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on Recent Challenges in Engineering and Technology  
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## **Acknowledgement**

IFERP is hosting the **6<sup>th</sup> International Conference on Recent Challenges in Engineering and Technology** this year in month of November. The main objective of ICRCET is to grant the amazing opportunity to learn about groundbreaking developments in modern industry, talk through difficult workplace scenarios with peers who experience the same pain points, and experience enormous growth and development as a professional. There will be no shortage of continuous networking opportunities and informational sessions. The sessions serve as an excellent opportunity to soak up information from widely respected experts. Connecting with fellow professionals and sharing the success stories of your firm is an excellent way to build relations and become known as a thought leader.

I express my hearty gratitude to all my Colleagues, staffs, Professors, reviewers and members of organizing committee for their hearty and dedicated support to make this conference successful. I am also thankful to all our delegates for their pain staking effort to travel such a long distance to attain this conference.



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# ICRCET-18

## 6<sup>th</sup> International Conference on Recent Challenges in Engineering and Technology

Nagpur, Maharashtra, November 24<sup>th</sup> - 25<sup>th</sup>, 2018

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# Electrical Vehicle Drive in India: Challenges and Opportunities

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**Abstract:--** It's time to step-up on the gas, as Petrol & Diesel Prices are at all-time high. Devaluation of rupee is biggest concern, to counter this, now on the serious note India needs to reduce its import.

Oil and gas plays important role in importing and its backbone of transportation system, indirectly resulting in increase of price of food and vegetables & other items.

The year 2017 will be remembered as a significant one for defining India's mobility architecture. From big ticket announcement on marquee Ahmedabad – Mumbai high speed rail project to Hyperloop, India has seized its moment in the sun to announce big plans for finding next generation transportation solutions. One of them in Electric Vehicle. This EV industry is poised to take off. Although with a tiny percentage of overall vehicle market, it's started to reach an inflection point where it can have very significant impact.

The paper presents the Electric Vehicle solutions that needs to be adopted to reduce the carbon emission, use of clean energy solution. The advent of EV's will have helped curb a rise in share of oil and environment friendly gas would substitute oil in many uses. Its challenges and Opportunities

**Index Terms:** EV (Electrical Vehicle). Renewable Energy, GOI, FAME

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## OVERVIEW & BACKGROUND

Global warming is biggest concern all over the world. To address these concern various measures has been taken. Under Paris Agreement each member country must determine & regularly report on the contribution that it undertake to mitigate global warming. The negotiation of the agreement stated that 2<sup>o</sup>C reduction in temperature target by increasing use of renewable energy and energy efficiency initiative for sustainable development. Across the globe last couple of years a transport revolution has been in making. It is slow, challenging but immensely ambitious.

Electric mobility is raising its head. The challenge to fossil fuel is daunting one. In developed countries from taming fossil fuel based vehicle to discount for EV, the regulation noose is getting tighter as nations realised that the fastest way to de-carbonise the economy is to get internal combustion engines off the roads and replaced them with electric vehicle.

For the successful deployment of EV's technology development to rise efficiency of vehicle (for longer distance in single charge) & adequate charging infrastructure to meet the potential growth of EV's in next few years.

## INDIA STORY

India adopted the 17 sustainable development goals on september-15 and enter into Paris Agreement on November-15. The Government of India launched National Action Plan on climate change (NAPCC), comprising eight missions in specific areas and announced NEMMP-2020 for promotion of Electric Vehicle (EV's) as part of NAPCC.

The Indian automotive industry is today amongst the fastest growing automotive industries globally. It is expected that, by 2020 the annual demand for passenger vehicle, commercial vehicle and two-wheelers in India will be 10 Mn, 2.7Mn & 34 Mn units respectively, thereby making India 3rd largest vehicle market in the world with Automobile industries contributes approx. 21% of GDP.

The increase in vehicular population will lead to sharp rise in demand for fossil fuels and have an undesirable impact on the environment. As per International Energy Agency (IEA) estimates , globally the transportation sector accounts for 30% of worldwide energy consumption and is the 2nd largest source of CO<sub>2</sub> emission. India's per capita emission of 1.72 t CO<sub>2</sub> equivalent in 2016 was 38% of world avg. (4.49t)

This coupled with hardening of the crude prices is leading to increase in the trade deficit. This poses a serious challenge to India's energy (fuel) security.

#### **Reasons for the shift to Clean Mobility**

- Air Quality Indices related to India, indicate that the air in many cities of India is no longer healthy. Automobile related pollution has been one of the causes for this.
- Aspects related to global warming needs a shift to automobile solutions that reduces/ do not produce greenhouse gas emissions.
- The need to reduce dependency on a fossil-fuel based economy. India's crude oil imports approximately 7, 00,000 crore rupees, further de-valuation of rupee also having big impact on it.
- India can become a global provider for clean mobility solutions and processes that are affordable and scalable.
- People living in some of the Indian cities are being affected by noise pollution. Some of the Indian cities have the worst noise pollution levels in the world. Electric vehicles may contribute to a reduction in noise pollution levels in the cities.
- Although Energy efficiency and emission reduction has improved in automobiles, the growth in total number of vehicles on road and the resulting total pollution and total energy consumption removed all gains made by betterment in energy efficiency and emission reduction by automobiles. Energy efficiency measures and pollution control measures did not keep pace with the sales growth in vehicles.

#### **India offers a massive potential for EV Business**

The Government has been nurturing the EV market in a comprehensive manner, evolving policies to help nurture the nascent industry. Besides giving tax rebate for vehicles, research is rewarded with concessions. On the market side, recently, EESL went in for bulk procurement of electric cars to stimulate the EV market. These vehicles are to be used by government institutions.

India's commitment to its climate goals is reflected by the notable actions being taken for transition to low carbon economy. After announcing massive renewable energy targets, the country has set yet another ambitious target to move to 100 % electric "To achieve this ambitious target, the government is formulating schemes, which will allow citizens to purchase EVs on zero down payment, allowing them to pay out of their savings on expensive fossil fuels." Though this feat may seem achievable on paper, it would be interesting to see how this mission is executed. Some significant strides have been taken towards this aspiration in the past through the launch of NEMMP (National

Electric Mobility Mission Plan, 2013) and FAME (Faster Adoption and Manufacturing of Hybrid & Electric Vehicles, 2015). Under NEMMP, 6-7 million EVs/hybrid vehicles have been envisioned to be deployed on Indian roads by the year 2020. (The earlier numbers are not talking to Each other)

#### **Electric Vehicles policy Structure & Frame Work**

Introduction to National Electric Mobility Mission Plan (NEMMP)

Under this mission, the government would use the following mechanisms / policies to increase the usage of electric vehicle

- Permissive Legislations: Legislation to allow usage of electric vehicle in various areas, if not already allowed.
- Operational Regulations: use of legislation framework and regulation aimed at setting safety regulations, emission regulations, vehicle performance standards, charging infrastructure structure.
- Fiscal policy measures: Trade related policies for shaping the market, imports & exports.
- Manufacturing policies aimed at encouraging investments
- Specific policies aimed at incentivizing manufacturing and early adoption of electric vehicles through demand creation initiatives.
- Schemes and pilot projects for facilitating infrastructure creation.
- Policy for facilitating research and development.

#### **Faster Adoption and Manufacturing of Hybrid and Electric vehicles was launched in April 2015 to fast track the goals of NEMMP 2020 plan (FAME)**

- In order to promote the sale of electric vehicles in the Indian market , the government launched FAME scheme (Faster Adoption and Manufacturing of Hybrid and Electric vehicles) in India ,as part of the National Electric Mobility Mission Plan 2020, under which, the government would provide certain incentives to lower the purchasing cost of electric vehicles .
- The Scheme has 4 focus areas i.e. Technology Development, Demand Creation, Pilot Projects and Charging Infrastructure.
- Under the JNNURM (Jawaharlal Nehru National Urban Renewal Mission), NEMMP (National Electric Mobility Mission Plan) and the smart city plans launched by the government, various state and local transport bodies are expected to purchase electric buses over next 5 years.

Energy efficiency Services (ESSL) - With objective of facilitating faster adoption of electric mobility, ESSL has initiated a programme which envisage the replacement of existing government vehicles with electric vehicles. The ESSL aims to create a market for EV through a model of demand aggregation and bulk procurement.

Further ESSL will setup charging infrastructure in the offices where these cars will be provided. These charging stations will be connected to meters of respective government departments, which means the department have to pay through the bills.

#### Automotive Research Association of India (ARAI)

ARAI has been playing the crucial role in assuring safe, less pollutant and more efficient vehicles and also provide technical expertise in research and development. The government of India has recently notified the protocol adoption of standard & ARAI had publish these standard in 2016

#### Opportunities in the Indian Market

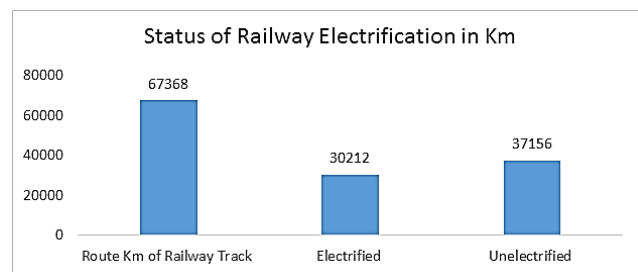
Public Transport (Railways, Bus and Fleet Cars) and 2/3W seems to be first movers towards EV India.

In India, the focus will be on getting Public transport Fleet on to electrification journey before focusing on private vehicles. Priority is expected to be given in order of electrification of railways, electric buses, 3 Wheelers, Fleet cars, 2 Wheelers and then private cars.

To push these philosophy into actions, the central government has started some key initiatives such as

#### Electrification of Railways

Indian Railways is one of the largest rail networks in the world with ~70000 km of tracks and 22,550 trains that carry 22.24 million passengers and 3.04 million tonnes of freight every day.



Indian trains primarily run on electricity or diesel. Currently, around two-third of freight and more than half of passenger traffic in Indian Railways are ferried by electric traction (engines). However, electric traction accounts for just 37% of the total energy expenses of Indian Railways. If railway tracks electrified at the earliest, then this will reduce dependence on imported fossil fuel and reduce costs for the Railways.

Government wants to improve efficiency and by saving cost make Indian Railways profitable. This without burdening the passengers,” also reduce pollution.

#### Other Transportation initiatives

□ DHI has come out with schemes to assist populated cities to buy electric buses with subsidiary support for charging infrastructure.

□ ESSL- With objective of facilitating faster adoption of electric mobility, ESSL has initiated a programme which envisage the replacement of existing government vehicles with electric vehicles. The company aims to create a market for EV through a model of demand aggregation and bulk procurement.

□ In order to promote the sale of electric vehicles in the Indian market, the government launched FAME scheme (Faster Adoption and Manufacturing of Hybrid and Electric vehicles) in India, as part of the National Electric Mobility Mission Plan 2020, under which, the government would provide certain incentives to lower the purchasing cost of electric vehicles.

□ The Scheme has 4 focus areas i.e. Technology Development, Demand Creation, Pilot Projects and Charging Infrastructure.

□ Under the JNNURM (Jawaharlal Nehru National Urban Renewal Mission), NEMMP (National Electric Mobility Mission Plan) and the smart city plans launched by the government, various state and local transport bodies are expected to purchase electric buses over next 5 years.

□ World’s 3rd largest automobile market is now starting its EV journey – India could learn from the world’s largest EV market

□ Lead India’s EV journey in many dimensions- from helping in EV regulations & standards to being a technology provider for smart mobility program.

□ EV business throws up multiple new business / technology challenges such as EV charging, smart charging, batteries, cloud based mobility etc which could be key areas where technology can be introduced.

□ Business related to Charging spaces – EV chargers / smart charger (equipment/ technology) Charging infrastructure services, smart charging networks, cloud based solutions for charging.

#### Key Challenges in the Indian Market

□ Policies are still in the making and due to multiple stakeholders, it may take a while before a clear horizon for EV emerges.

□ Existing strong domestic auto industry & ecosystem could pose a challenges in terms of entry barriers. Local partnership will be vital for companies to enter the Indian market

□ Indian EV market will face initial hiccups and will require some time to be stabilized, companies need a longer view to succeed in India.

- “Value for money” association is vital to succeed in India- same applies for EV business as well.
- Charging infrastructure is at the heart of E-mobility and needs to be developed across the country in the same way as petrol & diesel or Gas stations.
- Unless there is adequate density of charging stations that are accessible by all, people will be not encouraged to adopt E-vehicles. At the same time, if there are insufficient E-vehicle, there would not be much incentive to set-up the charging station.

### CONCLUSION

Within the next decade, set of four transformative low carbon technologies – LED’s, Solar Energy, Wind Energy, & EV’s will be reconfigure dynamics in several industries with parallel to other tech-driven developments. While India is making significant progress in first three, but there is hardly progress with regards to EV’s.

EV’s have long way to go before reaching deployment scales capable of making a significant dent in the growth of global oil demand and CO<sub>2</sub> emission. The economic environment, health & security related benefits of replacing diesel / petrol driven vehicle with EV’s in India, along with listing of key areas where substantial changes are required in some of our statues, polices standard and practices

The Government of India is working on solutions to overcome regulatory gaps in order to promote E-mobility. While under FAME, the government has been setting aside money to subsidise EV purchases on an annual basis, all concerned infrastructure developers and policy makers will have to plan for the installation of sufficient public EV charging infrastructure to facilitate hassle free commuting. Workplace, public transport parking lots, multiplexes and residential townships – low hanging fruits Large private work places and cooperative housing societies (large private establishments), which are regularly maintained, could be targeted first for installing charging stations. Simultaneously, public transport parking yards could be retrofitted with charging stations.

In a scenario with 100% EV sales by 2030, India’s cumulative battery requirements between 2026 and 2030 will exceed 2410 GWh from existing level of 1100 Gwh. Production volume is a key factor in determining the cost of battery packs. Therefore, Government of India (GoI) must take immediate steps to promote the creation of facilities to design and build solar cells/modules and storage systems in quantities commensurate with NEMMP 2020. Manufacturing EV batteries in India will enable Indian automakers to produce EVs at attractive prices and will potentially enable the country to become an export hub for batteries. Domestic manufacturing of batteries at

this scale presents an enormous economic opportunity for India. Therefore, Government of India ( GoI) should make an effort to implement all enablers required to facilitate the domestic industry to put up advanced battery manufacturing capacities in the country.

Government of India must secure key raw materials for batteries (especially lithium, nickel and cobalt) in India and/or abroad with the same zeal dedicated to acquiring oil and gas fields earlier. Government of India( GoI) must also facilitate research in the recycling and reuse of used Li-ion batteries to reduce the need for such imported minerals with limited global supplies today.

Government of India must step in infrastructure development including upgradation of local electricity grid to feed power efficiently to fast charging stations, fiscal incentives and R&D efforts to achieve the goals of NEMMP-2020.

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# Fuzzy Logic Control Method for D-STATCOM to Mitigate Voltage Sags and Swells

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**Abstract:**-- This paper presents a robust control scheme to vary the gate pulse pattern of the switching devices of D-STATCOM, a custom power device used to maintain the voltage profile of a distribution system dynamically. The work is carried out on IEEE 13 bus industrial distribution system with a shunt compensating device. The system receives 69KV from the grid and distribution feeder is rated for 13.8KV. D-STATCOM is realized using eight 6 pulse insulated Gate Bipolar Transistor (IGBT) voltage source inverters(VSI) for reactive power compensation and voltage stabilization for the cases of voltage sag and swell. The control strategy used in this work is fuzzy logic controller (FLC). FLC overcomes the drawbacks of conventional controllers like Proportional integral (PI) and proportional integral derivative (PID) controllers and provides a dynamic control action to vary the gate signals given to the power electronic switches which provides voltage support to the load bus thus mitigating power quality issues such as voltage sag or swell caused due to varying load patterns. FLC do not require precise mathematical modeling of the system as in the case of PI and PID controllers. A test distribution network, subjected to sensitive load variation is simulated with and without compensation. The response obtained clearly demonstrates the effectiveness and robustness in voltage stability and power quality issues. The simulation work is carried out in MATLAB/Simulink environment.

**Index Terms:** D-STATCOM, Power Quality, Fuzzy Logic

## I. INTRODUCTION

Power quality(PQ) issues such as voltage sag and swell contributes more than 80% that exist in power systems. Sensitive equipments such as Variable speed drives (VSD) used in modern industrial plants are sensitive to voltage sag[1]. Conventional methods such as usage of capacitor banks, introduction of new parallel feeders to mitigate voltage sag could not solve the issue satisfactorily due to uncontrolled reactive power compensation and high cost incurred to install parallel feeders. Flexible AC transmission systems (FACTS) provide proven technical solution to these operating challenges. One such device which is located in shunt with distribution network is static synchronous compensator D-STATCOM [1].For realization of shunt compensating device cost effective high power VSI are necessary. Multi level inverters with higher operating range are built due to effective operation at lower switching frequencies, generating very low harmonic component symmetrical output voltages than conventional two pulse inverters[2].

This paper deals with cascaded multilevel converter model. There are three topologies of multilevel inverters: cascaded, flying capacitor and diode clamped. The benefits of multilevel inverter configurations are they draw input current with low distortion, do not require harmonic filters [3]. In this work diode clamped, 48 pulse voltage source

inverter is designed. Multilevel configurations can be realized using four, 12-pulse inverters with four phase shifting transformers [4]. For effective harmonic neutralization, 48 pulse converters is built using eight 6 pulse inverters with eight phase shifting transformers. Voltage generated by each six pulse circuits are applied to secondary windings of eight zig-zag phase shifting transformers.

In this paper, using fuzzy logic controller (FLC) a closed loop control scheme is designed for dynamic operation of D-STATCOM. Unlike PI and PID controllers FLC do not require any mathematical modeling and any effects of any uncertainties, disturbances and unmodelled dynamics of the system can be compensated [2].

## II. D-STATCOM

D-STATCOM is static counterpart of synchronous condenser and in principle performs the same regulation function of static voltage controllers (SVC), but in a robust manner. Major attributes of STATCOM are quick response time, higher flexibility in operation under various conditions. It regulates bus voltage magnitude by absorbing or generating reactive power to grid dynamically[3]. Fig. 1 shows VSI converts an input DC voltage to an AC at fundamental frequency. These voltages are in phase and coupled with grid electromagnetically through coupling transformer.

Typical six pulse inverter is shown in Fig. 2. A 24 pulse inverter can be obtained by connecting four such inverters in series. For high power applications, low distortion 48 pulse inverters are preferred, which is realized using eight six pulse inverters.

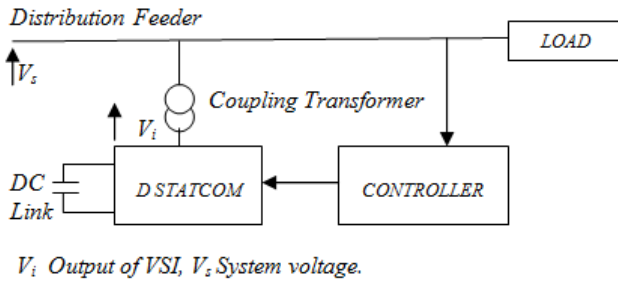


Fig.1 D-STATCOM representation

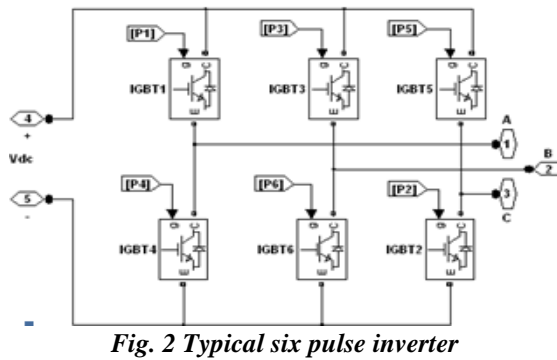


Fig. 2 Typical six pulse inverter

In this paper 48-pulse operation is realized with eight six pulse groups, with one set of transformers of one 24-pulse converter phase shifted from other by 7.5 degrees, or one set shifted by +3.75 degrees and the other by -3.75 degrees. With 48-pulse operation, ac filters should not be necessary [4]. Fig. 3 shows the output of 48 pulse IGBT based voltage source inverter built using eight 6 pulse inverters.

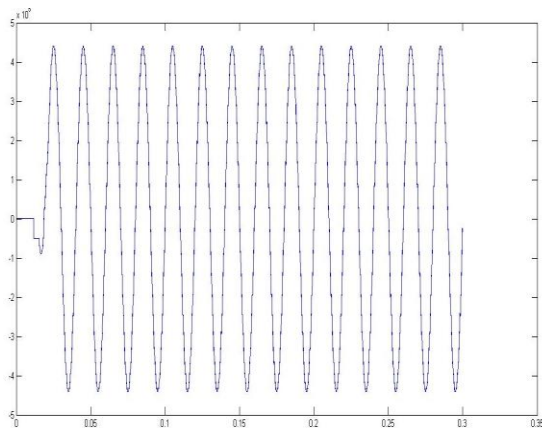


Fig. 3 Output of 48 pulse IGBT based VSI.

### III. CONTROL SCHEME FOR D-STATCOM

To maintain the voltage profile of a node in a power system dynamically, gate pulse pattern of switching devices in D-STATCOM has to be varied. The line voltage are sensed at a particular node and using park's transformation d-q components are obtained. Park's transformation computes the direct axis, quadratic axis, and zero sequence quantities in a two-axis rotating reference frame for a three-phase sinusoidal signal. The following transformation is used

$$V_d = \frac{2}{3} (V_a \sin(\omega t) + V_b \sin(\omega t - 2\pi/3) + V_c \sin(\omega t + 2\pi/3)) \quad (1)$$

$$V_q = \frac{2}{3} (V_a \cos(\omega t) + V_b \cos(\omega t - 2\pi/3) + V_c \cos(\omega t + 2\pi/3)) \quad (2)$$

$$V_0 = \frac{1}{3} (V_a + V_b + V_c) \quad (3)$$

Reference voltage  $V_{ref}$  is compared with actual voltage component  $\sqrt{V_d^2 + V_q^2}$  to get the error signal. Error signal is given as input to FLC. Fig. 4 represents the control scheme.

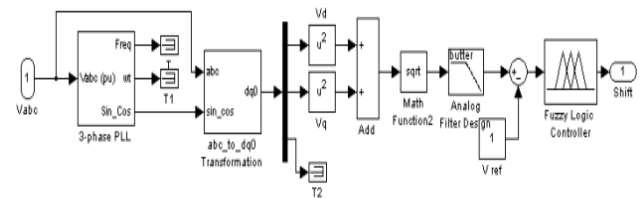
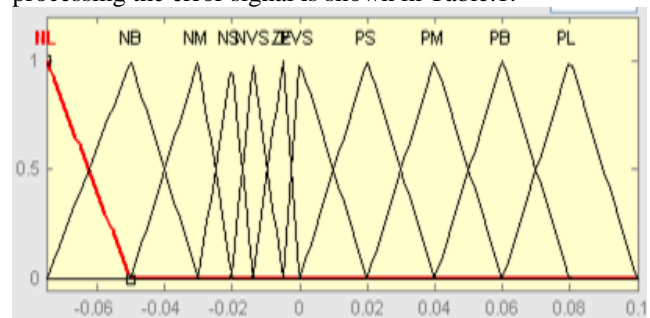


Fig. 4 D-STATCOM closed loop control scheme

Fuzzy logic controller is a non linear controller and its insensitivity to system topology makes it appropriate for power system application[5]. Fig. 5 shows degree of membership function used for fuzzification and defuzzification. Error in RMS value of voltage measured with respect to reference is taken as input variable and gating pattern to switching devices of D-STATCOM is taken as output variable of FLC. Set of fuzzy rules for processing the error signal is shown in Table.1.





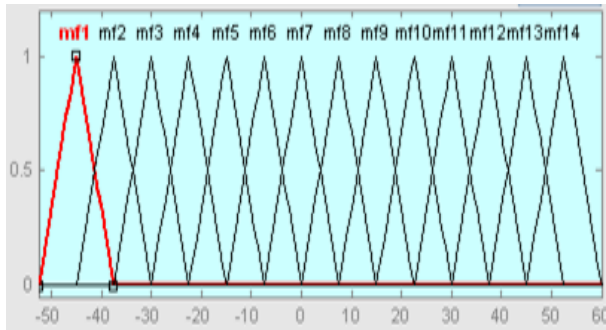


Fig. 5 Membership function of error and output of FLC's

TABLE. 1 FUZZY RULES

Error (Input)	Gate Pulse Variation (Output)
NB - Negative Big	-52.5 <sup>0</sup> to -37.5 <sup>0</sup>
NM- Negative Medium	-45 <sup>0</sup> to -30 <sup>0</sup>
NS - Negative Small	-37.5 <sup>0</sup> to -22.5 <sup>0</sup>
NVS-Negative Very Small	-30 <sup>0</sup> to -15 <sup>0</sup>
ZE - Zero	-22.5 <sup>0</sup> to -7.5 <sup>0</sup>
PVS-Positive Very Small	- 15 <sup>0</sup> to 0 <sup>0</sup>
PS- Positive Small	0 <sup>0</sup> to 15 <sup>0</sup>
PM- Positive Medium	7.5 <sup>0</sup> to 22.5 <sup>0</sup>
PB - Positive Big	37.5 <sup>0</sup> to 52.5 <sup>0</sup>
PL - Positive Large	45 <sup>0</sup> to 60 <sup>0</sup>

Gate pulse pattern to trigger the switching devices are set based on the fuzzy rules framed.

IV. RESULTS AND DISCUSSION

To verify the proposed method in order to mitigate voltage sag and swell, the IEEE 13 bus distribution system is employed. It consists of 13 buses representing medium sized industrial plant [6]. The plant is fed from a utility supply at 69kV and the distribution system of the plant operates at 13.8KV. The system is shown in Fig. 6. A 48 pulse VSI based D-STATCOM is connected in shunt with the system by closing breaker at 0.1s, for maintaining load RMS voltage at 1 p.u. The system is simulated for the cases of voltage sag and swell caused by dynamic loading at bus 12 in the system.

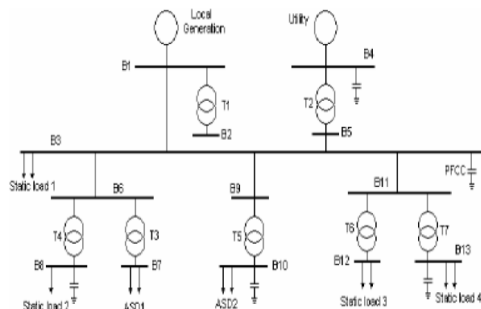


Fig. 6 IEEE 13 bus test system

A. Simulation results for voltage sag

The RMS and line voltages  $V_{abc}$  at bus 12 and error signal provided as input to FLC are respectively shown in Figs. 7,8 and 9. The case when system operates without D-STATCOM and under addition of load. Voltage drops by almost 20% with respect to reference value. At  $t=0.1s$ , the D-STATCOM is connected to the distribution system. Voltage sag at bus 12 is corrected using proposed control scheme. Figs. 10 and 11 show the mitigated RMS and line voltages using control method which provides voltage regulation. Between time periods 0.1s and 0.2 s, D-STATCOM injects the required reactive power to the system, maintaining the voltage profile. The error in voltage reduced by reactive power compensation is shown in Fig. 12.

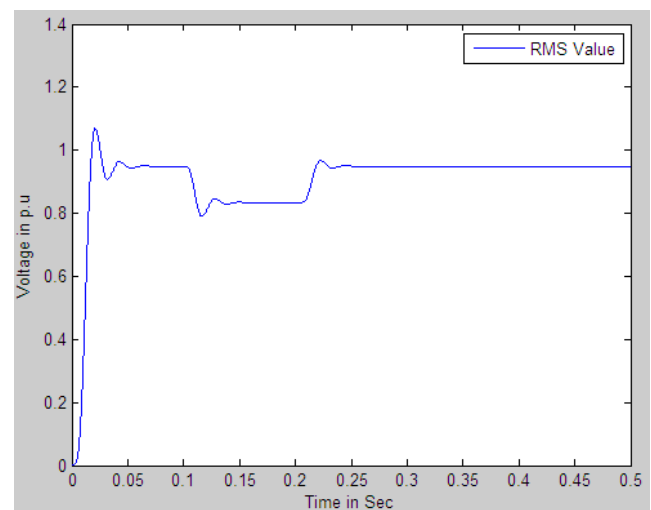


Fig. 7 RMS value of voltage at bus 12 with sag.

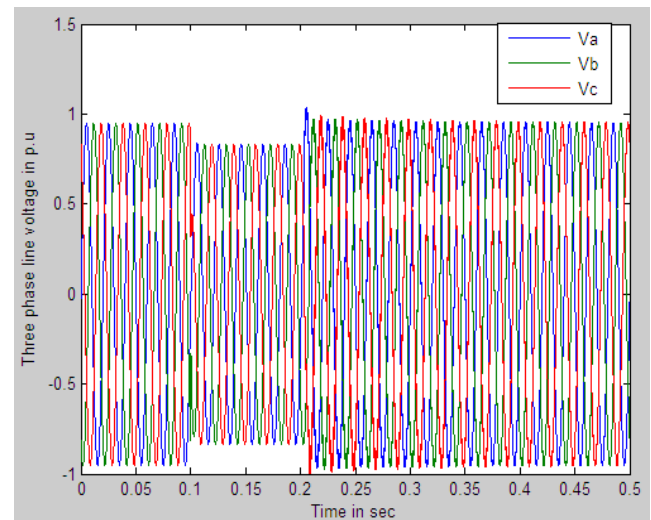
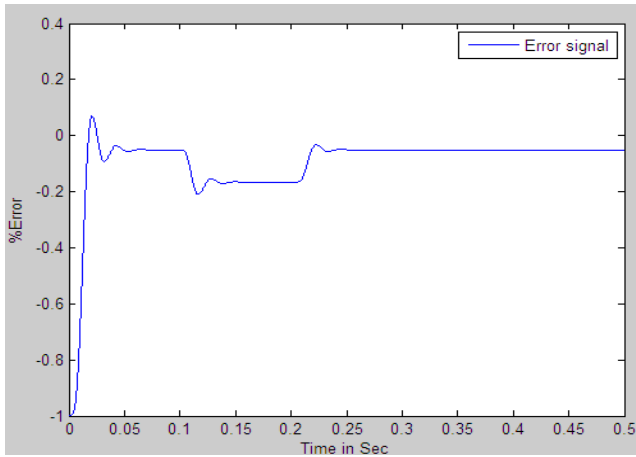
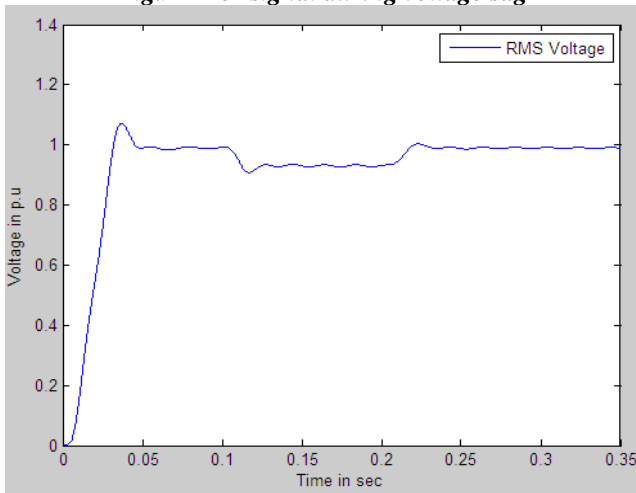


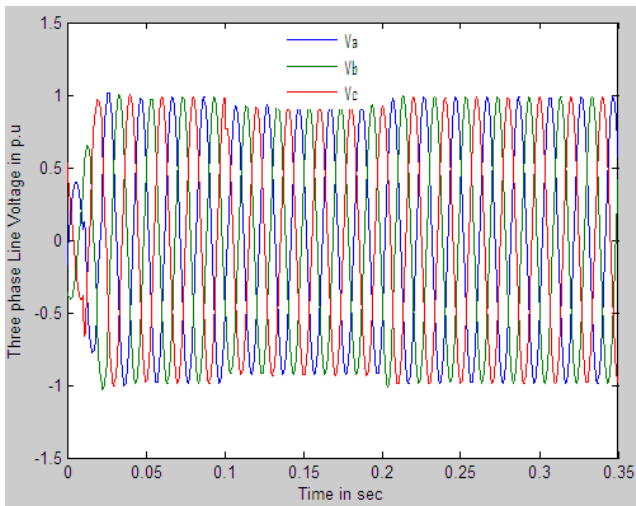
Fig. 8 Three phase line voltage at bus 12 with voltage sag



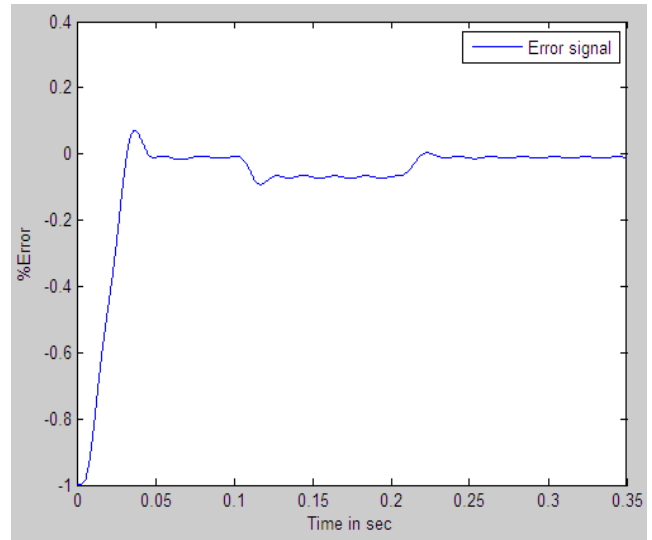
**Fig.9 Error signal during voltage sag**



**Fig. 10 RMS value of voltage at bus 12 with sag compensated.**



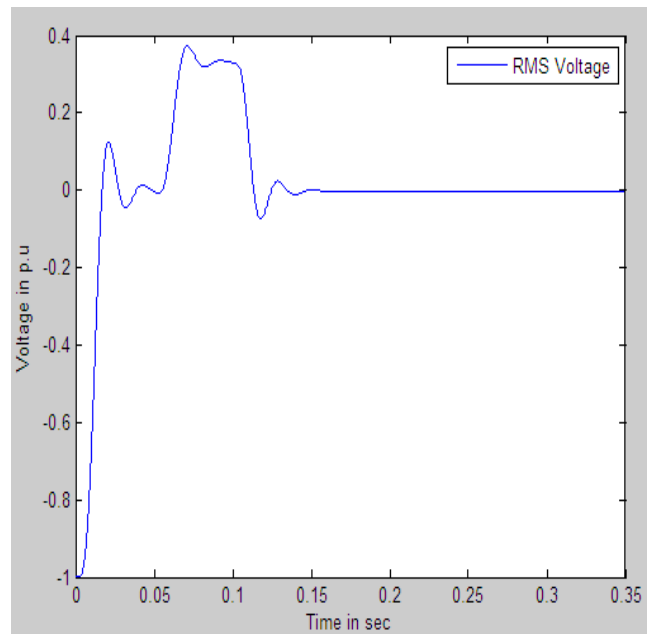
**Fig. 11 Three phase line voltage at bus 12 with sag compensated.**



**Fig. 12 Error signal after compensation**

**B. Simulation results for voltage swell**

Figs.13 and 14 represents RMS and line voltages Vabc at bus 12 when the system operates without compensation by the FACTS device with load reduction. Voltage profile increases by 30% with respect to reference value. D-STATCOM with its closed loop control mechanism maintains the voltage at 1 p.u. Figs. 15 and 16 show the corrected RMS voltage and line voltages by FLC applied to STATCOM between 0.1s and 0.2s. Figs. 17 and 18 indicates the error signals before and after compensation.



**Fig. 13 RMS value of voltage at bus 12 with swell.**

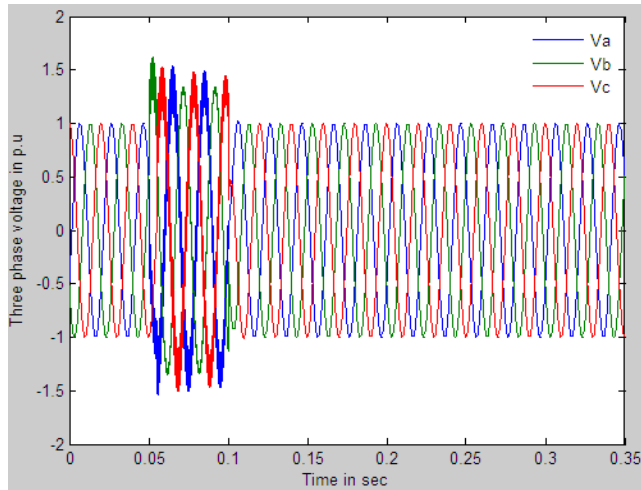


Fig. 14. Three phase line voltage at bus 12 with swell.

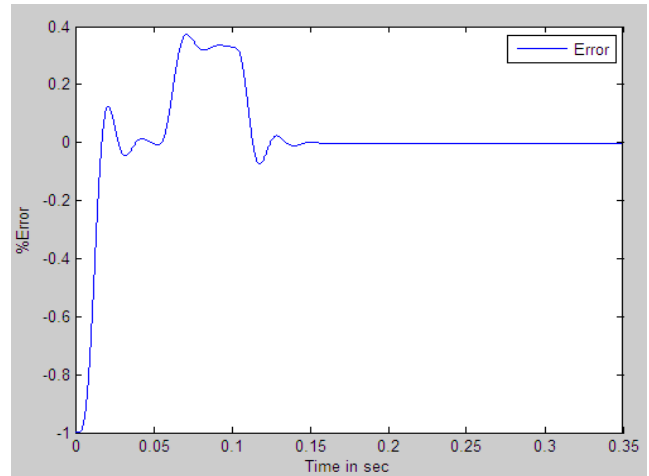


Fig 17. Error signal during voltage swell.

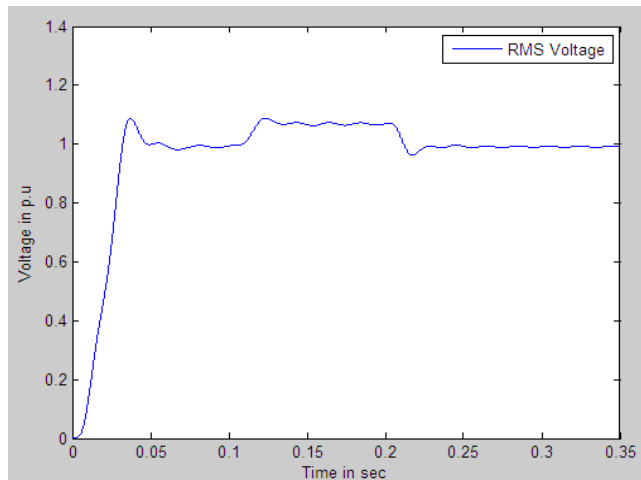


Fig 15. RMS value of voltage at bus 12 with swell compensated.

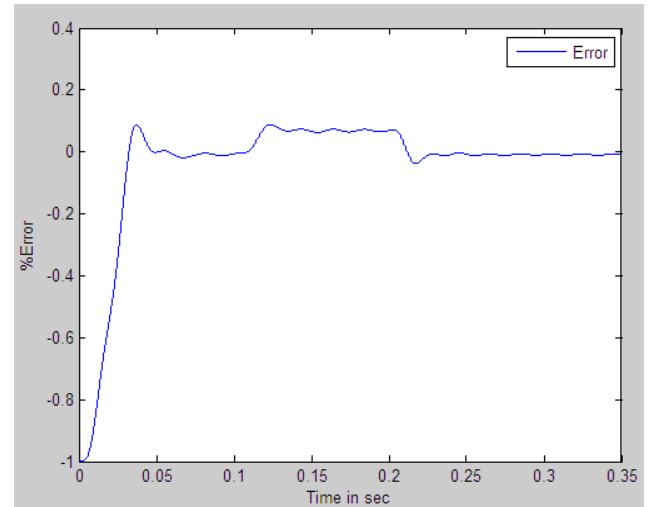


Fig 18. Error signal after voltage swell compensation.

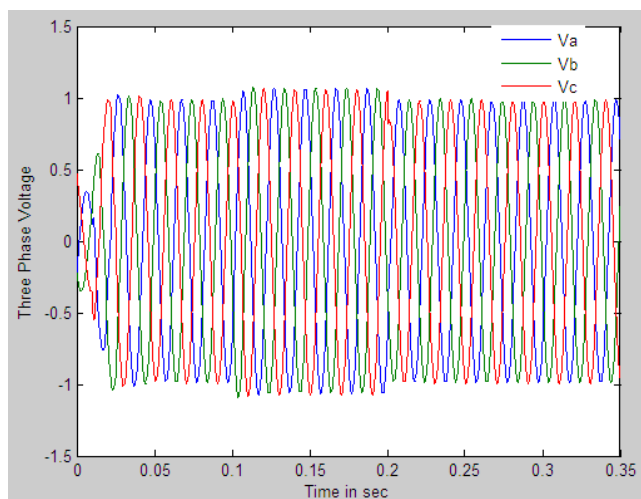


Fig 16. Three phase line voltage at bus 12 with swell compensated

## V. CONCLUSION

A 48 pulse multilevel cascaded voltage source inverter was designed to operate as D-STATCOM to address the power quality issues such as voltage sag and swell dynamically. The compensating device is connected in shunt with the IEEE 13 bus industrial distribution system. A closed loop control scheme using FLC is designed to vary the gating pattern of the switching devices with change in magnitude of the voltage at bus 12 as input to the control system. The distribution system is extensively tested for dynamic load variations and the performance of the control scheme is validated with the results obtained for voltage sag and swell at a given bus.

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# Heart Disease Prognosis and identification using different machine learning techniques

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**Abstract:**-- Heart diseases strike down a substantial ratio of the population and lead to prolonged suffering and disability in a greater quantity. Although heart disease reached plague proportions, yet it is preventable through an early examination of risk factors. Due to the increased cost and significant mortality figures by heart diseases, we seek to develop an accurate heart disease risk assessment model using machine learning techniques. The designed model would predict the patients at its earliest based on the decisive heart disease risk factors. We use the benchmark Cleveland heart disease dataset to conduct numerous experiments using specific performance evaluation metrics. We perform algorithmic measures like accuracy, precision, recall, and AUC for each method to compute the optimal estimates. Exploratory outcomes demonstrate that random forest algorithm perform better than support vector machine and gradient boosting tree techniques with the highest accuracy values of 0.874588, precision of 0.889570, recall of 0.878787 and AUC value of 0.9706. For significance of heart disease risk factors we use boosted tree algorithm and from the results we come to know reversible defect Thalassemia, asymptomatic chest pain, ST depression from exercise, maximum heart rate, age, resting blood pressure, and serum cholestrol are the most important heart disease risk attributes for initial prognosis and diagnosis. The results carried out in this study are, to the finest of our observation, higher than published values in the literature. Simulation results got from these machine learning techniques prove that the model produces higher accuracy and prove its usefulness in the initial prognosis and examination of heart disease.

**Index Terms:** Cardiovascular Disease (CVD); Heart Disease; HealthCare Industry; Machine Learning Algorithms; Classification Techniques

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## I. INTRODUCTION

Heart disease is a growing socio-economic and public health problem. Heart conditions involve both genders almost in same magnitude with significant mortality figures and disabilities [15]. As per statistical records, heart disease remains the foremost global cause of fatality with 17.3(31%) million deaths [16]. Heart disease risk factors increase the possibility of many other disorders. Medical reports recommend that unless there is a reversal of behavioral risk factors, these diseases will continue to increase which would drag the world to human and economic destruction. Cigarette smoking, stagnation, unhealthy diets and the harmful usage of liquor are the distributed causative risk components of heart disease [17]. Unhealthy behaviors lead to metabolic/physiological changes like hypertension, obesity, diabetes and dyslipidaemia. Each risk attribute shares a significant fraction to world's overall mortality rate. Heart disease risk attributes like raised blood pressure knocked down 13% of all the global deaths, cigarette smoking contributes to 9% of deaths, stagnation contributes to 6% and overweight shares to 5% of all the global deaths.

Although heart disease reached outbreak proportions, yet it is preventable through the behavioral risk factor reduction. To predict and diagnose heart disease at its earliest, we

apply machine learning techniques on raw healthcare data to extract insights from it. The purpose of research in healthcare using machine learning analytics is not to replace physicians or doctors, but to give assistance where humans struggle. These techniques help the people in early prediction and detection that would cause saving human lives and money. This paper is an attempt to build heart disease risk assessment model using machine learning techniques which would help physicians for initial prediction and diagnosis of disease.

## II. RESEARCH BACKGROUND

Researchers mine the raw healthcare data through machine learning techniques and derive insights from it to assist clinical practitioners in disease prognosis and diagnosis at early stages before it causes human suffering and economic damage. [1] Kumari & Godara, [2] Das et al., [3] Aqueel & Hannan, [4] Jabbar et al., [5] Bialy et al., and [6] Tu et al., proposed machine learning ensemble techniques to predict and diagnose the heart disease. [7] Applied and compared different techniques like C5.0, Neural Network, Support Vector Machine, K-Nearest Neighbor and Logistic Regression techniques to predict the risk of heart diseases. Results show that C5.0 decision tree algorithm outperforms other applied algorithms with an accuracy of 93.02%. [8] Build a heart disease risk evaluation model using PSO-

C4.5 algorithm. The proposed model yields reduced set of features using the feature selection algorithm along with improved prediction accuracy. Researchers [9] designed a heart disease prediction model in MATLAB tool using Multilayer Perceptron and Adaptive Neuro-Fuzzy Inference Systems algorithms. [10] Designed a Fuzzy Expert heart disease diagnosis system based on the Cleveland database. The system has 13 input fields and one output field. [11] Predicted the presence of heart disease with reduced number of attributes using Classification and Regression Tree (CRT). [12] Used Bagging and C4.5 classification algorithms to predict coronary artery disease. [13] Developed a heart disease prediction system using Naïve Bayes and K- means clustering algorithms. It explores the integration of K-means clustering with naïve Bayes and the results indicate that the integration of the K-means clustering with naïve Bayes with different initial Centroid selecting naïve Bayesian improve accuracy in diagnosis of the patient. [14] Predicted and diagnosed the heart disease using decision tree, Naive Bayes, K-nearest neighbor (KNN), support vector machine (SVM), and artificial neural network techniques. Results show that SVM and neural networks perform positively high to predict the presence of coronary heart diseases (CHD).

**III. RESEARCH METHODOLOGY**

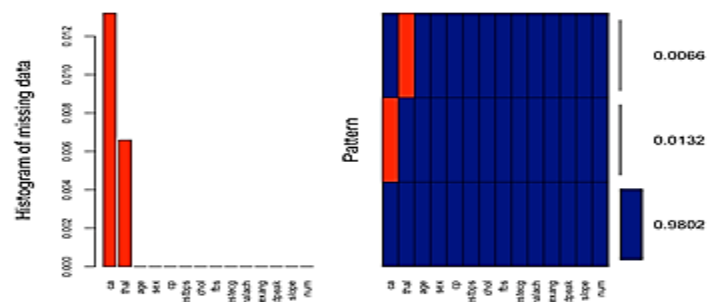
The goal of the proposed method is to design a heart disease risk assessment model using machine learning algorithms. We train and test the random forest, support vector machine, logistic regression, and Gradient boosting tree method on the Cleveland dataset for the early prediction and diagnosis of heart disease patients. The proposed model is built on Jupyter Notebook web application. We perform various algorithmic measures like accuracy, precision, recall, AUC and the 10-fold cross validation for each machine learning algorithm to measure the unbiased estimates.

**IV. DATA ANALYSIS**

We use the benchmark Cleveland heart disease dataset having 303 instances and 14 medical attributes for our research [18]. We select the significant thirteen attributes among the raw seventy six (76) attributes for the early heart disease risk. Given table1 shows the description of the attributes which we use in our research for diagnosing heart disease risk patients. The Cleveland heart disease dataset is noisy and comprise several missing attribute hence we use simple mean imputation data cleaning technique to fill-in the missing values. The categorical risk attributes like “Ca” and “Thal” in the dataset contain four and two missing values as shown in below given fig.1.

**Table1. The Cleveland heart disease dataset’s description [19, 20]**

Attributes	Attribute Type	Attributes with their corresponding values and explanation
Age	Numeric	Measured in the number of years
Gender	Nominal	Represented in 0 and 1 where 0= Female and 1= Male
Chest Pain	Nominal	Type of chest pain the patient is suffering from: 1= angina pectoris, 2= Atypical Angina, 3=Non-Angina pain, 4=Asymptomatic chest pain
Trestbps	Numeric	It is normal systolic and diastolic pressure measured in millimeters of mercury
Cholesterol	Numeric	It is the total Serum cholesterol measured in milligrams per deciliter
Fbs	Nominal	Is Fasting Blood Glucose Level > 120 mg/dl( milligrams per deciliter) 1=Yes and 0=No
Rest ECG	Nominal	12-Lead ECG records during rest with different values: 0=Normal, 1=having ST-T wave abnormality, 2=showing probable or definite left ventricular hypertrophy by Estes’ criteria
Thal	Numeric	A thallium stress test shows the maximum heart rate achieved while you’re exercising or at rest
Exang	Nominal	Is the patient suffering from exercise induced angina also called as stable angina: 0=No, and 1= Yes
oldpeak	Numeric	ST segment depression induced via exercise relative to rest
Slope	Nominal	ST segment slope during peak exercise: 1=Up Sloping, 2=Flat, 3=Down Sloping
Cardiac Cath	Numeric	Total number of Coronary Arteries colored by contrast dye that ranged 0 to 3
Thallium Stress Test	Nominal	A nuclear imaging test showing Exercising thallium scintigraphy defects values 3= normal, 6=fixed defect, and 7=reversible defect
Diagnosis	Nominal	1=Yes and 0=No



**Fig.1. Histogram representation of missing data in heart disease dataset**

V. PERFORMANCE EVALUATION METRICS

The real progress of any algorithm is evaluated through its performance evaluation measurements. In this research work we check the overall accuracy of classifiers using 10-Fold cross validation, confusion matrix and AUC measures. The accuracy evaluators are discussed as follows:

a) K-fold Cross validation: In k-fold cross validation, the given dataset is randomly split into k mutually exclusive subsets of approximately equal size. The classification model is trained on k-1 folds and then tested on the remaining single fold [33].

b) Contingency Matrix: The contingency matrix also called as confusion or error matrix is a principal source of performance measurements in classification problems. In contingency table there are four values TP, FP, FN, and TN which are explained as below:

- True positives (TP): if an algorithm correctly classifies the diseased cases then it is True Positive.
- True Negative (TN): If the algorithm correctly predicts the not diseased cases then it is called as True Negative.
- False Positives (FP): when an algorithm falsely classifies the diseased cases as not diseased then it is called as false positive or Type I error.
- False Negative (FN): If an algorithm wrongly classifies not diseased cases as diseased then it is called as Type II error.
- The confusion matrix for two variable classifications is shown in below given table2.

Table 2 Contingency Matrix For Two Class Classification

		Predicted Cases	
		Positive	Negative
Actual Cases	Positive	True Positive	False Positive
	Negative	False Negative	True Negative

From the error matrix we can generate the following formulas to check the performance of an algorithm:

c) Accuracy: the total percentage cases that are correctly classified by an algorithm [34].

$$Accuracy = (TP+TN)/(TP+TN+FP+FN) \tag{1}$$

Sensitivity: the ratio of diseased cases that are correctly identified. It is also called as true positive or recognition or recall rate [34].

$$Recognition\ rate = (TP)/(TP+ FN) \tag{2}$$

Specificity: the ratio of patients without the disease that are correctly identified.

$$Specificity = (TN)/(TN+ FP) \tag{3}$$

Precision: precision means if an algorithm predicts yes and how often is it correct.

$$Precision = (TP)/(TP+ FP) \tag{4}$$

AUROC (Area under the Receiver Operating Characteristics) performance measurement to see the probability curve and measure of separability.

VI. EXPERIMENTAL RESULTS

We build heart disease risk assessment model that would assist medical practitioner to check the patient at its initial with optimal accuracy. The proposed model is developed on anaconda with Jupyter notebook web application using machine learning algorithms. We import different libraries from anaconda like Sci-Kit Learn library, Matplotlib, Pandas and plan a general function for training our models. The Cleveland heart disease dataset is mined through support vector machine, logistic regression, random forest, and gradient boosting algorithms using cross validation to get unbiased results. To obtain the optimal and accurate results we checked the accuracy, precision, recall and AUC of the proposed model. Below given table3 shows the outcome of the proposed algorithms.

Table3 Measurements of algorithms on heart disease dataset

Algorithms	Accuracy	Precision	ROC Curve	Recall
Random Forest	0.874588	0.889570	0.9706	0.878787
Logistic Regression	0.825082	0.858895	0.9095	0.823529
Boosted Tree	0.838283	0.876543	0.9070	0.871165
SVM	0.848184	0.868752	0.7399	0.847556

The results show that random forest algorithm outperform other algorithms with an optimal accuracy of 87.4588%, Precision values of 88.9570, AUROC curve values of 0.9706 and Recall values as 87.8787. Below given figure2 show the combined AUROC curves with their respective values for the applied algorithms from the figure2 it is clear that random forest is having highest AUROC with 0.9706 values.

In our study we also use the gradient boosting tree algorithm to compare the importance of different heart disease risk parameters. Below given figure3 shows the

significance and rank of different risk attributes for early prognosis and diagnosis of heart disease. Results show that the attributes “Thallium Stress Test with reversible defect value”, “Asymptomatic chest pain”, “Oldpeak”, “Thal”, ”Age” and “Trestbps” are the most important predictors for early heart disease prediction and diagnosis whereas attributes “Rest Ecg”, ”Fasting Blood Sugar” and ”Slope” are less significant for heart disease diagnosis.

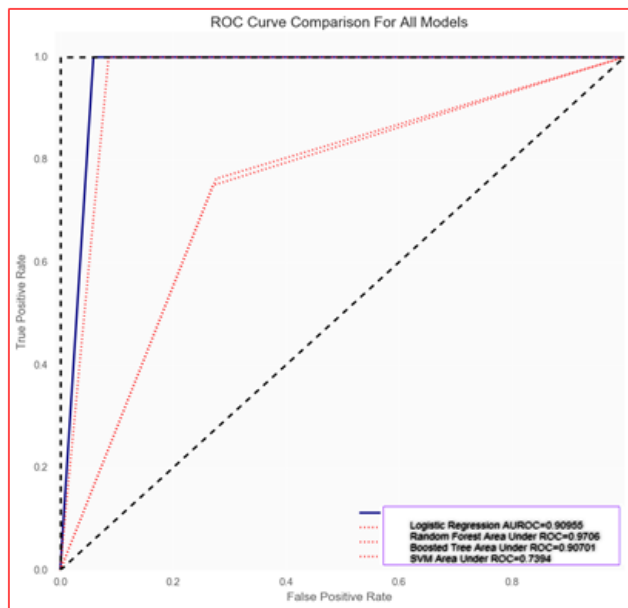


Fig.2. AUROC curve values of machine learning algorithms

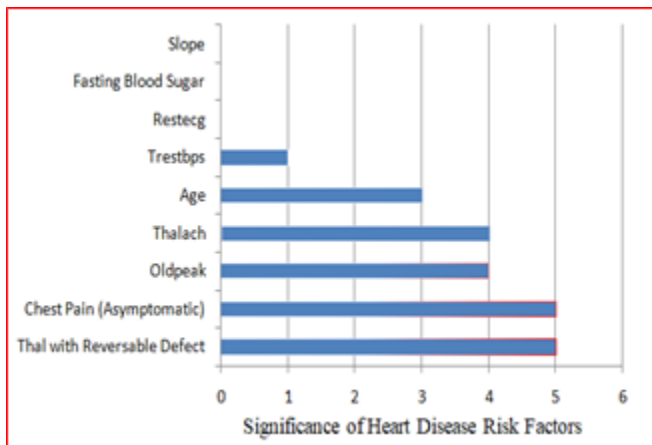


Fig. 3. Importance of heart disease risk attributes by boosted tree algorithm

### CONCLUSION

Heart Disease is a global problem with enormous health and economic consequences. Diagnosing heart disease is a very complicated process which involves a myriad of

factors. This paper examines gradient random forest, support vector machine logistic regression and boosting tree method algorithms for the initial prognosis and identification of heart disease and compares performances of classifications among them. We use the benchmark Cleveland heart disease dataset for our study. We compute recognition rate, precision, sensitivity and AUC for each method using out-of-sample testing to check how accurately our heart disease risk assessment will perform. The experimental results show that random forest algorithm outperform the gradient boosting tree method, support vector machine and logistic regression algorithms with the highest accuracy, precision, recall and AUC of 0.852, 0.864619, 0.821162 and 0.94. In this study we also applied the gradient boosting tree algorithm to check the significance and weight of different risk parameters used in heart disease prognosis and diagnosis. From significance results we come to know attributes like “Thal with the value of reversible defect”, “chest pain asymptomatic”, “Oldpeak”, “Thalach”, ”Age” and “Trestbps” are the most important predictors for heart disease diagnosis while attributes “Restecg”, ”Fasting Blood Sugar” and ”Slope” are less significant for heart disease diagnosis. We test performance of the proposed heart disease risk assessment model with existing models which show that the results are very promising with excellent predictive power.

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# Improving Durability Properties of Concrete by Using Quarry Dust and Waste Plastic as Fine Aggregate

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**Abstract:** -- The scope of this study is to enhance the industry understanding of the sustainable utilization of quarry dust, and to identify any gaps in current knowledge. The term sustainable utilization implies the use of quarry dust to their full potential to meet the needs of the present, while at the same time conserving natural resources and finding ways to minimise the environmental impacts associated both with quarry fines production and use. Concrete mixes were casted using ordinary river sand and compared with 25%, 50%, 75%, 100% replacement with quarry dust in combination with waste plastic in fabric form. The addition of quarry dust along with waste plastic significantly improved the concrete matrix properties in terms of strength and permeability resistance. The addition of fine quarry dust with ldpe as waste plastic in concrete resulted in improved matrix densification compared to conventional concrete. Matrix densification has been studied qualitatively through petrographical examination using digital optical microscopy. The structure was evaluated using SEM in quarry dust and ldpe composites.

**Index Terms:** Natural sand; quarry dust; waste plastic, SEM analysis, RCPT, Cracked permeability.

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## INTRODUCTION

In the recent past good attempts have been made for the successful utilization of various industrial by products (such as fly ash, silica fume, rice husk ash, foundry waste) to save environmental pollution. In addition to this, an alternative source for the potential replacement of natural aggregates in concrete has gained good attention. As a result reasonable studies have been conducted to find the suitability of quarry dust in conventional concrete. Pacheco-Torgal et al (2002) dealt with the durability properties of concrete with different types of aggregates. They found that there was not much difference on concrete durability parameters when produced either with granite, gabbro or calcareous coarse aggregate. The results obtained for vacuum water absorption, oxygen and water permeability of all concrete mixes showed the same order of magnitude. This indicated that the quality of concrete mixes produced with different aggregates looked approximately same, in all cases. Crouch and Jason Philips (2009) investigated both river sand and manufactured limestone sand used as fine aggregate in concrete mixtures. The mixtures exhibit comparable cost and enhanced the durability properties. Bayasi and Zeng (1993) (1) investigated the effect of recycled plastic on the permeability of concrete. They concluded that 19-mm polypropylene fibers significantly increased the permeability of concrete with an inconsistent effect on the volume fraction of permeable voids; 12.7-mm long fibers

somewhat increased the permeability of concrete and tend to decrease the volume of permeable voids. Zainab Z. Ismail \*, Enas A. AL-Hashmi, 2007(2). In another study, the concrete made of stone dust, of about 48 MPa strength, showed 10%, 24%, and 26% higher strength in compression, tension and flexural tension, respectively over the controlled concrete. With the fact that concrete contains numerous flaws and micro cracks the use of waste plastics in present study has been incorporated. The rapid propagation of micro cracks under an applied load is considered responsible for the low tensile strength of concrete. It is reasonable to assume that the tensile strength as well as the flexural strength of concrete can be substantially increased by introducing closely spaced fibers. These fibers would arrest the propagation of micro cracks, thus delaying the onset of tensile cracks and increasing the tensile strength of the material. Research has been done to investigate the use of quarry fines in various concrete applications. The International Center for Aggregates Research (ICAR) identified the use of micro fines (particles below 75  $\mu\text{m}$ ) in concrete. Studies suggested that artificial fine aggregate mortars with high fines content had higher flexural strength, improved abrasion resistance, higher unit weight and lower permeability due to filling of pores with micro fines. Hence concrete can be manufactured using all of the aggregate, including micro fines from 7 to 18% without the use of admixtures. Ahn and Fowler, 2001(3,4), 2002 Hanson(5,6) considered structural concrete using 12% unseparated

sandstone quarry fines. The product is being sold as standard C35 strength concrete (35 N/mm<sup>2</sup>). However results showed that the strength of the ultimate product would be considerably higher than 35 N/mm<sup>2</sup> after 28 days. Hence, it was put forth that, if the filler material was to be replaced, and then much higher content of the coarser grained material have to be mixed.

### RESEARCH SIGNIFICANCE

The main objective of the present work was to systematically study the effect of percentage replacement of natural sand by quarry dust & waste plastic (ldpe) in fabriform as 0%, 25%, 50%, 75%, and 100% respectively on the strength properties of concrete. The study was carried out on M30 grade concrete with 0.5 water cement ratio. Waste plastic was mixed as 2, 4, 6, and 8% along with quarry dust to make full combinations. Waste plastics have been incorporated with a view to enhance mechanical properties of concrete. Durability measurements were quantified using cracked permeability and rapid chloride permeability test methods. Cracked permeability of concrete is an important measure determined in this study which provides an actual estimation on the permeability properties of concrete under stressed conditions. Powders of microfines were analyzed using Scanning electron microscope (SEM) imaging was performed on specially prepared microfine samples. Using SEM enabled the microfines to be seen at higher resolution than possible with an optical microscope.

### SEM –EDS

SEM coupled with EDS can be an effective tool for visually examining a particle that is too small to be seen under an optical microscope. The SEM works by aiming an electron beam at the surface of the specimen. When the electron beam strikes a solid object, the electrons are either scattered or absorbed; the collection of these responses is what forms the SEM image. Any electrically conductive object can be microscopically examined in this manner (Sarkar et al., 2001) (07). EDS detects the elements present in a specimen based on the detection of x-rays emitted by that specimen. Each element has a characteristic emission from the electron beam because of each element's characteristic energy position. The x-ray photons emitted by the specimen are collected by EDS and converted to a number of "counts" at each emission voltage. "The total number of counts for a particular element is proportional to the amount of that element present in the object". Magnified images taken with SEM can be analyzed to determine several factors that could possibly relate to the performance of micro fines in concrete. The elements found in the material from EDS study are shown in table 1, 2, 3. The SEM images for sample1, sample2, sample3

under various magnifications ranges are shown in figures as follows.

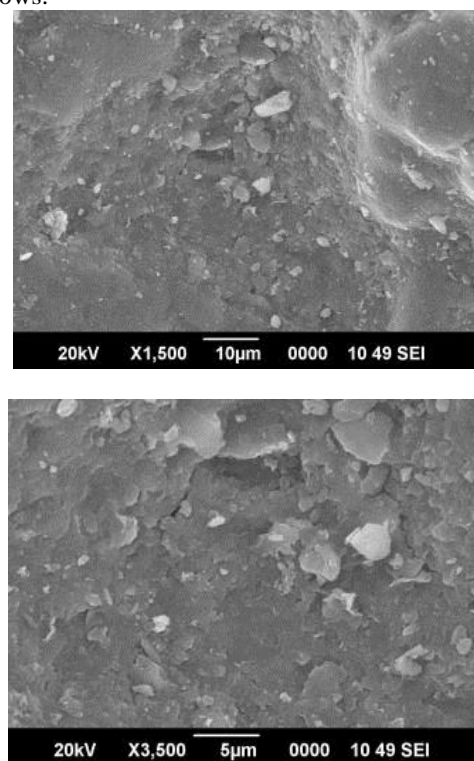


Figure 1. SEM-EDS for natural sand under X1500 , X7000 magnification range

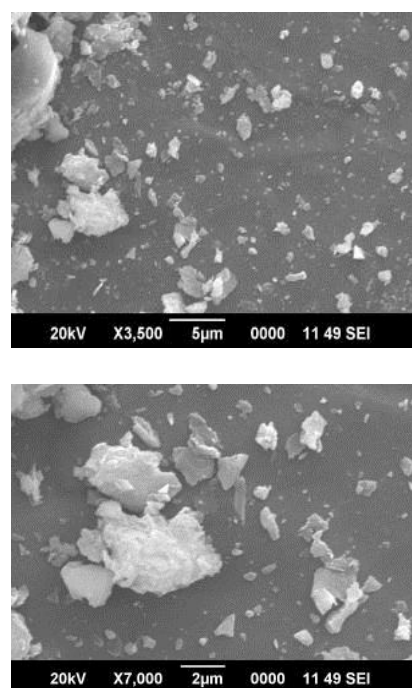


Figure 2. SEM-EDS for Quarry dust under X1500,3500 magnification range

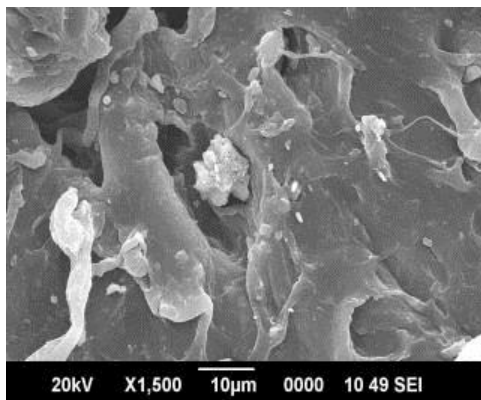
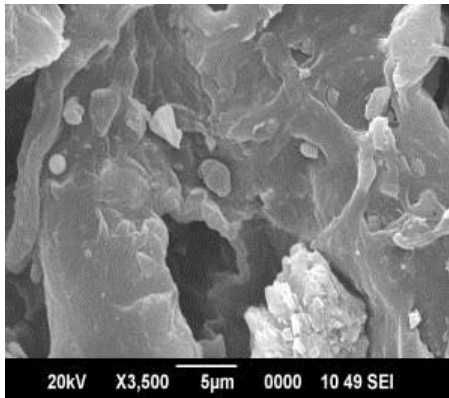


Figure 3. SEM-EDS for waste ldpe under X1500,3500 magnification range

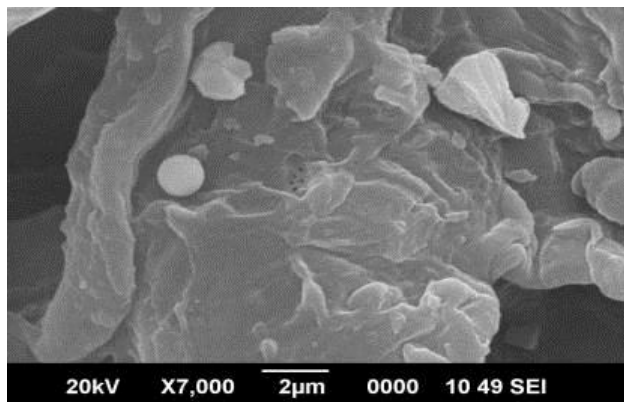


Figure 4. SEM-EDS for waste ldpe under X7000 magnification range

Table 1. Elements found in EDS Analysis (ICAR-107)

Aggregate	Elements found in EDS
N̄S01	Ca, Pd, C, O, P, Zr, Mg, Al, Si, Fe, Au
PF01	C, O, Mg, Ca, P (Si, Cl trace)
TR02	Mg, Al, Si, Pd, O, K, C, Na

Table 2. Elements found in EDS Analysis of Natural sand , Quarry dust Natural sand

Element	Weight%	Atomic%
C K	4.03	6.13
O K	64.01	73.15
Al K	0.3	0.2
Si K	31.13	20.27
Ca K	0.53	0.24
<b>Quarry dust</b>		
Element	Weight%	Atomic%
C K	2.78	5.29
O K	40.64	58.02
Na K	1.45	1.44
Mg K	3.09	2.9
Al K	5.34	4.52
Si K	18.53	15.07
Ca K	6.81	3.88
Ti K	2.28	1.09
Fe K	19.08	7.8

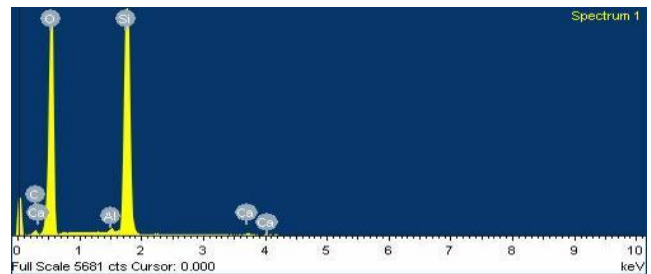


Figure 5. EDS Analysis of Natural sand

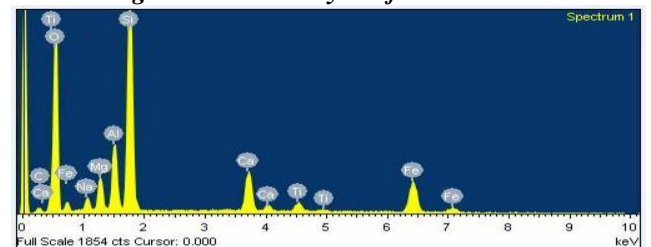


Figure 6. EDS Analysis of Quarry Dust

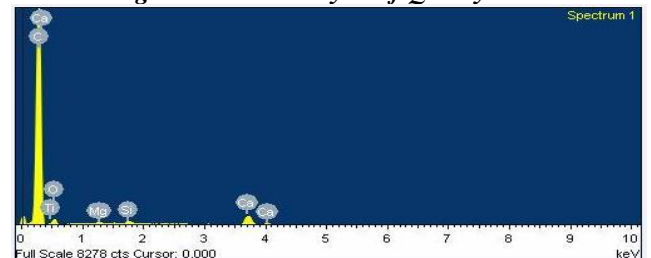


Figure 7. EDS Analysis of Waste Plastic (ldpe)

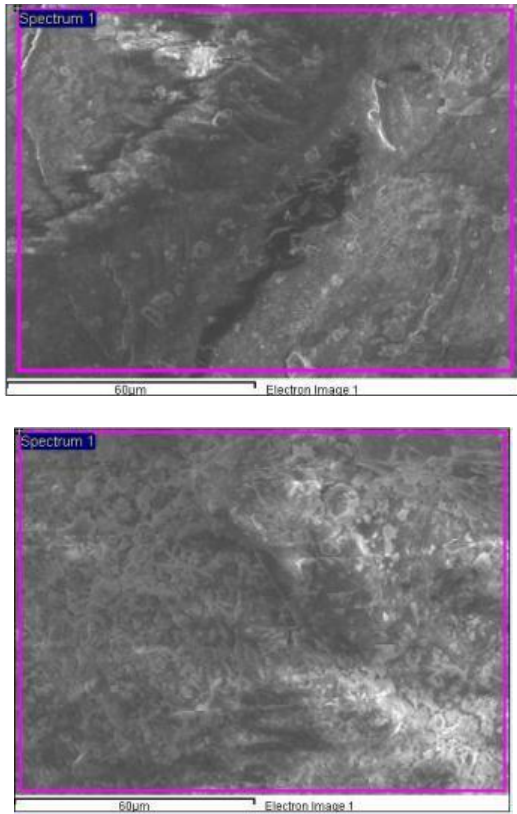


Figure 8 .EDAX Image of Natural, Image of Quarry Dust

Table 3. Elements found in EDS Analysis of Waste plastic (LDPE)

Element	Weight%	Atomic%
C K	4.03	6.13
O K	64.01	73.15
Al K	0.3	0.2
Si K	31.13	20.27
Ca K	0.53	0.24
Totals	100	

**DURABILITY EVALUATION IN CONCRETE USING CRACKED PERMEABILITY AND CHLORIDE PERMEABILITY TEST**

The rapid chloride penetration test was conducted as per (ASTM C 1202-1979) with a concrete disc specimen of size 100mmdiameter and 50mmthick. This test method was useful for the determination of the electrical conductance of concrete to provide a rapid indication of its resistance to the penetration of chloride ions penetration of chloride ions. The test method consisted of monitoring the amount of electrical current passed through cylinders for a 6-hour

period (log time), and recording was maintained at every 30-minute interval. The cracked permeability of concrete was determined in accordance with (IS 3085 1965).Permeability was determined in plain and quarry dust concrete by means of initial loading applied on the concrete specimens and measuring the weight of concrete gained due to ingress of water upon micro cracking. A constant pressure of 5 kg/cm2 was given for all the concrete mixtures, and the reading in the graduated glass limb of the concrete permeability test setup was noted for the amount of water entering the cracked specimen.

Table 4. RPCT Values for Various combinations of M30 concrete

Grade of concrete	MIX IDENTIFICATION	RCPT charge passed for 6hrs (coulombs)	
		28 days	90 days
M30	M100-0-0	1080	1000
	M75-25-0	1060	990
	M75-23-2	1040	980
	M75-21-4	1020	960
	M75-19-6	1000	900
	M75-17- 8	990	880
	M50-50-0	980	860
	M50-48-2	970	840
	M50-46-4	950	820
	M50-44-6	930	800
	M50-42-8	920	780
	M25-75-0	900	760
	M25-73-2	890	750
	M25-71-4	880	730
	M25-69-6	870	700
	M25-67-8	860	690
	M0-100-0	850	765
	M0-98-2	820	745
	M0-96-4	800	730
	M0-94-6	780	710
M0-92-8	750	690	

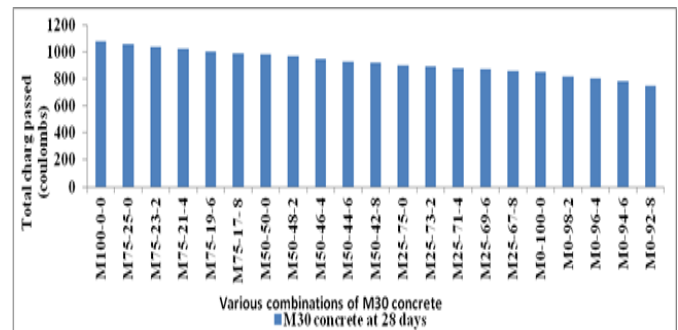


Figure 9. RPCT for M30 concrete at 28 days

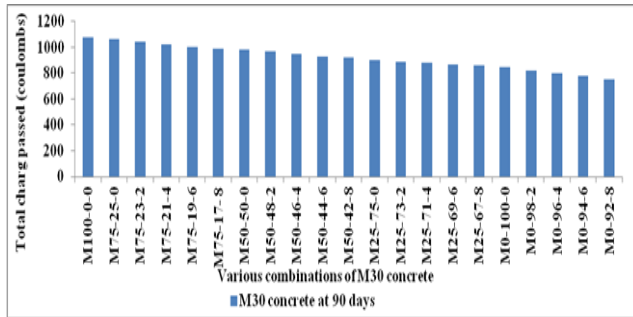


Figure 10. RPCT for M30 concrete at 90 days

Table 5 Coefficient of permeability for M30 concrete

Grade of concrete	Mix Identification	Coefficient of permeability ( $10^{-12}$ m/s)	
		28 days	90 days
M30	M100-0-0	4.500	2.500
	M75-25-0	4.450	2.450
	M75-23-2	4.300	2.300
	M75-21-4	4.250	2.250
	M75-19-6	4.100	2.100
	M75-17-8	4.000	2.000
	M50-50-0	3.950	1.950
	M50-48-2	3.800	1.800
	M50-46-4	3.750	1.750
	M50-44-6	3.650	1.650
	M50-42-8	3.550	1.550
	M25-75-0	3.450	1.450
	M25-73-2	3.250	1.250
	M25-71-4	3.150	1.150
	M25-69-6	3.000	1.000
	M25-67-8	3.000	1.000
	M0-100-0	3.000	1.000
	M0-98-2	2.950	0.955
	M0-96-4	2.750	0.950
	M0-94-6	2.650	0.850
M0-92-8	2.35	0.750	

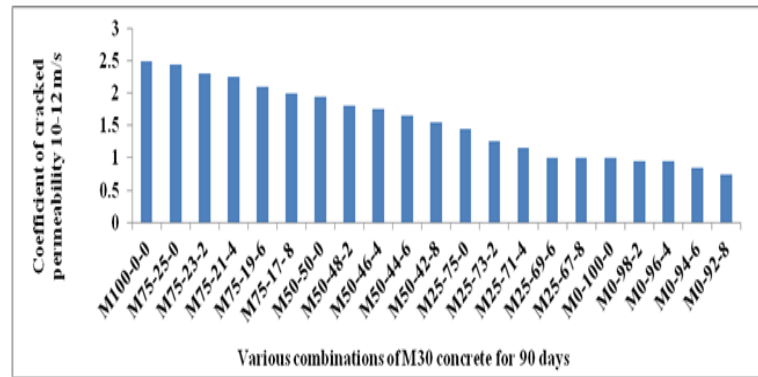


Figure 12 Coefficient of cracked permeability for M30 concrete at 90 days

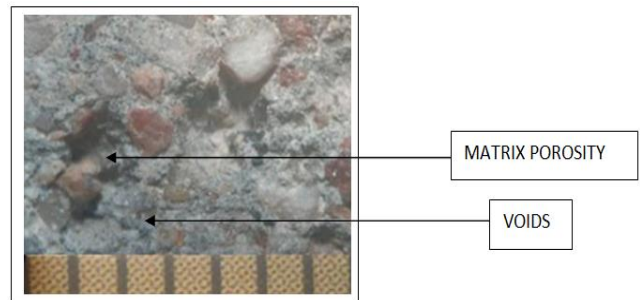


Figure 13. Microscopic view of conventional concrete without initial stress (50x magnification).

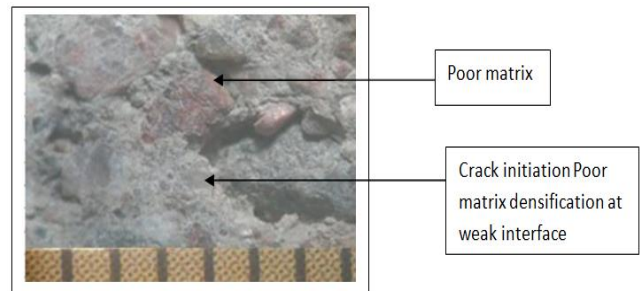


Figure 14. Microscopic view of conventional concrete at 40% load (50x magnification).

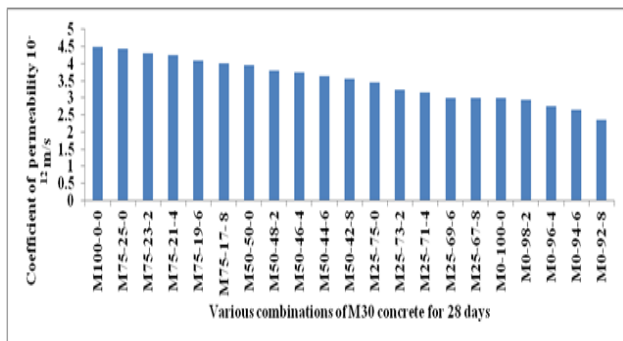


Figure 11 Coefficient of cracked permeability for M30 concrete at 28

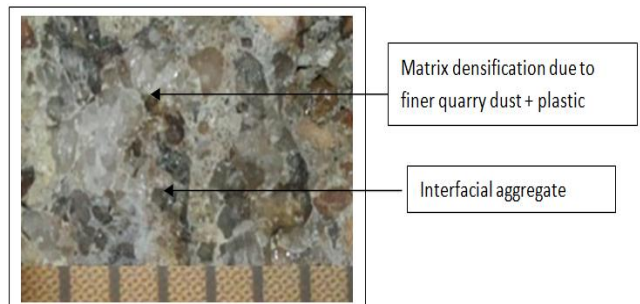


Figure 15. Microscopic view of quarry dust concrete without stress (50x magnification).

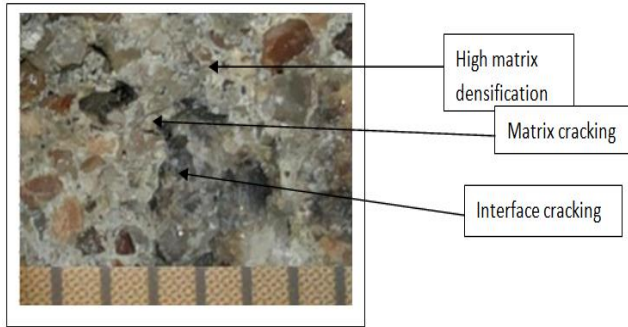


Figure 16. Microscopic view of quarry dust concrete at 40% load (50x magnification).

### CONCLUSIONS:

Quarry fines below 6 mm may be included in an end product (for example, aggregate), be a product in their own right (for example, fine aggregate) or be surplus to market demand, namely excess fines which remain unused. The fines may include a high proportion of ultra fine (dust) particles (below 75  $\mu\text{m}$ ), which may also be part of an aggregate product, or be produced in excess, or be produced as a by-product.

With manufactured sands, produced from sound durable rock, it is possible that the passing 75 micron material will be composed of finely ground rock flour with little deleterious mineralogy. It is possible that high quantities of inert fines with a high specific surface could still cause an increase in water demand. However, the tests indicated that inert, passing 75 micron fines in manufactured sand can act as filler and as part of the binder, increasing the workability of the mix in the plastic state and reducing porosity in the hardened state.

With the introduction of quarry dust there has been gradual recognition that much of the passing 75  $\mu\text{m}$  materials will be ground primary minerals and not clay minerals. This material will act as a rock flour or filler and may have advantages in the concrete mix.

The cracked permeability experimental test results showed that the addition of the quarry dust improved the permeation resistance of concrete. This can be seen from the concrete mixes containing 100% quarry dust instead of river sand for the mixes M30 which showed a substantial reduction in the coefficient of permeability values up to 40%, and the reduction was significant for higher cement content 450 kg/m<sup>3</sup> as well as for F/C ratio of 0.5.

It can also be noted from the chloride permeability test results that the permeation resistance was higher for quarry dust concrete compared to river sand concrete specimens. However, it is concluded from quarry dust along with

waste plastic concrete that the permeability of concrete is controlled due to inhibition of the crack opening and requires higher stress for further opening and propagation. This is evident from the cracked water permeability test results as well as chloride permeability test results. Compared with natural sand, 100% quarry dust replacement in concrete showed the considerable reduction in cracked permeability and chloride permeability at higher cement content and higher F/C ratio.

It is also understood from the particle size analysis that the fineness of quarry dust led to the improved pore structure properties leading to matrix densification properties. This is evidently seen from the digital microscopy studies that the porosity of conventional concrete mixes were more and resulted in matrix cracking whereas a refined matrix densification is achieved with the quarry dust substitution.

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# Heart Disease Risk Assessment Model Development using Machine Learning Techniques

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**Abstract:**-- Heart disease is a serious disorder that inflict adverse burden on all societies and economies'. The enormous health and economic burden of heart disease is due to its risk factors. Considering the mortality rate of heart disorder and its rising health care costs, it is important to predict this malignant disease at its earliest. Early identification and prediction of heart disease reduces progression to severe and costly illness and complications. The existing models are not excellent in accuracy so we seek to develop a heart disease risk assessment model using decision tree, support vector machine and random forest machine learning algorithms. We build the proposed model on Jupyter Notebook web application which predicts and diagnoses the disease at its initial based on the decisive risk features that describe the disease. On the Cleveland heart disease dataset we conduct various experiments to predict and diagnose the heart disease at its earliest and check their performances using different methods. We compute the recognition rate, precision, recall and AUC for each method and also use out-of-sample testing model validation technique to calculate the impartial measurements. Experimental outcomes show random forest method outperforms other proposed algorithms with the highest recognition rate, precision, sensitivity and AUC of 0.9042, 0.9197, 0.8975 and 0.94. We simulate the achieved results against the existing study; the results carried out in this research are, to the finest of our insight, higher than published results in the literature.

**Index Terms:** Cardiovascular Disease (CVD), Classification Techniques, Machine Learning, Medical Data, Heart Disease.

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## I. INTRODUCTION

Cardiovascular disease (CVD) is the chronic condition ascribed to the heart and blood circulation system [18]. The Cardiovascular Conditions are one of the foremost health and socioeconomic challenges at the present times because it drags the world population towards the high mortality rate and cause the immense damage on the world economy. Cardiovascular Diseases (CVDs) are the leading contributors to global mortality rate which causes 17.9 million deaths per year [24]. The primary values that drag the world to this outbreak are the fundamental CVD risk considerations. Medical reports recommend that if there is no cessation of risk factors, the fatality rates and economic burden associated with disease may grow and exceed all other conditions in the forthcoming years. Diagnosing the CVD based on the association and causal relationship between its parameters is an intricate process and comprises a myriad of influences. To predict this malignant disease at its earliest and to scale down its health and economic burden researchers apply machine learning algorithms on an inundated data of healthcare industry. Machine learning techniques evaluate the unbridled healthcare data to identify useful patterns and observations that allow us to make nontrivial predictions on new data. Considering the damaging consequences of this destructive disease in view we seek to develop a risk assessment model using machine learning techniques that identifies patients at high risk at initial stages.

## II. RESEARCH BACKGROUND

The CVD prognosis is not free from the wrong assumptions hence could cause dangerous consequences. To predict this disease, researchers' timely used different machine learning algorithms on various healthcare data sets to exploit knowledge hidden deep inside these databases. Different researchers had done various efforts to predict and diagnose this disease by discovering valid and novel patterns in the dataset. Researchers like [1] Colombet et al., 2000 tested Decision tree and Multilayer Perceptron algorithms to diagnose heart risk from the real dataset and [2] Yan et al., 2003 tested Multilayer Perceptron Neural Network for heart diseases prediction on the database comprising 352 instances. [3] Ture et al., 2005 developed a heart disease prediction model comprised of decision trees, neural networks and statistical methods on the data set collected from Cardiology Clinic of Trakya University Medical Faculty in Turkey. [4] Palaniappan and Awang, 2008 developed an Intelligent Heart Disease Prediction System using Naïve Bayes, Decision Tree and Neural Network on 909 records with 15 medical attributes got from the Cleveland Heart Disease database and implemented in .NET platform. [5] Tu, Shin, and Shin, 2009 propose the use of decision tree C4.5 algorithm, bagging with decision tree C4.5 algorithm and Bagging with Naïve Bayes algorithm to identify the heart disease patient and compare the effectiveness, correction rate among them. [6] Das, Turkoglu, and Sengur, 2009

proposed NN (Neural Networks) Ensemble method enhanced with SAS enterprise miner 5.2 for heart disease diagnosis and evaluated their scheme with accuracy, sensitivity and specificity parameters. [7] Shouman, Turner, and Stocker, 2011 provided a novel classification model that enhances the accuracy of the decision tree in identifying cardiac patients. [8] Khemphila and Boonjing, 2011 implemented Multi-Layer Perceptron with Back-Propagation learning algorithm and a feature selection technique alongside with biomedical test values to predict heart disease on Cleveland Clinic Foundation dataset. [27] Mai Shouman, Turner Tim, and Rob Stocker, 2012 applied K-Nearest Neighbour data mining technique on the Cleveland dataset for the classification of heart disease patients and [10] V. Chaurasia, 2013 presented an efficient heart disease prediction survivability model using variants of a decision tree CART, ID3 and Decision Table classification algorithms. They train and test the proposed heart disease predictive model on benchmark Cleveland Heart Disease dataset with 11 vital heart disease attributes. The data is analyzed and is implemented in WEKA tool using various performance measures. [11] Al-Milli and Nabeel, 2013 use back propagation neural network algorithm to develop a heart disease prediction model on the benchmark Cleveland dataset. [12] Alizadehsani et al., 2013 collected data from 303 patients of Rajaie Heart, Medical and Research Center, Tehran, Iran. They use bagging and C4.5 classification algorithms to analyse the laboratory and echocardiography data to diagnose the coronary artery heart disease. [13] Jabbar, Deekshatulu,

and Chandra, 2014 collect heart disease dataset having 96 patient records with 10 features from various hospitals in Hyderabad. They develop effective alternating decision tree approach for early diagnosis of heart disease. [14] Al-batah, 2014 use Statlog heart disease dataset comprising of 270 instances and 13 medical attributes and applied Classification and Regression Tree (CRT) to determine the attributes which contribute more towards the diagnosis of heart ailments. Literature review instict us to fill the research gap through developing the novel machine learning classification model that would predict and diagnose CVD at its earliest efficiently with the reduced number of factors.

### III. RESEARCH METHODOLOGY

We use the benchmark Cleveland heart disease dataset for our study. The proposed dataset comprises of 303 instances and 14 different heart disease risk features [19]. The complete explanation of the Cleveland heart disease dataset is given in below given Table1 [9, 21]. After analyzing the proposed dataset we found that the attributes “Ca” and “Thal” comprise missing values. To remove those missing values we applied simple mean central tendency imputation technique. We use the Jupyter notebook web application and pandas, Scikit-learn, Matplotlib, and Numpy libraries to build the heart disease risk assessment model. Below given Fig.1 shows the histogram representation of different attributes of Cleveland heart disease dataset used for early prognosis and diagnosis.

**Table1. Description of Cleveland Heart Disease Dataset**

Heart Disease Attributes	Attribute Data Type	Attributes with their corresponding values and explanation
Age	Numeric	Measured in number of years
Gender	Nominal	Represented in 0 and 1 where 0= Female and 1= Male
Chest Pain	Nominal	The type of chest pain patient is having such as: Typical Angina=1, Atypical Angina=2, Non-Angina pain=3, Asymptomatic chest pain=4
Trestbps	Numeric	It is normal systolic and diastolic pressure measured in millimeters of mercury
Cholesterol	Numeric	It is the total Serum cholesterol measured in milligrams per deciliter
Fbs	Nominal	Is Fasting Blood Glucose Level > 120 mg/dl( milligrams per deciliter) here value 1=Yes and 0=No
Rest ECG	Nominal	Resting electrocardiogram records having numerous values: 0=Normal, 1=having ST-T wave abnormality, 2=showing probable or definite left ventricular hypertrophy by Estes' criteria
Thallium Test	Numeric	A thallium stress test is a nuclear imaging test that shows the maximum heart rate achieved while you're exercising or at rest
Exang	Nominal	Is patient suffering from exercise induced angina also called as stable angina: 0=No, and 1= Yes
oldpeak	Numeric	ST depression induced by exercise relative to rest
Slope	Nominal	The slope of the peak exercise ST segment: 1=up sloping, 2=flat, 3=down sloping
Calcium Score	Numeric	Number of major vessels colored by fluoroscopy that ranged between 0 and 3.
Thallium Stress Test	Nominal	Exercise thallium scintigraphic defects: 3= normal, 6=fixed defect, 7=reversible defect
Diagnosis	Nominal	1=Yes and 0=No

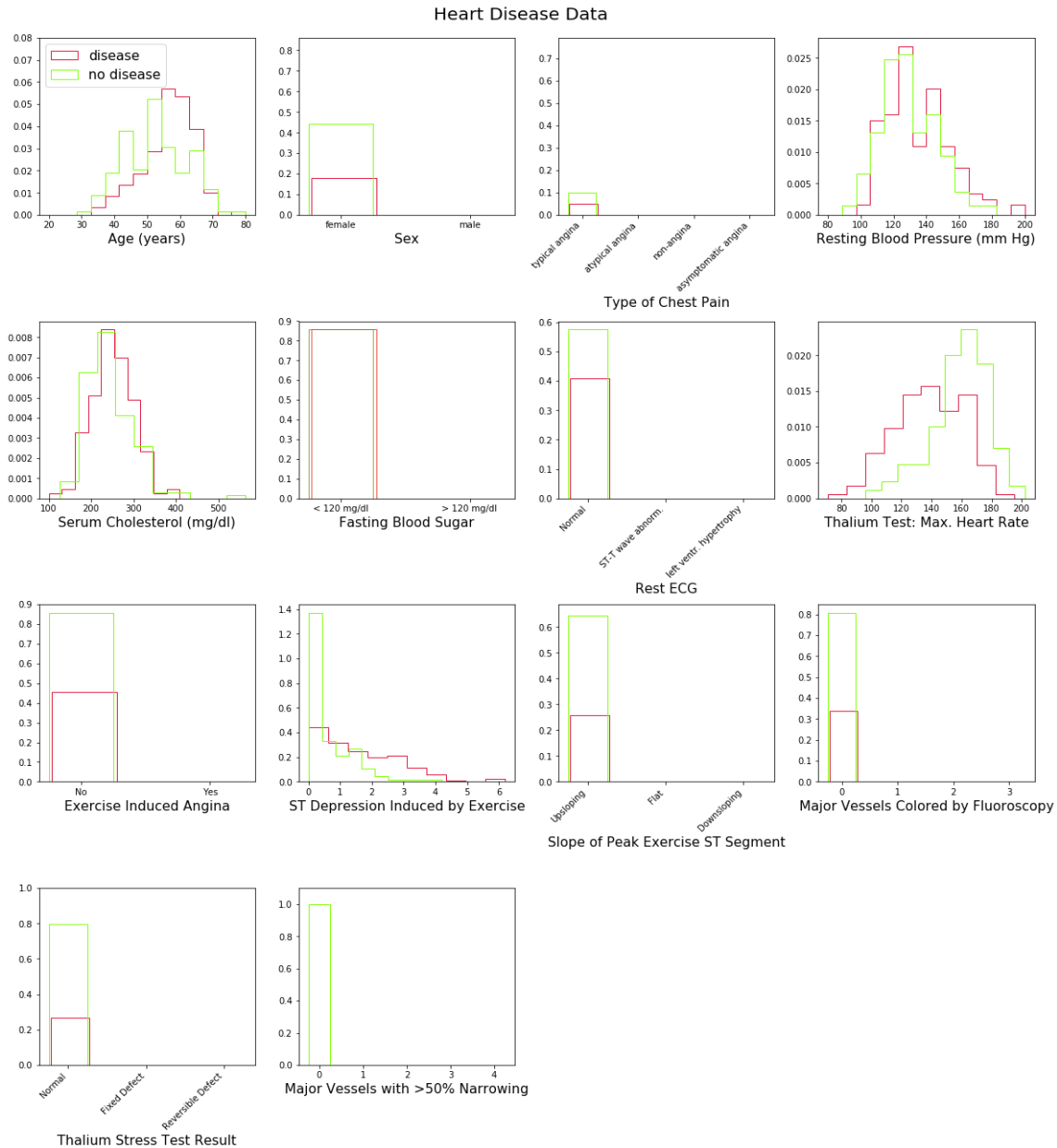


Fig.1 Histogram representation of heart disease dataset attributes

#### IV. PERFORMANCE ESTIMATION OF THE PROPOSED MACHINE LEARNING TECHNIQUES

To check performance of the proposed heart disease risk assessment model, we use the various measures which are explained as follows:

a) Error Matrix: Error matrix also called as confusion matrix is a principal source of performance measurements in classification problems. Below given Table2 shows the two class confusion matrix which provides insights of the

types of errors being made by a classifier. The basic terminology used in confusion matrix is as follows

- True positives (TP): if an algorithm correctly classifies the diseased cases then it is True Positive.
- True Negative (TN): If the algorithm correctly predicts the not diseased cases then it is called as True Negative.
- False Positives (FP): when an algorithm falsely classifies the diseased cases as not diseased then it is called as false positive or Type I error.
- False Negative (FN): If an algorithm wrongly classifies the not diseased cases as diseased then it is called as Type II error.

**Table2. Error matrix for the classification problem**

		Predicted Classes	
		Positive	Negativ
Actual Classes			e
	Positive	True	False
		Positive	Positive
	Negativ	False	True
	e	Negativ	Negativ
		e	e

b) Accuracy: is the total percentage cases that are correctly classified by an algorithm.

$$Accuracy = \frac{TP+TN}{TP+FP+TN+FN} \text{-----equation1}$$

c) Sensitivity: is the ratio of diseased cases that are correctly identified. It is also called as sensitivity or true positive or recognition or recall rate.

$$recognition\_Rate = \frac{TP}{TP+FN} \text{-----equation2}$$

d) Specificity: is the ratio of patients without the disease that are correctly identified.

$$Specificity = \frac{TN}{TN+FP} \text{-----equation3}$$

e) Precision: precision means if an algorithm predicts yes and how often is it correct.

$$Precision = \frac{TP}{TP+FP} \text{-----equation4}$$

**V. HEART DISEASE EVALUATION THROUGH MACHINE LEARNING TECHNIQUES**

We applied decision tree, random forest and Support vector machine algorithms to build risk assessment model that would assist in early recognition of heart disease patients with optimal accuracy based on significant risk factors.

Decision Trees are a type of supervised techniques where the data is continuously split according to a certain conditions. In decision tree there are two entities, namely

decision nodes and leaves. The nodes define the conditions where to split and leaves represent final results. Decision Tree algorithm creates a model that predicts the value of a target variable by learning simple decision rules inferred from the data features [20, 22, 23]. The recognition rate, precision, sensitivity, and AUC results of decision tree algorithm are shown in below given Table3.

Support Vector Machine is a discriminative algorithm that takes labelled training data and produces optimal hyperplanes as output which categorizes the unknown examples. SVM supports both regression and classification tasks and can handle both continuous and categorical data types [16]. The performance results of SVM algorithm is shown in below given Table3. To achieve the maximum performance results from SVM algorithm we hyper-tune two parameters, "C", and 'kernel' of SVM algorithm.

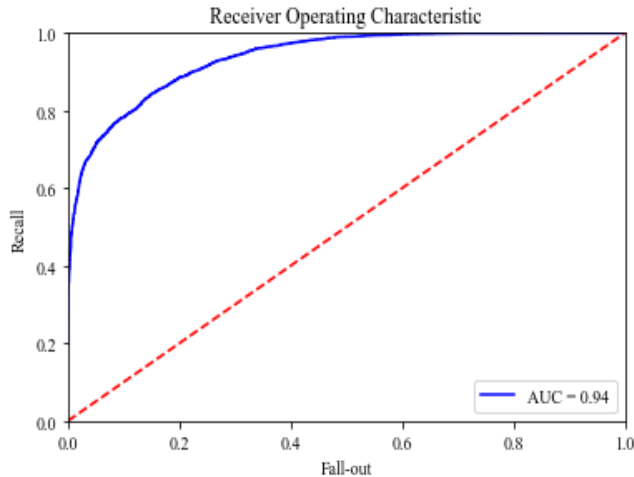
Random Forests are an ensemble of simple tree predictors that can be used for both classification and regression techniques. Random forest classifier creates a multitude of decision trees from randomly selected training set.

In random forests classification process each decision tree votes and the aggregated votes decide the final class of the test object and in regression process mean prediction or regression of the individual trees is calculated [17]. The performance metrics of random forest algorithm after hyper-parameter tuning are shown in below given Table3.

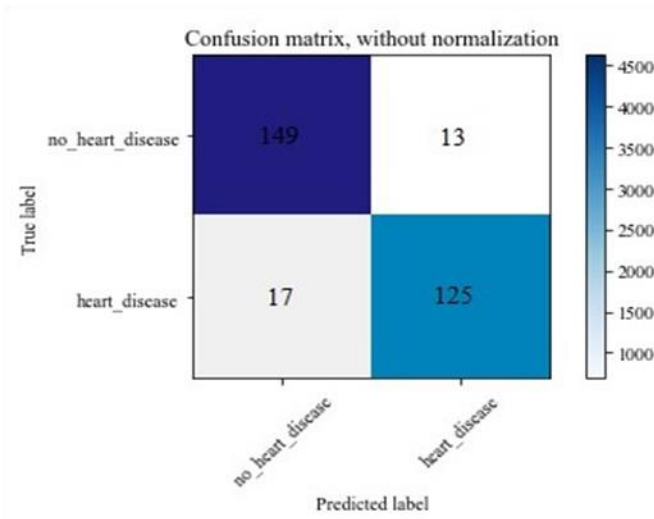
**Table3 performance metrics of the algorithms for heart disease prediction**

Algorithm/s	Recognition Rate	Precision	Sensitivity	AUC
Decision Tree	0.8761	0.8878	0.8821	0.88
Support Vector Machine	0.8836	0.8923	0.8857	0.90
Random Forest	0.9042	0.9197	0.8975	0.94

We import Scikit-Learn library to generate the AUROC (Area under the Receiver Operating Characteristics) performance measurement to see probability curve and measure of separability. Below given fig.2 shows ROC curve obtained from random forest algorithm with AUC value of 0.94. The Matplotlib library is imported for visual display of confusion matrix of random forest algorithm shown in below given fig.3



**Fig.2 AUROC representation of Random Forest Algorithm**



**Fig.3 Confusion Matrix of Random Forest Algorithm**

**VI. CONCLUSION AND FUTURE WORK**

Healthcare industry is immersed with raw medical data and to transfer this raw data into functional knowledge we use the machine learning techniques. Stimulated by the growing heart disease mortality rates and its overall burden on all over the world, we seek to develop a model that would help in the early prognosis and identification of heart disease victims. Although the newer diagnostic tests and therapeutic technologies have now become the standard of care, but these tests are costly that restrain their use at public-level screening evaluations. In our research work we develop the heart disease risk assessment model implemented in Jupyter notebook web application. We mine the Cleveland heart disease dataset using Random Forest, Decision Tree, and Support Vector Machine techniques to find out if a person having various personal

characteristics and symptoms, will have heart disease or not. We compute recognition rate, precision, sensitivity and AUC for each method using out-of-sample testing to check how accurately a predictive model will perform. It is worth to emphasize that in most cases hyper-parameter tuning is a prerequisite to get robust results out of these techniques. Experimental results show that random forest algorithm outperform other algorithms with the best recognition rate, precision, sensitivity and AUC. We simulate the accomplished outcomes against the prevailing research; the outcomes obtained are, to the finest of our observation, greater than published values in the literature. For future enhancement, we would prefer to improve the proposed work using large real datasets entailed with the varying number of attributes. We would apply different algorithms for heart disease predictions that will provide the exact diagnosis so to help in reducing mortality rates and economic burden caused by the disease.

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# Perception for Adoption of International Financial Reporting Standards for Small and Medium Sized Entities in India

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**Abstract:**-- Small and medium sized enterprises play a very important role for the development of an economy. They not only provide large employment opportunities but also helps in industrialization, more equitable distribution of national income, creation of wealth and reducing regional imbalances. According to estimates SME's generate around 100 million jobs by employing almost 40% of India's workforce and contribute around 8% of India's GDP. Indian SMEs generate highest employment after agriculture. SMESs often face the problems of raising funds from banks or other financial institutions especially for their high risk projects. The inception of common accounting principles will help SMEs in comparability of their financial statements globally and will also help them in raising funds. On 1st July 2009, IASB issued a single set of global reporting standards called IFRS for SMEs, a separate code of GAAP applicable only to SMEs around the globe. Many companies regardless of their size are compelled by legal rules of a specific country in which they run to make financial statements that are in conformity with their particular set of rules. As stated by IASB almost 95% of the companies of the world are qualified to use IFRS for SMEs. One of the main reason to adopt IFRS for SMEs is that of better access of capital because most of the SMEs often face the problem of capital because they don't have proper books of accounts, not having valid bills and because of the insufficiency of capital SMEs often face the problem of investment and growth. This paper will study the current situation of SMEs accounting and financial reporting and what are the views of SMEs, Chartered Accountants, academic experts regarding these standards for SMEs and whether SMEs are ready to adopt it. This Paper is based on a questionnaire based survey investigating the appropriateness of the IASB proposed standards for SMEs

**Index Terms:** SMEs, IFRS for SMEs, GDP, GAAP, IASB

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## I. INTRODUCTION

IFRS plays a very vital role in uniformity of accounts at global level. IFRS for SMEs have been designed so that SME's can also face the global market and have uniformity in reporting but implementation of IFRS on SMEs is not an easy task. Different user requirements, cost involved in adopting IFRS and the lack of knowledge are some of the strands which dissuade the adoption of IFRS for SMEs. As per Economic Survey 2017-18, credit given by banks depicts that out of total outstanding credit of Rs 26,041 billion as in November 2017, 82.6% of the amount was lent to large enterprises and MSMEs got only 17.4 % of total credit. We all know that the contribution of MSMEs in India is remarkable. Not only they have contributed significantly to country's GDP but also helps in creating immense employment opportunity but still the progress of MSMEs is not up to the mark. The economic survey of 2017-18 shows that because of the insufficiency of credit MSMEs are not able to enlarge their businesses. In spite of various attempts by Ministry of Small and Medium Enterprises, SIDBI and help given by RBI to include them under priority sector still there continues a problem of huge demand supply mismatch in small enterprises. Main reason

for the incompetency of banks to bridge this gap is the risk of credit involved in financing MSMEs because these enterprises does not maintain proper books of accounts, valid bills, proper accounting system etc. So because of all these reasons IFRS for SMEs have been introduced by International Accounting Standards Board (IASB). IFRS for SMEs will help enterprises to maintain proper books of accounts. It will also help entities in comparison of their financial statements globally. IFRS for SMEs are set of standards that are designed specifically for small and medium sized entities. We have full IFRS but full IFRS have been designed with the objective of providing an accounting framework for large publically accountable entities that are generally listed companies and they are developed with that in mind as a consequence when people started using full IFRS they realized that there was a need for something different for smaller companies and IASB responded to international demand for something to cater for smaller side of industry. So IFRS for SMEs are essentially a set of standards that cater to the very specific requirements of smaller companies. Financial statements are prepared to cater to the requirements of users of financial statements. Now smaller companies tend to find that they have different user base. Different user base

because they are closer to the entity, they have the better understanding of the entity, they have more ability to ask the questions to the entity directly. Smaller companies tend to have less complex transactions, less complex activities and they also tend to have less resources. It is a self-contained standard so it is a complete independent from full set of standards. As a company who is using IFRS for SMEs will never have to look at full set of standards.

IFRS for SMEs are used in almost 80 countries and have been converted in almost 24 languages. Besides these standards range just 230 pages in comparison to complete IFRS which is almost of 3700 pages. IFRS for SMEs have less than 300 disclosures whereas in full IFRS there are around 3000 disclosures.

IFRS for SMEs is a reformed and simpler version of full IFRS focused on gathering the needs of private companies financial reporting. It will help SMEs to ameliorate the burden of financial reporting as IFRS for SMEs is in itself an independent global accounting and financial reporting standards that can be applied in financial reporting by SMEs. IFRS for SMEs are made by IASB and are made specially to fulfil the needs of small and medium sized enterprises and can be used by any non-public entity. The approach of IFRS for SMEs have caused turmoil in the economy due to various reasons; the high cost, lack of knowledge, riskiness of new system and the influence which the new standards will have on users need are some of the crucial factors which SMEs have to contemplate. At the starting point IFRS for SMEs have removed topics that are not relevant for smaller companies. It simplified much of the drafting, much of the language, removed much complex options that are otherwise available in full IFRS. Because of the different user requirements same level of disclosures are not necessary so disclosures requirements are considerably simplified as compared to full IFRS. IFRS for SMEs are currently permitted or acquired in 80 different jurisdictions so it gives you an idea of the geographical spread. Within those individual jurisdictions we generally found that there are far greater than smaller companies than large companies

IFRS for SMEs are a solitary set of standards which are being provided by IASB which means that these standards are distinct set of standards from full IFRS. In these standards the topics are divided into sections unlike in IFRS. They include sections for different topics. For e.g. IAS 1 in case of IFRS deals with presentation of financial statements but in case of IFRS for SMEs there are sections from 1 to 6 which deal with the presentation of financial statements. IASB has made extensive amendments in IFRS for SMEs. These were issued in 2009 and the amendments came up in 2016. Significant changes were made in 27 sections of IFRS for SMEs. IASB has given considerable time for this changeover and the accounts which are

beginning on or after 1st January 2017 are required to apply these amendments.

#### **IFRS for SMEs**

The definition of an SMEs has been very different across geographies. Various countries have lot of turnover thresholds, lot of quantitative criteria to define SMEs. In India there is a quantitative criterion to define SMEs

“An SME is defined as an entity that:

- Does not have public accountability and
- Publishes general-purpose financial statements for external users.

Public accountability is further defined as an entity that:

- Has debt or equity instruments traded in a public market (or it is in the process of issuing such instruments) or
- Holds assets in a fiduciary capacity for a broad group of outsiders as one of its primary businesses.”

“The spread of IFRS for SMEs limits its use only to those enterprises which fulfils the criteria of the definition. It is clearly mentioned that enterprises which do not fall under the definition cannot claim the conformity with IFRS for SMEs even if they are allowed to do so in their jurisdiction”

General purpose financial statements are those statements which are available to a larger level of stakeholders who cannot demand a separate report and fiduciary capacity includes Banks, Insurance companies, Mutual funds which are not listed but are accountable to the public. They raise money from the public and public are very much dependent on them because even if bank is not listed but people have their deposits in the form of saving account or as fixed deposits. So even though they are not listed but they are required to give detailed disclosures. If an entity is not able to fulfill both these criteria for SMEs, they cannot claim the compliance

In case of separate financial statements, the parent company needs to examine its status based on its sole activities rather than looking from the viewpoint of the entire group. Suppose parent company is not doing any kind of public activity and it is preparing general purpose financial statements but is having some subsidiary which is doing business in respect of Bank or it is listed then in such a case the parent company can opt for IFRS for SMEs because it is not publically accountable in its own business and it is preparing general purpose financial statements which means it can claim the compliance of IFRS for SMEs even if its subsidiary is listed but it is applicable only in the case of separate financial statements not in case of consolidation. In case of consolidation it cannot be complied because in consolidation we are thinking as single entity. The same applies to subsidiary even if the entire group is applying IFRS the subsidiaries are having the liberty to apply IFRS for SMEs which means if there is parent which is applying full IFRS and it is having one subsidiary which is not publically accountable and is



preparing general purpose financial statements then in such a case it can apply IFRS for SMEs in their accounts For the first time a standard has been introduced for small and medium sized enterprises which is applicable globally. This standard gives great opportunity to SMEs to prepare something on a different scale and compare themselves with the SMEs of the rest of the world. The other advantage of adopting IFRS for SMEs is that this is the standalone statement so there is no cross reference to full IFRS so this brings a lot of acceptability because there is no need of going through a larger volume of principle based standard.

**LITERATURE REVIEW**

Adetula, Owolabi, Folashade, Onyinye Oyeoka Ifeoma (2014) in their study which was carried out in Nigeria from the standpoint of accountants of small firms to examine IFRS for SMEs it was found out that IFRS for SMEs are pertinent to SMEs in Nigeria as small businesses in Nigeria enjoy the benefit and easy access of international investments

Albu (2010) did the study on comparison of existing accounting of small entities with IFRS for SMES in Romania by taking interviews with accountants, auditors and regulators. They found that to abrogate the current rules will be very difficult in Romania. Rule based approach of small business accountants and the inadequacy of their professional judgement are the most alarming factors in the execution of IFRS for SMEs.

Bunea-Bontus, C. A., and Petre, M. C. (2010) studied that financial and resource cost needed to bring the change in accounting standards are sometimes harder on smaller firms. The barriers which the small firms face are high cost of training, unimposing attitude of management of SME, big cost of employing and keeping accountants with IFRS proficiency by small businesses and the present dearth of accountants who understands IFRS

Müllerova, L., Pasekova, M., and Kubickova, D. (2010) in their study found out that IFRS for SMEs is less complicated as compared to full IFRS. Many of the topics which are included in full IFRS have been removed in IFRS for SMEs. Secondly many principles for calculating assets and liabilities; income and expenses in complete IFRS are made easier under IFRS for SMEs. Thirdly the disclosures under IFRS for SMEs are remarkably reduced from 3000 disclosures to less than 300 in IFRS for SMEs. Fourthly the standards are written in an understandable and easy translatable language without much composite details which are included in full IFRS. To lessen the reporting load for SMEs emendation to the standards will be restricted to once every three years.

Jacob, R. A., and Madu, C. N. (2009) found out that IFRS for SMEs can play a very important role in helping SMEs to have better access to capital because IFRS for SMEs will ameliorate the quality of reporting as contrast with many existing national accounting standards. Another reason will be improved comparability, comprehensibility and clarity for users of accounts both globally and domestically. All this will raise then confidence in financial statements of SMEs and will guide in making better investments decisions and will make sure of making proper allocation of resources across international economy.

Delloitte have conducted a research in 2009 in order to find out “the challenge of US GAAP and the level of interest in IFRS for SMES. According to the survey 43% of the answerers were not aware of IFRS for SMES, about 2/3 of the respondents were not in the favor to adopt IFRS unless it is mandatory and smaller firms were more keen to have a distinct set of IFRS

Nerudova, D. & Bohusova, H. (2008) they did a study on Czech SMEs and found out that the major difficulty will be the suitability of IFRS for SMEs in the execution process. As stated by their research the first approach of the IFRS for SMEs will be costly and time engrossed. But later the profits are anticipated to surpass the cost.

**RESEARCH METHODOLOGY**

The sample consists of in-depth interviews of 50 Chartered Accountants. The interviews were taken during the month of July, August and September 2018. Because of the lack of knowledge and awareness of this concept the interviews were limited only to the opinions of Chartered Accountants. The responses of the professionals were measured on five point Likert scale (1=Strongly agree, 5= Strongly Disagree)

**Table 1. Descriptive statistics**

Characteristics	Number	%
<b>Experience</b>		
1-5 years	12	24.0
6-15 years	9	18.0
More than 15 years	29	58.0
Total	50	100
<b>Area of Specialization</b>		
Accounts	23	46.0
Taxation	27	54.0
Total	50	100

**RESULTS AND DISCUSSIONS**

**Awareness regarding IFRS for SMEs**

During the interviews the respondents were asked that whether they are aware of these standards for SMEs. The majority of the respondents were not even aware of IFRS for SMEs and what it is. In fact, most of the CAs have no or very moderate knowledge of and information that IASB has introduced a standalone standard for SMEs. Awareness of the professionals plays a very important role for the successful adoption and implementation of the standards. Because of the lack of knowledge and information the respondents were not in the favor of adopting these standards for SMEs

Perception of the respondents regarding adoption of IFRS for SMEs

The perceptions of the professionals were also ascertained. The results show that because of the lack of knowledge and information the respondents were pessimist about the implementation process and most of them was of the view that it will be a burden for the SMEs to adopt such standards.

The relationship between awareness and respondent’s perception of the implementation was measured by using Spearman’s rho correlation. (Table 2). The results show the negative relationship between the awareness regarding IFRS for SMEs and the perception regarding the implementation of IFRS for SMEs. These finding may show that as the knowledge and information level increases regarding IFRS for SMEs they will become more positive in adopting IFRS for SMEs

Table 2. Spearman’s rho correlation analysis

		Correlations	
		AWARENES S	PERCEPTIO N
Spearman's rho	AWARENESS	1.000	-.631**
	N	50	50
PERCEPTION		-.631**	1.000
	N	50	50

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**CONCLUSION**

It is very necessary to study SMEs specially for a developing country like India where SMEs give employment to almost 40% of India’s workforce and contribute 8% to GDP.

As far as IFRS for SMEs are concerned the content is very different. The requirements are much more simplified. This is a first time that there is standard for small and medium sized entities and which is applicable globally. So it gives an immense opportunity to SMEs to prepare on a different scale and compare themselves with the SMEs of the rest of the world. The other thing about these standards are that it is standalone statement so there is no cross reference to full IFRS. So in other words it is more like a self-contained IFRS for small entities where there is no cross referencing with the full IFRS so that kind of bring a lot more acceptability for this because instead of going through the larger volume of principle based standard we are going to do in much simpler way. There are many SMEs who deals in foreign exports and imports. So IASB has taken such initiative so that SMEs could also benefit by providing internationally comparable accounting information to their stakeholders. The problem which came up during the interview is that there is a lack of awareness for these standards. Most of the SMEs don’t know what IFRS for SMEs is. Introducing new standards for SMEs will not solve the purpose because SMEs are already using their national accounting standards and are satisfied with its use. Attempt should be made for bringing the awareness among SMEs. Seminars, training programs, workshops and conferences can be arranged in regard to bring the awareness of IFRS for SMEs. The biggest consternation that SMEs have are the difficulties and cost involved with the implementation of IFRS for SMEs. Guidance should be given to SMEs that neither IFRS for SMEs is a complex set of standards nor the cost involved in the adoption will be so high. In the initial stage of adoption complexities will appear but later on companies can use it in a normal way as they use their national accounting standards but with improved features in terms of quality and comparability.

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# Reliability Evaluation of linear transmission line tower structure for random wind loading under parameter uncertainty

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**Abstract:** -- Reliability evaluation of any structure is very essential to know the present condition of the structure as well as to avoid the failure of the structure. Transmission towers are a vital component and management needs to assess the reliability and safety of these towers to minimize the risk of disruption to power supply that may result from in-service tower failure. The proposed paper deals with the evaluation of conditional reliability and unconditional reliability estimation in frequency domain under random dynamic wind excitation considering parameter uncertainty. A three dimensional linear elastic multi degree of freedom model of transmission line tower has chosen for the present work. The reliability is evaluated using conditional crossing rate following the Vanmark's modification. The perturbation based stochastic finite element method is utilized in deriving unconditional reliability. Reliability has evaluated based on basically maximum displacement criteria of each degree of freedom. Results are presented to compare the change in reliability in each degree of freedom and associated variance of reliability due to parameter uncertainty.

**Key Words:** Dynamic wind, Random Excitation forces, Frequency domain, Parameter uncertainty, Reliability

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## 1. INTRODUCTION

The deterioration of civil structures due to bad weather condition may lead to structural damage and failure, associated with the events such as member fracture, column buckling etc. Overhead transmission tower-line systems are critical infrastructure for electrical power transmission and are used throughout the world. Overhead Transmission line tower systems are prone to the dynamic excitation, such as wind, earthquake, and iced shedding. In reality, there exists a strong interaction between the motion of the truss tower and that of the transmission lines subjected to dynamic loading. The failure of the towers under dynamic loading has been recognized in many literatures. Therefore, it is very much important to assess the dynamic performance of transmission tower-line system. The absolute safety of a structure cannot be guaranteed because of unpredictability of future loading condition, inability to obtain and express the in place property accurately, the use simplified, limitations in numerical methods and human factors. However, the failure probability of structure can be limited to a reasonable level. Structural systems consist of many interconnected structural components. Therefore, it is important to distinguish between the reliability of the entire system. While considering system reliability, it is important to recognize the failure of a single component which may or may not mean failure of the structure as a whole. Consequently the reliability of an individual

member may or may not be representative of the reliability of entire structure system. Seismic reliability analysis of structures, Seismic risk, reliability, safety and fragility analysis of structures are loosely used in the literature to denote seismic probability of failure of structures, failure being defined by the different limit state conditions. In seismic reliability analysis of structures, the uncertainties of earth quake and ground intensity parameters are considered to affect the reliability estimates significantly and assumed more important over the uncertainties inherent in the occurrence of earthquake and in defining its different intensity parameter. However, many problems are also being solved in which uncertainties of material behaviours and modelling of the physical phenomena is also included along with the uncertainties of ground motion and earthquake. Peterka and Cermak (1975) proposed a technique to calculate the peak wind pressure on building which is expected to act on the structure during the lifetime. Yinghong et al.(2000)proposed an improved algorithm for digital simulation of the stochastic wind velocity field on long – span bridges, when the cross-spectral density matrix of the field is given. Ricardo and Riera (2002)proposed the method of analyzing the structures subjected to random wind loading by simulation in the frequency domain. Choi and Hidayat (2002) studied the dynamic response of structure to different types of wind and investigated that the responses of large-scale (monsoon wind) as well as small-scale wind (Thunderstorm) of a SDOF structure. Ronaldo et al.

(2003) proposed an analytical-numerical model to a chosen type of steel transmission line towers (TLT) dynamic characteristics of the towers and the lateral movement of the electric cables under the action of wind forces. Ricciardelli (2003) studied the wind loading mechanism of the long span bridge deck box sections, and the mechanism of the wind excitation is investigated through the analysis of the mean and the fluctuating deck pressure distributions. Kanda et al. (2003) has studied the probabilistic model of the gust buffeting of structures that takes into account the uncertainties inherent in the atmospheric turbulence, structural, aerodynamic parameters and the randomness of the mean wind velocity. Jakobson and Tanaka (2003) predicted that the flutter wind speed is associated with a number of uncertainties, so that it would be natural to treat the critical wind speed as a stochastic nature of the (extreme) wind speed. The probability of the bridge failure due to the flutter can be defined as probability of the flutter speed exceeding the extreme wind speed at the bridge site for a given period of time. Abhijit Chaudhuri and Subrata Chakraborty (2004) proposed Sensitivity evaluation of response under static and dynamic load is proved to be an essential part of the optimization and reliability analysis of structure. Yang et al. (2004) presented a benchmark problem for the response control of wind excited tall building. Qu and Chen (2005) gave a rational analytical method to determine dynamic response of wind excited large truss towers installed with friction damper and investigate the effectiveness of the friction dampers. J S Ali et al., (2006) studied the stochastic dynamic action of wind different type of structures. Pourzeeynal and Datta (2005) performed a fatigue reliability analysis of suspension bridge due to gusting of wind was presented by them combining concept of bridge aerodynamics, fatigue failure and reliability analysis. Cheng et al. (2005) showed a stochastic finite – element based algorithm for the probabilistic free vibration and flutter analysis of the suspension bridge. Jie Li et al. (2007) explored the wind stochastic field from a new viewpoint of stochastic Fourier spectrum (SFS). Lin-lin Zhang et al. (2008) proposed wind stochastic field from a new viewpoint of stochastic Fourier spectrum (SFS). The results demonstrate that the PDEM is applicable and efficient in the dynamic response and reliability analysis of wind-excited tall building. Ahsan Kareem (2008) proposed numerical simulations of wind loads and their effects are critical in the design of structures to ensure their safety under winds. The objective of the present work is to study the stochastic dynamic analysis of a transmission line tower model in frequency domain subjected to few well established random wind load model and subsequent evaluation of reliability. The sensitivity of reliability considering the uncertainties associated with both the geometric and material properties are also to be studied.

2. THEORETICAL FORMULATION

The equation of motion

$$([K] - \omega^2[M] + i\omega[C])\{H_u(\omega)\} = -[M]\{L\}\{\ddot{U}_g(\omega)\}, \text{ i.e. } [D(\omega)]\{H_u(\omega)\} = \{F(\omega)\}, \tag{2.0.1}$$

$$\text{where, } [D(\omega)] = -\omega^2[\bar{M}] + i\omega[\bar{C}] + [\bar{K}]$$

where,  $[D(\omega)]$  is the dynamic stiffness matrix and  $\{F(\omega)\}$  is the forcing vector. All these matrix and vectors are the functions of either of any design variable or in combination, which may be Young’s modulus (E) and/or Poisson’s ratio, mass density (m), cross-sectional area, boundary conditions etc. if the depths  $\{d\}$  of beams and sides of columns are considered as design variables. Thus Eq.(3.5.2) can be explicitly re-written as,

$$[D(\omega, \{d\})]\{H_u(\omega, \{d\})\} = \{F(\omega, \{d\})\} \text{ or } \{H_u(\omega, \{d\})\} = [D(\omega, \{d\})]^{-1} \{F(\omega, \{d\})\}. \tag{2.0.3}$$

Power spectral density (PSD) function of the responses and spectral moments when the forcing functions on the right-hand side of Eq. (3.5.1) is non-stationary, the cross correlation matrix of responses can be expressed as

2.1 Conditional Reliability:-

$$\alpha(\bar{u}, t) = \frac{\sigma_u(t)}{2\pi\sigma_u(t)} \exp\left[-\frac{1}{2}\left(\frac{\bar{u}}{\sigma_u(t)}\right)^2\right] \tag{2.1.1}$$

The reliability is defined as the probability that the absolute value of the response process will not exceed a specified threshold level from time t = 0 to any time t. Then, the time dependent reliability of the structure based on the first passage failure criterion for double barrier problem can be expressed as

$$R_c(x_0, t) = R_c(x_0, 0) \exp\left(-\int_0^t \alpha(x_0, s) ds\right) \tag{2.1.2}$$

$$\alpha(x_0, t) = \frac{\sigma_x(t)}{2\pi\sigma_x(t)} \left( \frac{1 - \exp\left(-\sqrt{2\pi} \frac{x_0 (q(t))^{1.2}}{\sigma_x(t)}\right)}{\exp\left(\frac{1}{2}\left(\frac{x_0}{\sigma_x(t)}\right)^2\right) - 1} \right) \tag{2.1.3}$$

where,

$$q(t) = \sqrt{1 - \frac{\lambda_1^2(t)}{\lambda_0(t)\lambda_2(t)}} \tag{2.1.3a}$$

is called the measure of narrowness. Finally the reliability is evaluated using (2.1.3).

2.2 Uncertainty in the Structural Parameter

Any response variable which depends on the system parameter is uncertain can be expanded in the Taylor series about the mean value of the uncertain system parameter (with the assumption that the random variable is small).

Let the  $\Theta\{\Delta d\}$  is any such variable. Now the Taylor series expansion about the mean is

$$\Theta\{\Delta d\} = \bar{\Theta} + \sum_{k=1}^N \Theta^I_k \Delta d_k + \frac{1}{2} \sum_{k=1}^N \sum_{l=1}^N \Theta^{II}_{kl} \Delta d_k \Delta d_l + \dots, \tag{2.2.1}$$

where

$$\bar{\Theta} = \Theta(0), \quad \Theta^I_k = \left. \frac{\partial \Theta(\{\Delta d\})}{\partial d_k} \right|_{\{\Delta d\}=0}$$

and

$$\Theta^{II}_{kl} = \left. \frac{\partial^2 \{\Theta(\{\Delta d\})\}}{\partial d_k \partial d_l} \right|_{\{\Delta d\}=0} \tag{2.2.2}$$

The mean value of the dynamic stiffness matrix and its derivatives with respect to the uncertain parameters at the mean system parameters can be derived from the equation (2.1.3) as

$$[\bar{D}(\omega)] = [D(\omega, 0)] = -\omega^2 [\bar{M}] + i\omega [\bar{C}] + [\bar{K}] \tag{2.2.2a}$$

$$[D^I_k(\omega)] = -\omega^2 [M^I_k] + i\omega [C^I_k] + [K^I_k] \tag{2.2.2b}$$

$$[D^{II}_{kl}(\omega)] = -\omega^2 [M^{II}_{kl}] + i\omega [C^{II}_{kl}] + [K^{II}_{kl}] \tag{2.2.2c}$$

If the Young's Modulus is taken as the random parameter, the first order derivative of the mass matrix vanishes and the second order derivative of the mass, damping and stiffness matrix become zero i.e.  $[M^I_k] = 0$  and

$[M^{II}_{kl}] = [C^{II}_{kl}] = [K^{II}_{kl}] = 0$ . The derivatives of the force vector also vanish in the case. With the strength of the equation, the mean value and the derivatives of the  $\{H(\omega)\}$  can be obtained from equations(3.5.4)

$$\{\bar{H}(\omega)\} = [\bar{D}(\omega)] \{F(\omega)\} \tag{2.2.3a}$$

$$\{H^I_{u,k}(\omega)\} = [\bar{D}(\omega)]^{-1} (-[D^I_k(\omega)] \{\bar{H}(\omega)\}) \tag{2.2.3b}$$

$$\{H^{II}_{u,kl}(\omega)\} = [\bar{D}(\omega)]^{-1} (-[D^I_k(\omega)] \{H^I_{u,l}(\omega)\} - [D^I_l(\omega)] \{H^I_{u,k}(\omega)\}) \tag{2.2.3c}$$

Similarly from the expression of the output PSDF function the derivatives can be obtained as:

$$[\bar{S}_{xx}(\omega_1, \omega_2)] = \{H_x(\omega_1)\} S_{\ddot{u}_g \ddot{u}_g}(\omega_1, \omega_2) \{\bar{H}_x^*(\omega_2)\} \tag{2.2.4a}$$

$$[S^I_{xx}(\omega_1, \omega_2)] = \{H^I_{x,k}(\omega_1)\} S_{\ddot{u}_g \ddot{u}_g}(\omega_1, \omega_2) \{\bar{H}_x^*(\omega_2)\} + \{\bar{H}_x(\omega_1)\} S_{\ddot{u}_g \ddot{u}_g}(\omega_1, \omega_2) \{\bar{H}_x^{*I}(\omega_2)\} \tag{2.2.4b}$$

$$[S^{II}_{xx}(\omega_1, \omega_2)] = S_{\ddot{u}_g \ddot{u}_g}(\omega_1, \omega_2) [\{H^{II}_{x,kl}(\omega_1)\} \{\bar{H}_x^*(\omega_2)\} + \{H^I_{x,l}(\omega_1)\} \{\bar{H}_x^{*I}(\omega_2)\} + \{H^I_{x,k}(\omega_1)\} \{\bar{H}_x^{*II}(\omega_2)\} + \{H_x(\omega_1)\} \{\bar{H}_x^{*II}(\omega_2)\}] \tag{2.2.4c}$$

3.RESULT & DISCUSSION:

To illustrate the proposed formulation based on frequency domain analysis and total reliability of the 33kV electric transmission tower, a numerical code is developed in MATLAB 9.2 platform based on the theoretical formulation.

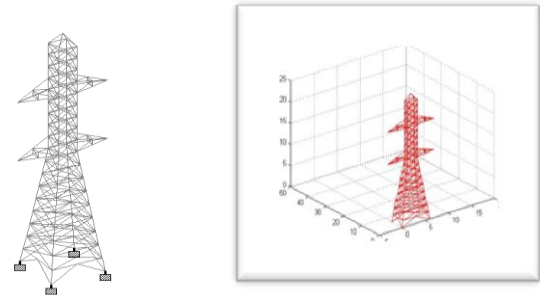


Fig 3.1: Transmission tower model in SAP & MATLAB

Height (m)	Material	Base Width (m)	Base Area (m <sup>2</sup> )	Length of wing (m)	Mass Density (kg/m <sup>3</sup> )	Young Modulus (GPa)
30	Steel	6	36	4.12	7850	200

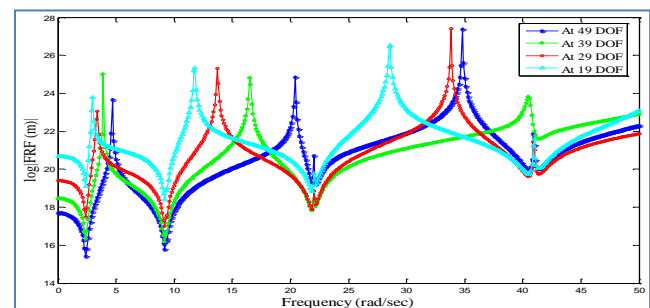


Fig 3.2.: Plot of FRF (logarithm scale) with frequency at few DoF.

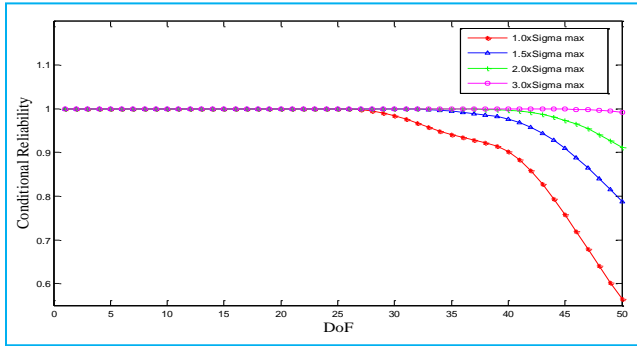


Fig 3.3: Conditional reliability in different Barrier level for Wind considering Rayleigh's damping coefficients Alpha is  $4.774 \times 10^{-4}$  and Beta is 0.0947 respectively.

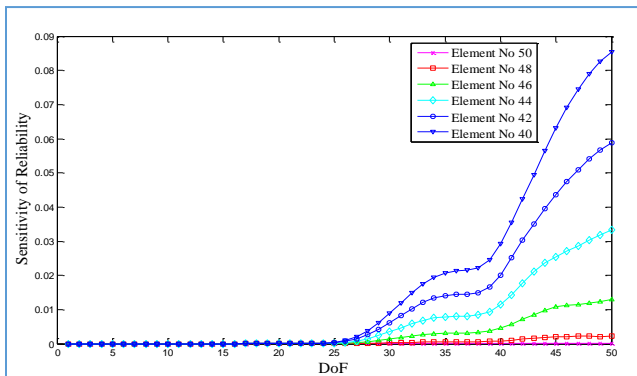


Fig 3.4: Plot of sensitivity of reliability with respect to each DoF considering moment of inertia of upper level elements under Wind.

**CONCLUSION**

From the above study it can be concluded that Reliability at different degrees of freedom of the structure largely depend on the crossing level for any stochastic random process. The reliability of the structure at different DOF does not change if no of damaged element is less and The Reliability value gradually reduced in all DOF if most of the member in the structure is damaged.

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# Rule Based Parts of Speech Tagger for Chhattisgarhi Language

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**Abstract:**-- There is an increasing demand for machine translation systems for various regional languages of India. Chhattisgarhi being the language of the young Chhattisgarh state requires automatic languages translating system. Various types of natural language processing (NLP) tools are required for developing Chhattisgarhi to Hindi machine translation (MT) system. In this paper, we are presenting rule based parts of speech tagger for Chhattisgarhi language. Parts of Speech tagging is a procedure in which each word of sentence is assigned a tag from tag set. The Parts of Speech tagger is based on rule base which is formed by taken into consideration the grammatical structure of Chhattisgarhi language. The system is constructed over corpus size of 40,000 words with tag set consists of 30 different parts of speech tags. The corpus is taken from various Chhattisgarhi stories. The system achieves an accuracy of 78%.

**Key Words:** Chhattisgarhi, Machine Translation, Natural Language Processing, Parts of Speech tagger, Rule Based System.

## 1. INTRODUCTION

Most of the regional languages are low resources language. Some Indian languages are called low resource language as grammatical rules and literary work related to these languages is not present in public domain. Pre-processing task like POS tagging is a challenging task for these languages. In POS tagging process a specific grammar class which is called as tag is assigned to a word in the sentence from tag set. Tag set is a collection of grammar class which consist of English abbreviations like N(Noun),VM(Verb), PP(Preposition) etc.[1]. Parts of Speech (POS) tagging is a process of identifying the suitable class of tag for a word from a given tag set. It is very important task of pre-processing activity in machine translation. Machine translation systems take a source language and convert it into target language. Various tools are required in machine translation systems like tokenize, POS tagger, morphological analyzer and parser. POS tagger comes under pre-processing phase of machine translation system. Most of the regional languages are low resources language. Some Indian languages are called low resource language as grammatical rules and literary work related to these languages is not present in public domain. Pre-processing task like POS tagging is a challenging task for these languages. In POS tagging process a specific grammar class which is called as tag to a word in the sentence from tag set. Tag set is a collection of grammar class which consist of English abbreviations like NN(Noun),VM(Verb),PP(Preposition) etc.[2].

Example 1: हमन दुनो बैलगाड़ी म रायपुर जाबों

WORDS	हमन	दुनो	बैलगाड़ी	म	रायपुर	जाबों
TAGS	PRP	N	N	PP	N	VM

Table (a): Chhattisgarhi words and its tags taken from Chhattisgarhi tag set.

There are various approaches for POS tagging: Rule based approach, Statistical approach and Hybrid approach [2, 3]. Accuracy factor is the most important factor in deciding the performance of POS tagger [2].

The Rule Based POS tagging approach is based on grammar rules that are framed by observing the grammatical structure of any language. These rules can be written in form of production grammar rules. Example:

“A proper noun is always followed by a noun” as in the Table (a) हमन (Pronoun) is followed by दुनो (Noun)

There are some limitations of rule based approach; the main limitation is the formation of rule base. In this a rule is formulated for each condition [2, 3].

The Statistical Based POS tagging approach is based on two important factors. These are: Frequency and probability of occurrence of any word .In this approach most frequently used tag for a specific word in the annotated training dataset is used to tag that word in the un annotated dataset .The limitation of this system is that some sequences of tags can come up for sentences that are not correct according to the grammar rules of a certain language [3].

In Hybrid Approach the probability theory of statistical method is used to train the corpus and then the set of production rules are applied on the testing corpus for tagging of testing corpus [2, 3]. POS tagging process is broadly classified into two models: Supervised Model and Unsupervised Model [4]. Classification of POS Tagging is shown in Figure 1.

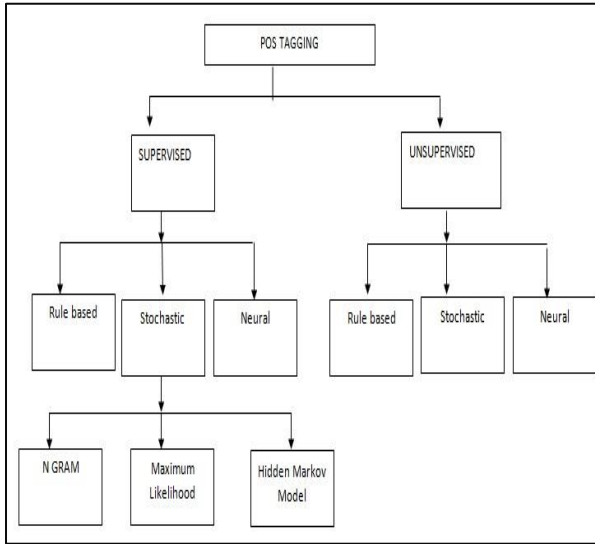


Figure 1: Classification of POS Tagging

2. LITERATURE SURVEY

Research has already been done in morphologically rich Indian languages like Hindi, Bengali, Telugu, Marathi, Tamil, Urdu, Gujarati, Kannada, Malayalam, Odia and Punjabi. There are some low resource languages in India like Awadhi, Magahi, Nimadi, Bhojpuri, and Chhattisgarhi for which machine translation tools have not been developed yet.

A POS tagger was developed using conditional random field for Bengali language In this system contextual information of the words has been used to search different POS tags for various tokenized words. The system was evaluated over a corpus of 72,341 words with 26 different POS tags and system achieved the accuracy of 90.3% [5]. A POS tagger was developed using Hidden Markov Model for Hindi, which uses a Naïve stemmer as a pre-processor based on longest suffix matching algorithm to achieve accuracy of 93.12% [6].

A POS tagger was developed using Hidden Markov Model for Assamese. Unknown words were tagged using simple morphological analysis .The system was evaluated over a corpus of 10,000 words with 172 different POS tags and system achieved the accuracy of 87% [7].

A POS tagger was developed using Hidden Markov Model for Hindi .They uses Indian language POS tag set to develop this tagger and achieved the accuracy of 92% [8].

3. METHODOLOGY

This system is developed using rule based approach and tagging will be done by the help of POS tag made in consultation with Chhattisgarhi linguistics expert. The system mainly works in two steps-firstly the sentences are spitted into words by the help of line splitter program and input words are found in the database; if it is present then rules are applied to tag to assign if a proper tag and if it is not found then UNK tag will be assigned to it.

3.1 Algorithm

The algorithm used for rule based part of speech tagger for Chhattisgarhi language is as follows:

1. Chhattisgarhi sentence is tokenized by the help of line splitter program.
2. The Tokenized Chhattisgarhi words are normalized.
3. Search the numbers and tag them by using regular expression.
4. Abbreviations are searched using regular expression.
5. In the database all the input words are searched and tag the word according to appropriate tag.
6. UNK tag will be given to the unknown words.
7. The tagged words are then displayed.

3.2 Rules that are applied to identify different tags

3.2.1 Noun Identification Rules

Rule 1: If word is adjective then there is high probability that next word will be noun.

For Example:-

असली बात ये हरे।

In above example असली is adjective बात is noun.

Rule 2: If word is relative pronoun then there is high probability that next word will be noun.

For Example:-

इही घर हरे जे ला तोखन बनाये हे ।

In above example इही and जेला is relative pronoun and घर and तोखन is noun.

Rule 3: If word is reflexive pronoun then there is high probability that next word will be noun.

For Example:-

ओ अपन धनी सन चल दिस।

In above example अपन is reflexive pronoun and धनी is noun.

Rule 4: If word is personal pronoun then there is high probability that next word will be noun.

For Example:-

ऐ मोर पुस्तक हे।

In above example मोर is personal pronoun and पुस्तक is noun

Rule 5: If current word is post position then there is high probability that previous word will be noun.

For Example:-

धनीराम रायपुर म रथे।

In above example रायपुर is noun and मैं is post position.

Rule 6: If current word is verb then there is probability that previous word will be noun.

For Example:-

तोरण नहाये बर गे हे।

In above example तोरण is noun and नहाये is verb.

Rule 7: If word is noun then there is probability that next or previous word will be noun.

For Example:-

सुरिवात बिलासपुर म पढ़ते।

In above example सुरिवात and बिलासपुर both are noun.

### 3.2.2 Demonstrative Identification Rules

Rule 1: If current word is pronoun in database and next word is also pronoun, then first word will be demonstrative.

For Example:-

ते कोन हरस।

In above example current word is कोन and next word is हरस and both are pronoun so ते is demonstrative.

Rule 2: If current word is noun in database and next word is verb, then previous word will be demonstrative.

For Example: -

ओ घर चल दिस।

In above example current word is घर which is noun and next word is चल which is a verb, so ओ is demonstrative.

### 3.2.3 Proper Noun Identification Rules

Rule 1: If current word is not tagged and next word is tagged as proper noun, then there is high probability that current word will be proper noun.

For Example: -

तोरण, बलदाऊ

In above example तोरण and बलदाऊ are proper noun.

Rule 2: If current word is name and next word is surname then we tag current and second word as single proper name.

For Example: -

सुरिवात राम साहू will be tagged as सुरिवातराम साहू where 'सुरिवातराम' is proper noun.

### 3.2.4 Adjective Identification Rules

Rule 1: There is more chance that a word before a verb is adjective.

सचिन तेंदुलकर बढ़िया खेलथे।

In above example बढ़िया is a adjective and खेलथे is a verb

### 3.2.5 Verb Identification Rules

Rule 1: If current word is not tagged and next word tagged as an auxiliary verb, then there is high probability that current word will be main verb.

For Example:-

ओ हा खाना खात रिहिस।

In above example खात is main verb and रिहिस is auxiliary verb.

## 4. RESULTS AND DISCUSSION

In order to test the system, few lines of a Chhattisgarhi story titled 'मौंगरा' is taken as an input sentence :

### Input Chhattisgarhi Sentence

आज सुरुत्ती हे न तउने पाके दियना के अंजोर ह रइपुर भर मं बगरे हवय।

### Output Chhattisgarhi Sentence

Chhattisgarhi Words	Tagging
आज सुरुत्ती हे न	आज <N_NN > सुरुत्ती
तउने पाके दियना के	<V_VM > हे
अंजोर ह रइपुर भर	<V_VAUX>न <PSP>तउने
मं बगरे हवय।	<R_PRP>पाके<CC_CCD> दियना<N_NN>के<PSP>अं जोर<N_NN>ह<CC_CCD> रइपुर<V_VM> भर<V_VAUX>मं<V_VA UX>बगरे<CC_CCD>हवय <V_VM>।<RD_PUNC>

Table1: Chhattisgarhi words and corresponding tags



Figure 2: POS Tagging of Chhattisgarhi sentence

### 5. CONCLUSION AND FUTURE WORK

In this paper Part of Speech tagger for Chhattisgarhi language by the help of using rule based technique has been discussed. The sentence is broken in to tokens by line splitter program The tokenized words are search in the database and then appropriate rules are applied to tag them. The system is constructed over corpus size of 40,000 words with tag set consists of 30 different parts of speech tags. The test data is taken from various Chhattisgarhi stories and system achieves an accuracy of 78%.

The main limitation of rule based part of speech tagger is that it completely depends on rule. If rule is not present for a word then it will not be tagger by the system due to this accuracy of system will decrease.

In future there is need to shift towards neural network based system so that test data can be automatically gets trained and by increasing the size of corpus the accuracy of system will also increase.

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Appendix

Sr. No	Category	Label	Annotation Convention	Example	
	Top Level	Subtype			
1.1	Noun	Common	NN	N_NN	किताब
1.2		Proper	NNP	N_NNP	रामबरन
1.3		Nloc	NST	N_NST	उप्पर, नीचे, आहीं, आधू, पाछू, बाहीं
2.1	Pronoun	Personal	PRP	PR_PRP	वे
2.2		Reflexive	PRF	PR_PRF	अपन, खुद के, सियम
2.3		Relative	PRL	PR_PRL	जउन, जेन
2.4		Reciprocal	PRC	PR_PRC	अपने करन, तुँहार कस, तोरे करन
2.5		Wh-word	PRQ	PR_PRQ	कब, कोन
2.6		Indefinite	PRI	PR_PRI	केईए कते, कोन
3.1	Demonstrative	Deictic	DMD	DM_DMD	उहाँ, इहाँ
3.2		Relative	DMR	DM_DMR	जउन, जेन
3.3		Wh-word	DMQ	DM_DMQ	केन, बुता, कते बुता
3.4		Indefinite	DMI	DM_DMI	कोन्हों, कोनो
4.1	Verb	Main	VM	V_VM	गिरन, गिन
4.2		Auxiliary	VAUX	V_VAUX	हे, रिहिस, होइस
5	Adjective		JJ	JJ	सुग्धर, बढिया, नोक
6	Adverb		RB	RB	जल्दी, लउहत
7	Postposition		PSP	PSP	ह ल, ले धर
8.1	Conjunction	Coordinator	CCD	CC_CCD	अउ, भलुक, धलो
8.2		Subordinator	CCS	CC_CCS	अगर, कहूँ यदि
9.1	Particles	Default	RPD	RP_RPD	तभो ले
9.2		Interjection	INJ	RP_INJ	अरे, हे
9.3		Intensifier	INTF	RP_INTF	अब्बड़, बड़, जंगी, नंगत
9.4		Negation	NEG	RP_NEG	नो, नइ, बिन
10.1	Quantifiers	General	QTF	QT_QTF	कुछु, चिटकुन, चिटिक
10.2		Cardinals	QTC	QT_QTC	एक, दो, तीन
10.3		Ordinals	QTO	QT_QTO	दुसरइया, तिसरइया
11.1		Foreign word	RDF	RD_RDF	
11.3		Punctuation	PUNC	RD_PUNC	!, ?

# The Study of Goods and Services Tax on Multinational Companies in India

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**Abstract:**-- Although India has third largest economic growth, it can be much faster if we had an ideal tax system which collects taxes at different stages of manufacture, supply, wholesale, retailing and final consumption. These tax paid at different stages is not on the entire price but only on the value added. Keeping this in mind a new taxation system known as Goods and Services Tax (GST) was introduced in India, in order to remove the previous tax system which misses lead things and slower the economic growth. Due to the new introduction of the taxation system, many sectors of business were affected. Multinational Companies (MNCs) also faced changes. Import-export of MNCs, Customs duty application on MNCs and various effects on various MNCs are the things covered in this paper.

**Key Words:** Multinational Companies (MNCs), Goods and Service Tax (GST), Integrated Goods and Service Tax (IGST), Fast-moving consumer goods (FMCG), Input Tax Credit (ITC).

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## INTRODUCTION

In the nation-building series, knowingly or unknowingly people move towards the path that leads towards the new opportunities which can be helpful in building the dreams of an individual. Something similar happened in our country which changed the whole marketing world of the country in a midnight. The government which is working day and night for the betterment of the individuals of the country, has taken a decision after many debates, disagreements, discussion, and arguments of bringing in the goods and Services Tax (GST) in the India. The aim of bringing GST was to provide facilities to the promised group of people, mainly concentrating on poor class. The reason that present government is focusing more than anything else on improvement of the poor class is to develop the country. Every country has two levels – individual and national. It is not the government which has to be powerful, it is the people living in that country which makes the country powerful. In order to make the country prosperous and develop it, the individual of the country should be satisfied. If the individuals does not even have the basic needs like food, shelter and clothing then it would lead to crimes in the country and in turn create a problem in the progress of the country. Therefore it is most important for the government to keep the individuals happy and take care of them or we can say that we have to go down the pyramid and focus more on the individuals of the country. Not only concentrating on the individual, a country has to have minimum barriers between the different classes of the society because, our constituency

was framed in such a way to give equal opportunity and rights to all, and GST will bring many economic reforms as it is good example of Co-operative Federalism which will help in the growth of the nation [1]. It is the first time in the history of India that both state and central government will be heading towards same direction by implementing GST. The idea of taxation was described by the Chanakya is somewhat similar to GST [2]. The great scientist Albert Einstein once said that the most complex thing to understand is the Income Tax. Especially in a country like India where we have 29 states and 7 union territories, it is very difficult to maintain the taxation system as every state will have different prices for different products even if they are few kilometers apart (In case of Delhi, Noida and Gurugram) . To get rid of so much confusion like sales tax, service tax, VAT etc. one single taxation system GST was introduced to maintain uniformity in the country. The GST system is more transparent and will also help the country to move towards modern taxation system. Not only that, it will also reduce the amount of black money [1]. Any system has both advantage and disadvantage. GST is the path-breaking legislation for New India, the advantages include – Simpler procedure for online payment, Increased efficiency in logistics, regulating the unorganized sector, composition scheme for small business and a higher threshold for registrations [3]. However it did not bring good changes for many business people - earlier only people above 1.5 crore turnover had to pay the tax but now even the small business enterprises has to pay the tax. Though GST bought 'one nation one tax' system, it affected various

industries differently depending upon whether the company deals with distribution, manufacturing, service provider or retailing [4]. GST has encouraged the ability of manufacturing sector, as various indirect taxes created problems for manufacturers and distributes by increasing their outgoing costs. Therefore GST came as the rescuer for this sector by erasing the burden and encouraging the sector to grow dynamically. But the problem with GST is that, companies not registered under tax bracket has to now get itself registered which will lead to the avoidance of lesser tax. Although the increased limits for registration helped the Indian Startups, it also helped the agricultural sector by bringing the uniformity in the taxes of transportation of agricultural products from one states to another state [4].

### **OBJECTIVE OF STUDY**

The study comprises following objectives.

1. Understanding the concept of GST
2. Performing Impact analysis of GST on Multinational Companies
3. To study the change in taxes on import and export
4. To study interest of foreign companies in the Indian market after GST implementation

### **RESEARCH METHODOLOGY**

The research mostly focuses on the behavior of Multinational Companies towards GST implementation in India. The material is to be justified with the real data gathered from various newspapers, journals and other forms of mass media. Descriptive type research is to be the primary form of adaptation for persuasion of this research keeping the objectives into considerations. Various statistics from accessible secondary data is to be observed to make the conclusion of the study.

### **CONTENT**

In this paper, we will be mainly focusing on the impact analysis of the GST on various Multinational Companies (MNCs) associated with Indian economy, this study will cover possible merits and demerits of GST on MNCs. India in recent years has become the hub for many MNCs to come and set up their branch. The production cost has fallen down as the transportation of goods will not charge anything extra than just the price of goods and of course the transportation charges. Since the small scale companies now have to register itself and pay the tax, therefore they cannot sell their products cheaper which they earlier did because they saved money without paying tax, so now there will not be much price difference in the products of the MNCs and the small scale companies. Due to Central Sales tax (CST), MNCs had to pay extra for keeping their goods in different states but now stock transfer is not

chargeable and will save their extra costs. Earlier MNCs were set up based on the taxes of the area as the taxes were different for different locations, but now they can concentrate on some real factors like efficiency, commercial viability etc. of their goods [5]. The Countervailing Duty (generally 12.5%) and Special Additional Duty (generally 4%) no more exists. These were some of the advantages for the MNCs. With above points it can be proved that it is the only misconception of the people who think GST has not benefited for the foreign entities, as IGST looks after all the services and goods across Indian state borders, also international exports that is exports out of India need not be payable and imports will be claimable, but imports will cost same as it will cost for the transportation inside the country [6]. Instead of monthly collecting the GST, GST in form of IGST will be collected at the time of Imports itself. To claim the taxes, companies need to keep the record of the taxes which they have already paid.

These claiming can be done with two ways, the selling company has to be listed with GST else the Indian company wanting to purchases and is also listed can repel the charges and charge them on IGST along with Customs Duty associated with imports and will be eligible to claim the IGST. The purchasing company can also claim the tax if the company selling goods collects the tax for the monthly transactions GSTR5 mainly dealing with non-residential foreign taxable person and is also registered foreign taxpayer with GST. The probability of this scenario is very less as the foreign company might not have a particular place for business, because of they may be of consulting, specialized skills and educational background, these sectors people register themselves for 90 days and then must prepay the estimated taxes they are expecting to collect. Since the taxpayer is physical present India, the transactions will be counted as intrastate and will be related to SGST/CGST, other than that if they receive any goods in their office which is outside India can also claim the input tax credits as it is subjected to IGTS [6].

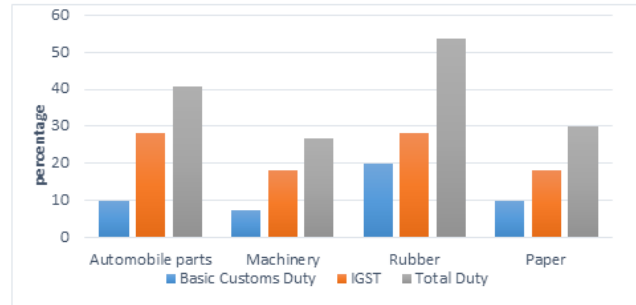
The petroleum company will not be able to claim for the input tax as it is beyond proximity and this does not solve the main aim of the GST of the cascading taxes. The MNCs related to engineering, consulting, advisory etc. will become expensive than before. The Chaos will be created as the companies now have to register for 12 monthly return and it will have to file depending upon the transactions done in the number of states [5]. Adopting to the new system will take time, but once adopted will be very beneficial for both India and the MNCs. In this paper, we have covered the Analysis of some MNCs like Nestle, Citigroup, Sony, Mahindra and Mahindra and Hewlett Packard in India and it's after the implementation GST.

**INFLUENCE OF GST**

Multinational companies started noticing the GST in India a while before its implementation. Companies like Avalara, the key player in getting small businesses tax compliance and automation has also faced their share of a curve with the adaptation of GST. Taxation on destination basis is fundamental of GST. Most MNCs in India being a foreign-based organization are subject to GST on a marginal scale. This is especially true for Integrated Goods and Service Tax or commonly known as IGST. The taxation of IGST mainly deals with the trade crossing Indian state border but is also applicable for international shipments [6]. Another huge impact of GST can be observed on the Fast-moving consumer goods (FMCG).

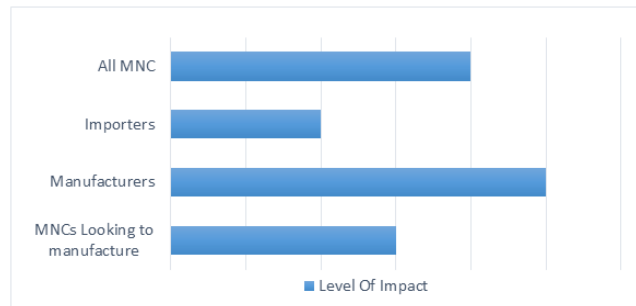
A lead company in the FMCG sectors had roughly twenty-three warehouses located in the states of India but all changed after implementation of GST. This is mainly because the need for warehousing in Indian decreased with GST as a centerfold for trade. Most companies have already developed the warehouses keeping GST into consideration for coming to any case scenario [7]. Also, the nominal impact of GST on FMCG is not limited to Multinational Companies but domestic-based companies too as "Made in India" gains its place in the market with some inflation and deflation on Indian market with GST. Although Goods and Service tax comes with its own perks for the Indian economy, same cannot be said for some of the FMCG firms both domestic and Multinational.

One of the major perks of GST comes in form of Avail ITC [10]. ITC or Input Tax Credit means taxation in form of input credited in form of taxation on the output. Before GST paying output as VAT was not used to get back any service tax paid for the Annual Maintenance Contracts (AMCs) but with GST one can take full advantage of ITC. Another subjected change after GST is with the import and export in India. When importing or exporting goods to any country the company must pay the corresponding custom duty or traffic. Before GST the importing or exporting entity had to pay Value-added Tax (VAT) along with the import/export duty. But after GST the scenario changed as the technique of valuation were considered on Cost, Insurance and Freight (CIF) basis stating that customs duty and charges payable are to be exerted on the entire shipping value. Currently, customs duty and the IGST are together implemented of any trade involving international border. Fig 1 shows some of the implemented import duty on raw material in India.



**Fig 1. Import duty on raw material and parts in India (April 2018) [9]**

GST affects various MNCs differently. Manufacturers have the upper hand being more beneficial as GST reduces the cost of production and remove differential valuations taxation, hence less tax means less cost. Multinational Companies looking for manufacture have their share of advantages as GST will reduce the cost of manufacture in India. Before GST factory location was chosen on tax basis as different states had different taxation scheme allowing states with less tax to have more factory units. But with GST as one tax for all, MNCs no longer have the desire for one state in particular for manufacturing location but whole nation as one.



**Fig 2. Benefits of GST for Various Types of MNCs in India [11]**

Duty free shops which are free from the liability of remission of few local and national taxes or duties, are located in the International airports of the country. The goods purchased by the international travelers need not pay the extra taxes in airports to maintain the uniformity in the International states. Some countries do not apply taxes on the imported goods where as others do. The Authority of Advance Ruling (AAR) confirmed that the duty free shops at the Indira Gandhi International airport (Delhi airport) will not be given relief from the taxes. Before the implementation of GST that is, 1st July 2017, the supply of goods were no different from the exports of the goods because of which CST and Value added taxes (VAT) were not applied on these goods. AAR stated that according to the Integrated GST Act the shops lie under the



circumference of Indian borders and hence have to pay the taxes even if the supply is from overseas. This rule was made after the request from the Rod Retailer Private Ltd, which has an outlet at Indira Gandhi International Airport. The companies which do not have any transaction for the 6 consecutive months, as they can easily file for the return of money. The council of GST is planning to allow the companies to file the return policy twice in a year that is after every six months. According to the counselling, 40% of the filed companies need not pay any kind of taxes and the companies with turnover around 1.5 crore or less need not fill the HSS code in the return form. Depended on the turnover of the companies the dates for filling the return will be decided, for example, companies with less than 1.5 crore turnover has to fill the form before 10th of the respective month and the companies with turnover above 1.5 crore can fill the for till 20th of the respective month. The form needs to be filled very carefully as the amendments can be made only after three months after filling the form. For the input tax credit the data will be compared for supplier with the invoice data.

All the companies may it be big or small needs to file the return every month. Last year after 1st July every month 3 return were filled and yearly 1 return was filled in total 37 returns were filled, which lead to many problems for the companies. After finding the lope holes in this system the committee then planned to reduce the number of fillings in a year, which will be very helpful for the companies, however the problem of matching the taxes with tax credit will remain same.

### **IMPACT ANALYSIS OF GST FOR VARIOUS MULTINATIONAL FIRMS**

#### **Nestle**

From the New Delhi, India, Nestle had decided to cut off the prices of their products like Maggi Ketchup, Cereal food for babies and the dairy products. This is due to introduction of GST (Goods and Service Tax). After the reduction effect in GST milk powder rate, prices of the everyday dairy is seen to be reduced by 4 to 5%. The company also said that the GST preparedness including engaging with and training over 3,500 suppliers, 1600 distributors would covering the direct value chain and aware the programs. Before GST consumer goods firms were paying 24 to 25% taxes including excise duty, VAT and entry tax. With a tax rate of 18% under GST, there could be a significant reduction of 6-7% in taxes [12].

#### **Citigroup**

From the Citigroup report, the new blueprint of GST structure is likely to be 'non-inflationary' or not in sudden rise of cost as most of the products found in the Consumer Price Index (CPI) value will face taxation at a current level

rate. A four tier GST tax structure was accepted by GST council, with low rates for essential items. Also for highest in luxury items also. The faulty items will also attract the consumers. According to the global financial services major, essential goods like food grains will be 0 taxed while some harming/non-essential goods like tobacco, luxury cars will be taxed higher than 28%. They also said that if services move to 18% tax, inflationary would not much effect, provided the tax implied is smooth [14].

#### **Sony**

From the Kolkata, West Bengal, India, Sony has put a target of Rs 250 crore sales in the Eastern Region as a strategy plan of aiming 25% growth during the festive season. Mr Kenichiro Hibi, Sony India Managing Director, said that the company is hopeful for the sales in festive season with customer demands. He said that the impact of the goods and services tax has moderated by now. Hibi said that they are expecting much bigger turmoil due to transition to GST. However, the industry has managed much better and the impact has moderated by now. They expect a good festive sales since the underlying consumer demand is strong. Hibi also said that the effective process in the online television space where scores of brands have entered and are under-cutting prices to gain market [13].

#### **Mahindra and Mahindra**

Mahindra and Mahindra announced on the reduction of prices of their utilities in their vehicles and SUV up to an average of 6.9% on the GST benefit to the customers. For small size cars, 1.4% is reduced. The company performed inflation on commercial vehicles in India by an average of 1.1% and 0.5% for light and heavy commercial vehicles. But they increased the prices of hybrid vehicles to only a limited extent. The company Mahindra and Mahindra stated that. The change in price for end customers will vary across the states or even various cities in a state. The company has decided to make no changes in prices of tractors. They believe their landmark will reform drastically and ease business India. It will also benefit consumers, thus being a win-win for all [15].

#### **Hewlett Packard**

HP Inc. India is re-evaluating its earlier proposal to set up a new manufacturing facility in India after the GST implementation. A study is underway right now, they have not taken a final decision yet. The HP company, US, said that the new manufacturing facility is totally designed and dedicated for printers and seen as a commitment to Honorable Prime Minister, Mr. Narendra Modi's 'Make in India'. HP India said that the retail price of ink cartridges has increased by 12 to 15 %, and 8 to 10 % for MFP. After GST, MFP were taxed at 28%. There is a boost of the prospects of the company's existing manufacturing facility in Pantnagar, Uttrakhand. HP is a market leaders with almost a third of the PC market in India [16].

## CONCLUSION

In this paper, we have discussed what GST is and how it affects Indian economy on a global scale. We have also studied the implementation of Integrated Goods and Service tax or IGST and how it affects the international trading in various sectors. We have looked at some existing data any analyzed how it has affected the various companies in India. We have seen how GST has played its role in changing market of FMCGs over a year. Along with interstate trading, we have studied how the import duty with customs duty and VAT has changed since the implementation of GST. We discussed the role of ITC and how it is a major advantage of GST. We have also seen how different type of MNCs has different benefits. We also studied various Multinational Firms or companies doing business in India and how they faced the change in taxation where some gained and some not.

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# Ultimate Capacity of Vertical Pile Subjected to Combination of Vertical and Lateral Load

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**Abstract:**-- Pile under general condition is subjected to combination of vertical and lateral loads. In the analytical approaches to predict the load-displacement responses of a pile under central inclined load, it is assumed that the lateral displacement of the pile head is independent by the vertical load factor of the inclined load. Similarly, while estimating the ultimate resistance it is considered that the vertical load factor of the inclined load does not influence the ultimate lateral resistance of the pile during determination of ultimate load carrying capacity of vertical pile. In the present work, an empirical relation has been developed to predict the ultimate load carrying capacity of vertical piles subjected to combination of both vertical and lateral load in cohesion less soil. Effect of lateral load on vertical load deflection behavior of vertical piles when axial loads are present are discussed through several experimental results obtained from tests on model piles. Ultimate capacity is found to be a continuous function of ultimate lateral load, ultimate vertical load capacity and tangent of angle of resultant load made with vertical axis of pile.

**Key Words:** Pile foundation; Ultimate vertical capacity; Lateral load on vertical pile;

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## INTRODUCTION

Foundations of many structures are subjected to inclined compressive loads like in foundations of transmission towers, wind energy converter towers, offshore structures etc. In such cases, to increase the load carrying capacities of adopted foundations and to decrease the corresponding settlements, piles may be employed. Besides, in the complex cases where the horizontal and vertical moments are generated along with the moments generated due to wind and seismic loads a pile foundation should satisfy the safety and serviceability conditions well. Normally the axial loading of the pile is predominant. But in special cases like piles supporting offshore wind energy foundations or conductors, the axial, mostly vertical load is accompanied by a lateral (horizontal) load as pointed out by Lianyang Zang et al. (2005).

Simplified methods to evaluate ultimate resistance under oblique pull have been attempted for vertical piles by Broms (1965), Meyerhof (1973), Poulos and Davis (1980), Chattopadhyay & Pise (1986) and for inclined piles by Flemings et al. (1985). Bearing capacity of rigid piles based on 1 g experiments in sand and clay has been studied by Meyerhof et al. (1965 and 1961) 1g model test on vertical (1981b), batter piles (1972) and pile groups (1973) by Meyerhof et al. showed the variation of ultimate capacity of model piles with load inclination. Several other results of investigations on the behaviour of piles subjected

to inclined loading have been reported Das et al. (1976), Chari & Meyerhof (1983), Ismael (1989), Sastry & Meyerhof (1990), Shahrour & Meimon (1991), Meyerhof (1995), Amde et al. (1997) and K. Abdel-Rahman & Achmus (2006). However, the comparative study by Lianyang Zang et al. (2005) has shown that these studies produced significantly different ultimate resistance values of single as well as pile group. This makes it difficult for practicing engineers to effectively select the appropriate method.

Current design practice involves separate analysis of axial and lateral pile capacities and does not consider the interaction of vertical and horizontal load components in case of inclined loading conditions. As there are limited experimental studies available on behavior of vertical piles subjected to inclined compressive loads. In this paper, an attempt has been made to study behavior of single pile subjected to varying inclined load until failure through a 1g model.

## WORK OBJECTIVE

In the analytical approaches to predict the load-displacement responses of a pile under central inclined load, it is assumed that the lateral displacement of the pile head is independent by the vertical load factor of the inclined load. Similarly, while estimating the ultimate resistance it is considered that the vertical load factor of the

inclined load does not influence the ultimate lateral resistance of the pile. The analytical approaches of K.Abdel-Rahman & Achmus (2006), Poulos and Davis (1980), to predict the ultimate resistance of vertical pile are over simplified.

Reliability on any theoretical approach depends on agreement of estimated results with the experimental observations. However, for pile under inclined loads, very few test results are available.

The present work provides results of model vertical pile tested under controlled conditions for load displacement and ultimate resistance under central inclined compressive loads. Present work was intended to study the assumed simple but rather complex behaviour of a single pile-soil interaction mechanism under different inclined loading system.

**EXPERIMENTAL SETUP**

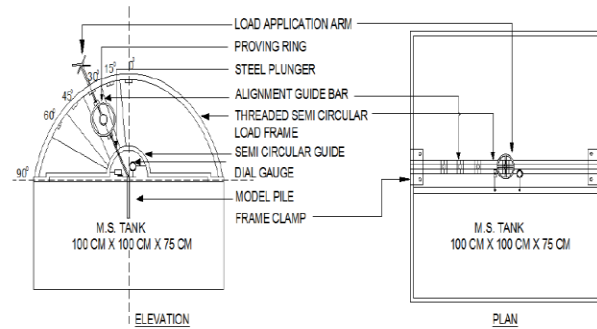
Dry brown uniformly graded Mogra sand obtained from sand mines of Hoogly district, West Bengal was used as soil medium. The physical properties of the sand are given in Table-1.

Rigid rough mild steel circular cross section having outside diameter 20 mm and wall thickness 5mm with three types of length to ratio viz. 10, 15, 20 were used as model piles. Surface of the pile is made rough by scratching the surface with iron paper followed by gluing mild steel powder carefully so that the outside diameter of the piles remain same as described in Chattopadhyay and Pise (1986). Procedure of the tests has been discussed elsewhere Roy et al. (2013). Pile is installed as fully embedded in sand bed. The tests were conducted in a steel tank of size 100 cm X 100 cm and 75 cm deep. Loads were applied on the top of the pile with load inclined at an angle (θ) 00, 150, 300, 450 and 900 with the vertical axis of the pile. A schematic view of the experimental assembly is shown in Fig.1. Details of the test procedure are described elsewhere (Roy et al. 2012).

*Table 1 Physical properties of sand*

Soil	Sand
$\rho_{max}$ (gm/cc)	1.545
$\rho_{min}$ (gm/cc)	1.431
$C_u$	1.25
$C_c$	0.96
$\phi^\circ$	39
$D_{10}$ (mm)	0.45

<b>Specific Gravity</b>	2.65
<b>Relative Density</b>	65%
<b>Classification</b>	Medium Dense



**Fig. 1 Elevation and Plan of Experimental Setup (Roy et al. 2012)**

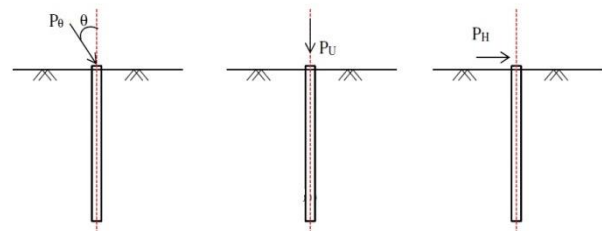
**EXPERIMENTAL RESULTS AND DISCUSSION**

When the applied load is inclined at an angle θ with the vertical, ultimate load of pile is denoted by,  $P_\theta$  and the ultimate resistance of the pile in case of purely axial load and purely lateral load is denoted by  $P_U$  and  $P_H$  respectively as shown in Fig. 2. Due to application of oblique load  $P_\theta$  on a pile, it is subjected to a vertical component,  $P_v$  and a horizontal component,  $P_h$ . These components were expressed as

$$P_v = P \cos \theta \quad (1)$$

$$P_h = P \sin \theta \quad (2)$$

Where, q is the load inclination from vertical with axis of the pile. From Eqn. (1) and Eqn. (2) it is seen that as θ increases,  $P_v$  decreases and  $P_h$  increases. Thus with the increase of tilt of load with the vertical direction the horizontal component dominates the vertical load component.

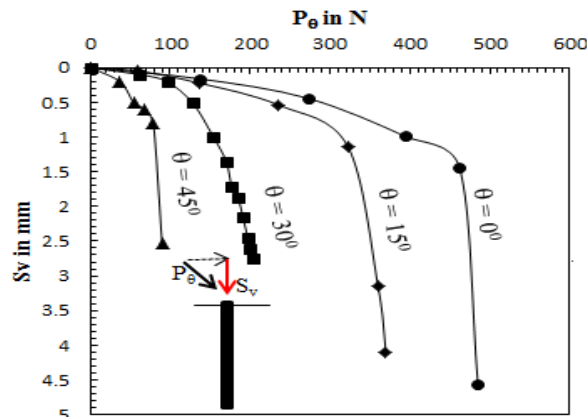


**Fig. 2 Pile under different loading condition and notations**  
As the applied compressive load increases, at an angle of inclination, both the vertical as well as horizontal

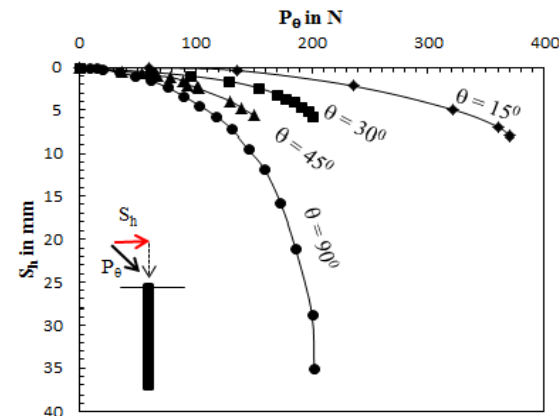
component of the load increases. Depending on the relative magnitudes of the ultimate axial capacity and lateral ultimate resistance of the pile, the vertical component may attain critical value equal to ultimate load carrying capacity of pile axially. In this case, the horizontal component remains smaller than the ultimate horizontal load carrying capacity causing axial failure of the pile. However, if the horizontal component reaches the critical value equal to the ultimate horizontal capacity, while the axial component is less than the ultimate axial load capacity, plastic hinge formation takes place and bending failure will occur. To permit reuse of the test piles, short rigid mild steel pile was selected.

**Load Verses Displacement Diagrams**

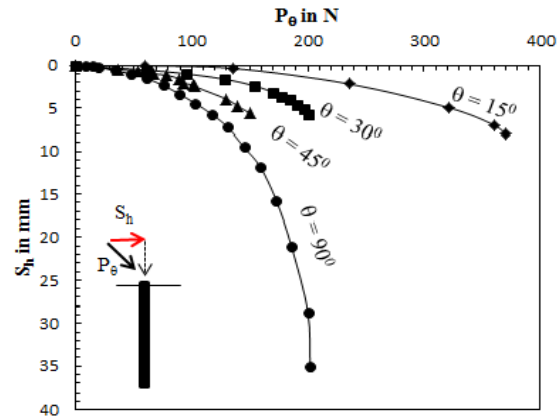
Fig. 3a, 4a, shows the vertical displacement of pile having  $L/d = 20$  and  $15$  under various inclination of load with the pile axis, where  $d$  is the pile diameter and  $L$  is the length. Failure was associated with noticeable peak values for  $\theta = 00$  and  $\theta = 150$ . However, for greater values of  $q$ , failure load were obtained where load settlement curves becomes almost vertical. The vertical load displacement curve patterns obtained are similar to those as reported by



Meyerhof et al. (1983).

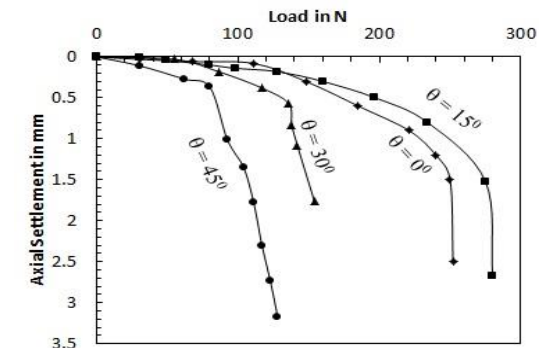


(a) Axial Displacement

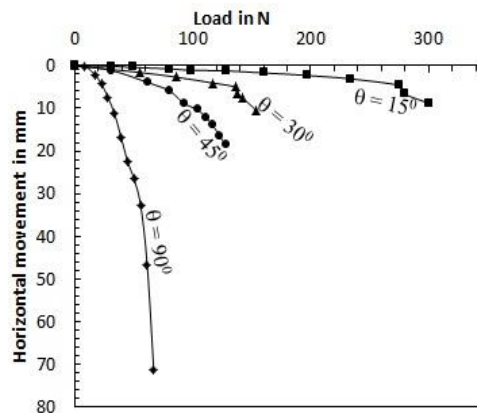


(b) Lateral Displacement

Fig. 3 Load versus displacement of pile ( $d = 20$  mm,  $L = 400$  mm)



(a) Axial displacement



(b) Lateral displacement

Fig. 4 Load versus displacement of pile ( $d = 20$  mm,  $L = 300$  mm)

**Ultimate Load Bearing Capacity of Pile under Inclined Load**

Failure of pile is considered at the load where associated load settlement curves become close to vertical. A polar plot of ultimate load on pile versus load inclination,  $\theta$  is shown in Fig. 5 to show the inclination effect of the applied load on pile capacity. To quantify the effect in bearing capacity with the increase in load inclination angle  $\theta$ , ratio of  $P_v/P_U$  is plotted with different values of  $\theta$  as shown in Fig. 6 for L/d ratio of 20 and 15.

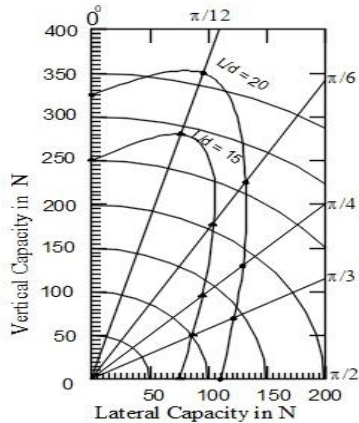


Fig. 5 Polar bearing capacity (Roy et. al 2013)

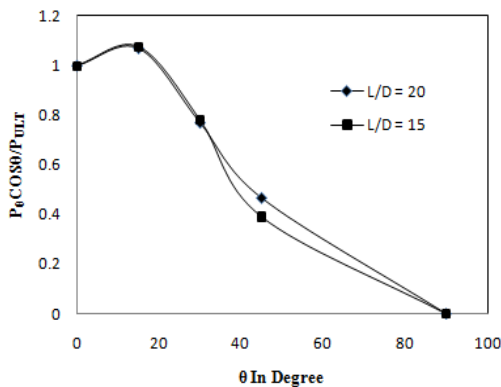


Fig. 6 Capacity of pile with load inclination

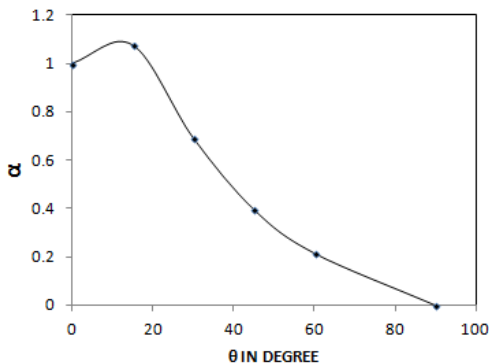


Fig. 7  $\alpha$  vs  $\theta$  plot

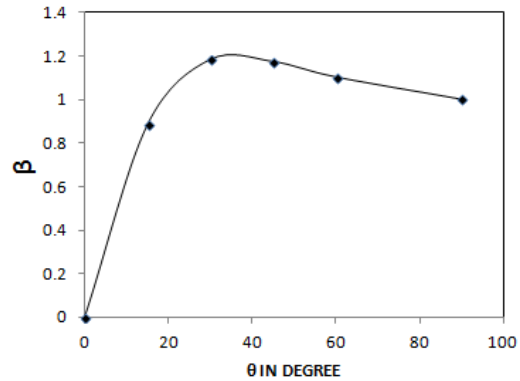


Fig. 8  $\beta$  vs  $\theta$  plot

Where ,  $\alpha = \frac{P_\theta \cos \theta}{P_{Vult}}$  and  $\beta = \frac{P_\theta \sin \theta}{P_{Hult}}$

**A. Developed Empirical expression**

Based on the test results conducted, the polar plot is done with ultimate capacity of vertical pile for different  $\theta$ . An empirical expression is developed from the polar plot between  $P_{vult}$  and  $P_{Hult}$ ,  $P_\theta$  and  $\theta$  in medium dense sand given by Eqn. (3) and (4) respectively .

$$\alpha = A_1 \theta^3 + A_2 \theta^2 + A_3 \theta + 1 \tag{3}$$

$$\beta = B_1 \theta^3 + B_2 \theta^2 + B_3 \theta \tag{4}$$

By doing Eqn. (3) + Eqn. (4) one gets ,

$$(\alpha + \beta) = C_1 \theta^3 + C_2 \theta^2 + C_3 \theta + C_4 \tag{5}$$

Or,

$$\frac{P_\theta \cos \theta}{P_{Vult}} + \frac{P_\theta \sin \theta}{P_{Hult}} = C_1 \theta^3 + C_2 \theta^2 + C_3 \theta + C_4$$

Or,

$$P_\theta \left[ \frac{\cos \theta}{P_{Vult}} + \frac{\sin \theta}{P_{Hult}} \right] = C_1 \theta^3 + C_2 \theta^2 + C_3 \theta + C_4$$

Or,

$$P_{\theta ult} = \frac{P_{Vult} \cdot P_{Hult} [C_1 \theta^3 + C_2 \theta^2 + C_3 \theta + C_4]}{P_{Hult} \cos \theta + P_{Vult} \sin \theta} \tag{6}$$

Where,  $(A_1 + B_1) = C_1 = 6 \times 10^{-5}$

$(A_2 + B_2) = C_2 = -0.0045$

$(A_3 + B_3) = C_3 = 0.1187$

$$C_4 = 1$$

Also ,

$P_{vult}$  is the ultimate vertical capacity of short pile when  $\theta = 0$ .

$P_{Hult}$  is the ultimate Lateral capacity of short pile when  $\theta = 90$ .

$C_1, C_2, C_3$  are regression analysis constants;

$P_{\theta ult}$  is inclined load capacity of vertical short pile for  $0 < \theta \leq 90^0$ .

**Design Procedure**

For design purpose the maximum vertical and lateral load that will be imposed on the structure including the earthquake and wind load consideration are required. For that purpose one may create STAAD PRO. Model or any other software or use hand calculation for finding the maximum vertical and lateral load.

The latter stage of this designing concept are described stepwise-

Step-01: Calculate the maximum vertical and maximum lateral load that will come on the structure. For one structure different footing subjected to different load but the maximum of vertical and lateral load will be taken.

Step-02: After findings of maximum vertical and lateral load such as PV and PH respectively then calculate the angle  $\theta$  with the following formula-

$$\theta = \tan^{-1} \left( \frac{P_V}{P_H} \right)$$

Step-03: After finding the  $\theta$  value the value of critical angle have to be calculated by the following empirical relation

$$\text{Critical angle} = (90^0 - \theta)$$

One pictorial representation is shown in the fig 9 below to demonstrate the different load components of pile also demonstrate the different angles like inclination angle and critical angle.

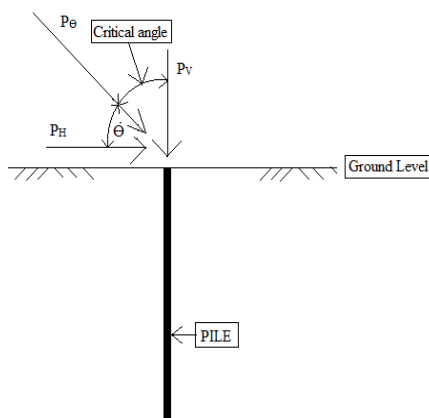


Fig. 9 Pile under different load components

Critical angle is that angle beyond which if the resultant of vertical and lateral load will act that results either failure of pile model or a significant change in the value of the ultimate pile capacity with some lesser value.

The value of this critical angle is found to lie in between 10 to 220 it was found by experimentally and the same value will getting by solving analytical problems. If we change the diameter, sub soil condition and all others parameters the value of this angle will remain same to confirm these we have run one excel program by changing different values of diameter, angle of internal friction and the unit weight of soil also that results the same.

To confirm this we will run different STAAD PRO model but the model gives the same results. So it is confirm that the critical angle value lies in between 10 to 200.

That value is the actual value of load considering for design purpose, after that moment will change those moment was found by only vertical or only lateral consideration and the design of pile foundation are most convenient.

**CONCLUSIONS**

An empirical relation is proposed for determination of ultimate load carrying capacity of vertical pile in medium dense sand subjected to combination of vertical and lateral load acting on pile head.

Several tests on the model pile under different inclined load in sand revealed that an inclination of load could noticeably reduce the ultimate vertical bearing capacity of short pile and lateral capacity of a vertical pile.

The load vertical displacement and load lateral movement of pile head in direction of load characteristics is nonlinear in nature.

Polar bearing capacity diagrams suggests that bearing capacity of vertical pile is a function of applied load inclination angle,  $\theta$ , vertical pile capacity,  $P_{vult}$  and ultimate lateral load carrying capacity of vertical pile.  $P_{hult}$

Determination of ultimate bearing capacity of vertical pile subjected to load combination of vertical and lateral load would be under safe if one or the other component  $P \cos \theta$  or  $P \sin \theta$  is neglected or assumed to be zero for predicting ultimate capacity of a vertical pile subjected to a general loading condition.

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# An NLP Based Plagiarism Detection Approach for Short Sentences

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**Abstract:** -- The notable issue in the fields of plagiarism detection is, to assess the semantic similarity between obfuscated sentences, and it becomes more completed in case of short sentences (only 4-8 words). An innovative approach, typed dependencies relationship (TDR), based on Natural Language processing is presented for detecting plagiarism on short sentences. In this study proposed approach performed on previous datasets of short sentences and compared results with 3 state-of-art methods. The investigation shows that the proposed calculation has exceptional execution in taking care of sentences with complex linguistic structure.

**Key Words:** Type dependencies relationship, Plagiarism detection, sentence similarity, syntactic and semantic similarity

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## 1. INTRODUCTION

The present human communication happens as a form of short text scraps of composed content like News features, messages and tweets- although the length of this short content is small but the meaning and utilization is broad, crossing an range of areas and NLP applications. Investigation and analysis of such short-information can uncover data that is essential, in various regions of present day human life. We cannot also ignore it in the field of education and research. In research, the short text or sentence plays an import role and smartly modified by the plagiarist without crediting the original source. The detection of plagiarism in short text is a very complicated task because short text consist only 4-8 words with 50% of syntactical part, which is also import and cannot be ignored by pre-processing task. Detection of the plagiarism between words, sentences, paragraphs and documents is an important component in plagiarism detection process. Finding matching between words is initial process of plagiarism detection system which is then used as a primary stage for sentence, paragraph and document detection. So the objective is to implement a viable technique to compute the similarity between short messages, more often than not around one sentence length. These processed sentence similarity could be helpful for plagiarism detection tools. This paper is organized as follows: Section 2 presents related work and methods for measuring fundamental similarity on short text. Sections 3 introduce proposed approach for plagiarism detection based on type dependency relationship model with illustrating one example. Section 4 presents the experiment and results from the proposed approach with Li (2006) data sets, and discuss our results with the results obtained from different state-of-the-art baselines. Finally, section 5

draws some conclusions on this work and outline possible future research in this area.

## 2. RELATED WORK:

A wide literature and increasingly approaches based on pre-processing techniques are available for measuring similarity on text [1]. Text similarity measure can be done from two ways: Lexical similarity and Semantic similarity; Lexical similarity measures uses String-Based algorithms which are further uses character based: Longest Common Substring (LCS) is based on the length of both strings. Damerau-Levenshtein (2,3) , Jaro (4,5) , Winkler (6), Needleman-Wunsch (7), Smith-Waterman (8), N-gram(9). Term based similarity measures are: Block Distance [10], Cosine similarity, Dice's coefficient [11], Euclidean distance Jaccard similarity [12], Matching Coefficient, Overlap coefficient.

Semantic similarity is introduced through Corpus-Based and Knowledge-Based algorithms.

Corpus-Based semantic similarity measure are: Hyperspace Analogue to Language (HAL) [13,14] Latent Semantic Analysis (LSA) [15], Generalized Latent Semantic Analysis (GLSA) [16], Explicit Semantic Analysis (ESA) [17], The cross-language explicit semantic analysis (CL-ESA) [18], Point wise Mutual Information - Information Retrieval (PMI-IR) [19]. Knowledge-Based semantic similarity the most popular measures that is based on identifying the degree of relatedness between words using information derived from semantic networks [20]. WordNet [21] introduced by Miller in 1990, is the most prominent evaluation for plagiarism detection system to detection of semantically similar word. WordNet changed the dimension of research and new approaches were

introduced for measuring semantic similarity: Resnik (res) [22], Lin (lin) [23] and Jiang & Conrath (jcn) [24]. The other three measures are based on path length: Leacock & Chodorow (lch) [25], Wu & Palmer (wup) [26] and Path Length (path). Above mentioned techniques are fundamental and soul of all present approaches which is based on lexical and semantic similarity on sentence. A strategy for estimating the semantic likeness between short sentences or short messages, based on semantic and word order arrangement was introduced by Lee(2006) and named it Semantic Text Similarity (STS). Li firstly, begins comparison with semantic similarity checking, extract information from knowledge base and corpus statistics. Secondly, proposed a strategy to consider the effect of word order on sentence. STS strategy accomplished a decent Pearson correlation coefficient for 30 pair of sentences and beat the outcomes [27]. Ercan in 2013 also worked on (Li, 2006) data sets and used methodology which is almost similar with STS (Li, 2006) method [28]. A remarkable work done by (Alzahrani's et al 2015) on detecting highly obfuscated plagiarized texts gained the maximum popularity that was based on fuzzy semantic-based comparability model and compared the result with (Li,2006)[27] and (Lee, 2011)[29]. Alzahrani's model can work on both short and moderate length of sentence. This model outperformed well as compared to five baseline (word-to-word and sentence-based) approaches [30].

**3. PROPOSED SYSTEM FRAMEWORK:**

A text is thought to be a grouping of words, each of which conveys important data. The word along with their structure, word order and relations with other participating words in sentence, shows specific meaning. The proposed approach detected similarity from syntactic as well as semantic information contained in the compared texts.

Fig.1 shows the proposed system framework which is divided into two similarity computing measures between two sentences- Syntactic similarity and Semantic similarity, which are described as follows:

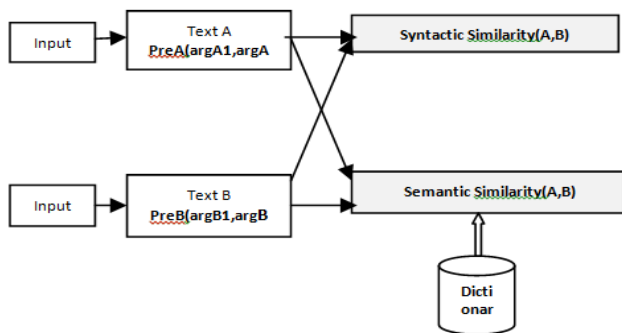


Figure 1: Proposed sentence similarity system framework

**3.1 Type Dependency Relationship (TDR):**

Previous work (Li 2006[27], Ercan in 2013[28] and Alzharani in 2015 [30]) worked on semantic meaning of word and word order of sentence for sentence comparison. Most of the previous methods applied text pre-processing techniques like removing stop words, stemming, lemmatization etc, which lost syntactic information of sentence which is also more import in case of short sentence. Proposed approach have not applied any text pre-processing techniques, although, it uses parse dependency relationship from Stanford University typed dependencies representation which was designed to provide a simple description of the grammatical relationships in a sentence that is easily understandable and easily used by people who have no knowledge about word relation in a sentence. So along with word meaning, proposed approach also added relationships between words in a sentence. For example-select any pair of sentence and found the typed dependency parse relationship from Stanford University [31]. Suppose first sentence is A and second sentence is B then the type dependency relationship fetched from Stanford University manual is in form of:

PredicateA (argumentA1, argumentA2)  
 PredicateB (argumentB1, argumentB2)

Where PredicateA shows a relationship between argumentA1 and argumentA2 in sentence A (an arguments are participating words in any sentence). Also PredicateB defines the relationships between argumentsB1and argumentB2 in a sentence B. The current representation contains approximately 50 grammatical relations defined by Schuster and Manning in 2016 [32]. Now, typed dependency structures of sentential pairs are checked for syntactic and semantic similarity denoted by simrel (A, B), such that

$$Sim_{rel}(A,B) = \frac{1 * |S(A,n) \cap (B,n)| + 0.67 * |S(A,n) \cap (B,n)| + 0.33 * |S(A,n) \cap (B,n)|}{\min(countA, countB)}$$

(1)

Where S(A) and A(B) represent the typed dependency relationships of paired sentence. Their intersection represents set of common relationships with n numbers and countA and countB shows the total number of relationships found from Stanford type dependency parser. Similarity measures with different overlapping factors like complete overlapping, partial overlapping and minimum overlapping, observed upon the matched typed-dependency relations extracted out of the input sentence pairs. It should be noted that expression 1 is same for both syntactic and semantic calculation, in semantic calculation synonym of arguments are compared between sentences.

**3.2 Concepts based dictionary construction**

Every research article has their own theme and idea and meaning of any words which is used in article may be

different in meaning from meaning depicting in WordNet. WordNet is a substantial lexical database of English language, created at Princeton University by a gathering drove by George A. Miller [21]. WordNet dictionary changed the direction of research and it plays a very important role in the area of intelligent and idea plagiarism detection because it contains synonyms, antonyms and other important information of a word, with the help of this information semantic similarity detection is possible. It is freely and publically available for researcher (Simpson T., 2005)[33]. But due to limited vocabulary in WordNet dictionary here we extend the WordNet dictionary according to our input text for that extracted all possible vocabulary words from input texts and try to fetch the synonyms of each word from WordNet, at any situation, synonyms found or not found proposed module will ask to user, "Do you want to add more meaning for this word ", and we can append more synonyms according to theme. Proposed approach used this dictionary for semantic calculation.

**3.3 Illustrative Example- Detailed execution of proposed method**

To illustrate how proposed method works for a pair of sentence, below we explain detail description of our method with taking a sentence pair from our study. In this study we optimized the majority of the computations in Python 3.6 (32 bit) framework, so as to make the usages as simple as possible for the end client. For Example:

Sentence1-I like that bachelor.

Sentence 2 - I like that unmarried man.

Above sentences looks like exact same from the view of human estimation. Proposed method produced two output similarity measures: syntactic similarity (without using dictionary) and semantic similarity (with using dictionary) which is close to human estimation. Now perform following steps for checking sentence similarity.

Step 1: Fetch the Type dependency relationship from Stanford University [32]. Total no of relationship fetched for sentence A and B is 4 and 5 as shown below:

**TDR of sentence A**

*nsubj(like-2,I-1)*  
*root(ROOT-0,like-2)*  
*det(bachelor-4,that-3)*  
*dobj(like-2,bachelor-4)*

**TDR of sentence B**

*nsubj(like-2,I-1)*  
*root(ROOT-0,like-2)*  
*det(man-5,that-3)*  
*amod(man-5,unmarried-4)*  
*dobj(like-2,man-5)*

Step2. Type dependency relationship of sentence A should be matched with Type dependency relationship of sentence B in the following manner:

PredicateA == PredicateB  
 ArgumentA1 == ArgumentB1  
 ArgumentA1== ArgumentB2

Step3. Now Search overlapping of relationships for 100%: In 100% overlapping, there should be one-to-one matching

between TDR relationships of both sentences. In 67% overlapping predicateA should be matched with predicateB with one of the its similar argument or if predicates are not similar but both argumentA1, argumentA2 is similar with argumentB1,argumentB2 then it also comes in the categories of 67% overlapping. similarly, In 33% overlapping any one of the argument of sentence A is matched with argument of sentence B with same word position.

Step3: Now the syntactic similarity and semantic similarity can be formalised from the expression (1) and categories them according to their overlapping. The syntactic overlapping similarity in sentence A and B can be formularized as follows:

Syntactic Similarity		
100 %Match	67%Match	33%Match
<i>nsubj(like, I)</i> ◇ <i>nsubj(like, I)</i>	<i>det(bachelor,that)</i> ◇ <i>det(man,that)</i>	<i>nsubj(like, I)</i> ◇ <i>dobj(like, man)</i>
<i>root(ROOT,like)</i> ◇ <i>root(ROOT,like)</i>	<i>dobj(like,bachelor)</i> ◇ <i>dobj(like, man)</i>	

Now the semantic overlapping similarity in sentence A and B by using self made concept based dictionary can be formularized as follows:

Semantic Similarity		
100 %Match	67%Match	33%Match
<i>nsubj(like, I)</i> ◇ <i>nsubj(like, I)</i>	<i>det(bachelor, that)</i> ◇ <i>det(man, that)</i>	<i>nsubj(like, I)</i> ◇ <i>root(ROOT, like)</i>
<i>root(ROOT, like)</i> ◇ <i>root(ROOT, like)</i>	<i>dobj(like, bachelor)</i> ◇ <i>dobj(like, man)</i>	<i>nsubj(like, I)</i> ◇ <i>dobj(like, man)</i>

Execution: From the table of syntactic similarity, number of relationships different matching categories are 2, 2,1(100% match,67% match and 33%match) respectively. Our method produced syntactic similarity is .9175%  $(2*1+2*(.67)+1*(.33))/4$  which is better than previous work( Li2006,Ercan2013,Alhzarani2015), again if we refine our method and uses our concept based dictionary for calculating semantic similarity then result is 100%  $(2*1+2*(.67)+2*(.33))/4$ , Here we put, the unmarried is synonym of bachelor. The proposed technique gives a generally high closeness. This case exhibits that the proposed technique can catch the significance of the sentence despite the co-event of words.

#### 4. EXPERIMENTS AND RESULTS

Currently, there are no appropriate benchmark data sets available for the assessment of proposed sentence (contains 4-8 words) similarity method. In spite of the fact, a couple of close studies have been published timely by researcher. So this research performed on Li (2006) data sets which are borrowed from different papers and books on natural language understanding. Table 1 show eight sentence pairs chosen from Alhzarani (2015) experimental data set, here we set threshold value 1.67 for syntactic similarity and .25 for semantic similarity, if it is greater than this then acceptable otherwise it should be 0. Results shown in Table 1 stated that proposed computed syntactic similarity values were found to be fairly consistent with previous values and semantic similarity values were found is more close to the human intuition and more better than previous methods.

#### 5. CONCLUSION

This paper presented a two practical sentence similarity evaluation approach. Firstly, a syntactic similarity approach is only based on type dependency relationships without using the concept based corpus (self made dictionary). Secondly, semantic similarities approach with using both TDR and dictionary. Our approach tackled the issue of text pre processing, as we accept sentence without changing their structure or loss of any information. It is observed that both proposed approach worked well for short length sentence with good time complexity. As a future work we will try this extended approach for moderate length text

*Table 1: Experimental result on raw sentences of short lengths.*

	Sentence 1	Sentence 2	Li (2006)	Canvas 2013	Alhzarani (2015)	Syntactic Similarity (TDR)	Semantic Similarity (TDR) with explanation
Pair A	I like that bachelor	I like that unmarried man	0.561	0.558	0.649	<b>.9175%</b>	<b>1.00</b>
Pair B	I have a pen	Where do you leave	0.000	0.277	0.000	<b>0.000</b>	<b>0.000</b> Because we are considering greater than the threshold.
Pair C	John is very nice	Is john very nice	0.977	0.599	1.00	<b>.833</b>	<b>.833</b> here the strings are exact similar but the type of sentence is totally different so exact match should not be 100%
Pair D	It is a dog	It is a log	0.623	0.182	0.737	<b>.670</b>	<b>.670</b> Here dog & log cannot be matched anyhow. So matching should be less.
Pair E	It is a red alcoholic drink	It is an dictionary	0.000	0.000	0.074	<b>0.000</b>	<b>0.000</b> Because we are considering greater than the threshold.
Pair F	Canis familiaris are animals	They are common pets	0.362	0.806	.391	<b>.335</b>	<b>.832</b> Considering pets are animals & put it as a synonym of animal in our dictionary.
Pair G	It is a glass of cider	It is a full cup of apple juice	0.678	0.253	0.652	<b>.558</b>	<b>.723</b> By putting synonym (Cider) is juice and synonym (glass) is cup.
Pair H	Dogs are animals	They are common pets	0.738	0.756	0.494	<b>.446</b>	<b>1.00</b> By putting synonym (Animal) is pet.

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# A Broadband Metamaterial Absorber

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**Abstract:**-- This paper presents design and performance of a broadband metamaterial absorber at microwave frequencies. The unit cell of proposed structure comprises of two set-square shape patches of copper placed diagonally, at the top of the FR4 dielectric substrate and a continuous ground plane of copper. The proposed structure shows the broadband response of an absorption bandwidth of 2.7 GHz with more than 95% absorptivity level ranging from 6.9 GHz to 9.6 GHz. It shows wideband absorption upto 45 degrees incident angles under oblique incidence for both TE and TM polarizations.

**Key Words:** Metamaterial, Absorption.

## 1. INTRODUCTION

Metamaterial is artificial materials that shows unusual electromagnetic wave (EM) characteristics that cannot be found in nature like negative refraction index, cloaking behavior, antennas, superlens, absorbers [1] and so on at different electromagnetic frequency. 'Perfect metamaterial absorber' had been proposed in 2008 by Landy [1] since than metamaterial absorbers have drawn considerable interests among many researchers. Due to its ultra-thin thickness, lighter weight and increased effectiveness, these metamaterial absorbers are currently replacing the conventional absorbers, which have the disadvantages of being bulky and fragile.

Metamaterial absorber is a periodic structure and consist of a unit cell. In general, a metamaterial absorber consists of typical three layers of the MDM (metallic-dielectric - metallic structures) type of configuration, which is in periodic pattern of unit cell has been widely used in various designs. These structures have the ability to control their effective electromagnetic parameters such that the input impedance of the structure becomes closely matched with the free space impedance. At the same time, if the lossy dielectric substrate absorbs the incident wave completely, then this results in nearly unity absorption. So far, many absorber structures have been designed exhibiting different properties such as single-band [1], multi-band [5], bandwidth-enhanced [4], broadband [2], polarisation insensitive [3] and wide-angle absorption [3] for various potential applications. In some of these applications (like stealth technology, anechoic chamber), broadband absorbers are highly recommended, whereas in other applications, such as radar cross-section reduction, electromagnetic interference/electromagnetic compatibility protection and radio frequency identification, multi-band absorbers are more preferred.

## 2. DESIGN AND SIMULATION OF THE PROPOSED STRUCTURE:

The top view of the proposed structure is shown in figure 1. It shows a single unit cell which is arranged in periodic manner consist two metallic patches placed diagonally opposite making replicate to each other. The patches are like set-square shape of copper having conductivity of  $5.8 \times 10^7$  S/m with 0.035mm thickness. The bottom of the structure is completely of copper with thickness 0.035mm and separated from top layer with a dielectric substrate of FR-4 ( $\epsilon_r = 4.4$  and  $\tan\delta = 0.02$ ) of thickness 2mm. All the dimensions of the unit cell are optimised as  $a=10$ mm,  $b=6$ mm,  $c=8.6$ mm,  $d=2.3$ mm,  $f=2$ mm,  $g=1.6$ mm,  $w=1$ mm.

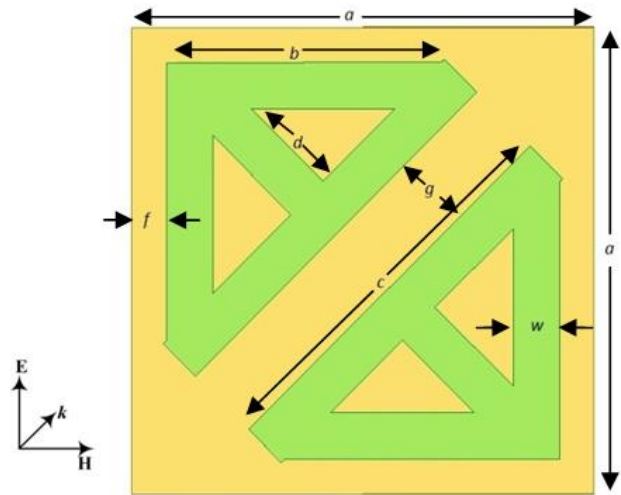


Figure.1 Unit cell of the proposed structure.

The absorption is closely related to the reflection and transmission and frequency of incident electromagnetic wave. A perfect metamaterial absorber can be achieved by minimizing the reflection and transmission waves to get

maximum absorption. The transmission of zero can be achieved by using metallic ground plane at the bottom of the structure, which is usually thicker than the skin depth of metal used at the operation frequency.

Therefore, when the EM waves are transmitted into the metamaterial absorber, they will disappear as a result of the dielectric and metal losses.

The absorption can be calculated through Eqn (1), where  $\omega$  is frequency of operation,  $A(\omega)$  is the absorption,  $R(\omega)$  is the reflection and  $T(\omega)$  is the transmission and  $S_{11}(\omega)$  and  $S_{21}(\omega)$  are the corresponding S parameters. Here  $Z_0$  is free space impedance and  $Z(\omega)$  is unit cell impedance.

$$A(\omega) = 1 - R(\omega) - T(\omega)$$

$$A(\omega) = 1 - |S_{11}(\omega)|^2 - |S_{21}(\omega)|^2 \quad (1)$$

The reflection of zero can be achieved by matching the impedance of the absorber with the impedance of free space through adjusting the geometric parameters of the structure to make the relative permeability  $\mu_r$  and the relative permittivity  $\epsilon_r$  of the same value,

$$R(\omega) = \frac{Z(\omega) - Z_0}{Z(\omega) + Z_0}$$

$$Z_0 = \sqrt{\mu_0 / \epsilon_0} = 377 \Omega$$

$$Z(\omega) = \sqrt{\frac{\mu_0 \mu_r(\omega)}{\epsilon_0 \epsilon_r(\omega)}}$$

The proposed structure is simulated in HFSS using periodic boundary conditions (master slave and floquet port) and the result of absorption is shown in Figure 2. The proposed structure exhibits a broad bandwidth of 2.7 GHz ranging from 6.9 to 9.6 GHz with absorption of 95%.

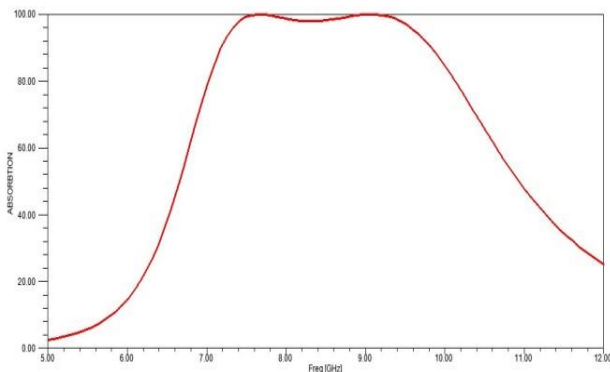


Figure 2. Simulated absorption performance of the proposed structure for the normal incidence EM wave.

### 3. DISCUSSION AND ANALYSIS:

The surface currents of proposed structure at the peak frequencies on the top and bottom surfaces are shown in figure 3.

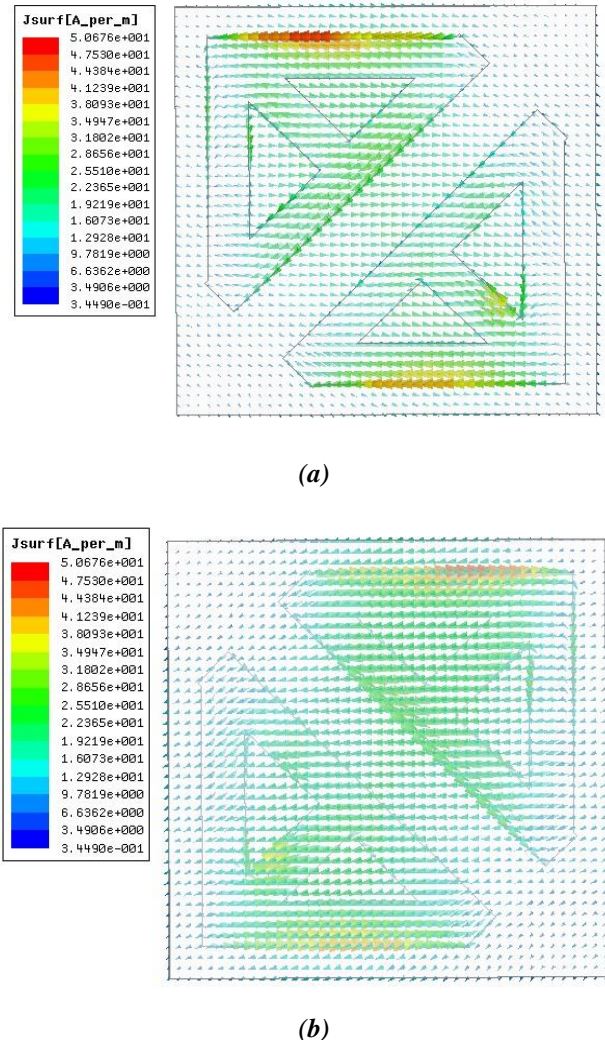


Figure 3. Surface current density distributions at the (a) top and (b) bottom surface of the proposed structure.

The anti-parallel surface currents at the two metallic patches as evident from figure 3 form a circular current loop within the substrate, which is controlled by the incident magnetic field, thus creating magnetic excitation.

The induced electric fields within the structure are also shown in figure 4 at the frequencies of interest, creating electric excitation. The overlapping of these two excitations results in strong electromagnetic absorption.



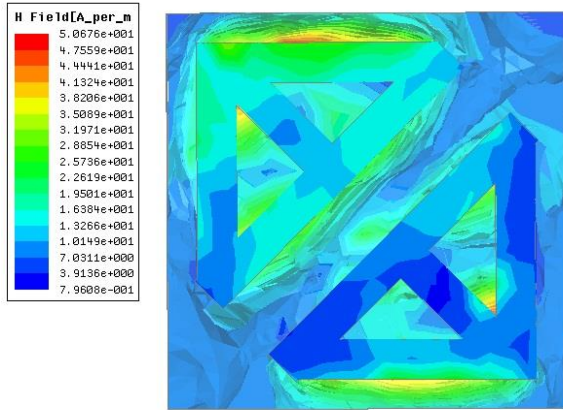


Figure. 4. Electric Field and magnetic Field distributions within the proposed structure

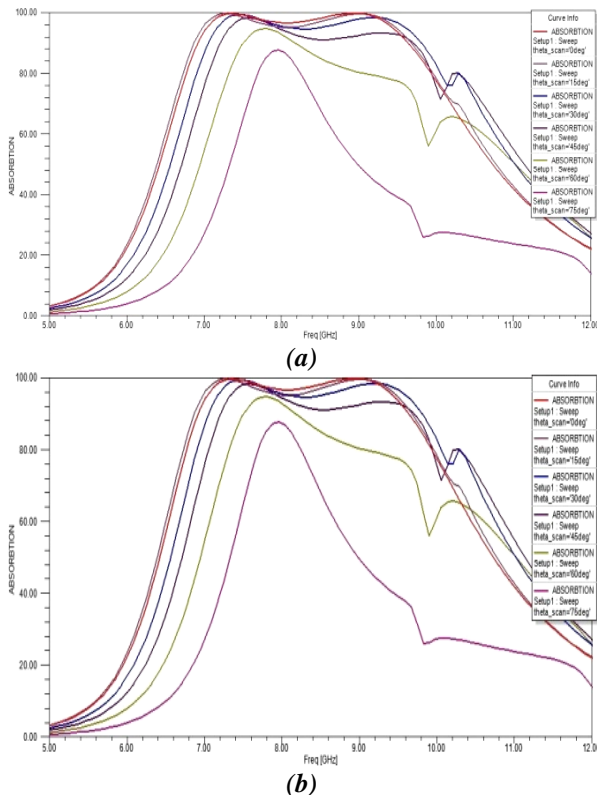


Figure 5. Simulated absorption response for the oblique incidence under (a) TE polarization and (b) TM polarization

The structure is simulated for different angles of incidence ( $\theta$ ) as shown in figure.5(a), under TE polarization. In this case, the direction of electric field is along x-axis and the magnetic field and incident wave vector directions are changed by an angle  $\theta$ . The bandwidth of wide absorption is maintained upto 45° incident angle.

The structure is also studied for different incident angles under TM polarization as illustrated in figure.5(b). Here, the direction of magnetic field is along y-axis, and the electric field and wave vector directions are varied by an angle  $\theta$ . Upto 45° incident angle, the wide absorption bandwidth is observed

The proposed structure has also been studied for different angles of polarization ( $\phi$ ) as shown in Figure 6, where the direction of incident EMwave remains parallel to z-direction while both the electric and magnetic field make an angle  $\phi$  with x-direction and y-direction respectively.

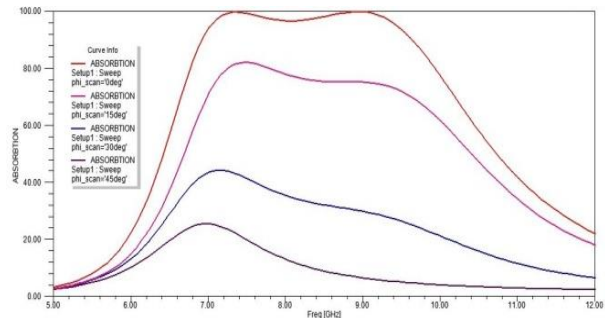


Figure.6. Simulated absorption response for the polarisation angle variation

The proposed structure have the two fold symmetry along xy plane, the structure needs to be studied only upto 45° angle of polarization. The simulated absorption response depicts in Figure 6, showing that the structure has broadband absorption upto 45° polarization angle.

4.CONCLUSION:

A metamaterial absorber has been discussed with two simple set-square shaped patches made up of copper placed diagonally at the top surfaces. The proposed

structure shows 2.7 GHz absorption bandwidth with more than 95% absorptivity from 6.9 to 9.6 GHz . The structure is only 2.07 mm thick ( $\sim \lambda/15$  with respect to the center frequency).The roles of several geometrical parameters of the structure have been studied to explain the broadband nature of the absorber. The proposed structure exhibits wide absorption bandwidth upto 45° incident angles for TE and TM polarizations as evident from simulated measured responses.

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# Determination of Lateral Load on Steel Plate Shear Wall by Indian Standard Code

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**Abstract:**-- The Steel Plate Shear Wall (SPSW) consists of horizontal beams commonly referred as Horizontal Boundary Elements (HBEs) and the vertical columns are commonly referred to as an Vertical Boundary Elements (VBEs) and the infill steel panels are commonly referred to as a steel plate shear wall.

For the last few decades, experimental and analytical studies on the use of SPSW in the buildings have been conducted as primary Lateral Load Resisting Elements (LLREs). To determine the lateral loads on the structure, various approaches ranging from purely linear elastic analysis to non – linear inelastic analysis have been developed for seismic analysis. The analysis for determination of lateral force is carried out by Clause no. 7.2, page no. 17 of (Indian Standard) I.S. 1893 (Part 1): 2016 “Indian Standard, Criteria for Earthquake Resistant Design of Structures, Part 1: General Provisions and Buildings”, Bureau of Indian Standards, 2016.

When subjected to lateral loading in the plane of the shear wall, the forces are resisted through the flexural and a coupled axial response of the HBEs and VBEs and by in – plane shear resistance of an infill steel panels, fixed between the frame members. The simplified method is also carried out, it is referred to as an equivalent static method, as per Clause no. 7.6, page no. 21 of (Indian Standard) I.S. 1893 (Part 1): 2016 “Indian Standard, Criteria for Earthquake Resistant Design of Structures, Part 1: General Provisions and Buildings”, Bureau of Indian Standards, 2016.

**Key Words:** Horizontal Boundary Elements (HBEs), Lateral Load Resisting Elements (LLREs), Steel Plate Shear Wall (SPSW), Vertical Boundary Elements (VBEs).

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## I. INTRODUCTION

For the past few decades, experimental and analytical studies have been conducted on the use of SPSWs as primary LLREs in buildings. SPSW have been proposed by the researches as viable structural alternatives to resist lateral loads in medium – rise and high – rise steel construction, particularly in areas of high seismic risk. Research programs worldwide have investigated various parameters and construction details associated with SPSW construction. Regarding the post – buckling behavior of SPSW, a limited amount of information is currently available for the analysis and design for the purpose of developing simple expressions of the structural system [8]. Fig. 1. Shows the typical SPSW with nomenclature.

## II. PREVIOUS WORK DONE FOR SPSW

### A. Review of Researchers

Jeffrey W. Berman have studied for the SPSWs the A.I.S.C. Seismic Design Provisions now include capacity design requirements, which consist of columns, denoted VBEs and thin web plates that infill frames of steel beams denoted HBEs. The thin un – stiffened web plates are expected to develop tension field action due to buckle in

shear at low load levels, providing energy dissipation and ductility through tension yielding of the web plate [48].

J. J. Cao et al. worked to connect braces and other attachments to hollow structural sections (HSS) although longitudinal plates have been widely used, for this type of connection there is no established design method available. To produce a rational design procedure, research work has been undertaken both analytically and experimentally [42]. Darren Vian et al. some results are studied by an experimental program of steel panel shear walls and are outlined. The tested specimen’s utilized reduced beam sections (RBS) and low yield strength (LYS) steel panels at the beam – ends. The allowances for penetration of the panel of two specimens by utilities, which could exist in a retrofit situation [18].

Jeffrey Berman et al. studied the specimen design, prototype design, experimental setup, and experimental results of three light – gauge SPSW concepts. Prototype light – gauge SPSW as seismic retrofits for a hospital structure in an area of high seismicity are designed, and emphasis is placed on minimizing their impact on the existing framing. Experimental results are compared to monotonic pushover predictions from computer analysis using a simple model and observed good agreement [47].

Matthew Eatherton studied the system and will have a new level of exposure among design engineers in the U.S., with the first U.S. code for SPSW in the recently released 2005 AISC Seismic Provisions. However, there are several issues, that an engineer will face in deciding whether to use SPSW, and in the process of design. In SPSW design the plate material and thickness is of paramount importance [55].

Hong – Gun Park et al. investigated the cyclic behavior of framed steel walls with thin infill plates an experimental study was performed. Tested five specimens with a single bay and three stories. The strength and the plate thickness and compactness of the column were the test parameters for the specimens. The test results showed that well – designed steel plate walls exhibited large ductility and energy dissipation capacity as well as high strength unlike conventional reinforced concrete walls and braced frames [26].

Berman W. Jeffrey et al. currently available to structural engineers SPSWs are one of the most economical and under – utilized LLRSs. SPSWs have fewer costly detailing requirements, allow for rapid construction, require less stringent construction tolerances, and result in fewer bays of lateral load resisting framing in comparison with traditional lateral load systems, such as reinforced concrete walls, steel braced frames and moment resisting frames [13].

Anirudha Das et al. in recent years the un – stiffened SPSW system has emerged as promising LLRSs. Because of being uneconomical, heavily stiffened SPSW systems that were designed earlier were not very popular [7].

B. Qu et al. as the primary lateral force resisting system in buildings the multi – story SPSWs are progressively being used. On the behavior of intermediate beams in this structural system as well as the performance of such beams having reduced beam sections (RBS), however insufficient information exists [10].

Cem Topkaya et al. in most seismic building codes, using the natural period of vibration of the structure, the design base acceleration is computed. To estimate the fundamental natural period of a system design specifications provide empirical formula [15].

Mehdi H. K. Kharrazi et al. a simple rational model was developed to determine the structural behavior of steel plate wall (SPW) systems, and is referred to as the Modified Plate – Frame Interaction (M – PFI) model. For the SPW system, the model considers shear and bending behavior and the interaction of the two [58].

Ronny Purba et al. a case study was conducted to investigate the seismic behavior of SPSWs having boundary elements designed by two different philosophies. To investigate behavior non – linear time – history and pushover analysis were conducted [61].

Lanhui Guo et al. states due to the excellent energy dissipation capacity and economic factor thin steel plate shear walls (TSPSWs) are especially concerned. Thin steel plate shear walls commonly define as steel plate with height to thickness ratio over 300. By structural engineers the deformability, energy dissipation capacity and post – buckling capacity of TSPSWs are now accepted [51].

Javier Rodriguez Martin et al. developed a new rectangular orthotropic finite element including non – nodal degrees of freedom and drilling rotations for plane stress analysis, and were fully compatible with a refined frame element; therefore, the frame and membrane actions are coupled. This plane stress element can accurately model SPSW systems in combination with a refined beam – column element [44].

M. Nava et al. before requirements for test specimens with 1:1 aspect ratios and the inclusion of a vertical panel joint some existing qualifications / validation data for alternatives to code – compliant light – frame cold – formed steel (CFS) shear wall construction were developed. The analysis showed that the performance of walls without a panel joint and with aspect ratio as high as provide reasonable lower bound measures of performance [53].

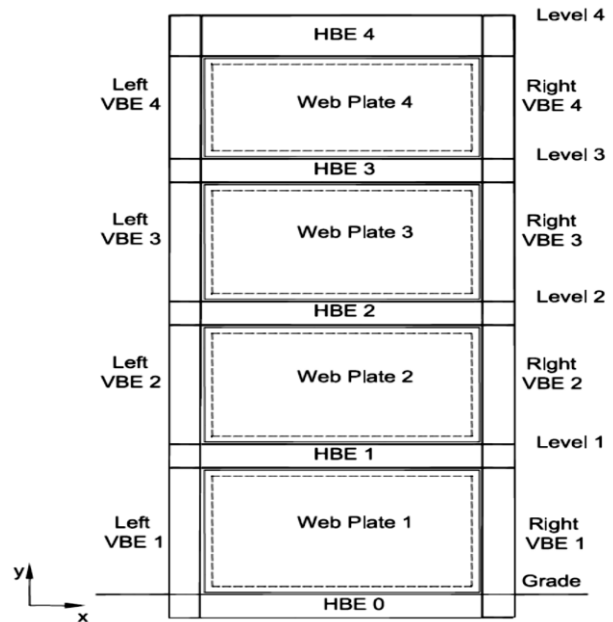


Fig. 1. Typical SPSW with nomenclature [48].

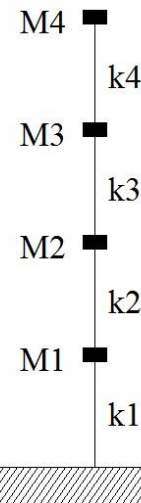
**Step 1: Preliminary Design Data:**

*Table. 1. Preliminary design data and parameters*

Sr. No.	Parameter	Data
1	Type of Structure	Steel Framed Structure
2	Material	Steel
3	Site Location	Nashik. Maharashtra State. India.
4	Seismic Zone [Annex E, Page 37, I.S. 1893 (Part 1) : 2016]	III
5	Peak Ground Acceleration [Seismic Zone Factor, (Z) Table 3, Page 10, I.S. 1893 (Part 1) : 2016]	0.16
6	Importance Factor, <i>I</i> [Table 8, Page 19, I.S. 1893 (Part 1) : 2016]	1.0
7	Response Reduction Factor, (R) Table 9, Page 20, I.S. 1893 (Part 1) : 2016]	5
8	Type of Soil	Rocky (Hard)
9	Response Spectra	As per I.S. 1893 (Part 1) : 2016
10	Method of Analysis Clause 6.4.3, Page 10, I.S. 1893 (Part 1) : 2016]	Equivalent static method

**Step 2: Load Calculation:**

1. Total Dead Load (TDL) = 3000 kN.
2. Total Live Load (TLL) = 550 kN.
3. TDL + TLL on Level 1, Level 2, Level 3 = 110000 kN. (Each)
4. TDL + TLL on Level 4 (Top Floor) = 70000 kN.
5. Seismic Weight at all floors =  $M_1 + M_2 + M_3 + M_4$   
= 110000 + 110000 + 110000 + 70000  
= 400000 kN.
6. Seismic Weight of the Building = 400000 kN.



**Fig. 2. Typical Lumped Mass Model Diagram.**

**Step 3: Location of Co ordinates for Centre of Stiffness:**

1. In X Direction = 9 m.
2. In Y Direction = 21 m.

**Step 4: Calculation of Design Seismic Base Shear:**

1. Fundamental Natural Period of Vibration (Seconds)  
=

As per Clause 7.6.2, Page 21 of I.S. 1893 (Part 1): 2016

$$T_a = \frac{0.09h}{\sqrt{d}} \tag{1}$$

$$T_a = 0.257 \text{ seconds}$$

As per Clause 6.4.3. Page 14 of I.S. 1893 (Part 1): 2016, Equivalent static method is used for analysis of the regular structures because the fundamental natural period of vibration  $T_a < 0.4$  seconds.

2. Design horizontal Seismic coefficient =  $A_h$  =  
As per Clause 6.4.2, Page 9 of I.S. 1893 (Part 1): 2016

$$A_h = \frac{\left(\frac{Z}{2}\right)\left(\frac{S_a}{g}\right)}{\left(\frac{R}{I}\right)} \tag{2}$$

As per Fig. 2A, Page 12 of I.S. 1893 (Part 1): 2016

For  $T_a = 0.257$  seconds,  $\left(\frac{S_a}{g}\right) = 2.5.$

$$A_h = 0.04$$

3. Design Seismic Base Shear =  $V_B$

$$V_B = A_h W$$

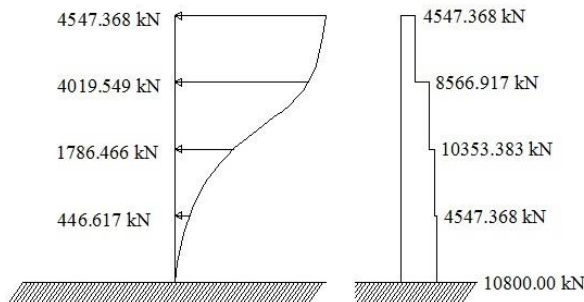
$$V_B = 0.04 \times 400000 = 16000 \text{ kN.} \quad (3)$$

As per Clause 7.6.3, Page 23 of I.S. 1893 (Part 1): 2016

$$Q_i = \left( \frac{W_i h_i^2}{\sum_{j=1}^n W_j h_j^2} \right) V_B \quad (4)$$

By using (4), the base shear is calculated and is given below,

- Q<sub>1</sub> = 446.617 kN.
- Q<sub>2</sub> = 1786.466 kN.
- Q<sub>3</sub> = 4019.549 kN.
- Q<sub>4</sub> = 4547.368 kN.



(a) Lateral Force Loading Diagram (b) Base Shear Diagram

**Fig. 3. Distribution of Lateral Force and Base Shear Diagram.**

**CONCLUSION**

I.S. 1893 (Part 1): 2016 “Indian Standard, Criteria for Earthquake Resistant Design of Structures, Part 1: General Provisions and Buildings,” Bureau of Indian Standards gives the guidelines for the calculation of lateral load on the structures.

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# Very Low or Almost Nil Exposure to Engineering & Technology in the Early Schooling Stage is the Biggest Problem in Technology and Engineering Advancement in Rural India and Reason for Inability to Produce Contextual Technology Solutions in Rural Areas of the Country.

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**Abstract:-- We are situated in Mohgaon, a Tehsil of Mandla district of Madhya Pradesh in India. It is 40 kilometre from Mandla District and constitutes 87 villages and 38 Gram Panchayats. Mohgaon is surrounded by Mandla tehsil towards the South, Mehandwani tehsil towards the North, Ghughri tehsil towards the East, Narayanganj tehsil towards the West. Kanha National Park, Bandhavgarh National Park and Kawardha are the tourist hubs near Mohgaon.**

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## INTRODUCTION

This paper explores a live program: the Narmada Valley Avishkar Labs (referred as NVAL in the paper) that aims to expose the tribal population to technology practices at a very early age, the underlying hypothesis being that when education is given a broader and contextual outlook, no one is a first-generation learner. Children respond to the cultural capital, a term that captures all the qualities that are intrinsic to their environment. This paper aims to demonstrate that educationists must integrate the necessary livelihood skills needed to survive with dignity with children's capacity and cultural capital to make for a meaningful learning process for children.

NVAL integrates the two factors below:

- a) The livelihood skills that are needed for a dignified livelihood
  - b) The contextual (cultural capital) knowledge of children for which they cannot be called first generation learners.
- The benefit of the program and that which the paper is pointing towards is a more flexible yet strong education system that builds on the cultural capital existing with the children, which results in a faster learning cycle and integrating this cultural skill set in a "modified- upgraded" manner to suit future needs for a secure livelihood.

The three major points that the paper will explore in regards to present context are these:

- a) The current contextual (cultural) skills that can be built through an intensive experience of the region and the children.
- b) Livelihood skills needed in the global market of the future that will see the rise of automated technology
- c) Upgrading the cultural capital to make it future-ready

This region has a majority of different tribes that include Gonds, Baigas and Mariyathey who are generally involved in following activities. Livelihood forest dwellers comprising archers and hunter-gatherers, are mainly dependent on forests, farmers on meager landholdings and landless farmers on lands owned by others. So these tribes are mainly dependent on the old-fashioned livelihood techniques as they don't have knowledge or connectivity to technology.

According to Census 2011, literacy ratio in Mohgaon block is 51%. Among males, the literacy ratio is 61% whereas female literacy ratio is 42%. Due to presence of poorly-educated or illiterate people, the need for livelihood generation and development in this region is greater to help people help themselves.

## LITERATURE SURVEY

We did a study of available literature to understand the paradigm of employability better. Nayana Mallapurkar, who is the Program Head for the TISS School of

Vocational Education, feels that about 90 per cent of employment opportunities require vocational skills. Only 20 per cent of graduates of the TISS School of Vocational Education get employed. The rest are unable to get suitable employment due to the lack of employable skills. In the present context of globalization, the demand for skilled and multi-skilled workers has increased. Therefore, in the context of developing countries, such as India, there is a critical need for high quality skill development and training. In general, apart from the core subject expertise, some of the prominent employable skills that employers seek are:

- communication skills (verbal and written)
- commercial awareness
- attitude towards work
- lifelong learning
- self-management
- teamwork
- problem solving
- initiative
- self-motivation
- adaptability
- stress management
- creativity
- interpersonal sensitivity
- technology/IT skills

Dr. Lakshmi Mohan who is the campus head of ITM Business School says that at school level, options must be available for skill development courses and they must be provided in the secondary stage of schooling. Many more courses in fields such as hospitality and tourism, handicrafts, healthcare, textiles, photography, IT, retail, banking and insurance can be added that may interest students. For instance, if a student opts for healthcare, he could learn to be a blood-collection expert and later can add further courses to become full-fledged pathology technician or nurse. The pedagogy has to be practical; learning can be enhanced through field visits, e-learning, industry driven projects, digital or video inputs and so on.

As per a study from the latest edition of National Employability Report, Engineers 2014 by Aspiring Minds, only 18.43% engineers are ready to be deployed as software engineers in the IT services industry out of more than 6 lakh who graduate each year. For IT product roles, this number is a staggering 3.21%.

The current paradigm of employability does not consider the notion of cultural capital at all, preferring to equate all youth in the same basket of the unemployed and unemployable. Cultural capital is the accumulation of knowledge, behaviors, and skills that one can tap into to demonstrate one's cultural competence, and thus one's

social status or standing in society. The Gujarati and Marwari communities are known for their business acumen since the time business was first introduced here. Today, these communities are known for their diaspora scattered all across the world. Gujaratis are vegetarian and a food-loving people. A traditional Gujarati thali consists of dal (lentils), roti, rice and vegetables apart from salads, farsan and sweet dish followed by chaas, forms the morning meal. Evening food consists of bhakri-shak or khichdi kadhi. Most of the small-scale entrepreneurship in Gujarat has developed in the domain of food. Many Gujarati women are involved in food-related entrepreneurial activities. Majority of the Gujarati thrive as business persons as agriculture and livestock sector contribute 17.5 % and 4.5% share in the state's GDP.

Similarly, the Marwari community is from the desert and a lack of natural resources led Marwari people to become businessmen as they refused to resign themselves to poverty. They migrated across the world, thriving on the business opportunities available. According to the Census of 2001, Marwari is a language spoken by 79,36,183 people in India and they are majorly concentrated in the states of Rajasthan, Maharashtra and Gujarat. Most of the Marwaris are either Hindus or Jain. The Marwari cuisine is strictly vegetarian and offers a fabulous variety of mouthwatering dishes. Marwari community was created through trading and capitalist alliances. The Marwari trading networks themselves created the very possibility of a public community.

For the hilly people, serving in the armed forces is a key part of the cultural capital. Indeed, the Indian Army has regiments from hilly states Garhwal Rifles from Uttarakhand, Assam regiment from Shillong, Jammu Kashmir Light Infantry from Jammu, Naga regiment from



Uttarakhand, 1 and 4 Gorkha Rifles from Himachal Pradesh, 8 and 9 Gorkha Rifles from Shillong. A recurrent theme across the histories of all of these communities is that they built upon the cultural capital and became big and popular, evolving with time.

For a good engineer, we define cultural capital to be the ability to think creatively and innovatively, strong Mathematical and problem-solving skills. For the tribal communities, this cultural capital exists though it needs to be upgraded. In the subsequent paragraphs, we will

demonstrate instances of this, as we have observed in our study of the tribal community here.

**Agricultural Engineering**

The tribal people here work on the different rough and mountainous terrains which are not suitable for farming and still they are able produce good quality and quantity of crops.

**Civil Engineering:** The local communities make their own houses with mud and kothi to keep their crops secure.

**Water Resource Management:**

They have undulating land so they manage the source of water and accordingly provide water to their land.

**Environmentalists:**

Tribals are mainly dependent on forests and they are majorly Forest Dwellers who bring the resources from the forest and utilize it and also consume it but they are still protective towards the forests.



**Mechanical Engineering**

Tribals are less exposed to high quality tools so they make their own tools with the materials available with them from first principles, a skill set that many freshly minted engineers are incapable of.

**Innovators**

There are tribal kids who make their own toys by using waste items, so they have sense of utilizing waste materials and solving their problem of a lack of engaging play material.

It is commonly known that unless children receive sufficient exposure to a discipline, they will not imbibe it. A key finding of the research by the University of Calgary team found that students who take foreign language classes at school are unable to gain deep fluency unless they receive sufficient exposure to the language. “Learning a second language for 95 hours per year for six years will not lead to functional bilingualism and fluency in the second language. Expectations must be realistic,” cites the paper.

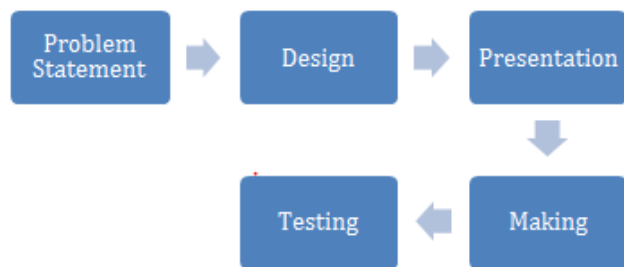
**Methology:**

To establish that by the time these children reach Class 10, they lose interest in Math and Science, we studied the data from the Mohgaon Government school. We found that out

of 109 students, there are 25% in science, 65% in Arts and 10% in Agriculture.

Our experience of the NVAL program with primary and middle school children indicates otherwise. Indeed, children have not only demonstrated a keen interest in science and Math but they have demonstrated understanding of the usage of a motor and a fan to creatively solve problems in a matter of three months. In three months, students of rural government school children from classes 6 and 7 have responded very well to learning and understanding the concepts and applications as below:

Projects	Topics of Applied Sciences Covered
Catapult	Elasticity
	Newton’s law of motion
Soldering Workshop	Basics of Soldering
	Practical sessions
Solar Cooker	Solar Energy
	Renewable Sources of Energy
	Heat
	Absorption of Heat
Electrical Conductivity	Electrical Circuits
	Electricity Conductive materials
Salt Water Conductivity Experiment	Salt water is good conductor of electricity
	Electric Circuit
Smart Almira lighting system	LED lighting system
	Circuit and Network
	Batteries
Torch (Flashlight)	LED bulbs
	Reflection of Light
	Switches
Motor Boat	Buoyant Forces & Buoyancy
	Archimedes’ Principle
Portable Fan	Motors
	Switches
	Circuit Connections



**Fig 2: Structure of the NVAL program that typically happens in Government school classrooms in groups of 4 children**

### DISCUSSION:

As per a report, there were only 44 engineering institutes in India with an intake capacity of 3300 students before independence. This number has increased to 3200 engineering institutes with intake capacity of 16.3 lakh, registering an increase of more than 75 times in institutes and more than 500 times in the intake capacity. There has also been a great progress in nuclear energy, medicines, information technology and space sciences. But it is an admitted fact that we have not been able to produce many research scholars of international repute and in consonance with our number of institutes and a large population.

In the 116 year history of Nobel Prize, we have so far received only one in 1930 won by C.V.Raman. This compels us to think where the fault lies. The President of India Pranab Mukherjee while addressing academicians and students recently at Rashtrapati Bhavan said, "Lack of conducive environment in academia was pushing the best talent towards regular jobs instead of critical research. We have excellent IITs, NITs and IIMs where campus recruitment is almost 100% but no Indian scholar working in an Indian university has won a Noble Prize since 1930. If they had given the time and energy to do research, the country would have benefitted much more." He has clearly referred to our education system which does not provide the required environment for research. Chandrashekher and Dr. Hargobind Khorana got the Nobel prize only when they shifted their citizenship and work place to America where they had a conducive environment of research. Hence, knowledge and understanding have been subordinated by marks and degrees. Existing education structure has not been able to imbibe a proper scientific culture. This is the reason that for the last some years about 50% of the seats in engineering colleges remain vacant.

### CONCLUSION

On the other hand, 72.2% of the total population is distributed in about 638,000 villages while the remaining 27.8% lives in more than 5,100 towns and over 280 urban

agglomerations, making rural India a powerhouse for national development. Since most of India's resources are concentrated in remote areas, by leveraging manufacturing and industry in rural landscapes, the nation can utilize them in an efficient manner. It will reduce the cost of manufacturing that will eventually help end customers. Productivity will increase impacting export and foreign exchange. Hence, these regions will be turned into growth engines to drive the nation towards progress. Thus, it is evident that for science and technology to take off in rural areas, there is a huge need to introduce these disciplines through a hands-on approach among rural school children. It is only through this that the spirit of Make in India will be fully realized.

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# Observations on Anonymization Based Privacy Preserving Data Publishing

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**Abstract:** Anonymization is a process of hiding the information such that an illegal user could not deduce anything from the records, on the other hand an analyzer will get necessary information[4]. The term Data Privacy is related with data collection and distribution of data. Privacy issues arise in different area such as health care, Bank sector, social media data, etc. It is one of the challenging issues when sharing or publishing the data between one to many sources for research purpose and data analysis[2]. Many organizations also release vast micro data. It excludes an individual's direct identity marks like name, address and consist of specific information like gender, DOB, marital status, Pin-code, which can be combined with other public data to recognize a person[3]. This inference attack can be worked to obtain any sensitive information from social network platform, by that putting the privacy of a person in danger. To stop such attacks by changing micro data, K-anonymization is used. In this paper, we provide a computational disclosure technique for releasing information from a private table such that the identity of any individual to whom the released data refer cannot be definitively recognized[1]. It is based on the topic of generalization, from which stored values can be replaced with trustworthy but less specific alternatives, and of k-anonymity.

**Index Terms**—Data publishing, privacy preserving, kanonymization, classification.

## INTRODUCTION

In a globally-network society, there is greater demand by society for individual-specific data, yet the widespread availability of information makes it extremely difficult to release any information about individuals without breaching privacy[1]. Even when released information has no explicit identifiers, such as name and phone number, other characteristic data, such as birth date and ZIP code, often combine uniquely and can be linked to publicly available information to re-identify individuals[5]. Typically, such information is stored in table format(T). Adversaries (attackers) link more than two dataset and use their background knowledge for deducing the sensitive information. Certain attributes are linked with external knowledge to identify the individual's records indirectly[2]. Anonymization techniques are used to convert the micro data D to D'[2].

A. What is the difference between the Security and Privacy?

In order to secure the data which is stored in the computer, needs to be secured by providing some data encryption, password and decryption algorithms, but the most essential thing is that only authorized person has a ability to deal with data. When privacy is considered, only the authorized person can decide the level to which information can be

revealed to the outside world[6]. Objective of Privacy Preserving Data

✚ Publishing the data require three steps:-

Step1: Publisher (owner) collects data from different data providers.

Step 2: For mining results, various anonymization techniques are applied on data.

Step3: As the privacy is preserved by different anonymization techniques the data is released for references.

Figure 1: Three steps for publishing the data

Mining (PPDM) is to publish assertion of privacy preserved dataset and preserve sensitive information in the table, so that researchers can go ahead with the proposal by uncompromising privacy of any individual. Main aim of

privacy preservation is to protect oneself from being revealed to unauthorized people.

**B. Challenges in privacy preserving data publishing**

- 1) sequential data publishing causes the linking attack of published datasets and infarcts the user’s sensitive information.
- 2) published anonymization techniques for data publishing brings down the data utility.

**II. BACKGROUND THEORY AND RELATED WORK**

In this section, we evaluate the existing anonymization techniques focusing on data publishing and talk about background knowledge and also problems of privacy preserving data publishing.

**A. Background Knowledge**

Background knowledge can be explained as the experience that already has, come across formally from the prior rules of the published datasets of various data publisher or as informally from the life experiences. An opponent could have the earlier published datasets and other publicly available datasets. These datasets could help the opponent to acquire the background knowledge for combining with the target sensitive values from the newly published datasets. Data publisher cannot define the background knowledge for the opponent. Therefore it is necessary to prepare a general framework which can deal with all background knowledge attacks[7].

**B. Anonymization Techniques**

There is various privacy preserving data publishing techniques have been published in the last many years. This is based on partitioning and randomization. In the partitioning method, the data values of quasi-identifiers QI (e.g., gender, age, and ZIP code) are labeled to construct an similarity class. Therefore, an individual cannot be identified with their sensitive values in the similarity class. By contrast, in a randomization anonymization techniques, the original values have been replaced by attaching some noise therefore it is difficult to point a person in a published data set. Some popular anonymization techniques, have been published for one-time data publishing for information revelation risks. kanonymity, l-diversity, t-closeness approaches are vulnerable to the linking attack[7].

**C. Problems of Sequential Data Publishing**

In the data publishing framework, the data publisher will publish their data on a regular basis. For example, hospital X( Table 1) publishes their data after every 3 months and user U visits the hospital X in March for the disease D. Later in June user U visits the hospital X for the same disease D.

Hospital X publishes their dataset in April and later in August. Now, the user U exists in the all published datasets with the similar QI values. An opponent may use these published datasets to assume the user U and the sensitive values in 100 percent confidence. There is various works have done to handle the data publishing privacy issues. Additionally, these published works decrease the data utility to ensure the personal privacy[7].

**D. k-anonymity and its variants**

A variant of k-anonymity known as l-diversity was introduced by Machanavajjhala et al[8]. It gives privacy in some situations where k-anonymity does not, such as when there is little diversity in the sensitive attributes or when the opponent has some background information. The t-closeness model is a more enhancement on the concept k-anonymity and ldiversity. One characteristic of the l-diversity model is that it serves all values of a given attribute in a similar way whatever is its distribution in the data. This is rarely the case for real data sets, since the attribute values may be much twisted. This may make it more difficult to create practical l-diverse representations. Usually, an opponent may use background knowledge of the overall distribution in order to make guessing about sensitive values in the data. Further, not all values of an attribute are equally sensitive. For example, an attribute related to a disease may be more sensitive when the value is positive, comparatively than when it is negative. t-closeness requires that the distribution of a sensitive attribute in any similarity class is close to the distribution of the attribute in the overall data set[9].

**III. GENERAL FRAMEWORK OF EXISTING SYSTEM**

In existing system architecture, there is an input dataset(file) which is not in appropriate format and then for proper dataset apply some pre-processing techniques(data cleaning, data reduction, data transformation) on it. On that pre-processed dataset apply k-anonymization and that anonymized data is used in simulation tools and identify the different classifier algorithm results. This general framework or architecture is as under:

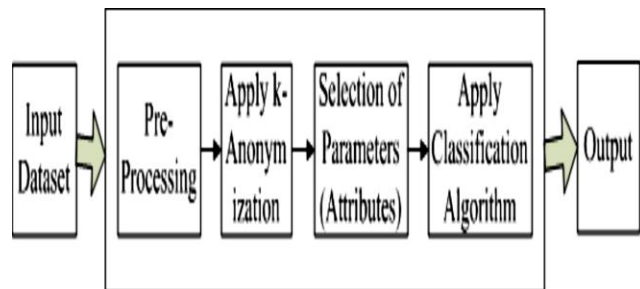


Figure 2: General architecture of existing algorithms

**IV. ANONYMIZATION ALGORITHMS**

There are number of algorithms based on various models of k-anonymity to achieve k-anonymity. In our relative study, we have chosen some k-anonymization algorithms. In the below section, we explain the algorithms applicable to the scope of this work, we likewise show a simplified representational so, a case for each of the algorithms, with the target of making them effortlessly possible for specialists[1]. (a) Samarati’s Algorithm (b)Incognito Algorithm (c) Sweeney’s Algorithm.

**A. Samarati’s Algorithm**

This algorithm scans for the possible k- anonymous solutions by grasping different levels in Domain Generalization Hierarchy. It uses the binary search to gain the solution in less time. [11] Samarati makes the hypothesis that great solutions are the ones where end results in a table have minimum generalizations.

Thus, her algorithm is planed to look at the generalizations that satisfy k-anonymity with minimal suppression. This algorithm accomplish the AGTS model, generalization is applied on column and suppression is applied on row. MaxSup is the greatest number of tuples that are allowed to be suppressed to achieve k-anonymity.

**B. Incognito Algorithm**

Incognito algorithm [10] produces the set of all conceivable k-anonymous full-domain generalizations of relation T, with an optional tuple suppression threshold. In the algorithm each iteration consists of two parts. It starts by checking singleattribute subsets of the quasi-identifier, and afterward repeats, checking k-anonymity with respect to larger subsets of quasiidentifiers.

**C. Sweeney’s Algorithm- Datafly**

Datafly algorithm is an algorithm for providing anonymity of Electronic Health Records [12].Anonymization is achieved by means of mechanically generalizing, substituting, inserting and removing statistics without losing details for research.

**V. COMPARISON OF EXISTING ALGORITHM**

Comparison of Samarati’s Algorithm, Incognito Algorithm and Sweeney’s Algorithm- Datafly for anonymization is given in the table with advantages and disadvantages of each algorithm.

	Algorithm	Pros	Cons
1	Samarati’s [11]	1. Uses the binary search to acquire the solution in minimum time. 2. Looks for the solution with the least generalization. 3.samarati’s outcome dependably has an chance to be an optimal solution 4. Great result when compared to Datafly	1.The chance to get an optimal solution practically varies with k, MaxSup lattice size.
2	Incognito [10]	1.The algorithm finds all the k-anonymous generalizations 2. Optimal solution can be selected according to various criteria	1.The algorithm uses breadth first search method which takes a lot of time to pass over the solution space
3	Sweeney-Datafly [12]	1.The algorithm checks very less nodes for k-anonymity due to which it is capable to give results very fast 2.It is a greedy approach that creates frequency lists and repeatedly generalizes those composition with less than k occurrences 3.Practically implementable	1. The algorithm skips many nodes, thus, resulting data is much generalized and sometimes this released data may not be useful for research purpose as it gives very less information. 2. Suppressing all values within the tuple

Figure 3: Comparison of existing algorithm

**VI. FUTURE WORK**

From this survey we understand that the more research is in work to include different extended data publishing scenarios such as Anonymizing sequential release with new attributes, multiple view publishing and incrementally update data records as well as non-numeric quasi identifiers. Other is to study on data in more detail and design various anonymization techniques which provide more accurate privacy preservation, and work on, semantic anonymization algorithm for decreasing the information loss and the dynamic version is provided based with a acceptable relation between privacy level and the utility.

**VII. CONCLUSION**

From above survey we can realize that anonymization is proportional to number of records, the value of k has to be chosen in a way it brings down the difference between the released microdata and the privacy. The number of k value enlarges the time taken for anonymization is increase, because when k increases, the time needing for anonymization is also increases. In the case of different size of data the anonymization time is incremented. In Sweeney’s algorithm there is large variation of execution time. In Incognito algorithm execution time has less variation with the k value and data size.Execution time is comparatively low in Samarati’s algorithm. When the data size is more,there is not any identifiable impact in the execution time. So from this analysis we can conclude that from between these three algorithms of anonymization Samarati’s algorithm is the best algorithm for anonymization.

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# Floating Architecture as Building Engineering Challenge

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**Abstract:--** The paper particularly focuses on the possibilities for the construction of building above water i.e. floating building. This research has come to an outcome about floating sustainable building, its construction techniques, services and its maintenance, floating mechanism and the energy efficiency of that particular building. For better results and analysing different aspects there is a comparative study and study of the similar projects which exist. At the end by collecting all the information this paper gives a brief analysis about the above head and can lead to optimum future approaches.

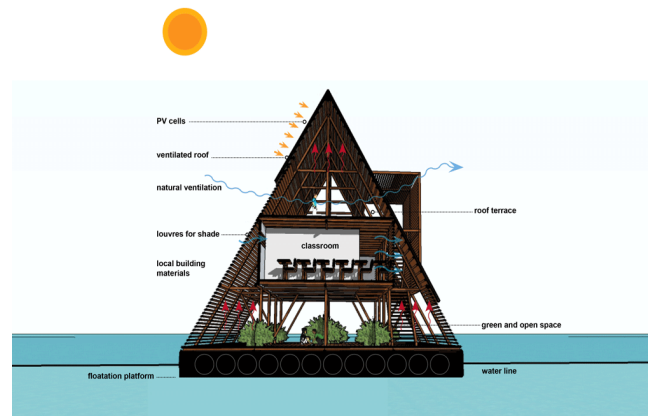
**Index Terms—** Floating architecture, sustainable building, energy efficiency, utilizing the nature's gift.

## INTRODUCTION

The condition of environment due to development of buildings is getting depleted day by day as the materials used are not eco-friendly and also for constructing a building the land has to be cleaned properly which directly affects the trees and plants as they are being harmed, the people are cutting trees to develop their lands and do artificial landscaping. This issue has been discussed and thus an outcome was released that building should be constructed eco-friendly which means materials should not be harmful to the nature as well as there should be some techniques adopted to make the building nature friendly which involved energy efficiency, landscaping at the sites, passive techniques etc.

The cities are developing more rapidly which has developed a new issue that is the shortage of land so to overcome that issue architectural community has introduced the concept of floating buildings as it is the innovative solution for this problem as well as the pollution is also control if we make that building energy efficient and nature friendly. This innovative idea is not new in fact it is an old concept as for instance we can say the boat houses in Kerala, in this place the people live into the boat houses from many years back, so this practise is traditional and now it is been modified as floating building and many different types of building are coming up into this concept. There is another example of floating building: Floating hotel "Salt & Silk", Sweden, year of exemption 2006. And a massive hotel concept, the Ark, designed by Russian architect Remi studio can endure extreme floods. In India this practise is not so popular but in other countries many buildings of this kind is been extruded above water with many facilities and is giving many advantages of that. People are considering this as a new

modernisation of architecture as they like the feeling of water in the building, the beauty of nature which is mesmerizing the observer, and the building of course is not harming the nature in any aspect. So this could be a beneficiary point to the designer to move the population over water so that the environment can cover a space for the trees, plants, animals as well as save the land for future. The plus point for the humans are without disturbing the nature they can enjoy the beauty of nature without any problem.



## Comparison between floating building and normal building

As we can see in the above examples about the floating building that they can withstand for many years without any damage as well as they are also capable of resisting the water natural happenings very strongly. As if there is a need to compare the normal and floating building in terms of durability, strength, sustainability, materials and construction techniques. The below points will lead for the differentiation of normal structures and floating structures:

**NORMAL STRUCTURES:**

- In general times the structures which are developed over the land needs strong foundation to extend any building vertically also the materials which are used for foundation are not 100% renewable as well as not much sustainable.
- They require proper curing and more quantity of material to have a proper stability and durability also to resist weather conditions.
- The norms for building a structure in the land has many restrictions and rules needs to be followed.
- Talking in terms of sustainability they are sustainable but the research for better sustainability is still in process as the materials used are not energy efficient also they release harmful radiations which results in environmental depletion.
- The construction on land takes several period of time so that it could give an effective result and also requires more labour work.
- But in aspect of material use many different types of material can be used as there is no restriction in accordance of floating architecture.

**FLOATING STRUCTURES:**

- In floating architecture the main focus comes over the floatation system on which the building will float over the water which can be done which the buoyancy formula also mooring and submerged building can also be constructed.
- The material chosen is sustainable as well as light weight for the purpose of floating, and the material selection also should be capable of resisting exposed condition of climate and water.
- Piles used as moorings for floating buildings resist the combination of loads acting on the floatation system and superstructure of the floating building and any vessel attached to the floating building or mooring pile.
- In these buildings extreme curing and labours are not required as the blocks can be precast and then placed over water.
- In terms of sustainability also floating structure are more effective as the protective layer which will be developed in the structure will help it to last for further generations.

**Requirements of Floating Architecture**

- If more than 1 exit is required by the Building Code of Australia (BCA), at least 1 permanent access for each required exit.
  - (ii) If paragraph(i) does not apply, at least 1 permanent access.
    - The permanent access must be a gangway, bridge or similar structure -
      - i) At least 1m wide, or a width required to satisfy D1.6 of the BCA, whichever is the greater, measured clear of all obstructions.
      - ii) Giving access to the shore; or
- A pontoon, float or wharf or similar structures at least 1.5m wide measured clear of handrails and giving permanent access to the shore.
- Over the total plan area of the superstructure disregarding projections such as roof overhangs, bay windows, enclosed decks and other architectural features; and to within 2m of such projections; and is a solid structure of reinforced concrete; and is a fully enclosed cellular construction with voids provided for buoyancy filled with expanded polystyrene or similar durable foam material is watertight; and is provided with a timber buffer or the like to protect it from minor accidental impact.
- To maintain positive stability with a minimum measurement of not less than 250mm from the waterline to the top edge of the floatation system under the most adverse combination of loads to which the floating building is likely to be subject including dead loads, live loads and wind loads calculated in accordance with the BCA and loads resulting from:
  - (1) Water turbulence; or
  - (2) Flooding of the waterway; or
  - (3) Tidal action; or
  - (4) Water flooding associated with fire fighting or accidental cause; or
  - (5) Accidental impact
- All materials used for decking, cladding, waterproofing, or structural purposes in a floating building or any mooring, gangway, bridge, pontoon, float, wharf or the like giving support or access to a floating building should be as per sustainability, stability and weather resistant capable.
- A floating building is located so that the minimum distance between the outermost projection of the floating building to any other building and the location of any proposed building is 3m plus 1mm for every 3mm in height in excess of 4.5m.
- A floating building is located so that no point on the floor of the floating building is either: beyond the reach of a fully extended hose reel that is connected to the water supply and situated in or in the vicinity of the floating building; or more than 90m from a hydrant.

**Sustainability Need**

Sustainable design is one of the most important factors in the building and planning process. Sustainable construction has emerged as a guiding paradigm to create a new kind of built environment: one that meets the need of humans in the present without limiting the ability of future generations to meet their own needs (1). Climate change and energy consumption have a significant impact on the sustainability. The first step in identifying and addressing environmental sustainability issues is to explore new concepts for renewable energy sources (2). Also sustainability is the capacity to endure. For humans, sustainability is the potential for long-term maintenance of well-being, which has environmental, economic and social dimensions. Sustainable building is a general term that describes environmentally conscious design techniques in the field of architecture. Sustainable building is framed by the larger discussion of sustainability and the pressing economic and political issues of our world (3).

To achieve sustainable vision certain needs to be fulfilled, as said according to the study the combination of different solutions has to be worked out to attain some sustainable objectives. New ideas and concepts should be discovered to get the result for various type of sustainable architecture in different aspects. Since floating architecture offers huge opportunities for manufacturing more cost-effective and energy efficient solutions for environmental difficulties. Sustainability of floating architecture can be interpreted as an energy and ecologically conscious approach to a building for living/working space on floatation system without navigation tool (3). There are three basic sustainable design components which are to be focused:

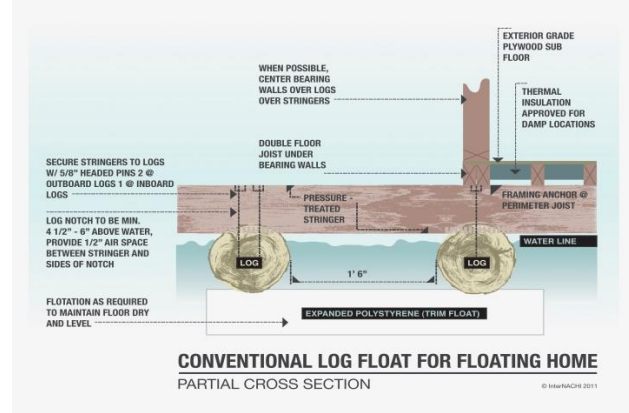
- Flows: energy, water and materials.
- Relation with the location.
- Accessibility

**Sustainable Design Considerations of Floating Architecture**

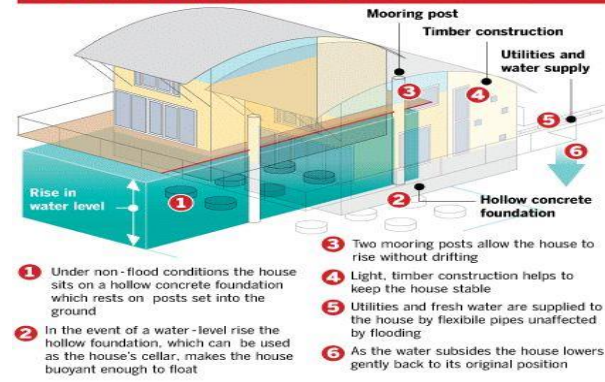
The development of the sustainable strategy in construction highlights the important role of sustainability to achieve efficiency and higher-quality performance in the buildings. In order to achieve sustainable development by promoting floating buildings, it is necessary that the analysis and design of floating buildings to be considered in relation to environmental sustainability indicators. Development of design criteria for floating buildings (not intended for navigational use) should also include a series of guidelines and frameworks such as global and environmental issues related to water, and understanding emotional and psychological aspects of living in floating buildings. Floating buildings can provide the concepts of sustainable design in architecture that are summarized as follows: promoting renewable energy generation, accessibility, reuse, recycling and self-supporting. To create a sustainable floating building, it needs to take key

design points into consideration which are described below:

- **Flotation system:** A floating building must have a floatation system which maintains an acceptable level of stability appropriate to the use or likely use of the building and which will not be affected by minor impact; and is capable of withstanding the most adverse combination of loads it is likely to be exposed to.



**CONVENTIONAL LOG FLOAT FOR FLOATING HOME**  
PARTIAL CROSS SECTION



- **Materials:** The material used for a building should be non-polluting, local and appropriate for the process of future deconstruction. Materials utilized in the construction process have a high environmental impact due to the uncontrolled use of resources, consumption of energy and water, wastes generated, and alteration to the environment caused by the extraction processes and transformation of materials. The main environmental objective is to reduce the impacts associated with the extraction, manufacture and reintegration of the materials. Types of materials which can be afforded for sustainability as well as the floating architecture are described below:

- Timber
- Use of recyclable materials
- Steel pontoon

- **Rates:** When a building is constructed then the most necessary concern is the cost of the building which has to be under the budget without disturbing the design as well

as the sustainability aspect. It should also be taken into account that the maintenance cost should also does not cross the limits.

The development of floating building concepts for solving environmental issues should include a series of considerations such as waste management systems, durability of materials and accessibility. Therefore, environmental performance assessments of floating buildings can play a key role in forming and planning of floating offshore bases. There are many factors that should also be considered for design process methods in the floating architecture that can be summarized in the following steps:

- Long-term lifecycle
- Long-term GHG emissions
- Resource usage strategies
- Minimal environmental impacts
- Recycled and recyclable.

### Environmental Preservations

While using the source from the environment it is necessary to preserve the given article of the nature so that it does not result in decaying and for this purpose the preservation should lead to a huge global variation in the atmosphere. Preserving the natural source does not mean that keeping the nature's giving for a long time but it can be in such a way that utilising the sources and keeping it safe by the human activities which could destroy them as well as compiling it with the materials which could protect them from the decay.

In architectural terms we can say that the building should be actually sustainable as well as it should be built in such a way that it could be preserved for upcoming generations without disturbing the natural cycle also gives some advantage to the atmosphere by not doing pollution, energy deficiency, emission of harms etc. if the buildings at global level can be made considering all these aspects then the depletion of atmosphere can reduced at a certain level. Materials play a very effective role in case of energy preservation as it should be chosen such that after the deconstruction of a building the scrap can be utilised again in some or the other way.

Some of the below aspects can help in environmental preservations:

• **Pollution control:** As a major issue this problem is trending at the global level because of the human activities undoubtedly, the materials being used for the building construction, the wastage of energies, sustainability ignorance, etc. these all issues can be resolved by different solutions but architecturally it can be resolved in many ways such as making a buffer wall, the main aspect can be using the water as the land for constructing a building it can lead to reduce down the land pollution, making the

buildings sustainable. By combining the floating building and the sustainability we get a mixture of solving many global problems as it holds a good pollution control over the ingredients by which it has been constructed.

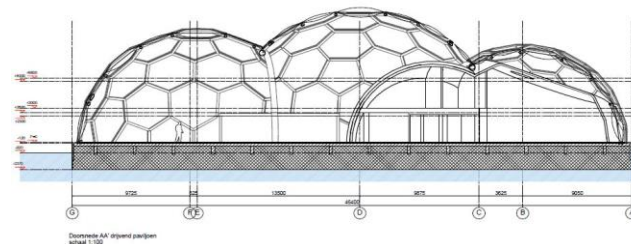
• **Energy efficiency:** Floating buildings can play a role in providing sustainable energy future and renewable energy sources. Important objectives of floating buildings also include ways to reduce energy consumption and CO2 emissions in the built environment. Offshore energy sources have potential advantages that have been given less attention and should be considered as one of the objectives of floating buildings to provide new sources of them. Wave energy as one of the main energy sources has the potential to address the development of effective energy efficiency policies over other renewable energy sources.

For example, wave conversion can occur all hours of the day; therefore, when electrical energy usage is low during the nighttime "wave energy can be used for economically powering desalinization and hydrogen production". Sea wave energy conversion can provide renewable energy for coastal cities and communities, but can also generate a new building typology. To illustrate this point, the design of floating hotel "Salt and Sill in Sweden was done with the environment sustainability concept such as heating energy for the building which is actually generated by geothermal wheels from underneath the building, at the bottom of the sea.

### Case studies

#### • Realised Floating Pavilion

As mentioned the geometry of the superstructure of the realised floating pavilion is the same as the geometry of the superstructure in this thesis, only the dimensions differ a little, since the calculations were done again. The floating body has a complete different geometry. In the figures below can be seen that the beams have less height, since the body was constructed on water. The height of the beams is 750mm, the width 250mm, the c.t.c. distance is 325mm.



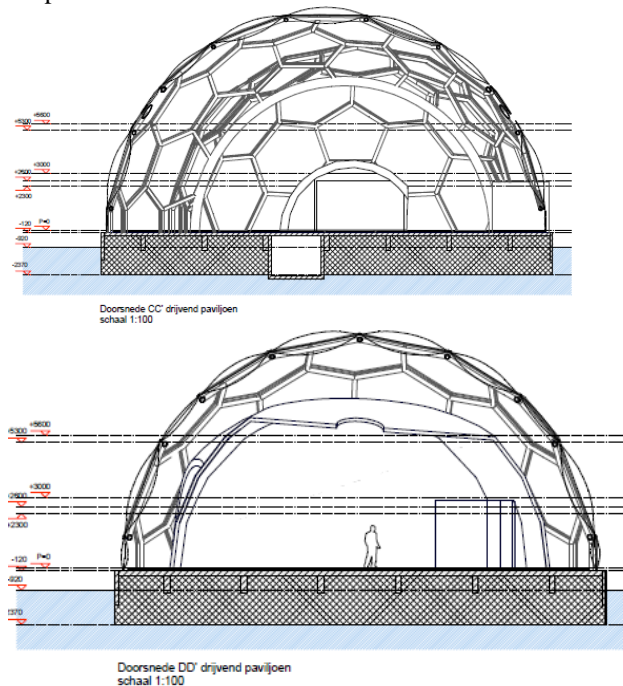
Below is mentioned how the structure is modelled in Scia.

- The geometry depicted in Fout! Verwijzingsbronnietgevonden was used. This beam grid and floor are converted as a 2D plate with beams.

- The water is schematized as an elastic support with a spring constant of 10kN/m<sup>2</sup>. In chapter 4 has already been checked that Scia give the correct results for rotation with this method.
- The elastic support acts directly on the concrete floor, which is schematised is 2D plate, with athickness of 100mm. In real, the water pressure is also passed on to the floor via the EPS. This mean the beams mainly hang on the floor.
- The net for calculation of the 2D elements has a grid of 1m.
- The beams are schematised as normal straight ribs with dimensions of 1650x100mm<sup>2</sup>.
- The effective width appeared very important in the Sciacalculation for the moments and normal forces in the beams and in the floor. The effective width is been put on 'standard', because this resulted in the largest forces and the least forces in the floor, which means the beams itself will take the largest part of the moments, which is expected to be the case in the real situation, because the beams are much more rigid.

**Load**

- The self-weight has been automatically generated
- Next to the self-weight also a surface load of 3 kN/m<sup>2</sup> has been added. This has been inserted as surface load over the complete 2D-slab
- Wave and imposed loading has also been inserted as surface load on the 2D-slab. This is done with the magnitude of the load and the surface area as mentioned in chapter 16.



**• Four seasons hotel, Australia**

- Location: Great Barrier Reef area in Queensland, Australia
- Year of completion: 1988
- Size & scale: 5 story, 140 double rooms and 34 luxury suites, 322,500sq.ft.

The world's first offshore floating hotel, four seasons hotel had been anchored adjacent to Australia's Great Barrier Reef (GBR) in March, 1988. The idea of a floating hotel came from the geography of the GBR which lies some considerable distance and travelling time from the mainland port. Tour companies estimated that visitation could be significantly increased with shorter or faster trip, or through the provision of onsite fixed offshore accommodation.

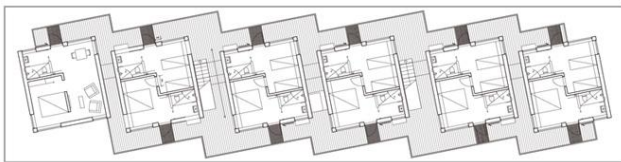


This hotel was designed and developed by Swedish naval architect StenSjostrand and was constructed by Consafe Engineering in Singapore. After the construction, engineers guided a half-submerged, heavy-lift carrier vessel under the floating hotel structure and then pumped the carrier dry, raising the building out of the water. The ship brought the hotel to the lagoon and reversed the loading process. Work crews connected the hotel building with pontoons that carry tennis court, marina and the rest of the complex. The hotel was a self-supporting floating building and so had a desalination plant for fresh water, on-board sewage and waste treatment, an underwater observatory and a semisubmersible vehicle for coral-reef cruises, as well as the usual luxury hotel amenities. Anchoring the whole resort is a mooring system originally developed for oil super tankers. The hotel's power plant, according the developers, will operate at almost noiseless levels so as not to disrupt the reef's delicate ecosystem<sup>4</sup>. Several accidents occurred during the early stage of the project. The catamaran designed to carry 400 passengers to the hotel was destroyed by the fire before first service. The hotel was hit by a cyclone and some of the peripheral structures including the floating tennis court were damaged before official opening.

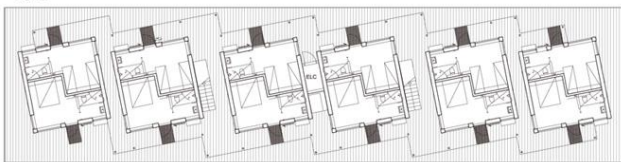
**• Floating hotel "Salt & Sill", Sweden**

- Location: Island of Klädesholmen, near Gothenburg, Sweden
- Year of completion: 2008
- Size & scale: 2 story, 23 rooms (46 beds)

In October 2008, Sweden's first floating hotel, designed by Mats & Arne Arkitektkontor AB.



Plan 2



Plan 1

Sweden opened alongside the famous restaurant "Salt & Sill". The hotel consists of six two-story buildings on floating pontoon. The hotel has 23 rooms with 46 beds, and all the rooms have their own entrance and access to an outdoor seating area. People can feel a cosy & personal atmosphere and a style characterized by modern Scandinavian simplicity. The owner has always been interested in the environment. During the construction of the floating hotel, protecting the environment was obviously top priority. The facility should have a positive impact on outdoor activities, and should have little effect on the living environment, safety or communications. It should not cause any significant pollution of noise, air and water. The design of the hotel was also done with the environment sustainability in mind as heating energy for the hotel is actually generated through geothermal wheels from underneath the hotel, at the bottom of the sea. The owner used local raw materials such as the wood from Swedish pine forests, environmentally friendly paints and have even used the left over quarrying stone to build a new lobster reef under the pontoon of the hotel. The sea life was increased by creating a perfect habitat for shells and mussels. All toiletries are organic and refillable. Sustainable features of the hotel can be summarized as protection of the environment, the use of local raw materials, the geothermal use of sea water, and the habitat creation for marine life by using the left over stone.

### Analysis

As observing all the pros and cons the final analysis comes to a note that floating building can be adopted as future development of a city as much as we will utilise the water source for architectural purpose the land utilisation can be reduced which will automatically reduce down the land deficiency as it indirectly reduce the pollution level as the harmful radiations which is being released from the buildings will also be less. Indeed the people will also get a pleasant experience living above water.

Nowadays sustainability is a vital aspect which should be kept in mind while designing any building so the structure existing over water can be sustainable in terms of material use as well as design techniques used to make it energy efficient building as well as green dwelling. Further generation can be depended on this resource because the global warming come up day by day the growth is unstoppable due to cutting trees and using toxic building materials instead so it can be reduced down to a certain level.

### DESIGN ISSUES:

- There will be the main issue of making the building sustainable because the material used should also as per the floating aspect.
- The services of the structure as per the activity in the structure and the type of building. It plays a major role as the sanitary, disposal, water supply and electricity should be properly planned and it should does not cross the budget.
- The building should be cost effective which is little bit uneasy to be solved.
- The climate conditions internally and externally.
- Materials which can do justice with flotation system are not easy available.

### DESIGN SOLUTIONS:

- The materials which can be used are concrete blocks; wooden logs for the floatation purpose which proper waterproofing and sealant to avoid depletion of the material.
- The activities in the floating building should be such that it does not acquire much population or if the population is more then the maintenance should be done in the daily basis or the building

should not be located farther from the shore so that it can be properly maintained regularly.

- The water supply for sanitary purpose should be transferred from the main source itself and should be cleaned for the reuse to avoid water wastage.
- The material and construction cost can be reduced by using any sustainable waste material or if using precast then it can be less expensive if it is manufactured in large numbers.
- The climate responsiveness can be adopted as in protecting the building by creating a buffer between sunrays and the structure also the green building techniques can be adopted to avoid humidity inside the building.
- Proper openings according to wind and light direction should be provided for natural light and ventilation.
- The major aspects for the design consideration is the building services which holds a complex thought of providing utilities under water or above it. The services should be provided in such a way that it can be maintained properly without any difficulty. The piping system, inspection chamber, sewage system then the fixing of different systems at the base level.

### **CONCLUSION**

The overall conclusion comes that the design opportunities for the sustainable floating architecture are found in such a way that it satisfies both the aspects and these solutions are in the relevance to use of materials, services in the building, sustainability requirements by adopting different techniques, energy efficiency and many more concerning options. These opportunities are the major characteristics to be fulfilled for better design solutions and sustainable structure. The mechanism of the floatation system has also been focused throughout to enhance the safety system of the building.

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# Technology-based learning using project

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**Abstract:**-- Technology has always fascinated human being towards itself. The modern period is seeing a tremendous change in technology. Education is one of the fields that has always been tempted to-wards revolutionary technologies. Continuing enthusiasm for new and emerging technologies is unlikely to diminish as innovative technologies offer new teaching and learning opportunities ( Chan et al. 2006). To make technology an agent of education change, the field needs to understand the kinds of learning outcomes that technology can enhance and the circumstances under which that enhancement will be realized in practice. (Barbara Means, 2010). Technology enabled learning is one of the ways that can change the dimensions of learning. Previously so much research had been done over the emphasis of technology on learning. So, in this research, we have tried to show how a supportive environment together with aid of technology can bring a positive effect on learning and studying pattern. In modern time our emphasis is moreover self-learning, cognitive-learning, collaborative learning. But providing a sustainable environment to promote all these factors is important. Our project takes a step towards providing a sustainable environment for programming language learners and keeping them motivated in the learning field.

**Index Terms**— Technology Enabled Learning, Project based learning, Technology-Based Learning.

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## 1. INTRODUCTION

Technology and education are the two most important factors that help in shaping the society and make their living better. In this era, technical education is the most prominent one that one should learn. For students those are new in the technical field, it is difficult to make them study from scratch. And it is more difficult when it comes to offline studying as there are two categories of student, one who got inspired by themselves and there is no effect of environment on them, one who required a more interactive environment with a lot of motivation. Efforts with second category students are considerably higher than first. To reduce these efforts this system helps them study in an interactive way with some inner motivation by providing them more and more information about many things on a single platform. This system is most appropriate for those students who are learning the programming languages and with programming learning they also want to give a try to web designing, this platform provides them not only some source of learning by videos but via a new and mostly considered approach of studying pre-written code deeply and efficiently with some built-in libraries for website designing projects on focusing project-based learning.

When it comes to studying of pre-written code, it is easier to understand the basics of the code, especially for the naive programmers. In this project, we categorized the different programmers according to their skills and did research on them. This research paper follows the following sequence: firstly, there are some basic approaches explained related to the project, followed by the section that explains the research methodology

followed by the section of analysis of the testing that had been done on different categories of programmers (categorized after the first testing) followed by the discussion and conclusion of results.

## 2. LITERATURE REVIEW

In this section, we described the basic approaches using the standard definitions used in this project that includes technology-based learning and project-based learning (with their benefits and features).

### 2.1 Technology-based learning:

Technology-based learning refers to the intention of constructive learning with help of technology. In today's world, we are totally dependent on technology. "The current education systems are facing unprecedented challenges. Traditional education systems alone, despite the essential role they have played and will continue to play, in learning, are simply not capable of serving the world's growing and changing needs". (John Chambers, Chairman & CEO, Cisco Systems). Technology is doing wonders in the field of education. Today we are involving technology to improve and enhance our productivity in the field of education. In our project, we have given technical assistance to those who are interested in learning thus encouraging the concept of self-learning. To give a real-world experience we have tried to involve as much assistance that we could have given like videos, pre-written codes, information on various functionalities of language.

## 2.2 Project-based learning:

Project Based Learning (PBL) is a teaching based technique where students acquire knowledge and gain skills by working for a prolonged period of time to investigate and respond to an authentic, engaging, and complex question problem or challenge (Buck Institute for Education). PBL is a prototype that basically focuses on learning through projects. According to the definitions in PBL handbooks for teachers, projects are complex tasks based on challenging questions or problems, that requires the involvement of students in design, problem-solving, decision making, or investigative activities ; also give students the opportunity to work entirely over prolong periods of time; and culminate in realistic products or presentations (Jones, Rasmussen, & Moffitt, 1997; Thomas, Mergendoller, & Michaelson, 1999).

### Features:

To understand the features of PBL it is better to focus on the project, project design & its elements. Projects are focused on students learning goals and include essential project design elements i.e. key knowledge, understanding and success skills; challenging problem or question; sustained inquiry; authenticity; student voice and choice; reflection; critique & revision;

public products (Buck Institute for knowledge). Five criterions for "what must a project have in order to be considered an instance of PBL?" are centrality, driving question, constructive investigations, autonomy, and realism (John W. Thom, 2006). Each project had to include the essential components of an essential question—driving the whole project; significant academic content built in; multiple drafts of work and critique on work provided by peers, teachers and others; a student-created final project; public exhibition of the work created; and an authentic audience to view and to comment on the work created (Victoria Menzies, Catherine Hewitt, Dimitra Kokotsaki, Clare Collyer and Andy Wiggins ;Durham University 2016).

One of the important features that differentiate project-based learning from traditional education approaches is that it's student oriented. In project-based learning, students define the problems, discuss the views or predictions, collect information, evaluate the collected information, make conclusions, combine views and create a product (Blumenfeld et al, 1991).

### Benefits of project-based learning:

- PBL help students in learning by performing not by saying.
- It's an easier way to see the engagement of students, as they solve the real-world problems

that directly affect or heavily interest them (Marcus Guido, 2006).

- A great project can be transformative for students. Seeing a real-world impact gives them a sense of agency and purpose (Buck Institute for Education).
- Knowledge in a practical way via projects.
- PBL allows students to control their study according to their suitability.
- Students actively engage themselves with PBL projects which provide them with a real-world relevance for learning. Students can solve problems that are important to them and to their societies (Buck Institute for Education).
- PBL encourages students to analyze a problem, correctly adjust them and apply knowledge to forge the solutions (Jelani Payne, 2017).
- PBL helps students to apply their theoretical

## 3. RESEARCH METHODOLOGY

The goal of this research was to determine the engagement of students, their efficiency, learning via this application. When it comes to the online environment provided for learning it becomes quite difficult to engross the students with the environment. This application includes so many approaches to capture student's interest like pre-written codes study helps them not only in understanding the code but also gives them idea behind the logic. The main goal of this research was to determine the helpfulness of this application on naive programmers, after getting these many learning approaches and environments on the same platform is helping them or exaggerating them by the excessive amount of sections accessible on the same time. Sometimes the project also does not help in learning as the students get trapped in the same environment and thinking of them is not self-productive anymore. This research was to analyze all these factors for naive programmers as well as for programmers. For this three case studies had been done for six months on three different categories of programmers. One who knew nothing about programming and required to learn everything from scratch, second who had basic knowledge about programming, third who had been doing programming from earlier.

### 3.1 All accessible environments:

It is the advantage of this application that students can access so many resources at the same time for their learning but there was also a problem behind that advantage that students don't get exaggerate after seeing so many resources. For this, we divided the sources into categories according to the level of programming,

according to the language of programming so that the different categories of students don't get mixed up with each other and also they don't get confused for different languages provided to them on the same platform.

### 3.2 Categorizing web projects:

To don't let all programmers get mixed it was essential to divide the projects according to the level of programmers So that they can learn according to their levels. Those who don't have previous knowledge of programming can do the projects for basic learning to just understanding the importance of programming. Those who have basic knowledge of programming can improve themselves by doing projects. Those who are doing programming from earlier can learn new concepts of programming with the help of advanced level of projects. In-built projects provided on the application for learning them the different categories of concepts of different languages. Also, the feature of self-made project environment is provided to make them test their skills.

Categorisation of projects according to different languages on the same platform according to their level of programming, So that they don't get confuse about the different languages and can't be exaggerated from the different levels of learning sources for the different level of programmers.

### 3.3 Competition with others:

Ranking according to their learning has been done for their self-motivation but it was also having a disadvantage of suppressing low-level programmers' confidence so ranking is also categorized according to the level of their programming in different languages that help them to sustain their programming learning continuously.

### 3.4 The diversity of learning resources:

Instead of focusing on only one resource there are different resources for learning programming. These resources help the students to test their ability and to check the suitability of the resource. The motive behind providing different approaches to learning is to fulfil their kind of requirements as much possible and helping them according to their suitability. We divided the approaches of learning into three categories:

Video Lectures

Study of pre-written codes

Project-based learning

#### 3.4.1 Video Lectures:

Each language covered on this application also has introductory lectures for basic to advanced concepts of those languages. These point to point lectures help to give students basic idea and implementation of that topic. This approach basically helps them to get introductory knowledge of different concepts of different programming

language on the same platform. With these video lectures, students also get the best reference to study the concepts furthermore. These references are provided by doing the survey on different references.

#### 3.4.2 Study of pre-written codes

This approach helps programmers to study the logic behind the code and to interpret the use of different functions, tags etc. with their definitions. This approach is not only time saving but also minimize the efforts for understanding the code. This saves a lot of browsing time for searching different languages functions as you get the definition of all the functions used in the code by simply clicking them.

#### 3.4.3 Project-based learning

After getting introductory knowledge students can use their theoretical knowledge in a practical way using the projects provided on the platform. They can implement all the skills they learned and also with enhancing their skills so that many new skills can be learned by them using the different projects provided to them.

## 4. RESULTS AND ANALYSIS

We tested our project at Jaypee University of Engineering and Technology over first-year students who were naïve to programming culture for three months continuously. We took 250 students from the first year most of them were unaware of the coding culture.. First of all, we saw how were they doing initially and noted their performance. According to our expectation their approaches, time is taken to execute problem, understanding of the problem was not good. Then we included our project in their laboratory exercise and noted their performance. After 3 months we took the final results and saw a satisfactory elevation in their performance. Their performance during the initial and final time is given below. In 250 students we have shown a sample of 30 students and graph of all 250 students.

We have drawn our conclusion on the basis of three primary factors -1) Time complexity 2) Optimization and efficiency 3) Number of the problems solved. The table contains the name of the students, an average time of execution before use of the project, time of execution afterwards, no of problems solved and review.

Review ratings are categorized as-

1-unsatisfactory

2-satisfactory

3-average

4-good

5-very good

Sl. No.	Name Of Students	BEFORE THE USE OF PRODUCT		AFTER THE USE OF PRODUCT		REVIEW
		Time Of Execution	No.Of Problem Solve	Time Of Execution	No.Of Problem Solve	
3	AKASH VEER ROY	2	2	0.4	3	3
4	ABHAY GOYAL	3	2	0.3	4	5
5	ANIRUDH ANAND	4.8	3	0.6	3	3
6	ARUN GUPTA	2	2	1	3	4
7	PRASHANT SWAMI	2	2	0.9	4	4
8	ROHIT GIRI GOSWAMI	2.2	1	0.8	5	5
9	SHREYASHI AGARWAL	2	2	0.4	5	5
10	SHUBHAM TIWARI	2.4	1	1	5	5
11	YASHOVARDHAN SINGH	3	1	1.5	1	4
12	ABHAY BAJAJ	3	2	1.2	3	4
13	ABHINAV KUMAR MITAL	3	3	1.3	4	4
14	ABHISHEK PRATAP	3	2	1.5	4	4
15	ABHISHEK SHARMA	2.8	2	1.3	4	4
16	ABHISHEK SRIVASTAVA	4.2	1	1.2	4	5
17	ADITYA RAJ	4	2	0.3	4	5
18	ADITYA VERMA	2	2	0.5	4	4
19	AJAY YADAV	2.9	1	0.6	4	5
20	HIMANSHU SINGH	2	1	0.2	3	5
21	ISHAN GUPTA	2	1	0.4	3	5
22	KANSHIK SINGHAL	3.1	2	1.4	3	5
23	KESHAV KUMAR	3	2	0.2	3	3
24	KRISHNA KANT ANAND	2	1	1.4	4	3
25	LALIT KUMAR SAINI	3	1	1.3	5	3
26	MOHAMMAD ZAMIN	2	2	1.8	3	4
27	MOHIT SHARMA	3.6	2	1.6	4	4
28	MIRADUL JAIN	3	1	0.5	4	4
29	MUKUL RAJBHAR	3	1	0.8	4	4
30	NANDU THAPA CHHAI	2	1	0.3	3	5
31	NAVNEET SHAH	3	1	0.7	3	5

First graph show variation between no of problems solved by 250 students before the use of project and problems solved after the use of the project. Grey colour lines denote the number of problems attended by the student of the first year before using the project while blue lines show a number of problems attended by students after using our project. The second graph shows the change in the time needed to execute a code. The second graph shows how efficient programs were written after using the project. Undoubtedly there is growth in performance of student which is visible in below-mentioned graphs. Here blue lines amount of time taken in a millisecond by students before using the project and grey lines denote the amount of time taken after using project.

5. DISCUSSIONS

We started our research with the hope that we can deliver a better platform to students those who are interested in self-learning. We thought to encourage technology mixed environment to inculcate a habit of self-learning. Our project was related to the programming language. Though there are several numbers of projects available which encourage the idea of self-learning with the help of technology but we brought everything over the same platform eradicate problems faced by learners and simplify as much as we could have done.

Findings from our research say that technology-enabled learning has a glorious future not only in the engineering field but everywhere. During our project, we learned that mixing technology with our Old ways can bring efficiency, save time and a lot more. Above table shows

that most of the students gave ratings between 4 and 5, means more students were satisfied by our work. Above table shows that there was a drastic change in time improvement and the number of the problem solved.

This gives of hopes that in future we can expect greater involvement and better results. It proves that these types of projects which not only enhance learning but also revamp idea of self-study are needed. During our research, we received greater engagement from students who were open to new ideas. During research, we came to know it really helped them in enhancing and improving their skills. Students those who used our project reported high involvement and were motivated throughout the studies that fade away the concern of demotivation which is highly suspected in these types of studies.

6. Conclusion

Technology is our future. Technology-based learning has a vital role to play in it. During our testing we found out most of the reviews given were above satisfactory level means students liked our project and it helped them in the understanding of language. The system serves the following purposes:

- 1-Students came out from a monotonous style of learning.
  - 2-Their efficiency and understanding increased.
  - 3-Motivation didn't fade away as most of the time happens.
- Though there are many challenges in programming field which we have to look forward to until now our project has served well.

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# Tool Wear Prediction in Drilling Nimonic 263-C Using Artificial Neural Network

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**Abstract:--** The tool wear predictions in drilling of Nickel based super alloys is performed using artificial neural networks on MATALB software. The drilling operations have been performed using an AlCrN coated tool on a CNC vertical milling machine. The cutting speed, feed rate, and surface roughness have been as input to the artificial neural network and the tool wear is taken as the output. The experimental results and the predicted results from the artificial neural networks are found to be in measured in R2 and in mean squared error.

**Index Terms—** Drilling, Tool wear, Neural networks, Super alloys.

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## INTRODUCTION

In manufacturing industries drill wear is a very important issue. The surface roughness of the hole, the life of the drill bit is also influenced by the drill wear especially when drilling super alloys such as Nimonic 263-C. Neural Networks can be used to predict the tool wear when they are trained with the input parameters.

[1] Dhahi et al. used neural networks to model the cutting performances in turning of 2017A aluminum alloy and experimentally corroborated the results. They obtained an R2 value of greater than 99, the mean square error of less than 0.3% between the target and output values.

[2] Panda et al. predicted the flank wear of the drill using back propagation neural network. The drilling operations were performed on mild steel by a high-speed steel drill bit. They included chip thickness as an input parameter in addition to the conventional parameters which lead to the better training of the network.

[3] Corne et al. analyzed spindle power data to monitor tool wear/breakage for real time data processing while drilling Inconel 625. They suggested that the spindle power data integrated with neural network can be used to enhance digital manufacturing systems.

[4] Drouillet et al. predicted the tool life using neural networks while milling stainless steel 4403 using carbide cutters. They NN approach was applied by considering various training functions. Levenberg–Marquardt function

was found to be the best training function in predicting the tool life of the milling cutter with a mean error of 1 minute. [5] Goh demonstrated the feasibility of using neural networks for establishing the non-linear interactions between various parameters. The study also reported that neural networks were able to produce accurate predictions.

[6] Zhang et al. in their study have surveyed the ANN applications in forecasting. They have provided their insights on issues regarding modeling issues while using ANN. They have also given a guideline on selecting the number of hidden nodes required for modeling.

## NEURAL NETWORKS:

The processing ability of the neural network is determined by the interunit connection strengths neuron called weights. The neural networks have three layers: the input layer, the hidden layer, and the output layer. The input  $X_n$  to the first layer can be a series of vectors with an information  $x_n$  and a weight  $w_n$ . The second layer is the hidden layer which can have one or more hidden layer of neurons. The third layer is the output layer which has a transfer function which processes the information passing through it which is considered as the output  $Y_p$ . This is known as a Multi-Layer Perceptron as shown in Fig 1.

Multi-Layer networks are trained using learning algorithms to adjust the weights of the neural network. The supervised back-propagation algorithm is the commonly used training algorithm. The algorithm defines the error function between the actual and error outputs, it also uses gradient descent search to which optimize the performance of a

neural network. The commonly used error function is the Mean Squared Error (MSE).

$$MSE = \frac{1}{m_1 q_{out}} \sum_{m=1}^{m_1} \sum_{k=1}^{q_{out}} e_k^2(m)$$

where  $q_{out}$  is the number of neurons of the output layer, and  $e_k^2(m)$  is the error of the  $k$ th output neuron for the  $m$ th weight.

By storing functions, the curve fitting problems can be solved by neural networks. The objective is to identify and establish a relationship between the input and output data. And when the relation is modeled accurately, the neural networks can be used as a function approximation. The neural network once trained with at least one set of data it becomes capable of predicting the future output also. Since, the neural networks forecast the results based on the input data characteristics and size, error on predicted results may be larger in the beginning of the process due to a smaller data size received. Continuous feeding of the data may result in the neural network acquire more experience for better prediction of the future output. The limitations of the neural networks are its “black box” nature and its computational requirements with software like MATLAB, and proneness to over-fitting, and the empirical nature of model development.

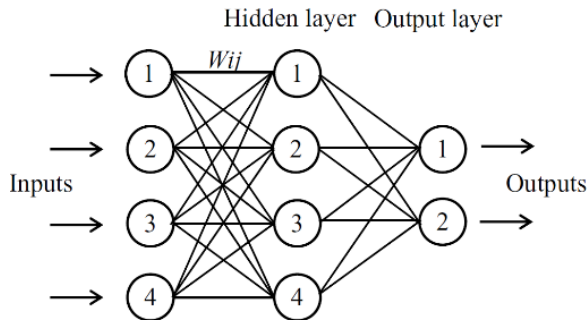


Fig 1 Multi-layer Perceptron

**MACHINING SETUP AND EXPERIMENTS**

The drilling experiments are performed on a 3 axis CNC vertical machining center (VMC 100) manufactured by ARIX CNC machine Co. Ltd. A billet of Nimonic C-263 with diameter of 70mm and length of 10mm is used for the drilling experiments. Since, Nimonic C-263 has excellent mechanical properties at elevated temperatures and high temperatures, AlCrN coated carbide drills were used for machining. The machining setup is shown in Fig 2. The thrust force is measured using online three-component Kistler piezo-electric tool dynamometer. the surface roughness and tool wear are measured using offline Talysurf coder and Tool makers microscope.

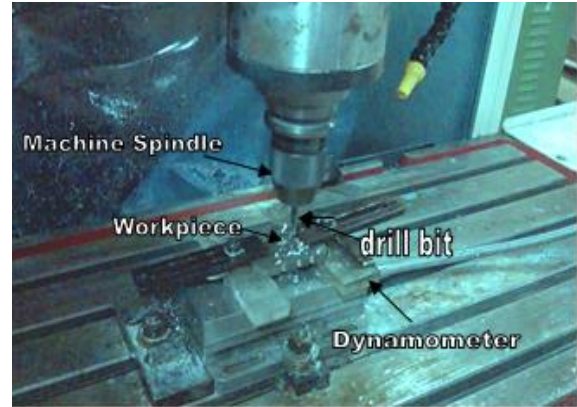


Fig 2 Experimental Setup

**SAMPLING:**

The sample size of the data set is determined by the user based on the importance of testing. A larger sample size to train the network will increase precision, but accuracy of the validation will be decreased. A compromise must be made between a precise evaluation of the performance of the network and the tool wear prediction. The drilling experiments provide a sample size of 27 wear data values from the following conditions: 750 rpm, 0.05 mm/rev; 750 rpm, 0.1 mm/rev; 750 rpm, 0.125mm/rev; 1000 rpm, 0.05 mm/rev; 1000 rpm, 0.1 mm/rev; 1000 rpm, 0.125mm/rev; 1250 rpm, 0.05 mm/rev; 1250 rpm, 0.1 mm/rev; 1250 rpm, 0.125mm/rev. The standard MATLAB sampling distribution divides the data in the following manner: 1) training: ~70% (19 out of 27); 2) validation: ~15% (4 out of 27); 3) testing: ~15% (4 out of 27).

**ALGORITHM:**

To determine the most precise training algorithm, the training algorithms provide by MATLAB are used, Trainlm, Trainbfg, and Traincgb the algorithms selected. These algorithms are compared for four hidden neurons. The performance of the regression is evaluated in terms of the mean square error and R values. Table 1 shows that the performance of all three algorithms applied to the 27 samples of tool wear data. It is found that the Trainlm algorithm performs the best in terms of error performance, i.e., lower MSE and larger R values. This indicates that, as compared to the other two methods, the Trainlm method has trained the network with the lowest error. However, no other criterion such as computing time was considered in the selection of the algorithms.

**NUMBER OF NEURONS**

The Precision level of the output prediction improves with the number of neurons. A smaller number of neurons make a consistent, robust but less precise NN. Table 2 depicts the

MSE and the R values at different number of neurons. It is seen that a NN with six neurons works the best considering both the validation and the testing parts together, but without much compromise in the training part, and this was

considered in tool wear prediction during the drilling process.

Algorithm	Training		Validation		Testing	
	MSE	R (%)	MSE	R (%)	MSE	R (%)
Trainlm	0.00685	91.89	0.01673	89.21	0.02616	80.21
Trainbfg	0.00998	92.8	0.020	90.45	0.0383	76.3
Traincgb	0.0076	94.89	0.0211	86.81	0.06372	75.52

Table 1 Performance comparison of Neural Network Algorithm

Algorithm	Training		Validation		Testing	
	MSE	R (%)	MSE	R (%)	MSE	R (%)
Trainlm	0.00685	91.89	0.01673	89.21	0.02616	80.21
Trainbfg	0.00998	92.8	0.020	90.45	0.0383	76.3
Traincgb	0.0076	94.89	0.0211	86.81	0.06372	75.52

Table 2 Performance comparison of Neurons

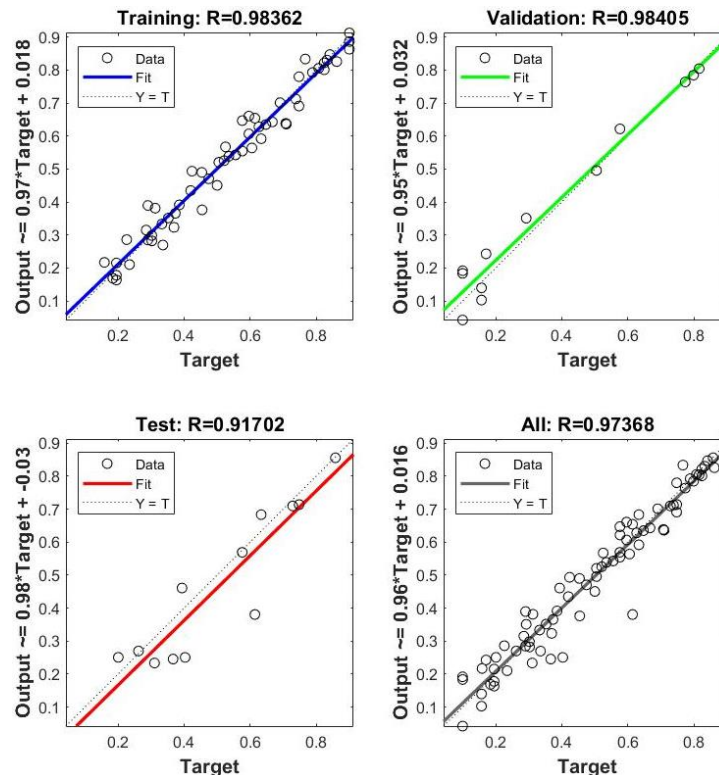


Fig 3 Regression Plot for the Neural Network

**TOOL WEAR PREDICTION:**

The tool wear is predicted by training the wear data samples which have been recorded at different levels as stated in the sampling section. The neural network is created using the following parameters: number of hidden layers is 1, number of neurons in hidden layer is 6, sigmoid transfer function in the hidden layer, linear transfer function

in the output layer, performance goal is 10<sup>-4</sup>(MSE), the number of epochs is 1250, and the number of validation checks is 50.

Out of the 27 samples, 17 of the data used are training, 5 for validation and testing respectively. The data is normalized before introducing to the network. The input and output data are normalized between the range of 0.1 and 0.9 as shown below.



$$x_{norm} = 0.8 \times \frac{x - x_{min}}{x_{max} - x_{min}} + 0.1$$

where  $x_{norm}$  is the normalized value of a variable,  $x$  is real value of this variable, and  $x_{max}$ ,  $x_{min}$  are the maximum and minimum values of  $x$ , respectively.

The training process is done by adjusting the weights of the neuron after each epoch to reduce the MSE. The R2 value obtained during training is 98.36%. The Fig 3 shows the R2 regression obtained during the training, validation and testing of the neural network with 6 neurons.

The output of the network is computed when the normalized data is presented to the network. Fig 4 shows the comparison between the experimental and estimated tool wear. In the figure there is a high correlation between the experimental and estimated results. There are only few points where a difference between the two values are observed. This can be due to instrumental error and unknown factor.

The error can be neglected as the R2 for training and testing are more than 95%, 90% respectively, and the average percentage error does not exceed 0.861%. The results confirm the ability of the neural network to model the tool wear performance accurately.

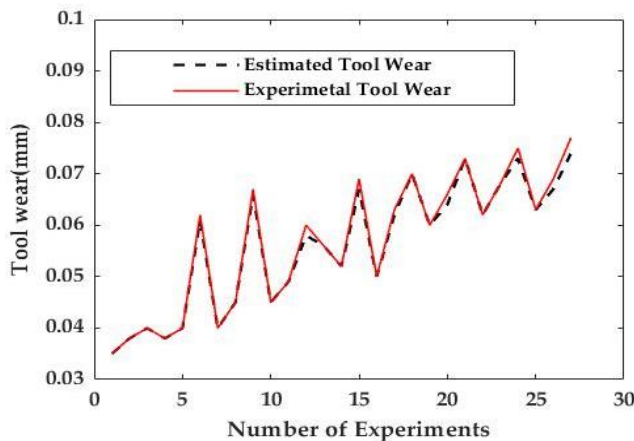


Fig 4 Comparison of the Experimental and Estimated Tool Wear

**CONCLUSION**

Using the neural network approach, the tool wear of the AlCrN drill tool in drilling of Nimonic 263-C has been modeled. The drilling experiments have been performed and the tool wear obtained has been recorded. The Levenberg Marquart algorithm is found to be the best for training the neural networks when compared to the Conjugate gradient backpropagation, and BFGS quasi-Newton algorithms. The optimal number of hidden neurons

was found to be 6. The network was trained and the R2 % was found to be 97.368%, which shows a high linear relationship between the estimated and experimental tool wear data. While predicting the tool wear using neural networks the average percentage error was found to be 0.861% between the experimental and estimated data. This model can be used for predicting the tool wear for any machining operation with high accuracy and reliability.

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