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COMMON

DIRECTOR'S FOREWORD

The Research Collection of MARA-Japan Industrial Institute, Beranang (MJII) is the first and foremost publication from MJII, in which all research articles are complied from the lecturer in this college. The purpose of this collection is to gather the research done by the lecturers, with the expectation that it will be benefited to all students and lecturers in MJII specifically and the whole MARA in general. Since all the research articles are written by MJII lecturers, it is also hoped that the credibility of these lecturers can be acknowledged.

Articles published in this collection are intended to increase society's awareness on new ideas and practices in relation with innovations and services, as well as to expand the readers' spectrum. Furthermore, with this punlication, it is hoped that it will become a good platform for sharing the research findings, to foster the new creation as well as to innovate the existing products and services. I also wish that this effort will inspire other lecturers to write research, hence the publication of the research articles can be continued.

Lastly I would like to acknowledge all the writers with a deepest thank you for their contributions to The Research Collection of MJII.

HAJAH ZARINAH BT IDRUS
DIRECTOR
MJII BERANANG

EDITOR'S PREFACE

This is the first volume of research collection for MARA-Japan Industrial Institute, Beranang (MJII). The idea to publish this collection is to gather all the researches that have been conducted by the lecturers from all programme at MJII.

The programmes involved in this research collection are as below:

1. Robotics and Automation
2. Measurement and Control
3. Data Transmission and Network
4. Microelectronic
5. Embedded System
6. General Studies

Hopefully, this research collection will be a good platform for all lecturers at MJII to start writing research paper and documenting the technical skills of findings, recording information and the intellectual skills of understanding the material, developing original ideas, and making informed judgements in a proper and systematic way.

EDITOR
MOHD MUHAYMIN BIN MUHAMAD

ELECTRONIC

DESIGN AND MODELLING OF 6 DOF REVOLUTE ROBOT USING FUZZY PID CONTROLLER

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Abstract: Designing a robot manipulator with great performance is one of the fields of interest in the industry. This is due to the nonlinearities and input couplings presented in the dynamics of the robot arm. This project report is concerned with the problems of modelling and control of a 6 degree of freedom direct drive arm. The research work was undertaken in the following five developmental stages; Firstly, the complete mathematical model of a 6 DOF direct drive robot arm including the dynamics of the brushless DC motors actuators in the state variable form is to be developed. In the second stage, the state variable model is to be decomposed into an uncertain model. Then, the Fuzzy PID Controller is applied to the robot arm. In the fourth stage, the simulation is performed. This is done through the simulation on the digital computer using MATLAB/SIMULINK as the platform. Lastly, the performance of Fuzzy PID controller is to be compared with the conventional controller which is PID. The simulation results show that the output performance of Fuzzy PID is greater than the performance of conventional method of PID controller.

INTRODUCTION

A robot manipulator system often consists of links, joints, actuators, sensors and controllers. The links are connected by joints to form an open kinematic chain. Robot manipulator consists of a collection of n-links to move in the robot workspace. The total maximum points that the end effector can reach is called robot workspace. Both end of the robot is attached to the base and another end is equipped with a tool (hand, gripper or end-effector) to perform an operation or tasks

The joints used to connect the robot links can be prismatic or rotary. Prismatic joints can be described as sliding joint which the relative displacement between links is a translation. Figure 1 shows the symbol of prismatic joint. Joint distance, d is a translation distance of the previous frame (axis x, y & z) along the z axis.

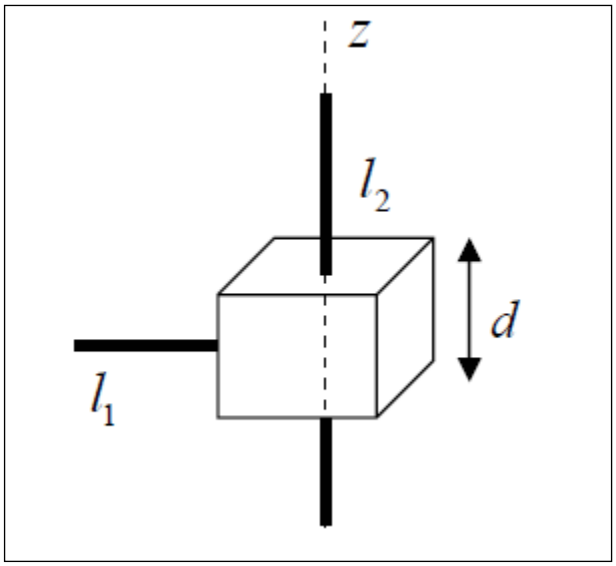

Figure 1: The symbol of prismatic joint [10]

Rotary joint can be explained as having revolute joint with angle θ is rotated with respect to the z axis. Figure 2 shows the symbol of rotary joint.

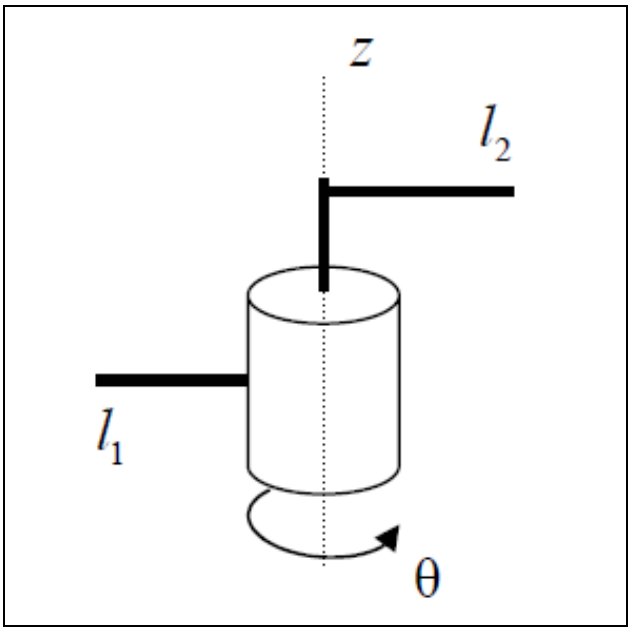

Figure 2: The symbol of rotary joint [10]

In a robot manipulator, the number of DOF is refers to the number of independent joint variables that would have to be specified in order to locate all parts of the mechanism. For example, a robot manipulator is usually defined with a single variable; the number of joints equals the number of degrees of freedom. If a robot manipulator has 6 independent joint variables, so that the robot has 6 DOF.

Robot manipulator can be classified based on the geometric types and the configuration of the robots. For example, if all joints of robot manipulator are prismatic, the robot is known as Cartesian manipulator while the robot with rotary joint is known as a revolute robot or articulated robot.

Figure 3 and Figure 4 show the Cartesian robot and articulated robot respectively. There are another three types of robot geometric configuration

which is cylindrical, spherical and SCARA. This project focused on the analysis of 6DOF robot with articulated robot configuration.

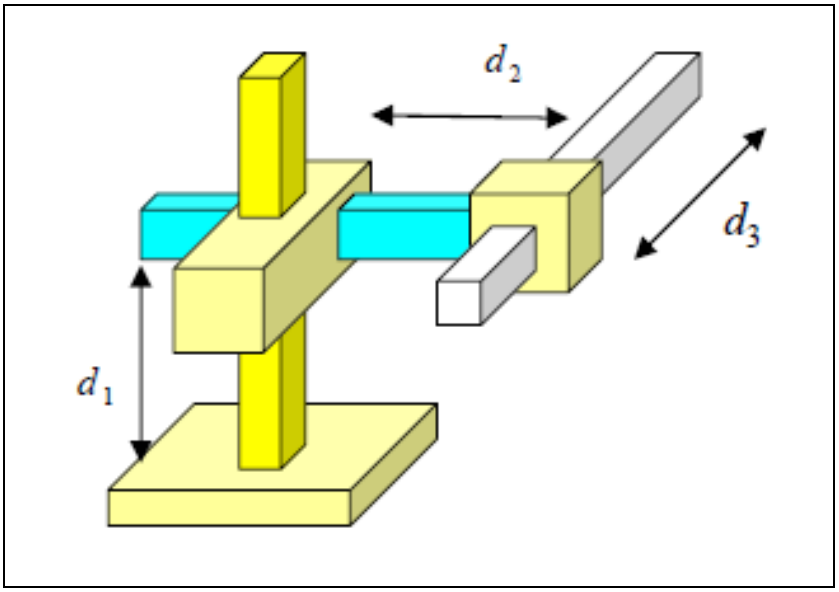

Figure 3: Cartesian robot [10]

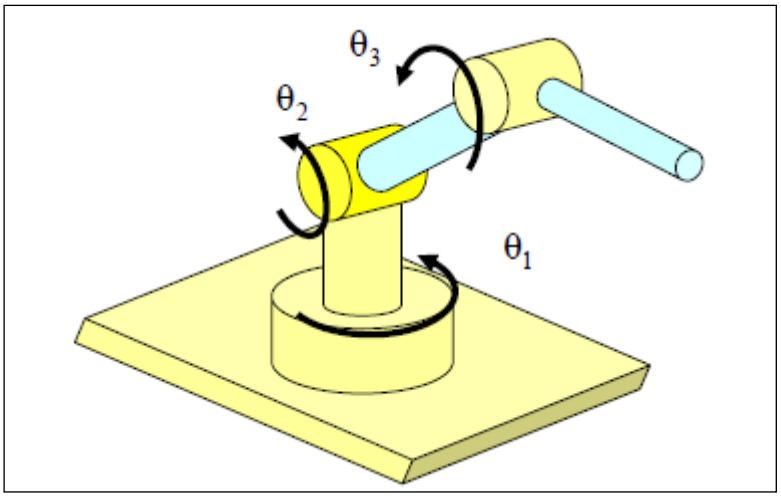

Figure 4: Articulated robot [10]

METHODOLOGY

In accomplishing this project, the scope of the work has been divided into a few parts. The first part is to design CAD model of 6 DOF robot arm. The second part is to design the PID and fuzzy-PID controller for the robot arm for comparison purpose. The third part is to perform simulation using MATLAB/Simulink. The last part is to analyze the output performance of both controllers. The research methodology flow chart is shown in Figure 5.

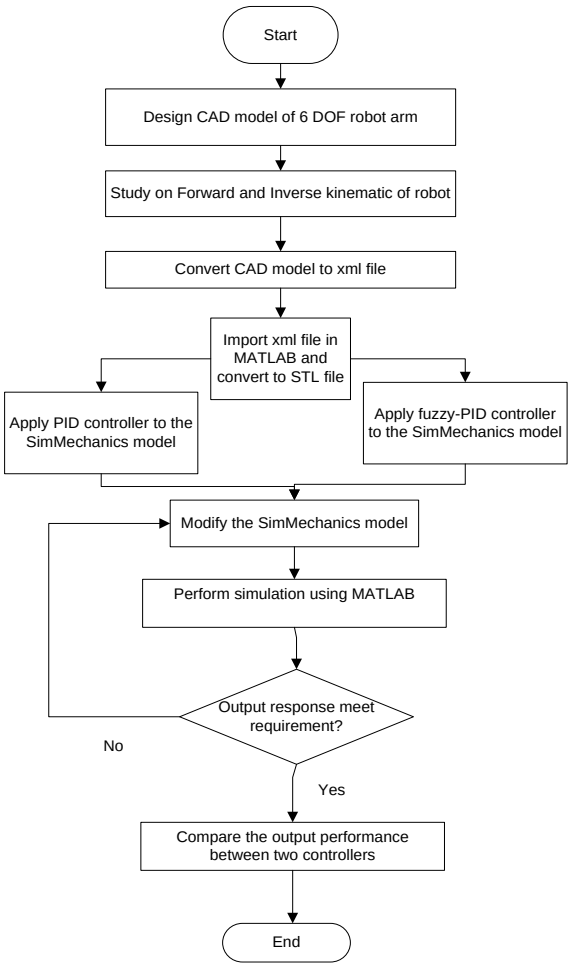

Figure 5: The Flow Chart of Research methodology

RESULT, ANALYSIS AND DISCUSSION

MATLAB and SIMULINK were used to simulate and evaluate the performance of the proposed controllers that are applied on the robot. The two types of control algorithms are PID controller and FLC were implemented to control the 6 DOF revolute robot arm using an independent joint control mechanism. The purpose of the two controllers used was to improve the performance of the robot arm to acquire the desired tasks.

1) Simulation Using PID Controller

In order to study the performance of the proposed controller, simulation studies have been conducted to check the efficiency of the system. The PID controller was tested as the first attempt to control the robot arm. Figure 6 and Figure 7 show the output response of the motors of the 6 DOF robot arm using PID controllers.

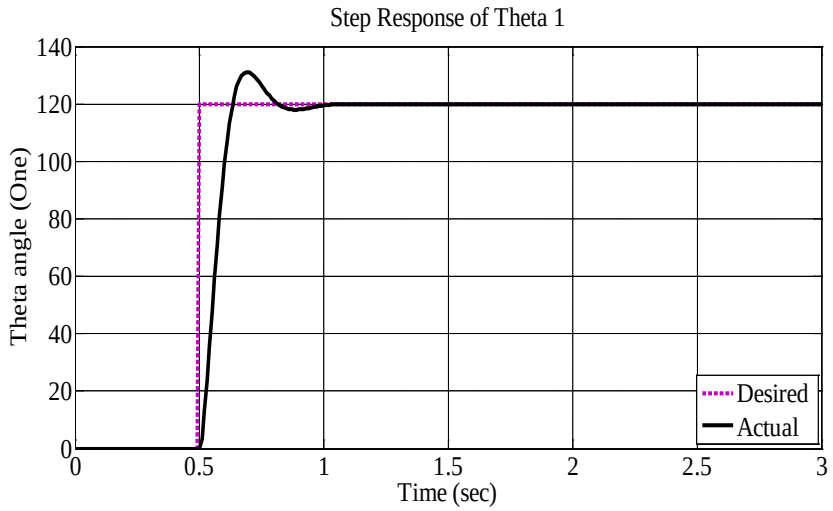

Figure 6: PID control step response for $\theta 1$

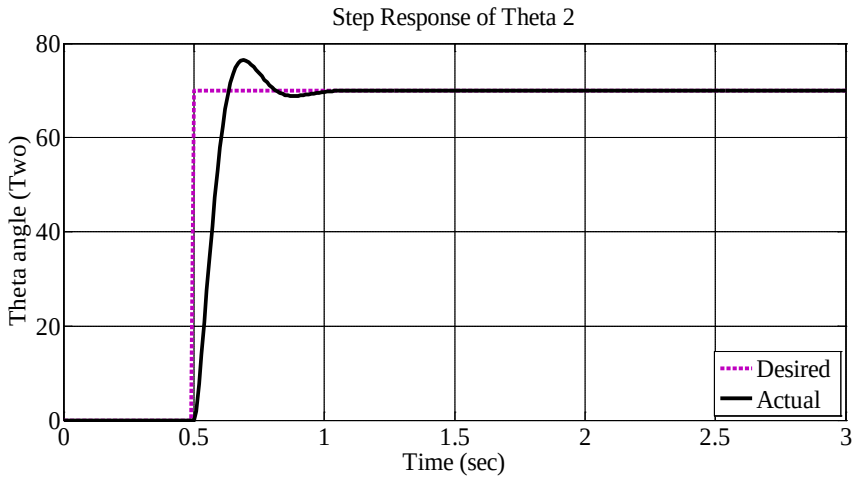

Figure 7: PID control step response for $\theta 2$

Table 1 tabulated the performance of the six motors using PID controller.

Table 1: Performance of the PID controller

Theta	System characteristics		
	Rise time (t_r) sec	Overshoot (O.S)	Settling time (t_s) sec
$\theta 1$	0.0928	11.00	0.4657
$\theta 2$	0.0814	6.50	0.4190
$\theta 3$	0.0929	9.30	0.4600
$\theta 4$	0.0930	5.55	0.3900
$\theta 5$	0.0931	4.10	0.3800
$\theta 6$	0.0930	1.85	0.4000

The effect of disturbance is studied by performing simulation of the control system in the presence of the disturbance. The disturbance is considered as the load torque that was applied to the motor for each joint. Step input disturbance was used in the simulation. Figure 8 shows the effect of the disturbance on the output response of $\theta 1$. The feed forward method was

applied to the motor for each joint to reject and eliminate the output angular deviation.

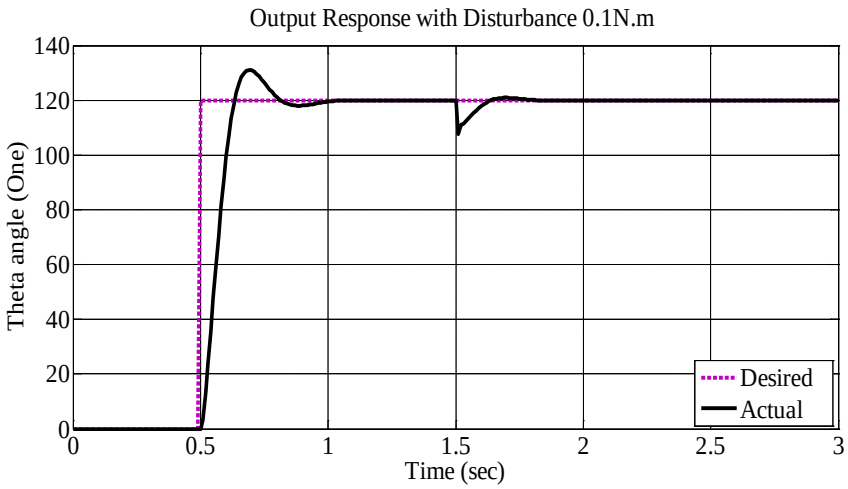

Figure 8: PID control step response with disturbance for $\theta 1$

2) Simulation Using Fuzzy PID controller

Fuzzy PID controller was applied to the 6 DOF robot arm. The output response of the sixth joint of the robot arm was analysed using step input signal. Figure 9 and Figure 10 shows the output response of the Fuzzy PID controllers using step input signal.

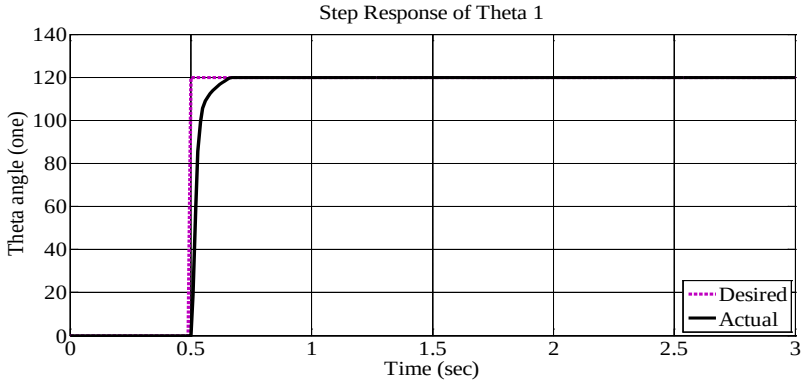

Figure 9: Fuzzy PID control step response for $\theta 1$

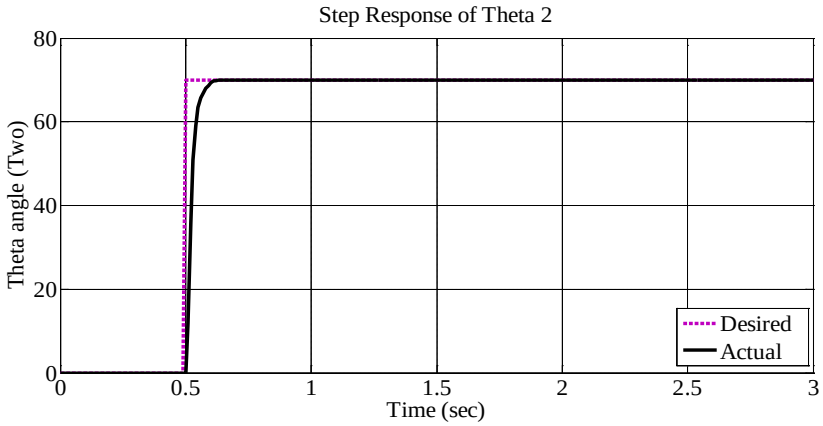

Figure 10: Fuzzy PID control step response for $\theta 2$

It is clear from the Figure 9 and Figure 10 that the response obtained using the fuzzy logic controller is better than the response of PID controller. Table 2 shows the performance results for the motors of the robot manipulator using Fuzzy PID controller.

Table 2: Performance of the Fuzzy PID controller

Theta	System characteristics		
	Rise time (t_r) sec	Overshoot (O.S)	Settling time (t_s) sec
$\theta 1$	0.0502	0.00	0.1600
$\theta 2$	0.0381	0.00	0.0947
$\theta 3$	0.0423	0.00	0.1168
$\theta 4$	0.0397	0.00	0.0753
$\theta 5$	0.0362	0.00	0.0629
$\theta 6$	0.0295	0.00	0.0458

Simulations and numerical results which compare between PID controller and fuzzy logic controller prove that the performance of fuzzy logic controller is better than the PID controller performance for controlling robot manipulator in terms of reducing overshoot size, enhancing rising time

and minimizing settling time. The rising time for the Fuzzy PID is 68% less than PID controller. The settling time for the Fuzzy PID is 88.5% less than PID controller. The overshoot of Fuzzy PID is 100% less than the PID controller. There is no overshoot for Fuzzy PID controller.

The effect of disturbance was also studied and applied to the fuzzy PID controller. Step input disturbance was used in the simulation. Figure 11 shows the effect of the disturbance on the output response of $\theta 1$. The feed forward method was applied to the motor for each joint to reject and eliminate the output angular deviation.

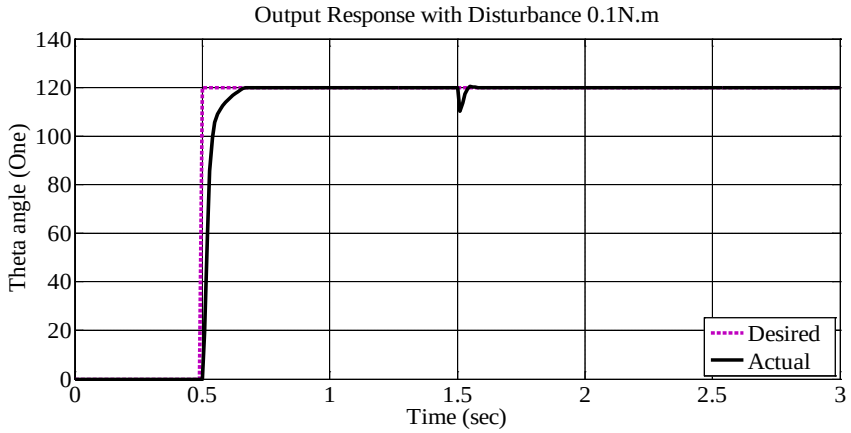

Figure 11: PID control step response with disturbance for $\theta 1$

3) Simulation Using Fuzzy PID and PID controller

Figure 12 shows the comparison between Fuzzy PID and PID controller. Simulation result shows that the Fuzzy PID controller has good performance compared to the PID controller.

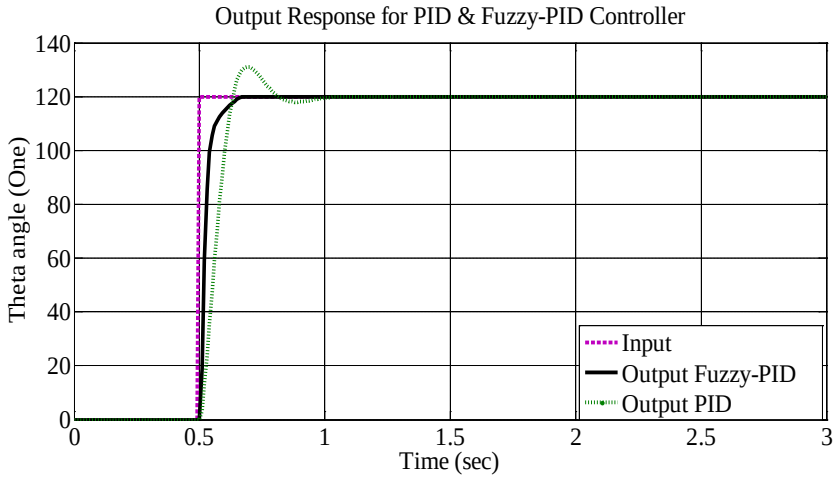

Figure 12: Output response for $\theta 1$ for both controllers

CONCLUSION

Robotics has recently becoming an interesting area of research. In this project report, the study of robot manipulator comes from two different aspects: modelling and control. Modelling process includes kinematic analysis and DC motor modelling. This process is important before controlling the real robot to save the robot from being damaged. Appling a control technique is important to guarantee high efficiency and lower error for the motion of the robot.

The desired tasks were accomplished using three stages: the first stage was to provide systematic rules for analysing forward and inverse kinematics solutions for the robot manipulator with revolute using DH parameters, then analysing the mathematical model of the DC motor in both frequency and time domains. In the second stage, the problem of control techniques was discussed. PID controller was applied to control the robot manipulator and then Fuzzy PID was implemented. Fuzzy PID was considered as a second choice to control the robot. In the third stage, the result of using

both controllers for controlling the robot manipulator was compared. All simulations were presented using MATLAB and SIMULINK, which are widely used in control applications.

The simulations and numerical results of the previous controllers were presented in this report. It is proven that the Fuzzy PID is more efficient in the time response behaviour than the PID controller. The rising time for the Fuzzy PID is 68% less than PID controller. The settling time for the Fuzzy PID is 88.5% less than PID controller. The overshoot of Fuzzy PID is 100% less than the PID controller. There is no overshoot for Fuzzy PID controller. These numerical results showed that the Fuzzy PID gives satisfactory results in tuning PID parameters compared to traditional methods. To summarize, the obtained results achieved the desired performance in terms of improving time response as expected.

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CLASSIFICATION OF EEG SIGNALS FOR HUMAN COMPUTER INTERFACE (HCI) APPLICATION

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Abstract: Brain Computer Interface (BCI) is one of Human Computer Interaction (HCI) application used as alternatives available in situation when all other typical interface such as joystick is not an option. This situation is generally true for users with severe motor impairment such as spinal injury who are unable to control wheelchair. In this research, method to classify EEG signals for controlling wheelchair for severe impairment users is proposed. The proposed system will be using a low-cost consumer grade device, Neurosky Mindwave Mobile, to safely measured and acquired EEG data. Two types of model are proposed, the first one is based on visualizing colour model, and the other one is imagining doing motor task. Colours chosen are cyan, black, green and yellow as these colours are proven to generate high brain activity. For mental task, subjects are required to imagine doing motor task such as running, kicking, juggling, and signing a song. Data acquired will then go through simplest pre-processing stage to obtain signal contain enough information for classification. Classification implemented using linear classifier, Support Vectro Machine as EEG brainwave is presumed to be linear. Results by trying different combination of task were analyzed to deduct the best way to classify direction which might work for controlling wheelchair.

INTRODUCTION

Standard joystick provided for electric wheelchair is unable to accommodate users with severe impairments. According to Simpson [1] the disabilities may due to several reasons such as cerebral palsy or cognitive impairment. Patient cannot use a power wheelchair because they lack of requisite motor skills and strength. Fehr, Langbein and Skaar [2] concluded that "individuals indicate with severe disabilities which compromise respiratory drive and/or limit the dexterity of the head and hands have few options for steering a power wheelchair". Input devices based on cues or actions generated from the head (e.g., facial, brain, gaze, tongue and bite) can be possible media for such users at all levels of injury [3]. The use of brain waves is the best alternative for users with severe motor impairment (e.g. spinal cord injury) to control wheelchair since they are lack muscle control and in worst cases they are unable to control the movement of arms and legs. To do so, electroencephalography (EEG) signal patterns can be used to capture the different pattern of brain waves. The EEG signal need to be acquired, classified and grouped into different actions such as forward, reverse, right and left.

This project builds upon previous project - Enhancing Wheelchair Maneuverability for Severe Impairment Users [4]. Two modules were proposed in previous project in order to enhance wheelchair maneuverability. The first one was the alternative hybrid input interface to issue control easily and second one is semi-autonomous driving assistance to assist the user's mobility in difficult situation.

The project's aim is to expand the capabilities of the first one (alternative hybrid input interface) by introducing brainwave as hands-free interface (HFI). This method however will not be used to continuously control

the wheelchair because the user needs high level of concentration and if it is used in full–time operation, user will find it tiring and not practical. Therefore, the signal from brainwave will be extracted and classified according to user's intended direction only such as forward, reverse, left and right. The rest will be taken care of by semi-autonomous driving assistance done in previous project.

METHODOLOGY

Method used in the classification of EEG signals to control wheelchair for severe impairment users is shown in Figure 1.

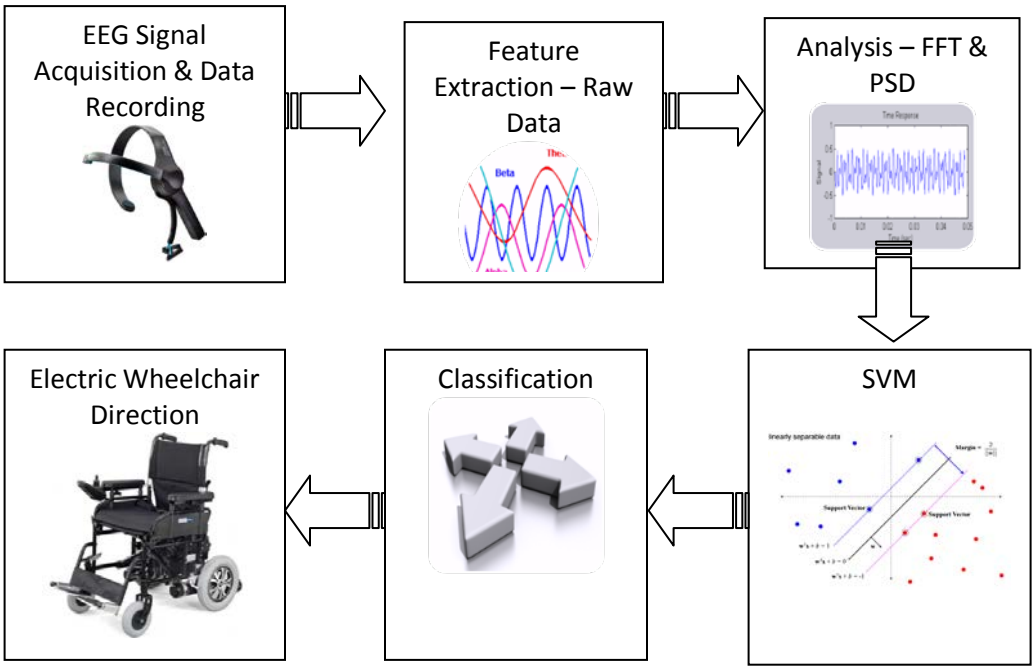

Figure 1: Overall diagram showing method used in the classification of EEG signal to control wheelchair for severe impairment users.

The main aim of this system is to utilize the most economical means of extracting the brainwave so that it will be available as one of the HCI used to maneuver the wheelchair for severe impairment user. Therefore, EEG signal

acquisition process will be done by using Neurosky Mindwave Mobile (M003), a low-cost consumer grade product. Graphical User Interface is used to collect raw data from the Mindwave Mobile to determine whether the data obtained can be mapped out to classify different direction based on user's intention. Fast Fourier Transform will be used to obtain the frequency component in time domain signal from raw data. Data obtained (both in frequency domain and power spectrum) will be tested offline in Phyton using SVM. The output will be classified to four directions: forward, backward, left and right based on user's intention.

EEG Signal Acquisition

The main component of Neurosky Mindwave Mobile as shown in Figure 2 consist of EEG electrode which is placed at FP1 in 10/20 International Standard Electrode Placement System, and an ear clip to picks up environment noise generated from the body movement and other electrical devices such as laptop and power outlet. The ear clip functions as a ground and reference in order for the Mindwave Mobile to filter out noise and focus on brainwave.

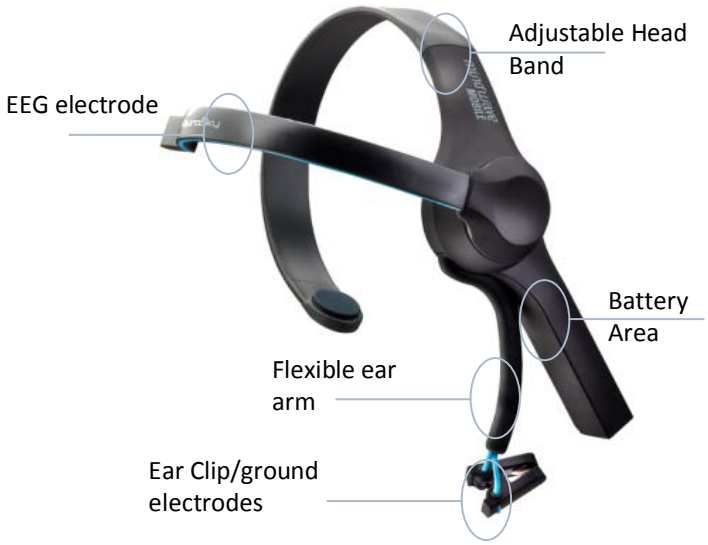

Figure 2: Neurosky Mindwave Mobile.

This device was design to be connected with computer using Bluetooth and able to generate output of raw data sampled at 512Hz. An attention value was recorded as benchmark. Data will only be recorded when attention value reach certain level.

Data Recording

Data for both model (imagine mental task and colour visualization) recorded for each participant in office with an uncontrolled environment. Ten-second recordings were gathered for data collection. Each participant performed ten trials to ensure enough trials for both training and testing sets when doing cross-validation. Graphical User Interface (GUI) was design by using Visual C# to record the data.

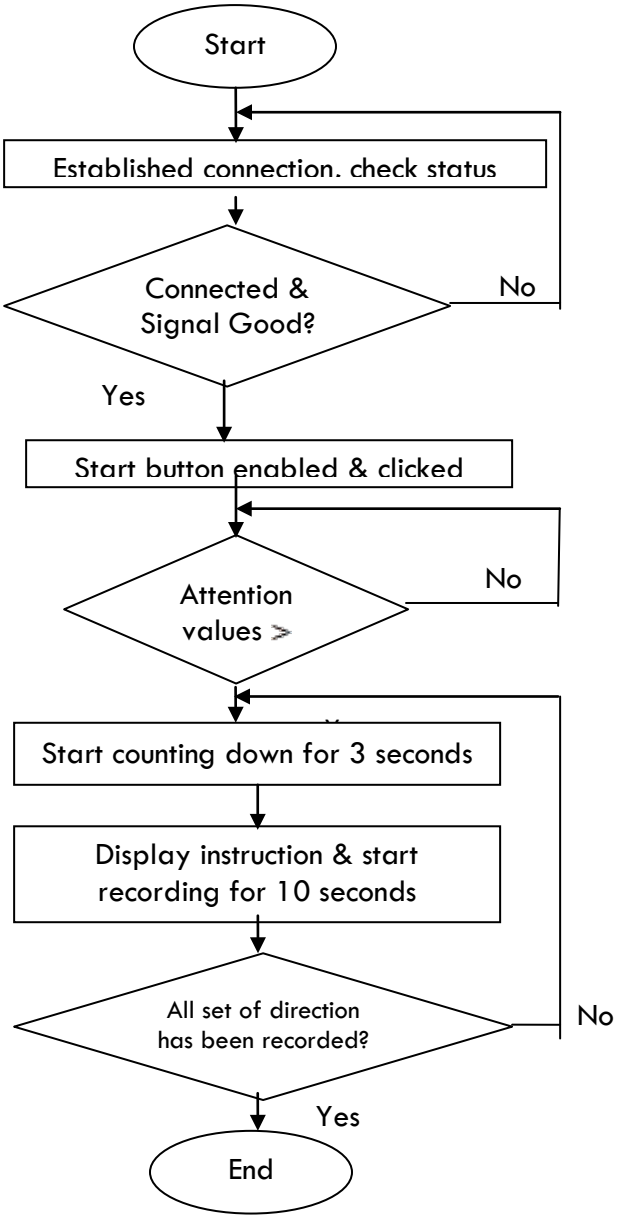

Figure 3: Flowchart for data recording

There are four types of colour chosen to distinguish between directions. All colour was chosen because they emanate high brain activity responses [5]. Table 1 listed the respective colour and imaginary task assigned to each direction.

Table 1: Type of colour and imaginary task assigned to each direction.

Direction	**Colour**	**Imaginary Task**
Forward	Cyan	Running
Right	Green	Kicking
Left	Black	Juggling
Reverse	Yellow	Singing a song

Pre-processing

Data obtained from the Neurosky Mindwave need to be pre-processed to extract meaningful features. The data was first converted to the frequency domain using fast fourier transform (FFT) to helps eliminate problem of recognizing signal pattern which is shifted by time. The power spectrum is then calculated before truncated to 0-60 Hz as this is where most of the meaningful signal exist. However, there is another problem observable from the output. There is significant peak in 0 Hz component. Further investigation revealed that this is known as DC mean component [6]. Therefore, the next step is to eliminate this component to validate the output of power spectrum. The whole pre-processing stage is summarized as Figure 4.

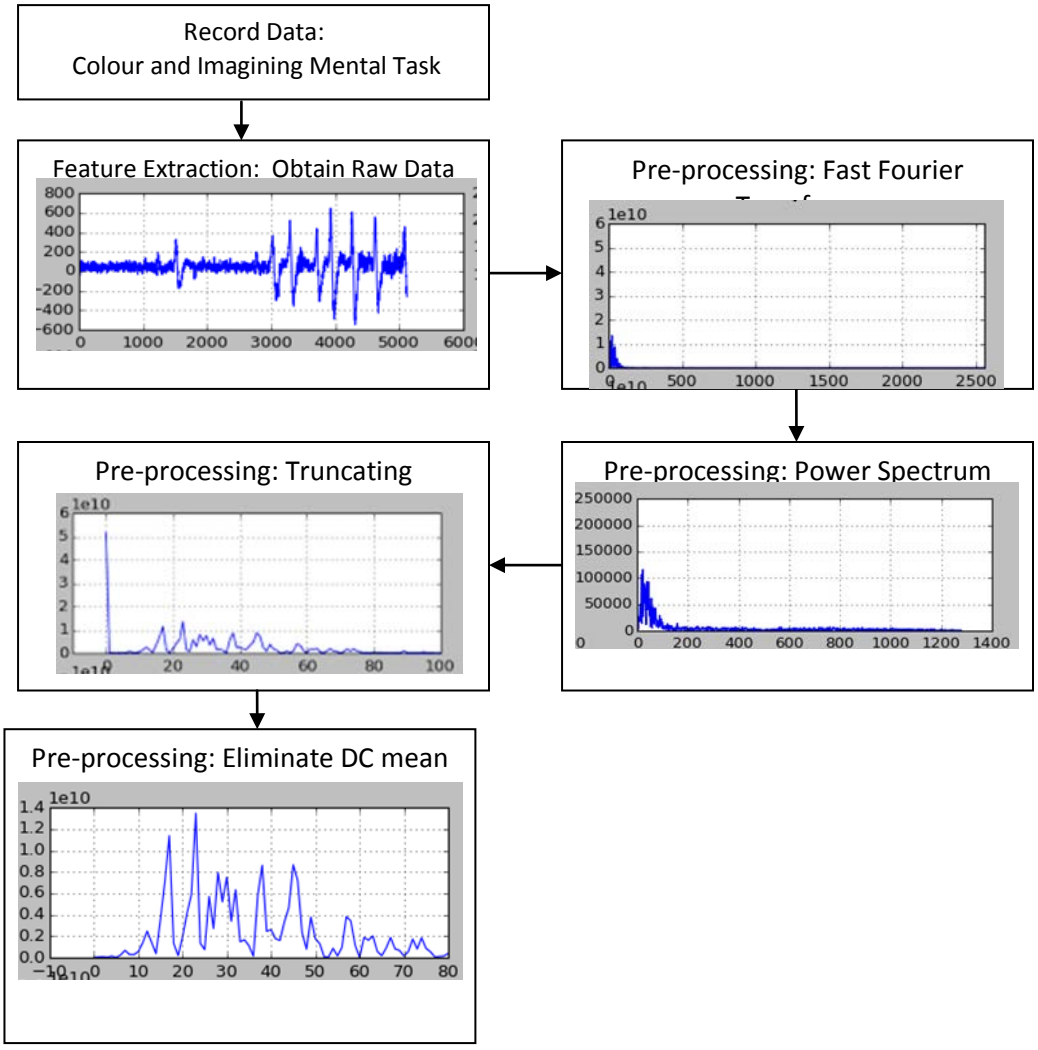

Figure 4: Block diagram summarize pre-processing stage.

RESULT, ANALYSIS AND DISCUSSION

Result for Pre-Processing Stage

The summary of result for preprocessing is shown in Figure 5.

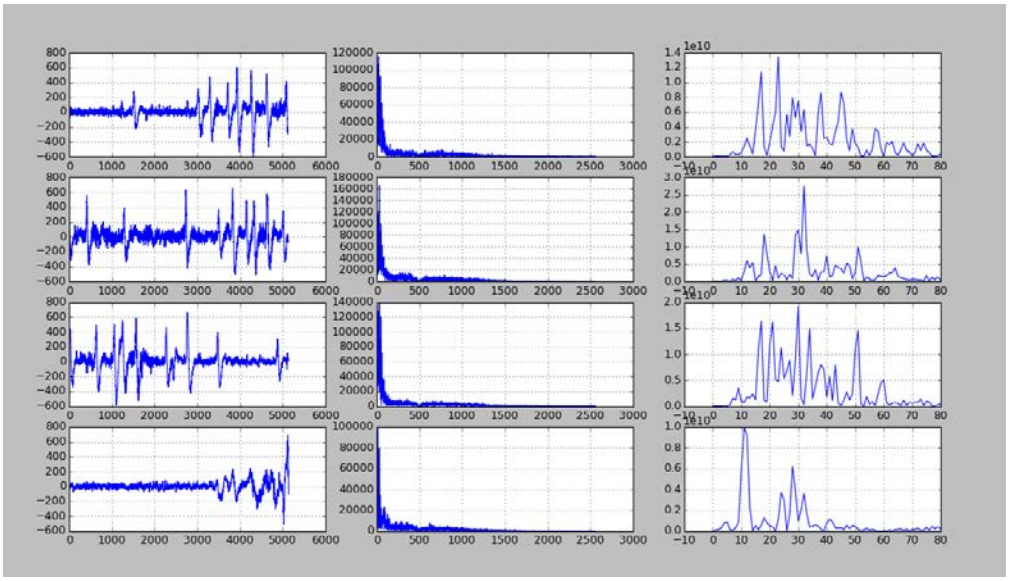

Figure 5: From left is raw data, FFT plot and power spectrum for four different task.

Training and Testing

The classification process was made using SVM which is implemented using Python. The task was made easier by using scikit-learn library. The task for classification starts with training to learn w or bias which will be used to draw the decision boundaries. Only then the confusion matrix can be deduced for different configuration of task for colour and mental task. The process flow for training and testing can be summarized as in Figure 6.

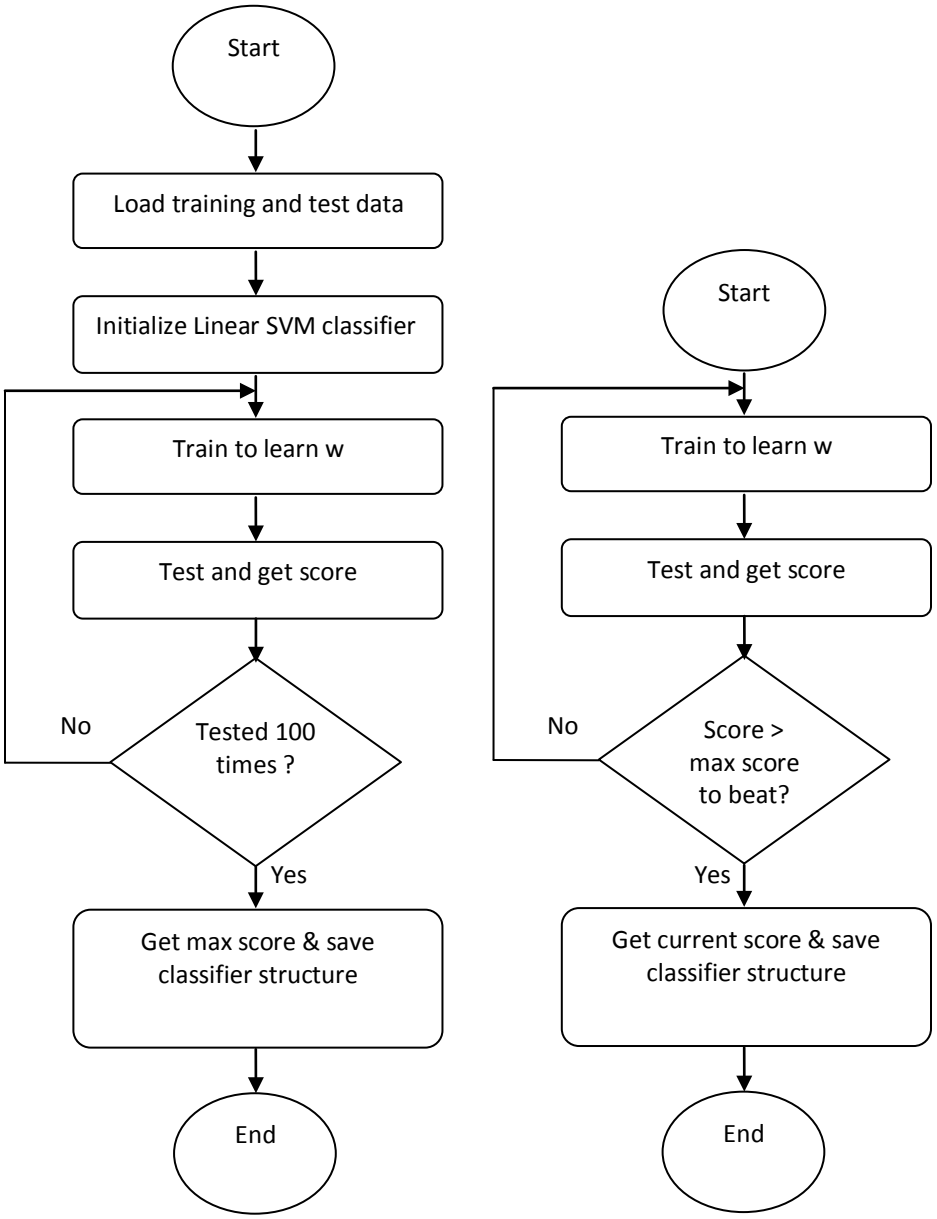

Figure 6: Flow chart for training and testing classifier using SVM.

Analysis using Confusion Matrix

Analysis was done based on two models proposed – using colour and imagining physical task. Structure of analysis is further elaborated as in Table 2 and 3. The test was arranged so that it will consist of combination of task and colour to search for the best result.

Table 2: Combination of analysis done for colour

<table>
<tr><th colspan="3">Colour</th></tr>
<tr><th>All Colours</th><th>3 colours</th><th>2 Colours</th></tr>
<tr><td rowspan="8">cyan, yellow black, green</td><td rowspan="2">cyan, yellow, black</td><td>cyan, yellow</td></tr>
<tr><td>cyan, black</td></tr>
<tr><td rowspan="2">cyan, yellow, green</td><td>cyan, green</td></tr>
<tr><td>yellow, green</td></tr>
<tr><td rowspan="2">yellow, black, green</td><td>yellow, black</td></tr>
<tr><td>black, green</td></tr>
<tr><td>cyan, black, green</td><td></td></tr>
</table>

Table 3: Combination of analysis done for imagine mental task.

Imagine		
All Imagining Task	3 Task	2 Task
Run, Song, juggling, kick	run, song, juggling	run, song
		run, juggling
	run, song, kick	run, kick
		song, kick
	song, juggling, kick	song, juggling
		juggling, kick
	run, juggling, kick	

The classifiers are unable to distinguish between four combinations of colours with overall result of only 34.7% correctly predicted. Between four colours, cyan have the highest percentage of correctly predicted with 61.11%. The data was further tested by combining only three colours at one time to see the difference. All sample were tested with accuracy of 42.59% which is only 22.73% increment compared with testing for all combination of colours. The best result achieved when comparing between two different colours (cyan and black) with 67% accuracy.

The overall percentage of successful classification when using all imagining mental task is 42%. When reduced to only three types of task, the best accuracy achieved is 55.55% by combining imagining task between run, song and jiggling. This is a 32.26% increase compared with the previous result. The best result achieved when comparing between juggling and sing a

song as the mental task. The percentage achieved is 75%, which achieved the threshold of BCI literacy [7].

CONCLUSION

This paper has successfully implemented the basic method to obtain raw data, process, and apply linear classifier for classification of EEG signals to control wheelchair for severe impairment users. However, from result obtain, imagining mental task has slightly higher score compared to visualizing colour task. The best combination that achieve minimum threshold for BCI literacy was combination between imagining a song and juggling. Therefore it is possible to classify between two directions, which quite promising, given that the neurosky mindwave is consumer grade product and process of obtaining data was done in uncontrolled environment.

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Bandwidth Enhanced Rectangular Patch Antenna Using Partial Ground Plane Method For WLAN Applications

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Abstract: In this paper, the 2.4 GHz Industrial, Scientific and Medical (ISM) Band patch antenna is simulated and analyzed using CST Microwave Studio 2014 software to comply with IEEE 802.11b Wireless Local Area Network (WLAN) Standard. This paper gives comparison of rectangular patch antenna with full ground plane and rectangular patch antenna with modified ground plane in terms of return loss and bandwidth performance. The substrate used is FR4 having dielectric constant of 4.3 and dielectric tangent loss of 0.001. Based on an ordinary patch, the substrate thickness (mm) and Copper thickness (mm) used are 1.6 and 0.035 respectively. The antenna is fed by inset feed line. The design was optimized to obtain the most suitable configuration in terms of desired values of return loss, Voltage Standing Wave Ratio (VSWR) and bandwidth, for antenna with and without modifying on ground plane.

INTRODUCTION

Microstrip patch antenna becomes very popular recently because it is easy to analyse and fabricate, low cost, low profile, light weight, easy to feed and has attractive radiation characteristics [1]. Nowadays microstrip patch antennas have been widely used in wireless communication, satellite communications, aerospace, radars and reflector feeds. The resonant frequency, polarization, radiation pattern and bandwidth of patch antenna are very versatile that makes it unique as an antenna.

In wireless communication systems, Wireless Local Area Network (WLAN) is widely recognized as viable, cost effective and high speed data connectivity solution, enabling user mobility. The IEEE 802.11 group has the responsibility for setting the standards. The most significant technology exists in the ISM bands: 2.4–2.4835 GHz [2].

In spite of having a lot of advantages, patch antenna has some limitations; narrow bandwidth is one of a kind. As described in [3] various techniques have been introduced and
developed to overcome the limitation, such as using different thickness of dielectric substrate[4], slots on the patch [5]–[8] and modified ground plane [9]–[11]. Different techniques to improve the bandwidth have been reported. In [12], E-shaped with two parallel slots patch antenna is introduced to achieve a wide bandwidth antenna. In [13], ultra-wide band (UWB) antenna using stepped feed, partial slotted ground, two level stairs with notches in patch has been presented. Another design constructed using three different geometry shapes, E, U and H has been developed from a rectangular patch using dielectric substrate with higher dielectric constant shows bandwidth enhancement also reported in [14].

The purpose of this paper is to present the partial ground plane technique to improve bandwidth of rectangular patch antenna for 2.4 GHz WLAN applications. The patch was mounted on substrate FR4 and inset feed line is used as feeding method due to its simplicity of realization [15][16]. The modified ground plane dimension is 20mm x 40mm. The designed antenna has been simulated and analyzed using CST Microwave simulation software.

DESIGN CONSIDERATION

2.1 Rectangular Patch Antenna with Full Ground Plane

A. Design procedure for patch antenna

In this paper, the proposed rectangular patch antenna has been designed to operate at resonant frequency of 2.4 GHz with input impedance of 50 Ω using FR4 substrate with εr = 4.3, loss tangent δ = 0.001 and thickness h = 1.6 mm. Fig.1 and 2 illustrate the physical dimension and parameters of the proposed antenna. The patch antenna parameters are calculated from the following standard antenna design equations [17] at reference resonant frequency. The width, W is critical in terms of power efficiency, antenna impedance and bandwidth. It is largely dependent on the operating frequency and the substrate dielectric constant [15].

Calculation of width (W):

$$W=\frac{c}{2f_r}\sqrt{\frac{2}{\varepsilon_r+1}}=38.39\ mm \qquad (1)$$

Where c is the speed of light (3x108 m/s), fr and εr is the resonant frequency and substrate dielectric constant respectively.

The effective dielectric constant due to the air dielectric boundary is given by:

$$\varepsilon_{reff} = \frac{\varepsilon_r + 1}{2} + \frac{\varepsilon_r - 1}{2}\left[1 + 12\left(\frac{h}{W}\right)\right]^2 = 3.9972 \qquad (2)$$

Where Ɛreff is the effective dielectric constant and h is the thickness of substrate (1.6 mm). The extension of the length, ΔL which is the function of effective dielectric constant, Ɛreff and the width-to-height ratio (W/h) is determined by the following formula

$$\Delta L = 0.412\left[\frac{\varepsilon_{reff} + 0.3(\frac{W}{h} + 0.264)}{\varepsilon_{r_{eff}} - 0.258(\frac{W}{h} + 0.8)}\right](h) \qquad (3)$$

And the value obtained is ΔL = 0.7591 mm. Thus, the actual length, L of the patch element is then calculated using:

$$L = \frac{c}{2 f_r \sqrt{\varepsilon_{reff}}} - 2\Delta L = 29.7\ mm \qquad (4)$$

The ground plane dimensions are approximately six times the substrate thickness all around the periphery. For this design the ground plane dimension would be given as:

$$L_g = 6h + L = 40.5\ mm \qquad (5)$$

$$W_g = 6h + W = 49.2\ mm \qquad (6)$$

Where Lg = length of ground plane and Wg = width of ground plane.

B. Determination of microstrip inset feed

In this type of feeding technique, a connecting strip is connected directly to the edge of the microstrip patch [18]. The conducting strip is smaller in width as compared to the patch. Impedance control is achieved by cutting out a notch from the radiating edge and extending the feed line into the notch [19].

The following formulas were used to design the feeding element.

Calculation of the feed line width, ωo

$$Z_c = \frac{87}{\sqrt{\varepsilon_r + 1.41}} \ln\left[\frac{5.98h}{0.8\omega_0 + t}\right] \quad (7)$$

Where Zc = 50Ω is the characteristic impedance. ωo is the width of microstrip inset feed line as shown in Fig.2. The value obtained for ωo is 3.0291 mm. Input impedance of the inset feed patch antenna mainly depends on the inset distance, y0 and to some extend on the inset width [15].

The typical input impedance, Zin at the edge of a resonant rectangular patch can be approximated as the following equation:

$$Z_{in} = 90\frac{\varepsilon_r^2}{\varepsilon_r - 1}\left(\frac{L}{W}\right)^2 \quad (8)$$

Hence the total impedance and the length of the inset feed line, y0 is calculated using:

$$Z_T = \sqrt{Z_c * Z_{in}} \quad (9)$$

$$R_{in} = \frac{Z_0}{Z_T} = \cos^2\left(\frac{\pi}{L}\right)y_0 \quad (10)$$

Thus the calculated value of y0 is 8.3253 mm.

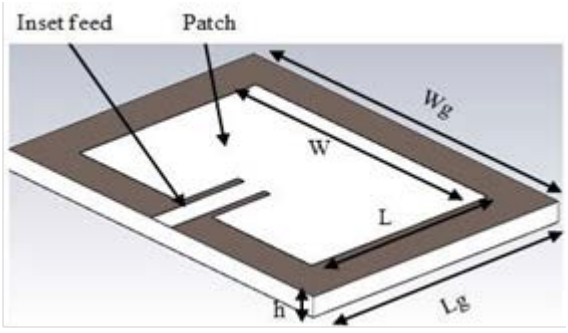

Fig. 1. Perspective view of the proposed rectangular patch antenna with full ground plane

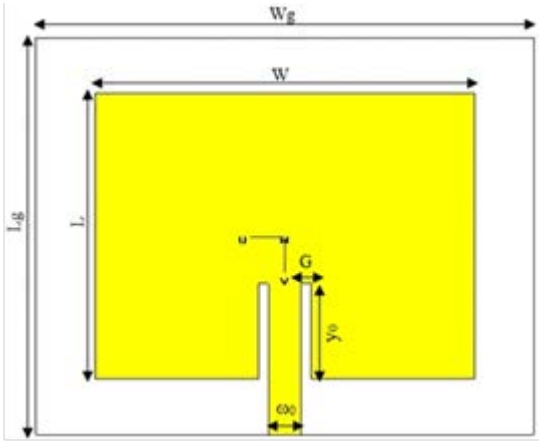

Fig. 2. Front view of the proposed patch antenna with full ground plane

The optimized parameters of the proposed rectangular microstrip patch antenna are specified in TABLE I. It is obtained by using Parameter Sweep option in CST software which is analyzed for 2.4 GHz operating frequency to find the optimum value of return loss and bandwidth.

TABLE I. OPTIMIZED DESIGN PARAMETERS OF THE PROPOSED ANTENNA

No.	*Parameter*	*Value*
1	Substrate dielectric constant, ε_r	4.3
2	Dielectric loss tangent	0.001
3	Substrate thickness, h (mm)	1.6
4	Ground plane length, Lg	40
5	Ground plane width, Wg	50
6	Copper thickness, t (mm)	0.035
7	Patch length, L (mm)	28.74
8	Patch width, W (mm)	38.1
9	Width of feed, ω_0 (mm)	3.3
10	Inset feed line, y_0 (mm)	9.8
11	Inset gap, G (mm)	1

2.2 Bandwidth Enhancement using Partial Ground Plane

The proposed antenna consists of rectangular patch etched on top of the substrate and a partial ground plane on the other side. The patch and ground plane used Copper material. The parametric studies have been performed by using Parameter Sweep option in CST to obtain the suitable position and width of the ground plane. It is observed that the changing dimension, length and position of the ground plane cause noticeable changes in antenna performance; i.e improved bandwidth and decreased return loss which indicated better impedance matching.

Fig. 3 and 4 represent the patch antenna with modified ground plane. The width and length of ground plane is Wg = 20 mm and Lg = 40 mm respectively with the substrate dimension remain constant. The ground plane is positioned at the center of the substrate where the point of H field is higher.

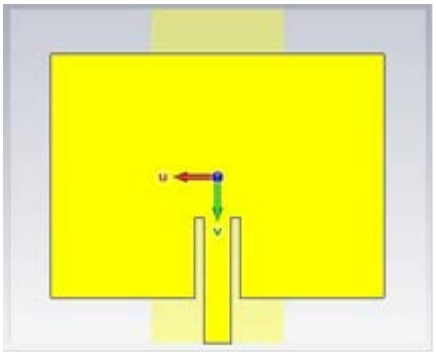

Fig. 3. Front view of patch antenna with Modified Ground Plane

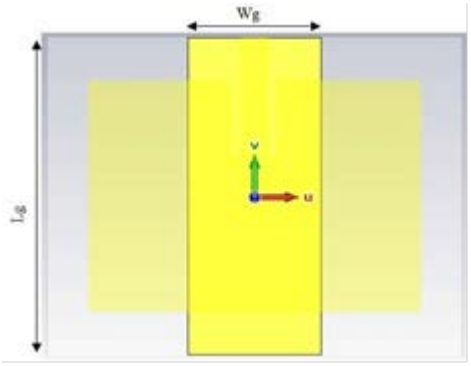

Fig. 4. Back view of Modified Ground Plane

SIMULATION RESULTS AND DISCUSSION

In this section, simulated frequency responses of return loss, input impedance, Voltage Standing Wave Ratio (VSWR) and bandwidth of the proposed antenna with full ground plane and modified ground plane are presented. As the design is intended to operate at 2.4GHz resonant frequency, simulation is performed on fixed inset length or position. The simulation has been carried out using CST Microwave 2014 simulation software.

3.1 Simulated Results of Antenna with Full Ground Plane

Considering design parameters of TABLE 1, the antenna was designed with full ground plane. The best result of return loss, S-11 as shown in Fig. 5 is – 41.38 dB at resonant frequency 2.4 GHz and bandwidth observed is 57 MHz.

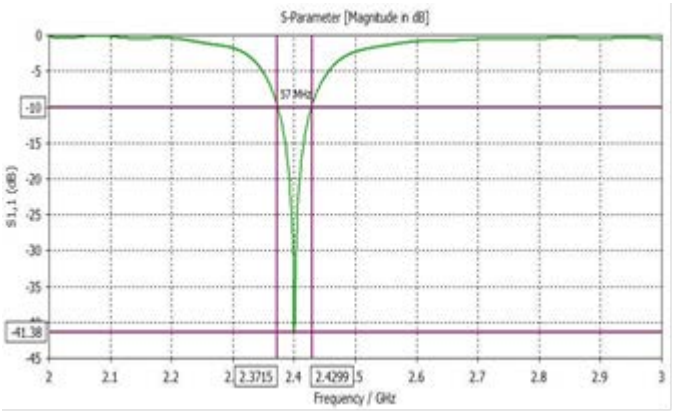

Fig. 5. Return Loss versus Frequency Plot

Fig. 6 shows the VSWR versus frequency plot. The VSWR obtained is 1.017 at frequency 2.4 GHz. Input impedance plot, observed as 49.52 Ohm at 2.4 GHz is presented in Fig. 7.

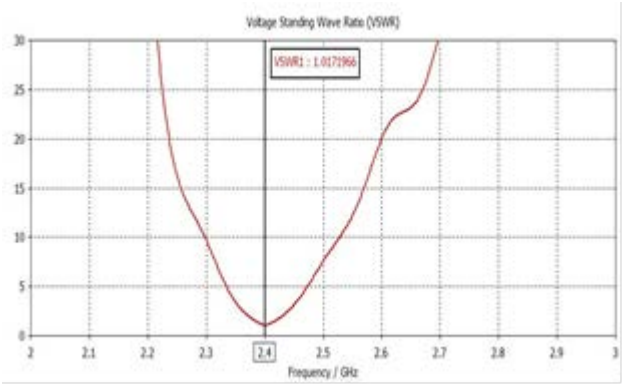

Fig. 6. VSWR versus Frequency Plot

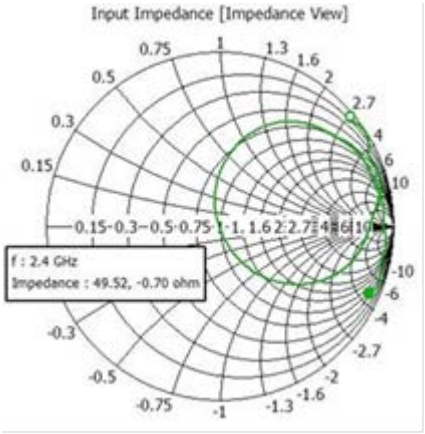

Fig. 7. Input Impedance plot

3.2 Simulated Results of Antenna with Partial Ground Plane

Fig. 4 shows the design of a patch antenna with Partial Ground Plane. The dimension of ground plane is Wg = 20 mm and Lg = 40 mm. The best result of return loss, S-11 as shown in Fig. 8 is – 47.58 dB at resonant frequency 2.4 GHz and –10dB impedance bandwidth from 2.3499 GHz to 2.455 GHz achieved 105 MHz. It is observed that by modifying the ground plane influence the bandwidth of patch antenna to increase from 57 MHz to 105 MHz (increased by 46 %). The return loss shows considerable reduction from – 41.38 dB to – 47.58 dB which indicated better impedance matching

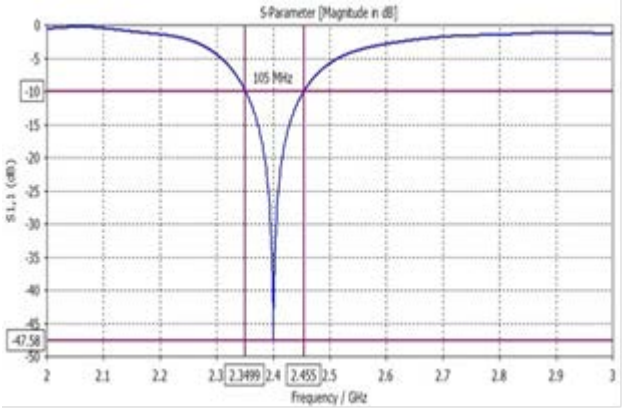

Fig. 8. Return Loss versus Frequency Plot

Fig. 9 shows the VSWR versus frequency plot. The VSWR obtained is 1.00 at frequency 2.4 GHz. Input impedance plot, observed as 49.62 Ohm at 2.4 GHz is presented in Fig. 10 indicating a perfectly matched antenna at the input.

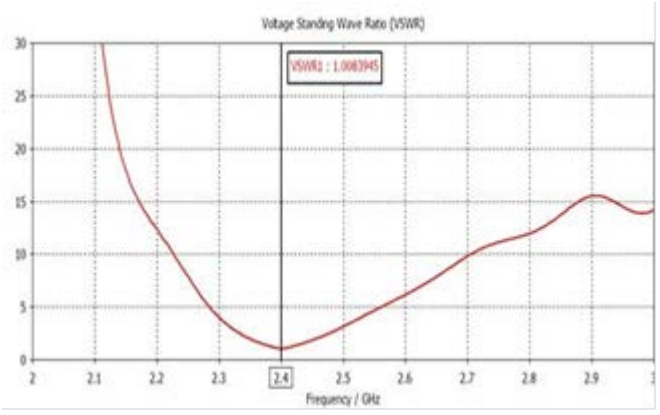

Fig. 9. VSWR versus Frequency Plot

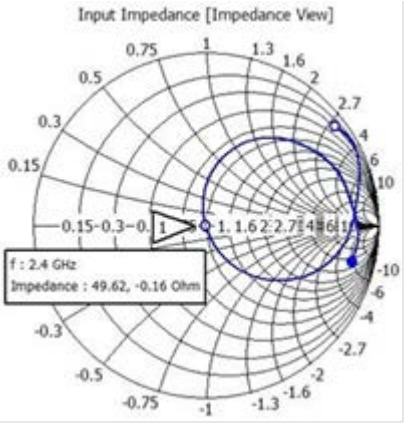

Fig. 10. Input Impedance plot

3.3 Comparison of Results

For patch antenna with full ground plane the bandwidth and return loss are 57 MHz and – 41.38 dB. The deployment of partial ground plane of the antenna improves the bandwidth and return loss to 105 MHz and –

47.58 MHz with respect to center frequency 2.4 GHz. The return loss comparison is illustrates in Fig. 11. The bandwidth enhancement is near about 48 MHz was achieved and can meet the bandwidth requirement of 802.11b applications.

Performance and simulated results for both antennas with full and with partial ground plane is compared in TABLE II.

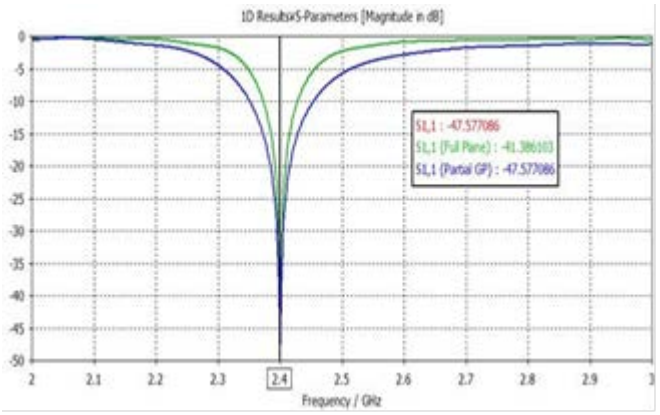

Fig. 11. Return Loss versus Frequency Plot Comparison

TABLE II. RETURN LOSS, VSWR, BANDWIDTH COMPARISON OF TWO DESIGNS OF PATCH ANTENNA

Lg	*Wg*	*Resonant frequency, GHz*	*Return Loss, dB*	*Bandwidth, MHz*	*VSWR*
40	50	2.4	-41.38	57	1.02
40	20	2.4	-47.58	105	1.00

3.4 Parametric Study

From this work it is understood that changing dimension, length and position of the ground plane cause significant improvement in antenna performance; i.e return loss and bandwidth. The width of ground plane variation effect on the antenna performance has been investigated in this section. The width of ground plane described as Wg in Fig. 4 of the proposed

design antenna. The values of Wg have been varied from 36 to 16 mm. The observed return loss is shown in Fig. 12. As the width of ground plane increased, the resonant frequency decreased. It can be clearly observed that the return loss and bandwidth vary as Wg varied. The summaries of simulated return loss response with respect to width of ground plane are represented in TABLE III.

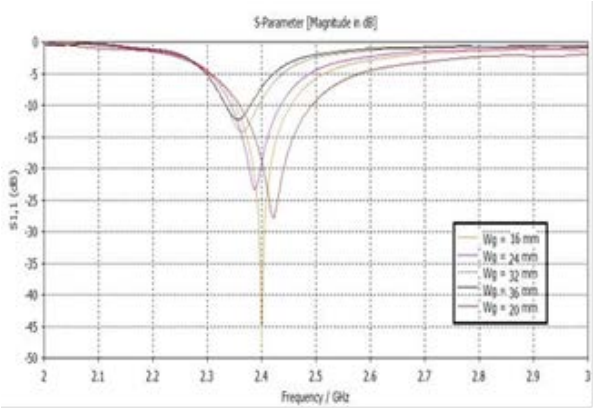

Fig. 12. Return Loss Curves for Different Width of Ground Plane

TABLE III. SUMMARIES OF RESULTS

Wg / mm	*Ground Plane Specification /mm*	*Fr, GHz*	*Return Loss, dB*	*Bandwidth*
16	Lg = 40 t = 0.035	2.422	-27.82 dB	132 MHz
20		2.4	-47.58 dB	105 MHz
24		2.388	-23.30 dB	91 MHz
32		2.364	-14.19 dB	58 MHz
36		2.356	-12.28 dB	40 Mhz

CONCLUSIONS

The single band microstrip patch antenna operating at 2.4 GHz with full ground plane and partial ground plane has been designed. The proposed antenna design with partial ground was found to have better operating bandwidth of 105 MHz and considerable reduction in return loss which is – 47.58 dB which indicated better impedance matching. The antenna performance such as return loss, VSWR and impedance bandwidth for both antennas have been analyzed and compared. CST Microwave Studio 2014 is used for design and simulation. The proposed antenna is well suitable for 2.4GHz IEEE 802.11b WLAN Standard.

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DESIGN OF A PREDICTIVE PID CONTROLLER USING PARTICLE SWARM OPTIMIZATION METHOD

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Abstract: This paper proposes the project regarding the design of predictive PID controller system using particle swarms optimization algorithm (PSO). PID controller is widely used in various applications in industries such as process control, motor drives, magnetic memory and optical, automotive, flight control, instrumentation and others. PID tuning is to get the PID parameter (Kp, Ki, Kd) to generate the most optimum achievement of optimum fitness for any system. Determination of PID parameters is essential that any system can function in a stable mod. The simulation is run for determining the optimum PID parameters for dc motor applications. By using PSO algorithm, parameters such as inertia weight, acceleration constant, particle numbers and iteration numbers need to be determined for getting the most optimum results. A comparative study is presented between various inertia weights from 0.4 to 0.9 and number of iteration from 30 to 100. In this study, Matlab R2014a has been used. Results of a study conducted on inertia weight showed that inertia weight with 0.9 provides a good fitness achievement. It shows the overshoot generated is small, rise time and settling time is faster and it can produce a small fitness achievement. However the iteration number for improved inertia weight on iteration numbers is 100 to achieve optimum point. Comparison of PI-PSO and PID-PSO have been run in which the predetermined PID parameters are Kp = 43.4703 Ki = 132.4802 and Kd = 0.1083. The PID performance for rise time is 0.2806 while a settling time was 0.4326 and overshoot was 0.0050.

INTRODUCTION

Proportional-Integral-Derivative (PID) control is one of the earlier control strategies which are used to control a speed and position of various applications. Mostly PID used in industrial control such as process control, motor drives, magnetic memory and optic, automotive, flight control and instrumentation as it's being able to gives satisfactory result and capable to tune the control parameters to the optimum values. PID have simple structure, simple design, low maintenance, no error in steady-state error, can be used in process control linear and easy to use. Regardless of its widespread use, one of its major weaknesses is that there is no efficient tuning method for this type of controller (S. J. Bassi, M. K. Mishra & E. E. Omizegba. 2011).

There are several methods for tuning of PID controllers to obtain the optimum values of the PID parameters. The classical methods are Ziegler-Nichols method, Ziegler-Nichols reaction curve method, Cohen Coon reaction curve method and Tyreus-Luyben. The Ziegler-Nichols method give a quiet well result in tuning but occasionally it does not give a good tuning and tends to create a huge overshoot (S. Malik, P. Dutta, S. Chakrabarti & A. Barman. 2014). To increase the capability of classical PID parameter tuning techniques, the intelligent approaches have been recommended such as genetic algorithms (GA), Differential Evolutionary (DE) Algorithm, Ant Colony Optimization (ACO), Biogeography Based Optimization (BBO) and the particle swarm optimization (PSO) (M. I. Solihin, L. F. Tack & M. L. Kean. 2011).

In this paper, PID controller parameter tuning is using the PSO algorithm introduced by Kennedy and Eberhart and applied to dc motor system. The main advantage of PSO algorithm is that it is an auto tuning method and it does not require detailed mathematical description of the

process and finds the best possible for PID gain namely Kp, Ki, and Kd. A detailed study is presented with a PSO algorithm using various inertia weights from 0.4 to 0.9 with the iteration number of 60. The iteration number 30 to 100 with inertia weights of 0.9 also has been studied. A comparative study in controlling dc motor system is also carried out between tuning PID by PSO, PID with a gain of 1 and without PID controller. A comparative study also carried on PID-PSO and PI-PSO.

The PID controller calculation (algorithm) combines three separate parameters; the proportional (Kp), integral (Ki) and derivative (Kd) values with a control loop feedback mechanism. The proportional value determines the reaction to the current error, the integral value determines the reaction based on the sum of recent errors and the derivative value determines the reaction based on the rate at which the error has been changing (A. H. Mary. 2011). Figure 1 illustrates the core architecture of a PID controller.

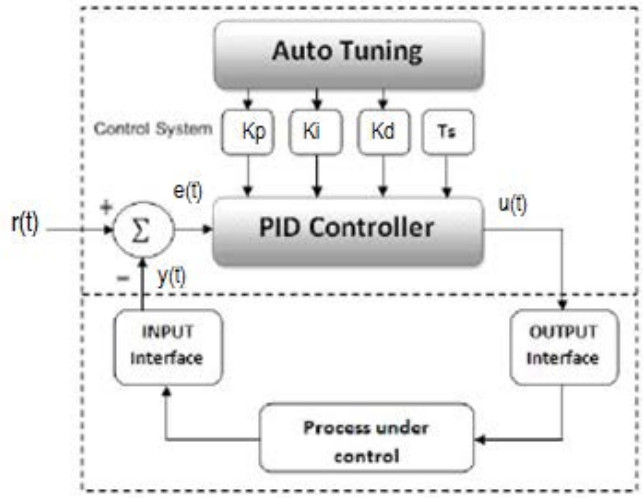

Figure 1 Type control loops with a PID controller (S. Karthikeyan, P. Rameshbabu & B.J. Robi. 2012)

As depicted in Figure 1, error voltage e(t) is the difference between reference voltage r(t) and real output voltage y(t). Error voltage enters PID controller and a control variable u(t) comes out. A PID controller attempts to minimize the error between a real output voltage y(t) and reference voltage r(t) through feedback controller by adjusting the control inputs. The control variable u(t) is proportional to the error, the sum of all the previous errors, and the change rate of the error at the instant (X. Li, M. Chen & Y. Tsutomu. 2013).

The functionalities of PID parameter as per below (M. Willjuice Iruthayarajan & S. Baskar. 2007):

- The proportional (Kp) – providing an overall control action proportional to the error signal through the all pass gain factor.
- The integral (Ki) – reducing steady state errors through low frequency compensation by an integrator.
- The derivative (Kd) – improving transient response through high frequency compensation by a differentiator.

For optimum performance, Kp, Ki and Kd are mutually dependent in tuning. By tuning this three parameter in the PID controller algorithm, the controller can provide control action designed for specific process requirements. An optimum tuning of Kp, Ki and Kp have been determined using Particle Swarm Optimization techniques by minimizing suitable performance measures. The system performance of PID controller can be measured by using performance index (M. Willjuice Iruthayarajan & S. Baskar. 2007). Using this technique, parameters of PID can be adjusted to meet the required specification and an optimum system can be designed. The performance of PID can be evaluated by four basic important items including

rise time, overshoot, setting time and steady state error. Their definitions are as follows (X. Li, M. Chen & Y. Tsutomu. 2013):

- Rise Time (t_r): The time taken to rise beyond 90% of the reference for the first time.
- Overshoot/undershoot (δ%): The difference between the peak value and the steady state value.
- Settling Time (t_s): The time taken for the output voltage to reach the specified accuracy.
- Steady-state Error (e_{ss}): The difference between the steady-state output and the reference.

The study of traditional PID controller has been done in 2009 by Zhao Xiaodong, Li Yongqiang, Xue Anke. They find that the first derivative represents the change speed of the error. The second derivative represents the acceleration of the error. Restrains the acceleration of the error getting bigger by adding the second derivative and produces the system's response quicker, lower the overshoot and increase the stability of the system. Hence, the controller parameter has better control effect. Nevertheless, increasing higher order derivative also makes some problems, such as increasing the time and the difficulty of setting the parameter and amplifying the noise interference (A. H. Mary. 2011).

PSO is a robust stochastic optimization technique based on the movement and cooperation of swarms. PSO is stimulated by social behavior of bird flocking and it is an evolutionary algorithm. In 1995, tt was proposed by Kennedy and Eberhart and then further expanded it in 1997 (X. Li, M. Chen & Y. Tsutomu. 2013).

The main theory is alike to how birds are able to prey for food in a limited area. While the birds are searching for food from one place to

another, there is always a bird that can smell the food very well. The bird can observe the place where the food can be found. Because they are transmitting the good information at any time, the birds will eventually flock to the place where food can be found. By taking every bird as a particle, this evolutionary algorithm is named by particle swarm optimization. Each particle keeps track of its own point. The most important point is their current positions (n dimensional vectors). Another point of the particle is current velocity which keeps track of the current speed and direction of travel by the particles. Each particle has a current fitness (best solution) value which is obtained by evaluating the error function of the particle's current position. This value is personal best, 'pbest'. Another best value found by any particle in the community is called global best, 'gbest'. Each particle tries to alter its position using the information such as the current positions, the current velocities, the distance between the current position and 'pbest', the distance between the current position and the 'gbest' (M. Willjuice Iruthayarajan & S. Baskar. 2007). In each iteration, every particle updates its velocity (speed) and position by tracking the local optimum and the global optimum. The position vector of a particle with respect to the origin of the search space represents a trail solution of the search problem. At the beginning a population of particles is initialized with random positions marked by the vectors x_i and random velocities v_i (S. Malik, P. Dutta, S. Chakrabarti & A. Barman. 2014). The equations are presented for the i-th dimension of the position $x_{i,m}^{(t+1)}$, velocity of the i-th particle $v_{i,m}^{(t+1)}$ and the weighting function w :

$$v_{i,m}^{(t+1)} = wv_{i,m}^{(t)} + c_1 \times rand() \times \left(pbest_{i,m} - x_{i,m}^{(t)}\right) + c_2 \times rand() \times \left(gbest_m - x_{i,m}^{(t)}\right) \quad (3)$$

$$x_{i,m}^{(t+1)} = x_{i,m}^{(t)} + v_{i,m}^{(t+1)} \quad (4)$$

$$w = w_{max} - \frac{(w_{max} - w_{min}) \times iter}{iter_{max}} \quad (5)$$

c1 and c2 are two positive constant. *rand* () is random function between 0 and 1. *m* represents iteration. Equation (3) is used to calculate particle's new velocity from its own best experience (position) and the group's best experience according to its previous velocity and the distances of its current position. According to Equation (4), the particle flies toward a new position. Equation (5) is the inertia weight to balance between the global search and local search capability by weighing the contribution of the previous velocity. When the inertia weight decreased from 0.9 to 0.4, the search will be narrowed from a large area onto a small area. Inertia weight is limited from 0.9 to 0.4 according to linear decrease which make the search is to start with a bigger area and locate the position quickly where there is the most optimist solution. As w is decreasing, the speed of the particle will also be slow to search for the delicate partial (Bai, Qinghai. 1998). The performance of each particle is calculated according to a pre-defined fitness function.

The advantages of PSO are:

- Ease to implement and have fewer parameters to adjust.
- It has a more effective memory capability where every particle remembers its own previous best value as well as the neighborhood best.
- PSO have no overlapping and mutation calculation. The search can be carried out by the speed of the particle. During the development of several generations, only the most optimist particle can transmit information onto the other particles and the speed of the researching is very fast.

METHODOLOGY

In this paper, a PID controller using the PSO algorithm was developed to improve the performance of dc motor system. It was also called the PSO-PID controller. The PSO was mainly utilized to determine three optimal PID controller parameter Kp, Ki, and Kd to obtain a good step response output for control system. The project was conducted in four phases as per Figure 2:

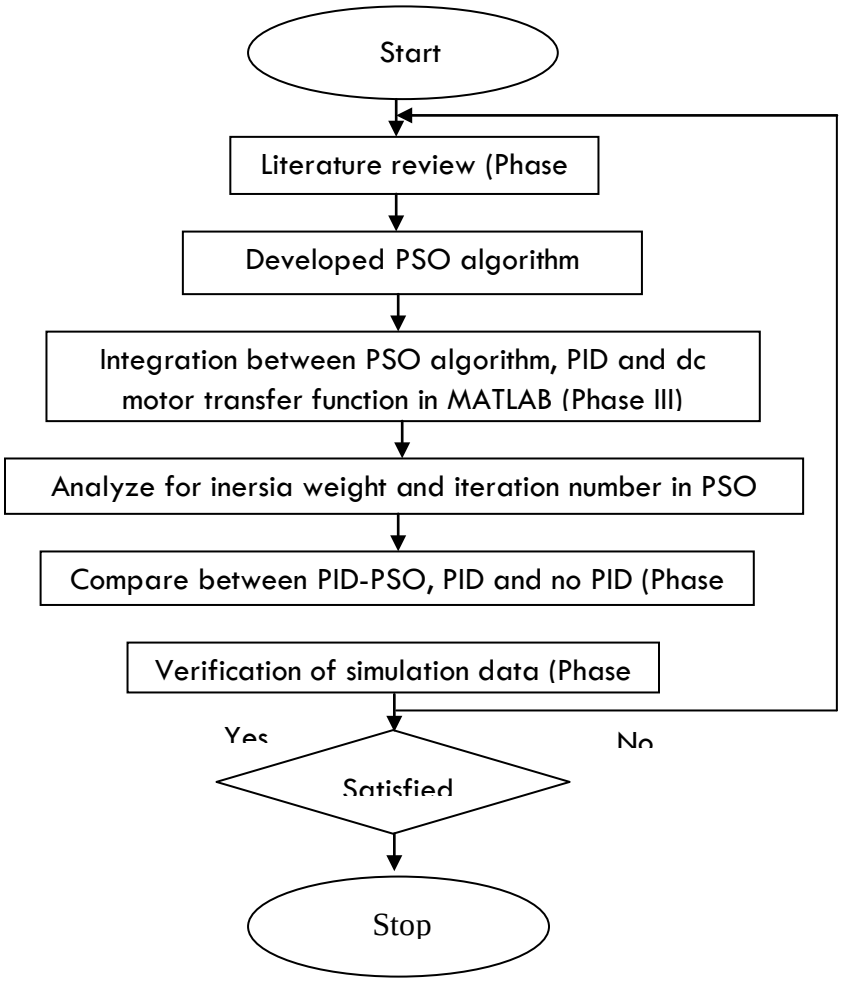

Figure 2 Research methodology flow chart

A. PSO Algorithm

Compared with other population-based stochastic optimization methods, such as GA and ACO, PSO has comparable or even superior search performance for many hard optimization problems, with faster and more stable convergence rates.

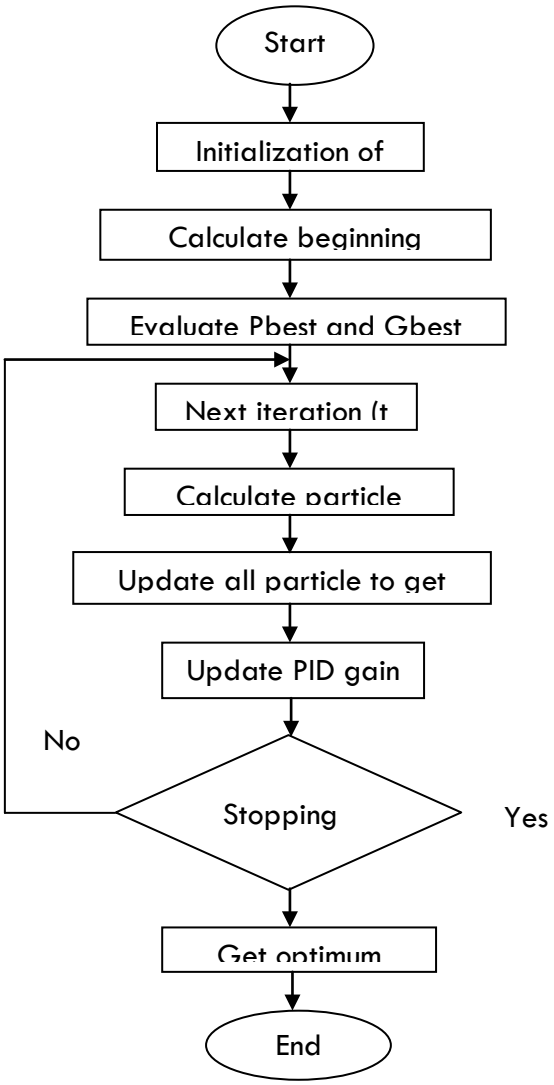

Figure 3 Process flow of PID-PSO

The implementation of PID-PSO is showing in Figure 3. At early stage, PSO parameter need to be initialize; number of particle, n=54, c1=c2=2, w=0.9, no of iteration=100. In this, a group of artificial birds is initialized with arbitrary positions Xi and velocities Vi. At early searching stage, each bird in the swarm is scattered randomly throughout the D dimensional search space. During the optimization search, each particle remembers its best position attained so far, Pbest and also obtains the global best position information achieved by any particle in the population, Gbest.

B. Fitness Function

Overall performance for the convergence speed, efficiency and PSO optimization algorithm accuracy is depends on the fitness function to control the searching of optimal parameter. For this study, a fitness function is measured according to the equation (6).

$$F = \min[(a) + \min(c) + \min(b) + \min(d)] \quad (6)$$

where a = Rise time, b = Settling time, c = Overshoot, d = Undershoot

C. Controller Tuning

Figure 4 shows the block diagram of PSO tuned PID controller used in this project.

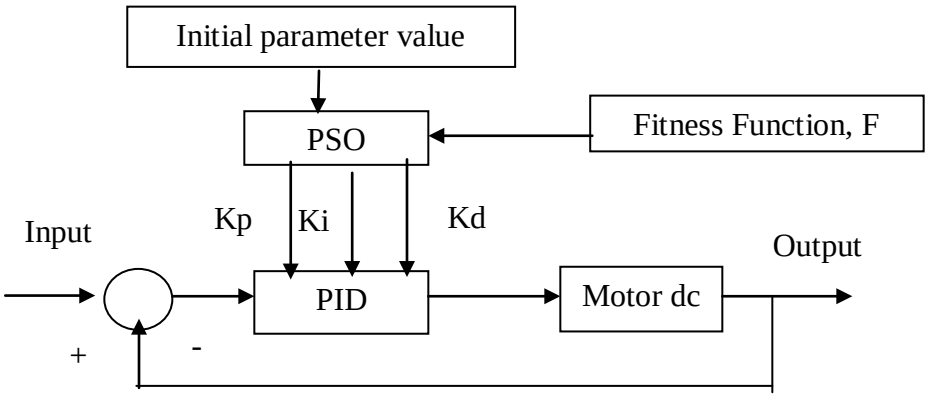

Figure 4 Feedback Loop PID-PSO of motor DC

RESULT, ANALYSIS AND DISCUSSION

Analysis 1. Analysis of Inertia Weight

The 2nd order transfer function of motor dc is considered. PSO based for PID tuning is proposed with the method shown in Figure 4. The parameter of PSO used shown in Table 1.

Table 1 Parameter for analysis of inertia weight

Parameter	Value	Parameter	Value
No of particle, n	54	Inertia weight, w	0.4 - 0.9
No of iteration, i	60	Initial velocity, v	0
C1	2	PID transfer function	$G_{PID} = \frac{K_d s^2 + K_p s + K_i}{S}$
C2	2	DC motor transfer function	$G_{mdc} = \frac{1}{s^2 + 2s + 3}$

The final optimized PID parameters with various w values are tabulated in Figure 5.

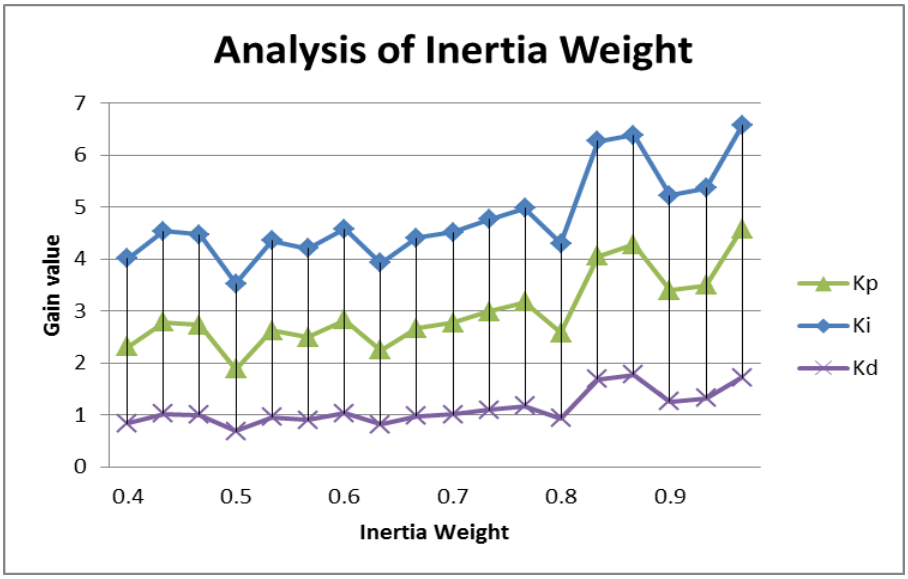

Figure 5 Optimized PID parameter on analysis of inertia weight

This graph presents three best values among 10 trials. These values are individually evaluated using the process model of Figure 3. Figure 6 represents the performance of PID controller obtained when inertia weight is varies from 0.9 to 0.4 with number of iteration 60.

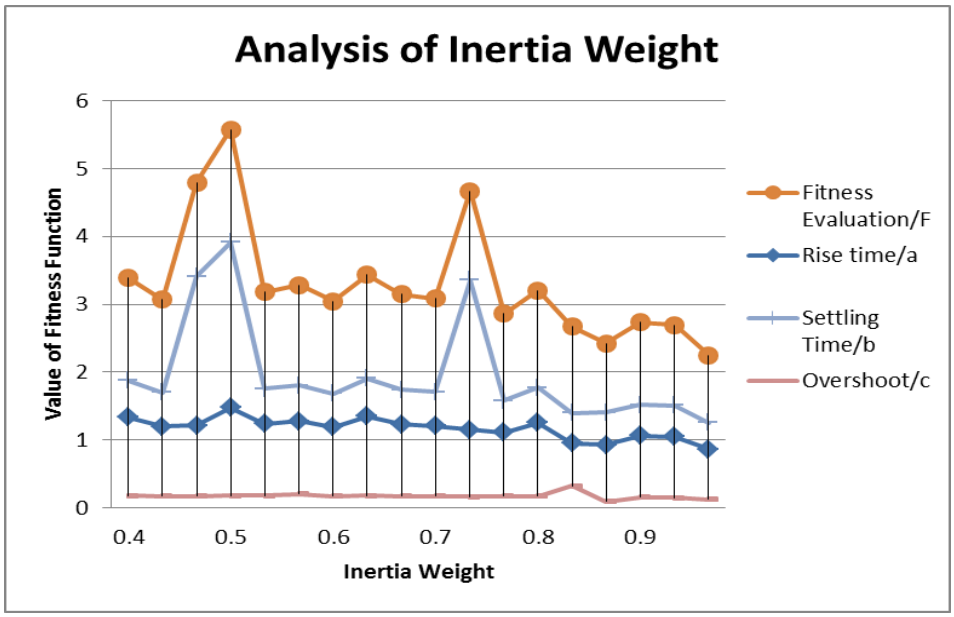

Figure 6 Process performance with various inertia weight

From Figure 6, for w=0.9, it is observed that even through the total iteration taken by the best value 3 is considerably large, it provides better performance compared to other values considered in this study. From Figure 5, the PID gain for w=0.9 is not stable and it is because of the iteration number for this analysis used is 60. So, the next analysis, the iteration number will be increased to 100 and used w=0.9.

Analysis 2. Analysis on number of iteration

The 2nd order transfer function of motor dc is considered. PSO based for PID tuning is proposed with the method shown in Figure 4. The parameter of PSO used shown in Table 2. The final optimized PID parameters with

various number of iteration are tabulated in Figure 7. This graph presents three best values among 10 trials. These values are individually evaluated using the process model of Figure 3. Figure 8 represents the performance of PID controller obtained when number of iteration is varies from 30 to 100 with inertia weight of 0.9.

Table 2 Parameter for analysis of number of iteration

Parameter	Value	Parameter	Value
No of particle,	54	Inertia weight, w	0.9
No of iteration,	30-100	Initial velocity, v	0
C1	2	PID transfer function	$G_{PID} = \frac{K_d s^2 + K_p s + K_i}{S}$
C2	2	DC motor transfer function	$G_{mdc} = \frac{1}{s^2 + 2s + 3}$

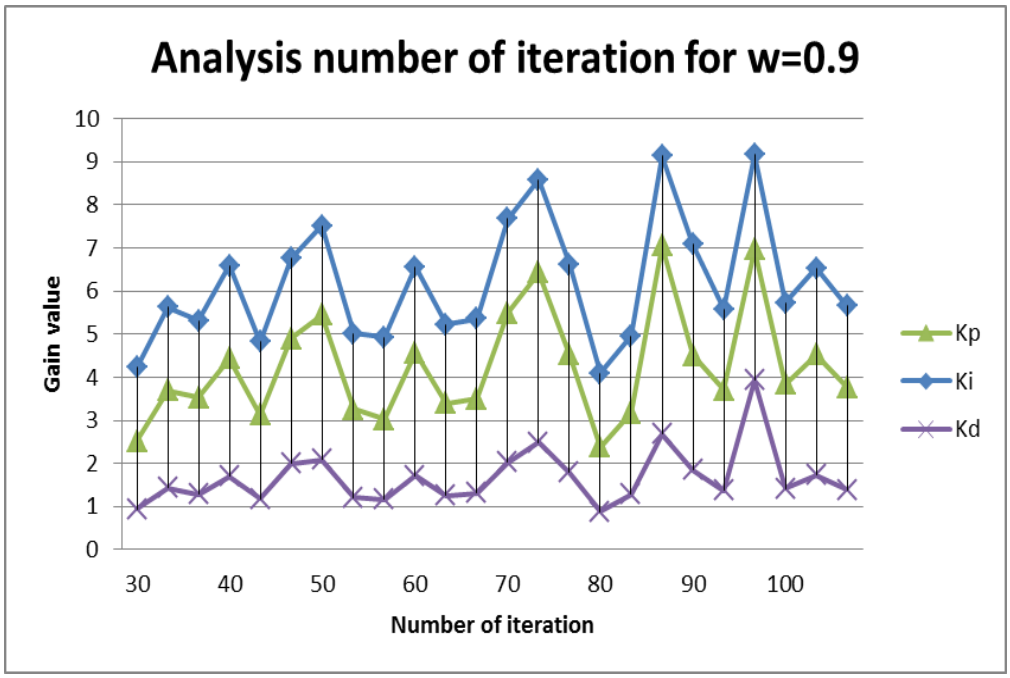

Figure 7 Optimized PID parameter on analysis number of iteration

From Figure 7, for w=0.9 and number of iteration is 100, it is observed that the PID gain value is more stable compared than using others number of iteration. The average of performance for fitness function also much lower compared the others shown in Figure 8.

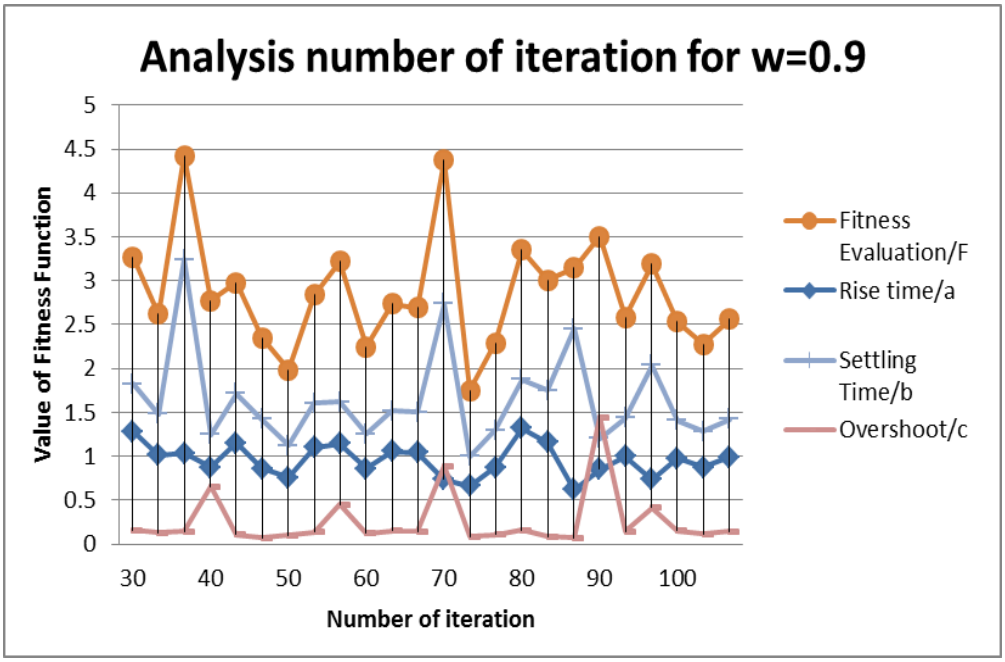

Figure 8 Process performances with various number of iteration

From this 2 analysis shown that the optimized parameter for PSO in order to get the stable PID gain with great performance of fitness function is n=54, c1=c2=2, w=0.9 and i=100.

Analysis 3. Comparison PID-PSO, PID and without PID

The 2nd order transfer function of motor dc is considered $G_{mdc} = \frac{1}{s^2+2s+3}$. The performance of fitness function of the system with PID-PSO, without PSO and without PID shown in Figure 9. The figures show that there has slightly different for rise time between PID-PSO and PID without

PSO but the overshoot was obviously can be reduced from 6.53 to 0.153 by implementing PSO. Table 3 summarized of output for PID gain and system performance with and without PSO and PID.

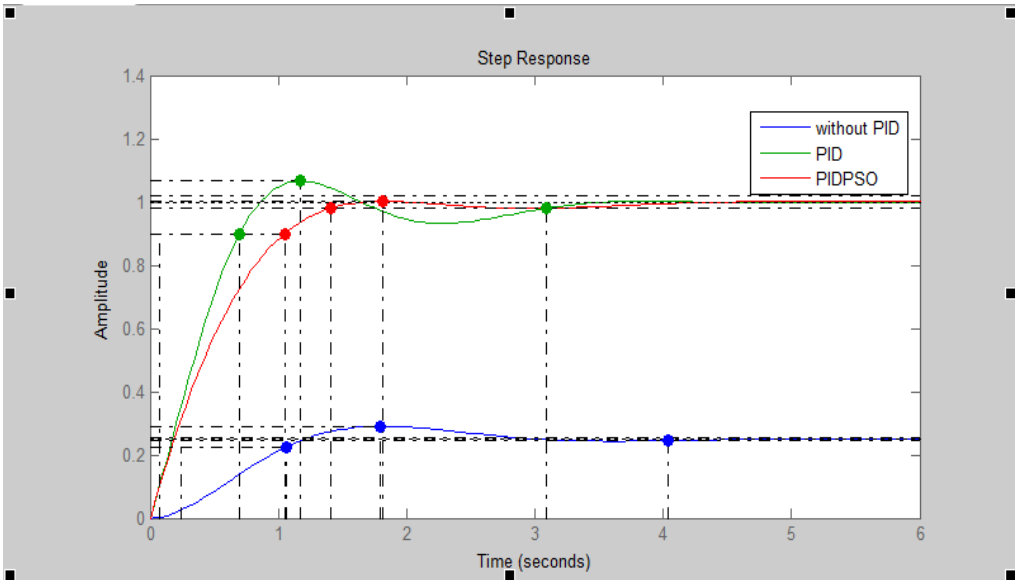

Figure 9 Performance of fitness function

Table 3 Performance criteria for PID-PSO, PID without PSO.and without PID and PSO

Parameter	PID-PSO	PID	without PID
Kp	3.8381	6.3735	N/A
Ki	5.7297	7.3835	N/A
Kd	1.423	1.3467	N/A
Rise Time/s	0.977	0.622	0.82
Settling Time/s	1.41	3.09	4.04
Overshoot/%	0.153	6.53	16.3
Fitness function, F	2.54	10.24	21.16

Analysis 4. Comparison PID-PSO and PI-PSO

In order to emphasize the advantage of the proposed PID-PSO controller, the analysis has been done to the transfer function of dc motor used by Rohit G. Kanojira, $G_1(s) = \frac{0.015}{0.01s^2+0.14s+0.40015}$ to PI-PSO controller, PI-ZN and PI-MZN. I have compared the performance of rise time, settling time and overshoot output shown in Figure 10. The figures shown that there has a slightly different for all parameter performance between PI-PSO and PID-PSO but by using Ziegler-Nichols method, the overshoot is obviously high compare to PSO method. Table 4 summarized of output for PI-ZN, PI-MZN, PI-PSO and PID-PSO

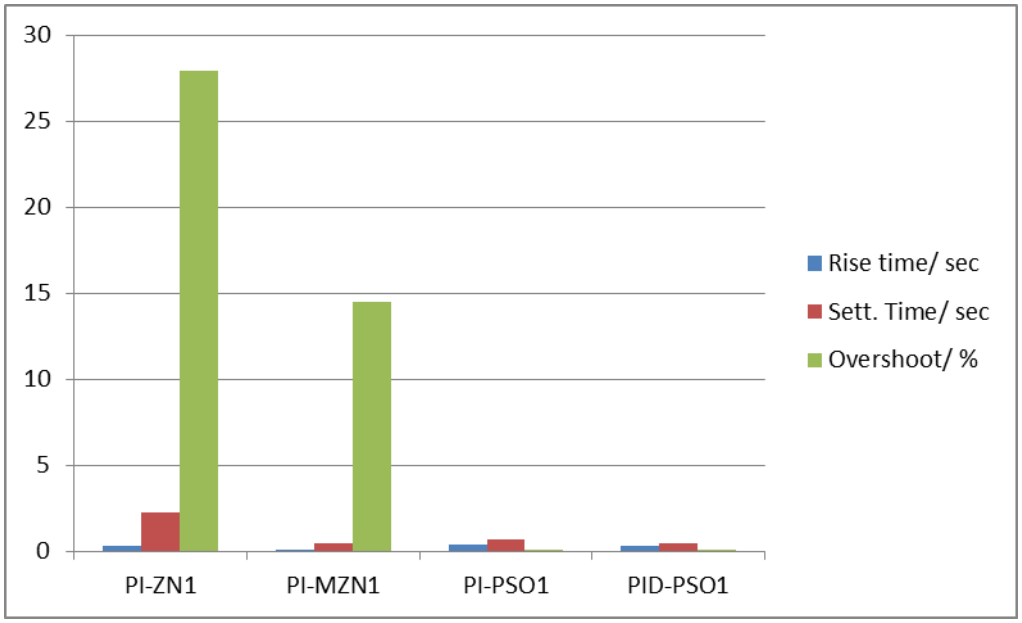

Figure 10 Comparison performance for PI-ZN, PI-MZN, PI-PSO and PID-PSO

Table 4 Performance criteria for PI-ZN, PI-MZN, PI-PSO and PID-PSO

Penerbit	Algorithm	Parameter PID			Prestasi PID		
		Kp	Ki	Kd	Rise time/ sec	Sett. Time/ sec	Overshoot/ %
Rohit G. Kanojira. 2012	PI-ZN[1]	N/A	N/A	N/A	0.312	2.27	27.9
	PI-MZN[1]	N/A	N/A	N/A	0.074	0.439	14.5
	PI-PSO[1]	N/A	N/A	N/A	0.3907	0.6467	0.042
Own research	PID-PSO[1]	43.4703	132.4802	0.1083	0.2806	0.4326	0.0050

CONCLUSION

This paper presented a design of predictive controller for dc motor using PSO method to optimize PID parameter. The study have been done on inertia weight and number of iteration for PSO parameter. From the conducted study, the optimized value for PSO parameter is w=0.9 and no of iteration=100 with number of particle is 54. From analysis done on 3 and 4, by tuning the PID by using PSO method, the best gain in performance may be found. There have a lot of tuning methods exist but the PSO algorithm method giving the most effective approach to tuning a controller. By comparison on PI-PSO and PID-PSO controller, PID-PSO controller giving the satisfactory performances and processes good robustness (very low overshoot, minimum rise time and settling time).

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MULTI-OBJECTIVES OPTIMIZATION OF POWER CONSUMPTION OF A BUILDING TOWARDS ENERGY SAVING

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Abstract: The sources of energy are limited but the need is growing and electricity is one of the highest operational costs of a building. The high cost is mainly contributed by the electrical energy consumption of the air-conditioning and lighting systems. Optimizing the power consumption of a building without sacrificing the occupants' comfort is extremely important as this will reduce electricity bills while maintaining the productivity level of the building's occupants. This work adopts the use of Genetic Algorithm (GA), for solving the multi-objective optimization problem of the power consumption and comfort in a building, focusing on the room temperature and illumination. The case study involves the use of one air conditioning unit and 12 units of 36-watt fluorescent lamps in a 5-m 2 room with the objective of minimizing the power consumption and maximizing comfort. With the application of the GA, the demand requirements have been satisfied. Comparisons between the use of the optimization technique and without the optimization technique have been carried out, both in simulation and real-time experiments. The results show that the GA optimization produces a 23.85% reduction in terms of current (amp), 24.68% reduction in terms of power (w), 23.09% reduction kWh, and 22.81 % reduction in terms of the electric billing cost.

INTRODUCTION

Thermal comfort is defined in British Standard BS EN ISO 7730 as 'that condition of mind which expresses satisfaction with the thermal environment.' So the term 'thermal comfort' describes a person's psychological state of mind and is usually referred to in terms of whether someone is feeling too hot or too cold. Thermal comfort is very difficult to define because you need to take into account a range of environmental and personal factors when deciding what will make people feel comfortable. These factors make up what is known as the 'human thermal environment'. The best that you can realistically hope to achieve is a thermal environment that satisfies the majority of people in the workplace, or put more simply, 'reasonable comfort'. HSE considers 80% of the occupants as a reasonable limit for the minimum number of people who should be thermally comfortable in an environment. So thermal comfort is not measured by air temperature, but by the number of employees complaining of thermal discomfort. To better understand why air temperature alone is not a valid indicator of thermal comfort. Why is thermal comfort important because people working in uncomfortably hot and cold environments are more likely to behave unsafely because their ability to make decisions and/or perform manual task deteriorates. A suitable physical climate is needed if one wants to feel comfortable and efficient at work. The environment feels comfortable when you are barely aware of the climatic conditions. It is only when temperature decreases and increases beyond ones' comfort limits that one becomes aware of discomfort (Jorn Toftum 2002). The comfort zone is about 20 - 22°C for a clothed person in the winter and 20 - 24°C in the summer. An increase in temperature 5 above the comfort level may make one tired and sleepy. A decrease in temperature may make one restless and less attentive. People vary in their feelings about what is a comfortable temperature and this depends on what

they are doing and what they are wearing (Peter Hoppe 2003). Light is effective when it corresponds to the visual needs of the worker. Morris defined good lighting as "the right kind and right amount of light at the right place". Sustainable lighting helps to avoid accidents, supports emotional and physical well being and contributes to security. Knez and Enmarkar(1998), Galsiu and Veitch (2006) opined that artificial lighting is needed to provide task luminance and adequate visual environment to carry on the tasks when natural light is inadequate or not available. Good artificial illumination prevents accidents, prospects health by minimizing eye strain and also contributes to the beauty in offices. Hence, the present study was undertaken with an objective to develop a scale for measuring thermal comfort and illumination in buildings. In conclusion, Malaysia faces big challenges ahead to meet the country's growing demand for energy using sustainable practices. Malaysia can succeed provided there is a concerted effort for increasing the: 1) implementation and management of sustainable energy sources, 2) energy efficiency.

METHODOLOGY

2.1 Determine the prime set of variables.

Building environmental system is shown in Figure 1. Power consumption is considered operating on a vertical axis and the comfort is considered operating on a horizontal axis. Mathematical model of the dynamics of the power consumption versus comfort is easily obtained from Rui Yang and Lingfeng Wang (2010). It is clear that the systems selection of the input such as temperature (°C) and illumination (Lux) and selection of the output such as power consumption and comfort with respect to an illumination and temperature.

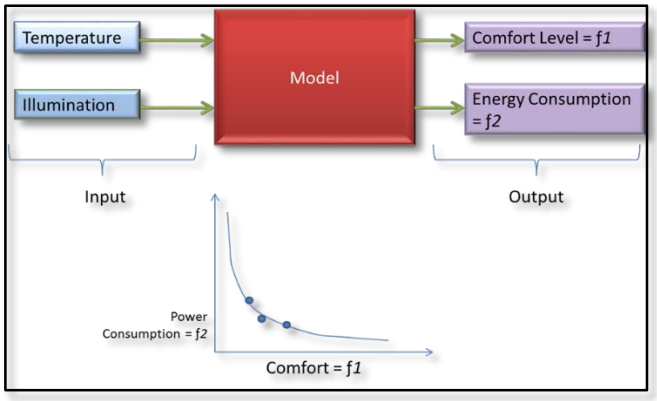

Figure 1: Selection of Variables

2.2 Determine the mathematical model

2.2.1 Comfort

$$\text{Comfort} = \delta_1 \{1 - (e_T/T_{set})^2\} + \delta_1 \{1 - (e_L/L_{set})^2\} \quad (2.1)$$

where

$\delta 1, \delta 2$ = User-defined values ($\delta 1 + \delta 2 = 1$), we set each delta 0.5 to make it simple

T_{set}, L_{set} = Set values of each variable, that is set to be 23.0°C, 650 lux.

eT, eL = Error between actual value and set value.(T is indoor temperature (°C), L is illumination (lux)

2.2.2 Temperature

$$P_{all} = q_{ac}\left\{\frac{BTUh_{ac}}{170.6\frac{T_{set}}{T_{set}-T_{out}}+56}\right\} + q_{lamp}\left(P_{lamp-avg}\right)$$

qac = Quantity of Aircond unit,

BTUhac = value BTU hour Aircond according to the manufacturer

A Btu is the amount of heat necessary to raise the temperature of 1 pound (0.45 kilograms) of water one degree Fahrenheit (0.56 degrees Celsius). One Btu equals 1,055 joules. In heating and cooling terms, one ton equals 12,000 Btu.

The air conditioner might be rated at 11,760 Btu.

Tset	=	Indoor temperature,
Tout	=	Outdoor temperature,
qlamp	=	Number of lamp,
Plamp-avg	=	Average power rating for every lamp unit.

Building environmental system is shown in Figure 1. Power consumption is considered operating on a vertical axis and the comfort is considered operating on a horizontal axis. Mathematical model of the dynamics of the power consumption versus comfort is easily obtained from Rui Yang and Lingfeng Wang (2010). It is clear that the systems selection of the input such as temperature (°C) and illumination (Lux) and selection of the output such as power consumption and comfort with respect to an illumination and temperature.

2.2.3 Lux to watts calculation formula

i. Lux to watts calculation with area in square feet

The power P in watts (W) is equal to the 0.09290304 times the illuminance E_v in lux (lx) times the surface area A in square feet (ft^2), divided by the luminous efficacy η in lumens per watt (lm/W):

$$P(W) = 0.09290304 \times E_{v(lx)} \times A(ft2) \; / \; \eta(lm/W) \tag{2.3}$$

ii. Lux to watts calculation with area in square meters

The power P in watts (W) is equal to the illuminance E_v in lux (lx) times the surface area A in square meters (m^2), divided by the luminous efficacy η in lumens per watt (lm/W):

$$P(W) = E_{v(lx)} \times A(m2) \; / \; \eta(lm/W) \tag{2.4}$$

RESULT

In order to validate and investigate the quality of results obtained from the GA, The result with optimization method and result without optimization method presented in electricity costing billing calculation approach.. The simulation of these algorithms was based on the parameter set defined earlier in Table 4.1 for the GA. In addition to the parameter set, the weights of the fitness function were based on a c=0. 999 and E=0. 001 with the objective function 1 (comfort) assigned a higher weight value than the objective function 2 (Energy). The results of comparisons of the optimization method of these algorithms (GA) and without optimization method are presented in Table 1.

Table 1: Result and Comparisons

Without Optimization Method **Temperature = 18°C** **Illumination= 536.7 lux**	No	Item	Quantity	Volt(V)	Current (A)	Power (W)	Hour in a day	No. of day	Kilo Watts Hour (kWh)	Cost (RM) per day
	1.	Mitsubishi Aircond (1.5hp)	1	225	4.3675	982.687	9	1	8.84	2.63
	2.	Fluorescent Lamp 36-watt (philips)	12	103	0.291	29.973	9	1	3.24	
			Total		4.6585	1,013			12.08	
With Optimization Method **Temperature = 24°C** **Illumination= 500 lux**	1.	Mitsubishi Aircond (1.5hp)	1	225	3.2564	732.69	9	1	6.59	2.03
	2.	Fluorescent Lamp 36-watt (philips)	10	103	0.291	29.97	9	1	2.70	
			Total		3.5474	762.66			9.29	
Result of total differences between optimization method and without optimization method			Total different		1.1111	250.34			2.79	0.60
			Total percentage % different		23.85%	24.68%			23.09%	22.81%

CONCLUSION

The application of the GA to the problem shows the ability of the algorithm in producing an optimal result for the system. The GA produced does not only reduce the power consumption but also the level of illumination in the building. Thereafter the performance of the GA shows that the GA poses a better chance of producing an optimal result. However there are some aspect of the GA that needs to be improved in order to make it more reliable and adaptive for more case study implementation. The

optimization considered the power consumption and comforts as for each degree set below 24 degrees Celsius (75F), reduce 3% to 7% more power consumption. This power saving tip will give you the most comfort at the least cost. 55 In the application in the tuning generation parameters, the GA has successfully provided the reliability and optimized parameters in the simulation. However, the experimental results experience reduced the temperature and illumination level in the building. Nevertheless, the capability of GA in tune weight and generation parameters has overcome the problems and restrictions in the conventional tuning approaches. Hence, optimization using GA should find attention near future.

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A Rectangular Microstrip Patch Antenna (RMPA) with Defected Ground Structure (DGS) for Bandwidth Enhancement

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Abstract: In this paper, a rectangular microstrip patch antenna (RMPA) with defected ground structure (DGS) for wireless application is proposed. A rectangular shaped DGS is simulated using the Computer Simulation Technology (CST) Microwave Studio software to enhance the antenna bandwidth.

The simulation results is compared and analyzed. The antennas with Rectangular DGS could improve approximately 64% of bandwidth and miniaturize the antenna about 25%.

Keywords- Defected Ground Structure(DGS), Microstrip Patch Antenna, Computer Simulation Technology (CST) software

INTRODUCTION

Wireless revolution has become an essential in connecting everyday devices through embedded wireless technology. Embedded wireless communication technology such as WiMAX (IEEE 802.16), WLAN (IEEE 802.11), and WPAN (IEEE 802.15) such as Bluetooth, Zigbee, IrDa and RFID has widely use in today's application, from personal electronics and medical devices, to the transportation infrastructure and manufacturing. These devices require wider band and good radiation performance. It has lead the study and development in antenna field to improve antenna performance.

Microstrip patch antenna (MPA) has widely used in embedded wireless communication and microwave devices because of its characteristics: such as light weight, thin, low volume, low cost and easy manufacturability. MPA provide great advantages over the traditional antenna as it can be easily fabricated and integrated in solid-state devices.

However, the conventional antenna has a narrow bandwidth and low efficiency. Antenna bandwidth can be increased by increasing the height of the substrate, unfortunately this increment will larger the size of antenna and decrease the antenna efficiency.

DGS is used to enhance the MPA performances. DGS is realized by etching off a portion of the ground plan of antenna mostly in form of rectangular[1][2], triangle[3], dumbbell[4][5], circular[6-8], split ring[9], hexagonal[10] or spiral[8][11][12]. The defected ground will disturbs the shield current distribution in the ground plane, which influences the input impendence and current flow of the antenna [9][14-15]. The shape and dimension of the defect will give different effects such as size reduction [11][16], bandwidth enhancement[14][17][18] and gain increasing[18-20].

The purpose of this work is to use rectangular shaped defected ground structure to improve return loss, VSWR and provides higher bandwidth over conventional Rectangular Microstrip Patch Antenna (RMPA) operating at 2.4GHz frequency band for WLAN(IEEE802.11) application.

METHODOLOGY

1) Antenna Design and Geometry

The substrate FR4 with thickness 1.6 mm and dielectric constant of 4.3 has been used. Patch length, width and substrate height are given as *L*, *W* and *h* respectively. The coordinate axis is selected such that the length is along y, width is along x direction.

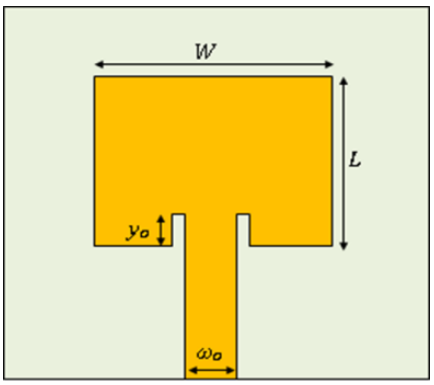


Fig. 1: Rectangular microstrip patch antenna

In order to operate in the fundamental TM_{10} mode, the length of the patch must be slightly less than $\lambda_g/2$ where λ_g is the wavelength in the dielectric medium and is equal to $\lambda_o/\sqrt{\varepsilon_{reff}}$ where λ_o is the free space wavelength.

$$\lambda_g = \frac{\lambda_o}{\sqrt{\varepsilon_{eff}}} \qquad (1)$$

The width of antenna patch must be kept small enough to avoid excitation of transverse resonance. Typically width must be less than λ_g. The width is calculated by transmission line model equation:

$$W = \frac{c}{2f\sqrt{\frac{\varepsilon_r+1}{2}}} \qquad (2)$$

where c is the speed of light ($3 \times 10^8 \mathrm{ms}^{-1}$).

Reducing the width will increase the resonant frequency, while, increasing the width will reduce the resonance frequecy.

Effective dielectric constant, ε_{eff} is given by the equation:

$$\varepsilon_{eff} = \frac{\varepsilon_r+1}{2} + \frac{\varepsilon_r-1}{2}\left(1+12\frac{h}{W}\right)^{-\frac{1}{2}} \qquad (3)$$

For a given resonance frequency f_0, the effective length is given as:

$$L_{eff} = \frac{c}{2f\sqrt{\varepsilon_{eff}}} \qquad (4)$$

Calculation of Length extention, ΔL is as follows:

$$\Delta L = 0.412\frac{(\varepsilon_{eff}+0.3)\left(\frac{W}{h}+0.264\right)}{(\varepsilon_{eff}-0.258)\left(\frac{W}{h}+0.8\right)}h \qquad (5)$$

The actual length of patch, L is given as:

$$L = L_{eff} - 2\Delta L \qquad (6)$$

Reducing the length of patch will increase the antenna resonance frequency, while increasing the length will reduce the resonance frequency.

The ground plane dimension is given as:

$$L_g = 6h + L \quad (7)$$

$$W_g = 6h + W \quad (8)$$

The width of feed line, w_o is given as :

$$Z_c = \frac{87}{\sqrt{\varepsilon_r + 1.41}} \ln\left[\frac{5.98h}{0.8\omega_0}\right] \quad (9)$$

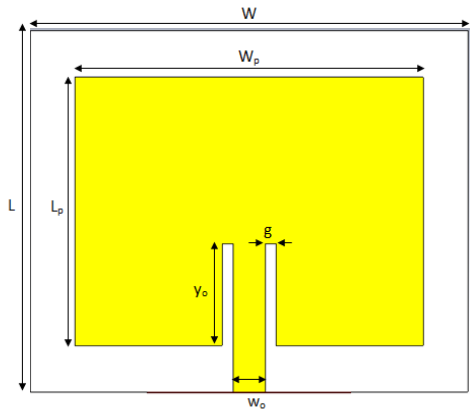
The size of feed line will influence the impedance of antenna. The increments of feed size decrease the input impedance.

Table 1: Parameters and Dimensions

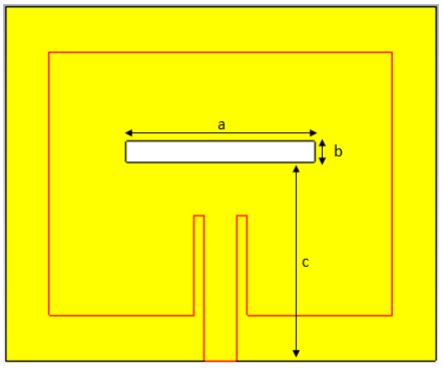
Parameters	**Dimensions**	
	Calculated	**Conventional Antenna**
Patch width, W_p	38.39	31.00
Patch Length, L_p	29.96	25.00
Insert cut Length, y_0	9.92	9.50
Feed Line Width, w_0	2.16	3.055

2) The Parameter of the Rectangular Shaped DGS

In this work, the effect of rectangular DGS position has been investigated. Fig 2 shows the proposed antenna with rectangular shaped DGS.



(a)



(b)

Fig. 2: Rectangular Patch Antenna with Rectangular Shaped DGS (a) Front view,

(b) Ground view

The first step is to identify the best parameter for rectangular shaped defect. The size of antenna is reduced by 1/8 to achieve the target which is 25% size reduction. Next, several size of rectangular shaped DGS have been simulated. The rectangular width, a, were increased by 2mm and the length, b, were increased by 1mm. From the simulation results show in Fig. 3, the

rectangular with 18 mm x 2 mm has been choosed for further study since it has the lowest resonance frequency and return lost.

Table 2: The dimension of DGS for the proposed antenna

	Dimension
Rectangular DGS width, a	18 mm
Rectangular DGS length, b	2 mm

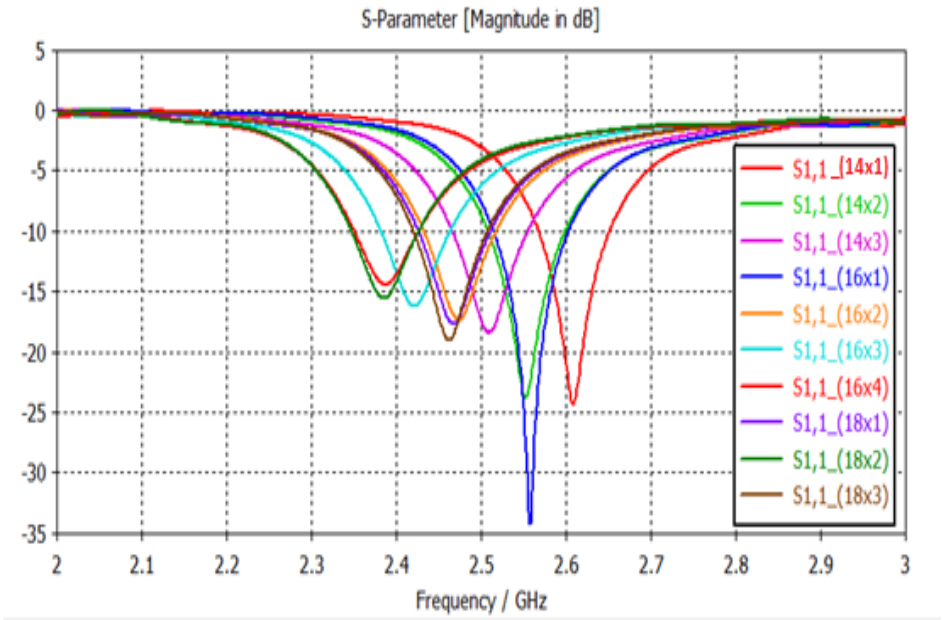


Fig. 3: Parametric studies of DGS parameters

From Fig. 3, it can be concluded that by increasing the DGS width, a, the resonance frequency will decreases, vice versa, decreasing the DGS width will increases the resonance frequency. Increasing the DGS length, b, will decrease the return loss.

The next step is optimization process. This process is done by doing a minor adjustment to rectangular patch and ground plane sizes to get desired resonance frequency at 2.4 GHz as well as the lowest return loss.

RESULT, ANALYSIS AND DISCUSSIONS

The antennas are modelled and simulated using CST Microwave Studio software. The simulation results of conventional antenna are shown in Table 3. The RMPA resonates at frequency 2.4GHz and return loss is -25.75 dB.

1) The position of rectangular shaped DGS

The rectangular shaped DGS was etched in the ground plane. The position of DGS was put in several different positions along y-axis. The results are shown in Fig.4.

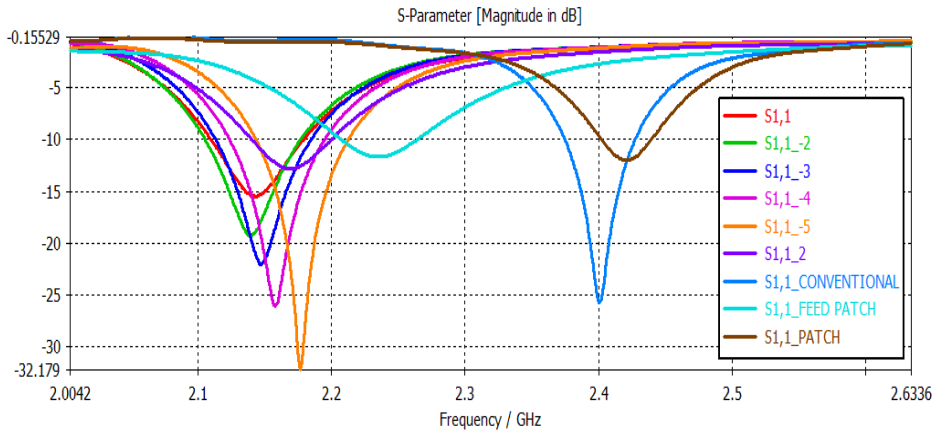
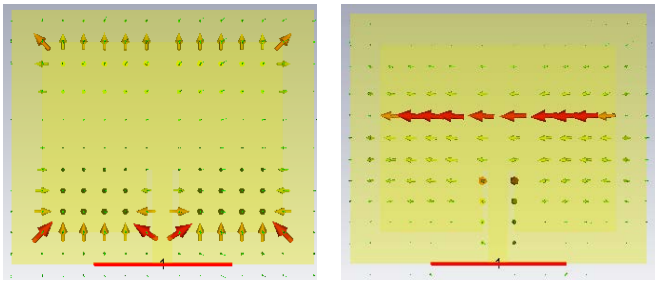
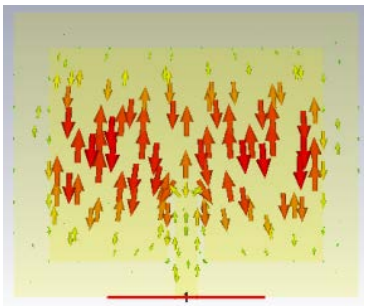


Fig. 4: Return loss for RMPA with DGS at various positions

From the graph above, it can be concluded that the position of DGS has affected the antenna performance. The DGS at c = 23.25 mm has the best antenna performance in term of return loss and bandwidth. DGS at c = 20.25 mm has the lowest resonance frequency.



(a) (b)



(c)

Fig. 5: (a) E-field (b) H-field wave propagation and (c) surface current

From Fig. 5, it can be concluded that the resonance frequency reduced when the DGS is put at the area with high H-field density. When the DGS is put at the area of high E-field density, the return loss become higher and it resonate to the higher frequency.

It can be concluded that the best position to put DGS in order to get larger bandwidth and compact antenna size is at the point with the highest H field.

2) The comparison size of RMPA without DGS and RMPA with Rectangular DGS

The DGS at point c = 20.25 mm was then optimized so that it resonates at center frequency of 2.4 GHz. The final design of antenna's parameters is

shown in Table 3. The size of antenna with rectangular shape DGS of 18mm x 2mm is found to be reduced by 25.4%. Fig. 6 shows the comparison of the size of the antenna between conventional antenna and RMPA with rectangular DGS.

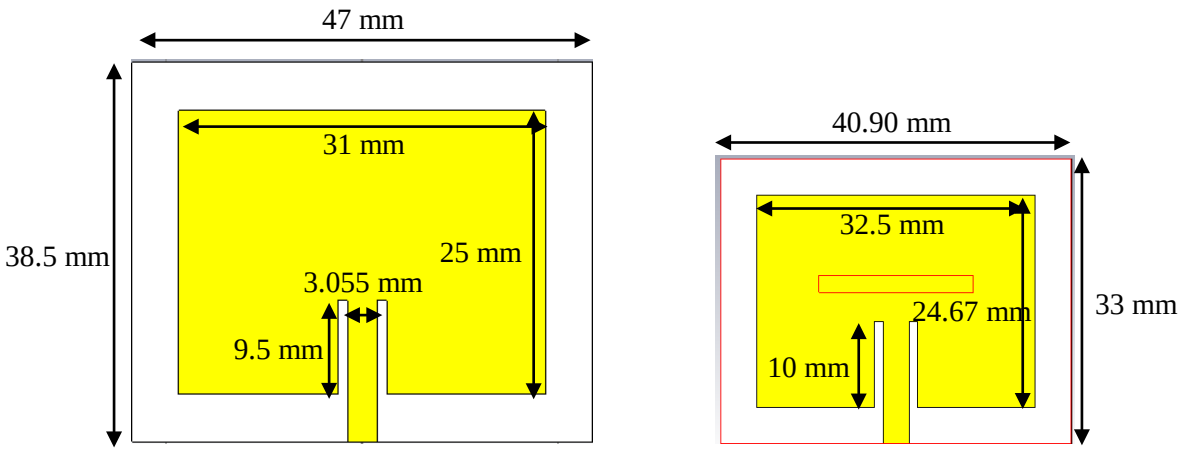


Fig. 6: Top view dimension of the RMPA (a) RMPA without DGS, (b) RMPA with Rectangular DGS

Table 3: Parameters of Proposed Antenna

Parameters	Dimensions	
	Conventional RMPA	**Proposed RMPA with Rectangular DGS**
Ground Width, W	47	40.9
Ground Length, L	38.5	33
Patch width, W_p	31	32.5
Patch Length, L_p	25	24.667
Insert cut Length, w_c	9.5	10
Feed Line Width, w_f	3.055	3.055

3) The Comparison of Return Loss Between RMPA Without DGS and With Rectangular Shaped DGS

Table 4 and Fig.7 shows the comparison of return loss, S_{11} between RMPA without DGS and optimized RMPA with DGS. It can be found that RMPA with DGS gives better return loss which is -39.42 dB compared to the simulated result for RMPA with DGS which is -25.75 dB. The impedance bandwidth for RMPA with DGS also increased about 64.3%, from 52.612 MHz to 86.457 MHz.

Table 4: Comparison Between Conventional RMPA and Proposed Antenna

	Conventional RMPA	**Proposed RMPA with Rectangular DGS**
Return Loss, S1,1 (dB)	-25.75	-39.417
VSWR	1.183	1.022
Bandwidth (MHz)	52.617	86.457
Gain (dB)	3.061	1.348

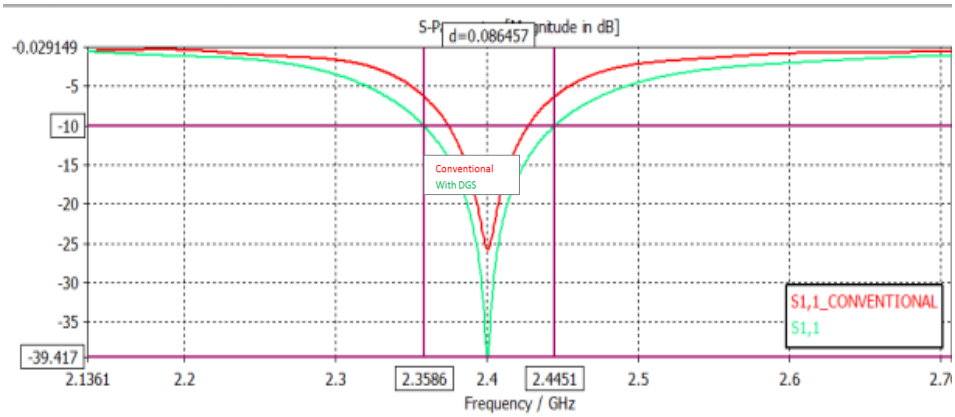


Fig. 7: Comparison between Conventional RMPA and RMPA with DGS

CONCLUSION

In this work it is found that the implementation of Rectangular Shaped DGS on a Rectangular Microstrip Patch Antenna (RMPA) significantly improves the antenna bandwidth by 64.3%, reducing the return loss by 53%, thus improved the impedance matching. Overall, the objective of this work to design a low cost and compact antenna with wider bandwidth is achieved, even though the performance of designed antenna does not show improvement. A future work recommendation is focusing on various shapes of DGSs to increase more bandwidth as well as gain and directivity suitable for WLAN and WiMAX application.

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FAULT TYPE CLASSIFICATION USING PATTERN RECOGNITION

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Abstract: An electromagnetic transient in power systems is due to various disturbances in the transmission line, such as a fault on the transmission line, it is very important. Fault occurs when two or more conductors in contact with each other or the ground in a three-phase system , the fault is classified as single line to ground fault , line to line fault , double line to ground fault and three phase fault. Fault identification of power system using the information presented by the wavelet analysis of transient power system is proposed to detect the type of line or wave transmission fault. The work presented in this study focuses on identifying simple power system fault. Discrete wavelet transform (DWT) analysis of transient disturbances caused due to the fault done by the creation of the standards, the maximum detail coefficients and energy signals for each type of fault simulation is simple in its nature and is used to distinguish the type of fault.

INTRODUCTION

An important objective of all the power systems is to maintain a very high level of continuity of service, and when abnormal conditions occur, to minimize the outage times. It is practically impossible to avoid consequences of natural events, physical accidents, equipment failure or disoperation which results in the loss of power, voltage dips on the power system. Natural events can cause short circuits that are faults which can either be single phase to ground or phase to phase or phase to phase to ground or a three phase fault. This research study of fault identification and classification on transmission lines using pattern recognition. In this research proposed Discrete Wavelet Transform (DWT) to detect and classify the fault accurately.

An overhead transmission line is one of the main components in every electric power system. The transmission line is exposed to the environment and the possibility of experiencing faults on the transmission line is generally higher than that on other main components. Line faults are the most common faults, they may be triggered by lightning strokes, trees may fall across lines (tree encroachment), fog and salt spray on dirty insulators may cause the insulator strings to flash over (pollution caused flashovers) switching over voltage and bird pollution accumulation on glass disc insulators. The occurrence of any transmission line fault give raise to a transient condition and will be affects the entire power system. When a fault occurs on an electrical transmission line, it is very important to detect it and to find its location in order to make necessary repairs and to restore power as soon as possible. The time needed to determine the fault point along the line will affect the quality of the power delivery. Therefore, an accurate fault location on the line is an important requirement for a permanent fault. The speed and accuracy of relays of transmission lines can be improved by accurate and fast fault detection and classification. Pointing to a weak spot, it is also helpful for

a transient fault, which may result from a marginally contaminated insulator, or a swaying or growing tree under the line. Figure 1, is an illustration of the electrical protective relaying system proposed in this work showing the multistage process.

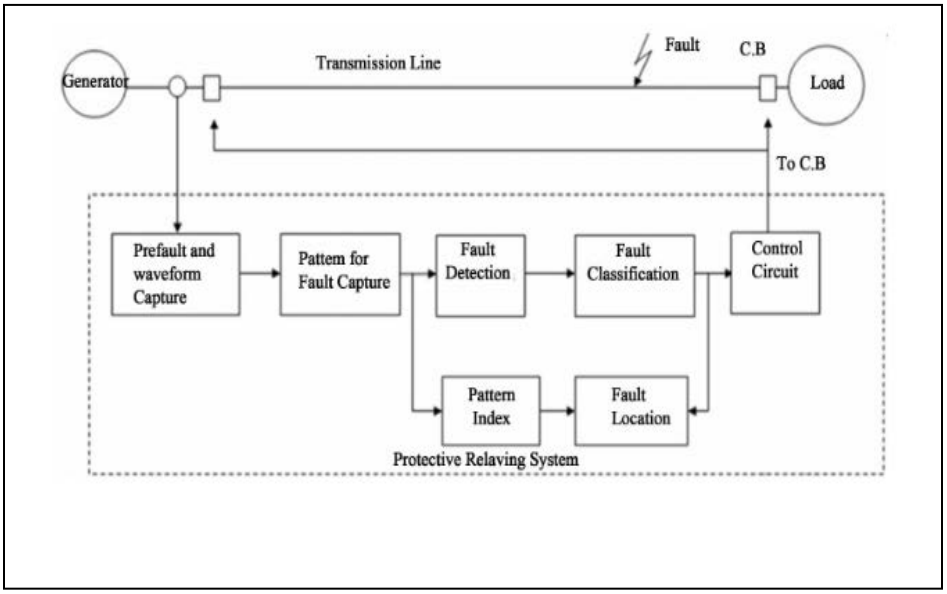

Figure 1: An illustration of the electrical protective relaying system proposed in this work showing the multistage process.

1. Research Methodology

2. Literatures reviewed on identify and classify the fault on transmission line using Discrete Wavelet Transform (DWT).
3. Designed circuits that include two of generator 20 KV (100MVA), transformer 20/220 KV (100MVA), circuit is parallel and simulate the circuits using MATLAB.

4. Develop discrete wavelet transform by design a program using Matlab tools for identify and classify the fault type.
5. Collect data of features discrete wavelet transform.
6. Compare the data features of discrete wavelet transform faulty and normal to analyze for fault.

2. Function block diagram of DWT method

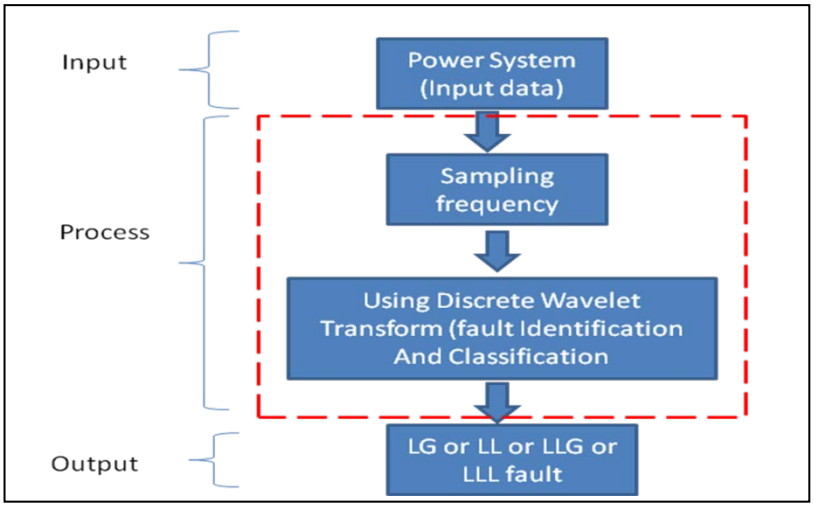

Figure 2: Function block diagram of DWT method

Figure 2, shows the proposed method's functional block diagram. The voltage and current waveforms of the simulated power system are fed as input to the sampling network. The signals are sampled at 50 KHz to obtain higher resolution. The sampled signals are given to the discrete wavelet transform to identify and classify the faults. Thus different types of faults are classified.

3. Setting Parameter And Its Implementation

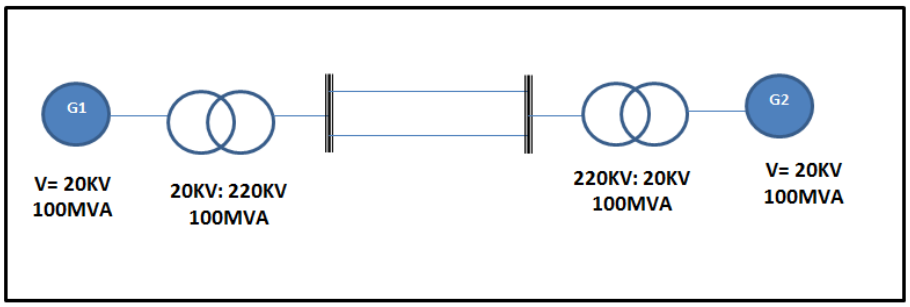

Figure 3: Power system under study

Figure 3, shows the power system under study and a simple transmission line circuit consisting of a generator at one end and a load at the other end and the line is extended to 200 km. The frequency of the system is 50Hz. Simulation of the simple power system is using by MATLAB.

The Parameter setting is:

a. Generator 1 and 2 is 20KV (100MVA)

b. Transformer 20: 220KV (100MVA)

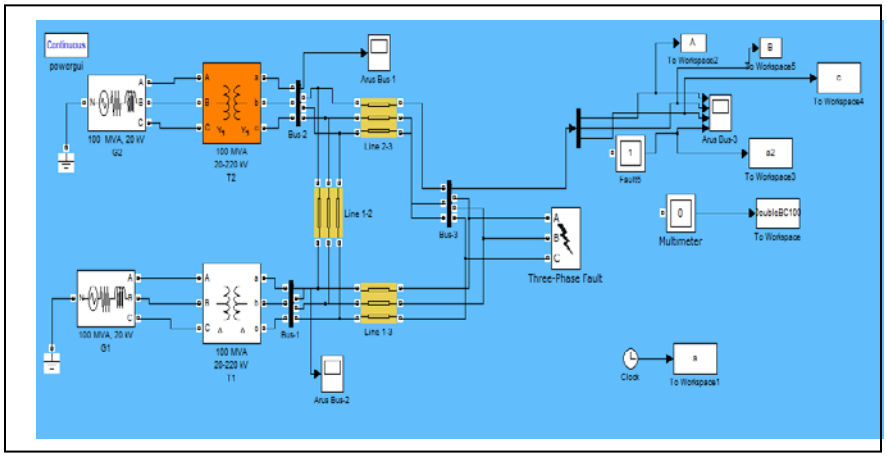

Figure 4: SIMULINK simulation

Figure 4, shows the SIMULINK simulation for the simulation study use Matlab.

The parameter setting is:

i. Fault Occurs At 100km
ii. Line Length 200km
iii. Frequency = 50Hz
iv. Voltage Source = 20KV and 100MVA
v. Fault Resistance = 0.001Ω
vi. Ground Resistance = 0.001Ω
vii. Resistance per unit length (ohm/km) = [0.01273 0.3864]
viii. Inductance per unit length (H/km)= [0.9337e-3 4.1264e-3]
ix. Capacitance per unit length (F/km)= [12.74e-9 7.751e-9]

4. Develop of Discrete Wavelet Transform

Three phase current signals at normal condition were recorded and decomposed using Discrete Wavelet Transform (DWT) daubechies four level four (db4 level 4) to get there maximum details coefficient, energy of these signals and then making compression of these signals. Take the ratio of energy change from the first level with keeping approximation with no change because fault inception have great effect on detail coefficient and standard deviation (SD) as it generate a high frequency component to signal. First Faults were created at a line for one cycle and analysis these signals before the realizing and switching of the circuit breaker. Different types of faults were simulated using MATLAB simulation and after recorded transient signals they were decomposed using wavelet toolbox to get there maximum details coefficient, energy of these signals and then making compression to these signals to get the ratio of energy change from the first level and how faults make changes to the energy of these signals.

5. Algorithm For Detection And Classification Fault

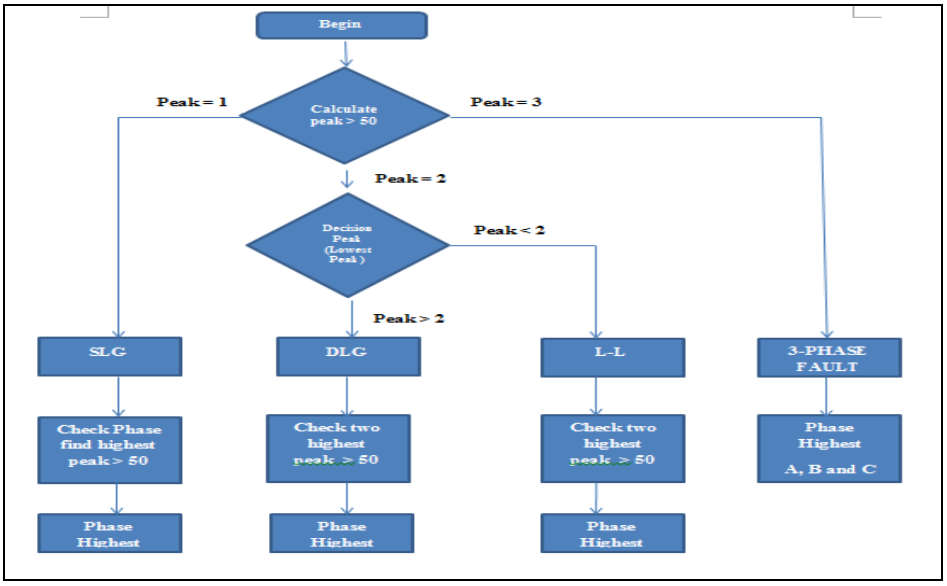

Figure 5: Algorithm For Detection And Classification Fault

Figure 5, shows that the algorithm for detection and classification of fault based on analysis data. Firstly, check the highest peak that peak is over than 50, if peak greater than 50 is equal to one that is single line to ground fault and find the phase highest. If peak greater than 50 is equal to three that is three phases fault and phase highest is phase A, B and C. If peak greater than 50 is equal to two, either double line to ground or line to line fault. After that, for the classify for double line to ground or line to line fault, check for the lowest peak. If peak less than 2, that is line to line fault and check for the two highest peak is over than 50. While, if peak more than 2 that is double line to ground fault then check for the two highest peaks is over than 50.

RESULT, ANALYSIS AND DISCUSSION

The results of the data and the signal is taken from the damage occurred in 100km and development programs results are also based on fixed parameters of Generator is 20 KV (100MVA) and 20/220 KV (100MVA) for the transformer.

Normal Signal Wave

Three phase current signal (phase A, phase B and phase C) are no fault condition are shown in Figure 6, here show that the normal wave signal is smooth and shaped sine wave with 120 per phase when there is no faulty. Four detail coefficient energy and standard deviation (approximation signal) data are shown in Table 1.

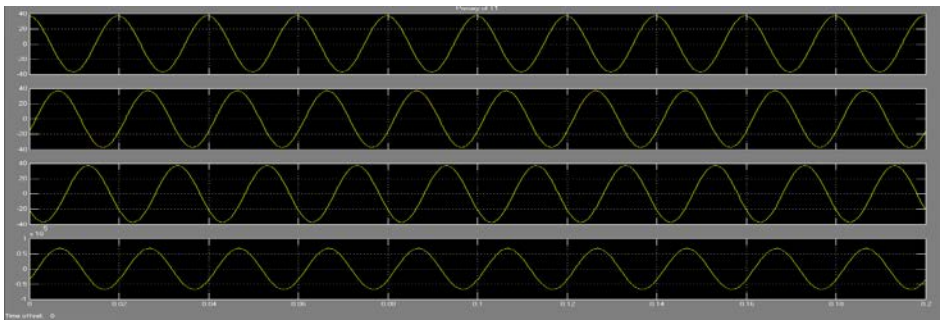

Figure 6: Signal Normal Wave

Table 1: Data Standard Deviation (SD) and Energy for Normal Signal

Types fault	**Normal**		
Phase	A	B	C
SD(A4)	26.32159	26.03359	26.14029
Energy(A4)	20881.93	20540.99	20748.45
D1	60.27666	61.10563	62.18352
D2	149.7814	158.442	159.9073
D3	211.3907	242.426	225.5558
D4	860.5535	888.3272	816.8739

Double Line To Ground At Phase A and B

Three phase current signal with phases A-B to ground fault were shown in Figure 7, here indicate that the signal is too high magnitude wave above ±400Amp phase A and B, but a slight interruption in the phase C during this fault. Magnitude on phase C is approximately 50Amp which is more than normal magnitude. Four detail coefficient energy and standard deviation (approximation signal) data are shown in Table 2.

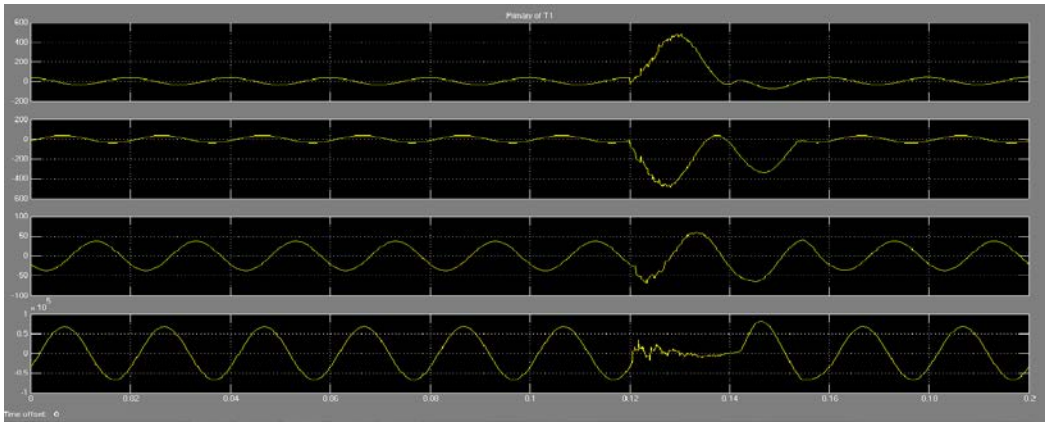

Figure 7: Double Line to Ground Fault Signal at phase A and B

Table 2: Data Standard Deviation Approximation Level Four (SD A4) and Energy for Double Line to Ground Fault Signal.

Types fault	**DLG (AB)**		
Phase	**A**	**B**	**C**
SD(A4)	149.6389	157.7467	33.59615
Energy(A4)	13254 2.6	16566 7.1	42136.03
D1	408.7273	396.4401	88.14577
D2	917.9392	839.6209	238.909
D3	1797.874	1907.704	463.7551
D4	2475.259	3182.968	1349.604

Comparison Graph For Data Standard Deviation (SD) Approximate level four (A4) with Double Line To Ground (DLG) At Phase A and B with Normal

Figure 8, shows graphically the difference between the Standard Deviation Approximation Level Four (SD A4) of Double Line To Ground Fault At Phase A And B and the Standard Deviation Approximation Level Four (SD A4), of normal signal. Table 3, shows the reading Standard Deviation Approximation Level Four (SD A4) for the fault of Double Line To Ground At Phase A and B (DLG AB) in phase A is 149.6839 and phase B is 157.7467 which is both of phase A and B Standard Deviation Approximation Level Four (SD A4) is too high where Standard Deviation Approximation Level Four (SD A4) for the normal signal is 26.32159 for phase A and 26.03359 phase B, and phase C features Standard Deviation Approximation Level Four (SD A4) change slightly due to differences with the normal signal with little

interference from the fault of the A and B phases, namely 33.59615 compare to normal at phase C is 26.14029.

Table 3: Comparison Data of Standard Deviation Approximation Level Four (SD A4) Double line To Ground Fault At Phase A and B DLG (AB) with standard deviation approximation level four (SD A4) Normal

Types fault	**DLG (AB)**		
Phase	**A**	**B**	**C**
SD(A4)	149.6389	157.7467	33.59615
NORMAL (SD A4)	26.32159	26.03359	26.14029

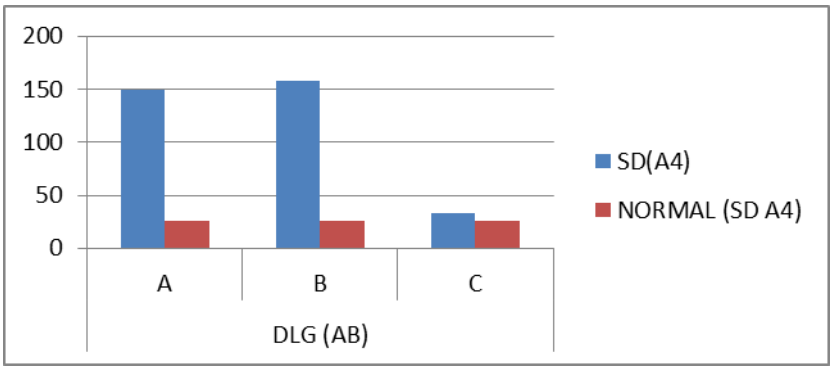

Figure 8: Comparison Graph of standard deviation approximation level four (SD A4) Double Line to Ground Fault at Phase A and B (DLG AB) with standard deviation approximation level four (SD A4) Normal

Line To Line Fault At Phase A and B

Three phase current signal with phases A-B fault were shown in Figure 9, here indicate that the signal is too high magnitude wave above ±400Amp phase A and B, but no change or signal interference that occurs in phase C. Signal on C is the same as the normal signal wave. Four detail coefficient energy and standard deviation (approximation signal) data are shown in Table 4.

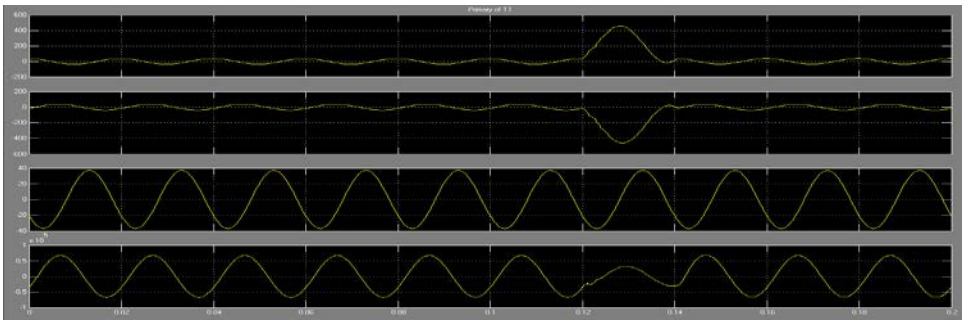

Figure 9: Line to line fault signal at phase A and B

Table 4: Data Standard Deviation Approximation Level Four (SD A4) and Energy for Line to line Fault Signal

Types fault	**L-L(AB)**		
Phase	**A**	**B**	**C**
SD(A4)	86.53241	85.92445	26.47072
Energy(A4)	43535.22	41727.22	23281.99
D1	145.552	142.4218	68.59234
D2	346.0663	345.1051	152.5941
D3	619.2732	642.8626	228.333
D4	1612.941	1751.215	905.4668

Comparison Graph For Data Standard Deviation Approximation Level Four (SD A4) with Line to Line Fault (L-L AB) and Normal

Figure 10, shows graphically the difference between the Approximation Level Four (A4) Standard Division Of Line To Line Fault At Phase A and B (L-L AB) fault and the Approximation Level Four (A4) standard normal division signal. Table 5, shows the reading Standard Deviation Approximation Level Four (SD A4) for the fault of Line To Line Fault At Phase A and B (L-L AB) in phase A is 86.5324078 and phase B is 85.92445 which is in which the two phases A and B phase fault has occurred Standard Deviation Approximation Level Four (SD A4) are the same, while the C phase unchanged SD (A4) with normal SD (A4). This is due to Line To Line Fault At Phase A and B (LL AB), if fault occurs on phase A and B there is no disruption in phase C. Phase C is the wave normal signal and has the same Standard Deviation Approximation Level Four (SD A4) of around 26.

Table 5: Comparison Data of Standard Deviation Approximation Level Four (SD A4) Line To Line Fault At Phase A and B (L-L AB) with standard deviation approximation level four (SD A4) Normal

Types fault	**L-L(AB)**		
Phase	**A**	**B**	**C**
SD(A4)	86.5324078	85.92445	26.47072
NORMAL (SD A4)	26.3215879	26.03359	26.14029

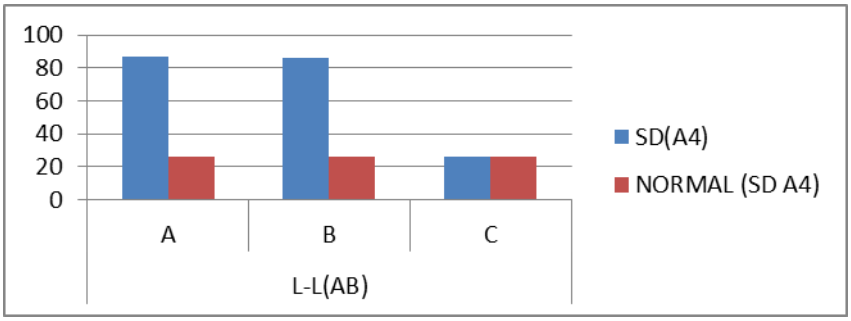

Figure 10: Comparison Graph of Standard Deviation Approximation Level Four (SD A4) Line To Line Fault (L-L AB) with Standard Deviation Approximation Level Four (SD A4) Normal

Single Line To Ground Fault At Phase A

Three phase current signal with phases A to ground fault were shown in Figure 11, here indicate that the signal is too high magnitude wave above 400Amp at phase A, but a slight interruption in the phase B and C during this fault. Magnitude on phase B and C is approximately 50 Amp which is more than normal magnitude. Four detail coefficient energy and standard deviation (approximation signal) data are shown in Table 6.

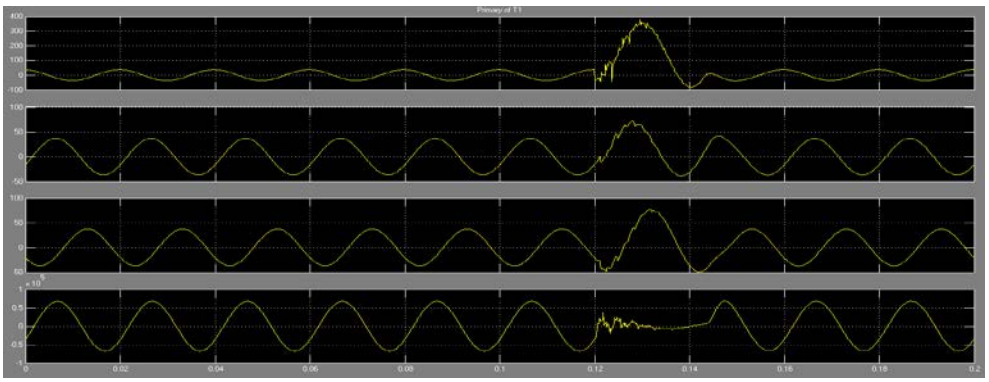

Figure 11: Single Line to ground fault signal at phase A and B

Table 6: Data Standard Deviation Approximation Level Four (SD A4) and Energy for Single Line to Ground Fault At Phase A Signal

Types fault	**SLG (A)**		
Phase	**A**	**B**	**C**
SD(A4)	109.1981	30.95394	33.69329
Energy(A4)	10564 9.7	38945. 47	42684. 06
D1	678.6979	82.63425	81.25792
D2	1429.528	219.2841	231.8587
D3	2664.481	439.8384	428.2918
D4	3100.158	1195.248	1191.4

Comparison Graph and Standard Deviation Approximation Level Four (SD A4) with Single Line To Ground At Phase A (SLG A) and Normal

Figure 12, shows graphically the difference between the Approximation Level Four (A4) Standard Division Of Single Line To Ground At Phase A (SLG A) fault and the Approximation Level Four (A4), standard normal division signal. Table 7, shows the reading Standard Deviation Approximation Level Four (SD A4) for the fault of Single Line To Ground At Phase A (SLG A) in phase A is 109.1981 which is phase A standard deviation approximation level four (SD A4) is too high where Standard Deviation Approximation Level Four (SD A4) for the normal signal is 26.32159 for phase A, and both phase B and C features Standard Deviation Approximation Level Four (SD A4) change slightly due to differences with the normal signal with little interference from the fault of the phase A, namely 30.95394 for phase B and 33.69329 phase C compare to normal at phase B is 26.03359 and 26.14029 at phase C.

Table 7: Comparison Data of Standard Deviation Approximation Level Four (SD A4) Single Line To Ground At Phase A (SLG A) with Standard Deviation Approximation Level Four (SD A4) Normal.

Types fault	**SLG (A)**		
Phase	**A**	**B**	**C**
SD(A4)	109.1981	30.95394	33.69329
NORMAL (SD A4)	26.32159	26.03359	26.14029

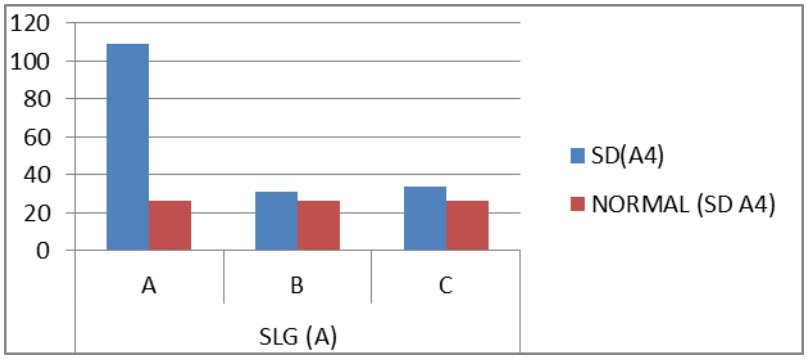

Figure 12: Comparison Graph of Standard Deviation Approximation Level Four (SD A4) Single Line To Ground At Phase A (SLG A) with Standard Deviation Approximation Level Four (SD A4) Normal

Three Phase Fault

Three phase current signals with three phase fault were shown in Figure 13 shown that at fault inception time there were great change to all phase energy, and all maximum detail coefficient of these faulty phases were higher. The energy of each signals were presented in Table 8, which were higher than normal condition.

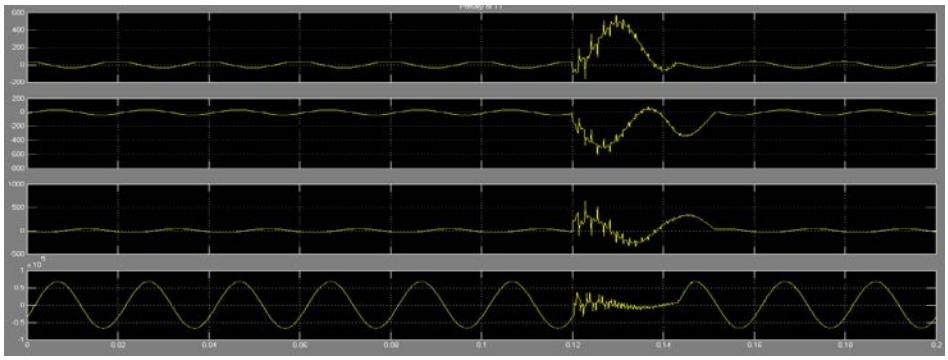

Figure 13: Three Phase Fault signal

Table 8: Data Standard Deviation Approximation Level Four (SD A4) and Energy for three phase Fault Signal

Types fault	**3-phase fault**		
Phase	**A**	**B**	**C**
SD(A4)	162.4976	173.6474	141.6016
Energy(A4)	193179.3	252436.2	192250.2
D1	1386.132	1215.258	2521.154
D2	3963.302	3604.771	7403.721
D3	6433.764	5764.848	11921.73
D4	9832.491	9108.372	18031.28

Comparison Graph For Data Standard Deviation Approximation Level Four (SD A4) with Three Phase Fault and Normal

Figure 14 shows graphically the difference between the approximation level four (A4) standard division of three phase fault and the approximation level four (A4) standard normal division signal. Table 9 shows the reading Standard Deviation Approximation Level Four (SD A4) for the fault of three phase fault in phase A is 162.4976 , phase B is 173.6474 and

phase C is 141.6016 which is Standard Deviation Approximation Level Four (SD A4) faulty in each phase were higher than normal condition.

Table 9: Comparison Data of Standard Deviation Approximation Level Four (SD A4) Three Phase Fault with Standard Deviation Approximation Level Four (SD A4) Normal

Types fault	**3-phase fault**		
Phase	**A**	**B**	**C**
SD(A4)	162.4976	173.6474	141.6016
NORMAL (SD A4)	26.32159	26.03359	26.14029

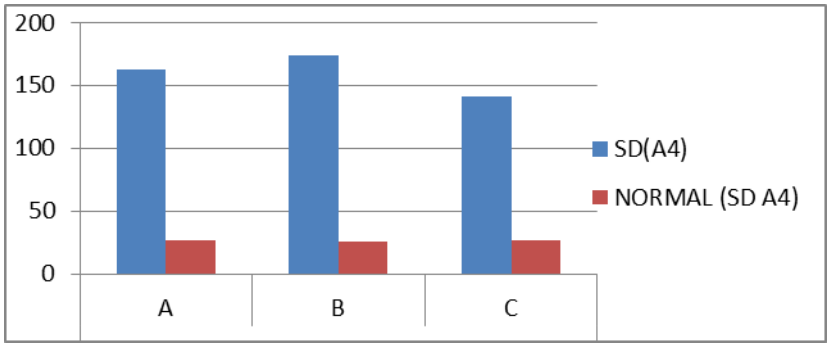

Figure 14: Comparison Graph of Standard Deviation Approximation Level Four (SD A4) Three Phase Fault with Standard Deviation Approximation Level Four (SD A4) Norma

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CONCLUSION

The application of wavelet transform to identify and classify the type of fault was achieved a very good and accurate classification for the change in the signal shape due to fault occurrence. The ability of wavelets to decompose the signal into frequency bands in both time and frequency allows accurate fault detection.

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VoIP Analysis Performance of Quality of Service in Converged Networks

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Abstract : One of the most common applications in use on converged networks today is Voice over Internet Protocol or VoIP. VoIP allows for much more flexibility in handling multiple calls simultaneously and also helps companies save money by providing additional telephony services like three-way calling and call-forwarding without the company having to pay for them individually[1]. The most key requirement for successful VoIP communications is a quality of service (QoS). Voice communications require networks with very low call delay, low jitter, higher MOS-LQ and minimal packet loss[1]. This thesis briefly describes performance of QoS in converged Networks environment in which many infrastructure WLANs are deployed in the same geographical area. The following method is use; firstly is to undertake a fundamental investigation to quantify the impact of traffic prioritization on perceived VoIP. Secondly to apply the results to develop efficient traffic prioritization model to benefit end to end voice quality for VoIP applications. Thirdly, to apply the developed models in voice quality monitoring, voice quality optomization (e.g jitter, delay and packet loss optimization) to meet The Mean Opinion Score- Listening Quality (MOS-LQ)[2].

INTRODUCTION

VoIP shares the same network with data, effectively consolidating bandwidth by sending packets to any available path at any given time resulting in more efficient use of network. However, the high quality and availability of traditional TDM (time division multiplexing) based telephone system create pressure for VoIP vendors as they construct the same service to which user are accustomed.

VoIP involves digitization of voice streams and transmitting the digital voice as packets over conventional IP-based packet networks like the Internet[1][2]. A major challenge facing VoIP is voice quality. The quality of VoIP does not yet match the quality of a circuit-switched telephone network due to several challenges such as available bandwidth, delay, jitter and packet loss. Therefore, VoIP developers need to focus on applying specific coding systems to monitor and reduce delay and packets loss to achieve higher voice quality.

What exactly constitutes a converged network? Any network that unifies voice, data, and video into a high-speed infrastructure is labeled "*converged*." As voice and data networks were designed for fundamentally different purposes, there have been significant challenges in creating networks that carry both types of traffic simultaneously[3]. Voice traffic has traditionally been comprised of circuit-switched connections in which the connection parameters remain static throughout a call's duration[3]. This allows for real-time communications to take place because a defined data path is established and doesn't change. In contrast, data networks are packet-switched, meaning that individual packets of data may take numerous paths from source to destination, making real- time communications more of a challenge. Modern converged networks attempt

to unify these into a single packet-switched environment. The problem with network priority schemes is that lower-priority traffic may be held up indefinitely when traffic is heavy unless there is sufficient bandwidth to handle the highest load level [4]. Even high-priority traffic may hold up under extreme traffic loads.

As traffic loads increase, router buffer begin to fill, which adds delay. If the buffers overflow, packets are dropped. When buffers start to fill, prioritization schemes can help by forwarding high-priority and delay-sensitive traffic happened before other traffic. This scenario requires traffic Class of Service (CoS) and it moved into queues with the appropriate service level. Prioritization can also be used in multiprotocol to give some protocols high priority than other protocols.

QoS Traffic Prioritization

One of the benefit that network traffic prioritization brings is the ability to differentiate levels of network service based on the type of traffic being prioritized. Current network traffic prioritization is often specified through standards 802.1 lq[4].

Data network are designed for maximum utilization that is to prevent wasted resources by using all available bandwidth. Because data rates tends to vary throughout the course of each day, design engineers are willing to accept longer delays during high traffic periods in order to "keep the pipes full" as often as possible. Clearly this poses a problem for voice systems which always require constant low-latency transmission. Today's application traffic consists of three common types of data:

1. Time critical data such as video and voice.
2. Business critical data such as database transactions and online

transactions.

3. Opportunities data such as web-browsing email and file transfers.

When these different types of data compete for the same bandwidth, a network can quickly become overloaded, resulting in slow response times (long latency), and application time-outs. Traffic prioritization is a mechanism that allows you to prioritize data so that time-sensitive and systems-critical data can be transferred smoothly and with minimal delay over a network.

Traffic Prioritization in VoIP

Good quality VoIP is time sensitive and demands high priority over other traffic to minimize delay and maintain acceptable call quality. Video on the other hand is bandwidth intensive and needs to have the proper priority and allocated bandwidth to perform well. It is also helpful to have mechanism to throttle back allocated bandwidth used by bandwidth intensive application if they pass specific thresholds and begin to affect overall network performance and/or other high priority applications.

However, this QoS prioritization is provided by statically configuring networking devices for types of data and the various levels of QoS the network is enabled to provide. Current systems can authenticate a user and provide the user with the proper network access by validating the users preconfigured authorization data such as user ID or MAC address and assigning them the already defined QoS.

In several prioritization schemes are available for propagating VoIP traffic through the network in a timely manner regardless of background traffic levels. One type of prioritization involves recognizing RTP packets and handling them differently from other data. This type of prioritization is

support by most network equipment vendors and when properly configured can meet the needs of real-time traffic with minimal effects on regular data. Cisco routers, for example, allow incoming or queued voice packets to be given priority access to up to 75% of interface bandwidth by configuring of the IP RTP Priority queue[5].

Since voice is useless with large delays, this parameter should be set high enough to cover the needs of all possible voice connections for a given link[6]. In order to protect the data transmission in light if this large allocation for voice, any RTP packets in excess of the configured bandwidth are dropped[6][7]. Queue and utilization statistics are checked each second by the router, and any reserved bandwidth not in use by RTP sessions is made available to data traffic[7].

a. Session Initiation Protocol (SIP)

SIP stands for session initiation protocol. SIP is a protocol that initiates and manages interactive user sessions involving voice, video, instant messaging, and other such multimedia sessions. It is a 3GPP (Third Generation Partnership Project) signalling protocol. It is one of the major signalling protocols used in Voice over IP (VoIP).

SIP is based on Hypertext Transfer Protocol (HTTP). It basically deals with embedding call setup and signalling features in networking elements such as user agents and proxy servers. The signalling and call setup can be used by IP-based communication system to support the call processing functions and features present in the Public Switched Telephone Network (PSTN).

It is anapplication layer control protocol that can be used to establish,modify, and terminate multimedia sessions (conferences) such as

Internet telephony calls [15]. Compared with H.323, SIP is a more flexible solution, simpler and easier to implement, better suited to support intelligent user devices, as well as for the implementation of advanced features. Many believe that SIP, in conjunction with the MGCP [1], will be the dominant VoIP signaling architecture in the future [3].

SIP is a peer-to-peer protocol. The peers in a session are called user agents (UAs). Figure 1 shows a typical SIP message flow between two UAs. In Figure 1, UA1 initiates the session by sending an INVITE request to UA2. UA2 will be alerted (i.e., the phone is ringing) about the request and an interim response,"180 Ringing", will be sent back to UA1. Subsequently, UA2 answers the phone, which generates an OK response back to UA1. UA1 acknowledges this response by sending an ACK message to UA2. After this INVITE/200/ACK three-way handshake [15], the session is established and the two UAs begin to exchange data. At the end of the data exchange, UA2 sends a BYE request to UA1. Upon receiving this request, UA1 will send a "200 OK" response back to UA2 and this session is closed bidirectionally.

Call set up delay in SIP depends on a variety of factors [6]. These factors include SIP connection delay, SIP processing/queuing delay and DNS delay. The impact of DNS delays should be considered when SIP is being used for VoIP in a wide area network. However, when the SIP protocol is being used across a LAN, the delays that can be attributed to the DNS system are negligible. SIP processing/queuing delays are rather small and believed to be of minor importance in large-scale networks [6]. However, when considering VoIP over corporate LANs, the processing and queuing delays must be considered. Thus in the experiments conducted during this research, the call set up delay is mainly composed of SIP connection delay and processing/queuing delay.

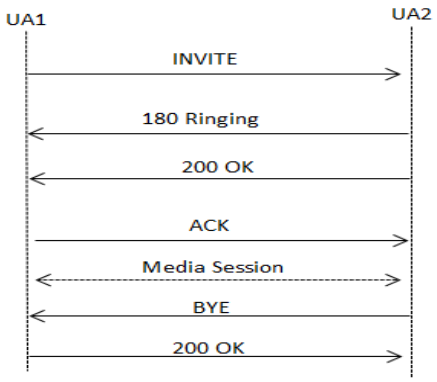

Figure 1 : SIP message Flow

b. VoIP measurement metric

In order to measure the performance and quality of a VoIP session it is normally used the ITUT E-Model [19] as a reference. In this model, a subjective quality score, Mean Opinion Score (MOS), is defined as the metric of the perceived VoIP quality. The score ranges from 1 ("unacceptable") to 5 ("excellent"), and is computed using the nonlinear function established in [1, 8], as shown in Equation (1) as per below, where R is referred to as the R-factor. The R- factor is determined by a set of parameters.

The mapping from MOS to quality ratings is reported in [1, 12] is summarized in Table 2. When a VoIP session receives an MOS score no less than 4.03, its quality is no worse than the current PSTN. An MOS score ranging from 3.10 to 3.60 corresponds to a low quality level, and many users are dissatisfied. Nearly all users are dissatisfied if the score is below 3.10.

Table 1: R-factor, MOS, and quality ratings.

R-factor	MOS	Quality of Voice Rating
90 < R <= 100	4.34 – 4.50	Best
80 < R <= 90	4.03 – 4.34	High
70 < R <= 80	3.60 – 4.03	Medium
60 < R <= 70	3.10 – 3.60	Low
50 < R <= 60	2.58 – 3.10	Poor

SIMULATION AND RESULTS

a. Simulation Setup

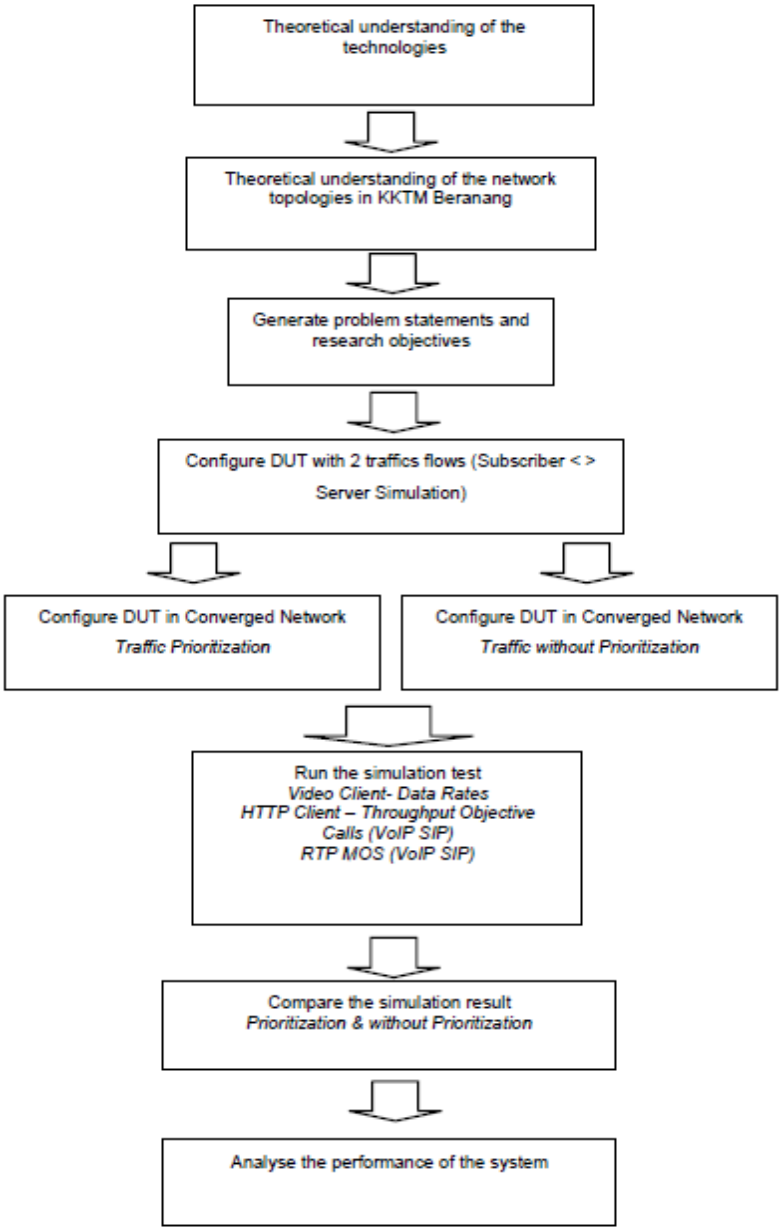

Figure 2: Process Flow in Conducting Experimental VoIP Analysis Performance of (QoS) in Converged Networks

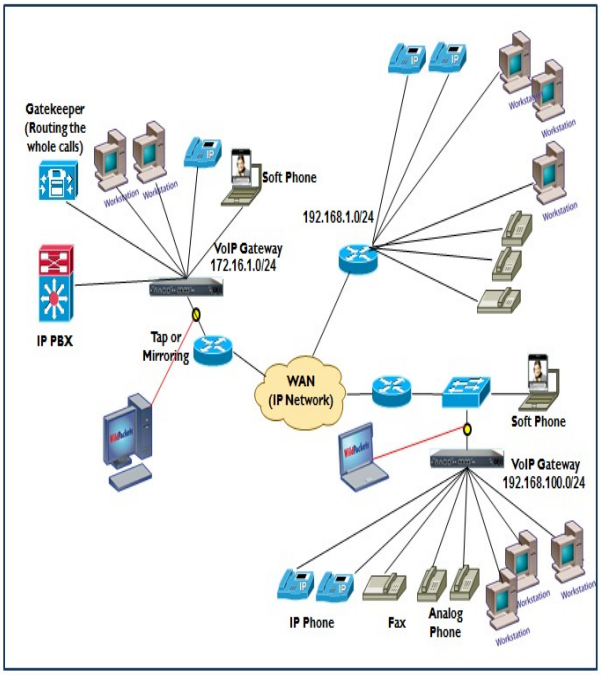

Figure 3: Experimental VoIP Analysis Performance of (QoS) in Converged Networks

b. Effect of Network Traffic Prioritization on VoIP Performance

The perceived quality of VoIP is generally determined by the delay and packet loss performance. However, making a comparative evaluation among pairs of delay and loss measurements is not a simple task. In achieving the objective of this research, experiment has been done both with and without traffic prioritization tools. To get the comparison data, a total of 30 voice calls are needed.

In this research, we attempt to use an objective method to evaluate the VoIP performance. To avoid the evaluation problems, we primarily pay attention to the levels of cross traffic load that result in

relatively low packet loss. This allows us to focus on evaluating the performance using the end-to-end delay. Fig. 4, 5, 6and 7 are the simulation results showing the effect of Quality of Service (QoS) when applying the network with and without network *traffic prioritization* tools.

From Fig.4 & 5 ,this is the result from traffic congestion in delivering the data from source to its destination using the *without prioritization* method, however this has not happened to *with prioritization* method. Congestion may happen due to time constraint and packet queue in network, resulted in higher packet loss, higher jitter and contribute delay during voice call transaction.

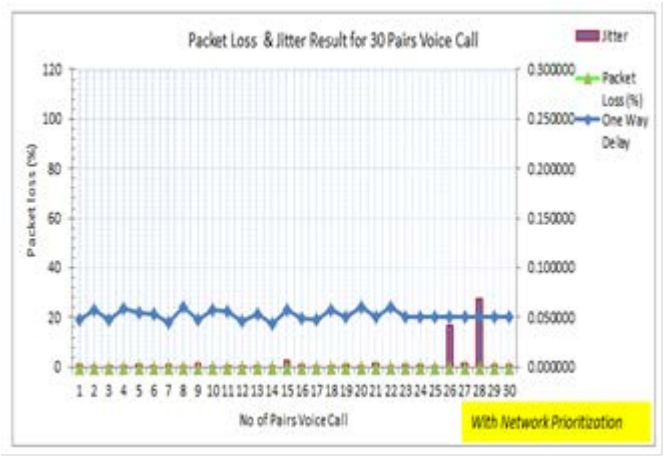

Figure 4: Packet Loss & Jitter Monitoring Result
(With Network Prioritization)

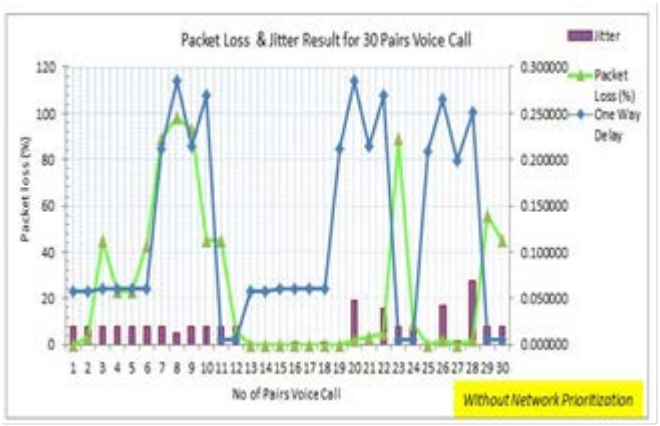

Figure 5: Packet Loss & Jitter Monitoring Result (Without Network Prioritization)

Table 2: One-Way Delay & Jitter Result for Network Prioritization

	Without Network Prioritization		With Network Prioritization	
Tx-Rx	One Way Delay	Jitter	One Way Delay	Jitter
G.711 192.168.1.12:54162 <--192.168.1.13:28486	0.058	0.019000	0.047	0.002692
G.711 192.168.1.25:47738 <--172.16.1.50:11282	0.058	0.000797	0.043	0.001242
G.711 172.16.1.53:6838 -->172.16.1.54:18558	0.060	0.002034	0.058	0.000264
G.711 172.16.1.59:30000 -->192.168.1.33:10070	0.005	0.019000	0.050	0.001865
G.711 192.168.1.33:26740 -->192.168.1.34:17808	0.209	0.000423	0.050	0.000423
G.711 192.168.1.34:26740 <--192.168.1.35:17808	0.266	0.041437	0.050	0.041437
G.711 192.168.1.35:16778 <--192.168.1.36:16442	0.199	0.003829	0.050	0.003829

Table 3:and R-Factor Comparison for Network Prioritization

	Without Network Prioritization		With Network Prioritization	
Tx-Rx	MOS-LQ	R-Factor	MOS-LQ	R-Factor
G.711 192.168.1.12:54162 <--192.168.1.13:28486	4.23	92	4.19	92
G.711 192.168.1.25:47738 <--172.16.1.50:11282	4.19	92	4.15	92
G.711 172.16.1.53:6838 -->172.16.1.54:18558	4.19	92	4.15	92
G.711 172.16.1.59:30000 -->192.168.1.33:10070	4.12	92	4.15	92
G.711 192.168.1.33:26740 -->192.168.1.34:17808	4.13	82	4.13	82
G.711 192.168.1.34:26740 <--192.168.1.35:17808	3.76	62	3.76	62
G.711 192.168.1.35:16778 <--192.168.1.36:16442	4.11	82	4.11	82
G.711 192.168.1.36:16778 -->171.16.1.100:16442	3.69	62	3.69	62

From Fig.6 & 7: This result means there is less or no network congestion during the voice call and the result are good and passing Mean Opinion Score Listening Quality (MOS-LQ) standard which is between 4.0 to 5.0 where generally considered top quality (as per voice call in PSTN). Meanwhile during the *without prioritization* network setup shown that the fluctuating of MOS-LQ and R-Factor occurred. It is shown that VoIP and the other different types of data compete for the same bandwidth, a network can quickly become overloaded, resulting in slow response times, packet loss and application time-outs.

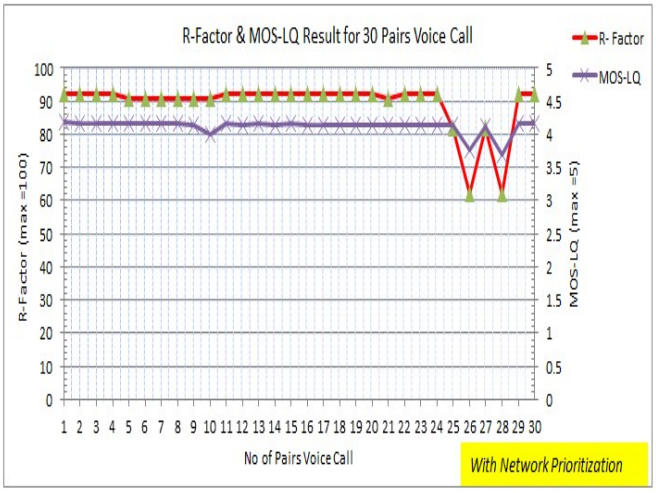

Figure 6: R-Factor & MOS-LQ Monitoring Result (With Network Prioritization)

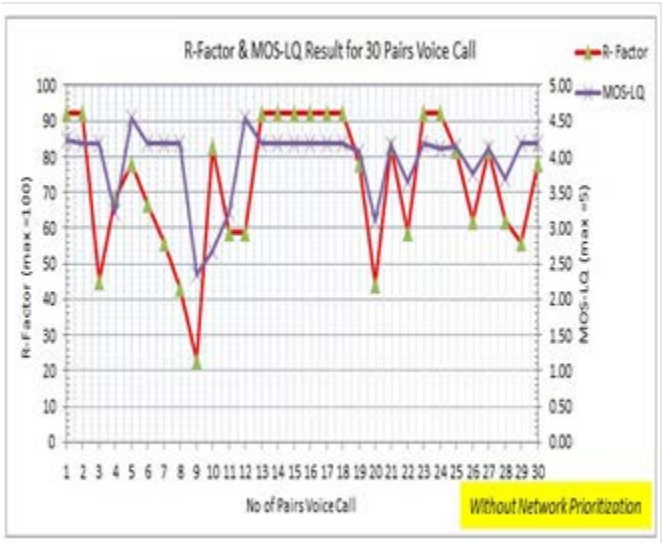

Figure 7: R-Factor & MOS-LQ Monitoring Result (Without Network Prioritization)

CONCLUSION

The primary goal of this research is to analysis VoIP performance of QoS in the converged networks. The main result of this research is, traffic prioritization is an effective way to perform voice quality required by QoS/MOS standards, because on the one hand is closely linked to perception, and on the other hand promote efficient end-to- end conversational process.We have shown by applying network prioritization can minimizing the end-to-end packet loss, delay performance and increase MOS-LQ.

The experience gained in the implementation phase and during initial experiment, we could also evaluate more complex models to improve the voice quality in VoIP network. Another possible direction for future work is the introduction of traffic prioritization policy management. Finally, based on the experiment gained in VoIP simulation testing, it is recommended that traffic prioritization modelling can be a good tool for predicting the voice quality in the VoIP network. The idea is to measure typical traffic patterns from applications used on the network, and feed a network simulator with this traffic multiplied by the number of users to the VoIP applications and the number of calls per time unit. The VoIP simulator models the network and predicts the performance given by the traffic load. Finally, it is learned that traffic prioritization gives IP providers a pre-emptive opportunity to maintain quality by increasing bandwidth, performing load balancing and rerouting traffic. This ensures their ability to deliver consistent and excellent voice quality.

RECOMMENDATIONS

The solution to the voice quality problems (e.g. packet loss, jitter, one-way delay) is to have a traffic prioritization to manage voice queues, and to prioritized voice data access to network links, providing higher priority to traffic with real- time voice constraint. From the experiments, it is possible for future researchers to foresee possible end-to-end voice quality problems in the VoIP network and act upon them proactively.

Local telecommunication provider such as TM (Telekom Malaysia Berhad) will benefited from this achievement as it provides a much deeper knowledge in the field of network management as well as opportunity for it's researchers to develop many technical skills, especially in VoIP networking. The idea is to measure typical traffic patterns from applications used on the network, and feed the network management with the best traffic prioritization tool to automate processes addressed by monitoring and manual follow ups. This application could be very interesting for TM.

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Optimization of classifiers technique for classification.

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Abstract: Recently, some research groups concentrated the attention on a multiple classifier approach. The rationale of this approach lies in the assumption that, by suitable combining the results of a set of base classifiers according to a rule, the obtained performance is better than that of any base classifier. This paper deals with the combination classifier in order to improve the results of single classifiers. Three Artificial Neural Network (ANNs) classifiers are employed for the combination has been studied. In this work, one combination method has been investigated; used Genetic Algorithms as the optimization in seeking all the possible classifiers combination. The main processes of the system are generation of the initial population, fitness function calculation, reproduction, replacement of new population and performance evaluation. Visual Basic (Vb.Net) for windows application is used as Programming language to do simulation of the system. A series experiment results had shown that this method potentially provides a benefit performance classifier more accurate than any single model in term of increment of recognition rate.

INTRODUCTION

Researchers continue to focus on the design of pattern recognition systems to achieve the best classification rates. Usually, different classification schemes are developed for the problem at hand, and then by experimental assessment, the best classifier is chosen as the final solution to the problem. In particular, for problems involving a large number of different classes and the presence of significant amount of noise, often the use of a single classifier does not lead to satisfactory results. The used of multiple classifiers can enhance the decision about the patterns under classification. Also, multiple classifiers can improve the reliability of the final classifier, because the simultaneous use of different features and classification procedures [1]. In last decade there has been much more interest in the study of effective methods for combining the results of many simple classifiers, rather than in the study of powerful but highly complex individual classifiers [2-4]. On the contrary, combining different features sets and classifiers may improve overall classification results, because different classifiers are unlikely to make same errors. As a consequence, combining appropriate diverse classifiers may improve overall classification accuracy [*5-7*].

The objective of this project deals with the combination of multiple classifiers in order to improve the results of single classifiers by using GA-based method. The principle components of GA are the chromosome representation, generate initial population, evaluate the chromosome, reproduction and stop condition. The predictive accuracy of the combined results of the GA-based method will be compared to the single classifier performance.

METHODOLOGY

In this paper, we will focus on combining the output of each Artificial Neural Network (ANNs) classifier in accordance with the rules of the selected combination classification. Figure 1 shows the block diagram of a multi-classifier recognition system.

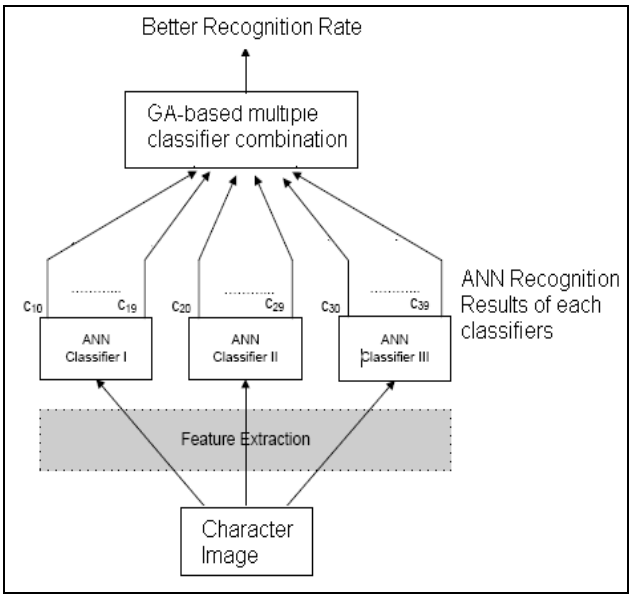

Figure 1 Processing steps of genetic algorithms combination system

Suppose the outputs of three ANNs are represented as: {c10, c11,…,c19}, {c20,c21,…,c29}, {c30, c31,…, c39}, respectively. Here are some criteria for measuring the recognition performance outputs of the ANNs' values.

The recognition rate (RR) is defined as:

$$RR\ ci = \frac{\textit{Number of correctly recognized characters}}{\textit{Total number of testing characters}} \quad (1)$$

where $ci = [ci_0, ci_1,\ldots,ci_9]$, $i = 1,2,3$ for three ANNs.

Data Set

As test data, we collect samples of handwritten digits from different peoples that fill in the given form. Images of digits are processed by scanning the forms. As can be seen in Figure 2, there is a great variety of sizes and writing styles. The number of characters for testing data sets in the experiments is 5,200 isolated digits (520 sampel * 10 characters).

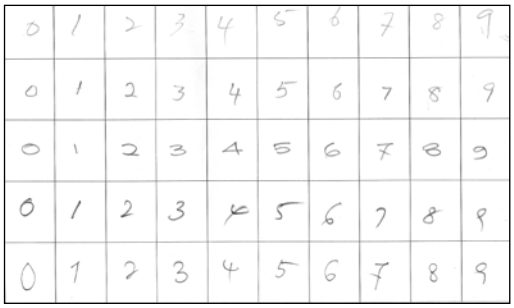

Figure 2 Samples of handwritten digits

Classification

Classification was implemented using the software tools provided by [8, 9] for this task. Three different neural network classifiers are chosen: NN1, NN2, and SOM-NN. Each classifier is a multi-layer perceptron trained which is consisting of a set of inputs (forming the input layer), followed by one or more hidden layers of non-linear neurons and an output layer of nonlinear neurons.

In this experiment, only one hidden layer is used. For each ANN, we use a three-layer structure:

Input layer ----------Hidden layer ---------- Output layer

where, the number of nodes at the input layer = the number of the input features. The number of nodes at output layer = 10 (representing 10 numerals).

CLASSIFIER CHARACTERISTICS

	Classfifier		
	Neural Network 1 (NN1)	***Neural Network 2 (NN2)***	***SOM -NN***
Number Of Nodes At The Input Layer	3	7	36
Number Of Nodes At The Hidden Layer	10	30	100
Others	NN1 and NN2 are supervised learning that use a back propagation network		• Iteration : 200 • BMU :Euclidean distance

Design of A GA-based multiple classifier combination

Figure 3 show overall Genetic Algorithms process. GA-based multiple classifier combination method integrates the measurement level classification results generated by multiple classifiers into a single result.

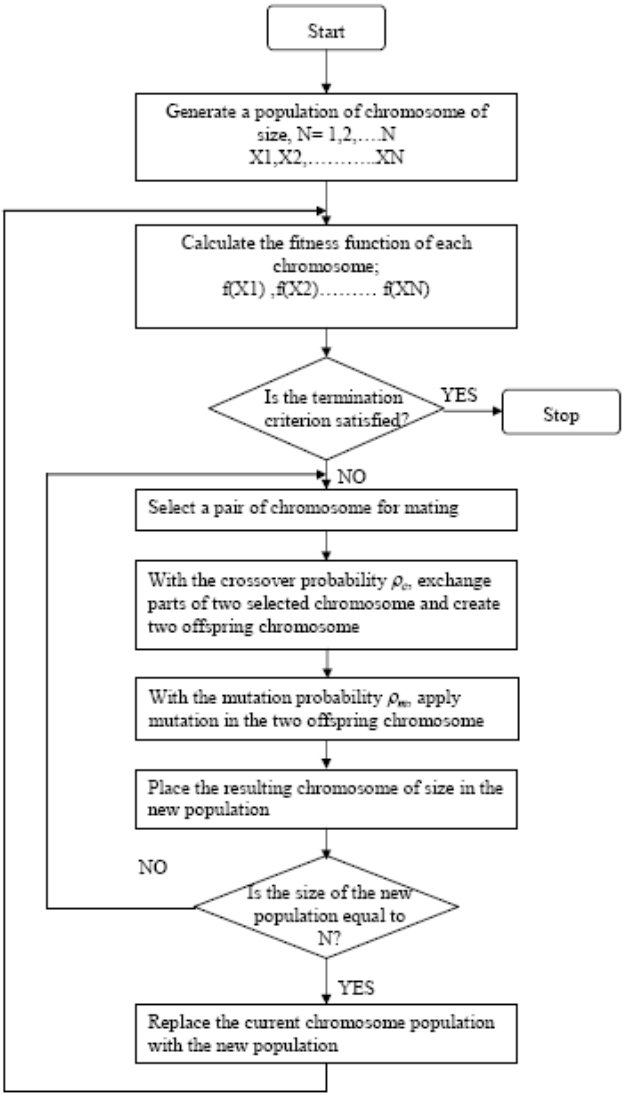

Figure 3 A flow chart of Genetic Algorithms process

i. Chromosome Binary Represent

A chromosome (binary strings) may consist of multiple genomes, each expressing a feature target system that must be consider a constraint or an objective function. In this case, there are 10 genome represent classification rate digit 0-9 of each three ANNs in our system as shown in Figure 4. Each

chromosome component is a binary string where 1 chromosome contains 10 genomes. Therefore each chromosome is sizeable 160 bits (10 X 16 binary bits).

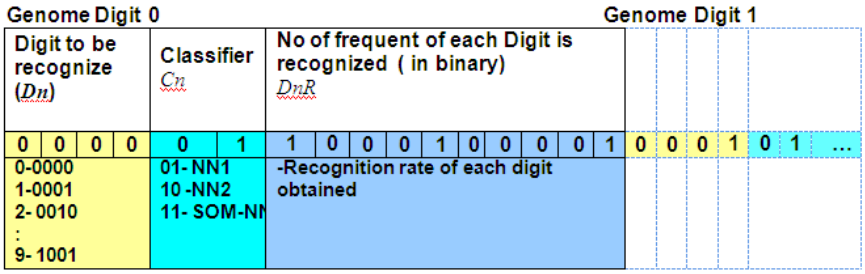

Figure 4 Diagram of representing the chromosome structure

ii. Creation of the Initial Population

The collection of chromosome is called a population. In this case, the maximum number of population size which is possible combination from 3 classifier that recognize 10 (0-9) digits handwritten is 59,049 (310).

The initial chromosomes X1, X2…XN, (59,049 populations in this paper), are randomly created:

Chromosome X1: [D0C1 D0R, D1C1 D1R, D2C1 D2R … D9C1 D9R]

Chromosome X2: [D0C2 D0R, D1C2 D1R, D2C2 D2R … D9C2 D9R]

……..

Chromosome XN: [D0Cn D0R, D1Cn D1R, D2Cn D2R … D9Cn D9R]

However, a good rule of thumb connects the initial population size to the number of variables in the algorithm (the number of loci in the chromosome) and the number of possible combination in the solution space. An initial population, as shown in Expression (2), should at least as large as five times the number of variables or about half of maximum number of possible combination, whichever is smaller [10].

$$p = \min \{ (5 \times v), (½ \times s) \} \quad (2)$$

Here, p is the population estimate

v is the total number of variables or chromosome loci

s is the number of possible combination in the solution space

With this rule of thumb, the population size estimate is 800 chromosomes: the minimum of 800 (five times the 160 chromosome loci) and 29524 (one-half the possible 59,049 combinations) are randomly (unique) chosen to go into the mating pool.

iii. Evaluation of the Chromosomes

Each chromosome has an adaption function f(Xj), or called fitness function which in our context is calculating the recognition rate (RR) for each chromosome. Therefore, the goal of our method is to select the optimal chromosome maximizing this Fitness function.

For fitness function of each chromosome, f(X1) ,f(X2)…… f(XN) can be calculated;

$$f(Xj) = \frac{\sum_{Dn=0}^{9} DnR}{N} \times 100\% \quad (3)$$

where,

Xj is the chromosome of the population [j=1,2…..N]

DnR is the Recognition rate of each digit obtained from classifier C1, C2 or C3.

N is the total sample digit testing

iv. Reproduction

In this phase, we create a new population in each iteration by applying the following genetic operators:

A- Selection

We use a proportional (or roulette wheel) selection which is based on the principles of 'each one has chance to be selected, according to his effectiveness' (Goldberg, 1998; Davis,1991). Thus, members are selected for mating with a selection probability, $\rho_{selesct}$ proportional to their fitness values. The most common way to implement this method is to set the probability of selection of each individual "$\rho_{i\ selesct}$ " is equal to :

$$\rho_{i\,select} = \frac{f_i}{\sum_{X=1}^{N} f_X} \qquad (3)$$

where,

f i is the fitness of the *i*-th chromosome

X f is the fitness of the *x*-th chromosome

N is the number of chromosomes in the population

To create roulette wheel, each chromosome is given a slice of circular roulettewheel (equal to the $\rho_{i\ selesct}$).The wheel is spun, and when the arrow comes to rest on one segment, the corresponding chromosome is selected. If the population is N, therefore the wheel would be spun randomly N times. The first 2 spin might select chromosome X1 and X2 to become 1st, parents, then continue to 2nd……N/2th parent. Once a pair of parent chromosome is selected, the crossover operator is applied.

B- Crossover

Crossover occurs when information is exchanged between two parent chromosomes and the new information is introduced to children chromosomes. The crossover begins by randomly selecting a crossover point in a pair of parents. We will apply the single – point crossover where two parent chromosomes 'break' at string bit *80-th* and then exchanges the chromosomes parts after that point. As result, two new offspring are created as shown in Table II.

THE SINGLE-POINT CROSSOVER PROCESS

Chromosome Binary Represent	**Bit String (-th) 0,1,2,..80,81,82,83……,160**
Chromosome 1	0 0 0……1 0 0 1 1…. 1
Chromosome 2	0 0 0……0 1 0 1 0…. 0
Offspring 1	0 0 0……1 1 0 1 0…. 0
Offspring 2	0 0 0……0 0 0 1 1…. 1

C- Mutation

In our experiment, the mutation rate is set at 0.01. According to the mutation rate, we randomly swap the *DnR* values of two selected gene in a chromosome. However comparative experiment with mutation =0.001 will be performed

v. Termination Criteria

In the training procedure, termination occurs when either the fitness value higher than 85 or the number of generation reaches its defined number. If one of these two conditions is satisfied, then we keep the individual of greater value of fitness function as final solution, and the genetic algorithm ends.

As [10] says, the default value for maximum number of generations is difficult to set independently of number variables and number of objective functions. However, a default of 2.5 * population size is often a good maximum generation count estimate. So, in our experiment, maximum number of generations is set to 2000 *(2.5*800)*.

EXPERIMENTAL RESULTS AND DISCUSSION

A series of experiment has been conducted to evaluate the performance of the GA performance.

A. Data Set and Classification Performance

Data set for recognition stage consist of 5,200 isolated digits (520 sampel * 10 characters) which is sample of handwritten digits from different peoples are used in the experiment. Three different neural network classifiers are chosen for classification stage : two MLP neural networks with back propagation with different numbers of hidden units, 10 and 30 (called NN1, NN2) and one called SOM-NN uses a self organising feature maps (Kohonen Model) which are based on competitive learning, where best matching neuron is found using the minimum – distance Euclidean criterion. The classification results from three classifier on the sample set testing is presented in Table III.

RECOGNITION RATES OBTAINED BY EACH BASE CLASSIFIER.

Classifier	Recognition rate (%)	Error rate (%)
NN1	62.60	37.40
NN2	65.06	34.94
SOM-NN	67.15	32.85
Average of 3 classifiers	64.94	35.06

B. Experimental Results of GA Performance

The GA based approaches, is used to find the best combination. The GA parameters are: Population size = 800 (calculated from Equation (2), maximum number of generation= 2000, Single-point Crossover probability = 0.7, Mutation rates are chosen to be 0.01 and 0.001. Selection Method is Roulette Wheel. For simulate the mechanism of GA, we developed user-friendly interfaces design for Genetic Algorithms by using the programming language 'Visual Basic (Vb.Net) windows application' as shown in Figure 5 and Figure 6.

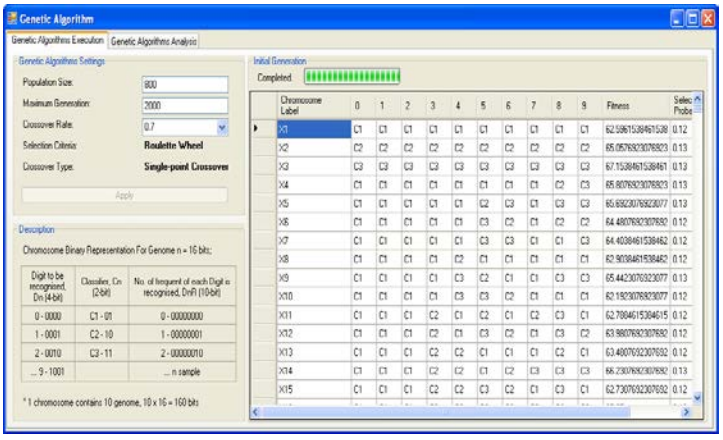

Figure 5 Initial populations setting of GA

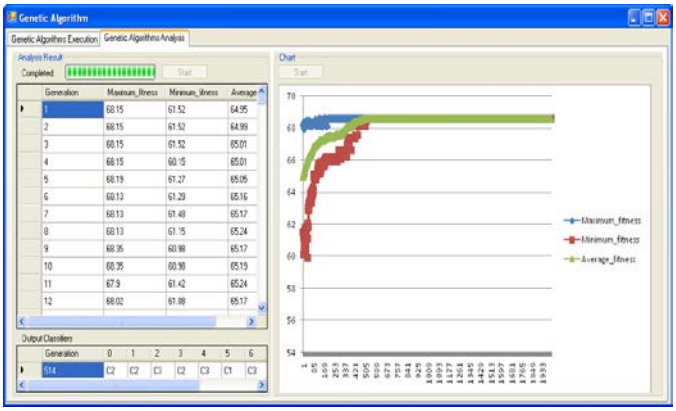

Figure 6 Result of 2000 generation

Generally, the population size is based on the size of the problem. We used 160 binary strings in the population. Several parameters had to be defined for genetic operators because the values of these parameters can have a great influence on the algorithm.

After a few experiment had been conduct with varies mutation rate and generation values, here the optimal GA parameters that have been choose:

- crossover rate : 0.7
- mutation rate set :0.01
- Generation: 2000 generations.

Figure 7 show performance graphs 2000 generations of 800 chromosomes. The best and average curves represented here are typical for GAs.

After 514 generations, there is no significant change in fitness value. As we can see the average curves rises rapidly at the beginning of the run, but then as population converges on the nearly optimal solution, it rise more slowly, and then flatten at the end. At this generation, our proposed GA-based multiple classifier combination method is achieving **68.58%** recognition rate based on maximum fitness function obtained with average values is **68.58%.**

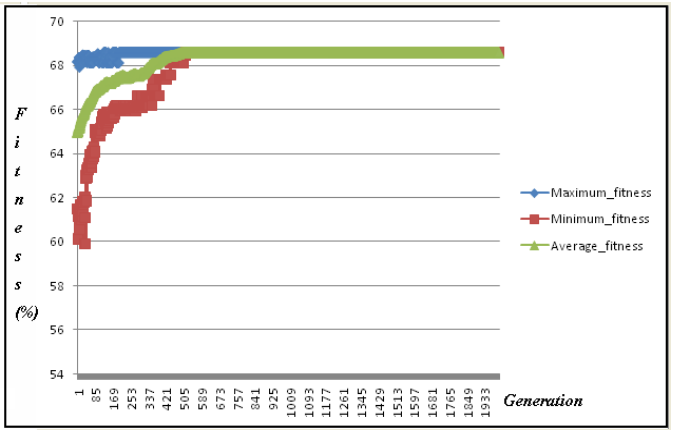

Figure 7 Genetic Algorithms Performance Graph

After a few performance experiments were performed with the GA approaches, finally the optimum solution has been found and was compared with three single classifier performances. Table IV shows the performance of the different classifiers.

THE PERFORMANCE OF THE CLASSIFIERS.

Classifier	*Recognition rate (%)*	*Error rate (%)*
NN1	62.60	37.40
NN2	65.06	34.94
SOM-NN	67.15	32.85
GA	**68.58**	**31.42**

It shows that the proposed method has better performance than any individual classifiers. It is found that proposed method outperform the individual classifiers performance in terms of recognition rate, with a significant improvement around 2% - 10%.

CONCLUSION

From our experiment, it shows that the proposed combining method outperforms any individual classifiers in terms of the proposed algorithm can improve the recognition rate of the digit handwriting. By applying 2000 generations, our proposed GA-based multiple classifier combination method is achieving 68.58% recognition rate based on maximum fitness function obtained with average values is 68.58%. It makes that proposed method outperform the individual classifiers performance, with a significant improvement around 2% - 10% recognition rate.

Performance of GA approach is evaluated to make sure of the quality of the combination and optimal solution is being reached. The performance average fitness increases with the increase of the *Generation* even though it takes more execution time to process. And by increasing the mutation rate to 0.01, there is improvement in the population fitness and the optimum solution has been found for these GA parameters: Population size = 800, Maximum number of generation= 2000, Single-point Crossover probability = 0.7.

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MECHANICAL

EVALUATION OF TOOL EDGE GEOMETRY FOR TURNING OF ASSAB DF-3 AND ALUMINIUM USING TAGUCHI METHOD

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Abstract: The machining of hardened steel is an interesting topic for today's industrial and scientific research. Hard turning is a more economical technology that is developed to substitute grinding in the finishing operations of hardened material (HRC 45 and above). This paper presents an optimization method of the cutting parameters (cutting speed and feed rate) and to analyse the tool edge geometry (honed, honed with wiper finishing and T-land) in hard turning of ASSAB DF-3 tool steel to achieve minimum cutting forces and high quality of surface. The experimental layout was designed based on the Taguchi's L9 (33) Orthogonal array technique and analysis of variance (ANOVA) was performed to identify the effect of the cutting parameters on the response variables. The result shows that tool edge geometry and cutting speed are the biggest influences for cutting force while feed rate is the most important parameter influencing the surface roughness. The minimum radial force is obtained when using T-land, cutting speed of 360m/min and feed rate 0.1mm/rev. The minimum tangential force is obtained when using Honed, cutting speed of 265m/min and feed rate 0.05mm/rev while the minimum feed force is obtained when using Honed with wiper finish, cutting speed of 360m/min and feed rate 0.05mm/rev. For the surface roughness, the optimum setting to achieve minimum surface roughness when using Honed, cutting speed of 180m/min and feed rate 0.2mm/rev. Prediction of optimization shows that the percentage of error of this experiment is within the engineering acceptable error which is below 10%.

INTRODUCTION

During the past few years unprecedented progress has been constituted in the hard turning. Hard turning is an operation in which materials in the hardened state are machined with the single point cutting tools. It is the most ordinarily applied in industry because of its ability to have faster metal removal giving reasonably good surface quality. The hard turning process provides many technical challenges due to the high level of stresses and hardness variations that are produced in a small layer below the work surface. Part integrity, tool performance, and productivity are of special concern, thereby warranting the attention of tooling, fixture, measurements, and process modelling and optimization methodology to ensure satisfactory process capability.

The hard turning process offers numerous advantages compared to the grinding process. During hard turning operation, material removal rates are higher than grinding, even though the procedure is performed in a modest depth of cut and feed rates. This process could reduce the machine time so that it would facilitate the flexible manufacturing system. Aside from decreasing the machining time, a decrease in the number of required machine tools may also be noted as a consequence of the increased flexibility (machining complex shape) of the turning process as compared to digging. A decrease in the number of machine tools would also be likely to reduce part handling costs and the cost related with multiple operators and machine setups. Usually, the hard turning process can be done in dry machining, so that it can eliminate cutting fluid cost and environmental welfare. As a result, research and development are required, especially in tool material and machine rigidity, in parliamentary procedure to capture the potential economic benefits of the hard turning process.

Research findings on hard turning is an attractive substitute for many grinding operations, but implementation in the industry remains relatively low, especially when surface roughness is of premier importance, this is because hard turning is a relatively new processing technique, and several questions remain unanswered. Hard turning also requires excellent tool strength and chemical stability during the machining operation. The developments of new cutting tools are making them becoming effective to satisfy the manufacturing needed thing. Different type of cutting tools such as carbide, ceramic and PCBN have been used in machining of hardened material. Thiele and Melkote (1999) found that CBN cutting tools are capable to machine tool steel until the hardness value of 57 HRC. Research by Anirban et al. (2009) reported that coated carbide cutting tool can also be used to machine hardened steel.

The development of tool edge geometry and its preparation plays a significant function in the machining productivity. The design of tool edge geometry and its preparation will influence the different machinability parameter. Hodgson et al. (1981) reported that CBN inserts with sharp edge produced the best tool life. In an almost the same study done by Thiele and Melkote (1999), experimental results showed the effect of edge geometry on the surface roughness and cutting force is significant.

In order to become a realistic replacement for many grinding operations, hard turning must prove its ability to create equal finished surfaces. For these reasons, more research must be done to evaluate the effects of cutting parameters on the different machinability parameters.

METHODOLOGY

A methodology was developed to analyze the impact of various tool edge geometry during hard turning tool steel based on previous experimental studies. During this study, three different types of tool edge geometry of cutting insert are going to be investigated. The outputs of the investigations were tabulated consequently. The output were consists of surface roughness, cutting forces and chip forms.

In this study, dry machining and high speed turning is employed to stimulate the machining conditions that are ascertained in nowadays manufacturing industry. This is following the present trend in manufacturing industries wherever high speed dry machining is typically used in manufacturing hardened steel part.

Machines, Equipment and Software

The following are the equipment, machine and software used throughout the experiments:

1) Pinacho S-90/180 conventional lathe machine.
2) A three component dynamometer compromising of basic unit (Kistler, Type 9257 A) and a screwed on working adapter in a form of a tool holder for turning (Kistler, Type 9441 B
3) A multi channel amplifier (Kistler, Type 5019)
4) A data acquisition system consisting of a laptop computer equipped with a National Instruments DAQ-NI usb 6008 board with the LabVIEW 2013 software
5) Mitutoya SJ 301 portable surface profilometer
6) Design and analysis of experiment software. Minitab 16 and 17

Work piece Material

The selected work piece material was ASSAB DF-3(AISI 01) made by ASSAB. The material used for conducting the experiment was provided by supplier (ASSAB Steel) in hardened state at 55 $\pm$ 1 HRC. The work piece was solid bar with 90 mm diameter and 250 mm length.

In this experiment, aluminium 6082T6 bar 30mm diameter with 250mm length also used to compare the result obtained with ASSAB DF3 tool steel.

Cutting Insert Material

Three kinds of commercially coated mixed ceramic inserts from Kennametal have been chosen to conduct the machining test. The insert was coated using a physical vapour deposition (PVD) technique. Coating substance takes place on the mixed ceramic substrate and PVD-TiN coated mixed ceramic with a matrix of Al_2 O_3 (70%):TiC (30%) +TiN, which are named as KY4400 grade. Ceramic inserts with three types of edge preparation which were used in this experiment:

(i) Honed

(ii) T-Land

(iii) Honed with finishing wiper.

Experimental Set Up

The turning tests on the work piece were conducted under dry conditions on a conventional lathe (PINACHO) that has a maximum power of 3.4kW. The work piece length to be machined was 40 mm repeated for every experiment and 45 mm in the chuck for support. A pre-cut with a 0.01mm depth of cut was performed on the work piece before the actual turning tests.

Taguchi Method

The S/N ratio takes both the mean and the variability into account. The S/N ratio is the ratio of the mean (Signal) to the standard deviation (Noise). The ratio depends on the quality characteristics of the product/process to be optimized. Usually, there are three categories of the performance characteristics to analyse the S/N ratio. They are: nominal-the-best, larger-the-better, and smaller-the-better.

Design of Experiments

If full factorial method is employed for this experiment to include all the possible combination of levels, there will be 27 experiments got to be conducted. By using the orthogonal array L9 (3^3), the number of experiment are reduced to 9 experiments. The cutting parameter that has been identified were cutting speed, feed rate and depth of cut were constant. The control parameters and also the levels used in experiment are given in the Tables 1 below.

Table 1 : Parameters and their Level

Parameters	Level		
	1	2	3
Tool Edge geometry A	Honed	T-Land	Honed-Wiper Finish
Cutting Speed (m/min) B	180	265	360
Feed Rate (mm/rev) C	0.05	0.1	0.2

RESULT, ANALYSIS AND DISCUSSION

Confirmation Experiment

Optimum parameters level combinations was used in order to obtain minimum cutting force and surface roughness value in hard turning of ASSAB DF3 is shown in table 2 below. The results of the experiments using these optimum parameter levels are shown in table 3.

Table 2: Optimum Parameter Level Combination for All Parameter

	Optimum Parameter Level
Radial Force, Fy	A2 B3 C2
Tangential force, Fz	A1 B2 C1
Feed Force, Fx	A3 B3 C1
Surfaces Roughness, Ra	A1 B1 C3

Table 3: Confirmation results for cutting force and surface roughness using Optimum Parameter Level Combinations

	Optimum Parameter Level	Confirmation Result
Radial Force, Fy	A2 B3 C2	35.06 N
Tangential force, Fz	A1 B2 C1	195.70 N
Feed Force, Fx	A3 B3 C1	60.78 N
Surfaces Roughness, Ra	A1 B1 C3	0.111 µm

Prediction of Optimization

The predictions are used to predict the optimization results in this experiment by using Taguchi predicted value methods. The predicted value (PV) of Taguchi methods was obtained using the equations below.

$$(\mathrm{PV}) = \bar{y} + (\overline{Ax} - \bar{y}) + (\overline{Bx} - \bar{y}) + (\overline{Cx} - \bar{y})$$

Where the value of Ax, Bx, Cx and Dx are the values of an optimum level for each factors in means while the value of y is the average value of all means values. The results of prediction optimum levels for each parameters as shown in Table 4.

Table 4 : Prediction value of Optimum Level combinations of for cutting force and surface roughness

	Optimum Parameter Level	Prediction Value
Radial Force, Fy	A2 B3 C2	31.84 N
Tangential force, Fz	A1 B2 C1	178.38 N
Feed Force, Fx	A3 B3 C1	63.00 N
Surfaces Roughness, Ra	A1 B1 C3	0.103 µm

The predicted percentage error is calculated as shown in equation.

$$\text{Error} = \frac{\text{Predicted value-Experimental value}}{\text{Experimental value}} \times 100$$

The results of predicted errors are shown in Table 5.

Table 5: Prediction of optimization with experiments value for cutting force and surface roughness in percentage of error

	Optimum Parameter Level	Prediction Value	Confirmation Result	Percentage of Error %
Radial Force, Fy	A2 B3 C2	31.84 N	35.06 N	9.0
Tangential force, Fz	A1 B2 C1	178.38 N	195.70 N	8.9
Feed Force, Fx	A3 B3 C1	63.00 N	60.78 N	3.7
Surfaces Roughness, Ra	A1 B1 C3	0.103 µm	0.111 µm	7.2

Comparison result between ASSAB DF3 and aluminium 6082 T6

1. Comparison of Radial Force, Fy with different Tool Geometry, Cutting Speed and Feed Rate.

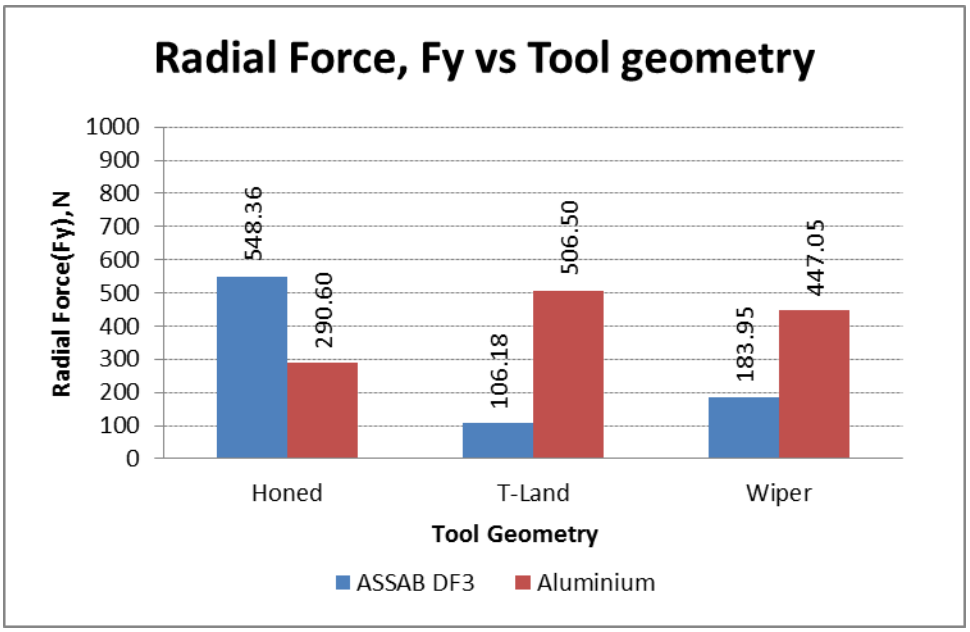

Figure 1: Radial Force, Fy comparison with different tool geometry

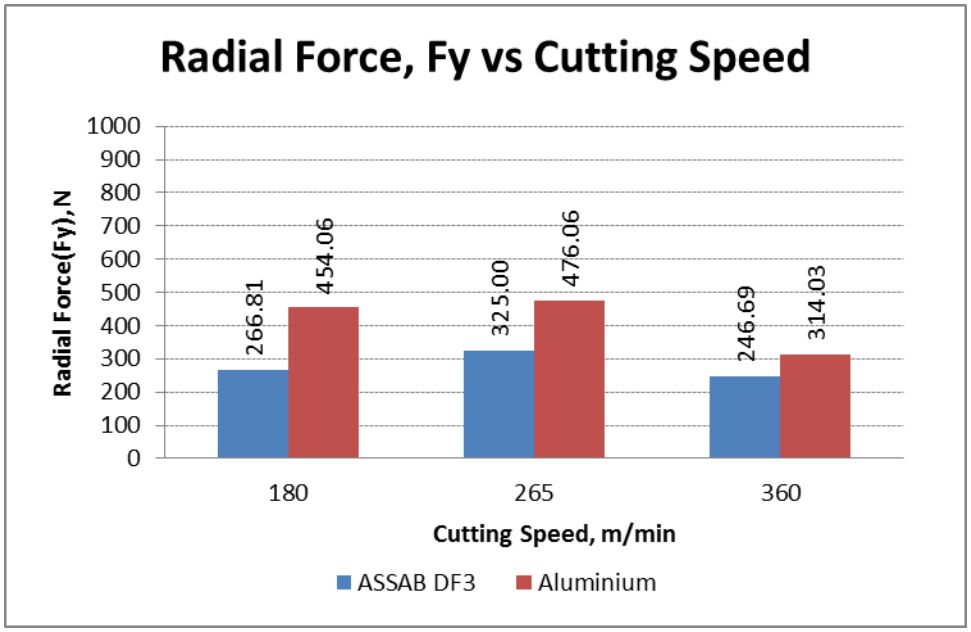

Figure 2: Radial Force, Fy comparison with different cutting speed

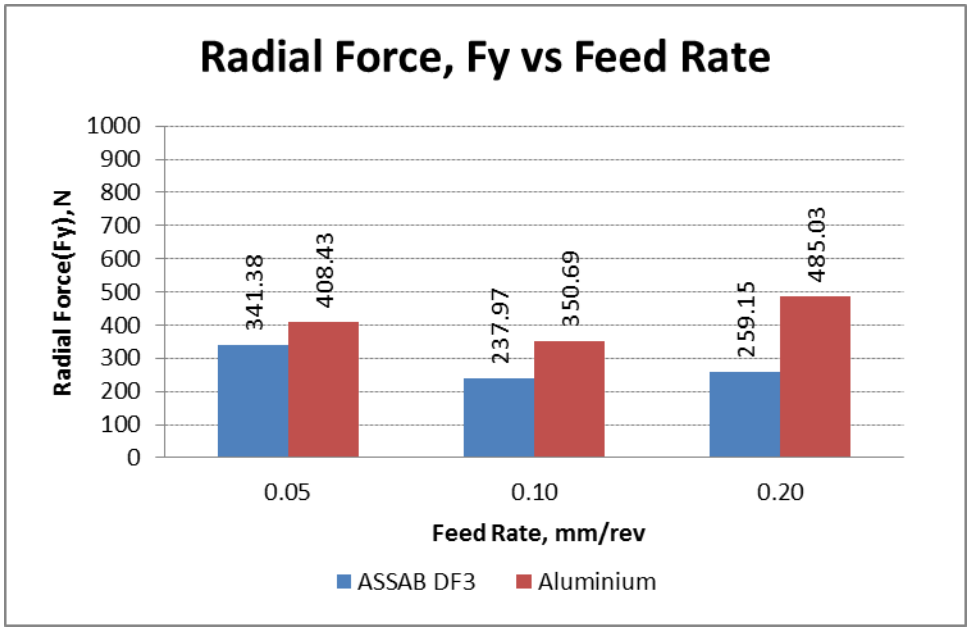

Figure 3: Radial Force, Fy comparison with different feed rate

2. Comparison of Tangential Force, Fz with different Tool Geometry, Cutting Speed and Feed Rate.

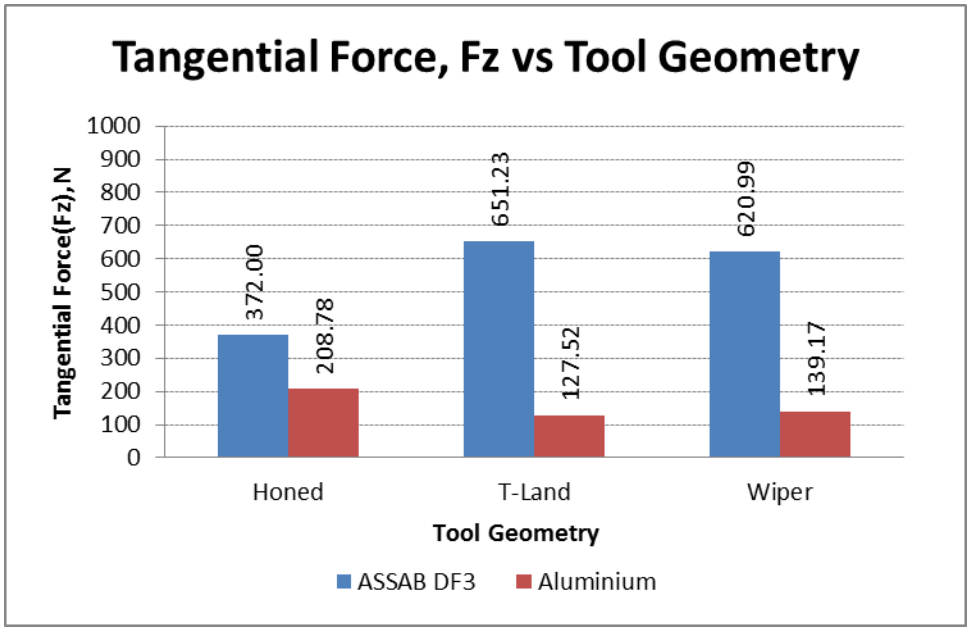

Figure 4: Tangential Force, Fz comparison with different tool geometry

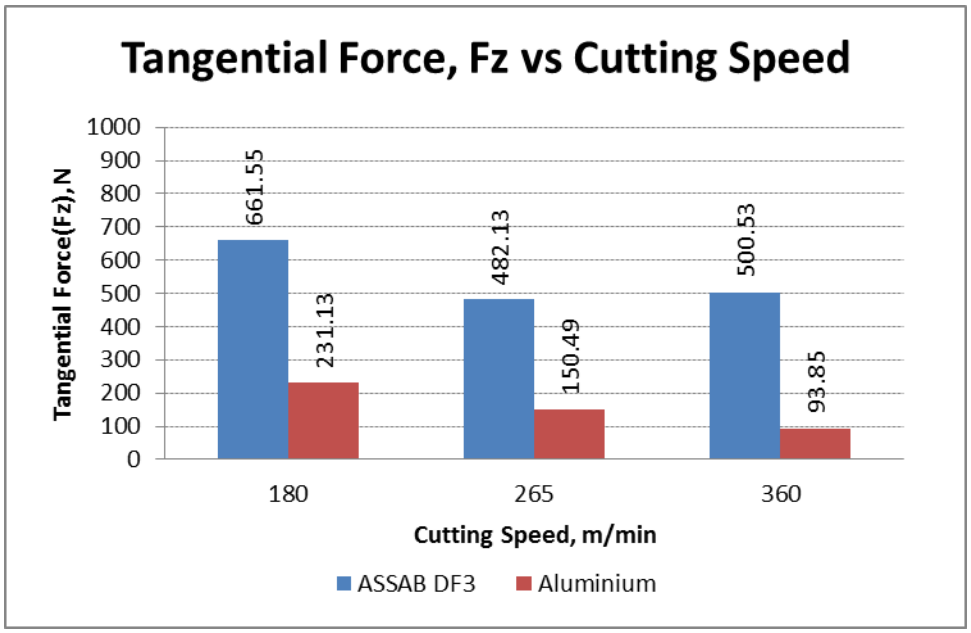

Figure 5: Tangential Force, Fz comparison with different cutting speed

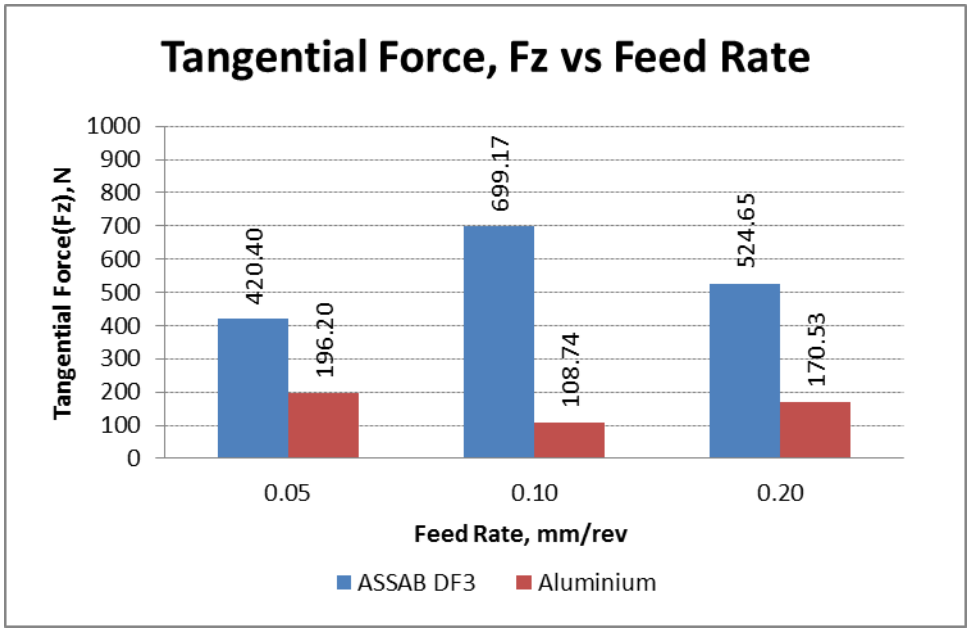

Figure 6: Tangential Force, Fz comparison with different feed rate

3. Comparison of Feed Force, Fx with different Tool Geometry, Cutting Speed and Feed Rate.

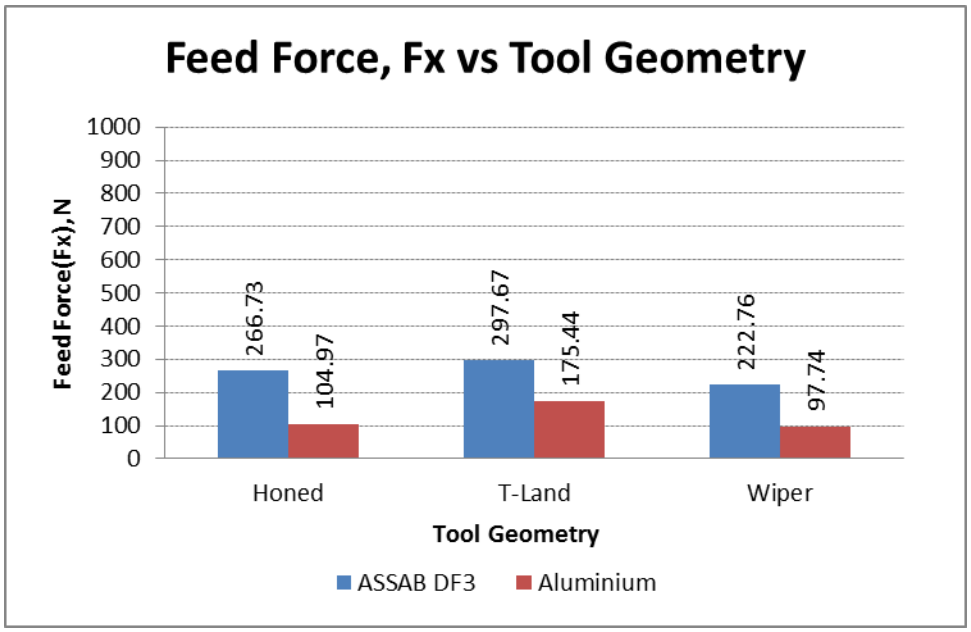

Figure 7: Feed force, Fx comparison with different tool geometry

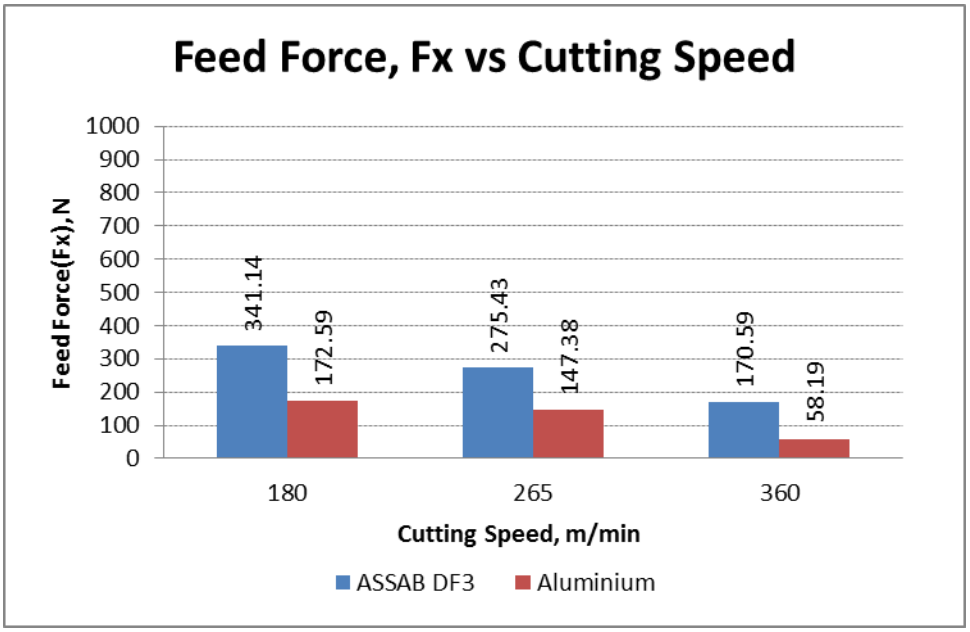

Figure 8: Feed force, Fx comparison with different cutting speed

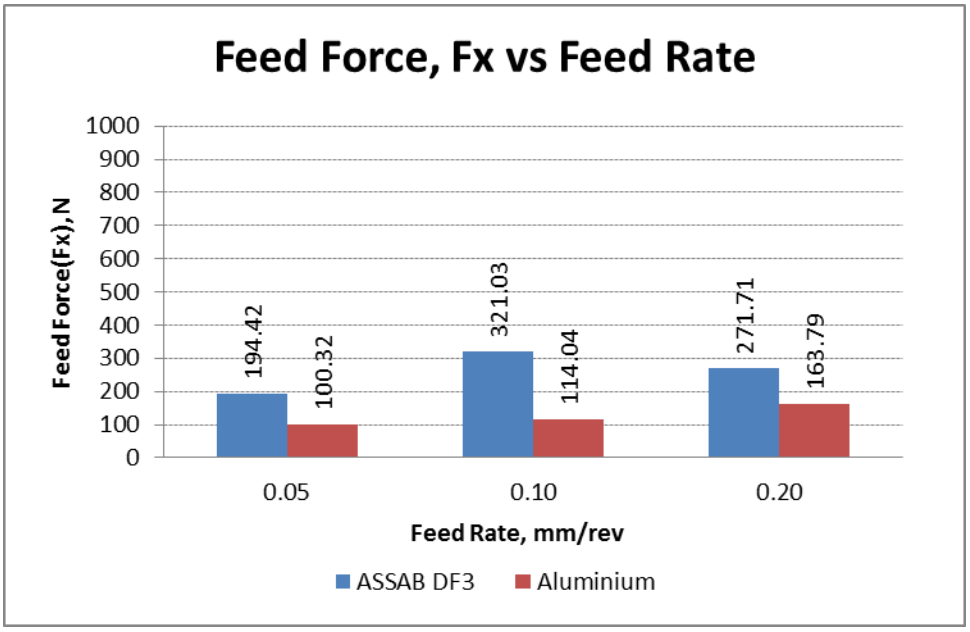

Figure 9: Feed force, Fx comparison with different feed rate

4. Comparison of Surface Roughness, Ra with different Tool Geometry, Cutting Speed and Feed Rate.

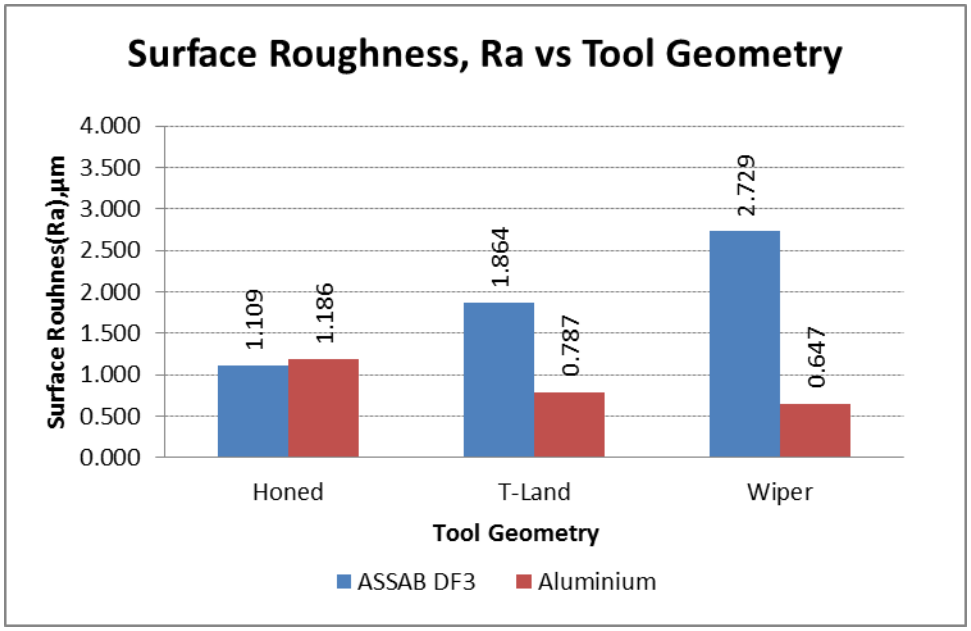

Figure 10: Surface Roughness, Ra comparison with different tool geometry

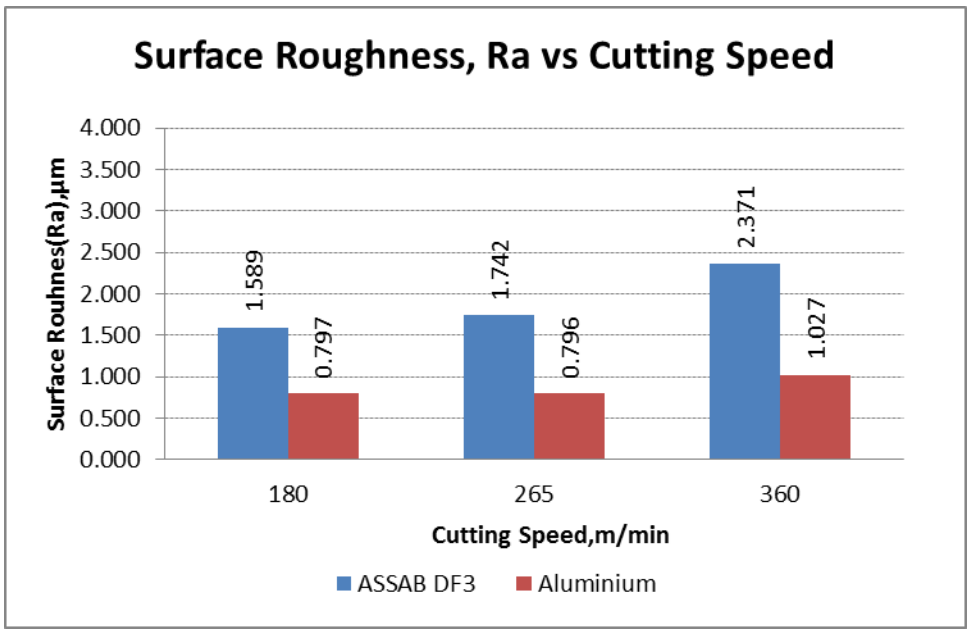

Figure 11: Surface Roughness, Ra comparison with different cutting speed

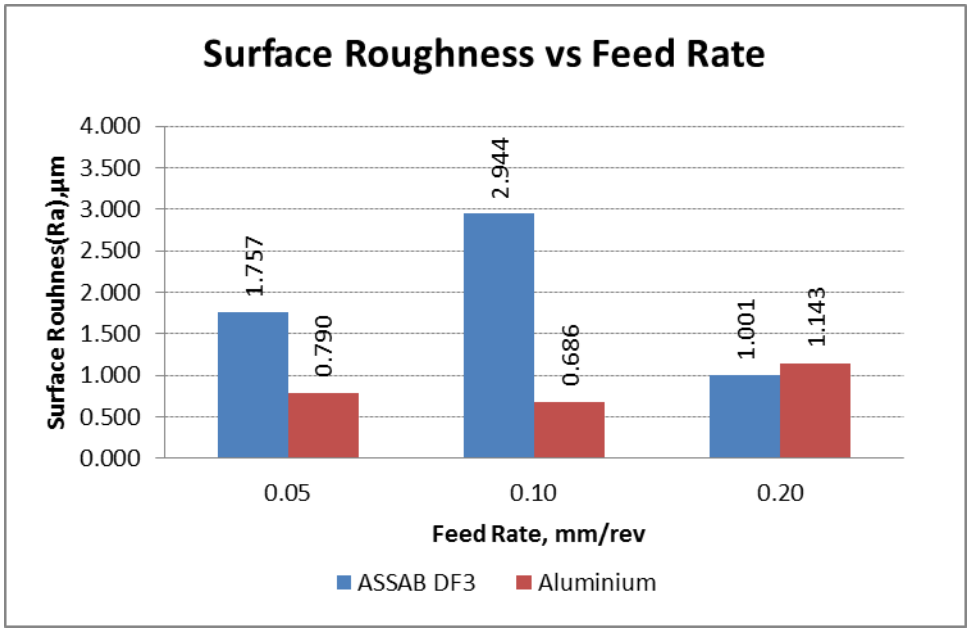

Figure 12: Surface Roughness, Ra comparison with different feed rate

Discussion on Tool Geometry

1. Effect of Tool Geometry on Cutting Force

From figure 13, shows the cutting force produces with different tool geometry. The results show that tangential force, Fz are the highest force compared to radial force, Fy and feed force, Fx with T-Land and wiper finish tool geometry. For honed tool geometry, radial force, Fy is the highest force followed by tangential force, Fz and feed force, Fx. T-land geometry gives lower radial force, Fy as compared with other types of tool geometry. Honed tool geometry produced the highest radial force, Fy and feed force,Fx almost nominal for all tool geometry

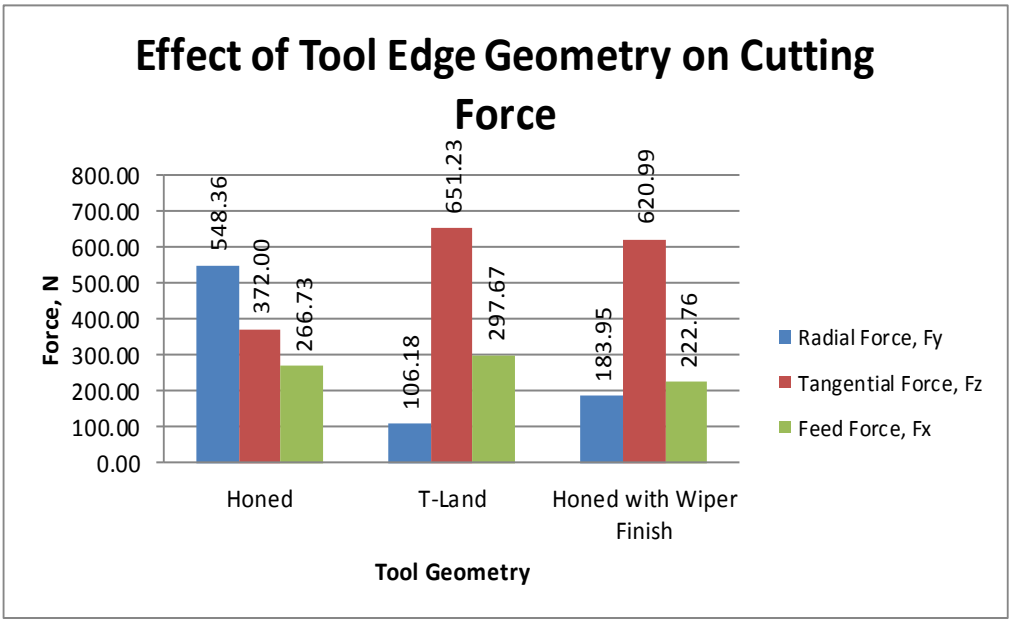

Figure 13: Effect of tool geometry on cutting force

Based on previous researcher, the main effect of tool geometry are statically significant to tangential force, Fz (Ozel, 2005). Chen (2000) has found that radial force, (Fy) was the largest among the three cutting force components. T-Land produced the lowest radial force, Fy and feed force, Fx while honed and honed with wiper finish produced a large feed force, Fx and radial force. (Rosmaini, 2009)

2. Effect of Tool Geometry on Surface Roughness

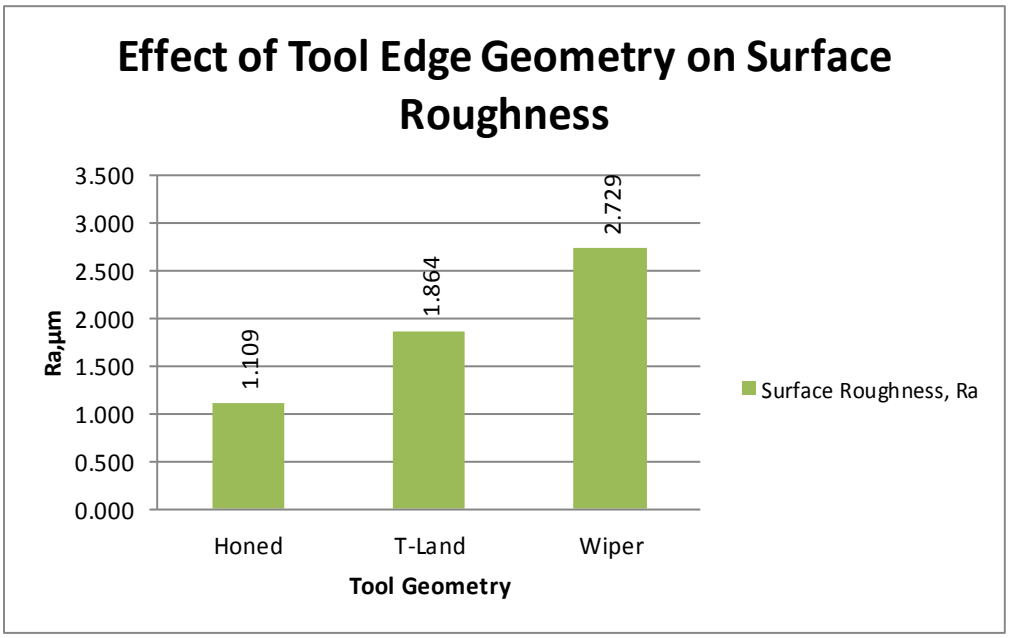

Figure 14: Effect of tool geometry on surface roughness

Figure 14 illustrates the results when turning process carried out using the honed, T-land and honed with wiper finish tool geometry. Honed with wiper produced the highest surface roughness followed by T-Land and honed tool geometry.

Types of tool geometry were found to possess some impacts on the surface roughness. Honed with wiper finish was found to have the lowest surface roughness, while honed was found to have the highest surface roughness. (Rosmaini, 2009)

Chou and Song (2004) studied the consequences of tool nose radius size on surface finish, tool wear, cutting forces, and white layer depth, for various cutting conditions. AISI 52100 steel at 61HRC was turned using ceramic tools (70% Al2O3 and 30%TiC). They came to the conclusion that

large tool nose radii only provide finer surface finish; however offer no additional advantages, comparable tool wear, similar cutting forces and increased specific cutting energy.

The results obtained from this experiment are totally different from the previous researchers where they have conclude that wiper finish will produced better surface roughness. This is probably due to some machining error during turning operations such as positioning of the tool and vibration.

Discussion on Cutting Speed

1. Effect of Cutting Speed on Cutting Force

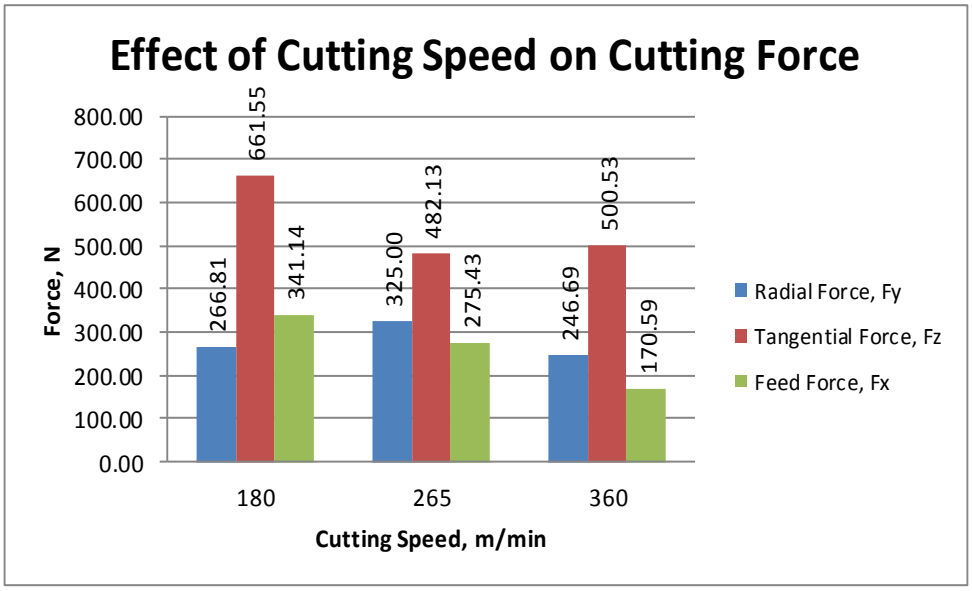

Figure 15: Effect of cutting speed on cutting force

From the figure 15, the result shows that the increased in cutting speed generally leads to a reduction in the components of cutting force. It is similar to the results obtained by B.Frides (2008). Cutting speed are statistically significant to tangential force, Fz. Ozel, 2005, based on AISI H13 shows that

the edge geometry and cutting speed are statistically significant to tangential, Fz,

From the figure 15, shows that the cutting force will decreases when the cutting speed increases. At the lower cutting speed, less heat is generated and the temperature induced softening of the work piece reduced, giving rise to the system cutting force (Abhijeat, 2006). At a high speed, the energy input to the system and stress are higher and leads to increased heat generation so that it will helped the material to soften the work piece material thus reduced the cutting forces.

2. Effect of Cutting Speed on Surface Roughness

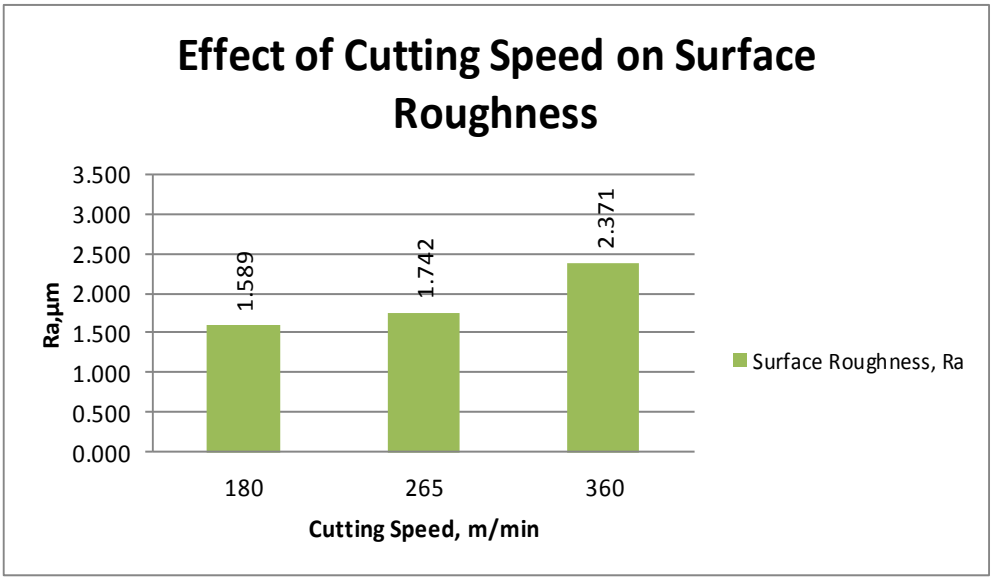

Figure 16: Effect of cutting speed on surface roughness

Figure 16 shows results on surface roughness when turning process carried out using varieties of cutting speed condition. The results indicates that by increasing the cutting speed above 350 m/min will increase the surface roughness.

B.Frides (2008) claimed that the increased in cutting speed will improved the machined surface quality. Surface roughness is stabilized slightly because of the reduction in cutting forces stabilizing the machining system. If the speed is higher than 350 m/min, the curves related to surface roughness take ascending forms because of the vibrations related to high speeds.

Discussion on Feed Rate

1. Effect of Feed Rate on Cutting Force

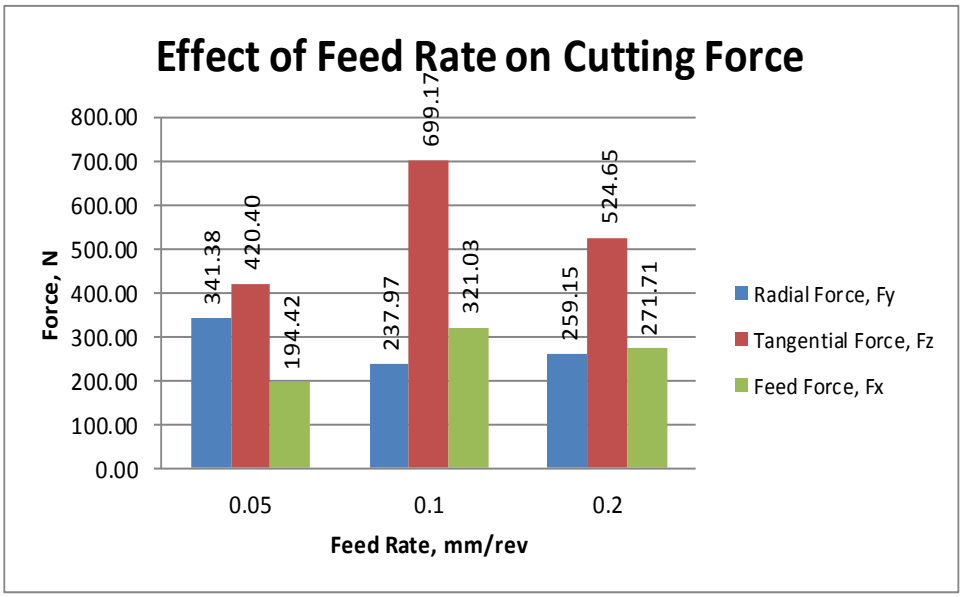

Figure 17: Effect of feed rate on cutting force

The figure 17 shows that tangential force, Fz are very affected by the feed rate, followed by the feed force, Fx and lastly the radial force, Fy. It was similar with the experiment that has been conducted by B.Fnides (2008). The radial force, Fy and feed force, Fx are statistically nominal from the figure. The feed force, Fx will be increased when the feed rate increases (Rosmaini 2009), it is due to an increased in chip load.

2. Effect of Feed Rate on Surface Roughness

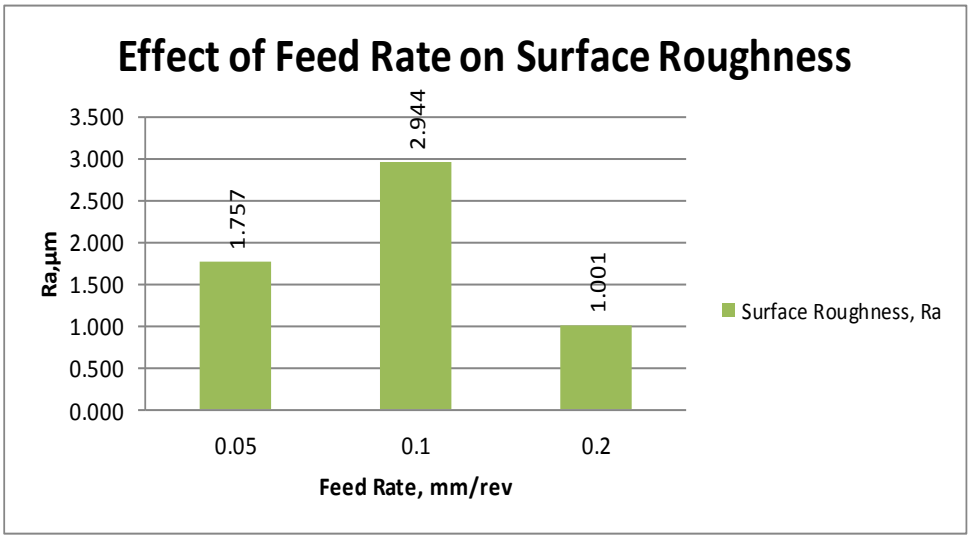

Figure 18: Effect of feed rate on surface roughness

It can be seen from figure 18 that when the feed rate increases from 0.05 mm/ rev to 0.1 mm/ rev, surface roughness will be increase but when the feed rate was increased to 0.2 mm/rev the surface roughness changes oppositely

In practice, the consequences of the influences of the feed rate on surface roughness are as follows: the increase in the feed makes respectively increase the criteria of roughness Ra. It was to be concluded that the feed rate contributes largely to the evolution of surface roughness (B.Fnides 2008).

The increase in surface roughness quality at a lower feed rate is due to the fact that the distance from peak to valley on the machine surface is smaller (Gabriel and Alexendre, 2003). This will result in a better surface finish. At a higher feed rate, the distances between peaks to valley were larger and caused the surface finish quality to reduce. The increased in

surface roughness with the increased in the feed rate follows the formula was derived by Boothroyd and Knight (1989).

CONCLUSION

Based on the results and analysis that has been carried out during this study, several conclusions will be made on hard turning of DF-3 hardened steel of hardness 55 HRC and aluminium using three different types tool geometry of ceramic cutting tool KY 4400 grade insert. In hard turning of ASSAB DF-3, the tool geometry is the biggest influence of radial force, Fy followed by feed rate and cutting speed. In hard turning of aluminium, the tool geometry is the biggest influence of radial force, Fy followed by cutting speed and feed rate. In hard turning of ASSAB DF-3, the tool geometry is also the biggest influence of tangential force, Fz followed by feed rate and cutting speed. In hard turning of aluminium, the cutting speed is the biggest influence of tangential force, Fz followed by feed rate and tool geometry. In hard turning of ASSAB DF-3, the cutting speed is the biggest influence of feed force, Fx followed by feed rate and tool geometry. In hard turning of aluminium, the cutting speed is the biggest influence of feed force, Fx followed by feed rate and tool geometry. In hard turning of ASSAB DF-3, the feed rate is the biggest influence of surface roughness, Ra followed by tool geometry and cutting speed. In hard turning of aluminium, the tool geometry is the biggest influence of surface roughness, Ra followed by feed rate and cutting speed.

For comparison with aluminium 6082 T6, the radial force, Fy is lower than aluminium 6082 T6, the tangential force, Fz is higher than aluminium 6082 T6, the feed force, Fx is higher than aluminium 6082 T6 and the surface roughness is higher than aluminium 6082 T6. Optimum parameter setting for radial force, Fy is obtained when using T-land, cutting speed of 360 m/min

and feed rate 0.1 mm/rev. Optimum parameter setting for tangential force, Fz is obtained when using Honed, cutting speed of 265 m/min and feed rate 0.05 mm/rev. Optimum parameter setting for feed force, Fx is obtained when using Honed with wiper finish, cutting speed of 360 m/min and feed rate 0.05 mm/rev. Optimum parameter setting for surface roughness, Ra is obtained when using Honed, cutting speed of 180 m/min and feed rate 0.2 mm/rev.

The prediction of optimization is sufficient for predictions of cutting force components and surface roughness since the value within the engineering acceptable error which is below 10%. The percentage of error for radial force, Fy is 9.0%, tangential force, Fz is 8.9%, feed force, Fx is 3.7% and surface roughness is 7.2%.

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COMMON

A CRITICAL EVALUATION OF ENGLISH LANGUAGE NEEDS IN MARA-JAPAN INDUSTRIAL INSTITUTE (MJII) BERANANG

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Abstract : English for Specific Purpose (ESP) is generally understood as being different from that of "General English" (GE). Among the characteristics of ESP are that is usually designed based on the specific needs of learners, uses the underlying methodology of the discipline it serves and employs specific language registers of the specific course or field of study. A needs analysis is criterial to ESP as it is a key tool in designing a course. The notion of "need" could be operationalised by employing the approaches to needs analysis which are the Target Situation Analysis (TSA), Present Situation Analysis (PSA) and Learning Situation Analysis (LSA). The collection and collation of these different kinds of data and their analyses would constitute a Generalized Needs Profile (GNP) of learners which is highly valuable for ESP practitioners in the design of courses, learning syllabus, tasks and classroom materials. This study based its research in the field of English for Academic Purposes (EAP), a prominent branch of ESP with focus on seeking to identify the English language learning needs of students of one of the higher learning institutions in Malaysia. The purpose was to gather data to upgrade the current teaching and learning activities and to devise future course syllabus based on the needs of the students with some input from the subject specialists and as well as language lecturers. Sets of questionnaires were administered to different target groups used as instruments to collect data on TSA, PSA and LSA. The GNP showed that for the respondents English is needed as means to communicate and for betterment in future.

INTRODUCTION

ESP stands for English for Specific Purposes which is generally understood as the teaching of a variety of the English language in its specific context use (Dudley-Evans & St John, 1998). The teaching of language to a certain context is crucial mostly for the development of specific vocabularies and terms that are discipline-based such as Medical English, English for Engineering, English for Science and many other disciplines.

The emergence of ESP as a branch of English language studies has started since the 1960s where it had undergone three main phases of development (Hutchinson and Waters, 1987) and has continuing developing into an important branch of English language studies nowadays. Hutchinson and Waters (1987) further elaborated that among the reasons why ESP has achieved such important status were because it apparently complies with the "Demands of the Brave New World", it is seen as a revolution in linguistics and finally the central focus of ESP is the learners. All three unique characteristics of ESP set it apart from the traditional English language teaching or commonly known as General English (GE).

Compared to the old ways of language teaching where great emphasis were given to studying rules or the grammar of language, ESP's paradigm is based on specifically teach the language that the learners want or wish to learn. The nature of ESP encompasses the teaching of English for certain or to an extent, specific purposes that there are certain language learning objectives to be achieved. Mackay and Mountford (1978) stated that the purpose of learning is usually defined with reference to some occupational requirements or vocational training programmes. In order to achieve the goals, there are a number of factors taken into considerations. The factors vary in many ways according to the various kinds of the learners.

Mackay and Mountford (1978, p. 28) outlined the two different needs of students in learning ESP that is the academic needs and job needs. In academic needs, students learn English to understand the context of the course usually provided in journals and textbooks where English is the main language used. In job needs, the situation is more or less similar to the academic needs, but the students have to learn and use English to perform tasks specific to particular practical job or project that needs English to get the work done.

This view was supported by Chamberlain and Flanagan (1977) who also stated that ESP programmes put great effort in emphasizing the needs of the learners as to increase the motivation to learn and these programmes are supposed to be introduced in school level to create awareness of variety of communicative initiation and interaction among students. Mackay and Mountford (1978) believed that the learners require the linguistic knowledge as a means to further becoming the specialists and performing specific social or working role in working environment such as scientist, technologist, or technician efficiently. The role of ESP is seen as to equip individual with specific language registers and to further develop their linguistic competence needed in becoming field specialists.

According to Kerr (1977), in ESP, the learning objectives have to be made clear prior the teaching-learning activities in classroom and syllabus needs to be designed specifically according to students' learning needs. If all the conditions are met, the teaching is then deemed as purposeful. In order to determine the specificity of the learning needs of the learners, ESP advocates the use of Needs Analysis prior to the development of course design, syllabus, topics to be covered, types of materials used and the selection of tasks. The outcome from the analysis conducted will help the construction of effective curriculum that reflects the specific language learning needs of the students.

Statement Of The Problem

Learning English is undeniably crucial especially in terms of the transfer of technical knowledge such as in the field of engineering, medicine and science. Specific language, terms, themes and topics that are related to the fields are discussed as well as the curriculum design is specialized to suit the learning needs of the students. The courses offered by most of the higher learning institutions are the variations of the English for Specific Purposes course.

Among the aim of teaching and learning the English for Specific subject is to provide the learners the necessary linguistic knowledge that help facilitate the transfer of knowledge content. Thus it is important that the curriculum is designed to suit the learning needs as well as to fulfil the nation's aspiration to produce knowledgeable professionals who have good English proficiency. The development of strategic materials, teaching approach and course content should be tailored to the needs of the stakeholders, which are the students. Having proper motivation to learn, driven by the opportunity to voice their needs and necessities are therefore the crucial.

It is undeniably a common practice of many learning institutions in this country to implement the syllabus that has been constructed by the subject experts prior the teaching activities. The top-down practice is considered the norm by almost all language instructors thus needs analysis for ESP courses is seldom conducted though it is the important feature in ESP that distinguishes it from the teaching of General English (Hutchinson and Water, 1987).

By conducting a needs analysis in this present study, the researchers could gain an insight of the current language proficiency and what are the expectations by studying the ESP or EAP courses. The target group of the present study was considered as adult students and they were not at the

entry level in studying English. The syllabus and materials provided for the English courses in the institution were predetermined by the higher management level. The teachers are expected to teach according to the learning outlines and the students are expected to achieve the learning objectives by the end of the course.

The common teaching practices of many learning institutions lacking the sensitivity to the real needs of the students because no emphasis is put at conducting needs analysis. The importance of the analysis is to identify the needs and to help design effective courses by responding to the learners' point of views. The relevance of the study can be justified and it is expected that the data collected could be used to amend and improvise the current syllabus and curriculum and above all to facilitate the student learning the ESP courses in future.

Research Questions

The study was conducted to seek answers to these questions:

1. What are the target situation language needs of the Diploma of Electronics Engineering students?
2. What are the present situation needs of the students in question?
3. What are their English language learning needs?

METHODOLOGY

The present study was an exploratory non-experimental study. Participants from five different courses were given set of questionnaires to answer. Some questions in the questionnaire were intended to elicit more information that is personal from the students' perspectives. The findings of various kinds of data (TSA, PSA and LSA) would enable the construction of generalized needs profile for the students regarding the English language learning in the institution. The advantages of employing the questionnaire are the ease of administration purposes which can be used with many participants and easy to be analysed (Abdullah, 2003). The respondents were needed to choose the best answers that represent their opinions.

RESULTS

Table 1: Analysis of Student Personal Details

	Category	Mean	Description
Robotics and	Age	1.04	18-20 years old
Automation	SPM Result	3.47	3B – 4B
Embedded	Age	1.25	18-20 years old
Systems	SPM Result	3.00	3B
Microelectronics	Age	1.50	18-20 years old
	SPM Result	5.00	5C
Measurement	Age	1.40	18-20 years old
And Control	SPM Result	5.40	5C
Data Transmission	Age	1.66	18-20 years old
And Network	SPM Result	5.00	5C

In Table 1, the age of the students who were involved in the study was between 18 to 20 years old. They were semester three students and were in their second year of their study. Their SPM English results ranged from 3B to 5C. The SPM result can be used to infer that the students' English language proficiency is at a moderate level.

Table 2: Analysis of academic English skills

	Category	**Mean***	**SD**
Robotics and Automation	Speaking	**1.61**	1.07
Embedded Systems	Speaking	**2.00**	1.41
Microelectronics	Speaking	**2.00**	0.00
Measurement and Control	Speaking	**1.60**	0.89
Data Transmission And Network	Speaking	**1.55**	1.13

***Mean: 1= Strongly agree, 2= Agree, 3= Disagree, 4= Strongly disagree**

From the table above, out of the four linguistics skills, the skill that is highly rated was the speaking skill. It was rated as being the most important by all students from all departments. This could be an indicator that being able to speak or communicate in English is crucial for the students. The notion of ranking the importance could determine the students' motivation factor of learning the English language and to discover what the learning intention is. From the findings, it can be inferred that the students' perception on the importance of speaking skill might be based on the needs to communicate well in academic context or for future purposes.

Table 3: Analysis of the importance of learning English

	Mean*	SD	Description
Robotics and	4.76	0.43	To communicate with others
Automation	4.71	0.46	To be good user
	4.71	0.56	To get good jobs
Embedded	4.50	0.57	To get good jobs
Systems	4.25	0.50	To be good user
	4.25	0.50	To expand vocabulary range
Microelectronics	4.00	1.41	To communicate with others
	3.00	2.82	To further study abroad
	3.00	0.00	To feel good about self
Measurement	4.00	1.41	To communicate with others
And Control	3.00	2.82	To further study abroad
	3.00	0.00	To get good jobs
Data Transmission	4.11	1.36	To get good jobs
	4.00	1.22	To be good user
And Network	4.00	1.32	To further study abroad

***Mean: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree**

From the table above, the importance of learning English language was found similar between a few departments which English is the means to communicate with others. Another point to note is learning English is seemed important to get good jobs in future and most of the respondents felt being good users of the language is crucial and the language could be helpful for them to further their studies abroad. Students from the department of Embedded Systems thought that they need to learn English to expand their vocabulary range which could be related to other reasons as to be good users of the language and subsequently to secure good jobs in future. From this example, English is perceived as a means to achieve something important in life.

From the results, it can be seen that there are certain level of awareness of the importance of learning English language and the students

understood the reasons why English needed to be mastered. From the list above, language teachers can then identify the key aspects of English language learning that should meet the needs of the students. Aspects that could be emphasized by the teachers should encompass the learning objectives or targets from the perspectives of the learners.

Table 4: Analysis of the needs to learn English language

	Mean	SD	Description
Robotics and	4.80	0.40	Learning English language is important
Automation	4.61	0.49	To improve my linguistics skills
	4.47	0.67	To communicate with lecturers
Embedded	4.80	0.40	Learning English language is important
Systems	4.61	0.49	To improve my linguistics skills
	4.47	0.67	Because I am interested
Microelectronics	4.00	1.41	Scientific terms are in English
	4.00	1.41	To communicate with classmates
	4.00	2.50	Because I am interested
Measurement	5.00	0.00	Learning English language is important
And Control	4.80	0.44	To improve my linguistics skills
	4.60	0.54	Because I am interested
Data Transmission	4.88	2.36	Because I am interested
	4.11	1.26	Learning English language is important
And Network	4.00	1.32	Scientific terms are in English

***Mean: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree**

Among the reasons why the students need to learn English was due to the notion that learning English is important. This could be due to the aims to secure good jobs, to further their studies abroad or to communicate with

others. The students also needed to learn English because they wanted to improve their linguistics skills as well as to communicate well with lecturers and classmates in academic context. They also made it clear that English is needed where in studying Engineering subjects, the scientific terms are in English. It is then crucial to learn English as it serves as the medium to understand the subject better.

It was noted that most of the students learn English because they are interested to learn. This could be an indication of English language learning needs of the students is because they wanted to learn the language. In general, there are various reasons as to why students needed to learn English language. To summarise the results from the table above, it is appropriate to infer that the main intention to learn English language was due to communicative purposes of the language which can be related to the needs to function well in the target situation which is the engineering field.

Table 5: Analysis of the ways of learning English

	Mean	SD	Description
Robotics and	4.66	0.48	I refer the internet for new information
Automation	4.66	0.57	I use/explore computer
	4.42	0.67	applications
			I am needed to do more presentations
Embedded	4.25	0.50	I am needed to do more presentations
Systems	4.00	0.81	I am given the opportunity to
	4.00	0.81	talk more
			I use/explore computer applications
Microelectronics	4.00	0.81	I am needed to do more presentations
	4.00	1.41	I work on my own
	4.00	1.41	I write my journal
Measurement	4.80	0.44	I refer the internet for new information
And Control	4.60	0.89	I do group activities
	4.40	0.89	I am given the opportunity to talk more
Data Transmission	4.11	0.92	I refer the internet for new
	4.00	0.86	information
			I work on my own
And Network	3.88	0.92	I use/explore computer applications

***Mean: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree**

From the result in table 5, there were several ways the students preferred to learn English. The reasons varied among departments but the most common option was learning by referring the internet. Another option that surfaced as the preferred method of learning English was by using or exploring computer

applications. These two options showed that the respondents prefer to learn on their own and it is generally known that the language used in most internet websites and computer applications is English language.

Apart from independent learning, the students believed that they learn English language better when they are needed to do more presentations in classroom, doing group activities and if they were given the opportunity to use the language. This shows that the types of tasks are considered important in inculcating the learning environment for students. Some students also noted that they could learn better on their own and by writing journals.

Table 6: Analysis of the course evaluation in regards of learning English

	Descriptor	Evaluation
Robotics and Automation	Teaching style / approach	Should pay more attention to weaker students
	Classroom activities	More outdoor activities
	Resources	Could use magazines and newspaper more to learn English
Embedded	Course content	Should be revised and make it simpler
Systems	Classroom activities	More presentation, games and quizzes
	Resources	Should provide module and more notes
Microelectronics	Classroom activities	Use songs or movies in classroom
	Course content	Should be simplified
	Resources	Use magazines to learn English
Measurement	Teacher	Should me more approachable
And Control	Teaching style / approach	Should facilitate students' understandings
	Classroom activities	More / variety of classroom activities
Data Transmission	Classroom activities	Group works and more presentations
	Course content	Students should be informed
And Network	Classroom facilities	Should have internet connection in classrooms

From Table 6, it can be seen that the responds varied between students from each department. The students from a course felt that in terms

of teaching style or approach, more attention should be given to weak students and more outdoor activities should be conducted. The highest suggestion came under the classroom activities where the students suggested that more games, quizzes, presentations and group works could be done by the language lecturers. The suggestions could be due to the current teaching and learning practice that uses the conventional method. In reality, there were efforts to make the English classroom session more interesting by providing variety of tasks and activities that are centered to the students so that the learning would be more meaningful for the learners.

In regards of course content, the students felt that it should be revised, simplified for the students and the students should be informed of the course structure and outlines. Improvisation could be done by reviewing the current content and based on the feedback from the students, modifications on the content, activities and tasks could be suggested. An interesting point to note was in terms of the teacher factor, students from a department suggested the language teacher should be more approachable and teacher should facilitate the students' understandings in English classrooms.

The results also showed that the students wanted the resources or the learning materials of the English language courses to include the use of magazines and newspaper. These students believed that these materials could help them learn English better. The course module was suggested to be given and class notes should be provided for the students. These materials would be valuable for the students especially during tests, quizzes and examinations.

Another suggestion was made on classroom facilities which proposed that classroom should be equipped with internet connection. This could infer the needs for the students to search for information on the internet and subsequently to complete their assignments. This suggestion could be taken

into consideration as internet is undeniably important for the students as well as for the lecturers.

CONCLUSIONS

PSA – Present Situation Analysis Outcomes

PSA estimates the strengths and weaknesses in language, skills and learning experiences (Tony Dudley-Evans and St John, 1998). At present situation of the institution, the students who enrolled in the Engineering courses are not proficient in English which can be evident from the result of their English subject of Sijil Pelajaran Malaysia (SPM). This could affect their confidence level and learning motivation in learning English subjects and technical Engineering classes.

The respondents wanted to be good speakers of English but the lack of participation in English language classrooms and the lack of use of the language might not be helpful for them to achieve their targets. The language lecturers had the same view where speaking skill would be the most important skill for the students and suggestions were made so that the students have the opportunity to polish their skills in that area.

TSA - Target Situation Analysis

From the findings, the students were aware that learning English is important in various aspects and English is used as a tool to communicate especially with lecturers. The communicative purpose of English is equally important for them where the technical terms are usually in English so they need to master the language. It was evident that they have high interest in learning English and they were also hopeful that they could improve their linguistics skills.

It was also noted that English is generally important for them to achieve good results in their studies and again the English can be used to achieve their targets. English is mainly used in the classroom because most of the lectures are conducted in English and this is where TSA plays a significant part where students' needs are more in the classroom than in any other places. This could be due to the factor that they want to secure good jobs in future where it is undeniably important to have good English conduct especially in attending job interviews and to perform well in future workplaces.

LSA – Learning Situation Analysis

LSA needs are subjective, felt and process oriented. They are derived from the students themselves that corresponds to the underlying cognitive and affective factors. This could be referred to as how students learn the way they learn English language.

The findings showed that students learn English to achieve something in future. This means that language is seen as a tool to succeed. By giving thoughts on improving the course the students are stating their learning preferences and they are contributing to design an EAP course that reflects the real learning needs of students.

The Generalised Needs Profile (GNP)

Listed below is the Generalised English Language Learning Needs Profile of MARA-Japan Industrial Institute students. The structure of GNP is adapted from Abdullah (2003). The information from the GNP would be used as parameters that could be used by the language lecturers and the

management to design and construct appropriate EAP course that corresponds to the needs of students.

A. Present Situation Features (PSA outcomes)

1. Language Proficiency

Average English language proficiency level, students' SPM results between the grades 3B to 5C, English language is only used when necessary in academic context, the level of English usage in technical classes were between 50% to 90% of the times.

2. Approaches to Studying

Claim to learn English language better if they are given more opportunity to talk in target language and through group activities.

B. Target Situation Needs (TSA outcomes)

1. Target Language Skill

(a) Student perceived needs: Speaking skill is the most important skill to be

learned by students apart from other language skills.

2. English Learning Needs

(a) Student perceived needs: To communicate with lecturers and classmates, to learn scientific terms, to improve linguistics skills, awareness of English language importance, own learning interest and motivation.

3. English Language Learning Opportunities

Using the internet for information, exploring computer applications, independent or group work and presentations and writing journals.

C. Learning Situation Attributes (LSA outcomes)

1. Language Priorities

To secure good jobs in future, to further study abroad, to communicate with others, to be good English language users.

2. Areas of Improvements in regards of English Language Learning

More attentive teaching approaches, variety of classroom activities, classroom presentations and games to promote English language usage, assortment of up-to-date resources that stimulate learners' learning interest and internet connection in classrooms to ease information search to complete assignments.

Suggestions for Future Research

The researchers believed that there are many aspects of the ESP or EAP programmes that could be researched on. Needs analysis is one of the tools that can be used to elicit such information on TSA, PSA and LSA and practical solutions can be suggested accordingly on certain issues of concern. Among the research projects that can be proposed is an analysis of current language programme syllabus or a research on the effectiveness of materials used in current ESP or EAP classrooms.

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Terapi Realiti Bagi Menangani Kemurungan Di Kalangan Ahli Akademik

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Abstrak: Artikel ini membincangkan Aplikasi Terapi Realiti terhadap klien yang berdepan dengan isu kemurungan akibat kematian orang tersayang. Klien ialah seorang staf yang berumur 30 tahun dari sebuah institusi pengajian tinggi di Selangor. Kajian ini berbentuk kualitatif yang menggunakan sesi kaunseling sebagai instrumen. Maklumat diperolehi daripada catatan kaunselor dalam empat sesi kaunseling. Kaunselor menggunakan konsep WDEP yang merupakan perkara utama dalam terapi realiti. W *(Wants)* merujuk kepada meneroka kehendak, keperluan dan persepsi. D *(Doing and Direction)* pula melihat tingkah laku dan arah tujuan tindakan. Manakala *E (Evaluation)* pula menjalankan penilaian kendiri dan yang terakhir P (*Plan and Action)* iaitu merancang dan melaksanakan pelan tindakan. Kajian ini mencadangkan Pendekatan Realiti dapat diaplikasikan pengamal kaunseling dalam membantu klien membuat perubahan emosi yang sejahtera.

PENGENALAN

Perasaan sedih apabila mengalami peristiwa kehilangan orang tersayang adalah normal. Setiap individu mempunyai tahap kesedihan yang berbeza. Namun begitu kesedihan yang berpanjangan serta sukar menerima kenyataan tersebut boleh menyebabkan berlakunya kemurungan. Menurut Mohd. Sufian (2004), kemurungan adalah suatu masalah yang tidak seimbang emosi yang mana biasanya dialami manusia yang berdepan dengan kekecewaan atau tekanan dalam kehidupan harian mereka. *Kemurungan* (depression) juga dikenali salah satu penyakit psikologi yang melibatkan tekanan perasaan yang serius kepada individu baik lelaki atau wanita, kanak-kanak,remaja, dewasa dan warga emas. Ia melibatkan rasa kesedihan, kepiluan, kecewa, putus atau putus harapan, hilang semangat untuk meneruskan kehidupan yang bermakna dan gembira. Kehidupan dirasakan sunyi dan kosong (Norhayati Ya'acob, 2013).

Bagi kebanyakan orang, gangguan emosi ini hanya berjangka masa pendek sahaja. Namun dalam kes-kes tertentu, perasaan murung ini berlanjutan sehingga membawa kepada akibat yang tidak diingini seperti membunuh diri atau penyakit mental yang lebih serius (Ingersoll, 1989). Kemurungan boleh dianggap sebagai suatu perasaan, suatu sindrom atau suatu penyakit klinikal (Dacey & Kenny, 1997). Setiap individu akan mengalami perasaan sedih atau muram pada masa yang tertentu sepanjang hayatnya. Mereka yang murung juga mengalami simptom fizikal seperti berat badan atau selera makan meningkat (atau menurun), bangun terlalu awal, kurang bertenaga, sakit kepala, masalah penghadaman dan rasa sakit yang kronik. Orang di sekitar individu yang murung mungkin perasan penampilan yang semakin runsing (Norhayati Ya'acob, 2013).

Justeru itu, klien yang mengalami kemurungan ini perlu dibantu supaya klien boleh bertindak secara positif dan dapat mengatasi masalah yang dihadapi. Klien perlu berusaha untuk melaksanakan perubahan dalam hidup supaya dapat melupakan peristiwa lalu dengan melalukan aktiviti-aktiviti yang boleh mengembirakan dirinya. Klien boleh menyibukkan diri dengan melakukan aktiviti sukan contohnya.

Kaunselor berperanan membantu klien dalam menangani pelbagai permasalahan ataupun isu. Individu yang berdepan dengan masalah kadang-kadang tidak boleh berfikir dengan normal. Justeru itu kaunselor berperanan membantu klien agar klien mendapat celik akal dan boleh bertindak dan berfikir secara normal. Kebanyakan individu mendapatkan bantuan kaunseling untuk menangani isu kehidupan seharian seperti masalah hubungan, stres dan simptom-simptom depresi (Melati Sumari, Ida Hartina, 2014).

TERAPI REALITI.

Terapi realiti berasal daripada teori pemilihan yang melihat manusia sebagai individu yang mampu menentukan arah hidupnya sendiri. Manusia dianggap sebagai seorang yang berautonomi, mampu membuat pilihan, bertanggungjawab dan boleh mengawal tindakan sendiri. Menurut terapi realiti kita sentiasa berusaha untuk memenuhi keperluan psikologi diri (Melati Sumari, Ida Hartina, 2014). Di dalam terapi ini kaunselor bertindak secara aktif, mengarah, didaktif dan kognitif. Di samping itu, ia juga mengikat kontrak dengan klien di dalam usaha klien untuk mengubah tingkah lakunya.

Sebagai suatu bentuk terapi arahan kaunselor, kaunselor berperanan sebagai guru dan sebagai contoh atau teladan. Sungguhpun demikian, ia tidak pula teragak-agak untuk mencabar klienya untuk berhadapan dengan

realiti masa kini. Ia langsung tidak mempedulikan peristiwa-peristiwa masa lampau dan tidak juga member perhatian atau fokus kepada sikap, celik akal atau pun motivasi-motivasi tidak sedar.

Terapis realiti amat yakin yang kliennya mempunyai keupayaan-keupayaan tertentu untuk melakukan sesuatu pada masa kini bagi mengubah tingkah lakunya. Terapis juga yakin tentang adanya komitmen di dalam diri klien untuk mengubah, untuk merancangkan rancangan-rancangan tindakan dan seterusnya untuk melakukan tindakan-tindakan yang dirancangkan itu.

Selain daripada itu terapi realiti menolak konsep '*mental illness*' atau sakit jiwa seperti yang dipelopori oleh teori psikoanalisis. Ia lebih mengutamakan tingkah laku dan menggunakan konsep-konsep mengubah tingkah laku. Ia boleh digunakan di dalam terapi atau kaunseling individu, kerja-kerja sosial, pendidikan, kaunseling kelompok, kaunseling keluarga, kaunseling pemulihan dan perkembangan serta kemajuan masyarakat.

Kejayaan-kejayaan cemerlang telah dicapai oleh terapi realiti dalam merawat belia-belia yang telah melanggar undang-undang atau penyeleweng- penyeleweng masyarakat dengan memasukkan mereka ini ke dalam institusi-institusi rawatan dan seterusnya mengikuti rancangan terapi realiti dengan sepenuhnya.

Terapi realiti agak berbeza dengan terapi-terapi kaunseling dan psikoterapi yang lain, kerana ia tidak mempunyai konsep-konsep tertentu. Sebaliknya, terapi realiti telah mengemukakan sebagai alternatif ciri-ciri tertentu yang boleh dan harus diperhatikan. Terapi realiti menolak konsep sakit jiwa dan kerana itu tidak langsung memberikan perhatian atau fokus kepada diagnosis jiwa. Ia lebih menitikberatkan tingkah laku yang tidak siuman, yang menurut terapi realiti adalah hasil daripada penolakan tanggungjawab. Apabila individu menolak atau membelakangkan

tanggungjawab yang harus dilaksanakannya, maka akan terhasillah tingkah laku yang tidak siuman atau bilazim.

Terapi realiti memberi fokus kepada tingkah laku dan tidak kepada perasaan dan sikap. Menurut terapi realiti, bila tingkah laku berubah, sikap dan perasaan akan turut berubah. Terapi realiti menumpukan perhatiannya kepada keadaan klien pada masa kini. Ia tidak menghiraukan peristiwa-peristiwa dan keadaan-keadaan masa lampau, kecuali jika masa lampau itu ada kaitan langsung dengan keadaan masa kini. Bagi terapi realiti tidak ada gunanya kita memberi perhatian kepada masa lampau, kerana masa lampau adalah sejarah yang tidak boleh diubah lagi.

Di dalam memberi perhatian kepada tingkah laku masa kini, terapi realiti menekankan aspek-aspek positif, seperti potensi individu itu, kejayaan-kejayaannya, kelebihan-kelebihannya serta kualiti-kualiti positif yang ada padanya. Terapi realiti menggalakkan kliennya untuk meneliti dan menilai tingkah lakunya di dalam usaha kaunselor untuk mendorong kliennya mengenali jenis-jenis tingkah laku yang ada pada dirinya.

WDEP

Pengamal teori juga perlu memahami konsep WDEP yang diperkenalkan oleh Wubbolding (1991) yang merupakan perkara utama dalam terapi realiti. W *(wants)* merujuk kepada meneroka kehendak, keperluan dan persepsi. D *(doing and Direction)* pula melihat tingkah laku dan arah tujuan tindakan. Manakal *E (Evaluation)* pula menjalankan penilaina kendiri dan yang terakhir P (*Plan and Action)* iaitu merancang dan melaksanakan pelan tindakan.

Kaunselor berperanan sebagai guru yang aktif semasa sesi untuk membantu klien membentuk pelan perubahan, memberi pilihan atau cadangan serta membimbing klien mencapai keperluannya. Sebagai kaunselor realiti, kaunselor perlu fokus kepada kekuatan , sikap dan potensi klien yang boleh menghasilkan kejayaan.

Reality therapists teach clients how to engage in self-evaluation, which is done by raising the question. "Is what you are choosing to do getting you what you want and need?"here are some other questions that therapist tend to ask clients :

1) *How would you most like to change your life?*
2) *What do you want in your life that you are not getting?*

(Corey, 2013)

Tahap peranan kaunselor berubah mengikut situasi yang dibawa oleh klien ke dalam sesi. Kaunselor boleh bertindak sebagai pemimpin klien ataupun sebagai pengikut klien. Situasi tertentu memerlukan kaunselor mendengar dengan penuh tumpuan dan membantu klien mengawal tindakan-tindakannya yang boleh mendatangkan kepuasan terhadap keperluannya. Ada kalanya kaunselor bersikap mencabar, memberi maklum balas tentang tingkah laku yang spesifik dan banyak bertanya.

Dalam semua situasi, kaunselor perlu mewujudkan suasana yang sesuai, selesa dan kondusif untuk menggalakkan perubahan. Berikut adalah lapan peranan utama kaunselor di dalam sesi realiti :

Peranan yang pertama ialah mewujudkan hubungan teraputik. Kaunselor perlu mewujudkan hubungan teraputik dengan klien. Seterusnya yang kedua ialah fokus kepada tingkah laku semasa klien. Kaunselor perlu

tahu tingkah laku klien pada masa itu sebelum proses ini berlaku. Yang ketiga, kaunselor juga perlu mempelawa klien menilai perlakuannya. Klien perlu nilai tingkah lakunya. Ini akan membantu klien untuk proses yang seterusnya.

Membantu klien membentuk pelan tindakan merupakan peranan yang keempat yang perlu dimainkan oleh kaunselor. Kaunselor perlu membantu klien untuk membuat pelan tindakan yang bersesuaian dengan isu klien. Bagi isu murung, kaunselor harus menolong klien menyediakan pelan supaya klien boleh menghilangkan perasaan murungnya. Peranan yang kelima ialah kaunselor perlu mendapatkan komitmen daripada klien. Sekiranya tiada komitmen dari klien proses membantu agar sukar. Klien perlu menunjukkan sikap untuk berubah menjadi seorang yang normal untuk mendapatkan hasil yang memuaskan.

Peranan yang keenam iaitu kaunselor juga perlu enggan menerima alasan klien. Klien yang beralasan biasanya akan mengulangi perbuatannya dan sukar untuk berubah. Peranan yang ketujuh, kaunselor seharusnya tidak menggunakan penderaan, hukuman atau penalti. Sekiranya klien tidak melakukan perubahan tingkah laku kaunselor tidak boleh melakukan hukuman kepada klien. Peranan yang terakhir iaitu kaunselor tidak berputus asa atau menyerah kalah terhadap klien. Kaunselor perlu berusaha membantu klien walaupun tiada perubahan yang dilakukan oleh klien.

Dalam peringkat permulaan, kaunselor boleh mengajukan soalan "Apa yang anda inginkan?". Klien diminta mengenal pasti dan menyatakan apa yang diingini. Kaunselor realiti sering menggunakan soalan untuk mengetahui tentang harapan dan keinginan klien. Sebagai contoh, klien yang murung. Kaunselor mengajukan pertanyaan iaitu apa yang diinginkan oleh pelajar.

METODOLOGI KAJIAN

Simptom Kes.

Siti (bukan nama sebenar) merupakan seorang pekerja berumur 30 tahun dan berasal dari Johor yang tinggal keseorangan dan kadang-kadang ditemani oleh 3 orang adik beradik dan merupakan anak sulung perempuan dalam keluarganya. Bapanya tinggal di Johor dan ibunya telah meninggal lebih kurang setahun yang lalu. Sebelum ini arwah ibunya memang tinggal bersama Siti di Selangor. Arwah ibunya telah lama mengidap penyakit kencing manis. Arwah ibunya telah diserang strok dan lebih kurang dua bulan diserang penyakit tersebut ibunya telah meninggal dunia. Beliau agak terkilan kerana tidak dapat menjaga dan berada di samping ibunya di saat-saat terakhir pemergian arwah ibunya. Beliau pada awalnya seorang yang bercita-cita tinggi, ingin menyambung pelajaran ke peringkat Phd, seorang yang pemurah, ceria, suka beraktiviti lasak dan senang memberikan pertolongan kepada pelajar dan juga kawan-kawan. Setelah berlaku peristiwa kehilangan tersebut, beliau telah tidak bersemangant untuk bekerja, cita-citanya untuk menyambung pelajaran juga terbantut, penampilannya juga kurang ceria, tidak suka berhias dan juga tidak suka menghadiri majlis-majlis yang dianjurkan oleh pihak kolej. Prestasi kerjanya sedikit merosot. Beliau mengalami kesedihan dan kesunyian setelah kematian ibunya. Beliau sentiasa teringat apa yang dilakukan oleh arwah. Beliau seolah-olah ternampak-nampak arwah yang sedang menunggu bas. Apabila berada di rumah klien juga tidak boleh menahan perasaannya. Rumah itulah banyak meninggalkan kenangan antara klien dan ibunya. Apabila berada di rumah ingatan klien pada arwah sangat kuat. Beliau ada terfikir juga untuk berpindah ke rumah lain. Namun apabila difikirkan kekangan-kekangan yang harus dihadapi, klien membatalkan niatnya. Beliau juga mengalami kesukaran untuk tidur. Beliau akan terlelap setelah malam

menghampiri pagi. Beliau mengalami keadaan tidak cukup tidur. Apabila keadaan ini berlaku, keadaan fizikal beliau juga kurang bermaya. Prestasi kerja beliau juga sedikit merosot disebabkan keadaan fizikalnya yang kurang sihat. Beliau merasakan beliau perlu berkongsi dengan kaunselor keadaan yang dialami. Beliau datang secara sukarela bagi mendapatkan khidmat kaunseling.

INTERVENSI DAN PERBINCANGAN

Intervensi.

Kajian ini menganalisa proses kaunseling ke atas seorang pekerja di sebuah kolej. Empat sesi kaunseling telah dijalankan dan kaunselor telah menulis catatan dalam laporan sesi kaunseling.

Sesi 1
(a) Mewujudkan hubungan serta penerokaan masalah fokus kepada kehendak, keperluan dan persepsi (*wants, needs and perceptions)*.

Pada sesi ini hubungan yang teraputik antara klien dan kaunselor perlu dibina supaya boleh mewujudkan suasana kaunseling ke arah saling mempercayai dan boleh menerima antara kaunselor serta klien . Dalam sesi ini juga kaunselor harus memberi tumpuan kepada meneroka kehendak, keperluan dan persepsi terutamanya tingakahlaku klien sama ada buruk yang boleh merosak atau baik yang boleh membina diri dalam dunia sebenar klien. Kaunselor perlu menekankan kepada aspek positif atau kekuatan-kekuatan yang ada pada diri klien dari segi potensi, kejayaan, kualiti diri dan lain-lain dalam bentuk peneguhan positif. Dalam sesi ini Siti menyatakan bahawa prestasi kerjanya sedikit merosot dan dirinya tidak gembira setelah ibunya meninggal. Siti inginkan keadaan kembali seperti

sebelum ini. Ingin menjadi dirinya yang gembira, bersemangat, bercita-cita tinggi dan berkeyakinan.

Sesi 2

(b) Meneroka arah tuju (*Doing and Direction*).

Dalam sesi ke 2, Kaunselor hendaklah bertindak secara aktif, mengarah, didaktif dan kognitif bersama klien meneroka hala tujunya. Elemen D (*Doing & Direction*) akan muncul apabila kaunselor memfokuskan kepada tingkah laku semasa klien. Siti menyatakan dirinya tidak gembira dan sunyi setelah kehilangan ibu yang tercinta. Beliau merasakan hidupnya sunyi tanpa celoteh dan kata-kata semanagta ibunya . Ibu yang sentiasa mengambil berat tentang dirinya, sentiasa mendokan kejayaannya, sentiasa menemaninya dan sentiasa memberinya semangat. Semangatnya untuk belajar seolah-olah hilang bersama kehilangan ibunya. Beliau merasakan hidupnya sudah tidak bermakna. Beliau merasakan dirinya tidak perlu lagi untuk menyambung pelajaran. Apalah erti sebuah kejayaan tanpa ibunya. Beliau juga sedar prestasi kerjanya sedikit merosot, akibat dirinya yang tidak cukup tidur, kurang gembira serta kurang bersemangat Beliau merasakan tumpuan pada kerjayanya sebagai pensyarah telah berkurang. Klien sudah mula berasa kurang selesa dengan persekitaran yang dilalui kini dan pemikirannya juga tepu dengan sukatan pelajaran yang perlu dikuasai dan diajar kepada pelajar. Ini adalah dialog yang menunjukkan klien dapat menilai emosinya. Kaunselor "*Setelah kehilangan ibu tercinta, Siti merasakan hidup ini tidak memberi makna kepada Siti?* Klien " *Ermm macam tu lah. Saya merasakan semuanya tidak lagi beerti kepada saya.*" Kaunselor "*Adakah Siti merasakan hidup ini tidak perlu diteruskan?" Klien "Bukan macam tu, saya sedar…saya perlu meneruskan kehidupan ini. Walau apa yang berlaku..hidup*

mesti diteruskan. Saya perlu kuat untuk bangun daripada keadaan sekarang. Mungkin selama ini saya terlalu mengikut perasaan."

Sesi 3

(c) Membuat Penilaian Terhadap Diri (Evaluation)

Proses seterusnya dalam terapi ini ialah meminta klien menilai sama ada tindakannya setakat ini berkesan untuk mencapai matlamatnya. Pada sesi ini klien diajak untuk menilai dan meneliti pemikiran, perasaan dan perlakuannya selama ini sama ada baik iaitu yang boleh membina atau buruk yang boleh merosakkan dirinya. Klien juga diajak untuk melihat perkaitan antara tingkah lakunya dengan faktor-faktor yang menyebabkan dirinya gagal selama ini (identiti gagal). Kaunselor bukan sekadar menilai tingkah laku yang wujud tetapi ianya juga merangkumi persepsi, komitmen dan kesediaan klien untuk berubah. Siti dilihat lebih bersemangat untuk berubah. Berusaha untuk menjadi lebih gembira. Beliau merasakan dirinya yang murung dan keadaan dirinya akan merugikan masa depannya.

Sesi 4

(d) Membuat dan melaksanakan pelan tindakan

Kaunselor terapi realiti akan memandu klien membuat pelan tidakan efektif yang memiliki ciri-ciri mudah difahami, senang dicapai, boleh diukur keberkesanannya serta boleh dilaksanakan segera oleh klien. Seterusnya dalam sesi ini klien diajak untuk membuat perancangan untuk perubahan tingkahlaku dan mendapatkan komitmen klien. Perancangan berasaskan persetujuan klien untuk berubah, dirancang bersama, mudah, boleh dicapai, boleh diukur, segera dibuat oleh klien, penglibatan klien, dan klien mengawal setiap perancangannya. Siti sebenarnya tahu apa yang perlu dilakukan dan telah merancang beberapa tindakan yang ingin dilakukan.

Oleh kerana klien tidak gembira di tempat kerja sekarang, klien ingin memohon untuk mendapatkan kelulusan membuat latihan di industri. Klien kini lebih positif untuk melakukan perancangan yang telah dilakukan.

Perasaan negatif telah berkurang dalam diri klien. Tindakan positif boleh dibuat tanpa memberikan hukuman (contoh : *Siti, anda masih berpeluang untuk menjalani latihan di industri bagi mendapatkan suasana baru serta pengalaman baru)*. Siti berusaha untuk mengubah keadaan dirinya yang dahulu iaitu bersikap negatif seperti lemah, kurang berusaha dan tidak bersemangat kepada sikap yang lebih positif seperti berusaha keluar daripada kesedihan, akan melakukan aktiviti yang boleh menggembirakan dirinya serta menyibukkan diri dengan aktiviti-aktiviti lain seperti ke *gymnasium* dan sebagainya. Contoh dialog klien di dalam sesi : Kaunselor "*Bagaimana keadaan Siti sekarang?* Klien "*Saya dah semakin ok. Saya dah boleh menerima kehilangan tersebut. Saya akan berusaha menghilangkan perasaan sedih saya dengan melakukan aktiviti yang boleh menyibukkan diri saya.*"

Seterusnya dalam sesi ini klien diajak untuk bertanggungjawab bagi melaksanakan pelan tindakan yang telah dibina. Kaunselor tidak menerima alasan untuk klien lari daripada realiti dengan tidak memberikan komitmen. Kaunselor tidak mudah untuk mengalah sehingga klien benar-benar bertindak dan memberi komitmen melakukan tindakan dalam dunia realiti. Kaunselor perlu membuat rumusan serta maklumbalas dan menamatkan dengan membuat pengukuhan apa yang klien akan buat selepas selesai sesi ini seterusnya diharapkan klien dapat menikmati kelegaan, kesejahteraan diri dan akhirnya menjurus kepada perubahan tingkahlakunya. Setelah melalui proses kaunseling yang dijalankan Siti menyatakan bahawa beliau semakin gembira dan akan berusaha menguatkan dirinya untuk menerima takdir yang berlaku. Siti akan menjalani latihan di industri untuk mendapat

sausana dan pengalaman baru serta akan berusaha mencari peluang untuk menyambung pelajaran.

KESIMPULAN

Artikel ini mengupas satu kajian kes ke atas seorang klien yang berdepan dengan masalah kemurungan kerana kematian orang tersayang di sebuah institusi pendidikan. Kaunselor telah menggunakan pendekatan terapi realiti dalam 4 sesi kaunseling untuk mewujudkan celik akal dan perubahan kepada tingkahlaku. Antara konsep-konsep Realiti yang diaplikasikan termasuklah fokus kepada tingkahlaku kini, mengenal potensi diri dan teknik WDEP iaitu mengetahui tingkahlaku atau identiti gagal, menilai tingkahlaku, membuat dan melaksanakan pelan tindakan. Klien telah sedar dan boleh bertindak untuk memberi komitmen yang positif ke arah perubahan tingkahlaku baik yang diinginkan.

Terapi Realiti boleh digunakan untuk klien yang berdepan dengan kemurungan. Ini kerana Teori realiti berasal daripada teori pemilihan yang melihat manusia sebagai individu yang mampu menentukan arah hidupnya sendiri. Manusia dianggap sebagai seorang yang berautonomi, mampu membuat pilihan, bertanggungjawab dan boleh mengawal diri. Terapi realiti atau terapi membuat pilihan mementingkan keupayaan klien untuk membuat pilihan yang betul tentang dirinya bagi mencapai keperluan psikologi seperti kuasa, kebebasan, rasa dipunyai dan seumpanya.

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