogen dioxide (NO_2) , Chlorine (Cl_2), carbon monoxide (CO), sulpur dioxide (SO_2) and reducind gas hydrogen sulfide (H_2S) at 200°C operating temperature were studied. It is observed that the sensing responses to different gases go through maxima at different operating temperature. For 100 ppm NO_2 sensor response maximum at 200°C as compared to other test gases. The responses of pure $ZnSnO_3$ to NO_2, Cl_2, CO, SO_2, and H_2S at 200°C is shown in figure 5.

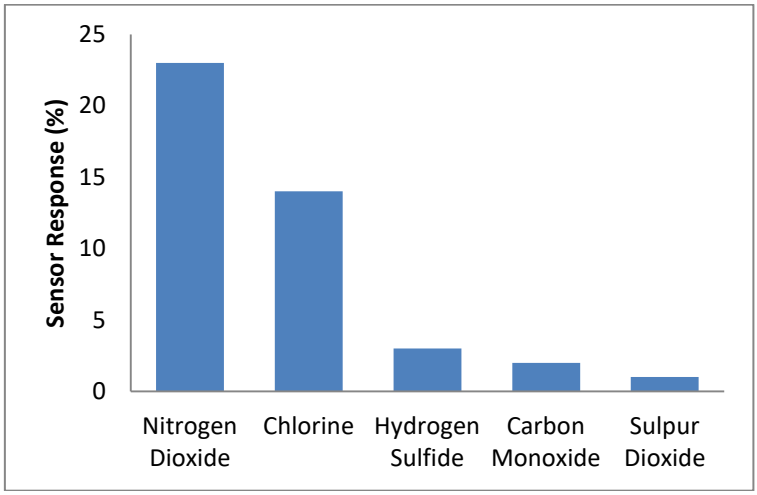

Fig. 5 : Sensor response of $ZnSnO_3$ towards different gases at 200°C.

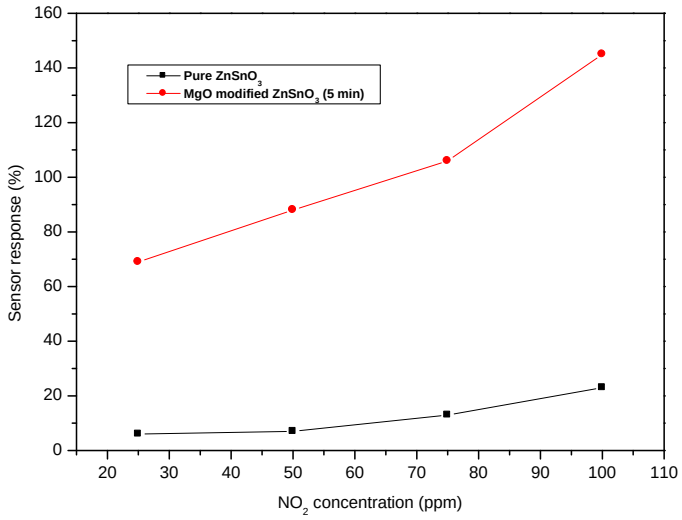

Fig. 6 : Sensor response of pure $ZnSnO_3$ and MgO modified $ZnSnO_3$ (5 min) based thick film sensor as a function of NO_2 concentration.

Figure 6 reveal the relationship between the response of pure $ZnSnO_3$ and MgO modified $ZnSnO_3$ (5 min) to different NO_2 concentration. It can be seen that MgO modified $ZnSnO_3$ (5 min) exhibits the excellent response 100 ppm NO_2 at 200°C. Excellent response of MgO modified $ZnSnO_3$ (5 min) towards NO_2 due to enhancement of surface adsorption property. The gas sensing mechanism of $ZnSnO_3$ film and NO_2 gas is established by a potential barrier form. Number of majority charge carriers at the boundary of gas and solid reduces as the electrons are taken from ionized donors through conduction band hence there is formation of a surface barrier for electrons. Due to enhance of the number of oxygen ions on the surface the additional oxygen adsorption is inhibited. It is noted that, there is sudden enhancement in the resistance of $ZnSnO_3$thick film due to exposure of NO_2 gas molecules. Such increased in the resistance of $ZnSnO_3$ thick film due to the adsorption of NO_2 gas on the surface of $ZnSnO_3$ thick film as well as the successive reactions between them. $ZnSnO_3$ is n-type semiconductor, once it interacts with oxidizing gas i.e. NO_2

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which is electron accepter then adsorption of oxygen leads to detaching of electrons. So there is decrease in charge carrier density of $ZnSnO_3$, which enhanced the potential barrier height. As the electrons density (majority carrier) of $ZnSnO_3$ gets decreased due to electron accepting nature of NO_2 gas which leads to decrease in the conductivity of material and hence sensors resistance increases.

IV. CONCLUSION

Co-precipitation method was used to synthesis nanocrystalline powder $ZnSnO_3$ powder samples with different preparation parameters followed by calcination at 800°C. This synthesis method is simpler and more capable compared to some of the other techniques. The precursor on heating yields nanocrystalline $ZnSnO_3$ particles. The effects of the preparation parameters, such as the reaction time and temperature, precipitation agents, calcinations temperature and time on the formation of composites were investigated. Nanoparticles were characterized by an different experimental techniques. XRD patterns showed the formation of nanocrystalline rhombohedral structure of prepared samples. The crystallite size were calculated by Scherrer formula which is found to be 11.3 nm. The average crystallite size of sample estimated from XRD analysis concurs with TEM investigation. Nanocrystalline pure and modified $ZnSnO_3$ thick films were fabricated by screen printing technique on glass substrate and by dipping method surface of $ZnSnO_3$ was modified by MgO. By using scanning electron microscopy with energy dispersive X-ray analysis (FESEM), the surface morphology confirm the $ZnSnO_3$ modified by MgO. The gas sensing property of $ZnSnO_3$ towards different gases like Cl_2, NO_2, H_2S, SO_2 and CO was studied. $ZnSnO_3$ thick film sensor exhibited maximum response to 100 ppm NO_2 at 200°C with quick response. The enhancement in the sensing response of MgO modified $ZnSnO_3$ (5 min) attributed to its smaller crystallite size.

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Innovation-Driven Business Case of Hanuman Vitamin

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Abstract

The proverbial saying – "to have mango at the coronel's price" - fits exactly true in case of Hanuman Vitamin Foods Ltd., Khamgaon, a Public company established in the year 1966 which produced oil cake from the stone of the mango. This uniquely innovated venture went on to add production of Sal Seed oil, Kokum oil, Dhupa Seed oil, Illepe Nuts (from Indonesia) oil and Shea Nuts (from West African countries) oil through ultra modern plants/process manufacturing De Oiled Cake (DOC) and Cocoa Butter Equivalence (CBE) and exported them to Japan, Italy, Switzerland and all European countries except US. The company became number one Indian manufacturer and exporter of these products and grew in scale and expanded by setting up a new plant at Raipur in the State of Chattisgarh. However, in 2002 – 2003, Hanuman Vitamin Foods Ltd. had to apply to the then Board of Industrial and Financial Reconstruction (BIFR) – now National Company Law Tribunal (NCLT) - for being declared as sick unit and for obtaining government assistance under insolvency and bankruptcy code for its revival. And it finally stopped production in the year 2008 after which the financer banks took the possession of the company through Asset Management Company. The steep rise and fall of Hanuman Vitamin unfolds a host of significant management lessons in innovation and entrepreneurship.

Keywords: Innovation-driven business, entrepreneurship, indigenous quotient (IQ)

1. Introduction

It all started by producing cotton seed oil through traditional method of *Kolhu Ki Ghani* in the year 1930 by Shri Jankilal Agarwal who had moved from his native in Rajasthan to Khamgaon of Buldhana district in Maharashtra in search of business. Cotton seed oil was not used as edible oil then and by conceiving its production Shri Jankilal Agarwal had sown the seeds of indigenous business innovation which percolated to the subsequent generations of his family. It is almost a century of years now that his legacy of business innovation was carried forward by Hanuman group of industries. Hanuman Vitamin Foods Ltd., Khamgaon is a flagship company of this group which is a uniquely innovated venture started by his two sons and incorporated after the name of his second son Hanumandas as a Public company in the year 1966 (https://www.zaubacorp.com/company/HANUMAN-VITAMIN-FOODS-LIMITED/U99999MH1966PLC013614) translating the proverbial saying – "to have mango at the coronel's price" - into reality as this company produced oil and oil cake from the stone of the mango. The company grew in scale of operation, even expanded by setting up a new plant in neighboring State, became number one company in India in manufacture and export of De Oiled Cake and Cocoa Butter Equivalence through a series of indigenously developed business innovations. With the fast growth of the company grew some internal challenges and some external threats which finally saw the demise of this company. This case attempts to capture the journey of Hanuman Vitamin and related firms, its growth and expansion, those practices which caused its downfall and the possibilities that came its way to survive.

2. Indigenous Innovation in Business

An entrepreneur shifts economic resources out of an area of lower into an area of higher productivity and greater yield, (Drucker, 1991) and this he does by starting his own, new and small business (Drucker, 1991). Enterpreneurs innovate. Innovation is the specific instrument of entrepreneurship (Drucker, 1991).

Business innovation is a process for introducing new ways, new ideas, workflows, methodologies, services or products to achieve goals of the organization (https://searchcio.techtarget.com/definition/business-innovation). It is for the leaders of the organization to consider the business viability, feasibility and desirability of introducing these new ways etc. that leads to some problem solution, revenue generation or value optimization. Hanuman Vitamin Foods Ltd. is a live case of business innovations mostly developed indigenously and its consequences. Innovation may sometimes end with an experienceof a `let down' at the end of a project which is also called as `post partum depression' (Gamez, 2003).

There are two types of business innovations (Jay Turo, 2018). They are revolutionary business innovations or radical business innovations which yield drastic change and the second one is evolutionary business innovation which passes through the test of time. Depending upon the success and failure of such business innovations its innovation quotient is measured in terms of the following two (Jay Turo, 2019):

*"**The first is discouraged energy:** It is burnout, caused by the passage of time, by much hard work without ample rest, and by the attempting of very many new things that just didn't work out and produce as planned."* And

*"**The second is unfocused energy:** It is where a great "fighting spirit" is alive and well but is scattered, with multiple new initiatives being pursued at the same time, but without clear senses of prioritization or realistic time frames for their completion."*

Some of the sources lie within the enterprise and they are therefore visible primarily to people within that enterprise. These sources are a) the unexpected success, the unexpected failure, the unexpected outside event; b) the incongruity between reality as it actually is and reality as it is assumed to be; c) innovation based on process need; and finally d) changes in industry and market structure that catch everyone unawares (Drucker, 1991). Indigenous quotient may be defined in terms of the degree or component of indigenous development and design of innovation. It would be seen in the following paragraphs that Hanuman Vitamin Foods Ltd. went in mostly for indigenous business innovations.

3. Methodology of Study

This paper is based on primary research. There were seven types of primary respondents who were interviewed for the purpose of developing this case. These respondents are listed as follows.

a) Promoter of Hanuman Vitamin Foods Ltd.

b) Relatives of promoter having worked in his company

c) Erstwhile employees of the company

d) Financing banks' representatives

e) Representatives of Asset Management Company

f) Erstwhile suppliers of the company

g) Erstwhile transporters of the company.

In addition some secondary sources including websites were also referred to for collecting information however their quantity was minimal.

This paper is an outcome primarily of a series of meetings and interactions with one of the Directors of Hanuman Vitamin Foods Ltd, Shri Premji Hanumandas Saraf. The authors pushed him down to his memory lanes to recollect the journey of the company which resulted in lots of facts and information coming out of him which were all captured by the authors to draft this paper. All these interactions took place at the venue of the company itself. Incidentally many old employees of this company used to come there to meet Shri Premji Hanumandas Saraf who eventually became another samples for data collection. In certain cases Shri Premji and his erstwhile employees would together answer the queries put up by the authors or they would sometimes cross verify their memories with each other to ensure correctness of facts and information. Some relatives of Shri Premji who had worked in the Hanuman Vitamin Foods Ltd. became another sample of respondents. Responses were also collected from erstwhile suppliers and transporters of this company who could be contacted on piece meal basis. The representatives of the banks which were financers to Hanuman Vitamin and the representative of Asset Management Company which took

possession of the company under study after being declared sick were also approached for collecting data.

4. Family Tree

Shri Jankilal Agarwal is the founder of Hanuman group of industries at Khamgaon starting with the traditional *Kolhu Ki Ghani* cotton seed oil producing unit in 1930. He had two sons namely Shri Hanumandas Agarwal and Shri Nathmalji Agarwal. All his firms were started in the name of Hanumandas – his second son – and hemce Hanuman group of industries. Shri Hanumandas used to look after entire manufacturing work in all the firms at Khamgaon where as Shri Nathmalji Agarwal would look after exports and imports from Bombay. Shri Nathmalji Agarwal had one son and three daughters but his son did not join his business due to family reasons. Shri Hanumandas Agarwal was blessed with three sons namely Shri Premji Saraf, Shri Ramesh Agarwal and Shri Murli Agarwal. Shri Premji Saraf got associated with his father Shri Hanumandas Agarwal and looked after entire manufacturing work and commercial functions at Hanuman Vitamin Foods Ltd., Khamgaon, Shri Ramesh Agarwal initially looked after production at Khamgaon but later on independently looked after Hanuman Minors Oils Ltd, Raipur which he is doing even today however, the plant has stopped manufacturing and it only does job works, and the third son Shri Murli Agarwal got associated with Shri Nathmalji Agarwal and started looking after entire exports, imports and banking and financial transactions works for both the units at Khamgaon as well as Raipur. Thus the three generations of entrepreneurs from Shri Jankilal Agarwal's family, as shown in the chart 1 given below, got engaged with his business that grew in scale of operation by leaps and bound.

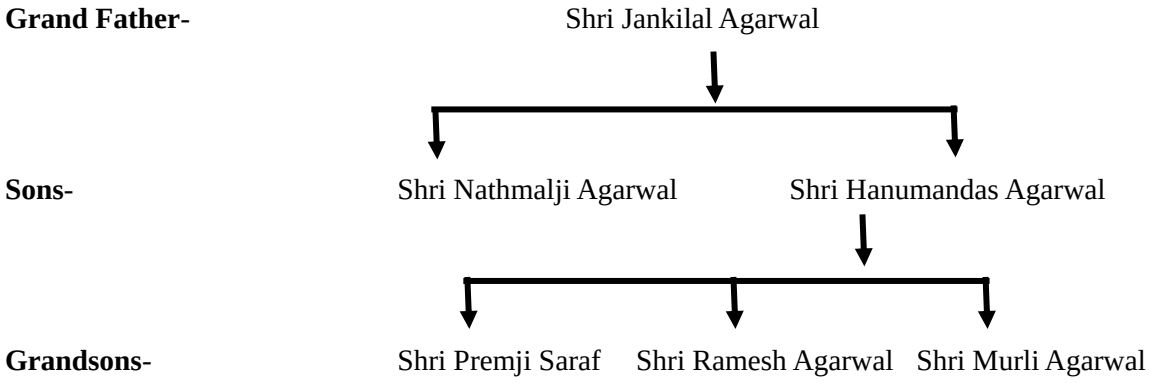

Chart 1. Showing Family Tree of Entrepreneurs

All the members of Shri Jankilal Agarwal's family had a clearly and categorically defined role in his business like any well structured organization.

4.1 The Genius in Shri Nathmalji Agarwal

Shri Nathmalji Agarwal was the elder son of Shri Jankilal Agarwal who was very highly educated and was a brilliant stuff by any standard. In 1940s, Nathmalji's education was B.Sc., M.Sc., L.L.B and then he went on to complete his B.E. in mechanical engineering from London. He was throughout – from B.Sc. onward – a gold medalist and he did his education from abroad through scholarships and not through family financing. After he came back from London he did not choose to accept employment of any organization which he could easily get then. He, instead, chose to join his father Shri Jankilal Agarwal in modernizing and developing his plant and business. He was a visionary man and people said that he always stood twenty years ahead of his time. He was a pure vegetarian and even though he travelled many countries about 50-60 years ago when vegetarian foods were rarely available on most of the foreign lands Nathmalji would live on milk and bread. He had spiritual bend of mind also and would always be companied by some spiritual guru with him. Towards the fag end of his life he settled at Puttuparthy, Bengaluru near by Satya Sai Baba who was live then and died at the age of 74 in the year 1992. But the innovations that he brought about are being implemented even today after about 25-30 years of his work. He would mostly look after the technological and other innovations in Hanuman Vitamin and at the same time would take care of its exports and imports from Bombay (now called as Mumbai). He was a voracious reader of literature where from he used to conceive innovations. He modernized cotton seed pressing unit, initiated production of high protein cotton seed oil cake through delinting, fiber and husks which were sold as cattle feeds, initiated production of cotton seed refined edible (first time in India) oil under Annapurna oil brand and popularized this edible oil in the region because the shelf life of materials fried in

cotton seed edible oil was more than any other oil. He was thus a truly enterprising man.

4.2 The Journey of the Firm

Hanuman Vitamin Foods Ltd. was incorporated as the flagship company of Hanuman group of industries on seven acres of land in the year 1966 as obvious from the Chart No. 1 given below about milestones in the journey. It was a culmination of the traditional *Kolhu Ki Ghani* unit of cotton seed oil. The older generation of entrepreneurs focused primarily on traditional methods of oil extraction and also from traditional raw materials i.e. seeds like cotton seeds, Kardi, sunflower, Neem seeds and soybean. The second generation of entrepreneurs under the particular leadership of Shri Nathmalji Agarwal shifted from conventional oil extraction method to non-conventional and modern oil extraction method called as solvent extraction of oil from non-conventional oil seeds like mango stone (9% oil content), Sal seed (14% oil content), Kokum seed from western Maharashtra (40% oil content with high melting character and hence a premium oil), Dhupa seed from Karnataka (20% oil content), Illepe nuts from Indonesia and Shea nuts from West African countries (40-50% oil content). Nathmalji Agarwal could know about these oil seeds through oil industries literature and his extensive tours to foreign countries. When he displayed his mango oil in one of the trade exhibitions in Germany it was so appreciated that the German media carried headlines stating "Gold lies in the streets of India".

The raw material base was also shifted from traditional farmer community to forest produce suppliers like lease contractors of forest produces. The plant was also modernized further from expeller plant to solvent plant where petroleum products used to be spread for extraction of oil from oil seeds and oil cakes. The processing was also modernized from press fractionation of oils to its solidification at lesser temperature and then hydraulically pressing to get products in liquid form called Oliene and solid form called Stearine. The finished products were also modernized from just being crude cotton seeds oil, to cotton seeds refined edible oil, to Staerine and Oliene, to Cocoa Butter Equivalence (CBE), to husk and fiber, to De Oiled Cake (DOC). The consumption end of the finished products were also diversified to local Vanaspati mills for sale of Oliene, to local market for use as cattle feed, to export markets like Italy, Japan, Switzerland and all European nations except United States for sale of CBE, to black soybean extraction (for the first time exported by any Indian firm then). Meanwhile a plant at Raipur was established in 1991 – 92 as subsidiary to Hanuman Vitamin Foods Ltd., Khamgaon on eight acres of land.

The supplies of raw materials used to be made through both rail as well as road transportation from all supply points including sea ports (for imported raw materials like Shea nuts from Western African countries and Illepe seeds from Indonesia). The rail supply accounted for 30-40% of raw materials and the roadways accounted for the remaining 60-70% of raw materials. Mango stones and Sal seeds used to be purchased from Orissa, Bihar, Chattisgarh and Nepal boarder area. Other seeds were purchased from suppliers, government tenders (particularly of forest produces), from trade centers at big cities. The daily consumption of raw materials was 60 to 200 tons of seeds and 100 to 250 tons of oil cakes. Hanuman Vitamin employed 60-70 office staff and 300-400 skilled and unskilled labors. Such was the magnitude of operation of Hanuman Vitamin Foods Ltd. that it achieved an annual sales turnover of Rs. 70 Crores to Rs 120 Crores during the period 1970 to 2000. The details of the journey of entrepreneurs under study have been shown in the table 1 given below.

Table 1. Showing Significant Milestones

Year	Milestones
1930	Setting up of Kolhu Ki Ghani Cotton Seed Oil Mill at Khamgaon
1935	Installation of Electric Expelling System for extracting Cotton Seed Oil
1960	Hanuman Oil Mill was set up along with Cotton Seed De-linting and Decortications Plant for producing high protein and low fiber cotton seed oil
1960	Export of Cotton Seed Oil Cake began
1964	Cotton Seed Oil Cake was sent to Bombay for converting it into Cotton Seed De Oiled Cake through job works by a plant there
1965	Hanuman Oil Mill was renamed as Hanuman Cotton Seeds Products Pvt. Ltd.
1966	Hanuman Vitamin Foods Ltd. to make protein out of Soybean De Oiled Cake and so named Vitamin Foods

1969	Solvent Plant was erected at Khamgaon
1971 – 72	Refined Cotton Seed Oil under brand name Annapurna Oil started being sold as first ever edible cotton seed oil. Before this crude cotton seed oil used to be sold by this company
1980	Micelle Refining Plant based on indigenous and self-developed technology was set up to produce mango oil with less loss compared to conventional refining
1980 – 81	Press Fractionation Machine was installed
1989 – 90	Press Fractionation Machine started operating
1991 – 92	Plant at Raipur, Chattisgarh was set up, in the name and style of Hanuman Minor Oils Ltd., as a subsidiary unit of Hanuman Vitamin Fooda Ltd. and as part of expansion program and in vicinity of raw materials supply points (Forest produces)
1997	Hexane Fractionation Plant was set up in Khamgaon which was again an indigenously self-developed technology
1997 on wards	Deodorizing System for tackling pesticides issue started
2002 – 03	Started heading towards closure

Important events which shaped the journey of the enterprise:

While Nathmalji Agarwal was on its way of incessant business innovations with indigenous touch a number of internal challenges and external threats erupted simultaneously into his business. Some of these events have been captured in table 2 showing chronology of important events.

Table 2. Showing Chronology of important events

Years	Important Events
1973 – 74	Gosypol – a substance harmful for cattle and banned in Europe was found in the cotton seed oil cake of Hanuman Vitamin hence its export to Europe stopped and because European nations except US were the major buyers the business suffered a great set back
1975 – 76	Alternative raw material was searched and mango stone was found to be producing mango oil cake with high protein and low fiber
1976	Mango oil was kept in an exhibition in Germany. It was so much appreciated that the German media carried headlines, "Gold lies in the Streets of India."
1980	Nestle India Ltd. Carried out a survey of Hanuman Vitamin for 2-3 months for a possible collaboration which did not strike
1990	Ferrero Rocher – an Italian company attempted to collaborate with Hanuman Vitamin but the same did not materialize because of logistical limitations at Khamgaon
1997 – 98	Excessive pesticides found in the products resulting into return of a consignment of 600 tons of products from Italy. The buyers became sensitive to pesticides content in the products and rigorously checked for it. Unfortunately the products of the company did not conform to their standards of below 50 ppb pesticides and it had to go for additional cost incurring process for removal of excessive pesticides through deodorizing.
1998 – 99	Bergad plant in Orissa was taken on lease which did not work properly
1999 – 2000	Import of 2000 tons of Shea nuts from Western Africa without having installed supporting technology. The oil remained in containers of transporters for a month and half and got rotten such that it was later sold at value of soap than that of Cocoa Butter Equivalence incurring huge loss.
2000 – 01	Some investors were approached for infusing money into Hanuman Vitamin to bail it out from bank's debt trap but that too did not work out.
2002 – 03	The Company applied to the then Board of Industrial and Financial

	Reconstruction (BIFR) – now National Company Law Tribunal (NCLT) – for being declared as sick unit and for obtaining government assistance under insolvency and bankruptcy code for its revival.
2007 – 08	Production completely stopped and Banks took over the possession of the company through Asset Management Company
2012 – 13	Equipment and machineries of Hanuman Vitamin Foods Ltd. sold by the Asset Management Company as part of Bank's debt recovery plan

Loopholes in the management of Hanuman Vitamin:

Recalling back his perceptions about the possible reasons for the collapse of Hanuman Vitamin Foods Ltd., Premji Saraft, its Director, says that there were obvious lapses in the management of this company which were never noticed then. He presents these loopholes as follows:

i) **Technology introduction without adequate home work:** Technology like press fractionation was introduced into the business in the year 1980-81 but it remained idle for about 8-9 years before it became operational in the year 1988-89. This escalated cost of operation of the company besides making investment into development of this technology idle and non-productive for years together.

ii) **Selection of wrong technology**: The technology used was most of the times indigenously innovated and not established imported technology. For example Hexane fractionation plant was developed indigenously which did not work well causing cost escalation of the firm.

iii) **Problem of excessive pesticides in oil produced from tree borne oil seeds (TBO):** Detection of pesticides in raw materials in quantity more than the acceptable limit of 50 ppb became another issue of concern. Deodorizing process was followed to bring down the level of pesticides to acceptable limit which became another cost center for the firm. Indigenously developing this deodorizing process also required a lot of money put into it.

iv) **Logistical limitations of Khamgaon:** Khamgaon is a place located neither near Bombay sea port for export – import access nor near any of the raw materials supplying States like Bihar, U.P., Chattisgarh, Orissa, Nepal boarders etc. This created a logistical limitation. It was for this reason that a plant in Raipur was set up which is in the State of Chattisgarh itself and nearer to Chattisgarh forests where from forest produces raw materials were supplied.

v) **Seeds procured during rainy season from rain and flood affected States were of poor quality:** It was also noticed that the raw seeds used to be spoiled due to excessive rains and flood situation in the states where from these seeds used to be procured.

vi) **Too many innovations with very high indigenous quotient and at a very fast pace with no pilot testing:** Mr. Nathmalji was a genius as already stated before. He was bubbling with innovations. Every now and then he would come out with an innovation primarily developed indigenously. He would be equally faster in implementing his innovation without any pilot trials. Eventually many innovations failed and all of these had incurred huge costs.

vii) **Ambitious over-trading:** The firm went in for over trading due to its high ambitions causing disruption in the market.

viii) **Lack of professional management:** Hanuman Vitamin Foods Ltd. was run through its own family members who had no exposure to professional skills of management. This by far became another reason of its collapse.

ix) **Debts trap of banks:** The losses of the company went on rising as a result of which it infused more fund in the business by taking additional loans in anticipation of arresting losses. Eventually losses were not arrested and debts mounted excessively resulting into fall of company in the banks debt trap. The firm thus became insolvent and bankrupt and had to seek government intervention to be declared as sick unit under BIFR.

5. Conclusions

The Hanuman Vitamin Foods Ltd. is a case of multiple and diversified products that ran in trouble in about 50 years

of time. From being just a conventional method based small venture this company grew into a technology intensive highly innovative multinational company. Business innovations are tool of progressive organizations. But this statement appears not to be appropriating with the case of present organization. Rather too many innovations with very high indigenous quotient and at a very fast pace probably landed this organization in trouble. Though this case highlights some of the perceived lapses in the management of Hanuman Vitamin Foods Ltd. it requires a thorough case analysis to go to the root cause of the collapse of this company and more importantly to forward possible mechanism to bail out Hanuman Vitamin. This about a century old entrepreneurial outfit needs a Vitamin dose.

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Notes

Kolhu Ki Ghani – A conventional method of extracting oil from seeds by putting them in a big wooden bowl called *"Kolhu"* in vernacular language and crushing it with heavy wooden block that is rotated in the bowl with the help of an ox.

CBE – Cocoa Butter Equivalence used as raw material in Chocolate production

DOC – De Oiled Cake

TBO – Tree Borne Seeds produced by forests

Deodorization – Minimizing pesticides contents from TBO

De-linting – A process to remove external shell – called lint - from cotton seeds by braking the seeds

Decortications – A process to get Coronel from de-linted cotton seeds

Expeller – A machine that squeezes oil from seeds by exerting physical pressure on it

ppb – Parts per billion

SEP – Solvent Extraction Plant

Hexane – A petroleum product spread on DOC to absorb remaining oil from it

Oliene – A liquid product used by Vanspati mills for producing vegetable oil

Stearine – A solid product exported for use in CBE which is subsequently used as raw material for manufacturing chocolates.

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