



2<sup>nd</sup> International Conference on Research Advancements  
in Applied Engineering Sciences, Computer and  
Communication Technologies  
(ICRAAESCCT -19)

Pune, Maharashtra

22<sup>nd</sup> - 23<sup>rd</sup> March' 19

Institute For Engineering Research and Publication

[www.iferp.in](http://www.iferp.in)

Publisher: IFERP Explore

©Copyright 2019, IFERP-International Conference, Pune, Maharashtra

No part of this book can be reproduced in any form or by any means without prior written  
Permission of the publisher.

This edition can be exported from India only by publisher

IFERP-Explore

## PREFACE

We cordially invite you to attend the **2<sup>nd</sup> International Conference on Research Advancements in Applied Engineering Sciences, Computer and Communication Technologies (ICRAAESCCT-19)** which will be held at **Kapila Business Hotel, Pune, Maharashtra** on **March 22<sup>nd</sup>-23<sup>rd</sup>, 2019**. The main objective of **ICRAAESCCT** is to provide a platform for researchers, engineers, academicians as well as industrial professionals from all over the world to present their research results and development activities in relevant fields of Science, Engineering and Technology. This conference will provide opportunities for the delegates to exchange new ideas and experience face to face, to establish business or research relationship and to find global partners for future collaboration.

These proceedings collect the up-to-date, comprehensive and worldwide state-of-art knowledge on cutting edge development of academia as well as industries. All accepted papers were subjected to strict peer-reviewing by a panel of expert referees. The papers have been selected for these proceedings because of their quality and the relevance to the conference. We hope these proceedings will not only provide the readers a broad overview of the latest research results but also will provide the readers a valuable summary and reference in these fields.

The conference is supported by many universities, research institutes and colleges. Many professors played an important role in the successful holding of the conference, so we would like to take this opportunity to express our sincere gratitude and highest respects to them. They have worked very hard in reviewing papers and making valuable suggestions for the authors to improve their work. We also would like to express our gratitude to the external reviewers, for providing extra help in the review process, and to the authors for contributing their research result to the conference.

Since January 2019, the Organizing Committees have received more than 40 manuscript papers, and the papers cover all the aspects in Science Engineering and Technology. Finally, after review, about 19 papers were included to the proceedings of **ICRAAESCCT - 2019**.

We would like to extend our appreciation to all participants in the conference for their great contribution to the success of **ICRAAESCCT 2019**. We would like to thank the keynote and individual speakers and all participating authors for their hard work and time. We also sincerely appreciate the work by the technical program committee and all reviewers, whose contributions made this conference possible. We would like to extend our thanks to all the referees for their constructive comments on all papers; especially, we would like to thank to organizing committee for their hard work.

## Acknowledgement

IFERP is hosting the **2<sup>nd</sup> International Conference on Research Advancements in Applied Engineering Sciences, Computer and Communication Technologies (ICRAAESCCT – 2019)** this year in month of March. The main objective of ICRAAESCCT 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.



**Ankit Rath**  
**Chief Scientific Officer**  
**Institute for Engineering Research and Publication (IFERP)**



044-42918383



Email: [info@iferp.in](mailto:info@iferp.in)  
[www.iferp.in](http://www.iferp.in)



Girija Towers, Arumbakkam, Chennai - 600106

# Keynote Message

I feel privileged, honored and most delighted to be a part of “ICRAAESCCT-19” and to interact with qualified experts and scientists from every part of the country, who have come together to explore their subject.

Today’s economies are mainly driven by technology and innovation and a research-intensive initiative taken by the education system. These technical conferences are not only for cutting –edge research and development but also showcase & make the engineers work more productive. Going through such conferences will be educational, eye-opening and life changes. One can learn something that is essential to the success of your project or business. It gives a platform for the young brains to showcase their skills & learn a lot of new ideas live and get inspired.

I hope researchers from different fields will act as a catalyst to spark innovative, creative and critical thinking ideas from each other and contribute to build “New India”.

I express my sincere gratitude and thank the organizing team and wish for the great successful, fruitful and joyous ICRAAESCCT-19

**Prof. (Dr.). Kshama V. Kulhalli**  
Vice Principal  
Head CSE, Dean I.I.I.  
D.Y.Patil College of Engg. & Technology  
Kolhapur

# ICRAAESCCT -19

## *2<sup>nd</sup> International Conference on Research Advancements in Applied Engineering Sciences, Computer and Communication Technologies*

*Pune, Maharashtra, March 22<sup>nd</sup> - 23<sup>rd</sup>, 2019*

### Organizing Committee

**N. Vivekanandan**  
Scientist, Central Water and Power  
Research Station, Pune

**Dr. Anand Y Joshi**  
Professor  
G.H.Patel College of Engineering &  
Technology, VallabhVidyanagar,  
Gujarat, India

**Dr. Ramachandra C. G**  
Associate Professor, School of  
Engineering, Presidency University,  
Bengaluru, Karnataka

**Dr. Mohammad Arif Kamal**  
Associate Professor, Aligarh Muslim  
University, Aligarh

**ArgadeRohit Ramesh**  
Assistant Professor, Dhole Patil College  
of Engineering, Pune

**V.V.S.Ramachandram**  
HOD & Professor, B.V.C.College of Engineering

**Dr. Rahul V. Ralegaonkar**  
Professor, VNIT, Nagpur, Maharashtra, India

**Dr. M.Shailaja**  
Associate professor, JNTUHCES

**Shaik Mahaboob Hussain**  
Assistant Professor, Vishnu Institute of  
Technology

**Mrs. Soma Niloy Ghosh**  
Assistant Professor, College of Engineering, Pune

**Dr.Yousef Daradkeh**  
Assistant Dean & Associate Professor,  
Academician of the International Higher  
Education Academy of Sciences

**Dr.Hardeep Singh Saini**  
Professor, Indo Global College of  
Engineering, Abhipur, Distt. Mohali

**Dr Urmila Shrawankar**  
Associate Professor, G H Raisonni College  
of Engineering, RTM Nagpur University  
Nagpur, India.

**Basavaraj Patil**  
Asst. Professor, SDM Institute of  
Technology

**Mr. Vishant G. Naik**  
Assistant Professor, SBJITMR, Nagpur

**Dr. Akshaykumar J. Meshram.**

Assistant Professor Yeshwantrao Chavan College  
of Engineering,Nagpur

**Achal Garg**

Engineer, Structural Section, Keppel Offshore &  
Marine Engineering Pvt. Ltd, Mumbai

**Dr. Nitin K.Dhote**

Associate Professor & Head, St. Vincent Pallotti  
College of Engineering & Technology , Nagpur.

**Dr. Shekhar. R**

Assistant Professor,ACED, Alliance University,  
Bangalore

**Prof. Sagar Dnyaneshwar Shelare**

Assistant Professor, Priyadarshini College Of  
Engineering,Nagpur

**Chitra Deshmukh/Chavan**

System Analyst, MMIT, Lohgaon.

**Dr.G.N.K.Suresh Babu** Professor, Acharya  
Institute of Technology,Bangalore

**Dr. Sureshkumar Ramkripal  
Choubey**

Assistant Professor, VMV Commerce, JMT Arts and  
JJP Science College,Nagpur, Maharashtra, India

**Mrs. Rashmi G. Dukhi**

Lecturer, GHRIIT,Nagpur

**Prathamesh M. Gurme**

Student Ambasdor, B.V. College of  
Engineering , Lavale , Pune

**Dr. (Mrs.) Surekha KS**

Associate Professor, Army Institute of  
Technology

**Deepak Mane**

Enterprise Big Data Solution  
Architect/Data Scientist, Tata Research  
Design and Development Center  
(TRDDC) – A R&D division of Tata  
Consultancy Services

# CONTENTS

SL.NO	TITLES AND AUTHORS	PAGE NO
1.	A Testbed Design of Spectrum Management in Cognitive Radio Network Using NI USRP and LabVIEW ➤ <i>Vinod H. Patil</i> ➤ <i>Dr. Shruti Oza</i> ➤ <i>Vishal Sharma</i> ➤ <i>Asritha siripurapu</i> ➤ <i>Tejaswini Patil</i>	1 - 7
2.	Fuzzy Logic Control Method for D-STATCOM to Mitigate Voltage Sags and Swells ➤ <i>Rakesh M N</i> ➤ <i>S G Srivani</i>	8 – 13
3.	Advanced Communication System for Power Distribution in Smart Grid Using NI USRP Framework ➤ <i>Vinod H. Patil</i> ➤ <i>Dr. Shruti Oza</i> ➤ <i>Shashank Shekhar</i> ➤ <i>Utkarsh Grover</i> ➤ <i>Vishal Srivastava</i>	14 – 22
4.	Improving Durability Properties of Concrete by Using Quarry Dust and Waste Plastic as Fine Aggregate ➤ <i>B.V.Bahoria</i> ➤ <i>D.K.Parbat</i> ➤ <i>C.Vikrant Vairagade</i>	23 – 29
5.	Lancefield Group of Streptococci Isolated From Dental Plaque Biofilm ➤ <i>Khushbu Verma</i> ➤ <i>Shailja Singh</i>	30 – 33
6.	Performance Evaluation of Various Geometries of Shear Wall in Buildings by Equivalent Static Analysis ➤ <i>Richa Gupta</i> ➤ <i>Dr. Alfia Bano</i>	34 – 40
7.	Experimental studies on Friction factor and pressure drop analysis for laminar flow of UCSCJ through a circular vertical pipe fitted with equispaced twisted tape. ➤ <i>Abhijit A. Patil</i> ➤ <i>Dr. U.C. Kapale</i> ➤ <i>Dr. P.B. Gangavati</i>	41 – 48
8.	Rule Based Parts of Speech Tagger for Chhattisgarhi Language ➤ <i>Vikas Pandey</i> ➤ <i>Dr. M.V Padmavati</i> ➤ <i>Dr. Ramesh Kumar</i>	49 – 53
9.	Mitigation Polynomials for Stress Concentration Factor around Circular Hole in Rectangular Plate under In-Plane Loading ➤ <i>Dr. Shubhrata Nagpal</i>	54 – 60
10.	Quantum Cryptography ➤ <i>Anquab khan</i> ➤ <i>Sanket gujar</i> ➤ <i>Mrunal giri</i>	61 – 63

# CONTENTS

SL.NO	TITLES AND AUTHORS	PAGE NO
11.	An NLP Based Plagiarism Detection Approach for Short Sentences ➤ <i>Shikha Pandey</i> ➤ <i>Dr Arpana Rawal</i>	64 – 69
12.	Object detection for the Dynamics of Moving Vehicles using Deep learning and CNN ➤ <i>Kaushal Jani</i> ➤ <i>Dr. Nileshkumar Modi</i> ➤ <i>Nisarg Patel</i>	70 – 73
13.	A Novel Approach for Fault Diagnosis of Multilevel Inverter Using Dwt and Fuzzy Logic Algorithm ➤ <i>Sudarshan R. Vhatkar</i> ➤ <i>Dr. Pradip D. Jadhao</i>	74 – 78
14.	Very Low or Almost Nil Exposure to Engineering & Technology ➤ <i>Digvijay Singh</i> ➤ <i>Chandra Shekhar Rao</i> ➤ <i>Satyajit Sen</i>	79 –83
15.	Observations on Anonymization Based Privacy Preserving Data Publishing ➤ <i>Nirzari Patel</i> ➤ <i>Dr. Mehul P Barot</i>	84 – 87
16.	Spectrum Sensing and Detection in Cognitive Radio Network ➤ <i>Vinod H. Patil</i> ➤ <i>Dr. Shruti Oza</i> ➤ <i>Rishika Dixit</i> ➤ <i>Harshita Rai</i>	88 – 94
17.	Technology-based learning using project ➤ <i>Vipul Katiyar</i> ➤ <i>Vaibhav Pathak</i> ➤ <i>Yukti Sharma</i>	95 – 99
18.	Tool Wear Prediction in Drilling Nimonic 263-C Using Artificial Neural Network ➤ <i>M. Nagaraj</i> ➤ <i>C. Ezilarasan</i> ➤ <i>A. John Presin Kumar</i> ➤ <i>Rishab Betala</i>	100 – 103
19.	What Are Language, Nature, and Language Acquisitions? What Speech Is the Verbal Means of Communicating in English Language Teaching (E.L.T) ➤ <i>Prakash s. Chauhan</i>	104 – 108

# A Testbed Design of Spectrum Management in Cognitive Radio Network Using NI USRP and LabVIEW

<sup>[1]</sup> Vinod H. Patil, <sup>[2]</sup> Dr. Shruti Oza, <sup>[3]</sup> Vishal Sharma, <sup>[4]</sup> Asritha siripurapu, <sup>[5]</sup> Tejaswini Patil  
<sup>[1][2][3][4][5]</sup> Department of Electronics and Telecommunication Engineering, Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune

**Abstract:**-- Cognitive radio automatically detects the available channel in the wireless communication and has an adaptive radio technology network. It also changes the transmission parameters to run concurrently for more smooth communication. CR network allows the user to utilize the band in an opportunistic manner because it has different characteristics like capabilities and re-configurability. In this article, it shown the methodology, on how the primary user and the secondary user should communicate to provide error free communication. And also the framework on how to overcome the unique challenges occurred in the spectrum management like interference avoidance, QoS awareness and seamless communication. We also discussed about spectrum mobility, spectrum sharing, spectrum decision, and also spectrum sensing which are the characteristics of spectrum management.

**Index Terms:** Cognitive Radio (CR), Quality of Service (QoS), Primary User (PU), Secondary User (SU).

## INTRODUCTION

Spectrum is known as a band of frequencies. There are two extreme points between which classification of discrete frequencies is defined in terms of its position on a scale.

Due to increasing in demand for wireless broadband, such as 3G and 4G mobile services, spectrum management was introduced. Spectrum is assigned through administrative licensing since 1930. Signal interference was considered as a major problem for spectrum users. Therefore, licensing was established to reject signal interference.

The main aim of this project is to use the unused part of spectrum of licensed user or primary user by unlicensed user or secondary user. Licensed user has authority to share its spectrum with unlicensed. The only condition is that licensed user is not using a band of frequencies so that unlicensed user can request them and can use those unused band of frequencies.

Here we managed spectrum by modifying it and utilizing it. It is the process to regulate the use of radio frequencies. It promotes efficient use and gain of radio frequencies. The range of radio frequency is from 3 KHZ to 300 GHZ. It is used for wireless communication. For this spectrum management, we used cognitive radio. Cognitive radio is a smart radio technology which has the capability to take smart decisions itself. It is used to detect the unused part of bandwidth of the primary user's spectrum.

Cognitive Radio provides the capability to share the wireless channel with licensed user in an opportunistic manner. Because of high variations in the spectrum and of QoS applications, the CR network has unusual problems.

Thus, to label these problems, each secondary user in the CR network must have: -

- 1) To find the availability of the portion in the spectrum.
- 2) To select the channel, this is available after checking the availability.
- 3) To access the channels for different users.
- 4) The channel should be available when the primary user needs [2].

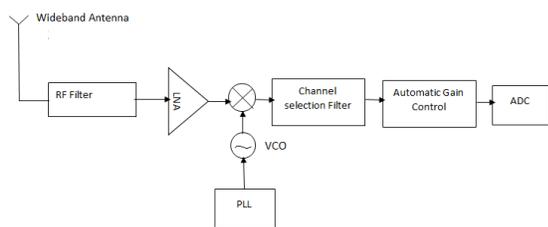
These challenges of spectrum management can be managed by the following four important functions known as: Sensing of spectrum, decision of spectrum, sharing of spectrum, and mobility of spectrum.

We will also learn about some functions and other research motive in this article. We will also discuss about our further research development of Cognitive Radio networks which requires no modifications in the present network. The brief description of Cognitive Radio network technology is described, and also the architecture of Cognitive Radio network is provided.

To overcome the spectrum unused problem, various measures or steps are taken by the licensed operator like, the primary user or licensed user allows the multiple secondary users or unlicensed users to divert their traffic through their spectrum by taking the frequency of that spectrum on rent for a fixed duration.

## METHODOLOGY

### a) Cognitive Radio Network



**Fig.1. Block diagram of Cognitive Radio**

Figure 1 shows the basic cognitive radio uses trans-receiver which consists of various functions such as

• **RF filter:**

RF filter removes the undesired frequency and selects the desired frequency.

• **Low noise amplifier (LNA):**

Low Noise Amplifier amplifies the input frequency so that we can determine the precise value of the noise figure of the input signal.

• **Mixer:**

Mixers are used to convert the high frequency signals into the low frequency signals i.e, Intermediate frequency signals, to make it eligible for the further process. This also allows making the low power filters, which helps to study about the low power signals and noises.

• **Voltage controlled oscillator (VCO):**

It is used to make the mixed frequency signals from the multiple frequencies.

• **Phase locked loop (PLL):**

Phase Locked Loop checks whether the frequency is constant as same as the time.

• **Channel selection filter:**

This filter selects the wanted frequency band and then rejects the next frequency signal

• **Automatic gain control(AGC):**

Over a great distance of input signal, the controller keeps the output power constant.

• **A/D converter(ADC):**

In analog to digital converter, the steps like quantization, encoding etc., takes place, which can leads to understand by the baseband signals generated at the baseband processing units.

**b) Architecture:**

The components of the Cognitive Radio network is divided in two groups

Primary network user (licensed user) and the CR network user (unlicensed user)

Then primary network or the licensed network, have the authority to operate in a given frequency band as they have buoyed the spectrum. If primary networks have any infrastructure then the primary user activities are controlled through primary base stations. The operations of primary

users should not be affected by any unlicensed user because of their priorities in spectrum access.

The CR network cannot operate in given spectrum band, as it has no authority (no license). Thus, CR user requires more functions to share the licensed spectrum. Finally, CR networks include some negotiator who negotiates the spectrum for different CR users.

The main functions of licensed user and the unlicensed user are defined as:

• **Primary user:** It should not get effected by any unlicensed user as only the licensed user have the authority to operate and access the spectrum band

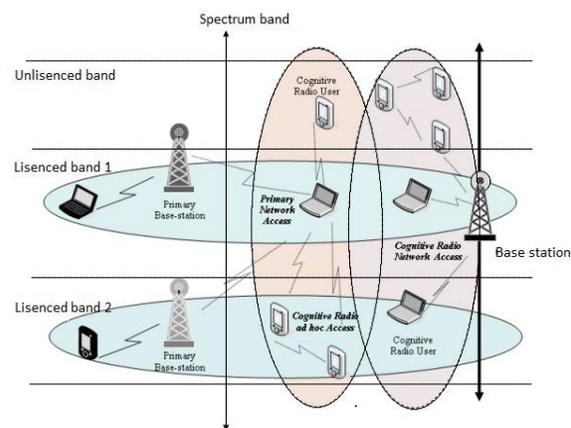
• **Primary Base-Station:** The main principle of base station is not having ability to share the spectrum with secondary users. To allot frequency to the secondary or CR users the primary user must have the legacy and CR protocols. Thus, the primary has the licensed spectrum which makes it a fixed infrastructure network.

• **Cognitive radio user:** This user does not have the licensed spectrum which is why it has only few limits to use the spectrum. CR user assumed for having the abilities not only to communicate with both base station and other secondary users. These capabilities also include sensing, sharing, and decision.

• **Cognitive radio Base-Station:** Even though there is no access over the spectrum, this base station provides the single hop connection.

CR user has different access over which the network can implement as it has to communicate with each other in either multi hop or access from base station manner.

• **Cognitive radio network access:** The medium access plan is to be independent of that of primary network as the interactions took place inside the CR network. Thus, CR user can ingress in authorized network and also in unauthorized network.



**Fig.2. Architecture of Cognitive Radio**

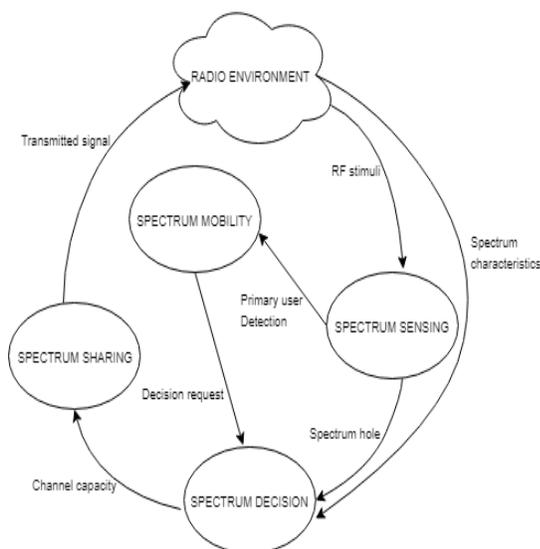
• **Cognitive radio Ad Hoc access:** Ad Hoc access is same as the network access. But in network access the ingress is done through medium plans whereas in this the communication is done by Ad Hoc connection and can have their own medium technology access.

• **Primary network access:** If primary network is allowed, the access to the primary base station is done through licensed spectrum by CR users. CR user supports the medium access technology of primary network unlike other users. Furthermore, primary base station should support CR capabilities.

**c) Framework of Spectrum Management:**

As discussed previously the CR network impose unique challenge because of its fact of living with different QoS resources. Thus, the spectrum management functions are used for Cognitive Radio networks for following challenges:

- **Interference avoidance:** there should be no interference or any disturbance between primary user and the CR user.
- **QoS awareness:** to decide the spectrum, the CR user supports the Quality of service awareness.
- **Seamless communication:** CR network should provide smooth communication for the appearance of primary users.



**Fig.3. Framework of Spectrum Management**

The spectrum management process consists of four major steps:

1. Spectrum sensing: A CR user has sensed the available spectrum by monitoring, gathering data and by identifying holes.
2. Spectrum decision: Once the band is sensed then CR user selects the best band according to their Quality of service [5].

3. Spectrum sharing: As there are many CR users, the spectrum band should be shared equally to prevent colliding.

4. Spectrum mobility: If any portion of the spectrum is required by the primary user which in use by the CR user, then the communication has been persist in other vacant portion.

**EXPERIMENTAL DETAILS**

**a) Hardware (NI USRP 2901)**

Ettus Research and its parent company designed a radios designed and sold, and the name of that software is Universal Software Radio Peripheral (USRP).It is generally used by research labs, universities, and hobbyists because it is intended be a competitively cheap hardware platform.

Universal Software Radio Peripheral (USRP), are generally connected with a high speed link to get in the connection with the host computer’s software which controls all the functionalities of the USRP. There are various types of USRP’s, with various functionalities. Some have a inbuilt hardware which have a inbuilt predefined processor which works in such a way that it works in its standalone state.

These devices are manufactured for approachable. The best part about this software is that it is open source codes and the software which is UHD is also open free to download. GNU Radio are basically used for the complex radio designs and system.

**DESIGN**

The USRP provides variety in models which works on the same architecture. Ait provides us various approaches like FPGA’s, host processor, DAC’s, power regulations, clock generations, ADCs and host interfacing. There is a front end board called daughter board which is used in various operations by a user’s like filtering, up/down conversion and other kinds of front end variations.

There is a FPGA which provides the user to a different point of views for different kinds of DSP operations which basically attenuates the real signals transferred through analogy medium to low bit rates, with desired basebands in the digital premises. In various approaches, the UHD software present on the host computer to transfer the high bit rate DSP techniques and methods and also FPGA is freely available to all can be modified in accordance to our need like high speed.

**SOFTWARE:**

The USRP hardware driver (UHD) is the software used to controls the functionality of the USRP. It also works well in various environments like Linux, Windows MacOS. UHD uses various frameworks like GNU Radio,

LabVIEW, and SIMULINK. It also provides a support to C and C++ functionalities, because it also supports their libraries too. e.g the UHD is also provides support to all kinds of USRPs by adjusting the variations of the input parameters in the USRPS.

LabVIEW supports all kinds of USRP interface like USRP1, USRP2 etc. and this also goes with the Simulink. They contain libraries which supports by both the software.

**NI USRP 2901 Specifications**

**Trans receiver**

Frequency range 70MHz to 6GHz

Maximum output power 20dBm

Bandwidth 56MHz

One channel 61.44MS/s

Two channel 30.72 MS/s

Digital-to-Analog converter (ADC) 512bits

**Power:-**

Total power, typical operation

Typical 3W to 3.5W

Maximum 4.5W

Power requirement accepts a 6V, 3A external DC connector

**b) Software (LabVIEW)**

Laboratory Virtual Instrument Engineering Workbench (LabVIEW) is a platform which helps the users to design their projects with the help of the visual representation and also uses the graphical representation.

LabVIEW is basically comes into the picture when we want to acquisition of the data, to control the instruments, and also industrial automation in various operating systems like Windows, MacOS, Linux etc.

**DATAFLOW PROGRAMMING:**

The dataflow programming is the primary basic approach of the LabVIEW. In this, program is defined by the graphical block diagram representation. It consist wires which used to connects different nodes for the transfer of data, through different blocks.it also allows us to implements the front view like input output and also implement the further improvements.

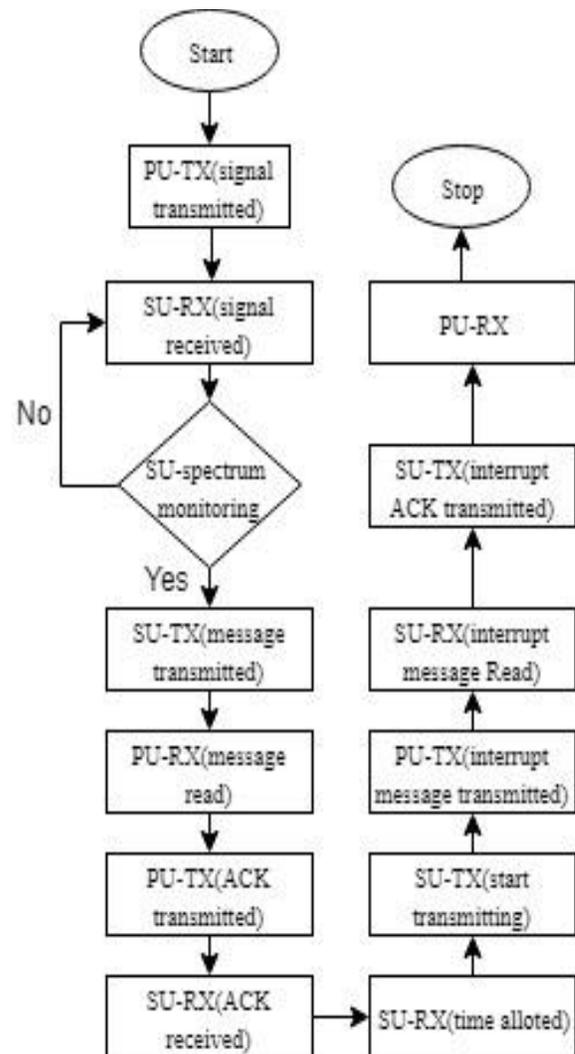
**GRAPHICAL PROGRAMMING:**

LabVIEW works as it allows the users to create different VI's which nothing is but virtual environment, which has a certain set of blocks combining and comes out as a working project. Every VI contains three different panels, a block panel, a front panel and a connection panel. The block panel contains the block diagram of the project and contains the functionalities, the libraries and codes which are responsible for the calculations of the logic and

algorithms. This software also provides user to control the output by providing output window where the user can put the values with respect to the desired output.

This type to graphical approach also allows the non-programmer users to use this software easily. The advantage of this software is that it allows the user to make stand-alone projects. It also allows tracking the data flow of the project. Also, user can track the real time response with the high accuracy of the data and with high data speed.

**EXPERIMENTAL WORKFLOW**



**Fig.4. flowchart of the project**

**Time Allocation Flowchart**

• As shown in fig.5., the acknowledgement request is received by the primary user, and then primary user system initially checks that the received string is empty or not, if it

is empty then it do nothing, otherwise it starts checking the index of the string.

- Then, after finding out the first index of the string, system starts comparing that index with the U which is the starting indentation of the string which help the system and the user to understand the start of the address, and then if they both proves unequal, then it states that it contains invalid information, otherwise, it proceeds to find the next index of that string.

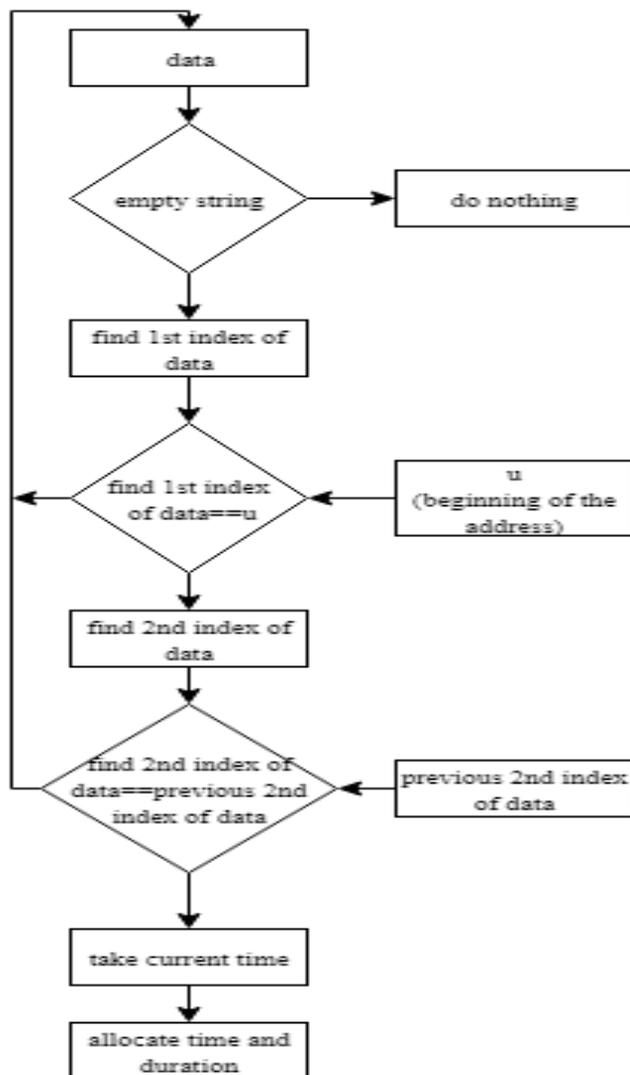


Fig.5. flowchart for the time allocation

- Now, the system compares the second index of the input string with the second index of the previous data's second index. If they prove equal then that means the input data is repeated and it will get terminated, otherwise it proves unique.

- After extracting the address of the secondary user, the primary system allocates the duration and time for the further session.

## EXPERIMENTAL SETUP



In our research, we have taken two users, the first one is the Primary User also we can name this the licensed user, which is considered as the high priority user and the other one is the Secondary User also we can say that the unlicensed user, which is considered as the low priority user as compared to the licensed one. For the communication between these two users we set up our system in which we used the frequency of 915MHz and also set the desired values of the gain, IQ rate, samples etc in accordance to our desired output. The system we used for our research, is of intel i5 generation, 8GB RAM. The USRPs we used require the power supply of 5W and also to increase the range of the antennas we connect main power supply. For data transfer between the system and the USRP, we connected the USRP with the 3.0 port of the system. We used the vertical 900 antenna for our research which connected in the USRPs both ports (first one is Tx/Rx port, second one is only for Rx ). The vertical antenna we used of peak gain +2DB, operating temperature of  $-20^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$  and a frequency range of  $\sim 902\text{-}928$  MHz centred at 915MHz.

## EXPERIMENTAL RESULTS

### a) Primary user transmit the signal

We use USRP 2901 as a both primary and receiver. The setup is designed in such a way that the when the primary is transmitting its signals through the frequency of 915M , it is utilizing its bandwidth. During this, as we already defined the primary users as the highest priority user, none of the secondary user allows to uses that frequency and also they are not even allow to generate the request to the primary users.

Table.1. shows the configurations of the waveform

CONFIGURATIONS	
CARRIER FREQUENCY	915MHz
IQ RATE	400k
GAIN	0

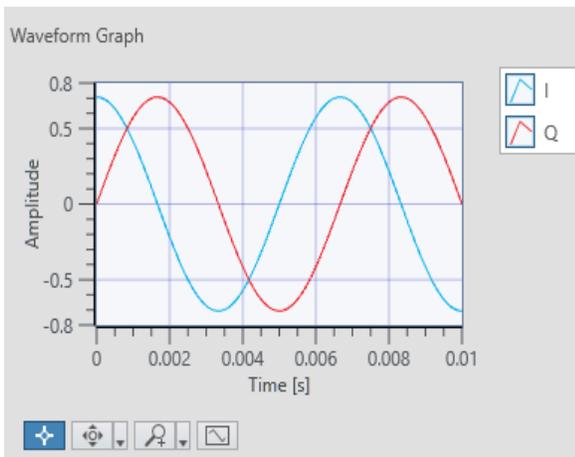


Fig.6. shows the waveform transmitted by the primary user.

**b) Secondary user monitors the signals**

In fig.7, during the primary user transmission, the secondary user is continuously monitoring the peak generates by the primary during the signal transmission. We designed the system in such a way that when the secondary receives the value 0, i.e. there is no peak generated by primary user. So, to utilize that bandwidth, the secondary user generates the request to the primary.

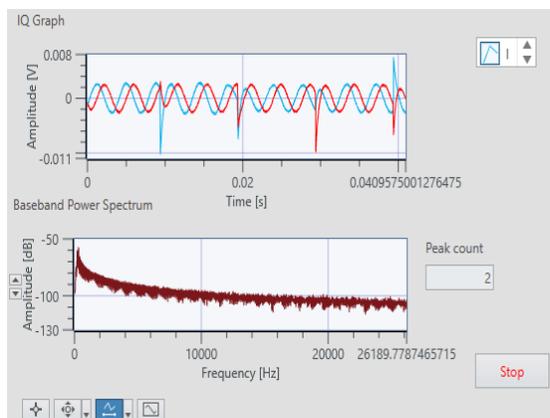


Fig.7. shows the signal detected by the secondary user.

**c) Secondary user transmits the signal**

Fig.8. shows, we designed our system in such a way that the request generated by secondary is of specific format like:

**U1: 915Hz;** here, the U indicates the starting of the address which helps the system to understand the address of the secondary user starts after ‘ U ‘ and ends before ‘ ; ‘ . So, after generating of this message request, the message bits are arranged it is transmitted to the primary for the further process.

Table.2. shows the configuration of the signal transmitted by the secondary user.

CONFIGURATIONS	
TxCARRIER FREQUENCY	915MHz
Tx IQ RATE	1M
Tx GAIN	0

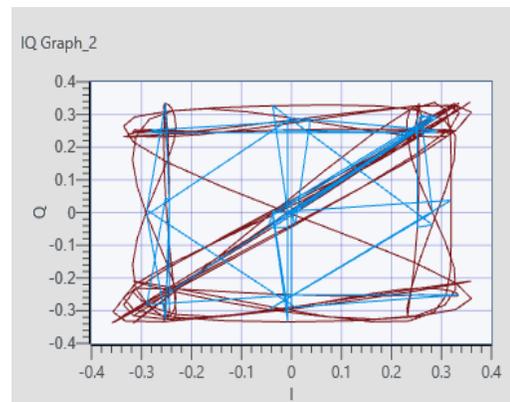


Fig.8. shows the signal of the message transmitted by the secondary user.

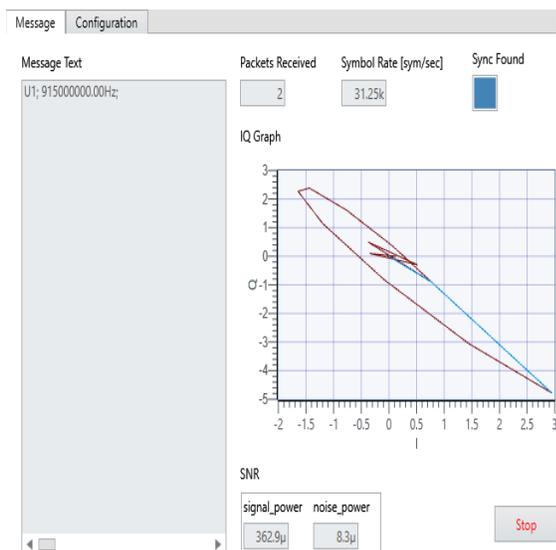
**d) Primary user receives the message**

In fig.9, at the receiving end of the primary user after receiving the request, the system designed by us is in such a way that firstly, it check that the received message string is empty or not. If it’s in not just an empty string, the system checks the first index of that string and compare it with the ‘U‘, if the string starts with the ‘U‘, then only it’s considered as an address otherwise it is just a random string for the system. After finding the ‘U‘, then the system starts scanning the string until its gets the first ‘;’, and between the ‘U’ and the ‘;’, its considered it as an address of the secondary user, and then after getting the first ‘;’ ,

the system starts searching for the next ‘;’. After getting the last ‘;’, the system excludes that ‘;’ and gets the frequency which is requested by the secondary user. Now, if the primary want to allow the secondary user to use that bandwidth, then it starts arranging all the received requests in a stack to track them, and then allow the desired time to all the desired secondary users with the free time available for the particular spectrum. In our research, we designed the system in such a way, that it allotted two hours to multiple secondary users and then after the ending time of each user, we allotted five minutes difference before the start time of the next user. During the time allotment for the whole particular day, the system is designed that it didn’t allow any further request after 22:00. And is still the primary received any request after 22:00, then that secondary request denied.

**Table.3. shows the configurations of the received message**

CONFIGURATIONS	
Rx CARRIER FREQUENCY	915MHz
Rx IQ RATE	400k
Rx GAIN	28
MODULATION SCHEME	BPSK
MESSAGE BITS	128



**Fig.9. shows the message received by the primary user.**

## CONCLUSION AND FUTURE SCOPE

Current research uses the primary user with the single frequency, which is to be sensed and considered as an available frequency for secondary user. All the transmission and reception are done for 915 MHz frequency only. The results are satisfactory for the testbed design for the small scale network. In future research the work will extended for the band of multiple frequencies, and to design the primary premises in such a way that the primary user should be able to allot the frequency on the demand of secondary user in that multiple frequency band. The primary user should also have to manage the secondary users request along with the time duration and cost for that allotted time interval.

## REFERENCES

- [1] FCC, ET Docket No 03-322 Notice of Proposed Rule Making and Order, Dec 2003.
- [2] I. F. Akyildiz et al., “NeXt Generation/ Dynamic Spectrum Access/Cognitive Radio Wireless Networks: A Survey,” *Comp. Networks J.*, vol. 50, Sept. 2006, pp. 2127–59.
- [3] S. Haykin, “Cognitive Radio: Brain Empowered Wireless Communications,” *IEEE JSAC*, vol. 23, no. 2, Feb. 2005, pp. 201–20.
- [4] F. K. Jondral, “Software-Defined Radio — Basic and Evolution to Cognitive Radio,” *EURASIP J. Wireless Commun. and Networking*, 2005.
- [5] I. F. Akyildiz, W.-Y. Lee, and K. Chowdhury, “CRAHNS: Cognitive Radio Ad Hoc Networks,” *Ad Hoc Net. J.*, vol. 7, no. 5, July 2009.
- [6] O. Ileri, D. Samardzija, and N. B. Mandayam, “Demand Responsive Pricing and Competitive Spectrum Allocation via Spectrum Server,” *Proc. IEEE DySPAN 2005*, Nov. 2005, pp. 194–202.
- [7] M. Oner and F. Jondral, “On the Extraction of the Channel Allocation Information in Spectrum Pooling Systems,” *IEEE JSAC*, vol. 25, no. 3, Apr. 2007, pp. 558–65.
- [8] S. M. Mishra, A. Sahai, and R. W. Brodersen, “Cooperative Sensing among Cognitive Radios,” *Proc. IEEE ICC 2006*, vol. 4, June 2006, pp. 1658–63.
- [9] B. Wild and K. Ramchandran, “Detecting Primary Receivers for Cognitive Radio Applications,” *Proc. IEEE DySPAN 2005*, Nov. 2005, pp. 124–30.
- [10] S. Krishnamurthy et al., “Control Channel Based MAC Layer Configuration, Routing and Situation Awareness for Cognitive Radio Networks,” *Proc. IEEE MILCOM 2005*, Oct. 2005, pp. 455–60.

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

<sup>[1]</sup>Rakesh M N, <sup>[2]</sup>S G Srivani

<sup>[1]</sup> Assistant Professor, <sup>[2]</sup> Associate Professor

<sup>[1][2]</sup> Electrical and Electronics Engineering, R.N.S Institute of Technology, Bengaluru, Karnataka, India

**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.

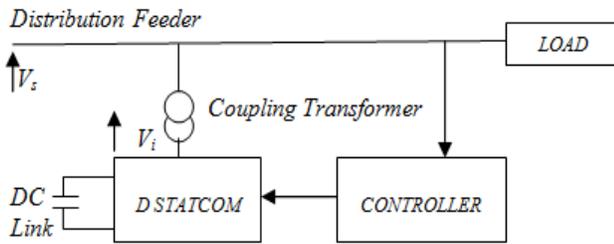
In this paper, using fuzzy logic controller (FLC) a closed loop control scheme is designed for dynamic operation of D-STATCOM. Unlike PI and PID controllers FLC do not require any mathematical modeling and any effects of any uncertainties, disturbances and unmodelled dynamics of the system can be compensated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



$V_i$  Output of VSI,  $V_s$  System voltage.

Fig.1 D-STATCOM representation

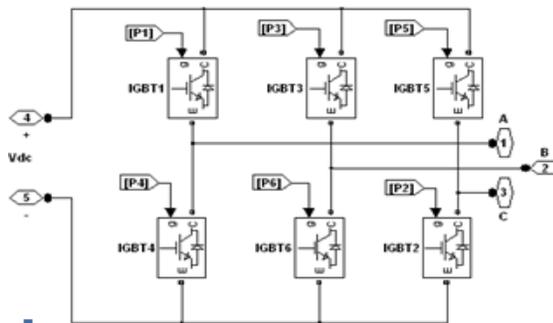


Fig. 2 Typical six pulse inverter

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.

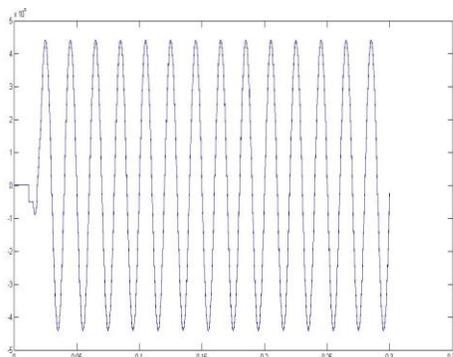


Fig. 3 Output of 48 pulse IGBT based VSI.

### 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.

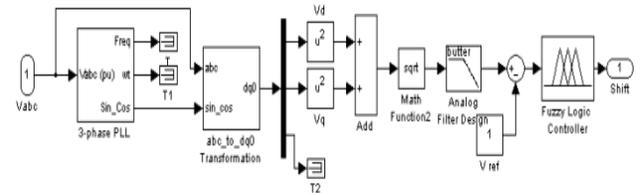


Fig. 4 D-STATCOM closed loop control scheme

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.

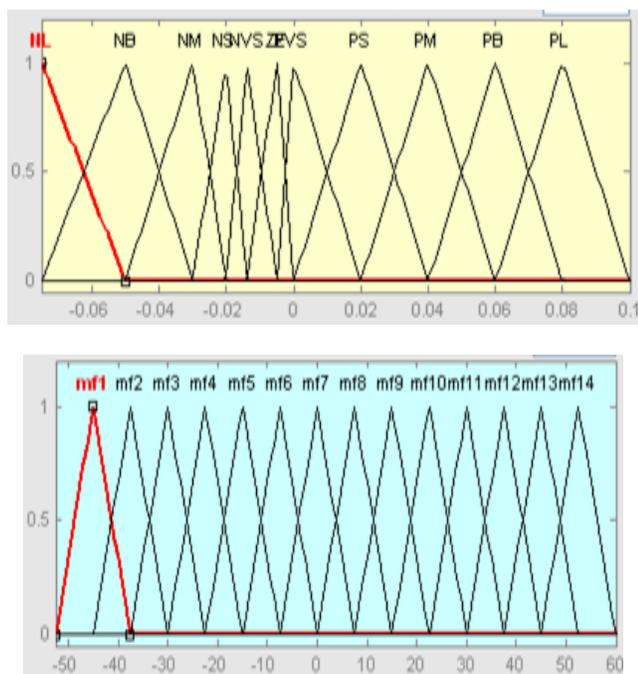


Fig. 5 Membership function of error and output of FLC's

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.

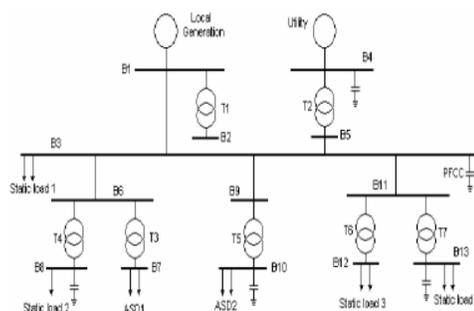


Fig. 6 IEEE 13 bus test system

#### 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.

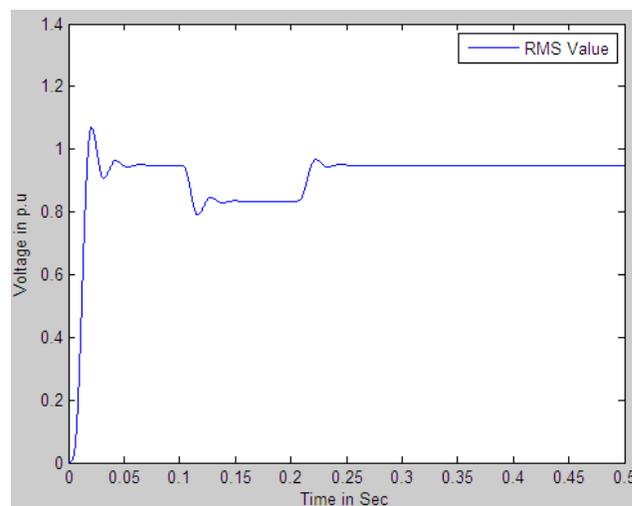


Fig. 7 RMS value of voltage at bus 12 with sag.

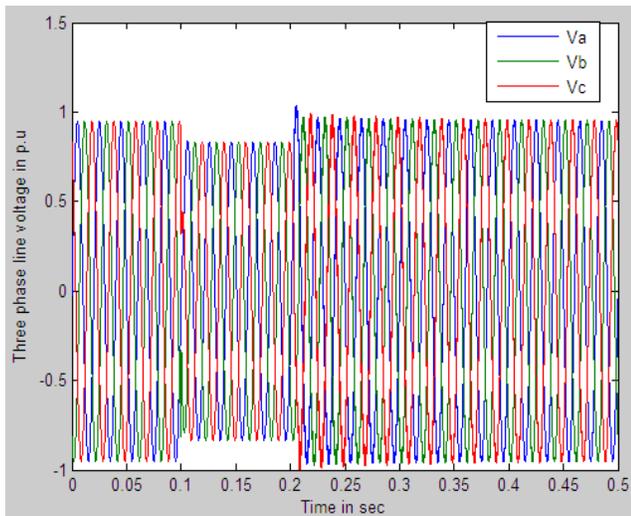


Fig. 8 Three phase line voltage at bus 12 with voltage sag

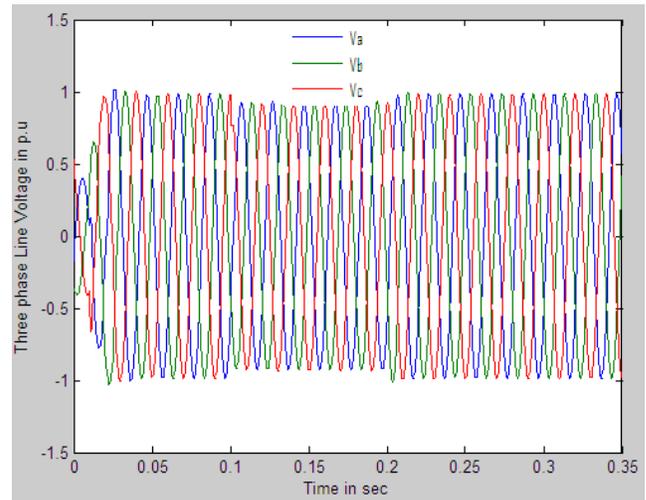


Fig. 11 Three phase line voltage at bus 12 with sag compensated.

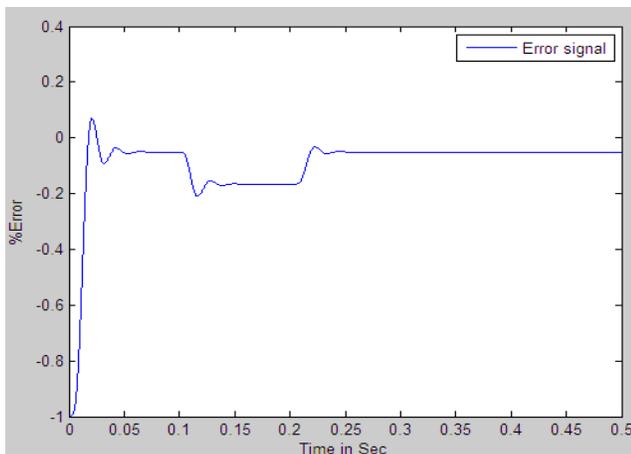


Fig.9 Error signal during voltage sag

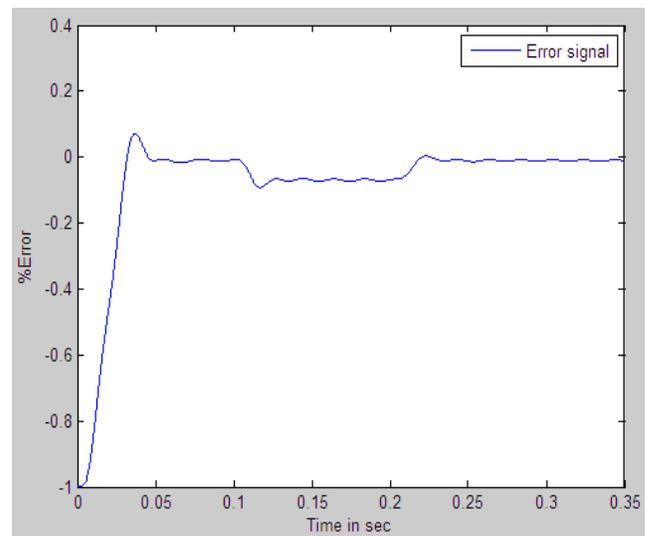


Fig. 12 Error signal after compensation

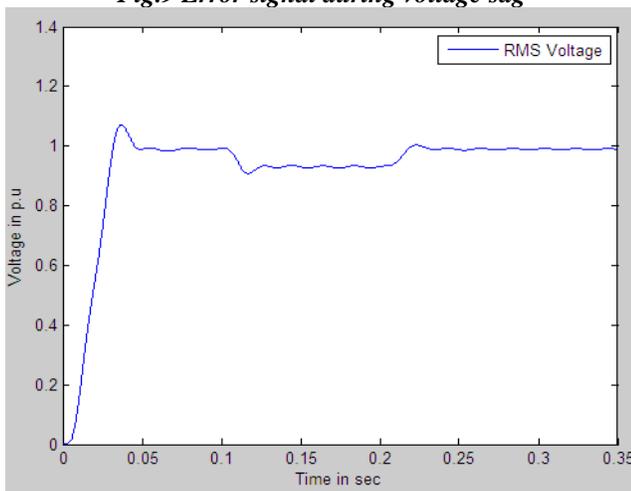


Fig. 10 RMS value of voltage at bus 12 with sag compensated.

### 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.

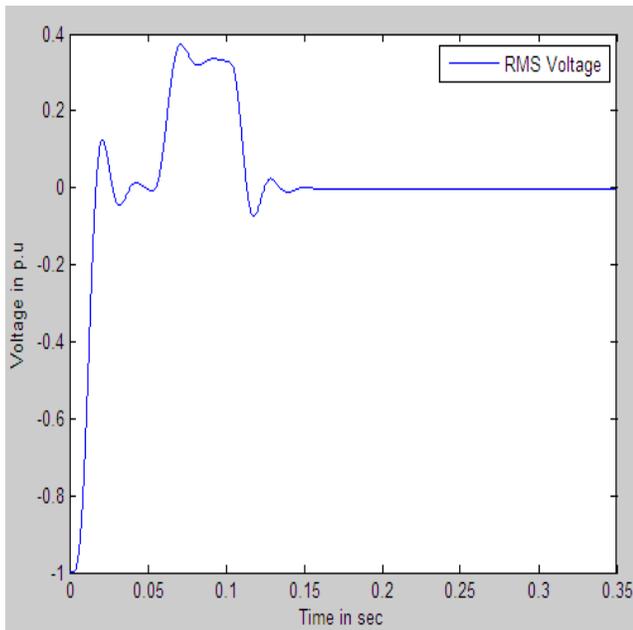


Fig. 13 RMS value of voltage at bus 12 with swell.

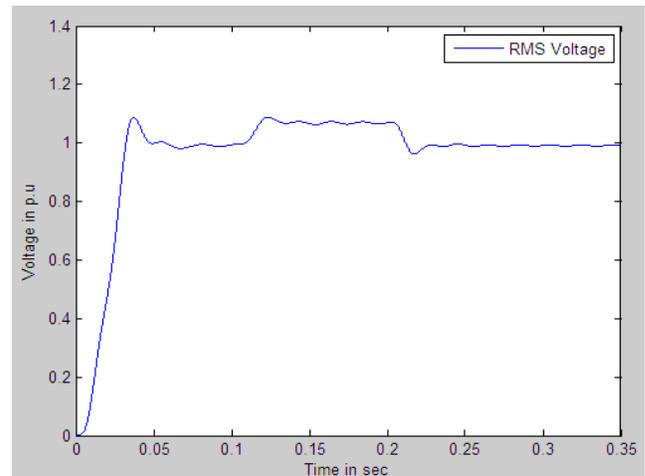


Fig 15. RMS value of voltage at bus 12 with swell compensated.

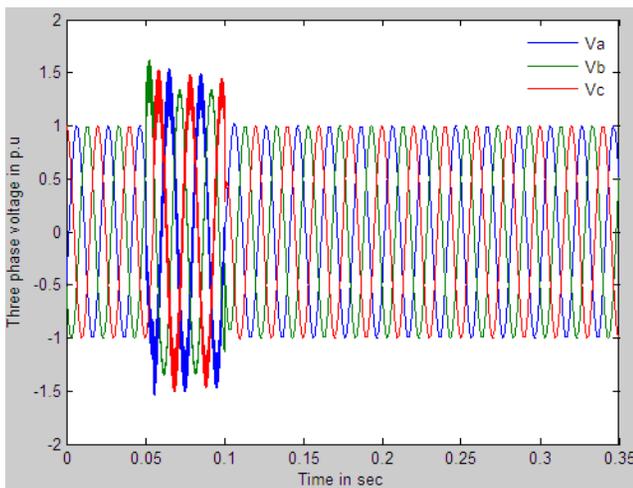


Fig. 14. Three phase line voltage at bus 12 with swell.

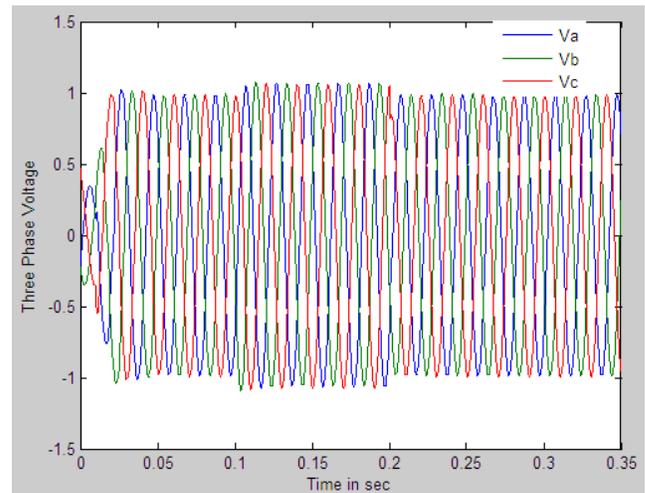


Fig 16. Three phase line voltage at bus 12 with swell compensated

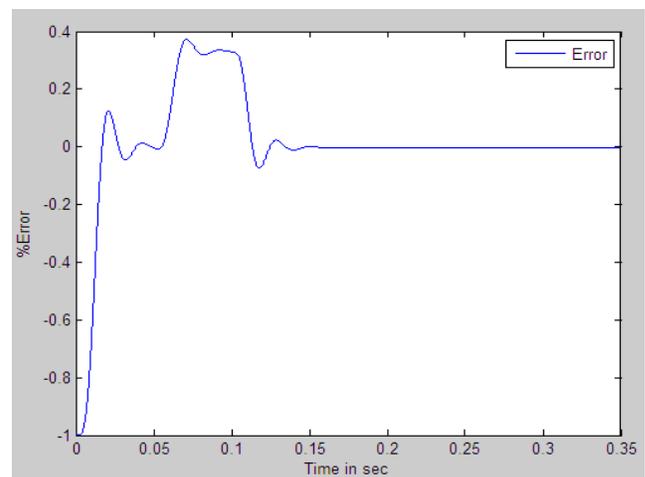


Fig 17. Error signal during voltage swell.

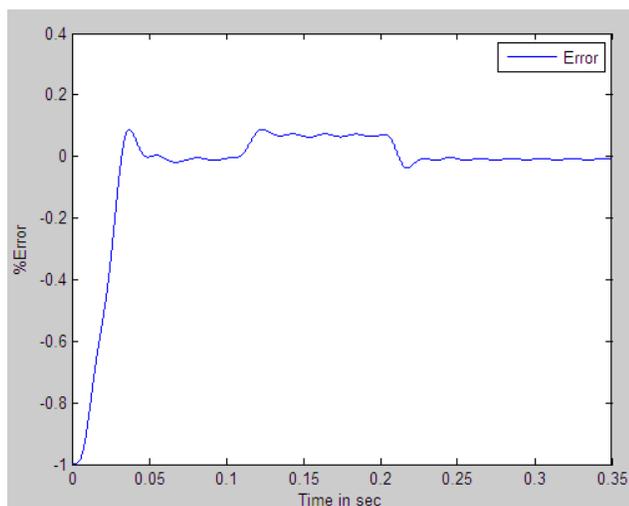


Fig 18. Error signal after voltage swell compensation.

## 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.

## REFERENCES

- [1] Seyed Hossein Hosseini, Member, IEEE, Amin Nazarloo, Student member, IEEE, Ebrahim Babaei, "Super- capacitor based D-STATCOM applied in IEEE 13-bus industrial distribution system". The 8th Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI) Association of Thailand- Conference 2011, pp 715-718.
- [2] B.Geetha Lakshmi, T.Hajmunnisa, P.Dananjayan, "A Fuzzy Logic Controller for enhancing the Transient Stability of 48-Pulse inverter based SSSC", *Electrica*, Vol.10, No.2, 2008, pp 53-58.

- [3] Narain.G.Hingorani and Laszlo Gyugyi, "Understanding FACTS, concepts and Technology of Flexible A.C. Transmission Systems", IEEE Press, New York 2000.
- [4] M.S.El-Moursi and A.M.Sharaf, Senior Member, IEEE, "Novel Controllers for the 48-pulse VSC STATCOM and SSSC for Voltage Regulation and Reactive Power Compensation", *IEEE Transaction on power systems*, Vol 20, No.4, November 2005.
- [5] Seyed Hossein Hosseini, Reza Rahnavard, Yousef Ebrahimi, "Reactive Power Compensation in Distribution Networks with STATCOM by Fuzzy Logic Theory Application", *IEEE Transaction* 1-4244-4249-5/06, 2006.
- [6] Transmission and Distribution Committee, IEEE Power Engineering Society, "Test system for harmonic modeling and simulation", *IEEE Trans on Power Delivery*, Vol. 14, pp. 579-583, April 1999.

# Advanced Communication System for Power Distribution in Smart Grid Using NI USRP Framework

<sup>[1]</sup> Vinod H. Patil, <sup>[2]</sup> Dr. Shruti Oza, <sup>[3]</sup> Shashank Shekhar, <sup>[4]</sup> Utkarsh Grover, <sup>[5]</sup> Vishal Srivastava

<sup>[1]</sup> Department of Electronics and Telecommunication Engineering  
Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune

**Abstract:** Smart Grid is going to be the next upgraded version of power grid. It includes power generation, management, transmission, distribution and utilization. It generates energy from various renewable resources. It is a multi-way communication between user and control unit. There are various wired and wireless technologies available for smart grid applications. We prefer wireless technology over wired one as wireless technologies have significant benefits over the wired technology. Wireless technology includes low installation cost, mobility and rapid deployment. In this paper we are generating energy from solar panel, wind mill and water turbine. The generation unit generates the energy and transfers it to the control unit. Then control unit distributes it to the user according to their request. The main characteristic of smart grid is that it enhances the efficiency, reliability, security, economy and agility.

**Index Terms:** Smart Grid (SG), Cognitive radio (CR) Primary User (PU), Secondary User (SU) Advanced Metering Infrastructure (AMI)

## SECTION I

### INTRODUCTION

Grid is a network, which consist of different lines, which cross each other to form a matrix. The lines are electrical wire through which electricity flows. There are two types of grid.

1. Traditional Grid
2. Smart grid

In traditional grid power is distributed through cable lines. In this there were some main lines through which the power is dispersed. These lines are called feeders. They have switches which are manually closed and open to provide power to users. Whenever the short circuit happens, one has to check everything manually, which is risky and would take a lot of time to again patch it properly.

To overcome this situation smart grid is implemented. The smart grid is the upcoming future in the field of electricity and data transfer. It is an electrical grid which includes a variety of operational and energy measures including smart meters, smart appliances, renewable energy resources. Electronic power conditioning and control of the production unit and distribution of the electricity are the important aspects of the smart grid. Smart grid uses smart meter for sensing the user requirement and according to that it sends the request to the generation unit.

India is currently one of the fastest growing countries in the world. Despite of its economic growth, the country is still facing problems regarding electricity. A smart grid is an electrical grid that facilitates the generation and distribution of information regarding the usage of power by suppliers and consumers.

Smart grid has some advantage over the traditional grid and highly beneficial for future generation.

Reliability- smart grid is more reliable as it improves error detection and allow self healing of the network as we have used wireless technology.

Flexibility in network topology – Traditional grids were designed for one way communication whereas smart grid is designed for two way communication. So it is more flexible than classic grid.

Load adjustment- the load can be increased or vary over a time depending upon the user's requirement. So at that time smart grid would warn the user about the load so that it can generate more load through various renewable resources.

Wireless communication has been used for making a path between user and the distributor. Wireless communication is used

for transferring the information or power to the various point which are not connected by an electrical wire. The wireless technology which are commonly used are radio waves etc. these radio waves shortens the distance for example a few meter for Bluetooth and a millions of kilometres for deep space communication. It incorporates

different types of mobile and portable application like two way radio communication, cellular phones and wireless networking. There are different methods to achieve wireless communication which include the consumption of other wireless technologies such as magnetic, electric field or the light or the usage of sound. Wireless technology uses no wire for the transfer of information.

For the wireless communication cognitive radio is used as an application in smart grid. It is important to use the spectrum efficiently due to the high traffic across the channel. Spectrum is divided as licensed and unlicensed. Most of the radio spectrum is allotted by licensing. As most of the spectrum is already in use, the challenge is to use the licensed spectrum without interfering with the transmission of other licensed user. The cognitive radio enables the usage of unused spectrum temporally, which is known as white space or spectrum hole. If this unused spectrum is again used by the licensed user then the cognitive radio moves to the other spectrum hole [1].

The spectrum management plays a vital role in cognitive radio cycle. The spectrum management is divided as

- Spectrum sensing
- Spectrum decision
- Spectrum sharing
- Spectrum mobility

1.) Spectrum Sensing – It senses the available spectrum bands and the presence of the PUS and detection of spectrum holes.

2.) Spectrum Decision – It consists of two stages, spectrum characterization and spectrum selection, which are the important steps to characterize the spectrum band in terms of the received signal strength, interference, energy efficiency and transition power.

3.) Spectrum Sharing – It mainly focuses on the selection of the best channel and power allocation and some of the functionalities resemble the core functionalities of MAC protocols.

4.) Spectrum Mobility – In spectrum mobility, spectrum handoff is used to overcome the interference caused by the smart grid components. [1]

Basically the smart grid users are divided into different classes on the basis of their roles. The higher class users or the primary users have the higher priority to use the available spectrum for ensuring their QOS. The smart grid has a feature to improve the priority during emergency. E.g. a lower class user can be allotted a primary band based on a situation that improves its quality of service.

To meet the QOS requirements for the smart grid applications, the communication technology is providing high bandwidth, low latency and low cost for the communication. The data rate, acceptable error rate, delay bound and bandwidth of the transmission can be determined based on the application requirements[1].

## SECTION II

### SMART POWER DISTRIBUTION SYSTEM

It contains following blocks which are as follows:

User block, Control unit, generation unit, Reserve power system

#### User Block: AMI

Advanced metering infrastructure (AMI) is basic term to define two way communication between the consumer and provider in which it senses the requirement of the customer according to the need of customer it sends the request to the provider and accordingly get the required unit. It's a collective system which controls the main body parts of a system. AMI uses SMART meters which has the capability of collecting data or information from the user's equipment at various intervals and accordingly send the request to the control unit to provide that much amount of units. It also has the information about pricing at the receiver end. The pricing or billings done by computer with basic logics like addition, subtraction, multiplication and division.

For sensing the requirement of the data, wireless communication has been used for two way communication between service provider and the consumer. Wireless communication has been used for making a path between user and the distributor. Wireless communication is used for transferring the information or power to the various point which are not connected by an electrical wire. The wireless technology which are commonly used are radio waves etc. these radio waves shortens the distance for example a few meter for Bluetooth and a millions of kilometers for deep space communication. It incorporates different types of mobile and portable application like two way radio communication, cellular phones and wireless networking. There are different method to achieve wireless communication which include the consumption of other wireless technologies such as magnetic, electric field or the light or the usage of sound. Wireless technology uses no wire for the transfer of information.

This VI deals with various process which help in the proper functioning of the user request block.

It comprises of two VI (Virtual Instruments) one for transmitting the request of units as demanded by the user and the other for receiving the acknowledgement of power being sent by the subsequent generation unit.

The various process are:

1. Providing request to the control unit block.
2. Receiving the generated power from the control unit.

We will discuss these processes in detail one by one

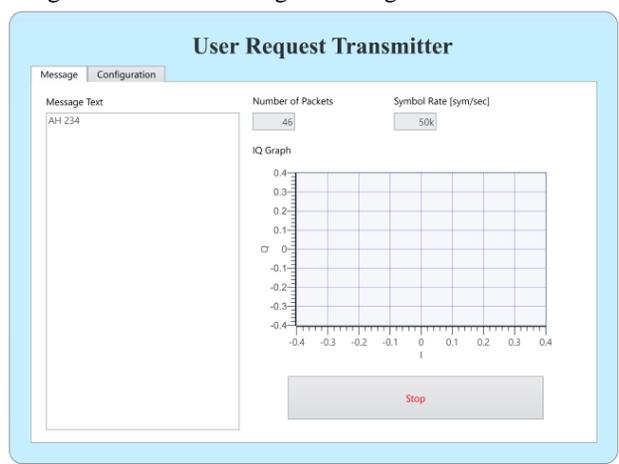
#### Step 1:

The user will request the amount of power which is required by him on a monthly basis in unit in range of 10 to 600 units. The request then will be sent to the control unit to in order to generated the required power

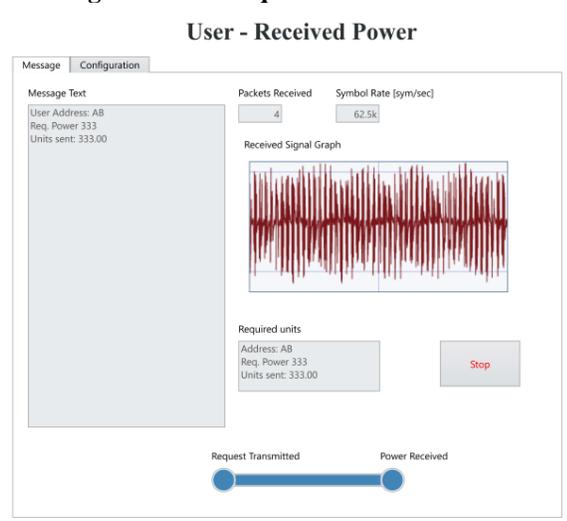
**Step 2:**

Now the user will receive the amount of power required which is generated in the generation block and transmitted by the control block. This amount of power is the one which is the monthly requirement of the user and the rest in emergency can be routed from the RPS.

The data received from the control block will be in this format: first the address of the user to which the power should be transmitted is present, second the power requested from the user and third is the generated power along with the acknowledgement is given to the user.



**Figure 1: user request transmitter block**



**Figure 2: user received power block**

Control unit: This VI deals with various process which help in the proper functioning of the control unit blocks.

The various process are:

1. Receiving request from the user.
2. Providing the user request to the generation block.
3. Receiving the required power generated acknowledgement from the generation block

4. Providing user the acknowledgement of the generated power.

We will discuss these processes in detail one by one.

**Step 1:**

In this process the control block is responsible to receive the user request from the user of the amount of power to be generated. The control block receives the request and provides it to the generation block.

**Step 2:**

As soon as the generation block receives the user request it generates the nearest high order value and provides the actual power required to the user and thus saving the extra power generated in the RPS (Reserved Power System).

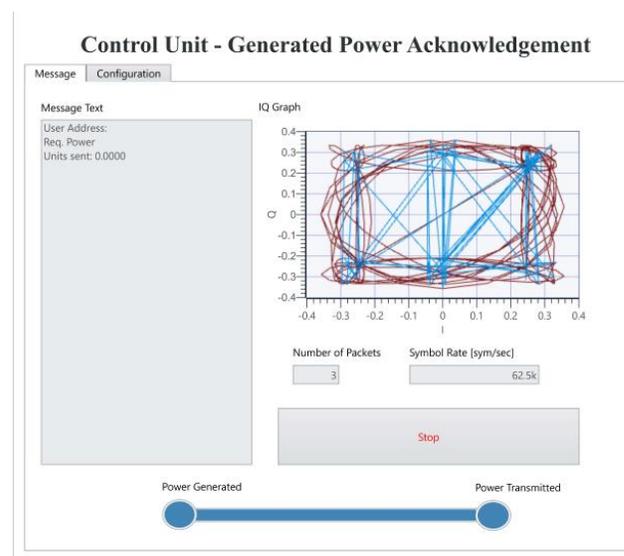
**Step 3:**

The generated power along with the acknowledgement is given to the control unit which is then further responsible to transmit the generated power to the user so that the actual smart power transmission take place.

**Step 4:**

The control unit transmits data in this format: first the address of the user to which the power should be transmitted is present, second the power requested from the user and third is the generated power along with the acknowledgement is given to the user.

In general, the Control block works in two phases which is firstly it receives the user request and second it transmits back the generated power to the user



**Figure 3: control unit block**

Generation unit: This VI deals with various process which help in the proper functioning of the generation blocks.

The various steps are

1. Bulk generation

2. Figuring out nearest value of Power for transmission to the user
3. Saving extra power in for of battery/cell
4. Sending the power to control unit (with Sync and Ack configuration )
5. Saving details of power generation in to sever file

We will discuss these processor in detail one by one. But before that let's see what is actually Generation block function is?

In layman terms Generation block is responsible for generating power for the user. Now the problem is that the generation block is directly linked with user hence the power produced can't be always exactly precise, thus some extra units are generated. If these extra unit gets wasted it will defeat the purpose of getting green communication that means hundred percent usage of power without getting any power wasted, thus this extra power has to be saved in order to make this whole arrangement of power grid to be green communication.

The generation block is also needed comprehend what would be the nearest possible value of power that will provide the user the amount of power asked and get minimum extra power for saving. This means let's say if the user asks for 95 units of power then the nearest possible value for the generation block will be 100 units, thus 95 minutes would be provided to the user and 5 units should be saved as a battery. This is due to the problem that the generation block can only generate power in the multiple of hundreds.

### **Step 1**

#### **Bulk generation**

In which module of generation the amount of power required for specific month by the user is entered in the cluster. This data which is entered then goes to bulk generation module, the bulb generation module then decides what would be the most possible nearest value in multiple of hundreds. The energy is generated from numerous power sources such as renewable resources and non-renewable resources and the renewable resources such as hydropower plant, solar energy, biogas plant, ocean Thermal Energy, geothermal energy etc, the non-renewable resources such as nuclear power plant, coal, petroleum etc. These sources provide apt power to generation unit so that it can provide the user with required power.

### **Step 2**

Figuring out the nearest possible value for power

It is the combination various circuitries such as for loop, addition, subtraction, multiplication etc. It helps in the processing of power from the generation module. This circuit plays an important role in figuring out the nearest possible value of power, if this circuit fails, the power generation unit cannot decide how much power to be

processed, this could lead to access power generation, which will result in loss of excess power and thus resulting in making the power grid generation, not suitable for green communication.

This process also helps to find out what amount of extra power is being generated by the generation unit and it separates extra of power from the required power.

### **Step 3**

Saving addition of extra power generated by the generation unit inform of batteries of a cell.

This process is interdependent on process 2. Process 2 defines the amount of extra power generated by the generation unit during, required power generation. It also removes the extra generated power and stores the power in the storage unit. Now the storage unit stores the power in form of cells or battery which then can be used as a secondary source of power in time of adversity.

Currently in the generation V I, the storage unit is replaced by a text file which can store a number of extra power generated as data.

At the time of real-time analysis and run this text file will be replaced by a general storage unit from which the power can be used as a secondary source.

### **Step 4**

Send power to the control unit with synchronization and acknowledgement configuration.

In the generation unit when the power required power has been generated, and if any extra power that was previously generated has been saved in the storage unit, then the required power has to be transmitted to the control unit. The control unit is a structure to which would be required for the transmission of power to various distribution and then provide it to major Cities. The control unit act as a mediocre between the generation unit and the distribution unit. The only other work that control unit is processing is that it's providing synchronization and acknowledgement signal for generation unit and control unit.

### **Step 5**

Saving the generation data in server files.

All the conversation between the user and generation unit, the generation unit and the control unit etc are needed to be sent to the user so that the using can be kept updated about the power that is going to reach him in what amount of time and what would be the price for the same power. Other than that the billing system needs to be updated and those payments and power consumption details and other synchronization and acknowledgement signals messages need to be stored in main server file which can be accessed by the user or professional expert at any point in time.

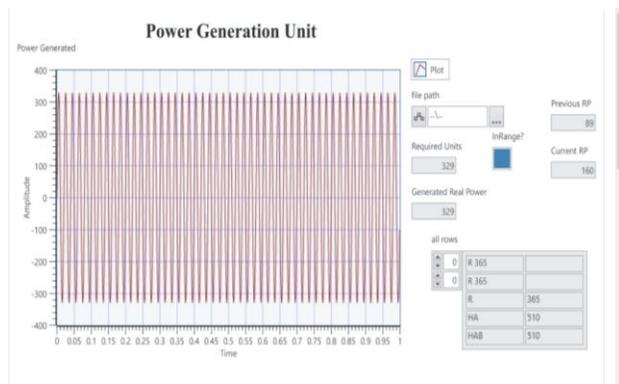


Figure 4: power generation unit block

Reserve power system (Rps): Reserve power system is used to reserve the some extra power to the battery so that if the load increases or at the time of peak hours it can provide the required power to the consumer. It's a very important system in the smart grid application because it allows one to save some extra unit reserve in the system so that at the time of crisis, it can be utilized.

### SECTION III OPERATIONAL ARCHITECTURE

This section in this paper mainly describes various types of architecture used in smart grid. The survey defines that there are basically two main classes, namely architecture for home area network (HAN) and the architecture for hybrid networks covering the rest.

#### ARCHITECTURE FOR HAN

##### 1. Wireless Sensor Network Architecture for CR based Smart Grid

It is basically a multi-layered architecture of cognitive radio based Wireless Sensor Network was proposed in [2]. In CR-WSN, a coordinator together with spectrum sensor and a geo location database collects information about the spectrum. The basic function of the geo location database is to maintain information regarding white spaces within a range of 50m. The coordinator accumulates the information about the free channels, performs like a gateway or a root node, schedules quite periods for spectrum sensing, ensures that it is properly synchronised, and communicates with geo location database to prepare a list of primary user channel that are to be scanned. As soon as a PU is detected the spectrum sensor issue a channel switch notification. The list of licensed and non-licensed channel user is again made and then forwarded to the coordinator[3].

##### 2. SC Architecture based on Radio Access Technology

In HAN the users basically have the luxury of next generation wireless systems comprising of several Radio

Access Technologies (RATs). The smart devices should have reconfigurable radios to accommodate real time traffic and best efforts from smart grid. The two resource controlling operators are : the Global Network Resource Controller(GRC) in the back end network and Base station (BS)/ Access Point (AP) for each RAT. Firstly, the GRC assigns the best possible BS/AP for connectivity to each RR on long time scales. Information collected from multiple HANs is sent to a NAN which relays the data to back end systems [5].

#### Hybrid Architectures

Here the architectures are divided into two main parts that are: a set of general architectures for combinations of HAN, NAN and WAN, and architecture for advanced metering system (AMI)

##### 1. Cognitive Machine-to-Machine Communication:

The cognitive machine-to-machine (CM2M) was first proposed to use the CR technology for M2M communication in FAN, HAN and NANs. This study basically focuses on justification of the use of CRs in M2M communication and the study of CM2M architecture for smart grids. Within this architecture was developed a energy efficient spectrums sensing scheme for smart metering system.

M2M for smart metering over TVWS

CM2M for renewable energy FANs

CM2M for protector of grid FANs

##### 2. Cognitive System Models for Small cells:

The data rate for multimedia applications in smart grid are quite high and results in high energy consumption. To improve the technology on this front we use cognitive system models for small cell. The energy consumption model of cognitive system for small cells not only sense radio spectrum but also sense the SG environment so as to manage the power allocation and interference management. It has been modelled with demand side management (DSM) and real time pricing (RTP).

Here in this model, one macro cell base station (MBS) is used to connect multiple small cell base station over a broadband connection, with the help of a cable modem or a digital subscriber line. Many users are served by SFCBS in each small cell. The SFCBSs are provided with cognitive technology i.e. used to sense the surrounding radio spectrum and intelligent sub-channel access. The range band that is authorized to MBS is partitioned into different sub-channel in each time slot. The sharing of spectrum between macro cells and small cell causes increased spectrum efficiency and also leads to cross-tier interference. The MBS charges the SFCBSs an interference price to reduce the interference effect.

### **3. Substation monitoring and Cognitive Radio based power line:**

This phenomenon has already been proposed in [4]. According to proposed data the sensor are used to transfer the monitored data. Zigbee, Wimax are some of the techniques used in this system. Wimax is used to transfer data over large bandwidth using multiple sensors, Zigbee is a technique used for short distance data transmission. The data collected by sensor is transmitted by Wifi. Wifi transmits this data which is received by Customer premises enterprises (CPE) which is then again transmitted through the air, radio interface[3].

### **4. Cognitive Radio on fibre technology:**

A system design comprising of Cognitive radio network with virtual free space association for rapid monitoring and control of network smart grid has been proposed. Radio on fibre is a technique that the architecture uses. Multiple input and output antennas are utilized at both ends of optical fibre. The three type of RoF\_MIMO for cognitive radio networks are serial RoF\_MIMO, parallel RoF\_MIMO and digital RoF\_MIMO. The basic function of serial RoF\_MIMO is remote site connection and that of parallel RoF\_MIMO is to mitigate interference in spectrum jammed area. Digital RoF\_MIMO uses the digital broadband network to exploit radio space transmission in digital pulse format.

### **5. Graphics processing technique:**

Fast spectrum sensing and dynamic access can be achieved using graphic processing technique. Cognitive radio communication that uses license free bands is used in HANs, and that used over license band is employed in NANs and WANs.

CR communication in HAN: Here packet error rate is periodically determined by each sensing center node. When the quality goes below a suggested value spectrum sensing command is initiated by the controller. The unoccupied bands are decided by the controller and are allocated to the sender nodes.

CR communication in NANs and WANs: Across network for successful delivery data can be categorized and prioritized in CR based NANs. Voltage drop, switching command are example of emergencies and disaster.

### **6. Advance metering infrastructure:**

The basic function of AMI is to estimate, collect and analyse the energy used and interaction with smart meters throughout communication media. It is a two layer architecture that uses TVWS and has two types of wireless network. The first layer has small scale white space through WhiteFi. The WhiteFi exploit white spaces in the UHF band. The second layer or the upper level consists of

802.22 networks operated by independent broadband service providers to interconnect WhiteFi access points and utility company. The spectrum sensing data from other clients of 802.22 service or sensors can be obtained by 802.22 service provider. Transmitter databases are available as well as there is a list of available channels for both spectrum sensing and transmitter database.

4G Cognitive radio architecture: The primary user base station does not have capability to support secondary user. The cognitive radio senses a wide frequency band known as cell region. When the unused bands are identified information is send to the cloud data user.

Wireless cloud data architecture: The principles of WCD are application layer, platform layer, networking and CR communication layer, and infrastructure layer. The above two layers represent cloud architectures and lower layers are enriched for CR networking [3].

### **PROCEDURE**

The functionality of the smart grid model that we worked on is defined as below:

User Block for Request Generation

This block deals with various process which help in the proper functioning of the user request block.

It consists of various devices at the user end that request for the required amount unit. This is then processed and after generation by generation unit it is fed to them.

Here the various processes used are:

1. Providing request to the control unit block

2. Receiving the generated power from control unit

Firstly, the user will request the amount of power which is required by him on a timely basis in range of 0 to 600 units. The request will be send to the control unit in order to generate the desired power.

Secondly, the user will receive the amount of required power which is generated by the generation unit and transmitted by the control block. This amount of power is the one which is the one that is the requirement of the user and the rest in case of emergency can be routed from RPS.

Control unit block

The processes that define control unit are as follows:

1.Receiving request from the user

2.Providing the user request to the generation block

3.Receiving the required power generated acknowledgement from generation block

4. Providing use the acknowledgement of generated power

Firstly, here the control block is responsible to receive the user request from the user of the amount of power to be generated. The control block receives the request and provides it to the generation block.

Secondly, as soon as the generation block receives the user request it generates the nearest high order value and provides the actual power required to the user and thus

saving the extra power generated in RPS (Reserved Power System).

After the excess power is stored in the RPS the generated power as demanded by the user along with acknowledgement is given to the control unit which then takes care of providing the generated power to the user so that actual smart power transmission takes place.

The control unit then transmits data in the format “ first the address where the power is to be transmitted which is the followed by a semicolon then comes the amount of unit that are being demanded by the which is again followed by a semicolon.

### Generation block

The main function of the generation block can be defined as follows:

1. Receiving the request from the control unit
2. Generating the desired amount of unit
3. Sending the unit generated to the control unit with a acknowledgement

The generation unit is a very important unit of the smart grid model.

The generation unit comprises of solar panels, wind mills, water turbines that generate energy without destroying the environment. Once the generation unit gets the data from the control unit it at once starts generating the desired amount of power as required by the user. When the power is generated the power is that is demanded by the user is send to the control unit and the excess power is stored in the RPS (Reserved power system).

Output voltage of solar panel is directly proportional to light intensity (LUX)

i.e.  $P(\text{solar}) = k \times \text{intensity of light}$

Output power of water turbine

$$P(\text{water}) = Q \times \rho \times g \times H \times n$$

Where

P = electric power in kVA

Q = flow rate in pipe (m<sup>3</sup>/s)

P = density (kg/m<sup>3</sup>)

g = acceleration of gravity (m/s<sup>2</sup>)

H = waterfall height (m)

n = global efficiency ratio (usually between 0.7 and 0.9)

Output power of wind turbine

$$P(\text{wind}) = 0.6 \times C_p \times N \times A \times V^3$$

Where

P = electric power

C<sub>p</sub> = rotor efficiency

N = efficiency of driven machinery

A = swept rotor area

V = wind speed

$$\text{Total Power Generated} = P(\text{water}) + P(\text{wind}) + P(\text{solar})$$

### Reserved power system

As soon as the generation unit generates the required amount of the units as desired by the user it is then forwarded to the control unit where it forwards the units to the user end. When the generation unit generates the required amount of unit it can be more than the units desired by the user. Hence those units are the send to reserved power system. This reserved power can be used during the time of emergency. If the user requires more units or suddenly the demand increases or may be if there is a sudden demand of the units in terms of unit the RPS comes into picture. It also stores the power that the user might generate for their use. It acts as a reserve for all the units so that it may not be wasted and can be used if there is sudden increase in demand.

The above defined blocks are main parts of a smart grid model. These blocks are also supported by the software. These blocks along with the programs designed in these software together make the unit as a whole.

The LABVIEW Communication suite 2.0, LABVIEW are the software that act as the heart of this smart grid model. There are several VI that together combined work as a single unit to run this model. The programs written in LABVIEW OR LABVIEW Communication suite 2.0 are known as VI.

The software domain is subdivided into three main VI. Those VI are as follows

- 1.) The VI for transmission of message (at user end)
- 2.) The VI for receiving message (at control unit)
- 3.) The VI for controlling the hardware

The VI for transmission of the message (at the user end)

For designing this VI LABVIEW Communication suite 2.0 software was used. The basic function of this transmission VI is to transmit user data or to generate a user request. The user data comprises of the user address and the units required by the user for the daily use. Initially we used the block present in our software to generate a format for the user request. This is done so that the transmission and the receiving of the data is not a problem, as well as the programming at the user end also depends on the same.

### The VI for receiving message

After designing the format for generation message, we designed the modulation technique to convert the information from text to code that can easily be transmitted using the antennas. Further we configured the USRP to transmit the code. USRP is a basic hardware tool that is responsible for the transmission and reception of message signal. The modulated text is converted into a queue and

then transmitted bit by bit to prevent any loss of packets and also to maintain the positional composition of the code. The user can enter his or her data in here which is then converted into packets and then send to the VI at the control unit with the help of tool known as USRP.

For designing this VI we too used the LABVIEW Communication suite 2.0 software. The all over working of this VI in layman's terms is the reception of the user request. So to receive the user request we first configured the USRP to receive the user request.

After the configuration the next task is to sense the type of the modulation used to send the signal by the transmitter. After conforming the modulation technique and automatically changing the settings accordingly, we defined a mechanism a mechanism to receive the message packet by packet.

The message received after this process is then logged into a file for our VI controlling the hardware domain to work with.

This is basically the front end of the block diagram that basically controls and makes it easier for user to control the entire block diagram.

#### **The VI controlling the hardware**

For this VI we used the LABVIEW software we first of all configured the arduino with the LABVIEW software. This is basically done so as to make the arduino work as directed by the VI designed. The data that was logged in by the VI for reception is then accessed by this VI for further processing. This is then followed by a unit that is solely dedicated to the parsing of data i.e. acquiring the useful data out of it for further use. That is first the address is abstracted from the message and then the unit request is extracted from the message signal

After abstracting the data the main process starts. Where the unit by the users is compared and then the main battery is supplied with specified power. Then this is forwarded to the battery at the relay side. This transfer of the units from main battery to the battery at the user end is controlled via relays. The relays are like switch that completes the circuit if and only if they are supplied with a threshold voltage. This threshold voltage controls the flow in and out of relay. If the specified amount of voltage is supplied the relay will complete the circuit else leaving the circuit completely broken.

It shows the current data that is being processed as well as the reserve battery voltage that RPS, the place where the data is logged and from where the VI can abstract data

from, the renewable generated voltage and also it gives the idea of the units required by the user.

#### **SECTION IV**

Impact of proposed system: much progress has been seen in the smart grid till now. The smart grid's future would have impact on our business landscape and energy marketplace. Different ways have risen to interact with socially and culturally. It has a large social impact on developing nations. Smart grid would provide enhance control and convenience in the industrial world. The best available technologies have been used for smart grid and it is making a very big difference to delivering electricity to the user.

#### **FUTURE SCOPE**

India is the 3rd largest transmission and distribution network in the world, and still faces problems about inadequate electricity supply, poor quality, network losses and reliability. To overcome these problems smart grid is the best solution as it generates energy from various renewable resources such as wind, water and solar energy.

In current generation we are taking energy from the government and according to the consumption we are paying them. But for future we are proposing a smart grid system which will encourage an individual to generate their own energy. Due to the rules and regulations of India we can't directly use that energy. We will transmit that generated energy to the government grid. According to the total generation and consumption we have to pay for the energy.

Let us assume if we are generating energy more than our consumption then the government will pay us for that extra energy that we are generating and if we are generating less energy than our consumption then we have to pay for that extra energy that we are consuming.

#### **CONCLUSION**

Smart grid is a next generation power grid. It includes power generation, management, transmission, distribution and utilization. The main features of smart grid is that it is highly efficient, reliable and secure.

There are various wired and wireless technologies available for smart grid application. Here the development of this system using National Instruments Universal Software Radio Peripheral (USRP) and simulation and hardware interfacing is done using Lab VIEW.

Energy is generated through various sources such as solar, wind and water turbine. Solar panel will generate 6V power, Wind mill will generate 2V power and water turbine will generate 6V power. The control unit will distribute these generated energy to the users according to their request.

**REFERENCES:**

- [1] Vehbi Cagri Gungor and Dilan Sahin, "Cognitive radio networks for smart grid applications" : IEEE vehicular technology magazine, June 2012.
- [2] A.Sreesha, S.Somal, and I.lu "Cognitive Radio Based Wireless Sensor Network For Smart Grid Utility," in Proc. IEEE LISAT conf. ,may 2011.
- [3] Athar Ali Khan, Mubashir Husair Rehamani and Martin Reisslein" Cognitive Radio For Smart Grid :Survey of Architectures , Spectrum Sensing Mechanism and Networking Protocol:"IEEE communication Surveys and Tutorial Vol.18 no.1 , first quarter of 2016.
- [4] B.Li , B.Zhang ,G.Guo and J.Yao ," Study of Cognitive Radio Based Wireless Access Communication of Power Line and Substation Monitoring System of Smart Grid:.", Proc. Int. Conf. CSSS. August 12.
- [5] R.Amin ,J.Martin and H.Zhou,"Smart Grid Communication Using Next Generation Heterogeneous Wireless Netowk:" in Proc. IEEE Int. Conf. Smart Grid Comm. Nov. 12.
- [6] H.Sun, A.Nallanthan ,B.Tan ,J.S.Thompson, J.Jiang and H.V.Poor, "Relaying technologies for Smart Grid communications," IEEE Wireless Commun. Vol. 19. No.6 pp.52-59, Dec 2012.
- [7] E.Hossain ,Z.Han ,H.V.Poor ,,"Smart Grid Communication And Networking, Cambridge U.K 2012".
- [8] A. Ghassemi ,S.Bavarian and L.Lampe "Cognitive Radio For Smart Grid Communication," in Proc. IEEE int. Conf. Smart Grid Comm. 2010.
- [9] W.Wang, Y.Xu and M.Khanna " A Survey On Communication Architecture of Smart Grid:" Comput. Netw. Vol 25 No.5 oct 11.
- [10] V.Dehalwar ,M.Kolhe ,S.Kolhe "Cognitive Radio Applicatipon For Smart Grid:" int. J.Smart Grid Clean Energy Vol.1 No.1 sep 12.

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

<sup>[1]</sup> B.V.Bahoria, <sup>[2]</sup> D.K.Parbat, <sup>[3]</sup> C.Vikrant Vairagade

<sup>[1]</sup> Assistant Professor, Rajiv Gandhi College of Engg.& Research,Nagpur , India,

<sup>[2]</sup> Professor, Govt.polytechnic ,Bramhapuri, India, <sup>[3]</sup> Assistant Professor PCE, Nagpur, India

**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 fabricform. . 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 petro graphical 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.

## 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 µm) 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.

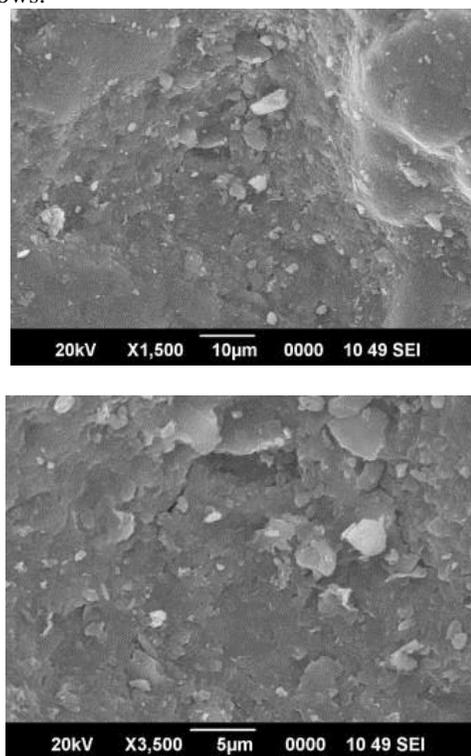
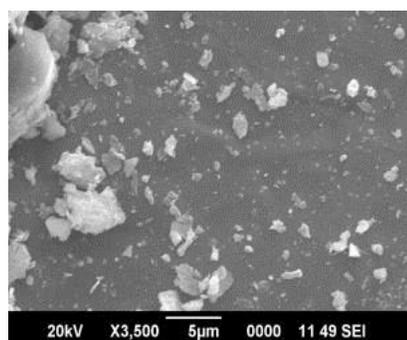


Figure 1. SEM-EDS for natural sand under X1500 , X7000 magnification range



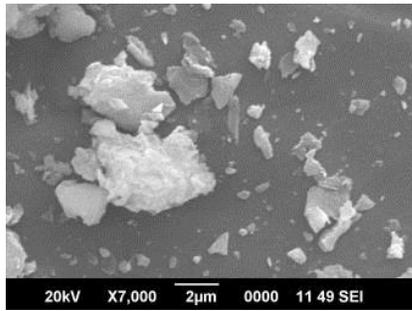


Figure 2. SEM-EDS for Quarry dust under X1500,3500 magnification range

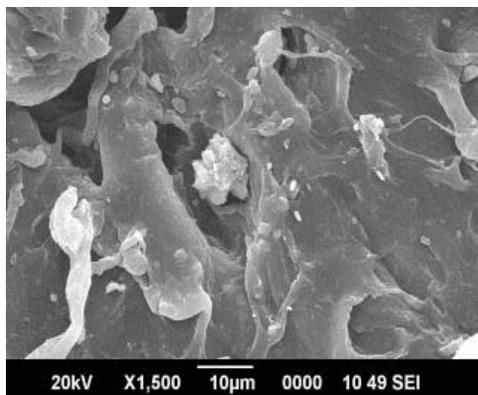
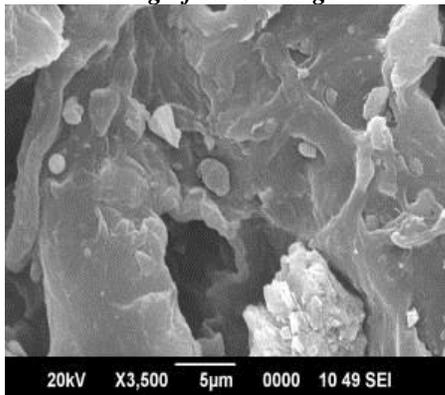


Figure 3. SEM-EDS for waste ldpe under X1500,3500 magnification range

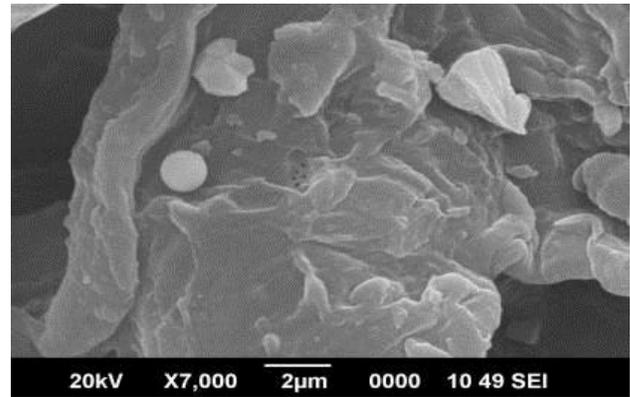


Figure 4. SEM-EDS for waste ldpe under X7000 magnification range

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

Aggregate	Elements found in EDS
ÑS01	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

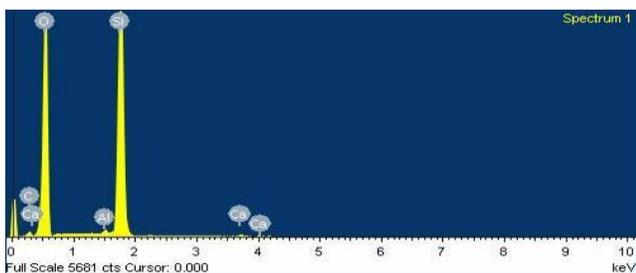


Figure 5. EDS Analysis of Natural sand

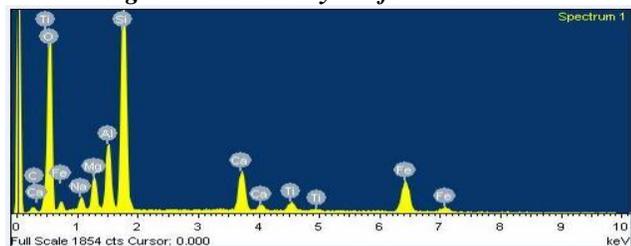


Figure 6. EDS Analysis of Quarry Dust

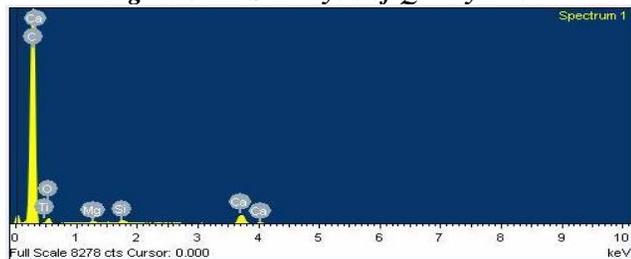


Figure 7. EDS Analysis of Waste Plastic (ldpe)

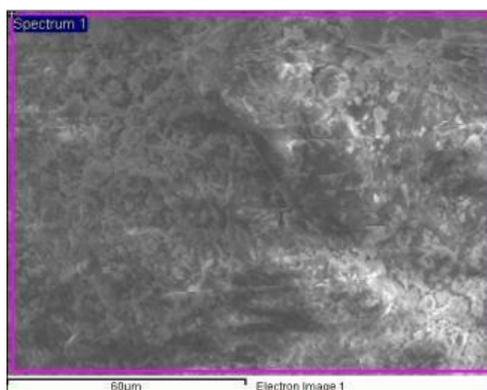
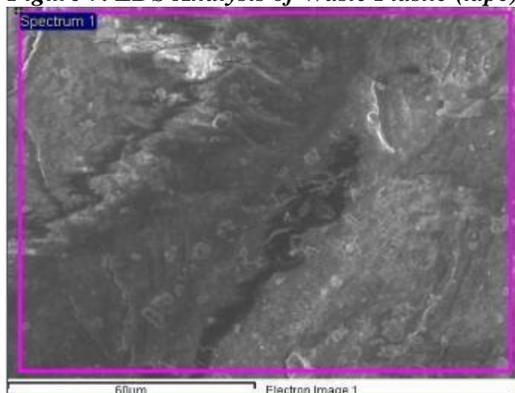


Figure 8 .EDAX Image of Natural, Image of Quarry Dust

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. 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/cm<sup>2</sup> 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	28 days	90 days
		RCPT charge passed for 6hrs (coulombs)	
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	

Table 5 Coefficient of permeability for M30 concrete

Grade of concrete	Mix Identification	28 days	90 days
		Coefficient of permeability (10 <sup>-12</sup> m/s)	
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	

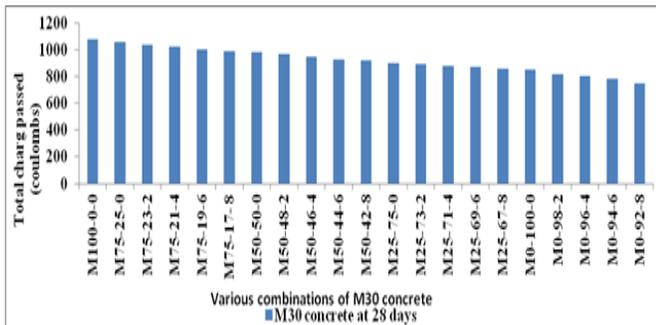


Figure 9. RPCT for M30 concrete at 28 days

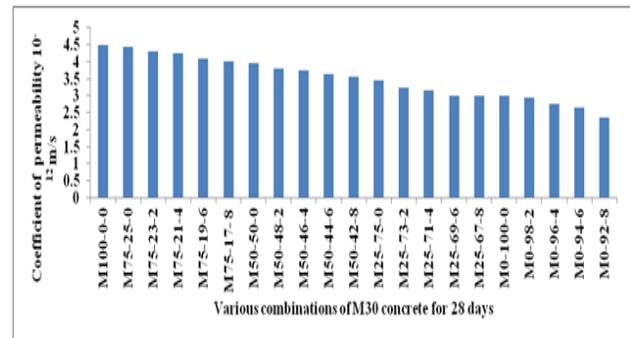


Figure 11 Coefficient of cracked permeability for M30 concrete at 28

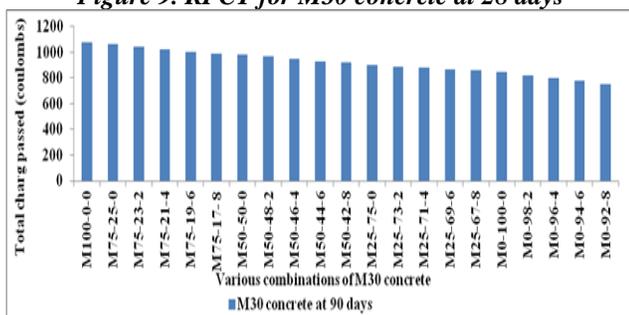


Figure 10. RPCT for M30 concrete at 90 days

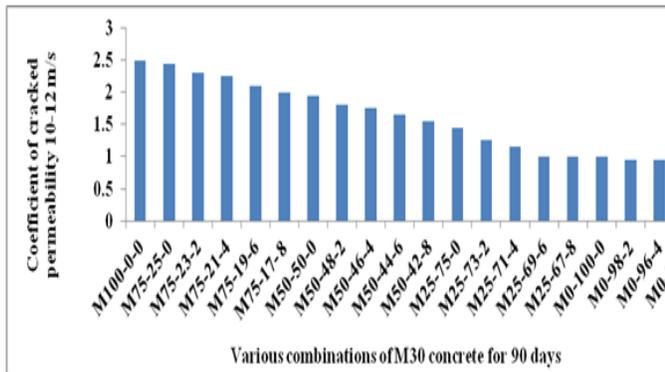


Figure 12 Coefficient of cracked permeability for M30 concrete at 90 days

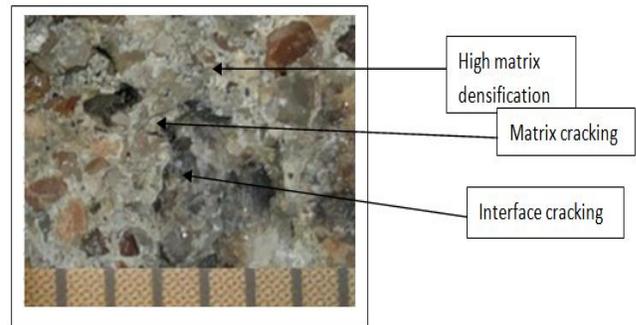


Figure16. Microscopic view of quarry dust concrete at 40% load (50x magnification).

**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 µm), which may also be part of an aggregate product, or be produced in excess, or be produced as a by-product.

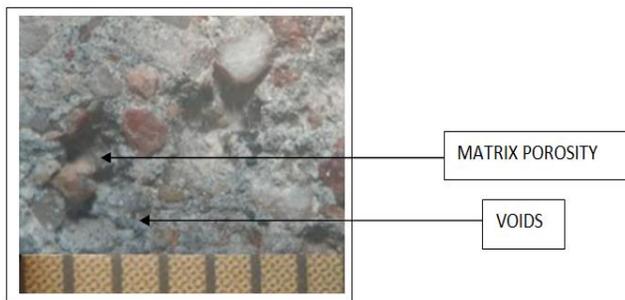


Figure13. Microscopic view of conventional concrete without initial stress (50x magnification).

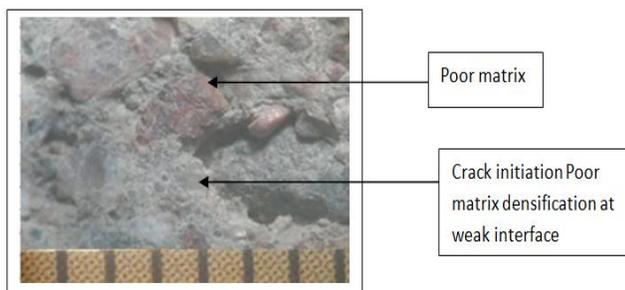


Figure14. Microscopic view of conventional concrete at 40% load (50x magnification).

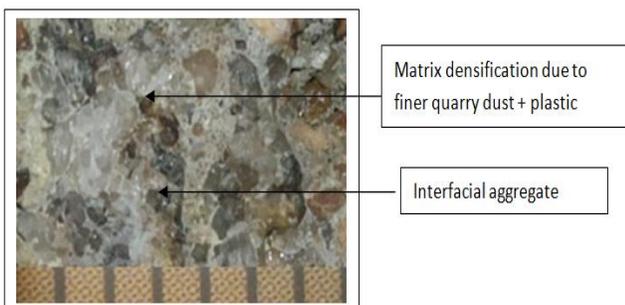


Figure15. Microscopic view of quarry dust concrete without stress (50x magnification).

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 µm 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.

#### **REFERENCES :**

- [1] Bayasi, Z., Zeng, J. "Properties of polypropylene fiber reinforced concrete". ACI, Materials Journal 90 (6),, 1993: 605–610.
- [2] Zainab, Z. Ismail, E., Hashmi, A., "Use of waste plastic in concrete mixture as aggregate replacement". S Waste Management, 2007.
- [3] Ahn, N. and Fowler, D.W (2001). "An Experimental Study on the Guidelines for Using Higher Contents of Aggregate Microfines in Portland Cement Concrete". ICAR-102-1S. International Center for Aggregates Research (ICAR). Fowler, Ahn and. "The effects of high fines on the properties of concrete. ICAR 10th Annual." 2002.
- [4] Hudson, B. " "Manufactured Sand – Destroying Some Myths," Quarry pp. 57-62." 1997.
- [5] Hudson, B. "Discovering the lost aggregate opportunity, Parts 1 to 9, Pit and Quarry." 2003.
- [6] Sarkar, S.L., Aimin, X., Jana, D. "Scanning Electron Microscopy, X-Ray Microanalysis of Concretes," Handbook of Analytical Techniques in Concrete Science and Technology, (Ramachandran, V.E., Beaudoin, J.J., ed.), Chapter 7, William Andrew Publishing/Noyes Publications, New York, 2001.
- [7] "IS: 10262:2009, "Concrete Mix Proportioning – Guidelines", First Revision, July." 2009.
- [8] "ASTM C 1202, Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration, American Society Testing of Materials, Philadelphia, Pa, USA." 1979.
- [9] ASTM C 1202-1979. "Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration, American Society Testing of Materials, Philadelphia, Pa, USA."
- [10] IS 3085. Method of Test for Permeability of Cement Mortar and Concrete, BIS Standard, New Delhi, India., 1965.

# Lancefield Group of Streptococci Isolated From Dental Plaque Biofilm

<sup>[1]</sup> Khushbu Verma, <sup>[2]</sup> Shailja Singh

<sup>[1][2]</sup> Department of Agriculture, Food & Biotechnology, Faculty of Engineering & Technology, Jayoti Vidyapeeth Women's University, Jaipur, Rajasthan, India.

**Abstract:**-- The purposes of this study were to detect Lancefield Group of Streptococci from different disease diagnose in dental patient visiting clinic. A total of 500 dental sample of plaque biofilm isolates were tested. Plaque sampling sited varied depending on the condition and disease diagnose in individual subjects. The plaque biofilm sample were collected from sub gingival and supragingival including cervical margin of all erupted teeth. Oral disease like aphthous stomatitis, burning mouth syndrome, gingivitis, dental plaque and early onset of periodontitis harboring Lancefield group of Streptococci revealed their varied titer depending on disease condition. Strains identified and differentiated with a simple enzyme extraction method that detects Streptococci Lancefield groups A, B, C, D, F and G. Group D showed highest titer in early onset of periodontitis and aphthous stomatitis oral infection. This latex method showed good discriminative ability for differentiation between these species, and suggested that it is a technique suitable for epidemiological studies on Lancefield Group of Streptococci isolated from dental plaque biofilm from different disease condition.

## INTRODUCTION

Dental plaque is a biofilm or mass of microscopic organisms that develops on surfaces inside the mouth. Fick the heft of the microorganisms that structure the biofilm are Streptococcus and distinctive anaerobes, despite the fact that the specific composition changes through region in the mouth. Numerous studies have been undertaken to determine the composition of the plaque microflora from diseased sites in order to try and identify those species directly implicated in causing pathology (1, 2). Cases of such anaerobes incorporate Fusobacterium and Actinobacteria. Streptococcus and different anaerobes are the preparatory colonizers of the veneer surface, and play an over whelming position in the foundation of the early biofilm community (1,3). Dental plaque is a biofilm and it is sticky assessment at to begin with, however when it types tartar, it is every now and again dark colored or light yellow. It is commonly found between the teeth, on the front of teeth, behind teeth, on biting surfaces, close by the gumline, or beneath the gumline cervical margins (3). Dental plaque is additionally perceived as microbial plaque, oral biofilm, dental biofilm, dental plaque biofilm or bacterial plaque biofilm. These dental plaque biofilm are responsible for generation many oral infection and dental caries (4,5,6,7). Dental caries is a transmissible infectious disease in which Streptococcus plays the major role. As in many infectious diseases, colonization by pathogens is required before the disease can occur. Streptococcus mutans are generally considered to be the principal etiological agent of dental caries (8,9). There is a scope of

destructiveness factors imperative for the foundation of Streptococcus in the complex microbial network of dental biofilm. Types of Streptococcus are grouped dependent on their hemolytic properties (10,11).

Beta-hemolytic Streptococci are additionally ordered by Lancefield grouping, a serotype characterization (that is, portraying explicit carbohydrates present on the bacterial cell wall) (11). The 20 depicted serotypes are named Lancefield bunches A to V (barring I and J). This arrangement of grouping was produced by Rebecca Lancefield, a researcher at Rockefeller University.

In the therapeutic setting, the most vital group are the alpha-hemolytic streptococci *S. pneumoniae* and Streptococcus viridans group, and the beta-hemolytic streptococci of Lancefield group A and B (otherwise called "aggregate A strep" and "gathering B strep"). Group D (enterococci), numerous previous group D streptococci have been renamed and set in the class Enterococcus The remaining non enterococcal amass D strains incorporate Streptococcus bovis and Streptococcus equinus (12,13).

The microbes that display the most fit pliancy for the adjustment in condition overwhelm the given condition. Aphthous Stomatitis Also saw as discontinuous aphthous ulcers or rankle, is among the most notable oral mucosal damage specialists and dental professionals watch. Aphthous stomatitis is an infection of cloud etiology that may in like manner reason full-measure awfulness (13,14). Gingivitis, the signs of gum disease are to an extraordinary degree non-specific and appearin the gum tissue as the

model reactions of irritation. Studies of the harmfulness elements of Streptococcus and their connection with species biodiversity are essential to understanding the pretended by colonization by various genotypes in a similar individual, and the statement of qualities that may or may not influence their virulence capacity and survival ability under different environmental conditions. A healthy oral cavity represents a complex micro system, changeable in a number and type of bacteria, fungi, viruses and protozoa, which can be found there as commensales or as a part of flora. In the oral cavity (8,15). 107 bacteria can be found (16,17). Almost all the types of bacteria found in the mouth have sufficient pathogenic potential to induce inflammatory processes on teeth and soft tissues. Bacterial flora is different in different areas of teeth. Dental plaque biofilm formation needs especial focus to develop new methods for treatment.

### MATERIALS AND METHODS

Patient visiting dental clinic were selected for collection of sample for dental plaque biofilm assay. The sub gingival, supragingival, and different multiple site were selected to Collect plaque sample of particular disease diagnose in patient. 500 dental plaque sample from caries dynamic and caries free mouth were collected from daman (U.T) And Vapi city of Gujarat state zone. An involved investigation of 500 sample counting 200 male, 200 female and 100 offspring of both genders. Grown-ups running from 18 to 60 years and youngsters from 5 to 16 years. The idea of work followed in this consider were completely disclosed to all members and the examination was directed with composed educate assent. Further, subjects were determined to have specific oral malady via prepared dentist. The clinical examination were led via prepared dental practitioner to evaluate intra-inspects unwavering quality. The sub gingival, supragingival, and distinctive numerous site were chosen to gather plaque test. Dental plaque test were gathered by utilizing sterile tongue depressor to maintain a strategic distance from defilement from other mouth parts and to help a superior vision of carious injuries.

The plaque sample were collected from specific site of mouth by using sterile disposable swab stick transferring sample to sterile tube container 1 ml sterile phosphate buffer saline. Sample were stored in cool place and then transported to laboratory. One hundred micro-liter of undiluted sample were spared on the surface of MS- agar plate using sterile swab. Culture were incubated an aerobically for 48 hrs. at 37°C Count of more than 250 colonies (104 cell/ml) was considered as to positive sample (22). Isolated strains were identified based on colony morphology, characteristics and biochemical test results. For performing latex typing, a culture of Todd-Hewitt

(TH) broth (SSI) was made from the plate and incubated overnight at 33 to 37°C. The aim of this study was to isolate Strains identified and differentiated with a simple enzyme extraction method that detects Streptococci Lancefield groups A, B, C, D, F and G using the Thermo Scientific™ Streptex™ Latex Agglutination Test.

### RESULT AND DISCUSSION

We were able to isolate and identify important cariogenic oral bacterial strains which belonged to the species Streptococcus and Enterococcus. Further lacified group of streptococcus were detected from the isolated strains from dental plaque biofilm. Seclude and recognize an assortment of streptococci with a straight forward enzyme extraction technique that distinguishes Lancefield groups A, B, C, D, F and G. Streptococci sanguis and enterococci recoverd more in caries free mouth as compare to Streptococci mutans. The percentage of group D and group concentration found more in female subjects as followed by children and male.

**Table 1: Detection of Lancefield Group of Streptococci from Caries Free Mouth by Antigen Identification Using Polystyrene Latex Particles with Specific Antibodies**

<i>Strains from Caries Free Mouth plaque sample</i>	<b>RESULT-TITRE</b>			
	<b>1:4</b>	<b>1:8</b>	<b>1:16</b>	<b>1:32</b>
<i>Streptococcus group A</i>	-	+	-	-
<i>Streptococcus group B</i>	-	-	-	-
<i>Streptococcus group C</i>	+	-	-	-
<i>Streptococcus group F</i>	-	-	-	-
<i>Streptococcus group G</i>	-	-	-	-
<i>Streptococcus group D</i>	+	-	-	-

**Table 2: Detection of Lancefield Group of Streptococci from Plaque Biofilm of Aphthous Stomatitis by Antigen Identification Using Polystyrene Latex Particles with Specific Antibodies**

<i>Strains from Aphthous stomatitis biofilm plaque sample</i>	<b>RESULT-TITRE</b>			
	<b>1:4</b>	<b>1:8</b>	<b>1:16</b>	<b>1:32</b>
<i>Streptococcus group A</i>	-	-	-	+

<i>Streptococcus group B</i>	+	-	-	-
<i>Streptococcus group C</i>	+	-	-	-
<i>Streptococcus group F</i>	-	-	-	-
<i>Streptococcus group G</i>	+	-	-	-
<i>Streptococcus group D</i>	-	+	-	-

**Table 3: Detection of Lancefield Group of Streptococci from Plaque Biofilm of Gingivitis by Antigen Identification Using Polystyrene Latex Particles with Specific Antibodies**

<i>Strains from Gingivitis biofilm plaque sample</i>	<b>RESULT-TITRE</b>			
	1:4	1:8	1:16	1:32
<i>Streptococcus group A</i>	-	-	-	+
<i>Streptococcus group B</i>	-	+	-	-
<i>Streptococcus group C</i>	+	-	-	-
<i>Streptococcus group F</i>	-	-	-	-
<i>Streptococcus group G</i>	+	-	-	-
<i>Streptococcus group D</i>	+	-	-	-

**Table 4: Detection of Lancefield Group of Streptococci from Plaque Biofilm of Burning Mouth Syndrome by Antigen Identification Using Polystyrene Latex Particles with Specific Antibodies**

<i>Strains from Burning mouth syndrome biofilm plaque sample</i>	<b>RESULT-TITRE</b>			
	1:4	1:8	1:16	1:32
<i>Streptococcus group A</i>	-	-	+	+
<i>Streptococcus group B</i>	-	+	-	-
<i>Streptococcus group C</i>	+	-	-	-
<i>Streptococcus group F</i>	-	-	-	-
<i>Streptococcus group G</i>	+	-	-	-

<i>Streptococcus group D</i>	-	+	+	+
------------------------------	---	---	---	---

**Table 5: Detection of Lancefield Group of Streptococci from Plaque Biofilm of Early Onset of Periodontitis by Antigen Identification Using Polystyrene Latex Particles with Specific Antibodies**

<i>Strains from Early onset of periodontitis biofilm plaque sample</i>	<b>RESULT-TITRE</b>			
	1:4	1:8	1:16	1:32
<i>Streptococcus group A</i>	-	-	+	-
<i>Streptococcus group B</i>	+	-	-	-
<i>Streptococcus group C</i>	+	-	-	-
<i>Streptococcus group F</i>	-	-	-	-
<i>Streptococcus group G</i>	+	-	-	-
<i>Streptococcus group D</i>	-	-	+	+

### CONCLUSION

In the present study, isolated strains from dental plaque biofilm of pathos stomatitis, periodontitis, burning mouth syndrome and gingivitis dental case showed positive result for presence streptococci Lancefield groups A, B, C, D, F and G. The experiments described above explored the fluctuation in titer of Lancefield Group of Streptococci isolated from different oral disease diagnosed. The result reveals the differences in titer obtain for Lancefield Group of Streptococci from selected dental plaque biofilm. Still we need further investigation to understand these potential mechanism of Lancefield group of Streptococcus to tolerate the harsh environmental of dental plaque biofilm under different disease condition and their difference in concentration.

### REFERENCES

1. Dahlen, G. 1993. Role of suspected periodonto pathogens in microbiological monitoring of periodontitis. Adv. Dent. Res., 7:163-174.
2. Dahlen, G., and Leonhardt A. 2006. A new checkerboard panel for testing bacterial markers in periodontal disease. Oral Microbiol. Immunol., 21:6-11.

3. Lafong, A. C., and Crothers.E. 1988. Simple latex agglutination method for typing pneumococci. *J. Clin. Pathol.*, 41:230–231.
- 4.Lancefield, R. C., McCarty M. and Everly W.N. 1975.Multiple mouse protective antibodies directed against group B streptococci *J. Exp. Med.*,142:165–179.
5. Lancefield, R. C. 1934.Serological differentiation of specific types of bovine haemolytic streptococci (group B. *J. Exp. Med.*, 59:441–458.
6. Martin, D., Rioux S., Gagnon E., Boyer M., Hamel J., Charland N., and B. R.Brodeur. 2002. Protection from group B streptococcal infection in neonatal mice by maternal immunization with recombinant Sip protein. *Infect. Immun.*,70:4897–4901.
7. Severin, W. P. J. 1972. Latex agglutination in the diagnosis of meningococcal Meningitis. *J. Clin. Pathol.*, 25:1079–1082.
8. Patterson M.J. 1996.Baron S; et al., eds. *Streptococcus*. In: *Baron's Medical Microbiology* (4th ed.). Univ of Texas Medical Branch.
9. Facklam R 2002. What happened to the streptococci: overview of taxonomic and nomenclature changes", *Clin Microbiol Rev.*, 15 (4): 613–30.
10. Cohen-Poradosu R., Kasper D.L. 2007 .Group A streptococcus epidemiology and vaccine implications. *Clin. Infect. Dis.* 45 (7): 863–5.
- 11.Schrag S., Gorwitz R., Fultz-Butts K., Schuchat A. 2002. Prevention of perinatal group B streptococcal disease.Revised guidelines from CDC. *MMWR Recomm Rep.* 51 (RR-11): 1–22.
12. Holt et al.1994. *Bergey's Manual of Determinative Bacteriology* (9th ed.). Lippincott Williams & Wilkins.
13. Whitworth J.M. 1990. Lancefield group F and related streptococci. *J. Med. Microbiol.*, 33 (3): 135–51.
14. Kawamura Y., Hou X.G., Sultana F., Miura H., Ezaki T. 1995.Determination of 16S rRNA sequences of *Streptococcus mitis* and *Streptococcus gordonii* and phylogenetic relationships among members of the genus *Streptococcus*.*Int J Syst Bacteriol.*, 45 (2): 406–408.
15. Domann, E., Hong G., Imirzalioglu C., Turschner S., Kuhle J., Watzel C., Hain T.,Hossain H., and Chakraborty T. 2003.Culture-independent identification of pathogenic bacteria and polymicrobial infections in the genitourinary tract of renal transplant recipients.*J. Clin. Microbiol.*, 41:5500-5510.
16. Dorana A., Kneist S. and Verran J. (2004), “Ecology control: in vitro inhibition of anaerobic bacterial by oral Streptococci. *Microb. Ecol. Health. Dis.*, 16:23-27.
17. Dzink, J. L., Socransky S. S., and Haffajee A.D. 1988.The predominant cultivable microbiota of active and inactive lesions of destructive periodontal diseases. *J. Clin. Periodontol.* 15:316-323.
18. Kistler, James O., Booth, Veronica., Bradshaw, David J., Wade, William G.,Glogauer, Michael 2013. Bacterial Community Development in Experimental Gingivitis. *PLoS ONE.* 8 (8): e7122
19. Simonovic D.D., KociC B., NedeljkoviC N.S., Gasic J., Dacic S., and Jovanovic N.2002. Microbiological Status of Different Areas of Tooth.*FactaUniversitatis Series: Medicine and Biology.* 9: 236-239.
20. Bowden G.H.W 2000.The Microbial Ecology of Dental Caries.*Microb. Ecol. Health D.*, 12: 138-148
21. Hillman, J. D., Socransky S.S., and Shivers M.1985.The relationships between Streptococcal species and periodontopathic bacteria in human dental plaque. *Arch. Oral Biol.*, 30:791–795
22. Friedrich, J. (1981), “The genus *Streptococcus* and dental disease”, In: “*Prokaryotes Hand Book of Habitats, Isoaltion and Identification of Bacteria*”, Mortimer, P.S (edit).,1598-1613.

# Performance Evaluation of Various Geometries of Shear Wall in Buildings by Equivalent Static Analysis

<sup>[1]</sup> Richa Gupta, <sup>[2]</sup> Dr. Alfia Bano

<sup>[1]</sup> M.Tech. Scholar, Department of Civil Engineering, NIT Raipur, Chhattisgarh (India)

<sup>[2]</sup> Assistant Professor, Department of Civil Engineering, NIT Raipur Chhattisgarh (India)

**Abstract:** In the present era, tall buildings are very much prominent, therefore its safety against earthquake forces is of vital importance. Shear wall provides an excellent means of resisting the earthquake forces by resisting the lateral force occurring on the building. Shear walls are used in the building to provide desired amount of strength and stiffness. However, positioning of shear walls requires due consideration both in symmetrical and unsymmetrical buildings. In symmetrical buildings the center of gravity and center of rigidity coincide, so that the placement of shear walls is symmetric along the outer edges or inner edges of building. Therefore, it is necessary to find the most ideal and efficient location of shear wall to minimise the effect of torsion. The work presented in this paper focuses on the performance of various geometries of shear wall namely: C-shaped, L-shaped, I-shaped, Rectangular-shaped. In this study G+6, G+16 and G+25 storeyed building is modelled and analysed for lateral displacement, storey stiffness, storey drift using ETABS-2016 software. The analysis of the building is done by using equivalent static method and the results obtained from this method are plotted graphically.

**Keywords:** Rigidity, Storey stiffness, Storey drift, torsion

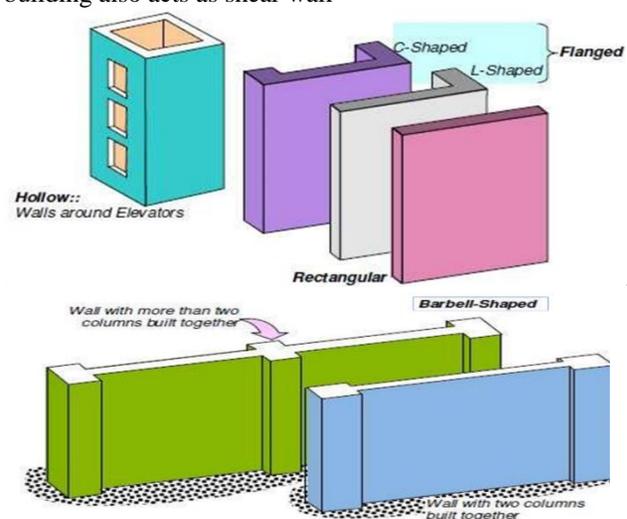
## 1. INTRODUCTION

Shear wall is vertical plate like RC Walls which starts basically from foundation level and continues to full height of the building. Shear walls is one of the excellent means of resisting the lateral forces occurring on the multi-storeyed RCC building. Shear walls plays a very important role in earthquake prone areas as the buildings in these areas are more susceptible to damage and destruction. Various factors which influence earthquake design of structure: Ductility of the structure, Type of foundation of the structure, Importance of building, Damping factor of the structure, Natural frequency of the building. Shear wall when in use helps in improving the seismic response of the building since it provides adequate lateral stiffness to resist the lateral load. In tall buildings, beams, column sizes are heavy and the steel required is also large. Because of this reason there is lot of congestion at these points and it is difficult to place and vibrate concrete and the displacement is also quite heavy. Therefore, when shear walls are placed in an advantageous position, they form an efficient lateral force resisting system. In this paper 5 different models along with efficient location and geometry of shear wall is generated using ETABS -2016.

**Keywords:** Ductility, Damping factor, lateral stiffness

## Overall Geometry of shear wall

Shear walls being oblong in cross-section, i.e., one dimension of the cross-section is larger as compared to the other one. As rectangular cross-section is very much common, U and L- shaped sections are also used. Thin walled hollow shafts of RC around the elevator core of the building also acts as shear wall



**Fig1: Shear Walls in RC Buildings- different geometries are possible**

Source: Earthquake tips by C.V.R. Murty,2005

## 2. LITERATURE REVIEW:

Shaik Kamal Mohammed Azam, 2013 [6] focussed on seismic performance evaluation of RC framed multi-storeyed buildings with shear walls. In this study comparison is being made for strength, stiffness and damping parameters. Use of shear wall has a greater influence on lateral strength as compared to the lateral stiffness in tall buildings. In addition to it, shear wall has less influence on lateral strength as compared to lateral stiffness for buildings with shorter heights. The damping characteristics and performance for tall buildings in terms of damping characteristics is improved by the use of shear wall. Placement of shear walls symmetrically in the outermost frames has better performance in seismic areas in terms of strength and stiffness. Misam Abidi, Mangulkar Madhuri. N; 2012 [7] presented a comparative study for displacement, base shear and performance point. The assessment of inelastic behaviour has also been done. Shahabodin ,Zaregarizi; 2013 [8] presented a study on seismic performance in areas susceptible for greater collapse by using shear walls and concrete infill walls. Results shows that performance of concrete infill is dependent on nearby elements most importantly columns, that's why premature failure is to be considered in columns due to axial forces. Bozdogan K.B. Deierlein et.al., 2010 [9] discussed regarding the modelling issues along with shear wall structural system. A one-dimensional finite element method is used for lateral static analysis.

Load Combination: The structure is subjected primary load as per the provision of IS Code of practice:

- (1) 1.5DL+1.5LL
- (2) 1.2DL+1.2LL+1.2EX
- (3) 1.2DL+1.2LL-1.2EX
- (4) 1.2DL+1.2LL+1.2EY
- (5) 1.2DL+1.2LL-1.2EY
- (6) 1.5DL+1.5EX
- (7) 1.5DL-1.5EX
- (8) 1.5DL+1.5EY
- (9) 1.5DL-1.5EY
- (10) 0.9DL+1.5EX
- (11) 0.9DL-1.5EX
- (12) 0.9DL+1.5EY
- (13) 0.9DL-1.5EY
- (14) 1.2DL+1.2LL+1.2WLX
- (15) 1.2DL+1.2LL-1.2WLX
- (16) 1.2DL+1.2LL+1.2WLY
- (17) 1.2DL+1.2LL-1.2WLY
- (18) 1.5DL+1.5WLX
- (19) 1.5DL-1.5WLX
- (20) 1.5DL+1.5WLY
- (21) 1.5DL-1.5WLY

- (22) 0.9DL+1.5WLX
- (23) 0.9DL-1.5WLX
- (24) 0.9DL+1.5WLY
- (25) 0.9DL-1.5WLY

## 3. METHOD OF ANALYSIS:

In the study, the analysis of the high-rise structure is carried out for lateral loads using Equivalent Static Force Method.

### Modelling of Structure:

S/No.	Description	Specifications
Building frame		
1	system	SMRF
2	Ground storey height	3.5m
8	Typical storey height	3.5m
9	Type of soil	Medium (II)
10	Support condition	Fixed
11	Grade of concrete	M30
12	Grade of steel	Fe 415
3	Live load	2 kN/m <sup>2</sup>
4	Floor finish	1 kN/m <sup>2</sup>
5	Importance factor	1
Response reduction		
6	factor	5
7	Zone	V
13	Slab thickness	150mm
Thickness of brick		
14	wall	230mm
15	Wind Zone	V
16	Basic wind speed	50m/s
17	Terrain Category	III

## 4. BUILDING MODELLED:

1. Model 1: Building (without shear wall)
2. Model 2: Building with L shaped geometry of shear wall
3. Model 3: Building with rectangular shaped geometry of shear wall
4. Model 4: Building with C shaped geometry of shear wall

5. Model 5: Building with I shaped geometry of shear wall

Figure 2: Plan of Buildings with various shapes of Shear wall

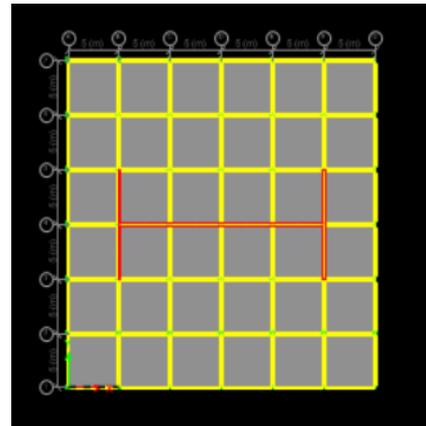
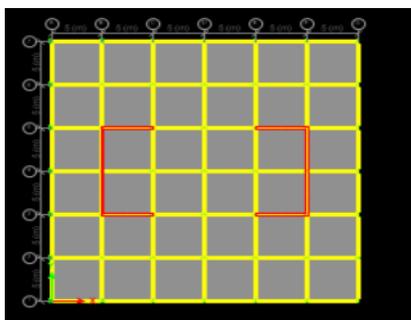
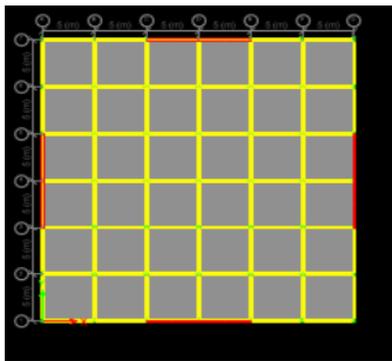
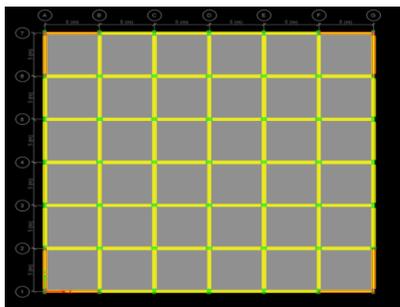
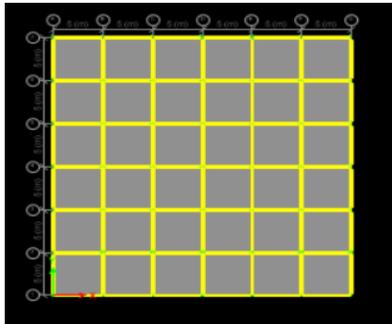
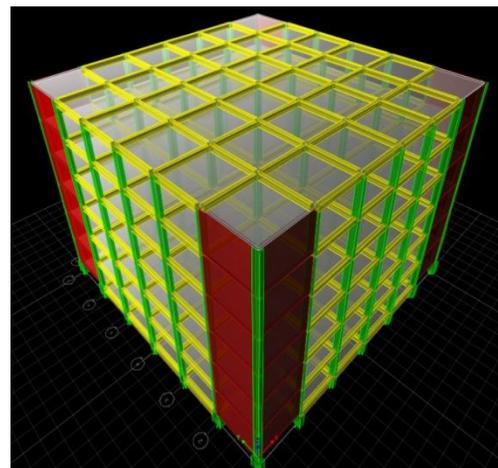
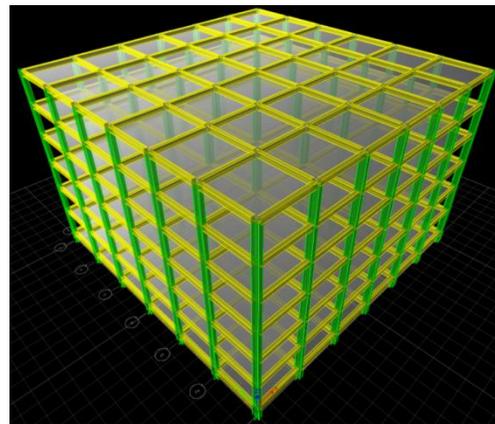
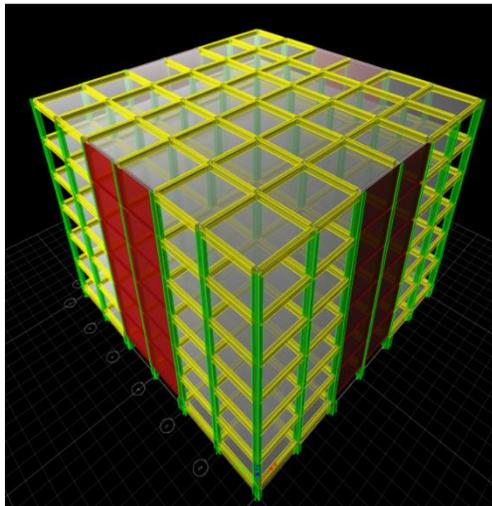
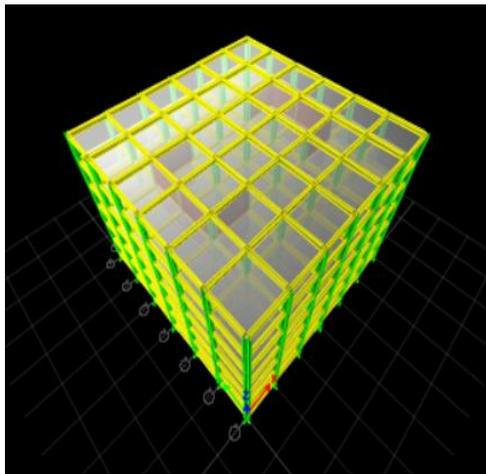


Figure 3: 3D view of RC Building with various shapes of shear wall

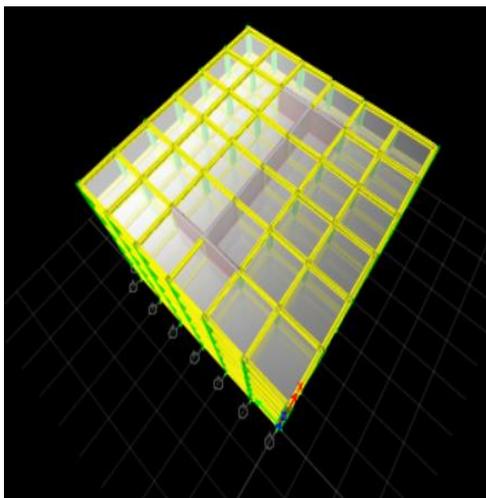




(c) Model 3



(d) Model 4



(e) Model 5

**MEMBER SIZES OF G+6 STOREY  
SALIENT FEATURES OF G+6 STOREY**

SNo.	Description	Specifications
1	Column size (Ground level)	350mm x 700mm
2	Column size (other stories)	350mm x 600mm
3	Plinth beam	400mm x 550mm
4	Beam size	350mm x 500mm

**MEMBER SIZES OF G+16 STOREY  
SALIENT FEATURES OF G+16 STOREY**

SNo.	Description	Specifications
1	Column size (Ground level)	500mm x 900mm
2	Column size (other stories)	350mm x 700mm
3	Plinth beam	450mm x 700mm
4	Beam size	400mm x 600mm

**MEMBER SIZES OF G+25 STOREY  
SALIENT FEATURES OF G+25 STOREY**

SNo.	Description	Specifications
1	Column size (Ground level)	600mm x 1000mm
2	Column size (other stories)	500mm x 900mm
3	Plinth beam	600mm x 800mm
4	Beam size	500mm x 700mm

Here the results observed for G+25 storeyed building is very much similar with G+6 & G+16 storeyed building. In this case also the performance of I shaped geometry shear wall has been better as compared to other geometries of shear wall.

5. OBSERVATIONS & RESULTS

1. G+6 building

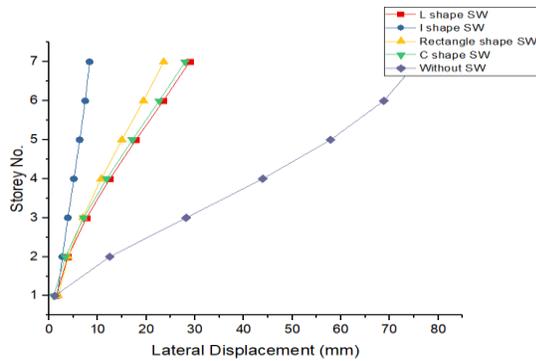


Fig 4: Lateral Displacement vs Storey No.

Here the graph shows the variation of displacement with Storey no. The lateral displacement increases continuously with the increase in storey no, however the amount of displacement observe in I-shaped geometry shear wall is comparatively less as compared to all other geometries of shear wall.

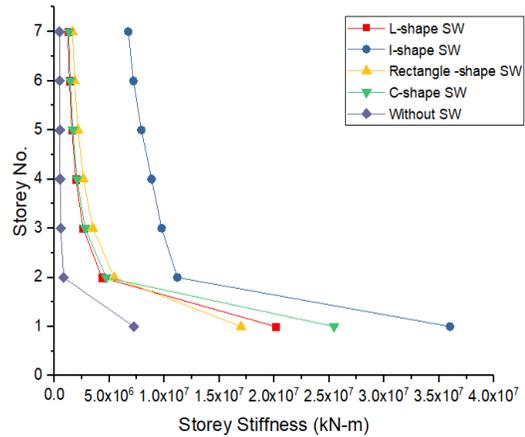


Fig6: Storey Stiffness vs Storey No.

The graph above shows the variation of storey stiffness with Storey no. Here the storey stiffness increases continuously with the increase in storey no., however the level of stiffness observed in I-shaped geometry of shear wall is comparatively more as compared to all other geometries of shear wall.

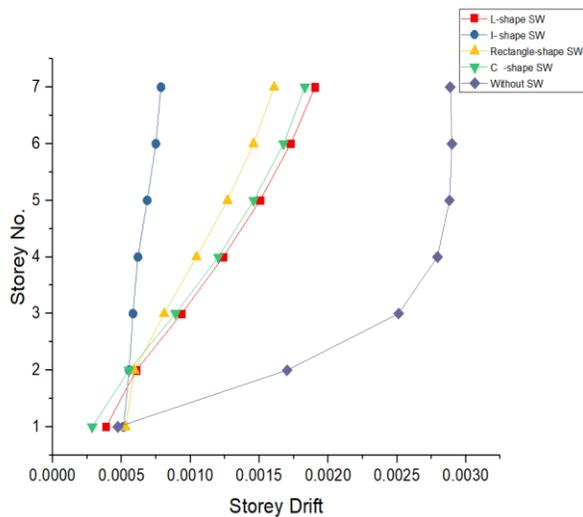


Fig 5: Storey Drift vs Storey No.

The graph shows the variation of Storey Drift with Storey no. Here the drift increases exponentially for various geometry of shear wall but the amount of storey drift observed in I-shaped geometry is very much smaller as compared to all other geometries of shear wall.

2. G+16 Building

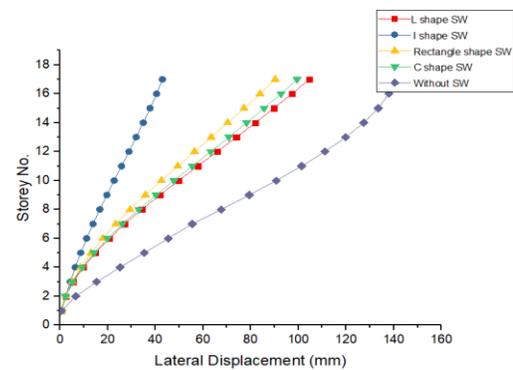


Fig 7: Lateral Displacement vs Storey No.

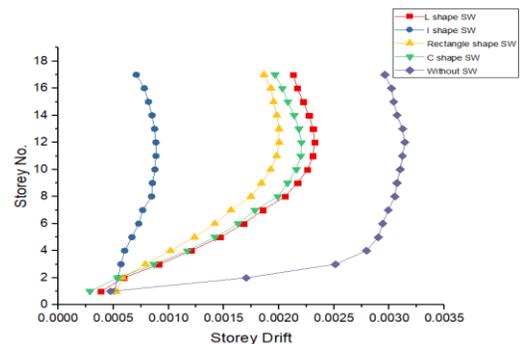


Fig 8: Storey Drift vs Storey No.

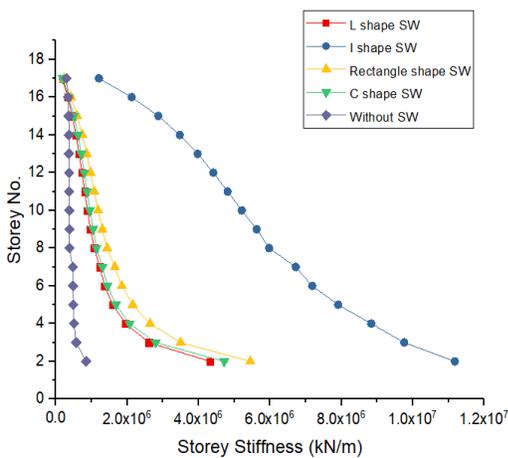


Fig 9: Storey Stiffness v/s Storey No.

Similar results have been observed in case of G+16 storeyed building. The performance of I shaped geometry shear wall has better performance as compared to other geometries of shear wall.

### 3. G+25 Building

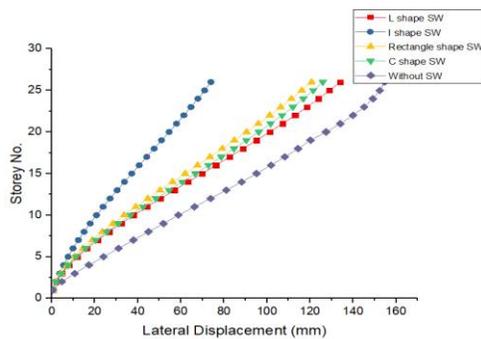


Fig 10: Lateral Displacement vs Storey No

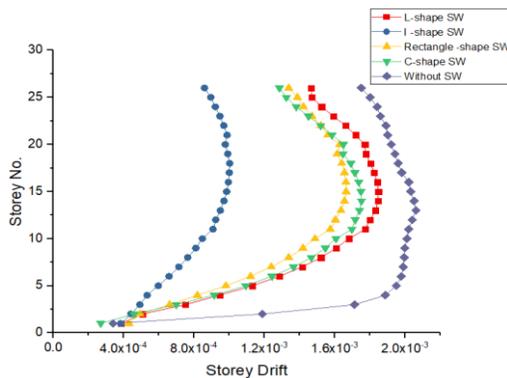
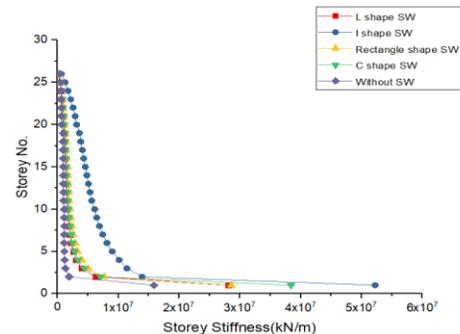


Fig12: Storey Stiffness v/s Storey No

Here the results observed for G+25 storeyed building is very much similar with G+6 & G+16 storeyed building. In

this case also the performance of I shaped geometry shear wall has been better as compared to other geometries of shear wall



. Fig 11: Storey Drift vs Storey No

## 6. DISCUSSION

- For the 3 different types of building it has been observed that there is decrease in lateral displacement & storey drift for buildings with shear wall when compared with buildings without shear wall. Among the buildings with various shapes of shear wall, the maximum decrease of lateral displacement & storey drift is observed in building with I -shaped shear wall.
- For the various different types of building it has been observed that there is increase in storey stiffness for buildings when compared with buildings without shear wall. Among the buildings with various shapes of shear wall, the maximum increase in lateral stiffness is observed in building with I -shaped shear wall.
- It has also been observed that considering the effect of wind do not play a significant role in zone 5 for designing a multi storeyed building.

## 7. REFERENCES

- (1) IS 456, “Indian Standard Code of Practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi,2000.
- (2) IS 875, “Code of practice for design loads (other than earthquake) for building and structures - Part 2: Imposed loads”, Bureau of Indian Standards, New Delhi,1987.
- (3) IS 1893 (Part I), “Criteria for Earthquake Resistant Design of Structures”, Bureau of Indian Standards, New Delhi,2002
- (4) IS 13920,” Ductile detailing of reinforced concrete structure subjected to seismic forces-code of practice”,1993

(5) IS 875(part 1-5)-code of practice for structural safety of Building loading standards

(6) Mohammed Azam, Shaik Kamal ,Hosur Vinod,” Seismic Performance Evaluation of Multi-storeyed RC framed buildings with Shear wall”, International Journal of Scientific & Engineering Research Volume 4, Issue 1, January-2013

(7) Abidi Misam, Mangulkar Madhuri, “Review on Shear wall for soft storey high rise building”, International Journal of Civil and Advance Technology, ISSN 2249-8958, Volume-1, Issue-6, August 2012

(8) Shahabodin. Zaregarizi.” Comparative investigation on using shear wall and Infill to improve seismic performance of existing buildings”, The 14th World Conference on Earthquake Engineering, Beijing, China. October 12-17, 2008.

(9) Bozdogan K.B. “A method for lateral static and dynamic analyses of wall-frame buildings using one dimensional finite element”, (2011) Scientific Research and Essays Vol.6(3), pp. 616-626, 4,2011

(10) Duggal S K, “Earthquake Resistance Design of Structure”, Fourth Edition, Oxford University Press, New Delhi,2010

(11) Shrikhande.M and Agarwal.P, “Earthquake Resistant Design of Structures”, Prentice Hall of India Private Limited, New Delhi.

(12) “Guidelines for earthquake resistant non-engineered construction” Indian Institute of Technology, Kanpur, 2004.

(13) S. K. Jain and C. V. R. Murthy “Seismic design of reinforced concrete buildings” Indian Institute of Technology, Kanpur, 1999

(14) P.C. Varghese “Advanced Reinforced Concrete Design” 2nd edition by prentice-Hall of India private limited New Delhi ISBN-81-203-2787-X,2005

# Experimental studies on Friction factor and pressure drop analysis for laminar flow of UCSCJ through a circular vertical pipe fitted with equispaced twisted tape.

<sup>[1]</sup> Abhijit A. Patil, <sup>[2]</sup> Dr. U.C. Kapale, <sup>[3]</sup> Dr. P.B. Gangavati

<sup>[1]</sup> Department of Mechanical Engineering, Sanjay Ghodawat University, Atigre, Maharashtra, India

<sup>[2]</sup> Professor, Department of Mechanical engineering, S.G. Balekundri Institute of Technology, Belgaum, Karnataka, India, <sup>[3]</sup> Professor, Department of Mechanical engineering, Basaveshwar engineering college,

Bagalkot, Karnataka, India

**Abstract:**-- The present experimental work is conducted for friction factor and pressure drop analysis of UCSCJ using full length twisted tape insert. The dimensions of the test pipe are considered the same as that of Robert evaporator used in the sugar industry. The test has been conducted on a circular vertical pipe and the insertion of uniformly distributed tape inserts of food grade SS, Cu and Al material with different twist ratios of 3.01, 5.06, 6.78 and 8.39. The tests were conducted in laminar flow and are maintained at a constant wall temperature of 115°C by peripheral heaters of 6000 watts mounted externally on the outer periphery of the test pipe. The trials were conducted by maintaining fluid temperature 90°C by using 2000 watts peripheral heaters and 2000 watts coil heater. The effect of the use of twisted tape with twist ratios 3.01, 5.06, 6.78 and 8.39 and by changing tape material was studied and compared with a test pipe without tape inserts. The experimental results show that the use of equispaced tape insert increases the pressure drop and friction factor as compared with a pipe without tape inserts. It is also noted that as the twist ratio decreases pressure drop and friction factor increases. The twisted tape with TR 3.01 generates more turbulence and voids as compared with TR 5.06, 6.78 and 8.39, also the twisted tape with TR 8.39 gives less enhancement in increasing the frictional factor as compared with test pipe without tape insert. The ratio of the experimental frictional factor and theoretical frictional factor were found in the range of 1-7.68 for pipe without tape insert, 9.08-25.42 for food grade SS, 6.01-8.96 for Cu tape insert and 7.20-16.16 for Al tape insert. In material comparison, it has been found that the food grade SS holds good results as compared with copper and Aluminium as a homogeneous material with a test pipe. In all, it has been experimentally proved to adopt a food grade SS material with TR 5.06 for enhancing heat transfer on account of relative pressure drop.

**Keywords:** Enhancement, Frictional factor, Laminar flow, Twisted Tape, Twist Ratio (TR), Uncleaned Sugar Cane Juice (UCSCJ).

## 1. INTRODUCTION

In today's scenario tremendous increase in demand of the market and the availability of technical advancement, an industrial sector is moving tremendously fast. Many process industries are in the era of transformation phase to make up with demand and supply. For the particular research, Sugar industry is considered as a case study, where the main objective is to enhance the heat transfer rate and thereby increasing the process efficiency also. Heat exchangers are used to transferring the heat energy from one fluid to other fluid. Though the design of heat exchangers reached to its optimized state, industry demands more effective methods for highly efficient heat exchangers.

In the 19th century, A. E. Bergles and Harmon L. Morton [1] identifies sixteen different enhancement techniques to augment convective heat transfer. The enhancement

techniques are broadly classified as active, passive and compound techniques.

1. Active method: This method uses external power as a resource input is utilized for the enhancement of heat transfer. Therefore, this method is not effectively implemented in the system as it increases the input power.

2. Passive method: This method utilizes structural change or geometrical modifications in the flow passage with the use of inserts or additional devices, like twisted tapes, wires, circular rings etc. Such inserts disturb or alter the flow behavior by creating the turbulence due to the swirling of the fluid. These techniques have more advantages as it does not requires external power also the tape inserts are easy to design, manufacture and apply.

3. Compound method: The compound enhancement method uses the combination of the above techniques simultaneously to enhance the heat transfer rate.

The use of inserts possibly increases the overall heat transfer coefficient and increases the performance of heat exchanger on account of an increase in pressure drop. These techniques are effectively implemented for both laminar as well as turbulent flow. Especially in the laminar flow, the heat transfer coefficients are generally low as there is no cross mixing of the fluid. The inserts provide a helical roughness element in contact with the tube inner surface. The convection coefficient increases by inducing the swirl through the insertion of twisted tape. Therefore, the effective utilization of tape inserts shows better results for laminar flow.

The twisted tape insert is a thin strip of material homogeneous or non-homogeneous with the base tube material periodically twisted through 360 degrees (Fig. 1). The tangential velocity component generates swirl and increases the flow of the fluid near the tube wall.

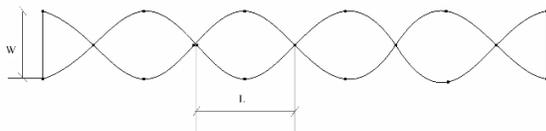


Fig. 1. Schematic sketch of Twisted tape

For this particular research, the sugar industry is considered as a case study. The friction factor and pressure drop analysis has been studied experimentally by maintaining the same geometry of the multiple effect evaporator. Uncleaned sugar cane juice (UCSCJ) has been used as a test fluid. The friction factor and pressure drop obtained by varying the tape material and geometry as a twist ratio are compared with the plain pipe. The objectives for the proposed setup are discussed as below:

To study various tests and trials for performance testing practically on a test model.

To study the friction factor and penalty in pressure drop for a plain pipe and pipe fitted with full length twisted tapes of different materials and twist ratios, under nearly UWT using UCSCJ as a test fluid.

To compare the experimental results with standard data and equations.

To suggest the material and the TR of a twisted tape obtain enhancement in friction factor with relative pressure drop.

## 2. LITERATURE REVIEW:

### 2.1 Plain TT:

L. Syam Sunder and K.V. Sharma [2] determined the thermophysical properties like thermal conductivity and viscosity of Al<sub>2</sub>O<sub>3</sub> nanofluid through experiments for different volume concentrations and temperatures. The result shows that the heat transfer coefficient and 'f' are higher as compared with water in a plain tube. They developed a generalized regression equation with the experimental data for the estimation of 'f' and 'Nu'.

S. Eiamsa-ard et al. [3] investigated the 'h', 'f' and 'η' parameters experimentally in a tube with the combined devices between TT and wire coil. The experiment is carried with two forms of wire coils as D coil and DI coil by varying two different twist ratios. The result shows the highest thermal performance by using DI coil with TT at lower Re. They developed an empirical co-relation of 'Nu' and pressure drop.

Kapatkar V.N. et al [4] investigates the heat transfer rate and 'f' with full-length TT by varying tape material, 'Re' and 'y'. It was found that the average 'Nu' improves more for Al material as compared with Stainless steel and insulated tape. The isothermal 'f' was higher as compared to the plain tube.

Suhas V. Patil et al [5] investigated the heat transfer and 'f' characteristics with increasing and decreasing order of 'y'. The tests were performed on a square duct and water as a fluid. The result shows not much variation in 'h' with increasing or decreasing 'y'. The value of 'Nu' increases as compared with the plain duct.

Najim Abid Jassim et al [6] investigated experimentally heat transfer and 'f' characteristics by using full-length plain TT inserts. The experiment was carried by varying 'y' and water as a test fluid. It was found that the heat transfer rate decreases with the increase in 'y'.

### 2.2 Modified TT:

P. Ferroni et al. [7] investigated the experimental dependence of the Darcy friction factor on the empty tube Re, y and TT spacing experimentally. Water is used as a working fluid at room temperature. From experimental results, a correlation for the Darcy friction factor in the form of 'f' was developed with excellent accuracy.

Yangiun Wang et al [8] presented the work by using CFD modeling on optimization of regularly spaced short length twisted tape in a circular tube. Air is used as a working fluid. The configuration parameters include 's', 'y' and 'a'. The conclusion is the larger value of 'a' gives higher heat transfer value whereas a smaller value of 's' results in better heat transfer.

Smith Eiamsa-ard et al [9] investigated experimentally on the enhancement of heat transfer and pressure drop in a round tube under UHF. The experiments were conducted using single TT's, full-length dual TT with three different

'y' and regularly spaced dual TT with three different space ratios. The result shows the heat transfer rate of the tube with dual TT was higher than that of a plain tube. The value of 'Nu' and 'f' increased with decreased 'y'.

K Hata et al [10] investigated the heat transfer and pressure drop for different mass velocities of water with different values of 'y'. The effect of 'y' and 'Re' based on swirl velocity on the TT induced swirl flow heat transfer was studied and a precise correlation is developed on the experimental data.

S. Eiamsa-ard [11] experimentally studied the heat transfer and 'f' characteristics of MT-VG with the different value of 'y' and 'Re' in a rectangular channel. The conclusion found was the smaller value of 'y' and free spacing ratio gives a higher heat transfer rate and pressure loss as compared with larger values of 'y' and space ratios. A correlation of 'y' and 'f' was developed.

Suvanjan Bhattacharyya et al [12] experimentally studied the effect of CTTT on heat transfer rate, 'f' and thermal enhancement efficiency. A numerical analysis is done by finite volume base. The results concluded that the heat transfer and thermal enhancement efficiency get decreased by decreasing 'y'. The 'Nu' also increased with 'Re'.

### **2.3 Modified Geometry TT:**

Jian Guo et al [13] computed results for good thermal performance with CC-TT and SW-TT. It was found that the heat transfer rate and thermal performance got enhanced for the tube with CC-TT as compared with conventional TT.

Khwanchit Wongcharee and Smith Eiamsa-ard [14] experimentally investigated heat transfer, 'f' and thermal performance characteristics of copper oxide-water (CuO) nanofluids. The experiment was conducted with a modified TT with TA fitted in a circular tube. The concentration of nanofluid was changed while the value of 'y' was kept constant. It was seen that the 'Nu' increases by increasing 'Re' and nanofluids concentration. The empirical correlation was developed for 'h', 'f' and thermal performance factor.

P. Murugesan et al [15] studied the effect of VTT inserts on 'h', 'f' and thermal performance factor characteristics in a circular tube for different twist ratios and different combinations of depth and width. From results, the conclusion made the mean Nusselt number and the mean friction factor in the tube with VTT increases with decreasing 'y', width ratios and increasing depth ratios. An empirical correlation was also formulated.

S. Eiamsa-ard et al [16] studied experimentally the effect of CT and CoT TT on 'Nu', 'f' and 'g' by varying 'y'. The results show that CT's are more efficient than CoT for heat transfer enhancement. The values of 'Nu', 'f' and 'g' increase with decreasing 'y'. An empirical correlation was

also developed between 'Nu', 'f' and 'g' from the experimental results.

Smith Eiamsa-ard and Pongjet Promvonge [17] presented experimentally study of turbulent heat transfer and flow friction characteristics in a circular tube with two typical twisted tapes and C-CCTT and different values of 'y'. Water as used as a working fluid. From obtained result the C-CCTT shows higher heat transfer rate, 'f' and HTE index than the typical twisted-tapes at similar operating conditions, also the heat transfer rate of the C-CCTT increases with the decrease of 'y' and the increase of 'α'.

CUI Yong-zhang [18] studied heat transfer characteristics and the pressure drop of air flow in a circular tube with ETT and with classic STT experimentally and numerically without varying 'y'. It was found that the Nusselt number of the tube with ETT is higher than that with STT, and the 'f' of the tube with ETT is higher than that of STT inserts.

Smith Eiamsa-ard and Pongjet Promvonge [19] investigated the effect of STT on heat transfer and pressure drop experimentally on air with constant 'y'. The result shows that the value of 'Nu' increases with increasing value of DR and decreases with increases in WR. An empirical relation was developed between SDR, SWR and 'Re' from the experimental data.

Sujoy Kumar Saha [20] experimentally studied the heat transfer and the pressure drop characteristics of turbulent flow for different types of ducts and tape inserts. The axial corrugations in combination with oblique teeth TT perform better than without oblique teeth TT.

S. Eiamsa-ard et al [21] experimentally studied the thermohydraulic properties in a round tube by using modified TT. For experimental purpose, three different types of TT were considered as WT, T-A, and typical TT. Different trials were conducted at a constant twist ratio. Water was considered as working fluid. The wings were generated along the center line of the tape with three different angles of attack. It was found that the heat transfer rate in the tube fitted with the WT-A was higher than WT, T-A, and plain tube. The heat transfer rate increased with increasing angle of attack. The experimental correlations of Nu, f and thermal performance factor were also developed.

Panida Seemawute et al [22] investigated experimentally the effect of PT-A with a uniform heat flux on the heat transfer enhancement characteristics. The tests were conducted with water as a working fluid. The correlations of the Nu, f and thermal performance were developed for the tube equipped with the PT-A, Re, and Pr.

S Eiamsa-ard et al [23] investigated heat transfer, 'f' and thermal performance factor characteristics by using water a test fluid. The experiments were conducted on different types of DWT. The effect of O-DWT and S-DWT were studied by varying the values of 'y'. It was found that the O-DWT gives higher 'h' as compared with S-DWT.

S Eiamsa-ard et. al. [24] investigated the effect of PT on heat transfer,  $f$  and thermal performance factor characteristics in a tube. Experiments were performed by varying DR and WR and by keeping 'y' constant. It was found that heat transfer increases as the DR increases and WR decreases. A predictive correlation of ' $f$ ' and ' $Nu$ ' was also developed.

Pratap Kumar Raut et al [25] investigated ' $f$ ' and ' $Nu$ ' data for laminar flow with a wire coil and helical screw TT in a circular duct. A correlation was developed for ' $f$ ' and ' $Nu$ '. It was found that helical screw insert TT with wire coil inserts performs better than individual enhancement methods.

A. M. Mulla et al [26] studied the heat transfer and pressure drop by applying typical TT and TTWB, keeping uniform heat flux, fixed 'y' and constant flow rate. The experiment was carried with water as a working fluid and flow as laminar. From results, it was found that the values of heat transfer and pressure drop increases as compared with a plain tube.

Durgesh V. Ahire et al [27] investigated ' $f$ ' and ' $h$ ' for different conical rings of different pitches. It was observed that the value of ' $h$ ' increases with an increase in ' $Re$ ' and decrease in ' $f$ ' for a conical ring.

Sibel Ginus et al [28] numerically investigated the heat transfer enhancement with hexagonal cross section wire coiled inserts by varying the pitch ratios. It was found that the heat transfer rate increased with wire coiled tape inserts as compared with a plain tube.

Zhenfei Feng et al [29] numerically investigated the heat transfer performance with wire coil inserts. The effect of length and arrangement of the wire coil is studied with distilled water as attest fluid. The microchannel heat sink with long wire coil placed at the center line resulted in higher heat transfer performance.

Various geometrical twisted tapes with TR 3.01,5.06,6.78 and 8.39 has been fabricated. Food grade SS, Cu, and Al materials are selected as a twisted tape material. Various trials on the test setup were carried with UCSCJ as a test fluid. As per the data available from the sugar factory the tests were carried by keeping the test fluids in laminar region. The heaters with 6000W capacity (500W×12) are provided with the thickness of 5mm on the outer periphery of the test pipe to maintain the UWT. The main components of the set up are a juice container and pump, calming section, a circular test tube (food grade stainless steel 304, 45mm O.D. 42mm I.D., 2000 mm length) with insulation, flow control valves, Piezometer, Rotameters, Resistance Temperature Detector (RTD). The calibration of RDT and rotameters are calibrated before conducting trials to minimize errors associated with experimental results. The test has been carried by varying the flow rate from 60 LPH to 500 LPH. The test pipe wall temperature is maintained at 110°C and the UCSCJ temperature is maintained at 80°C. The various readings have been taken by restricting the flow as laminar flow ( $Re < 2000$ ).

Sample calculations:

Plain pipe with UCSCJ as a test fluid:

Experimental frictional factor:

The cross-sectional area of flow passage (A)

$$A = \frac{\pi}{4} \times Di^2$$

The velocity of flowing fluid sugarcane juice,

$$V = \frac{m}{A \times \rho}$$

1mm of water column = 9.81 N/m<sup>2</sup>

$$f_{exp} = \left(\frac{\Delta P}{L}\right) \left(\frac{D}{2\rho V^2}\right)$$

Theoretical friction factor:

$$Re = \frac{\rho \times V \times Di}{\mu}$$

For a Laminar flow, theoretical friction factor ( $f_{th}$ ) was computed as,

$$f_{th} = 17.12 / Re$$

## 6. RESULT AND DISCUSSIONS:

The results obtained during experimental investigations are presented and discussed in this section.

Comparison of experimental friction factor with Reynolds number with food grade SS, Cu and Al with open tube are presented in Fig. 3, 4 and 5.

## 3. EXPERIMENTAL SET UP:

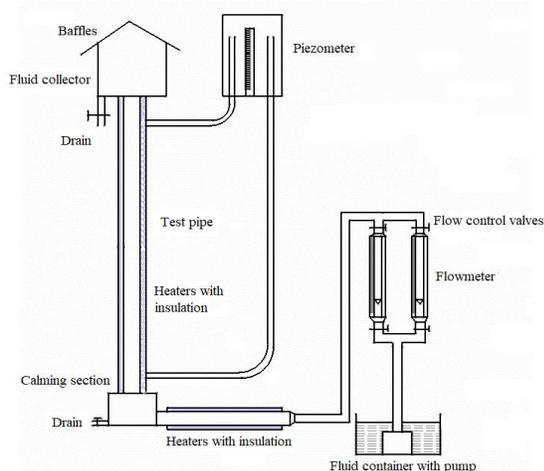


Fig. 2. Experimental setup.

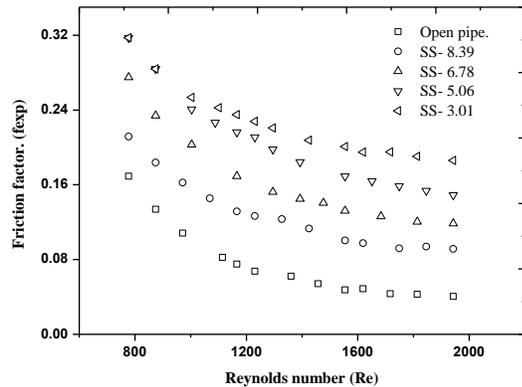


Fig. 3. Data verification of friction factor for food grade SS material TT.

For an open pipe, the friction factor has been found in the range from 0.1697 to 0.0406 for the Reynolds number ranging from 777 to 1943 respectively. The flow of UCSCJ is kept in the laminar region (Re<2000). Fig. 3 shows the experimental results with the use of food grade SS twisted tape with TR 3.01, 5.06, 6.78 and 8.39 keeping the flow in the laminar region. For TR 8.39 the friction factor has found in the range from 0.2114 to 0.09135 for the Reynolds number ranging from 777 to 1943. For TR 6.78 the friction factor ranges from 0.2749 to 0.1184 for the same range of Reynolds number. For TR 5.06 the friction factor ranges from 0.3172 to 0.1488 and for TR 3.01 it ranges from 0.3172 to 0.1860. The friction factor with TR 8.39 has been found 55% more as compared to open tube. With TR 6.78, 5.06 and 3.01 the incremental growth of approx. 20% has been found. All experimental results show a polynomial curve fitting. The regression analysis shows the following correlations.

For open tube,  
 $f_{exp} = 1.34E-7(Re)^2 - 4.16E-4(Re) + 0.4357...$  Open pipe  
 $f_{exp} = 1.04E-7(Re)^2 - 3.79E-4(Re) + 0.4365...$  TR 8.39  
 $f_{exp} = 1.4E-7(Re)^2 - 5.02E-4(Re) + 0.5716...$  TR 6.78  
 $f_{exp} = 1.31E-7(Re)^2 - 4.89E-4(Re) + 0.6109...$  TR 5.09  
 $f_{exp} = 1.1E-7(Re)^2 - 3.99E-4(Re) + 0.5526...$  TR 3.01

Fig. 4 and 5 shows the verification of data for Cu and Al twisted tape. for Cu the friction factor ranges from 0.16-0.05 for TR 8.39, 0.21-0.05 for TR 6.78, 0.21-0.071 for 5.06 and 0.23-0.084 for 3.01. The percent rise in friction factor has found to be 20% as compared with open pipe. For Al the friction factor ranges from 0.19-0.064 for TR 8.39, 0.23-0.087 for TR 6.78, 0.23-0.10 for TR 5.06 and 0.25-0.14 for TR 3.01.

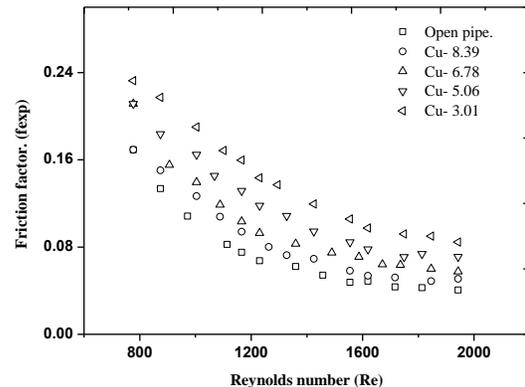


Fig. 4. Data verification of friction factor for Cu material TT.

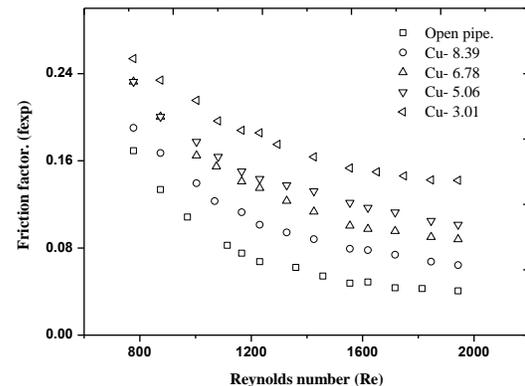


Fig. 5. Data verification of friction factor for Al material TT.

From the above figures it has been seen that the friction factor for food grade SS gives the highest friction factor for respective Re. The friction factor for TR 3.01 gives highest friction factor for all types of twisted tape material. Data verification of friction factor with Re for constant twist ratio is presented and discussed in Fig. 6,7,8, and 9. Fig. 7 shows a comparison of experimental friction factor for TR 3.01. from the figure it has been observed that the twisted tape of food grade SS offers more friction factor in the range of 0.31-0.18 for the same range of Reynolds number as compared with Cu and Al tape material whereas for Cu the friction factor range has found in the range of 0.23-0.08 and for Al 0.25-0.14. Similarly, from Fig. 7, 8 and 9 following observations were found.

Range of friction factor	TR 8.39	TR 6.78	TR 5.06

Food grade SS	0.21-0.09	0.27-0.11	0.31-0.15
Cu	0.16-0.05	0.21-0.05	0.21-0.05
Al	0.19-0.06	0.23-0.08	0.23-0.10

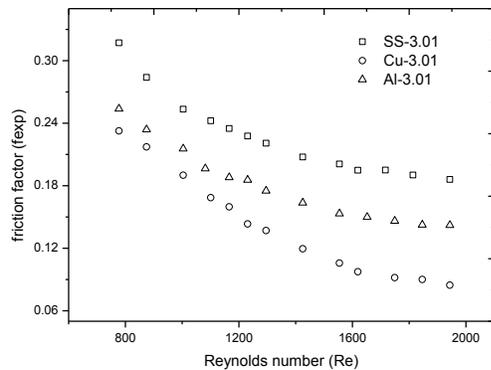


Fig. 6. Data verification of friction factor for TR 3.01.

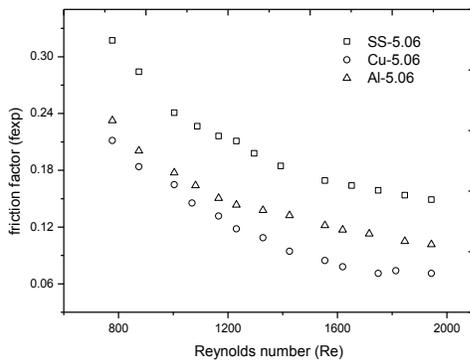


Fig. 7. Data verification of friction factor for TR 5.06.

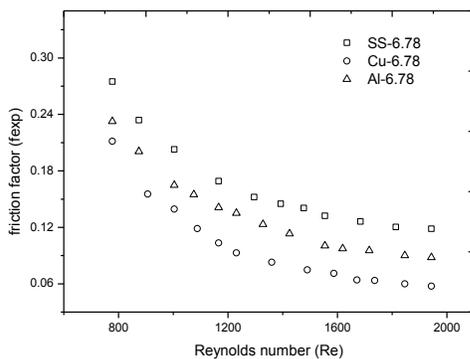


Fig. 8. Data verification of friction factor for TR 6.78.

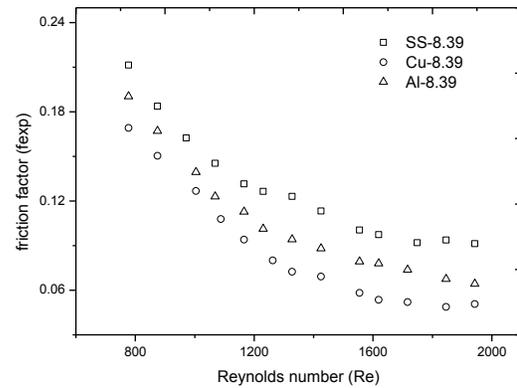


Fig. 9. Data verification of friction factor for TR 8.39

### CONCLUSION

Experimental studies on pressure drop and friction factor characteristics for a vertical pipe of UCSCJ using twisted tapes are presented in this paper. Experiments were carried for a uniform wall temperature condition. The friction factor increases by penalty of pressure drop. The use of twisted tape increases the turbulence in the flow pattern. The UNSCJ undergoes friction due to the turbulence created by the twists in the flow region. The results hold better for the laminar region as the fluid gets more disturbance across the twists. As the number of twists increases the friction factor also increases. As per the material selection, the food grade SS performs better as compared with Cu and Al twisted tape. The result shows the friction factor for TR 3.01 gives high friction factor as compared with TR 5.06, 6.78 and 8.39, but it may cause more scaling inside the pipe, which again hampers the heat transfer rate. However, it is suggested to implement the twisted tape with the TR 5.06 as it performs equivalent as compared with TR 3.01.

### NOMENCLATURE

- Di An inner diameter of the test pipe, m
- Do The outer diameter of the test pipe, m
- L Length of the test pipe.
- A The cross-sectional area of the test pipe, m<sup>2</sup>
- m Mass of UCSCJ, Kg/s
- V The velocity of UCSCJ.
- ΔP The pressure drop across test pipe, N/m<sup>2</sup>
- f<sub>exp</sub> Experimental friction factor, dimensionless.
- f<sub>th</sub> Theoretical friction factor, dimensionless.
- ρ The density of UNSCJ, Kg/m<sup>3</sup>
- μ Viscosity of UCSCJ, Kg/m.s
- Re Reynolds number, dimensionless.
- UWT Uniform wall temperature.

TT Twisted tape.  
TR Twist Ratio.

**REFERENCES:**

1. A.E. Bergles, H.L. Mortan, 'Survey and Evaluation of techniques to augment convective heat transfer', Massachusetts Institute of Technology National Magnet Laboratory Sponsored by the Air Force Office of Scientific Research (OAR) Air Force Contract AF 49(638)-1468 DSR Project No. 5382 (1965)
2. L. Syam Sundar, K.V. Sharma, Turbulent heat transfer and friction factor of Al<sub>2</sub>O<sub>3</sub> Nanofluid in a circular tube with twisted tape inserts, *International Journal of Heat and Mass Transfer* 53 (2010) pp.1409–1416.
3. S. Eiamsa-ard P. Nivesrangsarn, S. Chokphoemphun, P. Promvongel, Influence of combined non-uniform wire coil and twisted tape inserts on thermal performance characteristics, *International Communications in Heat and Mass Transfer* 37 (2010) pp. 850–856.
4. A. V. N. Kapatkar, A.S. Padalkar, Sanjay Kasbe, Experimental Investigation on Heat Transfer Enhancement in Laminar Flow in Circular Tube Equipped with Different Inserts, *AMAE Int. J. on Manufacturing and Material Science*, Vol. 01, No. 01, (May 2011), pp. 1-6.
5. Suhas V. Patil, P. V. Vijay Babu, Heat Transfer and Pressure Drop Studies Through a Square Duct Fitted with Increasing and Decreasing Order of Twisted Tape, *Heat Transfer Engineering*, 35(14–15) (2014), pp. 1380–1387.
6. Najim Abid Jassim, Kamel Abdul Hussin, Noor Yahya Abdul Abbass, Experimental Investigation of Heat Transfer Enhancement in Circular Tube Using Twisted-Tape Inserts, *Industrial and Systems Engineering*, (2017), 2(2), pp.7-12.
7. P. Ferroni, R.E. Block, N.E. Todreas, A.E. Bergles, Experimental evaluation of pressure drop in round tubes provided with physically separated, multiple, short-length twisted tapes, *Experimental Thermal and Fluid Science* 35 (2011), pp. 1357–1369.
8. Yangjun Wang, Meiling Hou, Xianhe Deng, Li, Cheng Huang, Haiying Huang, Gangfeng Zhang, Changhong Chen, Weijun Huang, Configuration optimization of regularly spaced short-length twisted tape in a circular tube to enhance turbulent heat transfer using CFD modeling, *Applied Thermal Engineering* 31 (2011), pp. 1141-1149.
9. Smith Eiamsa-ard, Chinaruk Thianpong, Petpices, Eiamsa-ard, Pongjet Promvongel, Thermal characteristics in a heat exchanger tube fitted with dual twisted tape elements in tandem, *International Communications in Heat and Mass Transfer* 37 (2010), pp. 39–46.
10. K. Hata, S. Masuzaki, Twisted-tape-induced swirl flow heat transfer and pressure drop in a short circular tube under velocities controlled, *Nuclear Engineering and Design* 241 (2011), pp. 4434–4444.
11. S. Eiamsa-ard, Study on thermal and fluid flow characteristics in turbulent channel flows with multiple twisted tape vortex generators, *International Communications in Heat and Mass Transfer* 31 (2010), pp.644–651.
12. Suvanjan Bhattacharyya, Himadri Chattopadhyay, Satyaki Bandyopadhyay, Numerical Study on Heat Transfer Enhancement through a Circular Duct Fitted with Centre-Trimmed Twisted Tape, *International Journal of Heat and Technology* Vol. 34, No. 3, (September 2016), pp. 401-406.
13. Jian Guo, Aiwu Fan, Xiaoyu Zhang, Wei Liu, A numerical study on heat transfer and friction factor characteristics of laminar flow in a circular tube fitted with center-cleared twisted tape, *International Journal of Thermal Sciences* 50 (2011), pp. 1263-1270.
14. Khwanchit Wongcharee, Smith Eiamsa-ard, Enhancement of heat transfer using CuO/water nanofluid and twisted tape with an alternate axis, *International Communications in Heat and Mass Transfer* 38 (2011), pp. 742–748.
15. P. Murugesan, K. Mayilsamy, S. Suresh, P.S.S. Srinivasan, Heat transfer and pressure drop characteristics in a circular tube fitted with and without V-cut twisted tape insert, *International Communications in Heat and Mass Transfer* 38 (2011), pp. 329–334.
16. S. Eiamsa-ard, C. Thianpong, P. Eiamsa-ard, Turbulent heat transfer enhancement by counter/co-swirling flow in a tube fitted with twin twisted tapes, *Experimental Thermal and Fluid Science* 34 (2010), pp. 53–62.
17. Smith Eiamsa-ard, Pongjet Promvongel, Performance assessment in a heat exchanger tube with alternate clockwise and counter-clockwise twisted-tape inserts, *International Journal of Heat and Mass Transfer*, 53 (2010), pp. 1364–1372.
18. CUI Yong-zhang, Three-dimensional Numerical Simulation of Thermal hydraulic Performance of a

- Circular Tube with Edgefold-twisted-tape Inserts, *Journal of Hydrodynamics*, (2010), 22(5), pp. 662-670.
19. Smith Eiamsa-ard, Pongjet Promvonge, Thermal characteristics in a round tube fitted with serrated twisted tape, *Applied Thermal Engineering* 30 (2010), pp. 1673-1682.
  20. Sujoy Kumar Saha, Thermohydraulics of turbulent flow through rectangular and square ducts with axial corrugation roughness and twisted-tapes with and without oblique teeth, *Experimental Thermal and Fluid Science* 34 (2010), pp.744–752.
  21. S. Eiamsa-ard, K. Wongcharee, P. Eiamsa-ard, C. Tianpong, Thermohydraulic investigation of turbulent flow through a round tube equipped with twisted tapes consisting of center wings and alternate-axes, *Experimental Thermal and Fluid Science*, 34 (2010), pp.151–1161.
  22. Panida Seemawute, Smith Eiamsa-ard, Thermohydraulics of turbulent flow through a round tube by a peripherally-cut twisted tape with an alternate axis, *International Communications in Heat and Mass Transfer*, 37 (2010), pp. 652–659.
  23. S. Eiamsa-ard, K. Wongcharee, P. Eiamsa-ard, C. Tianpong, Heat transfer enhancement in a tube using delta-winglet twisted tape inserts, *Applied Thermal Engineering* 30 (2010), pp. 310–318.
  24. Smith Eiamsa-ard, Panida Seemawute, Khwanchit Wongcharee, Influences of peripherally-cut twisted tape insert on heat transfer and thermal performance characteristics in laminar and turbulent tube flow, *Experimental Thermal and Fluid Science* 34 (2010), pp. 711–719.
  25. Pratap Kumar Rout, Sujoy Kumar Saha, Laminar Flow Heat Transfer, and Pressure Drop in a Circular Tube Having Wire-Coil and Helical Screw-Tape Inserts, *Journal of Heat Transfer*, (February 2013), Vol. 135, pp. 021901/1 -8.
  26. A.M. Mulla, Umesh Jangamashetti, Manoj, Kiran K, Experimental Study on Heat Transfer and Friction Factor Characteristics in Laminar Flow through Tubes of Shell and Tube Heat Exchanger Fitted with Twisted Tapes with Baffles, *International Journal of Research in Engineering and Technology*, Volume 03 Issue 05, (May 2014), pp. 426-431.
  27. Durgesh V. Ahire, Yogesh J. Bhalerao, Murtuza S. Dholkawala., Experimental Investigation of Heat Transfer Enhancement in Circular Pipe using Conical Ring Inserts, *International Journal of Mechanical and Production Engineering*, Volume- 5, Issue-3, (March 2017), pp. 148-153.
  28. Sibel Gunes, Veysel Ozceyhan, Toygun Dagdevir, Orhan Keklikcioglu, Numerical Investigation of Heat Transfer Enhancement in a Tube with Hexagonal Cross Sectioned Coiled Wire, *Proceedings of 83rd ISERD International Conference*, Barcelona, Spain, (24th-25th August 2017), PP. 5-9.
  29. Zhenfei Feng, Xiaoping Luo, Feng Guo, Haiyan Li, Jinxin Zhang, Numerical investigation on laminar flow and heat transfer in the rectangular microchannel heat sink with wire coil inserts, *Applied Thermal Engineering*, (25 January 2017), pp. 1-28.

# Rule Based Parts of Speech Tagger for Chhattisgarhi Language

<sup>[1]</sup>Vikas Pandey, <sup>[2]</sup>Dr. M.V Padmavati, <sup>[3]</sup>Dr. Ramesh Kumar

<sup>[1]</sup>Dept. of Information Technology, Bhilai Institute of Technology, Durg, India

<sup>[2][3]</sup>Dept. of Computer Science and Engg, Bhilai Institute of Technology, Durg, India

**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 जाबो

WORDS	हमन	दुनो	बैलगाड़ी	म	रायपुर	जाबो
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.

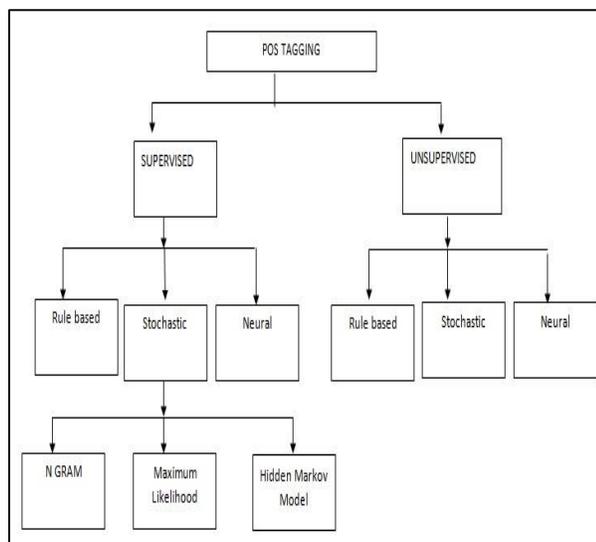


Figure 1: Classification of POS Tagging

## 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 a 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> रङ्पुर<V_VM> भर<V_VAUX>मं<V_VA UX>बगरे<CC_CCD>हव्य <V_VM>।<RD_PUNC>
--	--

Table1: Chhattisgarhi words and corresponding tags

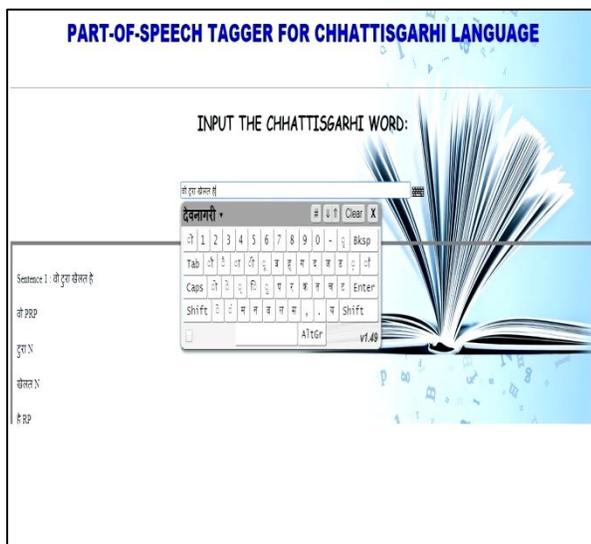


Figure 2: POS Tagging of Chhattisgarhi sentence

## 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.

## 6. REFERENCES

- [1] Agrawal, R., Ambati, B., & Singh, A.Singh.(2012). A GUI to Detect and Correct Errors in Hindi Dependency Treebank. In Proc.of Eighth International Conference on Language Resources and Evaluation, Istanbul, Turkey, 1907-1911.
- [2] Hasan, M., F.,Uzzaman, N., & Khan, M.(2006 ). Comparison of Different POS Tagging Techniques (n-grams, HMM and Brill's Tagger) for Bangla. International Conference on Systems, Computing Scienc and Software Engineering (SCS2 06) of International Joint Conferences on Computer, Information, and Systems Sciences, and Engineering.
- [3] Kumawat, D., & Jain,V. (2015). POS Tagging Approaches: A Comparison. International Journal of Computer Applications ,vol 118,32-38
- [4] Antony, P.,J.(2011). Parts Of Speech Tagging for Indian Languages: A Literature Survey. International Journal of Computer Applications, Vol 34, 22-29.
- [5] Ekbal, A., Haque, R, & Bandhopadha, S. ( 2007). Bengali part of speech tagging using Conditional Random Field. In Proc. of SPSAL2007. 131-136.
- [6] Shrivastav, M., & Bhattacharyya, P. ( 2008). Hindi POS Tagger Using Naive Stemming: Harnessing Morphological Information without Extensive Linguistic Knowledge. In Proc.of ICON, 1-6
- [7] Sharia, N., Das, D., Sharma U. , Kalita, J. (2009). Part of Speech Tagger for Assamese Text . In Proc. of the ACL-IJCNLP, 33-36.
- [8] Joshi, N., Darbari, H., & Mathur, I. (2013). HMM Based POS Tagger For Hindi. In Proc.of CCSIT, SIPP, AISC, PDCTA, 341-349

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, बढ़िया, 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, कहुँ 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, नड़, 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	!, ?

# Mitigation Polynomials for Stress Concentration Factor around Circular Hole in Rectangular Plate under In-Plane Loading

Dr. Shubhrata Nagpal

Department of Mechanical Engineering, Bhilai Institute of Technology, Durg (C.G.), India

**Abstract:** -- Minimizing stress concentration in structures arising due to irregularities is a major engineering concern. Various techniques are available for mitigation of stress concentration. Area reduction method by introduction of auxiliary holes in the vicinity is one of the established method. Present work provides formulation in the form of mitigation polynomials for size of auxiliary hole and its position for maximum mitigation of stress concentration factor. Formulation in the form of polynomials is arrived at by carrying out parametric finite element analysis of plate with circular hole and auxiliary holes of different size and at different positions. Different cases are analyzed to arrive at the order of mitigation polynomial. Results obtained have been validated experimentally by using two dimensional photo elasticity method. The proposed mitigation polynomials can be used to place optimum size of auxiliary hole at optimum position in the vicinity of circular hole for a particular value of stress concentration factor.

**Key Words:** Stress Concentration Factor; Circular Hole; Mitigation; Auxiliary Holes ; Mitigation Polynomial.

## NOMENCLATURE

A	Width of plate (mm)	L	Length of plate (mm)
D, R	Diameter, Radius of main hole (mm)	D', R <sub>1</sub>	Diameter, Radius of auxiliary holes (mm)
$\sigma$	Uniformly distributed applied load (N/mm <sup>2</sup> )	SCF, K	Stress concentration factor
N	Fringe order	$\delta$	Peripheral distance between holes

## 1. INTRODUCTION

In general all engineering structures consist of circular or other forms of openings. Presence of these openings or discontinuities alters the stress distribution around this discontinuity. Discontinuities can cause stress concentrations to occur. Stresses around discontinuities are larger than the average stresses calculated far from these critical locations. A dimensionless stress concentration factor (SCF) K, is used to quantify how the stress is concentrated. It is defined as the ratio of the maximum stress in the element to the reference stress or nominal stress. Stress concentration in the vicinity of singularity can be reduced by making the stress flow lines smooth around the singularity. Some of the approaches used for mitigation of stress concentration factor are removal of material from the vicinity by introduction of auxiliary/relief/defence holes, reinforcement of the hole by adding material, hole shape optimization etc.

## 2. LITERATURE REVIEW

According to Heywood [1], stress concentration can be reduced by introducing smaller auxiliary holes on either

side of the original hole, to smoothen the flow of the stress trajectories past the original hole. Rajaiah [2] proposed hole shape optimization to mitigate SCF. Auxiliary hole with optimum size and shape around the central hole has been proposed to minimize SCF up to 30%. Meguid [3] presented a technique for reduction of SCF in a uni-axially loaded plate with two coaxial holes by introducing defense hole system i.e. material removal in the form of circular holes. Three systems for defense holes were described for FEM analysis. Reduction in SCF ranging from 7.5% to 11 % were achieved. Giare et al. [4] reinforced the hole using composite material for the reduction of stress concentration around the hole in an isotropic plate under in-plane loading. Sanyal and Yadav [5], proposed optimum sized relief holes at optimum center distance between the main hole and relief hole for reduction of stress concentration. They [6] have also extended the work by introducing multiple relief holes. Mittal and Jain [7] proposed optimization of square plate with circular hole and reported around 30% reduction in SCF. A further modification of work was carried out by optimization of hole shape & optimization of auxiliary hole shape by giving trapezoidal shape to the auxiliary holes. Optimal hole shape for minimum stress concentration in two dimensional finite

plates using parametric geometry models are also given by Zhixue Wu [8]. Authors [9] have also compiled and reviewed the work of many researchers regarding stress concentration and its mitigation.

It can be concluded from the above literature survey that area reduction method can be applied to mitigate SCF. It also can be identified that mitigation of SCF is dependent on various geometric parameters like, the size of relief holes, its location and a parametric ratio i.e. main hole diameter to width of the plate ( $D/A$ ). In view of the above, an attempt has been carried out to formulate a mitigation polynomial dependent on the above parameters.

To carry out the above objective, parametric finite element analysis of a rectangular finite isotropic plate with circular hole under in-plane loading has been carried out by varying the various geometric parameters for maximum mitigation of SCF. Polynomial equations of different orders for SCF have been derived from the above analysis to give the optimum size and location of auxiliary holes for maximum mitigation of SCF. The results have been validated for few cases experimentally using two dimensional photo elastic method.

### 3. ANALYSIS AND RESULTS

It has been reported earlier that stress concentration effect can be mitigated by introducing auxiliary holes in the vicinity of a main hole. The mitigation is achieved due to interaction effect between two individual holes - main and auxiliary, each of which have positive and negative stress fields. Effect of mitigation is further analysed by varying different geometrical parameters, like  $D/A$  - hole to width ratio,  $\delta$  - peripheral distance and  $R1$  - auxiliary hole radius. Analysis is carried out using finite element analysis software ANSYS and experimental validation has been carried out by two dimensional photoelasticity method.

#### 3.1 Stress Concentration Factor

Two models are selected to incorporate various geometrical configurations to be studied. A rectangular plate of 200 mm\*100 mm and of 1 mm thickness with one circular hole under in plane loading Fig.1 and with one main hole and two auxiliary holes, Fig.2 are taken as Model 1 and Model 2. The isotropic material of the plate is selected as alloy steel with material properties, Poisson's ratio,  $\nu = 0.3$  and Young's modulus,  $E = 39$  GPa. Uniform in-plane tensile load ( $\sigma$ ) is applied to the plate in both the models.

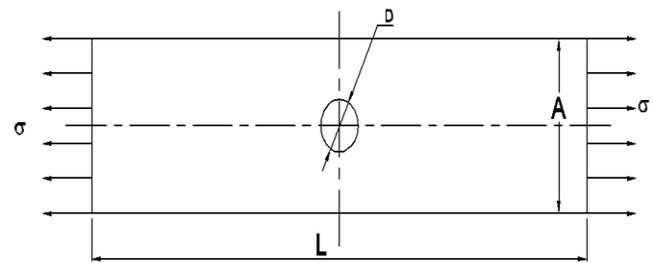


Fig.1. Plate with circular hole under in-plane loading, Model 1

An 8 noded structural plane 82 element type, Fig.2, from element library of ANSYS with 1 mm element size has been selected for meshing on the basis of convergence test to obtain the values of stress singularity. Each node has two degrees of freedom, making a total 16 degrees of freedom per element. Due to symmetry only quarter of the model for each case is discretized and analyzed.

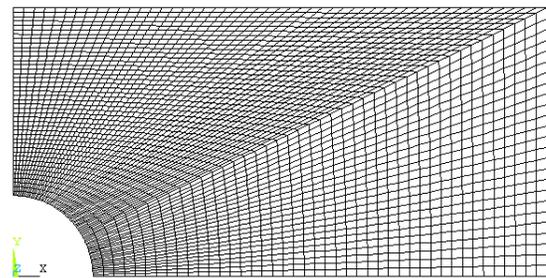
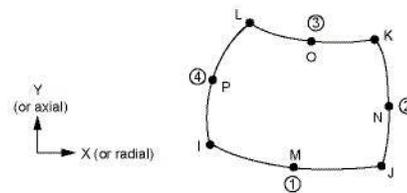


Fig.2. Model 1- Meshed one quarter plate model with Plane 82 element

$D/A$  ratio has been selected as 0.2, 0.3, 0.4, 0.5 and 0.6 for analysis. Stress concentration factors for different  $D/A$  ratio for model 1 are determined and tabulated, Table 1.

Table1 SCF in plate with circular hole

D/A	0.2	0.3	0.4	0.5	0.6
SCF	2.5128	2.3576	2.2452	2.1715	2.1256

#### 3.2 Mitigation of Stress Concentration by Auxiliary Hole

As is already established by earlier works, introduction of auxiliary holes in the vicinity of main hole in the direction of loading mitigates the stress concentration. The plate

with same dimension and diameter is selected for analysis of mitigation effect by introducing different sized auxiliary holes at different peripheral distances, Model 2, Fig.3.

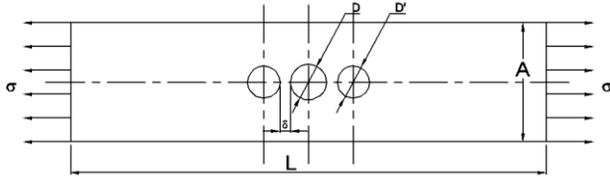


Fig.3. Plate with one main hole and one set of auxiliary holes under in plane loading, Model 2

### 3.2.1. Parameters effecting mitigation of SCF

By varying the size of auxiliary holes and its position from main hole, mitigation reported is found to be varying. Thus a detailed parametric study is carried out to assess the effect of parameters,  $\delta$  and  $R_1$ , peripheral distance between holes and auxiliary hole radius on the mitigation of SCF in different plates, i.e. for different  $D/A$  ratios.

#### 3.2.1.1. Peripheral Distance, $\delta$

To determine the optimum peripheral distance  $\delta$  for maximum mitigation of SCF around the main hole, set of smaller auxiliary holes are proposed at different positions from main hole. The peripheral distance is considered in terms of radius of main hole from 0.25 to 4.5 times of radius of main hole for different  $D/A$  ratio. It is found that for all the  $D/A$  ratios considered, optimum peripheral distance for maximum mitigation in SCF is 25% of radius of main hole, i.e.  $\delta = 0.25R_1$ .

#### 3.2.1.2. Radius of Auxiliary Holes, $R_1$

To determine optimum radius of auxiliary holes for maximum mitigation of SCF for same radius of main hole, the plate has been analyzed by considering different size of auxiliary holes at different positions. For each  $D/A$  ratio radius of auxiliary holes are varied from 10% to 100% of the radius of main hole and SCF values are determined. Optimum radius is found to be varying for different  $D/A$  ratio as 85% to 93% of radius of main hole.

### 3.3. Mitigation Polynomials

From the above analysis, it is established that mitigated SCF values depends on  $D/A$  ratio, radius of auxiliary hole,  $R_1$  and peripheral distance  $\delta$  between the main hole and auxiliary hole. Mathematical models in the form of polynomials are proposed for SCF as a function of all the above parameters. Polynomials of different orders are developed for the same analysis data using Vari Reg [10] for each  $D/A$  ratio. Variation in SCF value is found for different order of polynomials.

#### 3.3.1. Mitigation Polynomials for $D/A$ ratio

Polynomial equations up to seventh order for SCF values are generated for all  $D/A$  ratios from 0.2 to 0.6. For each case of  $D/A$  ratio, the polynomial equations generated are different. These polynomial equations have been optimized

for two relative variables in support of each order of polynomial. To represent the study, polynomial equations from 1st to 7th order for minimum SCF for  $D/A = 0.3$  are annexed and shown in appendix enclosed, however to attain a particular accuracy level, polynomials up to 3rd or 4th order can be used to determine the optimum values of  $R_1$  and  $\delta$  for maximum mitigation. Polynomials upto 4th order are shown for  $D/A$  ratio 0.3 for maximum mitigation of SCF.

#### First order polynomial equation:

$$SCF = 2.329 - 0.023 * R_1 + 0.003 * \delta$$

#### Second order polynomial equation:

$$SCF = 2.484 - 0.04 * R_1 - 0.001 * \delta + 0.0003 * (R_1)^2 + 0.0005 * (R_1)^2 * \delta$$

#### Third order polynomial equation:

$$SCF = 2.281 + 0.056 * R_1 - 0.012 * (R_1)^2 + 0.0005 * (R_1)^3 + 0.0003 * (R_1)^2 * \delta$$

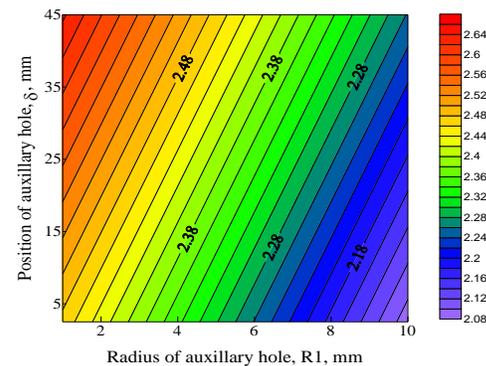
#### Fourth order polynomial equation:

$$SCF = 2.368 + 0.0149 * (R_1) - 0.0056 * (\delta) + 0.0036 * (R_1)^2 + 0.0004 * (\delta)^2 - 0.0028 * (R_1) * (\delta) - 0.0014 * (R_1)^2 - 0.0085 * (\delta)^3 + 0.0001 * R_1 * (\delta)^2$$

In case of all the  $D/A$  ratio the optimum peripheral distance  $\delta$ , for maximum mitigation in SCF is 25% of radius of main hole. Further, minimum SCF has been reported at different radius of auxiliary hole for different  $D/A$  ratio. For  $D/A$  ratios 0.2, 0.3, 0.4, 0.5 and 0.6 it is respectively found to be as 93.69%, 91.77%, 90.42% and 90.41% of radius of main hole.

## 4. RESULTS

The data obtained from analysis of all the cases considered has been plotted in the form of surface plots for  $D/A$  equals to 0.2 to 0.6.



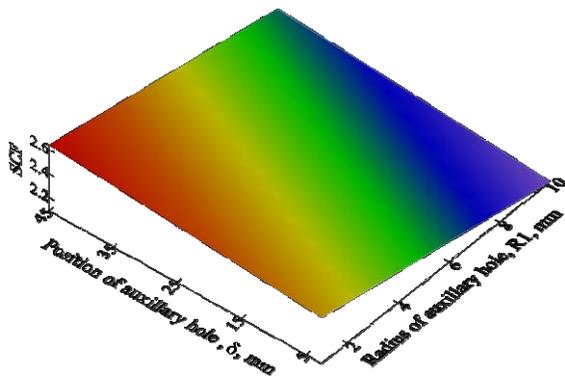


Fig. 4. Surface Plot for D/A = 0.2

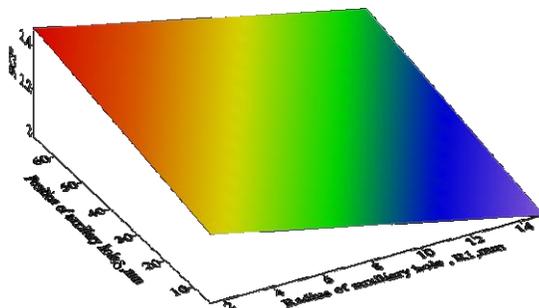
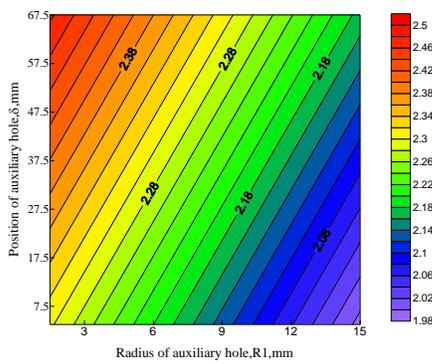


Fig. 5. Surface Plot for D/A = 0.3

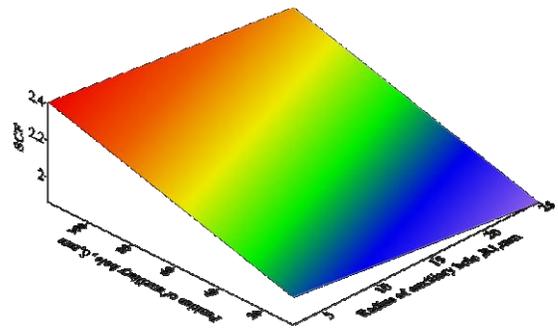
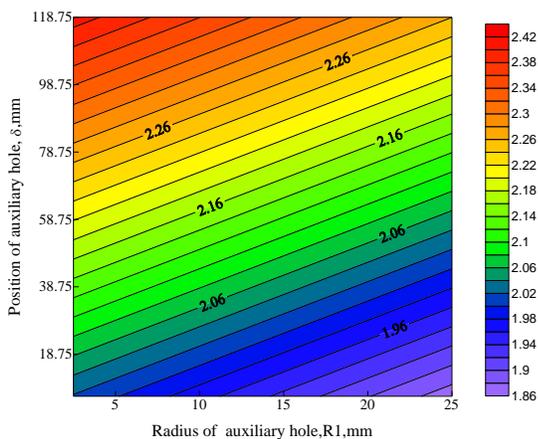


Fig. 6. Surface Plot for D/A = 0.5

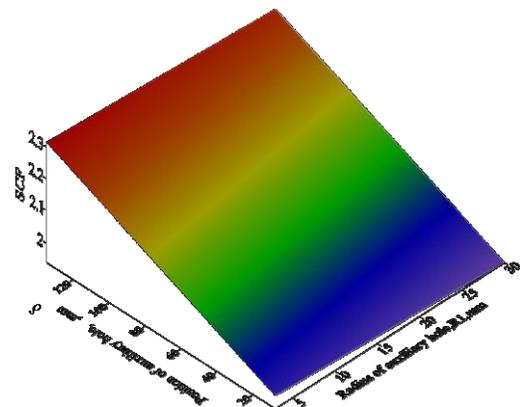
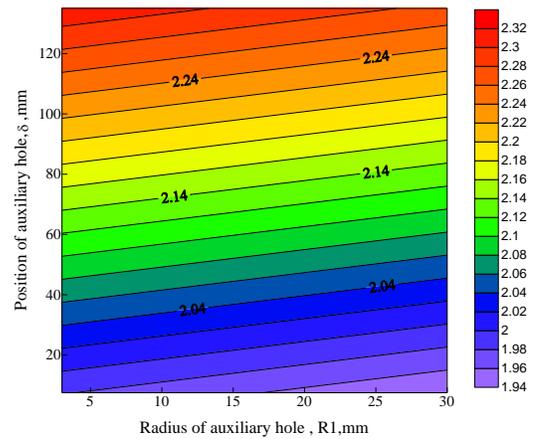


Fig. 7. Surface Plot for D/A = 0.6

Blue region depicts lower values of SCF while the orange region represents higher values of SCF. The slope of lines representing SCF values are different for different D/A values. These surface plots can be directly used to decide upon the location and size of auxiliary holes for a minimum value of SCF.

### 5. EXPERIMENTAL ANALYSIS

Analysis results have been validated by experimental method. Two dimensional photo elasticity method based

on stress optic law has been used to validate the results. The homogeneous mixture of araldite CY 230-1 1N and hardener Aradur HY-951 has been used in 12:1 ratio to cast the photo elastic epoxy circular calibration discs and rectangular plates. Casted plates have been cut in required size and the holes are drilled to get plate models for different D/A ratios. One example for D/A ratio as 0.3 is presented.

Calibration of model material has been done by determining the material stress fringe value using circular disk under diametral compression, Fig. 8. Material stress fringe value,  $f_{\sigma}$  ( $f_{\sigma} = 8P/IDN$ , at the center of the disk, N being the fringe order) is determined as 11.94 kg/cm.

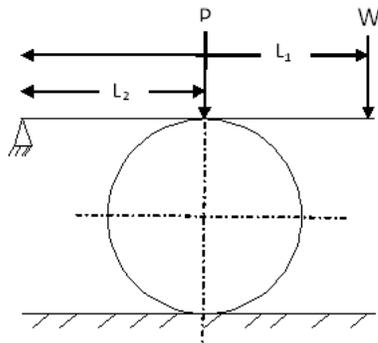


Fig.8.a. Circular disc under compression

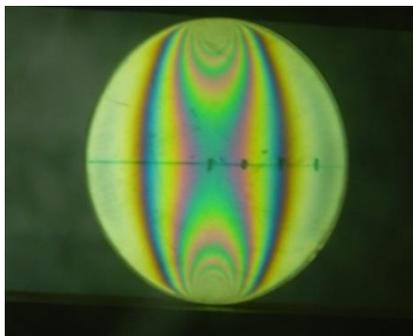


Fig.8.b. Iso-chromatic fringes in Circular disc

( $L_1 = 52.5\text{mm}$  and  $L_2 = 18.5\text{ mm}$ )

Plate of size 42 mm\*100 mm with hole of 12.5 mm diameter is considered for plate model with D/A as 0.3. The model has been modified by providing one set of auxiliary holes of diameter 8 mm at peripheral distance of 16.5 mm from center of main hole. The plates have been analyzed in dark field and light field arrangements in photo elastic bench. Plates have been analyzed by varying the loads and the fringe orders have been recorded, SCF has been determined using stress optic law.

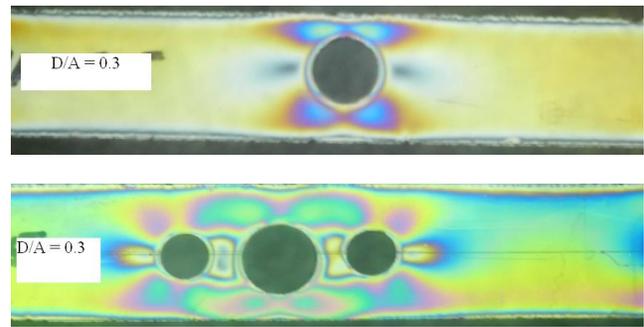


Fig.9. Fringes in axially loaded Epoxy Plate with main hole and auxiliary holes

By determining fringe order at the point of interest, maximum stress and SCF has been calculated for plate with single hole and plate with one set of additional auxiliary holes and the results are compared with results of finite element analysis, Table 2 and 3.

Table.2. Experimental Results of SCF for Plate with circular hole

S.N O.	W	P	N	SCF <sub>EXP</sub>	SCF <sub>MEAN</sub>
1	6.980	14.18	1.0	2.48	2.36
2	14.08	28.59	2.0	2.46	
3	20.78	42.18	3.0	2.50	
4	14.22	28.87	2.0	2.44	
5	7.170	14.56	1.0	2.42	
6	3.940	8.010	0.5	2.20	
7	11.05	22.44	1.5	2.35	
8	17.62	35.78	2.5	2.46	
9	11.37	23.09	1.5	2.29	
10	4.360	8.850	0.5	1.99	

Table.3. Experimental Results of SCF for Plate with additional one set of auxiliary holes

S.N O.	W	P	N	SCF <sub>EXP</sub>	SCF <sub>MEAN</sub>
1	5.72	16.18	1	2.18	2.15
2	11.46	32.43	2	2.17	
3	17.16	48.55	3	2.18	
4	11.70	33.10	2	2.13	
5	5.95	16.83	1	2.09	
6	2.72	7.70	0.5	2.29	
7	9.07	25.68	1.5	2.06	
8	14.33	40.57	2.5	2.17	

9	9.15	25.89	1.5	2.04	
10	2.82	7.98	0.5	2.21	

These results have been compared with the results obtained from Mitigation Polynomials and finite element analysis result, Table 4. Experimental results establish good agreement with computational results.

**Table.4. Comparison of SCF with experimental and FEM results**

D/A	Order of polynomial	SCF	SCF <sub>EXP</sub>	%Variation	SCF <sub>FEM</sub>	%Variation
0.3	1 <sup>ST</sup>	2.259	2.15	0.6	2.12	1.98
0.3	2 <sup>ND</sup>	2.175				
0.3	3 <sup>RD</sup>	2.199				
0.3	4 <sup>TH</sup>	2.199				
0.3	5 <sup>TH</sup>	2.182				
0.3	6 <sup>TH</sup>	2.173				
0.3	7 <sup>TH</sup>	2.163				
0.5	1 <sup>ST</sup>	2.109	1.99	0.8	1.96	2.31
0.5	2 <sup>ND</sup>	2.009				
0.5	3 <sup>RD</sup>	2.128				
0.5	4 <sup>TH</sup>	2.210				
0.5	5 <sup>TH</sup>	2.183				
0.5	6 <sup>TH</sup>	2.188				
0.5	7 <sup>TH</sup>	2.006				

### 6. CONCLUSIONS

Mitigation polynomials are formulated for optimum SCF around circular hole in rectangular plate in plane loading with one set of auxiliary holes around main hole. These polynomials can be directly applied for determining the optimum size and position of the auxiliary holes for maximum mitigation of SCF.

The polynomial expressions enable the designer to determine the other parameters i.e. R1 and  $\delta$  for maximum mitigation in SCF for different D/A ratios. The 3D surface plots gives relation between radius of auxiliary hole,

peripheral distance and SCF. These plots enable the designer to read any of the unknown parameter for given D/A ratio.

The experimental results establish good agreement with computational results and hence establishes the proposed findings.

### ACKNOWLEDGMENT

The authors acknowledge the institute authorities for supporting the present work.

### REFERENCES

- [1] Heywood, R.B. "Designing by Photo Elasticity", Chapman & Hall Ltd. London, 1952.
- [2] K. Rajaiah, A.J. Durelli, "Optimum hole shapes in finite plates under uni-axial load", Applied Mechanics 46(3), 691-695, 1979.
- [3] G.S.Giare, R. Shabahang, "The Reduction of Stress Concentration around the hole in an isotropic plate using composite material", Engineering Fracture Mechanics Vol.32 No.5, pp 757-766, 1989.
- [4] Meguid, S.A. "Finite Element Analysis Of Defense Hole Systems for the Reduction of Stress Concentration in a Uniaxially Loaded Plate with Coaxial Holes", Engineering Fracture Mechanics Vol.25, No. 4, p 403-413, 1986.
- [5] S. Sanyal, P. Yadav "Relief holes for stress mitigation in infinite thin plate with single circular hole loaded axially", ASME International Mechanical Engineering Congress & Exposition, 2005.
- [6] S. Sanyal, P. Yadav "Multiple Relief Holes for Stress mitigation in Infinite Thin Plate with Single Circular Hole Under Axial Loading", 2nd international conference SCCE, 5-8 July 2006.
- [7] N. D. Mittal, N. K. Jain, "The optimize design of a square simply supported isotropic plate with central circular hole for reduction of stress concentration subjected to transverse static loading", Proceedings of ICTACEM - 2007.
- [8] Zhixue Wu, "Optimal hole shape for minimum stress concentration using parameterized geometry models", Springer, 2008.
- [9] Shubhrata Nagpal, Nitin Jain, and Shubhashish Sanyal, "Stress Concentration and its Mitigation Techniques in Flat Plate with Singularities—A Critical Review", Engineering Journal Volume 16 Issue 1, January 2012.
- [10] G. Jekabsons, VariReg version 0.9.20, A software tool for regression modelling using various modeling methods, User's manual, 2009 (<http://www.cs.rtu.lv/jekabsons/>).

**Mitigation Polynomials for D/A as 0.3**

$$6.489E-14 * (\delta)^7 - 7.755E-11 * (R_1)^3 * (\delta)^4 - 1.27E-09 * (R_1)^4 * (\delta)^3 + 1.178E08 * (R_1)^5 * (\delta)^2 - 4.05E-08 * (R_1)^6 * (\delta)$$

**First order polynomial equation:**

$$SCF = 2.329 - 0.023 * R_1 + 0.003 * \delta$$

**Second order polynomial equation:**

$$SCF = 2.484 - 0.044 * R_1 - 0.0019 * \delta + 0.0003 * (R_1)^2 + 0.0005 * (R_1)^2 * \delta$$

**Third order polynomial equation:**

$$SCF = 2.281 + 0.0566 * R_1 - 0.0126 * (R_1)^2 + 0.0005 * (R_1)^3 + 3.016E-5 * (R_1)^2 * \delta$$

**Fourth order polynomial equation:**

$$SCF = 2.368 + 0.0149 * R_1 - 0.0056 * \delta + 0.0036 * (R_1)^2 + 0.0004 * (\delta)^2 - 0.0028 * R_1 * \delta - 0.0014 * (R_1)^2 - 8.5667E-6 * (\delta)^3 + 1.993E-5 * A2 * (\delta)^2 + 0.00035 * (R_1)^2 * \delta + 6.41197E-5 * (R_1)^4 + 5.0629E-8 * (\delta)^4 - 1.4142E-6 * (R_1)^2 * (\delta)^2 - 9.308E-6 * (R_1)^2 * (\delta)$$

**Fifth order polynomial equation:**

$$SCF = 2.368 - 0.013 * R_1 + 0.0033 * (R_1)^2 - 2.499E-5 * (\delta)^2 + 0.0005 * (R_1) * (\delta) - 0.0005 * (R_1)^2 * \delta + 1.727E-5 * (R_1) * (\delta)^2 - 9.919E-5 * (R_1)^4 + 5.939E-5 * (R_1)^3 * (\delta) + 5.407E-6 * (R_1)^5 - 1.187E-8 * (R_1)^2 * (\delta)^3 - 2.0659E-6 * (R_1)^4 * (\delta)$$

**Sixth order polynomial equation:**

$$SCF = 2.384 - 0.019 * R_1 + 0.0044 * (R_1)^2 - 7.66E-6 * (R_1) * (\delta)^2 - 0.00028 * (R_1)^2 * (\delta)^2 - 6.61552759950174E-5 * (R_1)^4 + 1.554E-5 * (R_1)^2 * (\delta)^2 - 1.8506E-5 * (R_1)^3 * (\delta) - 1.2517E-7 * (R_1)^2 * (\delta)^3 - 1.1537E-6 * (R_1)^3 * (\delta)^2 + 5.992E-6 * (R_1)^4 * (\delta) + 1.9863E-7 * (R_1)^6 + 4.7576E-9 * (R_1)^3 * (\delta)^3 + 3.7978E-10 * (R_1)^2 * (\delta)^4 + 2.0317E-8 * (R_1)^4 * (\delta)^2 - 2.3579E-7 * (R_1)^5 * (\delta)$$

**Seventh order polynomial equation:**

$$SCF = 2.3539 + 0.0073 * (R_1) - 0.0017 * (R_1)^2 + 0.0002 * (R_1)^3 - 0.00035 * (R_1)^2 * (\delta) + 0.00003 * (R_1)^2 * (\delta)^2 + 0.00003 * (R_1)^3 * (\delta) + 1.0222E-06 * (R_1) * (\delta)^3 - 5.76E-07 * (R_1)^2 * (\delta)^3 + 2.212E-08 * (R_1) * (\delta)^4 - 6.342E-07 * (R_1)^6 + 3.106E12 * (\delta)^6 + 5.967E-08 * (R_1)^3 * (\delta)^3 - 3.018E07 * (R_1)^4 * (\delta)^2 + 8.432E07 * (R_1)^5 * (\delta) + 3.725E-08 * (R_1)^7 -$$

# Quantum Cryptography

<sup>[1]</sup>Anquab khan, <sup>[2]</sup>Sanket gujar, <sup>[3]</sup>Mrunal giri

Department of Computer science and engineering, Ramdeobaba collage of engineering and management, Nagpur

**Abstract:** -- Quantum cryptography, also called quantum encryption, applies principles of quantum mechanics to encrypt messages in a way that it is never read by anyone outside of the intended recipient. It takes advantage of quantum's multiple states, coupled with its "no change theory," which means it cannot be unknowingly interrupted. Quantum cryptography can solve many issues of key exchange problems like speed, Authentication and security. This paper focuses on reviewing the fundamentals of quantum cryptography and the way it solves the issues of key-exchange in private and public key cryptography. It also shows some of the challenges faced by quantum cryptography itself.

## INTRODUCTION

In one of the seminal 1984 paper, Bennett and Brassard argued that some basic laws of physics may prove useful in cryptographic tasks. They considered first the task of key distribution between distant partners and noticed that quantum signals are ideal trusted couriers: if the eavesdropper Eve tries to obtain some information, her action cannot remain concealed, because measurement modifies the state or, equivalently, because of the no-cloning theorem. In the second part of their paper, they turned to the task of bit-commitment and proposed a quantum solution relying on entanglement. In 1991, Ekert independently re-discovered quantum key distribution, his intuition was based on entanglement, more specifically on Bell's inequalities. These two works are the milestones of the field, even if precursors for these ideas had been brought up. The fact that security is based on physical laws leads to the hope that quantum cryptography may provide the highest possible level of security, namely security against an adversary with unrestricted computational power; in the jargon, unconditional security. Further research vindicated only one of the two conjectures of Bennett and Brassard: key distribution can indeed be made unconditionally secure while bit commitment cannot. Most of the subsequent developments in quantum cryptography have therefore been devoted to quantum key distribution (QKD).

## CHALLENGES IN BASIC CRYPTOGRAPHY

### 1. Speed

Public and private key encryption is based on complicated mathematics. Because of this, users computer has to work very hard to both encrypt and decrypt data using the system. In applications where we need to work with large quantities of encrypted data on a regular basis, the computational overhead means that public and private key systems can be very slow.

### 2. Evesdropping

In classical cryptography Alice has to send a key to Bob to allow him decode received information. As we probably know — in cryptography information is sent using public/open channels but this information is encoded so it's very hard or sometimes impossible to decode it without using special key. Exactly this key in classical cryptography is sent using the same public channels what makes it dangerous that third person can listen to that channel or just intercept the key.

### 3. security

With the advent of quantum computers which has a very high computing speed measured in gigahertz which translates to a processing speed of few billion simple logical operations per second even the complex private key encryption algorithms like RSA can be broken by guessing its key that is why the security of the internet is under threat these days because most of the data is encrypted using classical cryptography.

Shor's Algorithm is a conceptual quantum computer algorithm optimized to solve for prime factors. It takes a factor (a number),  $n$ , and outputs its factors. It's magic lies in reducing the number of steps necessary to find a number's prime factors (thereby potentially cracking public and private keys).

The algorithm is broken up into two parts:

1. A reduction of the factoring problem to the problem of order-finding (which can be performed today on a classical computer)
2. A quantum algorithm to solve the order-finding problem (which is ineffective today due to the lack of quantum computing capabilities)

Using the most common encryption standard, it takes a classical computer 2128, that is to say 340,282,366,920,938,463,374,607,431,768,211,456 basic operations, to find the private key associated with a

public key. On a quantum computer, it would take 1283 (ie. only 2,097,152) basic operations to find the private key associated with a public key.

This is why conceptually the development of true quantum computing could pose a threat to today's classical encryption algorithm.

### **SOLUTIONS PROPOSED BY QUANTUM CRYPTOGRAPHY**

#### **1. Faster speed**

Key distribution systems deliver keys fast enough so that encryption devices do not exhaust their supply of key bits. This is a race between the rate at which keying material is put into place and the rate at which it is consumed for encryption or decryption activities. Today's QKD systems achieve on the order of 1,000 bits/second throughput for keying material, in realistic settings, and often run at much lower rates. This is unacceptably low if one uses these keys in certain ways, e.g., as one-time pads for high speed traffic flows. However it may well be acceptable if the keying material is used as input for less secure (but often secure enough) algorithms such as the Advanced Encryption Standard. Nonetheless, it is both desirable and possible to greatly improve upon the rates provided by today's QKD technology

#### **2. No eavesdropping**

The main advantage of QKDP is it allows the detection of eavesdropping because the error level will be comparatively more when the eavesdropper connects to the quantum channel than the error level that occurs naturally. Along with the detecting of eavesdropping, quantum mechanics laws will also allow the process of setting the error level between the intercepted data in dependence. Unrestricted security is provided by the QKD protocols and during this process isolation extension is permitted at the same time quantity of data is decreased considering the key that can be interrupted by the Eavesdroppers.

#### **3. More security**

Quantum Key Distribution (QKD) addresses the challenge of securely exchanging a cryptographic key between two parties over an insecure channel. QKD relies on the fundamental characteristics of quantum mechanics which are invulnerable to increasing computational power, and may be performed by using the quantum properties of light, lasers, fibre-optics as well as free space transmission technology. Since Quantum cryptography is not based on mathematical function hence there is no question of guessing the key by using algorithms like shor algorithm etc. Hence quantum cryptography is much more secure than classical cryptography.

### **CONCLUSION**

Based on comparison between classical and quantum cryptography one can conclude that clearly quantum cryptography has an edge over classical cryptography as it solves the various challenges in key distribution occurring in classical cryptography. Quantum cryptography provides us with better security and Eavesdropping detection. These features of quantum cryptography can be critical to solve cyber space security for future internet. However there are many limitations and unsolved challenges of quantum cryptography as well as shown below.

#### **Limitations of quantum cryptography**

##### **1) Lack of digital signature**

The digital signatures are those which demonstrate the authenticity of the digital data to the receiver. A valid digital signature gives a recipient reason to believe that the message was created by a known sender, and that it was not altered in transit. The digital generation scheme consists of three algorithms namely key generation, signing, key verification. But we know that algorithms cannot be implemented in QC very easily. Therefore QC lacks many vital features like digital signature, certified mail and thus the ability to settle disputes before a judge.

##### **2) Predicament Due to the Source**

A basic point to be taken care of while designing the source is the laser pulses' coherence in phase. It is essential that all the photons emitted should be having varying phase coherence. This requires a very sensational design of phase modulator that changes the phase of the successive photons in a rapid fashion. And the attenuated laser pulses are not single photons and the multi-photon components are important

##### **3) Need of a dedicated channel**

Exchanging information using single photon needs a dedicated channel of high quality in order to achieve high speed communication. It is impossible to send keys to two or more different locations using a quantum channel as multiplexing is against quantum principles. Therefore it demands separate channels linking the source with the many destinations which implies high cost. This is a major disadvantage faced by quantum communication especially through optical channel.

##### **4) Trojan Horse Attack**

While considering the plug and play systems, Alice's device is open to receive photons. So Eve in the middle may send in a light pulse towards Alice's polarizer, this light gets reflected from the polarizer and leaks vital information to Eve [13]. Other attacks such as the time-shift

attack, has been successfully used to crack commercially used quantum key distribution system. This is the first successful demonstration of hacking in a quantum channel[19]. Presently hackers are not having much to gain by spending their resource in hacking the sparsely used a quantum channel. But as QC users increase one can expect more such unexpected innovative attacks which are unthought-of till date.

#### **REFERENCES**

- 1) Vasileios Mavroeidis, Kamer Vishi, Mateusz D. Zych, Audun Jøsang “The Impact of Quantum Computing on Present Cryptography”, International Journal of Advanced Computer Science and Applications, Vol. 9, No. 3, 2018
- 2) Vibha Ojha , Anand Sharma , Vishal Goar , Prakriti Trivedi “Limitations of Practical Quantum Cryptography”, International Journal of Computer Trends and Technology- March to April Issue 2011
- 3) Tianqi Zhou,1 Jian Shen , 1,2 Xiong Li,3 Chen Wang,1 and Jun Shen1 “Quantum Cryptography for the Future Internet and the Security Analysis”, Hindawi Security and Communication Networks Volume 2018, Article ID 8214619, 7 pages
- 4) Aakash Goyal1 , Sapna Aggarwal2 and Aanchal Jain3 “Quantum Cryptography & its Comparison with Classical Cryptography: A Review Paper”.

# An NLP Based Plagiarism Detection Approach for Short Sentences

<sup>[1]</sup> Shikha Pandey, <sup>[2]</sup> Dr Arpana Rawal

<sup>[1]</sup> Research scholar, <sup>[2]</sup> Professor

<sup>[1][2]</sup> Chhattisgarh Swami Vivekanand Technical University, Bilai, Chhattisgarh

**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

## 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:

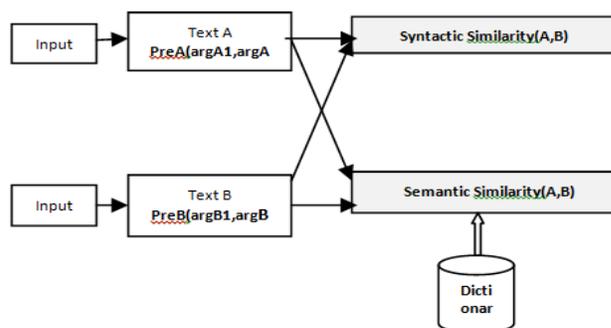


Figure 1: Proposed sentence similarity system framework

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

Previous work (Li 2006[27], Ercan in 2013[28] and Alzahrani 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 important 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 argumentsB1 and 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>det(bachelor,that)</i>	<i>nsubj(like, I)</i>
◇	◇	◇ <i>dobj(like, man)</i>
<i>nsubj(like, I)</i>	<i>det(man,that)</i>	
<i>root(ROOT,like)</i>	<i>dobj(like,bachelor)</i>	
◇	◇	
<i>root(ROOT,like)</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>det(bachelor, that)</i>	<i>nsubj(like, I)</i>
◇	◇	◇ <i>root(ROOT, like)</i>
<i>nsubj(like, I)</i>	<i>det(man, that)</i>	
<i>root(ROOT, like)</i>	<i>dobj(like, bachelor)</i>	<i>nsubj(like, I)</i>
◇	◇	◇
<i>root(ROOT, like)</i>	<i>dobj(like, man)</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

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.

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

Pair H	Dogs animals	are	They are common pets	0.738	0.756	0.494	<b>.446</b>	<b>1.00</b> By putting synonym (Animal) is pet.
-----------	-----------------	-----	----------------------------	-------	-------	-------	-------------	--

**REFERENCES:**

[1] Gomaa Wael H. & Fahmy A. (2013) A Survey of Text Similarity Approaches, International Journal of Computer Applications (0975 – 8887)

[2] Hall , P. A. V. & Dowling, G. R. (1980) Approximate string matching, Comput. Surveys, 12:381-402.

[3] Peterson, J. L. (1980). Computer programs for detecting and correcting spelling errors, Comm. Assoc. Comput. Mach., 23:676-687.

[4] Jaro, M. A. (1989). Advances in record linkage methodology as applied to the 1985 census of Tampa Florida, Journal of the American Statistical Society, vol. 84, 406, pp 414-420.

[5] Jaro, M. A. (1995). Probabilistic linkage of large public health data file, Statistics in Medicine 14 (5-7), 491-8.

[6] Winkler W. E. (1990). String Comparator Metrics and Enhanced Decision Rules in the Fellegi-Sunter Model of Record Linkage, Proceedings of the Section on Survey Research Methods, American Statistical Association, 354–359.

[7] Needleman, B. S. & Wunsch, D. C.(1970). A general method applicable to the search for similarities in the amino acid sequence of two proteins", Journal of Molecular Biology 48(3): 443–53.

[8] Smith, F. T. & Waterman, S. M. (1981). Identification of Common Molecular Sub sequences, Journal of Molecular Biology 147: 195–197.

[9] Alberto, B. , Paolo, R., Eneko A. & Gorka L. (2010). Plagiarism Detection across Distant Language Pairs, In Proceedings of the 23rd International Conference on Computational Linguistics, pages 37–45.

[10] Eugene F. K. (1987). Taxicab Geometry, Dover. ISBN 0-486-25202-7.

[11] Dice, L. (1945). Measures of the amount of ecologic association between species. Ecology, 26(3).

[12] Jaccard, P. (1901). Étude comparative de la distribution florale dans une portion des Alpes et des Jura. Bulletin de la Société Vaudoise des Sciences Naturelles 37, 547-579.

[13] Lund, K., Burgess, C. & Atchley, R. A. (1995). Semantic and associative priming in a high-dimensional semantic space. Cognitive Science Proceedings (LEA), 660-665.

[14] Lund, K. & Burgess, C. (1996). Producing high-dimensional semantic spaces from lexical co-occurrence. Behavior Research Methods, Instruments & Computers, 28(2),203-208.

[15] Landauer, T.K. & Dumais, S.T. (1997). A solution to plato’s problem: The latent semantic analysis theory of acquisition, induction, and representation of knowledge", Psychological Review, 104.

[16] Matveeva, I., Levow, G., Farahat, A. & Royer, C. (2005). Generalized latent semantic analysis for term representation. In Proc. of RANLP.

[17] Gabrilovich E. & Markovitch, S. (2007). Computing Semantic Relatedness using Wikipedia-based Explicit Semantic Analysis, Proceedings of the 20th International Joint Conference on Artificial Intelligence, pages 6–12.

[18] Martin, P., Benno, S. & Maik, A.(2008). A Wikipedia-based multilingual retrieval model. Proceedings of the 30th European Conference on IR Research (ECIR), pp. 522-530.

[19] Turney, P. (2001). Mining the web for synonyms: PMI-IR versus LSA on TOEFL. In Proceedings of the Twelfth European Conference on Machine Learning (ECML).

[20] Mihalcea, R., Corley, C. & Strapparava, C. (2006). Corpus based and knowledge-based measures of text semantic similarity. In Proceedings of the American Association for Artificial Intelligence.(Boston, MA).

[21] Miller, G.A., Beckwith, R., Fellbaum, C.D., Gross, D. & Miller, K. (1990). WordNet: An online lexical database. Int. J. Lexicograph. 3, 4, pp. 235–244.

[22] Resnik, R. (1995). Using information content to evaluate semantic similarity. In Proceedings of the 14th International Joint Conference on Artificial Intelligence, Montreal, Canada.

[23] Lin, D. (1998b). Extracting Collocations from Text Corpora. In Workshop on Computational Terminology , Montreal, Kanada, 57–63.

[24] Jiang, J. & Conrath, D. (1997). Semantic similarity based on corpus statistics and lexical taxonomy. In Proceedings of the International Conference on Research in Computational Linguistics, Taiwan.

[25] Leacock, C. & Chodorow, M. (1998). Combining local context and WordNet sense similarity for word sense identification. In WordNet, An Electronic Lexical Database. The MIT Press.

[26] Wu, Z.& Palmer, M. (1994). Verb semantics and lexical selection. In Proceedings of the 32nd Annual Meeting of International Journal of Computer Applications (0975 – 8887) Volume 68– No.13, April 2013 18 the Association for Computational Linguistics, Las Cruces, New Mexico.

[27] Li, Y., McLean, D., Bandar, Z.A., O’Shea, J.D., Crockett, K., 2006. Sentence similarity based on semantic nets and corpus statistics. IEEE Trans. Knowledge Data Eng. 18, 1138–1150.

[28] Ercan Canhasi 2013, measuring the sentence level similarity, ISCIM 2013, pp. 35-42 © 2013 Authors

[29] Lee, M.C., 2011. A novel sentence similarity measure for semanticbased expert systems. Expert Syst. Appl. 38, 6392–6399.

[30] Alzahrani, S. M., Naomie Salim, Vasile Palade(2015) ,:Uncovering highly obfuscated plagiarism cases using fuzzy semantic-based similarity model, Journal of King Saud University – Computer and Information Sciences 27, 248–268(2015).

[31] Marie-Catherine de, Marneffe, Bill MacCartney, Christopher D. Manning . In LREC (2006).

[32] Sebastian Schuster and Christopher D. Manning2016. In LREC 2016.

# Object detection for the Dynamics of Moving Vehicles using Deep learning and CNN

<sup>[1]</sup>Kaushal Jani, <sup>[2]</sup>Dr. Nileshkumar Modi, <sup>[3]</sup>Nisarg Patel

<sup>[1]</sup>Research Scholar, Kadi Sarva VishwaVidyalaya <sup>[2]</sup>Professor, Dr. Babasaheb Ambedkar Open University ,  
<sup>[3]</sup>Research Scholar, C. U. Shah University

**Abstract:**-- Perception technologies in Autonomous Driving are experiencing their golden age due to the advances in Deep Learning. Yet, most of these systems rely on the semantically rich information of RGB images. Deep Learning solutions applied to the data of other sensors typically mounted on autonomous cars (e.g. lidars or radars) are not explored much. In this paper we propose a novel solution to understand the dynamics of moving vehicles of the scene from only lidar information. The main challenge of this problem stems from the fact that we need to disambiguate the proprio-motion of the “observer” vehicle from that of the external “observed” vehicles. For this purpose, we devise a CNN architecture which at testing time is fed with pairs of consecutive lidar scans. However, in order to properly learn the parameters of this network, during training we introduce a series of so-called pretext tasks which also leverage on image data. These tasks include semantic information about vehicleness and a novel lidar-flow feature which combines standard image-based optical flow with lidar scans. We obtain very promising results and show that including distilled image information only during training, allows improving the inference results of the network at test time, even when image data is no longer used.

## 1. INTRODUCTION

Metamaterial is artificial materials that shows unusual Capturing and understanding the dynamics of a scene is a paramount ingredient for multiple autonomous driving (AD) applications such as obstacle avoidance, map localization and refinement or vehicle tracking. In order to efficiently and safely navigate in our unconstrained and highly changing urban environments, autonomous vehicles require precise information about the semantic and motion characteristics of the objects in the scene. Special attention should be paid to moving elements, e.g. vehicles/pedestrians, mainly if their motion paths are expected to cross the direction of other objects or the observer.

Estimating the dynamics of moving objects in the environment requires both from advanced acquisition devices and interpretation algorithms. In autonomous vehicle technologies, environment information is captured through several sensors including cameras, radars and/or lidars. On distilling this data, research over RGB images from cameras has greatly advanced with the recent establishment of deep learning technologies. Classical perception problems such as semantic segmentation, object detection, or optical flow prediction [1], [2], [3], have experienced a great boost due to new Convolutional Neural Networks (CNNs) and their ability to capture complex abstract concepts given enough training samples. However, in an AD environment cameras may suffer a significant performance decrease under abrupt changes of illumination

or harsh weather conditions, as for example driving at sunset, night or under heavy rain. On the contrary, radar and lidar-based systems performance is robust to these situations. While radars are able to provide motion clues of the scene, their unstructured information and their lack of geometry comprehension make it difficult to use them for other purposes. Instead, lidar sensors provide very rich geometrical information of the 3D environment, commonly defined in a well-structured way.

In this paper we propose a novel approach to detect the motion vector of dynamic vehicles over the ground plane by using only lidar information. Detecting independent dynamic objects reliably from a moving platform (ego vehicle) is an arduous task. The proprio-motion of the vehicle in which the lidar sensor is mounted needs to be disambiguated from the actual motion of the other objects in the scene, which introduces additional difficulties.

## II. RELATED WORK

Research on classical perception problems have experienced a great boost in recent years, mainly due to the introduction of deep learning techniques. Algorithms making use of Convolutional Neural Networks (CNNs) and variants have recently matched and even surpassed previous state of the art in computer vision tasks such as image classification, object detection, semantic segmentation or optical flow prediction [4], [5], [6], [7].

However, the crucial problem of distinguishing if an object is moving disjointly from the ego motion remains challenging. Analysing the motion of the scene through RGB images is also a defiant problem recently tackled with CNNs, with several recent articles sharing ideas with our approach. In [8], the authors train a CNN network on synthetic data that taking as input the optical flow between two consecutive images, is able to mask independently moving objects. In this paper we go a step further and not just distinguish moving objects from static ones, but also estimate their motion vector on the ground plane reference. Other methods try to disengage ego and real objects movement by inverting the problem. For instance, [9] demonstrate that a CNN trained to predict odometry of the ego vehicle, compares favourably to standard class-label trained networks on further trained tasks such as scene and object recognition. This fact suggests that it is possible to exploit ego odometry knowledge to guide a CNN on the task of disambiguating our movement from the free scene motion, which we do in Section III-B.

The aforementioned works, though, are not focused on AD applications. On this setting, common approaches segment object motion by minimizing geometrically-grounded energy functions. [10] assumes that outdoor scenes can decompose into a small number of independent rigid motions and jointly estimate them by optimizing a discrete-continuous CRF. [11] estimates the 3D dynamic points in the scene through a vanishing point analysis of 2D optical-flow vectors. Then, a three-term energy function is minimized in order to segment the scene into different motions.

Lidar based approaches to solve the vehicle motion segmentation problem, have been led by clustering methods, either motion- or model-based. The former [12], estimates point motion features by means of RANSAC or similar methods, which then are clustered to help on reasoning at object level. Model-based approaches, e.g. [13], initially cluster vehicle points and then retrieve those which are moving by matching them through frames.

Although not yet very extended, deep learning techniques are nowadays being also applied to the vehicle detection task over lidar information. [14] directly applies 3D convolutions over the point cloud euclidean space to detect and obtain the bounding box of vehicles. As these approaches are computationally very demanding, some authors try to alleviate this computational burden by sparsifying the convolutions over the point-cloud [15]. But still the main attitude is to project the 3D point cloud into a featured 2D representation and therefore being able to apply the well known 2D convolutional techniques [16], [13]. In this line of projecting point clouds, other works

propose to fuse of RGB images with lidar front and bird eye features [17].

However, none of these approaches is able to estimate the movement of the vehicles in an end-to-end manner without further post-processing the output as we propose. As far as we know, the closer work is [18] which makes use of RigidFlow [19] to classify each point as non-movable, movable, and dynamic. In this work, we go a step further, and not only classify the dynamics of the scene, but also predict the motion vector of the moving vehicles.

Our approach also draws inspiration from progressive neural networks [20] and transfer learning concepts [21] in that we aim to help the network to solve a complex problem by solving a set of intermediate “pretext” tasks. For instance, in the problem of visual optical flow, [22] and [1] use semantic segmentation pretext tasks. Similarly, during training, we also feed the network with prior knowledge about segmented vehicles on the point cloud information.

### III. DEEP LIDAR-BASED MOTION ESTIMATION

We next describe the proposed deep learning framework to estimate the actual motion of vehicles in a scene independently from the ego movement, and using only lidar information. Our approach relies on a Fully Convolutional Network that receives as input featured lidar information from two different but temporary close frames of the scene, and outputs a dense estimation of the ground-floor motion vector of each point, given the case that it belongs to a dynamic vehicle. For that, in Section III-A we introduce a novel dataset built from the Kitti tracking benchmark that has been specifically created to be used as ground-truth in our supervised problem. Since lidar information by itself is not enough to solve the proposed complex mission, in Section III-B we consider exploiting pretext tasks to introduce prior knowledge about the semantics and the dynamics of the scene to the main CNN defined in Section III-C.

#### A. Lidar Motion Dataset

In order to train a CNN in a supervised manner, we need to define both the input information and the ground-truth of the desired output from which to compare the learned estimations.

The simpler input data we use consists on the concatenation of two different projected lidar scans featuring the ranges and reflectivity measured, as the one shown in Figure 2a. For each scan, we transform the corresponding points of the point cloud from its 3D euclidean coordinates to spherical ones, and project those to a 2D domain

attending to the elevation and azimuth angles. Each row corresponds to one of the sensor vertical lasers (64) and each column is equivalent to a laser step in the horizontal field of view (448). This field of view is defined attending to the area for which the Kitti dataset provides bounding box annotations, that covers approximately a range of  $[-40.5, 40.5]$  degrees from the ego point of view. Each pair  $(u, v)$  of the resulting projection encodes the sensor measured range and reflectivity. A more detailed description of this process can be found in [13].

### **B. Pretext tasks**

As aforementioned, we guide the network learning towards the correct solution introducing prior knowledge obtained by solving other pretext tasks. This idea draws similarities from progressive networks [20] and transfer learning works [9], both helping in solving increasing complexity tasks. In this manner, we introduce three kinds of additional information: a) a lidar-optical flow motion prior to guide our network for finding matches between the two lidar inputs; b) semantic concepts that will help with focusing on the vehicles in the scene; c) the ego motion information based on the displacement given by the odometry measurements.

The motion prior for matching inputs is given by stating a novel deep-flow feature map that can be seen in Figure 3a. We developed a new deep framework that takes as input the 2D projection of lidar scans from two separated frames and outputs a learned lidar-based optical flow. As lidar-domain optical flow ground-truth is not available, we created our own for this task. To do this, we used a recent optical flow estimator [7] based on RGB images and obtained flow predictions for the full Kitti tracking dataset. We further created a geometric model of the given lidar sensor attending to the manufacturer specifications and projected it over the predicted flow maps, obtaining the corresponding lidar-flow of each point in the point cloud. Finally we stated a dense deep regression problem that uses the new lidar-flow features as ground-truth to learn similar 2D motion patterns using a flownet-like convolutional neural network.

### **C. Deep-Lidar Motion Network**

As network architecture for estimating the rigid motion of each vehicle over the ground floor, we considered the Fully Convolutional Network detailed in Figure 4. It draws inspiration from FlowNet [23], which is designed to solve a similar regression problem. However, we introduced some changes to further exploit the geometrical nature of our lidar information. [24]

We first transformed the network expansive part by introducing new deconvolutional blocks at the end with the respective batch normalization (BN) and non-linearity im-

position (Relu). Standard FlowNet output is sized a fourth of the input and bi-linearly interpolated in a subsequent step. [25] This is not applicable to our approach as our desired output is already very sparse containing only few groups of lidar points that belong to moving vehicles. Therefore mid resolution outputs may not account for far vehicles that are detected by only small sets of points.

## **CONCLUSION**

In this paper we have addressed the problem of understanding the dynamics of moving vehicles from lidar data acquired by a vehicle which is also moving. Disambiguating proprio-motion from other vehicles' motion poses a very challenging problem, which we have tackled using Deep Learning. The main contribution of the paper has been to show that while during testing, the proposed Deep Neural Network is only fed with lidar-scans, its performance can be boosted by exploiting other prior image information during training. We have introduced a series of pretext tasks for this purpose, including semantics about the vehicleness and an optical flow texture built from both image and lidar data. The results we have reported are very promising and demonstrate that exploiting image information only during training really helps the lidar-based deep architecture. In future work, we plan to further exploit this fact by introducing other image-based priors during training, such as the semantic information of all object categories in the scene and dense depth obtained from images.

## **REFERENCES**

- [1] M. Bai, W. Luo, K. Kundu, and R. Urtasun, "Exploiting semantic information and deep matching for optical flow," in European Conference on Computer Vision (ECCV), Springer, 2016.
- [2] A. Geiger, P. Lenz, and R. Urtasun, "Are we ready for autonomous driving? the kitti vision benchmark suite," in IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2012.
- [3] A. Behl, O. H. Jafari, S. K. Mustikovela, H. A. Alhajja, C. Rother, and A. Geiger, "Bounding boxes, segmentations and object coordinates: How important is recognition for 3d scene flow estimation in autonomous driving scenarios," in IEEE International Conference on Computer Vision (ICCV), 2017.
- [4] K. He, X. Zhang, S. Ren, and J. Sun, "Deep residual learning for image recognition," in IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2016.

- [5] S. Ren, K. He, R. Girshick, and J. Sun, "Faster r-cnn: Towards real-time object detection with region proposal networks," in *Advances in Neural Information Processing Systems (NIPS)*, 2015.
- [6] J. Long, E. Shelhamer, and T. Darrell, "Fully convolutional networks for semantic segmentation," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2015.
- [7] E. Ilg, N. Mayer, T. Saikia, M. Keuper, A. Dosovitskiy, and T. Brox, "FlowNet 2.0: Evolution of optical flow estimation with deep networks," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2017.
- [8] P. Tokmakov, K. Alahari, and C. Schmid, "Learning motion patterns in videos," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2017.
- [9] P. Agrawal, J. Carreira, and J. Malik, "Learning to see by moving," in *IEEE International Conference on Computer Vision (ICCV)*, 2015.
- [10] M. Menze and A. Geiger, "Object scene flow for autonomous vehicles," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2015.
- [11] J.-Y. Kao, D. Tian, H. Mansour, A. Vetro, and A. Ortega, "Moving object segmentation using depth and optical flow in car driving sequences," in *IEEE International Conference on Image Processing (ICIP)*, 2016.
- [12] A. Dewan, T. Caselitz, G. D. Tipaldi, and W. Burgard, "Motion-based detection and tracking in 3d lidar scans," in *IEEE/RSJ International Conference on Robotics and Automation (ICRA)*, 2016.
- [13] V. Vaquero, I. del Pino, F. Moreno-Noguer, J. Sola, A. Sanfeliu, and J. Andrade-Cetto, "Deconvolutional networks for point-cloud vehicle detection and tracking in driving scenarios," in *IEEE European Conference on Mobile Robots (ECMR)*, 2017.
- [14] B. Li, "3d fully convolutional network for vehicle detection in point cloud," in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2017.
- [15] M. Engelcke, D. Rao, D. Z. Wang, C. H. Tong, and I. Posner, "Vote3deep: Fast object detection in 3d point clouds using efficient convolutional neural networks," in *IEEE International Conference on Robotics and Automation (ICRA)*, 2017.
- [16] B. Li, T. Zhang, and T. Xia, "Vehicle detection from 3d lidar using fully convolutional network," in *Robotics: Science and Systems (RSS)*, 2016.
- [17] X. Chen, H. Ma, J. Wan, B. Li, and T. Xia, "Multi-view 3d object detection network for autonomous driving," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2017.
- [18] A. Dewan, G. L. Oliveira, and W. Burgard, "Deep semantic classification for 3d lidar data," *IEEE/RSJ Conference on Intelligent Robots and Systems (IROS)*, 2017.
- [19] A. Dewan, T. Caselitz, G. D. Tipaldi, and W. Burgard, "Rigid scene flow for 3d lidar scans," in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2016.
- [20] A. A. Rusu, N. C. Rabinowitz, G. Desjardins, H. Soyer, J. Kirkpatrick, K. Kavukcuoglu, R. Pascanu, and R. Hadsell, "Progressive neural networks," *arXiv preprint arXiv:1606.04671*, 2016.
- [21] J. Yosinski, J. Clune, Y. Bengio, and H. Lipson, "How transferable are features in deep neural networks?," in *Advances in Neural Information Processing Systems (NIPS)*, 2014.
- [22] L. Sevilla-Lara, D. Sun, V. Jampani, and M. J. Black, "Optical flow with semantic segmentation and localized layers," in *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, 2016.
- [23] A. Dosovitskiy, P. Fischer, E. Ilg, P. Hausser, C. Hazirbas, V. Golkov, P. van der Smagt, D. Cremers, and T. Brox, "FlowNet: Learning optical flow with convolutional networks," in *IEEE International Conference on Computer Vision (ICCV)*, 2015.
- [24] K. He, X. Zhang, S. Ren, and J. Sun, "Delving deep into rectifiers: Surpassing human-level performance on imagenet classification," in *IEEE International Conference on Computer Vision (ICCV)*, 2015.
- [25] K. Jani, N. Modi and N. Patel, "Object Detection for Driving Assistance in Autonomous Defence Vehicle," in *International Conference on Research Advancements in Applied Engineering Sciences, Computer and Communication Technologies*, 2019.

# A Novel Approach for Fault Diagnosis of Multilevel Inverter Using Dwt and Fuzzy Logic Algorithm

<sup>[1]</sup> Shiva Maruth Alapati, <sup>[2]</sup> Dr Varsha Singh

<sup>[1][2]</sup> Department of Electrical Engineering, National Institute of Technology, Raipur, India.

**Abstract:**-- With the advent of rapid development in technology use of multilevel inverter (MLI) increased drastically, it has many advantages compared to normal inverters. But, with increase in switches there is a high chance of occurrence of failure. So, for system to be more reliable fault must be detected and cleared as fast as possible. In this paper fault diagnosis is performed using discrete wavelet transform (DWT) and fuzzy logic. Valuable features for output voltage signals are extracted by DWT. Fuzzy logic is employed at last for switch fault detection. This method has satisfactory results and reasonable advantages over traditional methods.

**Key Words:** Multilevel Inverter, Fault Diagnosis, Discrete Wavelet Transform, Fuzzy Logic

## 1. INTRODUCTION

Nowadays, the use multilevel inverters have been increased drastically, increase in demand for of high power drives and renewable sources of energy drives are one of the major demands. As compared to two-level converters multilevel inverters provide higher power quality, low harmonic distortion and can operate at higher voltage level [1,2]. The most frequently used topologies are cascaded H-bridge, flying capacitors and Neutral-point clamped. The cascaded H-bridge multilevel inverter has low harmonic content of the output voltage, low switching loss and a simple design. However, semiconductor devices have high chances of failure, multilevel inverters have higher switches compared to two- level inverters so probability of failure is higher in multilevel inverters. So, to increase the reliability of inverters faults must be detected and cleared as fast as possible. Studies show that most of the failures in inverters can be classified into short circuit fault or open circuit fault. However, a short circuit fault can be converted into an open circuit fault by using a fuse [3]. Hence, usually open circuit faults are analysed in fault diagnosis of inverters.

There are several techniques to analyse the faults in inverters. In several research papers, various techniques such as wavelet decomposition, discrete wavelet transform with principal component analysis along with artificial neural network to classify the faults occurring in multilevel inverters. Although, artificial neural networks give good results, they have some disadvantages such as slow training performance and determination of network structure is difficult [4,5]. So, in this paper a novel technique based on Discrete wavelet transform and fuzzy

logic is proposed for fault analysis on cascaded H-bridge inverter. Firstly, the required from voltage waveforms are obtained by simulation of the cascaded H-bridge inverter in MATLAB and then required data is extracted using discrete wavelet transform. Then detail coefficients obtained after applying dwt is used for building fuzzy logic algorithm. Finally, the faults will be classified and detected using fuzzy logic algorithm and accuracy at which it detects is satisfactory.

## 2. INVERTER TOPOLOGY

A conventional five level cascaded h-bridge multilevel inverter consists of 8 switches and requires two dc supplies. This consists of two H-bridge circuits connected in series which are fed by dc voltage sources. To achieve higher output voltage h-bridges are connected in such a way that output is sum of all individual h-bridges.

The output voltage is,

$$V=V_1 + V_2 \quad (i)$$

$V_1$ = output voltage of first h-bridge

$V_2$ = output voltage of second h-bridge\*-

In Fig 1 an IGBT based H-bridge inverter is shown and in Table 1 switching sequence is shown. Cell one is made up of IGBT's  $G_1, G_2, G_3, G_4$  having input voltage  $V_1$  and for the second cell they are named as  $G_5, G_6, G_7, G_8$  having input  $V_2$ . Generally, the input voltages are considered equal  $V_1=V_2$  in symmetrical topology. The switching pulses are given by sinusoidal pulse width modulation (SPWM), which is based on multicarrier wave comparison with fundamental sinusoidal wave, as shown in Fig.2.

The output level of inverter(N) and number of sources (S) are related as  $N=S+1$ ; For a two cell inverter output levels are five ( $V_1, 2V_1, 0, -V_1, -2V_1$ )

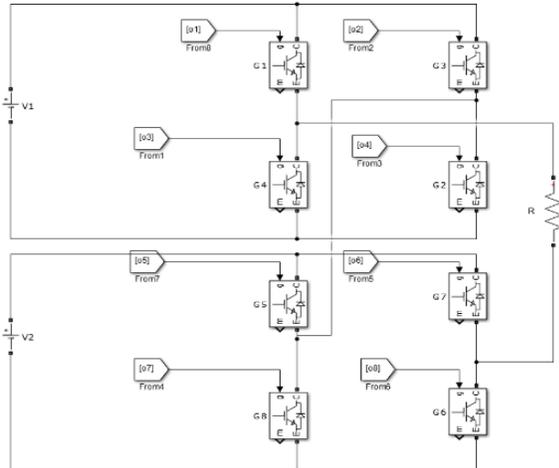


Fig.1 Cascaded 5 level H bridge Inverter

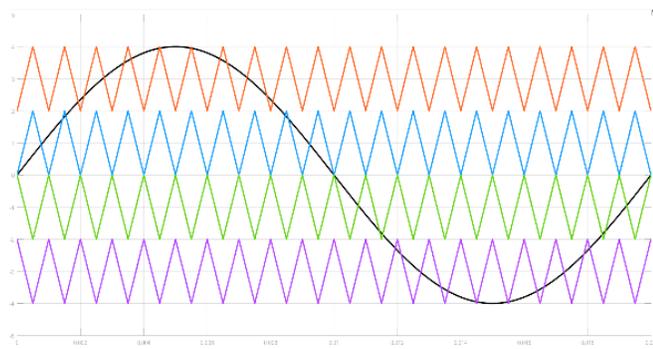


Fig.2 Multi carrier based sinusoidal PWM

Table1: Switching sequence of 5 level inverter

G <sub>1</sub>	G <sub>2</sub>	G <sub>3</sub>	G <sub>4</sub>	G <sub>5</sub>	G <sub>6</sub>	G <sub>7</sub>	G	OUTPUT VOLTAGE
1	0	1	0	1	0	1	0	0
1	0	1	0	1	1	0	0	V
1	1	0	0	1	1	0	0	2V
0	1	0	1	0	0	1	1	-V
0	1	0	1	0	1	0	1	0
0	0	1	1	0	0	1	1	-2V

### 3. DISCRETE WAVELET TRANSFORM:

A wavelet is a small localized wave having a particular shape and finite duration having an average value of zero. Wavelets come in different sizes and shapes, (Daubechies N, Gaussian, Meyer, Morlet, Haar etc.) are available for experiment, but the proposed method has used Daubechies wavelet for decomposing the output waveform of the inverter. The wavelet transform is a linear signal processing technique that when it is applied to a data of vector x, transforms it to a different vector consisting of wavelet coefficients [6]. There are different types of wavelet transforms broadly classified as continuous wavelet transform (CWT) and discrete wavelet transform (DWT), they mainly differ on how they discretize the scale and translational parameters. Generally, continuous wavelet transform uses non-orthogonal wavelets, it returns data vector one dimension larger than input and the data here is highly correlated. On the other hand, the discrete wavelet transform uses orthogonal wavelets, so it returns a data vector of similar length as input, many of these data present in the vector are zero. So, no redundant information is present here which makes DWT an excellent method for signal processing. DWT is closely related to the discrete Fourier transform [7,8]. However, DWT will provide a more accurate approximation of the original data compared to DFT. The main advantages of wavelet transform are that wavelets are quite localized in space and with frequency, its window size varies resulting in optimal time-frequency resolution. The discrete wavelet transform is represented in equation (ii) [9].

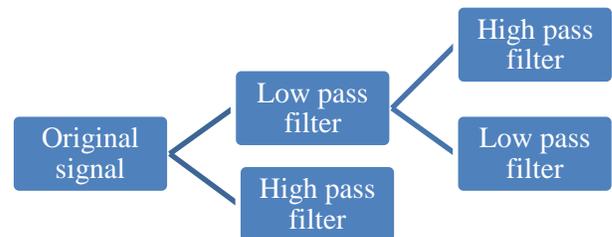


Fig.3 Wavelet Decomposition

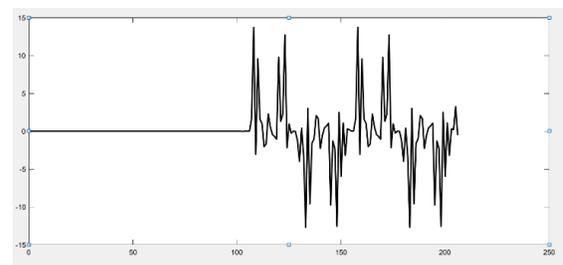


Fig.4 Wavelet Transform of scale 3 with switch G<sub>1</sub> faulted

$$DWT(x,y)=\frac{1}{\sqrt{2}}\sum_m f(m) 4\psi\left[\frac{y-m2^x}{2^x}\right] \quad (ii);$$

Where,  $\psi\left[\frac{y-m2^x}{2^x}\right]$  is mother wavelet.

By, simultaneous decomposition of using both low pass and high pass filter we obtain detail coefficients and approximation coefficients (Fig.3.). A mother wavelet is necessary for decomposition of fault signal while DWT method is used. Here, ‘dB4’ wavelet is used which belongs to ‘Daubechies wavelets’, a family of orthogonal wavelets. Here, the fault signal is decomposed into 3 levels and output of discrete wavelet transform of voltage signal with switch G1 faulted is shown in Fig.4.

#### 4. FUZZY LOGIC CLASSIFIER:

Fuzzy logic uses soft linguistic system variables and a continuous range of truth values, rather than strict binary (true or false); it is a range to range or point to range control unlike the classical control strategy which is a point to point control [10]. The fuzzy controller output is derived from the fuzzifications of both output and input using associated membership functions. A fuzzy set is defined by a membership function (MF), an MF assigns a membership grade to each element in the set under consideration. Since, a fuzzy set is completely characterized by its membership function; it must be chosen deliberately. Here, the trapezoidal MF has been chosen, as it best suited for this classification and it is one of the most used especially in real time applications. The number of MFs to be used must also be considered carefully, if we choose a smaller number of MFs the classification will not be accurate. On the other hand, if we take many MFs the system will become complex, so the optimum number of membership functions must be chosen [11-13]. In this work, the decision algorithm is based on the fuzzy logic toolbox in MATLAB (Fig 5) is used to classify the faults. Here, nine input signals are given; in which the first signal is the output signal to be classified and the remaining are pre-fault signals with different switches faulted. Here, three membership functions for each input (Fig.6) and two membership functions for output is chosen (Fig.7.). The defuzzification method used is the centre of the area. The input MFs are represented as low, medium, and high, covering the entire range of input variable and output MFs are fault and no fault.

The rules are made like “if input1 is low and input 2 is low then output 1 is no fault” and “if input 1is high and input 2 is low then output 1 is fault”.

The fuzzy rules are assigned to compare the input with pre-fault conditions and classify the fault accordingly. Below the overview of the complete process is presented in a flow chart form shown in Fig.8.

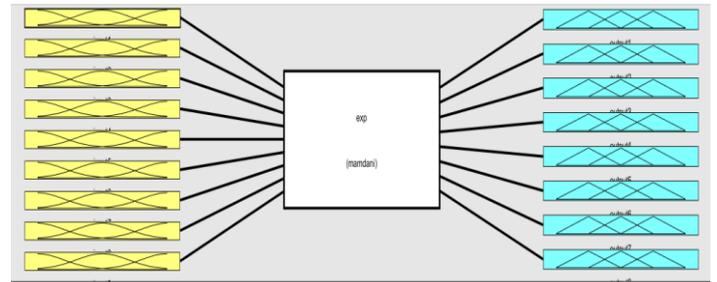


Fig 5 structure of Fuzzy Logic for classification of fault

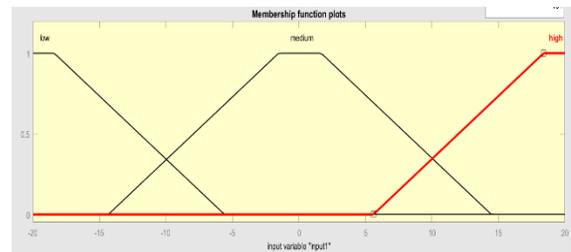


Fig.6 Membership function of input variable

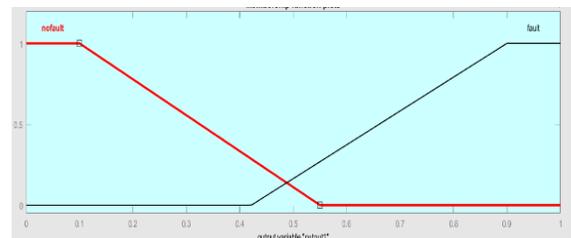


Fig 7 Membership function of output variable

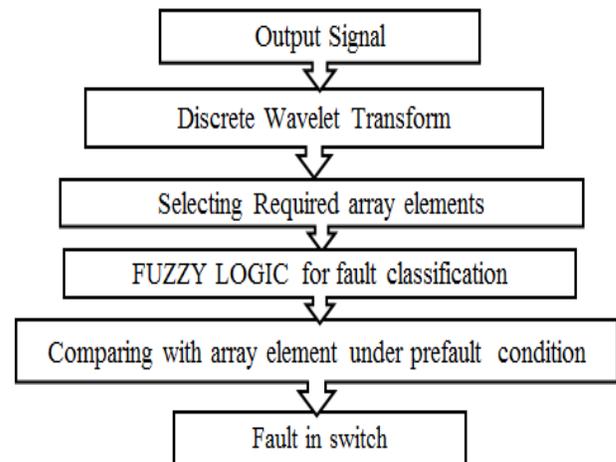


Fig.8 overview of the process

5. SIMULATION RESULTS:

Based on the analysis mentioned above, a simulation model is established in MATLAB for fault diagnosis of a multilevel inverter. The H-bridge multilevel inverter is a circuit is simulated to interpret the fault detection technique. A total of nine signals are obtained including the one with no fault. The obtained voltage waveforms from the simulation of H-bridge are shown below. Fig. 9(a) shows the normal output of inverter or output with no fault condition. Fig. 9(b) to 9(i) show the output waveform when open switch fault occurs in different 8 switches used in 5 level inverter.

A mother wavelet of ‘db4’ from Daubechies family of wavelets having three level decomposition is used decompose the fault signal. There will approximate coefficients and detailed coefficients after the decomposing the output signal. We will give importance to detail coefficients as they give the information required for the abrupt changes. Here we consider a particular sample of a detailed coefficient of every faulted signal. The array containing the wavelet coefficients is obtained after selecting the required samples from the faulted signals and signal to be classified. This array used as input for the fuzzy toolbox for classification of faults. The fuzzy rules are made such that if the selected sample from signal to be classified is matched with the respective sample of any pre-fault signal then fuzzy will provide an output close to zero otherwise it will provide an output close to 1. The outputs of the fuzzy classifier are shown in Table.2. Here we can observe that with no fault condition the fuzzy classifier outputs are closer to 1 and whereas with switch G1 faulted they are closer to zero.

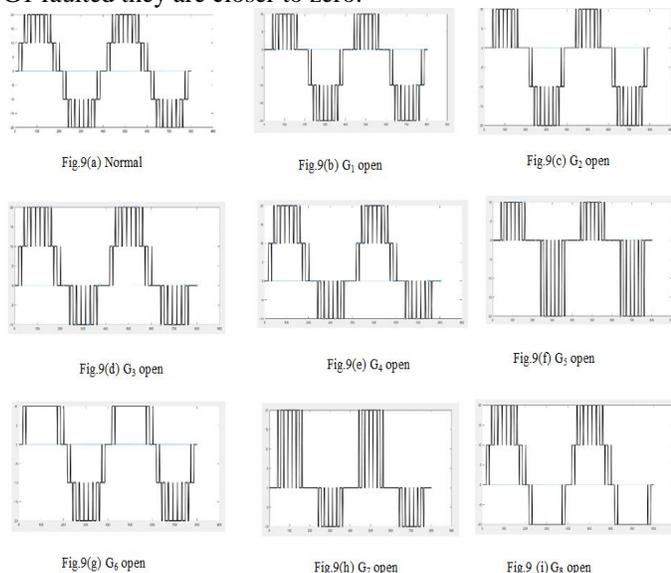


Table.2 Results of fault classification

FAULT	G <sub>1</sub>	G <sub>2</sub>	G <sub>3</sub>	G <sub>4</sub>	G <sub>5</sub>	G <sub>6</sub>	G <sub>7</sub>	G <sub>8</sub>
No fault	.7152	.7883	.8869	.8876	.8859	.7850	.8143	.8876
G1 faulted	.1806	.7099	.7172	.7252	.7323	.7562	.7698	.7877

6. CONCLUSION:

In the proposed work, a different approach for fault diagnosis of cascaded H-bridge multilevel inverter is proposed. Discrete wavelet transform is used to decompose the original fault signal. The data obtained after decomposing the fault signal is used to classify the faults. The required array is selected which shows deviation for each of the faults and that particular row is given to fuzzy logic for classification. The results show the effectiveness of the proposed DWT-FUZZY algorithm for fault diagnosis of cascaded H-bridge multilevel inverter. The proposed work will be applicable for hybrid MLI to classify the faults occurring in different switches.

REFERENCES:

[1] M.Malinowski, K. Gopakumar, J. Rodriguez, and M. A. Perez, "A survey on cascaded multilevel inverters," IEEE Trans. Ind. Electron., vol. 57, no. 7, pp. 2197–2206, Aug. 2009.

[2] S. Kouro, M. Malinowski, K. Gopakumar, J. Pou, L. G. Franquelo, B.Wu, J. Rodriguez, M. A. Perez, and J. I. Leon, "Recent advances and industrial applications of multilevel converters," IEEE Trans. Ind. Electron., vol. 57, no. 8, pp. 2553–2580, Jun. 2010.

[3] Florent Becker, Ehsan Jamshidpour, Philippe poure, "Study by modeling and simulation of open-switch fault diagnosis for five-level converters", Transaction of Environment and Electrical Engg", Vol 2(1), Jan 2017.

[4] S.G.Srivani, Ujjaval B. Vyas, "Fault Detection of Switches in Multilevel Inverter Using Wavelet and Neural Network", 7th International Conference on Power Systems (ICPS), College of Engineering Pune, India. Dec 21-23, 2017.

[5] Dhupchhaya Chowdhury, Monikuntala battacharya, Dibyendu khan "Wavelet Decomposition Based Fault Detection in Cascaded H-Bridge Multilevel Inverter using Artificial Neural Network" 2nd IEEE International Conference On Recent Trends in Electronics Information & Communication Technology (RTEICT), May 19-20, 2017, India.

[6] Jain Pei, Micheline Kamber, Jiawei Han "Data Mining" 3rd edition Micheline Kamber. Elsevier.

[7] Iwazskiewicz, A. Jan, and B. Jacek Perz. "A novel approach to control of multilevel converter using wavelets

transform." International Conference on Renewable Energies and Power Quality. Vol. 228. 2007.

[8] Mustafa Aktaş, "A Novel Method for Inverter Faults Detection and Diagnosis in PMSM Drives of HEVs based on Discrete Wavelet Transform", Advances in Electrical and Computer Engineering, Volume 12, Number 4, 2012, pp 33-38

[9] Saeed Valipour<sup>1</sup>, S. Saeid Moosavi<sup>2</sup>, D. A. Khaburi<sup>1</sup>, A. Djerdir, "An Open-Circuit Fault Detection Method using Wavelet Transform for Cascaded H-Bridge Multilevel Inverter", IEEE conference on Vehicle Power and Propulsion Conference (VPPC), 2017.

[10] Pathomthat Chiradeja and Chaichan Pothisarn, "Discrete Wavelet Transform and Fuzzy Logic Algorithm for Identification of Fault Types On Transmission Line", 8th international conference on power system control, operation and maintenance (APSCOM 2009), 8-11 Nov 2009, Hong kong, China.

[11] Fatiha Zidani, Demba Diallo, Mohamed El Hachemi Benbouzid, Rachid Naït-Saïd, "A Fuzzy-Based Approach for the Diagnosis of Fault Modes in a Voltage-Fed PWM Inverter Induction Motor Drive" IEEE Trans. Ind. Electron, Vol. 55(2), February 2008.

[12] Benish pailey, Kumaravel S., Malabika basu, and Miachel conlon, "Fault Analysis of VSC HVDC systems using fuzzy logic", International conference on signal processing, informatics, communication and energy system (SPICES), 2015, pp1-5.

[13] Varsha Singh, Dr.S.Gupta, Dr.S.pattnaik, Aarti Goyal, "A Novel Approach to GSA, GA and Wavelet Transform to Design Fuzzy Logic Controller for 1 $\phi$  Multilevel Inverter", International Journal of Power Electronics and Drive System (IJPEDS), Vol.7(4), December 2016

# Very Low or Almost Nil Exposure to Engineering & Technology

<sup>[1]</sup> Digvijay Singh, <sup>[2]</sup> Chandra Shekhar Rao, <sup>[3]</sup> Satyajit Sen.

<sup>[1]</sup> Founder, Mrida Education and Welfare Society Mandla district, Madhya Pradesh.

**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.

## 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:

- The livelihood skills that are needed for a dignified livelihood
  - 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:

- The current contextual (cultural) skills that can be built through an intensive experience of the region and the children.
- Livelihood skills needed in the global market of the future that will see the rise of automated technology
- 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.

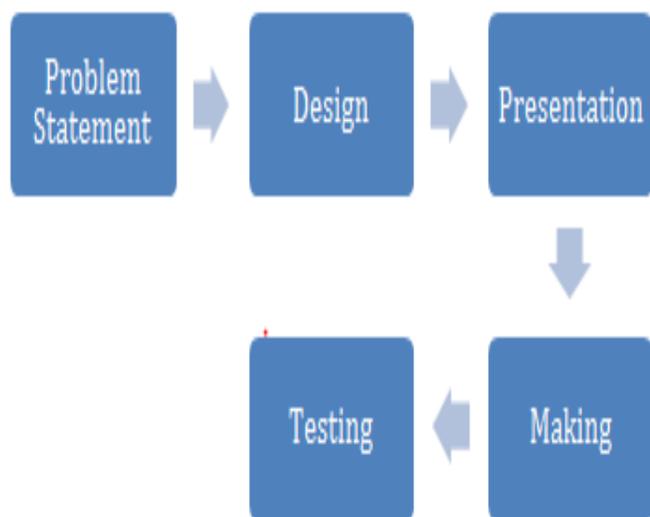
**Methodology:**

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 Almirah 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. Chandrashekhler 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.

#### REFERENCES:

- [1] The World's Largest Education Resource. (2018). Retrieved from <https://www.thoughtco.com>
- [2] ARTICLES, T., PRODUCTS, N., ELECTRONICS, G., PROJECTS, C., MICRO, E., & Lectures, V. et al. (2018). STEM Education: Helping to Create Jobs in Developing Countries. Retrieved from <https://www.allaboutcircuits.com/news/stem-education-helping-to-create-jobs-in-developing-countries/>
- [3] Ltd, L. (2018). Rocket Languages. Retrieved from <http://www2.rocketlanguages.com/hindi/learn/how-long-does-it-take-to-learn-hindi/>
- [4] Science education in India. (2018). Retrieved from <http://www.dailyexcelsior.com/science-education-india/>

- [5] Skill development in school education: Importance of evolving skill training from a young age. (2018). Retrieved from <https://www.indiatoday.in/education-today/featureophilia/story/skill-development-in-schools-from-young-age-337015-2016-08-24>

# Observations on Anonymization Based Privacy Preserving Data Publishing

<sup>[1]</sup>Nirzari Patel, <sup>[2]</sup>Dr. Mehul P Barot

<sup>[1]</sup>Research, <sup>[2]</sup>Assistant Professor

<sup>[1][2]</sup> Computer Engineering Department, LDRP Institute of Technology and Research, Gandhinagar

**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 inflicts 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 a 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. k-anonymity, 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 l-diversity. 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:

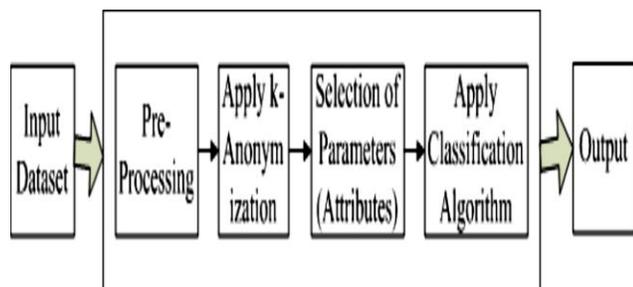


Figure 2: General architecture of existing algorithms

#### 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 tupples 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]	<ol style="list-style-type: none"> <li>1. Uses the binary search to acquire the solution in minimum time.</li> <li>2. Looks for the solution with the least generalization.</li> <li>3. samarati’s outcome dependably has a chance to be an optimal solution</li> <li>4. Great result when compared to Datafly</li> </ol>	<ol style="list-style-type: none"> <li>1. The chance to get an optimal solution practically varies with k, MaxSup lattice size.</li> </ol>
2	Incognito [10]	<ol style="list-style-type: none"> <li>1. The algorithm finds all the k-anonymous generalizations</li> <li>2. Optimal solution can be selected according to various criteria</li> </ol>	<ol style="list-style-type: none"> <li>1. The algorithm uses breadth first search method which takes a lot of time to pass over the solution space</li> </ol>
3	Sweeney-Datafly [12]	<ol style="list-style-type: none"> <li>1. The algorithm checks very less nodes for k-anonymity due to which it is capable to give results very fast</li> <li>2. It is a greedy approach that creates frequency lists and repeatedly generalizes those composition with less than k occurrences</li> <li>3. Practically implementable</li> </ol>	<ol style="list-style-type: none"> <li>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.</li> <li>2. Suppressing all values within the tuple</li> </ol>

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.

#### REFERENCES

- [1] Pierangela Samarati, Latanya Sweeney "Generalizing Data to Provide Anonymity when Disclosing Information".
- [2] R. Mahesh, T. Meyyappan "Anonymization Technique through Record Elimination to Preserve Privacy of Published Data" Proceedings of the 2013 International Conference on Pattern Recognition, Informatics and Mobile Engineering, February 21-22
- [3] Ms. Simi M S, Mrs. SankaraNayaki K, Dr.M.Sudheep Elayidom "An Extensive Study on Data Anonymization Algorithms Based on KAnonymity" IOP Conf. Series: Materials Science and Engineering 225 (2017) 012279 doi:10.1088/1757-899X/225/1/012279.
- [4] Athiramol. S, Sarju. S "A Scalable Approach for Anonymization Using Top Down Specialization and Randomization for Security" 2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICT)
- [5] Latanya Sweeney "Weaving technology and policy together to maintain confidentiality" Journal of Law, Medicine, Ethics, 25(2(3)):98110, 1997.
- [6] Preet Chandan Kaur, Tushar Ghorpade, Vanita Mane "Analysis of Data Security by using Anonymization Techniques" 978-1-4673-8203-8/16/in 2016 IEEE.
- [7] Qingshan Jiang, A S M Touhidul Hasan "A General Framework for Privacy Preserving Sequential Data Publishing" 2017 31st International Conference on Advanced Information Networking and Applications Workshops.
- [8] Machanavajhala A., Kifer D., Gehrke J., Venkatasubramanian M., "Diversity: Privacy beyond k-anonymity" 2007, ACM Transaction on Knowledge Discovery in Data, 1, 18-27.
- [9] Li, N., Li, T., and Venkatasubramanian, S., "t-Closeness: Privacy beyond k-Anonymity and l-Diversity" 2007, Proceedings, 23rd International Conference on Data Engineering, USA, 106-115.
- [10] L. Sweeney, "Datafly: a system for providing anonymity in medical data. In Database Security", XI: Status and Prospects, IFIP TC11 WG11.3 11<sup>th</sup> Int'l Conf. on Database Security, 356-381, 1998
- [11] K. Bache and M. Lichman. UCI Machine Learning Repository, 2013.
- [12] J. Soria-Comas, J. Domingo-Ferrer, D. Sanchez, and S. Martinez, "Improving the Utility of Differentially Private Data Releases via k- Anonymity", In Proceedings of the 12th IEEE International Conference on Trust, Security and Privacy in Computing and Communications, TRUSTCOM-13, pages 372-379, 2013.
- [13] <http://www.cs.waikato.ac.nz/ml/weka/>
- [14] <http://www.nltk.org/>
- [15] <https://opennlp.apache.org/>
- [16] UCI Machine Learning Repository <http://archive.ics.uci.edu/ml/datasets>

# Spectrum Sensing and Detection in Cognitive Radio Network

<sup>[1]</sup> Vinod H. Patil, <sup>[2]</sup> Dr. Shruti Oza, <sup>[3]</sup> Rishika Dixit, <sup>[4]</sup> Harshita Rai  
<sup>[1][2][3][4]</sup> Bharati Vidyapeeth (Deemed to be University) College of Engineering, Pune

**Abstract:--** This paper provides different ways of spectrum sensing and detection to increase the efficiency of the electromagnetic spectrum utilisation. The secondary users directly switches to use the spectrum without any delay by connecting them as soon as the primary users are not using that given band. The particular spectrum band is selected and compared with the rest of the frequency signals according to various quality analysis techniques. The cognitive radio allows the unlicensed user or what we might say as the secondary users to use the licensed limited spectrum band by dynamically allocating the channel or different strategies for accessing the spectrum when our primary users are not using the spectrum i.e. they are in a dormant state so that we can utilise our spectrum more efficiently and thus minimise the risk for scarcity of the spectrum.

As a result, there is a great need for intelligent spectrum sensing techniques which will help us in finding the unused spectrum gaps known as spectrum holes and eventually allocate those holes to our secondary user to be fully utilised for the time being but without hindering the activities of the primary user.

Firstly, sensing the frequency spectrum and detection of free spaces in the spectrum is done. PSD (power spectral density) method is used for the detection of white spaces. Secondly, selection of the appropriate channel for the transmission and reception of data is done. Thirdly, the project switches the modulation techniques adaptively. Then the spectrum is monitored until primary user is using that band as soon as there exist free band the secondary user requests primary user and sends the request. Primary user then either allows or declines it and further the secondary user processes the band based on the request result. The secondary user then selects the best frequency among the multiple frequency signals by comparing the frequency based on the SNR and BER (better bit error) values. Finally, the best output frequency signal is used.

## Index Terms—

ADC	Analog to Digital Converter
LNA	Low Noise Amplifier
PDF	Probability Density Function
PSD	Power Spectral Density
PU	Primary User
SU	Secondary User
SNR	Signal to Noise Ratio
TX	Transmission
RX	Reception

## INTRODUCTION

Today there is a tremendous need for a fast and more efficient wireless communication system. The mobile communication system and the internet technologies can be seen as the future of the wireless network in order to provide a wide range of services to its customers.

The original method for licensing the electromagnetic spectrum and then utilising it gave rise to static and other inefficient use of the available spectrum. The demands of the market and the need for different technologies have been leading to an unbalance use of the spectrum and as a result there exists a scarcity of the spectrum. The solution to our problem requires the introduction of new innovating

licensing policies and the proper coordination infrastructure which will enable the overall use of the spectrum and henceforth will also increase the spectrum efficiency.

Thus, due to following problems we need to sense the best spectrum band.

1)Channel Uncertainty -There will be uncertainty in the received signal strength which lead to the wrong interpretation because of fading and shading of the channel.

2)Aggregate Interference Uncertainty –Spectrum sensing will be affected by uncertainty in aggregate interference because of the multiple cognitive radios are operating in same licensed band.

3)Security- To threat attacks such as transmitter verification scheme is used that differentiate between

legitimate incumbent signal transmitters and secondary signal transmitter.

**DATA SPECIFICATIONS**

**SPECTRUM SENSING:** Spectrum sensing means the detection of the holes in the spectrum using sensing of the radio spectrum of a cognitive radio receiver in an unsupervised manner. Spectrum Holes are defined as the sub-bands of the radio spectrum which are not utilised at the particular instantaneous time and specific geographic location.

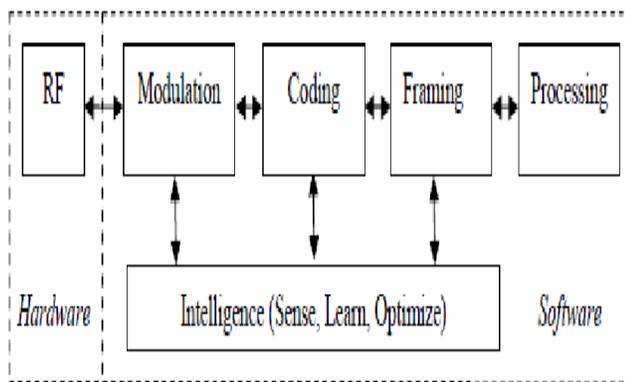
The main steps for spectrum sensing requires following steps-

- 1) Finding the desired spectrum holes in the band.
- 2) Spectral resolution of each spectrum hole.
- 3) To estimate the spatial direction of the incoming interferences and noise.
- 4) Classification of the signal is also done.

The main objective is to:

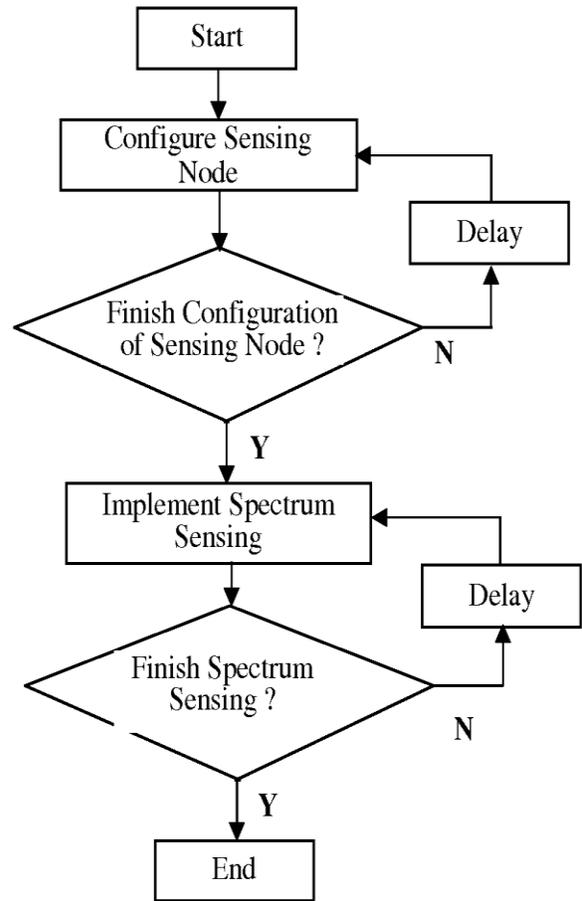
- 1) Spectrum sensing basically focuses on providing a reliable and a flexible communication to all the users irrespective of the time or the geographical location.
- 2) It provides effective utilisation of the electromagnetic spectrum in a cost effective manner.

From Fig.1 it is clearly visible that the main objective is that we are currently working on how to bridge a gap between the hardware and the software during the transmission of the message signal and effectively work on the types of modulation techniques, the coding via LabView and the USRP framework we are working on to build the sensing techniques that brings the best frequency signal and spectrum band that can be used with maximum efficiency and minimum delay of time and cost.



**Fig.1 Block diagram of Cognitive Radio**

**Fig.2 Implementation of Spectrum Sensing**



**Implementation Steps for Spectrum Sensing**

given to it by the primary user to stop as the primary user will resume its sensing and utilisation of the spectrum band.

**MATERIALS AND METHODS:**

**1)HARDWARE COMPONENTS:**

ANTENNAS- VERT 900 , VERT 2450 are used to generate the radio signals.

**UNIVERSAL SOFTWARE RADIO PERIPHERAL(USRP)**

In Fig. 2 the flowchart demonstrates that first the primary user transmits a signal either sine or cosine wave. Configuration of the primary user for transmission and then monitoring the spectrum for the secondary user until primary user has stopped using the band. If spectrum band

is free then we configure the secondary user for reception of the message signal and appears an automatic generated user request. If the request has been denied then it again goes to the spectrum monitoring stage and waits. Once the primary user accepts the request it gives the secondary user to use its spectrum band for the time. The secondary user uses the band until an interrupt has been Universal Software Radio Peripheral is a self- designed and self - defined software radio which was sold by Ettus Research and its parent company, National Instruments.

USRP was developed by a team which was lead by Matt Ettus, the USRP product family intended to be a comparatively most reasonable hardware platform for software radio and is mostly used by research labs, universities and hobbyists.

In general, the USRP's connects to a host computer through a high speed communication link, which the host based software uses to control the USRP hardware and transmits the received data and vice versa.

There are many USRP models which integrate the basic functionality of a host computer with an inbuilt processor and allows the USRP device to operate in an independently.

Basically, the USRP family was designed for accessibility and many of the products are open source hardware. The selected USRP models for board schematics are freely available to download the USRP products and are controlled with open source UHD driver which is a free and an independent open source software.



Fig. 3



Fig. 4

### Configuring USRP-2900/2901

#### Devices Confirming USB Connection

1. Select Start» All Programs» National Instruments» NI-USRP»NI-USRP Configuration Utility to open the NI-USRP Configuration Utility.

2. Select the Devices tab of the utility. Your device should appear in the list on the left side of the tab, similar to the following

#### Changing the Device ID

To change the USRP-2900/2901 device ID, you must know the current address of the device.

1. Verify that your device is powered on and connected to your computer using the USB 3.0 or 2.0 interface.

2. Select Start-> All Programs->National Instruments->NI USRP ->NI-USRP Configuration Utility to open the NI-USRP Configuration Utility.

3.Then select the devices tab of the utility. The device should show in the list on the left side of the tab appearing on the screen.

4.In the given list select the device for which you want to change the device ID. If the user has multiple devices then the correct device is been verified. The device ID of the selected device is displayed in the selected devices ID textbox.

5.The device ID for the given device is then entered in the New Device ID textbox. The device ID cannot contain spaces or special characters.

#### II)SOFTWARE COMPONENTS:

Laboratory Virtual Instrument Engineering Workbench (LABVIEW) :

LabVIEW stands for Laboratory Virtual Instrument Engineering Workbench (LabVIEW). It is system designed platform and development environment for a visual programming language from National Instruments.

The graphical language is stated as “G”, which is not to be confused with G-code. It was originally released for the Apple Macintosh in 1986, LabVIEW is basically used for the acquisition of the data ,controlling the instrument and automation of the industrial on a variety of Operating System(OS's) which includes Microsoft Windows, various version of Unix ,Linux and macOS.

The latest versions of LabVIEW are LabVIEW 2018 and LabVIEW NXG 2.1, released in May 2018.

LABVIEW is mainly used for these following purposes:

- 1)Automated Manufacturing Testing of a component system or subsystems is done through this.
- 2)Automated Product Design of a component sub system or system is being validated through this.
- 3)Industrial Equipment process of a component is done by controlling or monitoring of a machine.
- 4)Condition Monitoring of a machine or a piece of an industrial equipment.

There are likely some additional corner cases out there, but this covers the vast majority of applications we see at Viewpoint. Historically, LabVIEW has been widely adopted in the automated test realm, essentially becoming the de facto standard in that application space, whereas more recently it's been gaining traction within the realm of industrial embedded monitoring and control.

LabVIEW is a software development environment created by National Instruments. Originally it was focused on taking measurements from various lab instruments, but it's expanded drastically from its inception. Strictly speaking, LabVIEW is not a coding language, it's a development environment.

There are 4 ways that software developed with LabVIEW interacts with the real world (all requiring hardware with an appropriate processor on board (either desktop PC-based or SoC (System-On-Chip) based):

- 1) A GUI – either with a standard monitor or touch panel.
- 2) Interfacing with lab equipment/instruments (e.g. through GPIB, Ethernet, USB, PCI, RS-422) – for example power supplies, power meters, multi-meters, spectrum analyzers, oscilloscopes, switch matrices, and signal generators.
- 3) Measuring a signal with NI hardware (analog or digital) – for example temperature, pressure, vibration, current, load, voltage, flow, light, acoustics, force, location/orientation, vision, humidity/moisture, RF emissions, and magnetic field.
- 4) Controlling a signal with NI hardware (analog or digital) – for example motor control, actuator control, or mass-flow controllers.

**METHODOLOGY:**

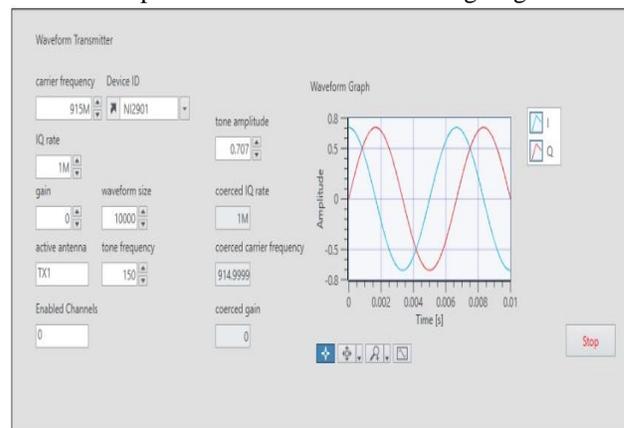
The Major Steps to follow for Spectrum Sensing and Detection

- 1)Primary Waveform Transmission
- 2)Spectrum Monitoring
- 3)Secondary Message Transmitter
- 4)Primary Message Receiver
- 5)Primary Permission Transmitter
- 6)Secondary Permission Receiver (Allowed)
- 7)Secondary(A) Waveform Transmitter
- 8)Secondary(B) Waveform Receiver (SNR-Quality Analysis)
- 9)Secondary(B) Message Transmitter (QA Result)
- 10)Secondary(A) Message Receiver (Which frequency is used).
- 11)Secondary(A) Final Waveform Transmitter.

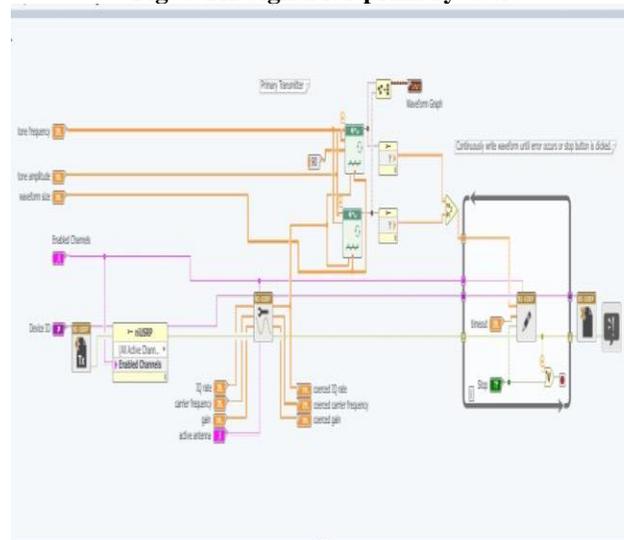
**RESULTS:**

1)PRIMARY WAVEFORM TRANSMISSION- In this the tone frequency, amplitude and transmission wave signal is set. The USRP is then configured with necessary requirements of carrier frequency, IQ rate which is approximately in the range of 100MHz sidebands and gain to set the signal strength. The antenna range and the

channels used either 1 or 0 is then set according to our need of reception or transmission of message signal.



**Fig. 5 TX Signal for primary users**



**Fig. 6 Block Diagram for PU TX**

In the block diagram we can see that output of the USRP and the signal is fed to the write data block in the while loop so that the data to be transmitted by the primary user can be continuously processed without any delay. When the primary user is not using the spectrum band the while loop will exit and go to the stop button instead.

**2)SPECTRUM MONITORING**

We monitor the spectrum by using the IQ graph and the Power Spectrum graph. The carrier frequency is approximately set to 915 MHz .Two signals one sin and the other cosine are transmitted. Number of samples are time to time adjusted to delay the buffer.

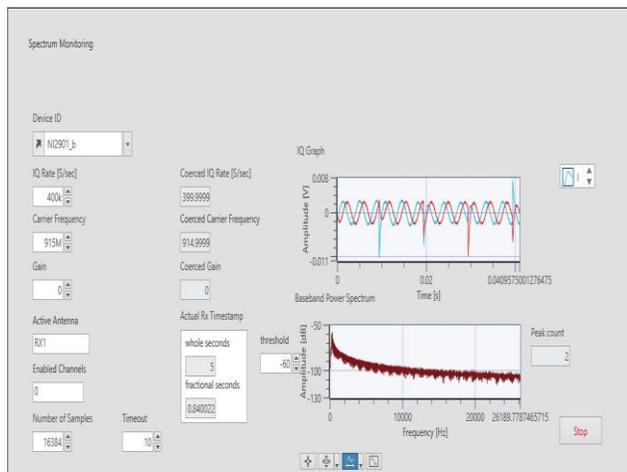


Fig. 7 Block Diagram for Spectrum Monitoring

In fig 7 block diagram it can be computed that firstly the USRP is configured then in the while loop the reading of the data is done i.e. reception of the data is done. Further the signal is fed through various FFT (Fast Fourier transform) techniques and converted to be processed. Finally, the peak is detected by the IQ rate which tells us about the sidebands of the frequency used.

If there exist more than zero peaks then it is derived that the primary user is still using the band and not free so the SU waits till it becomes free. As soon as the peak count is zero there is a free band and immediately the secondary users switches by using the conditional operators without any delay.

### 3) SECONDARY REQUEST MESSAGE TRANSMITTER

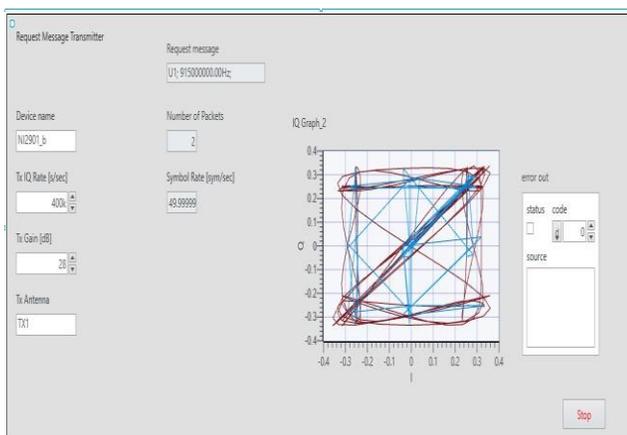


Fig. 8 SU Modulation technique detection and request message TX

At this point it is important that the number of samples sent by the primary user should be equal to the sample received by the secondary user in order to avoid any kind of buffer

or aborting of the data. Also the device name should be checked and the graph obtained during this shows the type of modulation technique that is being used i.e. here the graph travels in four major points showing that it has four times phase change which is QPSK(quadrature phase shifting key).This is applicable to all the pattern for the other techniques that will be used by the primary user and thus can be decoded by the secondary users very easily.

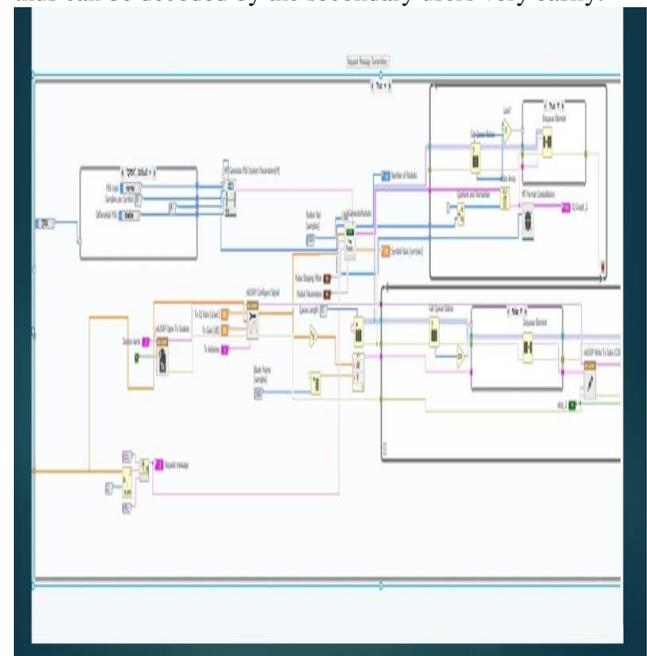


Fig. 9 Block Diagram for Message Signal Generation

An automatic generation of the message signal is generated by the secondary user is done to be transmitted. The block shows the back end working of the message signal which combines the various modulation techniques used on the signal which are then fed to the queue and dequeue section to be processed while the packets are being transferred one by one. It is helpful as it reduces the delay time for the reception of the packets.

### 4)PRIMARY MESSAGE RECEIVER- 1)MESSAGE RECEIVER CONFIGURATION

A request regarding the signal is received by the primary user regarding the authorisation of the spectrum band. It is upto the primary user only whether it allows or denies the request of the secondary users to use the free band of the primary user. The configuration of the primary user is done to receive the message and then decode the contents.



fulfilled. In order to maximise the underutilised spectrum we have been constantly working on improving the quality of the obtained signal. Thus there is still a lot of research on that is to be done in order to get the best sensing method taking minimum delay. Apart from that there are various challenges associated with the practical implementation of cognitive radio which need to be addressed and resolved very properly.

### **FUTURE SCOPE**

1)Spectrum Sensing in the wireless sensor technology- The basic concept for wireless technology today is dependent on the cognitive features.

2)Practical Implementation-In this the use of very wide band antenna could be a research challenge. Because in future the use of 28 and 38 GHz frequency signals can be potentially used with a overall band of approximately 1GHz.

3)Researching Scope- One of the most future scope of cognitive radio is in the application of mobile communication and internet technologies using fast spectrum sensing features to reduces the time and the traffic congestion. WLAN's are connected to FC that has very high signals level.

4)Direction for new invention- Femtocells over TV wide spaces, cognitive radio in the 5th Generation(5G) , LTE over TV wide spaces, multimedia services over cognitive radio networks.

5)Bluetooth- A new technology is introduced called AFW (Adaptive Frequency Hopping) to minimise interference between wireless technologies dividing 2.4 GHz unlicensed radio spectrum. Cordless phones and microwave ovens share the same wireless frequency with Bluetooth. It involves a sensing algorithm for determining the ISM band has other devices connected to it and methods to avoid them. This combines the algorithm to decide which best signal that should be transmitted.

### **REFERENCES:**

[1] S. Haykin, "Cognitive Radio : brain empowered wireless communications ," IEEE journal on Selected Areas in Communications, vol 23,no.2,pp.201-220,February 2005.

[2] I.J. Mitola , " Software Radio : survey, critical evaluation and future directions," IEEE Aerospace and Electronics Systems Magazine, vol 8,no.4,pp.25-36, April 1993.

[3] FCC, "Spectrum policy task force report ,"Tech. Rep.02-135, Federal Communications ,Commission, November 2002,Available: <http://hraunfoss.fcc.gov/edocs/public/attachmatch/DOC-228542A1.pdf>.

[4]M. A. McHenry, "NSF spectrum occupancy measurements project summary," Tech Rep., SSC ,August 2005,Available: <http://www.sharedspectrum.com/>.

[5]E. Larson and M. Skoglund, "Cognitive Radio in a frequency- planned environment some basic limits," IEEE Transactions on Wireless Communications, vol 7,no. 12,pp. 4800-4806,December 2008.

[6] A. Sahai, N. Hoven, and R. Tandra, "Some fundamental limits on cognitive radio,"in Proc. of Allerton Conference on Communication, Control ,and Computing ,October 2004,pp. 1662-1671.

[7] N. Hoven and A. Sahai, "Power scaling for cognitive radio," in Proc. of International Conference on Wireless Networks Communications and Mobile Computing,pp. 250-255 vol. 1,13-16 June 2005.

[8] H. Urkowitz , "Energy detection of unknown deterministic signals," Proceedings of the IEEE,vol. 55,no. 4,pp. 523-531, April 1967.

[9] H.L. Van Trees, Detection, estimation, and modulation theory :

Part I, John Wiley and Sons,Inc.,1968

[10] R. Tandra and A. Sahai , "Fundamental limits on detection in low SNR under noise uncertainty ," in Proc. of IEEE International Conference on Wireless Network , Communications and Mobile Computing ,June 13-16 2005,vol. 1,pp.464-469.

[11] R. Tandra and A. Sahai, "SNR walls for signal detection," IEEE Journal of Selected Topics in Signal Processing, vol. 2,no. 1,pp. 4- 17,February 2008.

# Technology-based learning using project

<sup>[1]</sup>Vipul Katiyar, <sup>[2]</sup>Vaibhav Pathak, <sup>[3]</sup>Yukti Sharma  
<sup>[1][2][3]</sup>Jaypee University of Engineering and Technology, Guna

**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.

## 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 criteria 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

1	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	
2						
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	KANISHK SINGHAL	3.1	2	1.4	3	5
23	KESHAV KUMAR	3	2	0.2	3	3
24	KRISHNA KANT ANU	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	MRADUL 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	NAVJEET 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.

### References

[1] A web-based system for project-based learning activities in 'web design and programming' course -Article in Procedia - Social and Behavioral Sciences • December 2010 {Main Idea, features of pbl}

[2] Barbara Means Technology and Education Change: Focus on Student Learning JRTE | Vol. 42, No. 3, pp. 285–307.

[3] (Drew Perkins, Director of Teach Thought Professional Development) <https://www.teachthought.com/project-based-learning/5-characteristics-of-project-based-learning-that-works/>

[4] Frances Bell (2011) University of Salford, United Kingdom. Connectivism: Its Place in Theory-Informed

Research and Innovation in Technology Enabled Learning.Vol.12.3 March -2011

[5] Ghavifekr, S. & Rosdy, W.A.W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. International Journal of Research in Education and Science (IJRES), 1(2), 175-191.

[6] [http://www.bie.org/index.php/site/RE/pbl\\_research/29](http://www.bie.org/index.php/site/RE/pbl_research/29) {PBL Defn}

[7] [https://www.bie.org/about/why\\_pbl](https://www.bie.org/about/why_pbl) {benefits,features}

[8][https://www.bie.org/blog/35\\_leaders\\_on\\_the\\_successes\\_and\\_challenges\\_of\\_project\\_based\\_learning](https://www.bie.org/blog/35_leaders_on_the_successes_and_challenges_of_project_based_learning) {PBL defn}

[9] [http://www.bie.org/about/what\\_pbl](http://www.bie.org/about/what_pbl) {PBL defn}

[10] Int. J. Technology Enhanced Learning, Vol. 9, No. 1, 2017 {Research Methodology}

[11] JOAN B. GARFIELD (1997)(University of Minnesota, USA), GAIL BURRILL(University of Wisconsin, USA)(1997) Research on the Role of Technology in Teaching and Learning Statistics. International Statistical Institute Voorburg, The Netherlands

[12] (Jelani Payne 2017) (<https://medium.com/@thinkmorenotlessinc/4-advantages-of-project-based-learning-d3faa3f94339>){benefits of pbl}

[13] John W. Thomas (2000), A REVIEW OF RESEARCH ON PROJECT-BASED LEARNING.

[14] Project Based Learning Evaluation report and executive summary November 2016 Victoria Menzies, Catherine Hewitt, Dimitra Kokotsaki, Clare Collyer and Andy Wiggins [Durham University 2016] Education Endowment Foundation (EEF) {features of pbl}

[15] Scardamalia, M., Bereiter, C., McLearn, R. S., Swallow, J., & Woodruff, E. (1989). Computer-supported intentional learning environments. Journal of Educational Computing Research, 5, 51-68.

[16] (Marcus Guido, 2006)(<https://www.prodigygame.com/blog/advantages-disadvantages-problem-based-learning/>){benefits of pbl}

[17] Nur Farha Hassana\*, Saifullizam Putehb, Rosnawati Buharic(2015). Student Understanding Through the Application of Technology Enabled Active Learning in

Practical Training. Available online at [www.sciencedirect.com](http://www.sciencedirect.com).

[18] Steven Higgins, ZhiMin Xiao and Maria Katsipataki School of Education, Durham University, The Impact of Digital Technology on Learning: A Summary for the Education Endowment Foundation.

[19] Tama Duangnamol1,2\*, Thepchai Supnithi3, Gun Srijuntongsiri2 and Mitsuru Ikeda1(2018) Computer-Supported Meta-reflective Learning Model via mathematical word problem learning for training metacognition. Duangnamol et al. Research and Practice in Technology Enhanced Learning (2018) 13:14.

[20] Ville Karavirta (2005) University of Turku, Ari Korhonen Aalto university, Lauri Malmi Aalto university Different learners need different resubmission policies in automatic assessment system available at [www.researchgate.net](http://www.researchgate.net).

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

<sup>[1]</sup> M. Nagaraj, <sup>[2]</sup> C. Ezilarasan, <sup>[3]</sup> A. John Presin Kumar, <sup>[4]</sup> Rishab Betala

<sup>[1]</sup> Research Scholar, Department of Mechanical Engineering, Hindustan University, Chennai, India

<sup>[2]</sup> Professor, Department of Mechanical Engineering, SMK Fomra Institute of Technology, Chennai, India

<sup>[3]</sup> Associate Professor, Department of Mechanical Engineering, Hindustan Institute of Technology and Science, Chennai, India, <sup>[4]</sup> Design Engineer, ARE PEE Polymer, Gummidhipoodhi, India

**Abstract:**— The tool wear predictions in drilling of Nickel based super alloys is performed using artificial neural networks on MATLAB 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.

## 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.

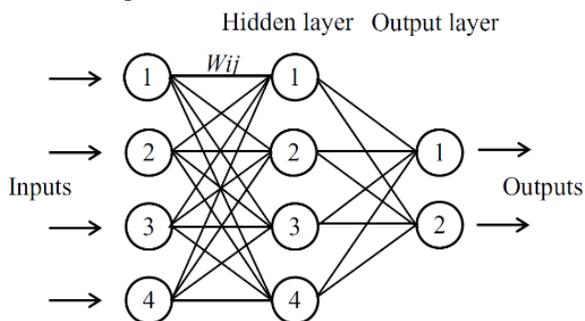


Fig 1 Multi-layer Perceptron

### 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

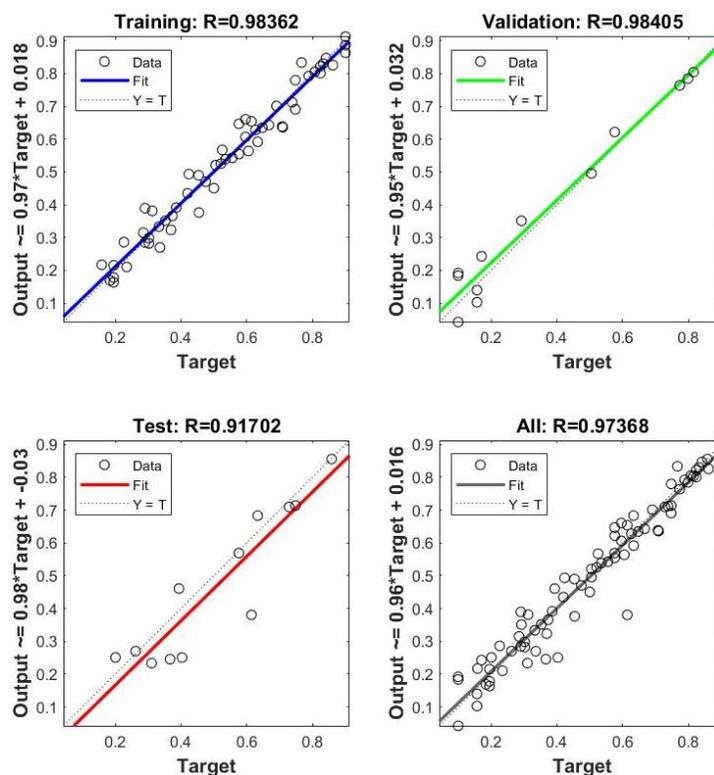


Fig 3 Regression Plot for the Neural Network

### 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  $10^{-4}$ (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.

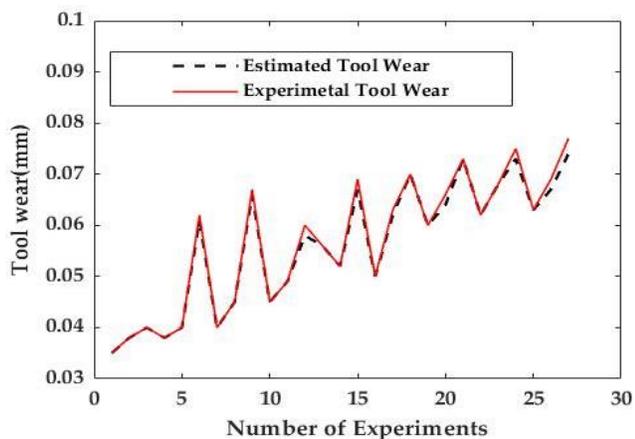


Fig 4 Comparison of the Experimental and Estimated Tool Wear

## CONCLUSION

Using the neural network approach, the tool wear of the AICrN 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.

## REFERENCES

- [1] Dahbi, S., Ezzine, L., & Moussami, H. E. (2017). Modeling of cutting performances in turning process using artificial neural networks. International Journal of Engineering Business Management 2017; Vol 9.
- [2] Panda SS, Singh AK, Chakraborty D and Pal SK. Drill wear monitoring using back propagation neural network. Journal of Materials Processing Technology 2006; 172(2): 283-290.
- [3] Raphael Corne, Chandra Natha, Mohamed El Mansori, Thomas Kurfess. Enhancing Spindle Power Data Application with Neural Network for Real-Time Tool Wear/Breakage Prediction during Inconel Drilling. Procedia Manufacturing 2016, Vol 5: 1-14.
- [4] Drouillet C, Karandikar J, Nath C, Journeaux AC, El-Mansori M and Kurfess T. Tool life predictions in milling using spindle power with the neural network technique. Journal of Manufacturing Processes 2016; 22: 161-168.
- [5] Goh ATC. Back-propagation neural networks for modeling complex systems. Artificial Intelligence in Engineering 1995; 9(3): 143-151
- [6] Zhang G, Patuwo EP and Hu MY. Forecasting with artificial neural networks: The state of the art. International journal of forecasting, 1998; 14(1), 35-62

# What Are Language, Nature, and Language Acquisitions? What Speech Is the Verbal Means of Communicating in English Language Teaching (E.L.T)

<sup>[1]</sup>Prakash s. Chauhan

<sup>[1]</sup>Department of English, Comparative Literature and Translation Studies (C.L.S.), Saurashtra University (NAAC), Gujarat, India

**Abstract:**-- “Language” the word plays very deep and extraordinary meaning since the birth of human being. Since human get notion and action he did not know they can speak and this feature is given by god that we believe in philosophy or in religious manner but, if we believe it as scientific manner also. Language played very great role since the born of homosapians on planet Earth. This feature or power only have human beings only on planet earth whether you look animals or mammals or other human revolutionary species they are not able to speak no doubt! They have voice but they don’t talk like us like we talk. They have their own specific language but we don’t understand it and they don’t understand our language. They barking but we can’t hear a chaste voice like we human speak during the conversation. That’s why it is known as god gifted power, human physical ability or scientific process of air. Human beings are that’s why different from the animals and due to this feature human and animals belongs to different categories.

Since, the time of human’s intelligence, power and revolution of body they get their rules on each and every species of the earth whether it is dinosaurs, mammoth, or elephants. Human’s these three abilities are concerned they still live long centuries to centuries.

If we talked about globally, glocally, or locally human beings are not become mum if you give them temptation they will not accept because not a single human can’t live without speaking ; human’s needs and their goals is concerned they have to intercourse with each other “Language” known as first and for most option for them.

Now,if we talk about globally, our planet Earth divided into 7 continentals. Where there are (Asia, Russia, Australia, North America, Latin America, Africa and Canada) these continental have their National Languages and Sub National Languages.

For Examples: -

**Hindi** —————> (First Indian National Language)

**English** —————> (Second Language)

**Gujarati** —————> (State Level National Language)

**Ahmadabadi** —————>(Sub Metro City State Level Language)

**Kathiyavadi** —————>(Sub City State Level Language)

**Talpadi** —————> (Sub Village Level Language)

So, since the time of incarnation of human being to eternity of Planet Earth Language is always remain immortal from the side of Human being (Homosapians).

What is Language? What speech is the verbal means of communicating:-

“Language is the Human capacity for acquiring and using complex systems of communication; a language is any particular example of such a system. The scientific study of language is called Linguistics. Language is the most important aspect in the life of all beings.”

We human use language to express our inner musings(thoughts) and emotions, make sense of complex and abstract thoughts, to learn to communicate with others, to fulfill our wants, needs even as well as to establish rules and maintain our culture and civilization. Language can be defined as following.....

<b>BASIC FORM OF COMMUNICATION</b>
<i>VERBAL FORM</i>
<i>PHYSICAL FORM</i>
<i>BIOLOGICALALLY INNATE FORM</i>
<i>SYMBOLICAL FORM</i>

Every so often, they will refer to language as verbal behavior. It is language that includes gesture, posture (body movements) as well as spoken word. When we define language then we have to be careful not to exclude symbols, gesture or motions. This is for the reason that if we exclude these from our definition, and we will be denying the language of the deaf community. (All human languages share basic characteristics. Some of them are organizational rules and infinite generativity. Infinite Generativity is the ability to produce an infinite number of sentences using a limited set of rules and words.

**“Language is different form speech.**

**Language is made up of socially shared rules.”**

That include the following.....

1. What words mean for examples: - “STAR” can refer to a bright object in the night sky or a celebrity.
2. How to make new words for example:- “Friend, Friendly or unfriendly”
3. How to put words together for example:- let’s say “Peg walked to the new store.” Instead of “Peg walk store new.”

Speech is the verbal means of communicating. Speech consists of the following.....

**1. Articulation:-**

How speech sounds are made

**For Example:** - children must learn how to produce the “r” sound in order to say “rabbit” instead of “wabbit”.

**2. Voice:-**

Use of the vocal folds and breathing to produce sound

**For examples:** - the voice can be abused from overuse or misuse and can lead to hoarseness or loss of voice.

**3. Fluency: -**

The rhythm of speech

**For example:** - hesitations or stuttering can affect fluency.

When a person has trouble to understanding others (receptive language) or sharing

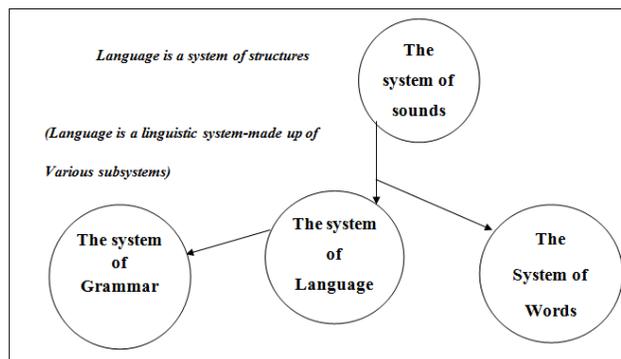
thoughts, ideas and feelings completely (expressive language) then he or she has a language disorder.)

When a person is unable to produce speech sounds correctly or fluently or has any disorders or problems with his or her voice then he or she has a speech disorder.

**For example:** - Leonard has a speech disorder that makes him hard to understand. If, her lips, tongue, and mouth are not moved perfectly at the right time or right place then what he says will not sound pure as well as rightly hearable. Children who stutter and denizens (folks) whose voice sounds rough or thick and muscular have speech problems.

Elaina has a receptive and expressive language disorder. She does not have a good understanding of the meaning of words and how and when to use them. Because of this, she has trouble including directions and speaking in long sentences. Large segment of adults suffer from (with) aphasia and children with learning disabilities have language problems.

Language and speech disorders can occur together or by themselves. The problem can be mild or severe. In any case, a comprehensive evaluation by a speech-language Pathologist (S.L.P) certified by the American Speech-Language-Hearing Association (ASHA) is the first step to improving language and speech problems.



The Swiss scholar Ferdinand De Saussure is an associationist. He believes and states that.....

**“All language items are essentially interlinked.”**

He argues that.....

**“Language was like a game of chess, a system in which each and every item is defined by Its relationship to all the others.....language is a carefully built and diagnosed structure of interwoven elements”.**

The cognitivists believe that.....

**“Everybody learns a language, not because they are subjected to a similar conditioning process but, because they possess an inborn capacity which permits them to acquire a language as a normal maturational process.**

**This capacity is by definition universal.....  
the nature of postulating an innate mechanism of a fairly well-defined kind”.**

According to Noam Chomsky is concerned.....

**“.....a theory of the “initial state” of the language faculty, prior to any linguistics experience.”**

The structuralist places emphasis on the surface structure/ (pattern...etc. the transformationalist lays emphasis on the processes of the deep structure and the stress in on learning to learn the development of a strategy of learning rather than the accumulation of information and rules. The structuralist tends to overemphasize the surface forms and the development of rules and to neglect the meanings.

Natural language learning principles are not “invented” by anyone but, since it imitates first language learning that had been done for centuries. It was first introduced in France and Germany and popularized by Berlitz . Proponents are L.Sauveur: used intensive oral interaction in target language and used Questions to present and elicit language.

According to F.Franke’s statement is concerned.....

**“Language is taught best by using it actively, and teachers are encouraged to use direct and spontaneous teaching.”**

Beliefs about knowledge of language are equal ability to speak it. L2 learning must be an imitation of L1 learning. Keep away printed word as long as possible then followed by written word and avoid grammar/translation.

The key elements are:

- I. Class is conducted only in the target language.
- II. Oral teaching precedes reading/ writing activities
- III. Grammar is taught inductively
- IV. Concrete vocabulary taught using regalia
- V. Teach through modeling and practice
- VI. Small groups
- VII. Attention to pronunciation
- VIII. Known words used to teach new vocabulary using mime, demonstration and pictures.

The techniques were as follows.....

- I. Reading aloud
- II. Question/ answer exercise
- III. Self-correction
- IV. Conversation practice
- V. Fill-in-the-blank exercise
- VI. Paragraph writing

The commandments were as follows....

- I. Never translate: demonstration
- II. Never explain : act
- III. Never speak with single words: use sentences
- IV. Never use the book : follow your lesson plan
- V. Never go to fast: keep the pace of the student
- VI. Never be impatient : take it easy

**Advantages:**

- I. Teaches the language, not just about the language.
- II. Natural method-mimic first language acquisition
- III. Teaches vocabulary through real life.

**Criticism:**

- I. Second language should not be taught in the same way as the first language
- II. Too extreme-avoiding native tongue
- III. Does not meet needs of educational systems

Views	Language	Language Learning
<i>Structural</i>	Language is a linguistics system made up of structural rules and vocabulary	To learn structural items. (vocabulary and grammar (sentence patterns)
<i>Functional</i>	Language is a linguistic system as well as a means for doing things (to be used in real life)	To know how to combine the grammatical rules and the vocabulary to express notions that perform the functions, communicative categories communicative ability (to be able to communicate)
<i>Interactional</i>	Language is a communicative	Not only to know the grammar and vocabulary

	tool to maintain social relation	of the language, but also to know the rules for using them in a whole range of communicative contexts.  To communicate appropriately (communicative strategies, cultural awareness, etc.)
--	----------------------------------	---

What is Nature? How it is different from nurture?

“The role of nature is social experience whereas the role of nature is natural ability.”

The character of natural ability:-

- Humans are born with a natural ability or innate capacity to learn any language.
- Naturally, it is the “given” capability. For the meantime, languages are complex and children can learn languages quickly. There is not any one way that can “learn” the language.
- Understanding children to be able to develop more abilities when they grow up as children mature they develop their language abilities.
- Individual variation may occur in learning. The rate of learning can differ but, then the stages are same for everyone which he/she has to go through
- If, the process does not happen at a young age then he/she will never learn the language later.
- The importance of social experience
- Children will never acquire language unless that language is used with them and around them. It does not matter which is their language.
- Immigrant children do not have interaction with their background. Therefore they will never learn the language.
- As long as children are experiencing input and social interaction, the rate and system of development doesn’t change.
- The only thing that may change is their pronunciation, vocabulary and social function.
- L1 is Mother tongue and L2 is the Medium of instruction for language learning.
- Initial state children have knowledge about language structures and principles
- Intermediate state they have basic language development final state-outcome of language learning

Initial State:-

- L1 – innate capacity
- L2 – innate capacity
  - L1 knowledge transfer
  - World knowledge
  - Interaction skills

Final State:-

- L1 = native competence (language fluency like a native speaker)
- L2 = Multilingual competence (never be a “native speaker” level of proficiency is variable)
- Still face interface of L1 (“solidification)

**Meaning of Language Acquisition:-**

The term “Acquisition” was originally used to emphasize the subconscious nature of the learning process however in recent years; learning and acquisition have become largely synonymous. Language acquisition is the process by which humans acquire the capacity to observe and comprehend language in addition to produce and use words and sentence to communicate.

**“Language acquisition is one of the classic human traits, because non-humans do not communicate by using language.”**

Language acquisition generally refers to first-language acquisition which studies infants’ acquisition of their native language. This is distinguished from second-language acquisition which deals with the acquisition in both children as well as in adults of additional languages.

The ability to successfully use language requires one to acquire a wide range of tools which includes phonology, morphology, syntax, semantics and an extensive vocabulary. Language might be vocalized as speech or manual as in sign. The human language capacity is finite; one can say and understand an infinite number of sentences which is based on a syntactic principle called Recursion. Evidence suggests that every individual has three recursive mechanisms suggests that every sentences to go indeterminately. These three mechanisms are relativization, complementation and coordination. The capacity to acquire and use language is a key aspect that distinguishes humans from other beings. Though it is difficult to pin down what aspects of language are uniquely human. There are a few design features that can be found in all known forms of human language however that are missing from forms of animal communication.

For example: - many animals are able to communicate with each other by singing or signaling to the things around

them but then again this kind of communication lacks the arbitrariness of human vernaculars. There is nothing about the sound of the word “dog” that would hint at its meaning. Other forms of animal communication may utilize arbitrary sounds but are unable to combine those can at that time be automatically understood by another.

Hockett called this.....

#### **“Design feature of human language “productivity”.**

It is important to the understanding of human language acquisition that we are not limited to a finite set of words but, somewhat must be able to understand and utilize a complex system that allows for an infinite number of possible messages. Therefore while many forms of animals’ communication exist but they differ from human languages and they have a limited range of non-syntactically structured vocabulary tokens that lack cross cultural variation between different groups. Language acquisition capacities are picked up by infants from the linguistic input. Input in the linguistics context is well-defined as “all words, contexts, and other forms of language to which a learner is exposed, relative to acquired proficiency in first or second languages”. Nativists find it difficult to believe by considering the tremendously complex nature of human languages. The relatively limited cognitive abilities of an infant those are able to acquire most aspects of language without being clearly taught. Children within a few years of both understand the grammatical rules of their native language without being openly taught, as one learns grammar in school. A range of theories of language acquisition have been proposed in order to explain this apparent problem. These theories in natism and psychological nativism, in which a child is born prepared in some manner with these capacities. As opposed to other theories in which language is simply learned as other cognitive skills including such ordinary motor skills as learning to ride a bike. The conflict between the theories assuming humans are born with syntactic knowledge. Those who claim all such knowledge is the product of learning from one’s environment are often referred to as the “Nature vs. Nurture” debate. Some consider that there are some qualities of language acquisition that the human brain is automatically wired for a “nature” component and some think that are shaped by the specific language environment in which a person is raised “nurture” component. Others, specifically evolutionary biologists, strongly object to assume syntactic knowledge is genetically encoded and provided by automatic wiring of the brain.

#### **CONCLUSION**

In short, we come know that at how much level language is important in the world; but somehow it also give us the

knowledge that how language is used and will be used in worldly manner also and this research paper also bring the reader to the world of English Language Teaching (E.L.T) where we can see some different charm and importance in different linguistic ways.

#### **BIBLIOGRAPHY**

1. Halliday, M.A.K Strevence, P.D and McIntosh, A. The Linguistic Sciences and Language Teaching, Longman, 1964.
2. O’Donnel, W.R, applied Linguistics and the Teaching of English Longman.
3. Lado, R, Language Testing: The Construction and Use of Foreign Language Tests Longman, 1957.

