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Remote Controlled Ground Rover for Collecting Objects and Sensing Environment

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Abstract: In this paper, three main portions of ground rover, robotic arm and base station with remote control have been designed and implemented. The ground rover provides driving on the rough paths or in places where there cannot be accessible by people for collecting objects. On this ground rover, robotic arm has been implemented to collect the objects within visible range. Temperature, humidity and gas sensors are used to sense the environment condition where the ground rover has gone. Real time sensing data can be monitored at the base station, which has been communicated through 433 MHz transmitter and receiver pair from the ground rover to the base station. Arduino microcontrollers are used as the main units of automation for the remote control system of the ground rover and base station. In addition, flash memory module is set up at PC in the base station as the backup system to store the sensing data. The main purposes for this project work are to provide detection on the environment condition and to collect the specific objects.

Keywords: Arduino microcontrollers, base station, ground rover, robotic arm, sensors

1. INTRODUCTION

In this project work, the rover is focused on ground exploration to make surveillance of the outside conditions such as ambient temperature, humanity and air pollution. Also the function of the rover is to pick the specific objects in which they can be out of reached for people. In this work, there are three portions on design and system: namely ground rover, robotic arm, and base station with RC (radio controlled) transmitter. Ground rover design provides the accessibility and movability to the specific route by the remote control. Robotic arm supports the pick and place system for the specific objects. In the system of base station with RC transmitter, it is consisted of the control system for ground rover and data backup system with the sensing information which can be monitored on PC display.

The proposed ground rover is designed and implemented with the reference of rocker–bogie suspension system which has become a proven mobility application known for its superior vehicle stability and obstacle–climbing capability [1]. In this design, there are six wheels on drive system and bogie system for travelling rough terrain and stair and obstacle climbing. For the robotic arm, it has been designed with servo motors which provide pick and place system. Through wireless communication, the information which the sensors have made surveillance on outside conditions can be observed for forecasting the environment.

2. SYSTEM ARCHITECTURE

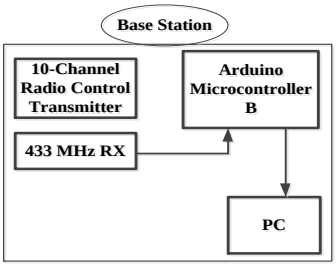

Figure 1. Proposed block diagram of base station

The system block diagrams have been described for the base station with remote control, the ground rover and the robotic arm as shown in Figure 1, Figure 2 and Figure 3.

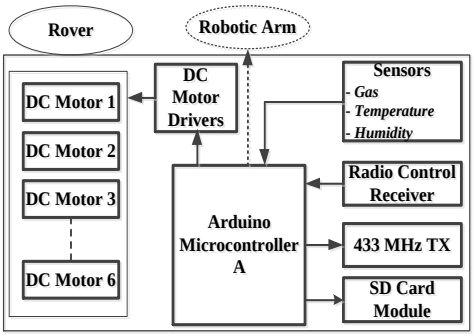

Figure 2. Proposed block diagram of ground rover

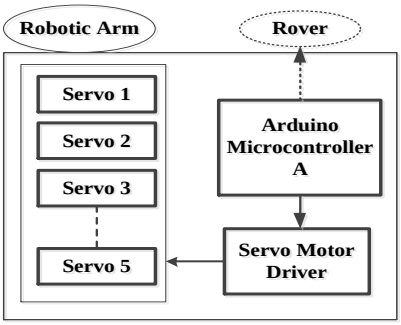

Figure 3. Proposed block diagram of robotic arm

2.1 Hardware Approach

The following components are mainly used in ground rover, robotic arm and base station with Radio Controlled (RC) transmitter. For ground rover, it is consisted of Arduino Mega 256, radio controlled receiver, RF 433MHz transmitter, DC motors and drivers, rover frame, wheels, gas sensor, temperature and humidity sensor, SD card module and SD card. In robotic arm, rotary axis, gripper, servo motors and driver are used. For base station with RC transmitter, Arduino Uno, 10–channel RC transmitter, RF 433MHz receiver and

PC. The circuit connection diagrams for the robotic arm on the ground rover are shown in Figure 4 (a) and (b).

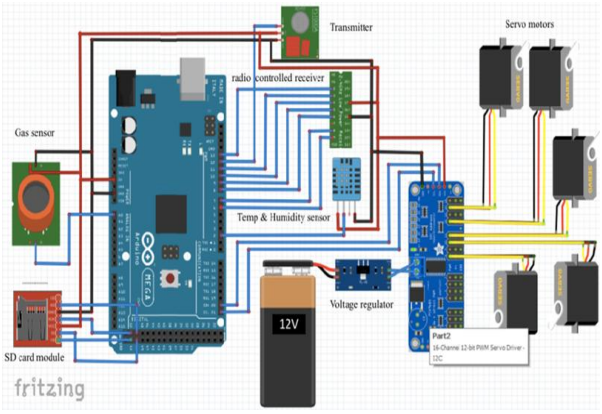

Figure 4. (a) Circuit diagram of payload system and robotic arm

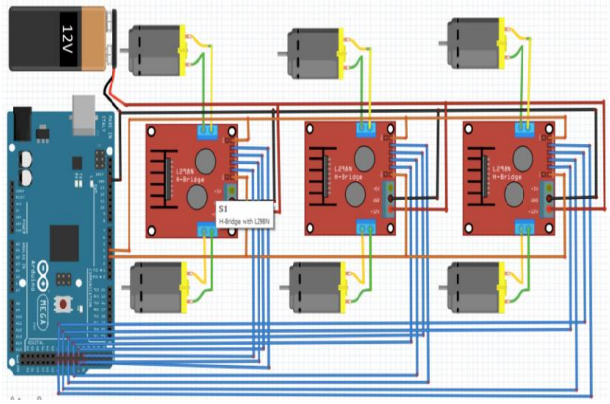

Figure 4. (b) Circuit diagram for ground rover

2.2 Programming Approach for Rover

Algorithms for rover control on the specific way have been described in Figure. 5 (a), (b), (c), (d), (e), (f) and (g) based on assigning the channel no. The existing 10 channel RC transmitter is used for rover movement in the specific direction.

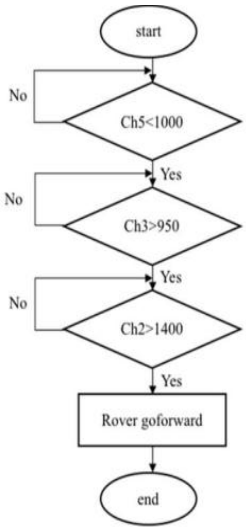

Figure 5. (a) Go forward movement

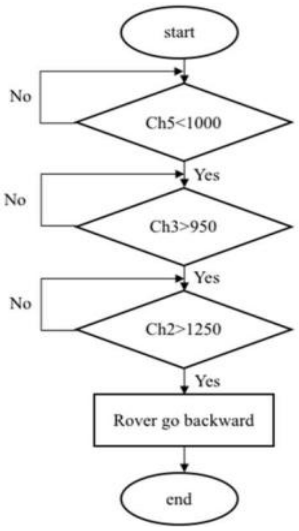

Figure 5. (b) Go backward movement

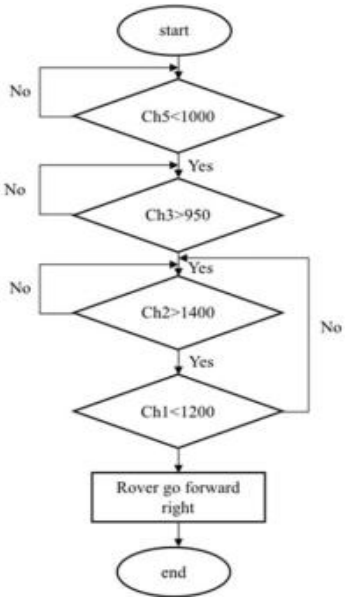

Figure 5. (c) Go forward right movement

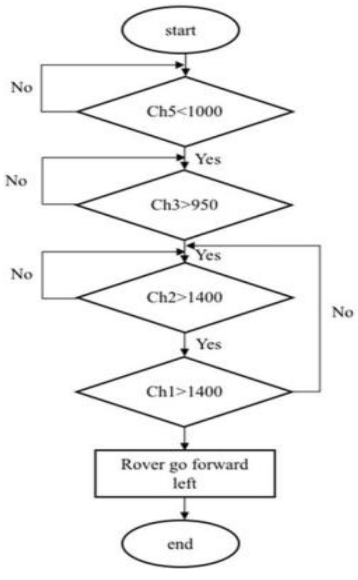

Figure 5. (d) Go forward left movement

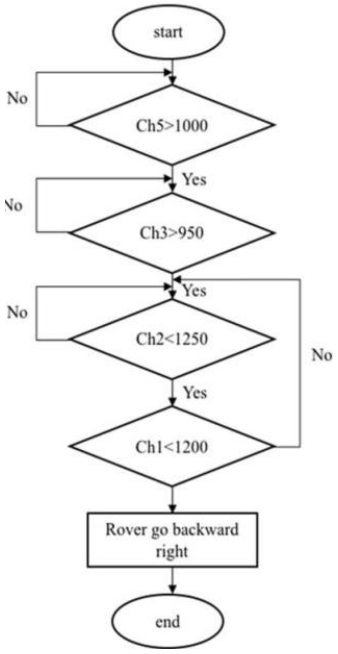

Figure 5. (e) Go backward right movement

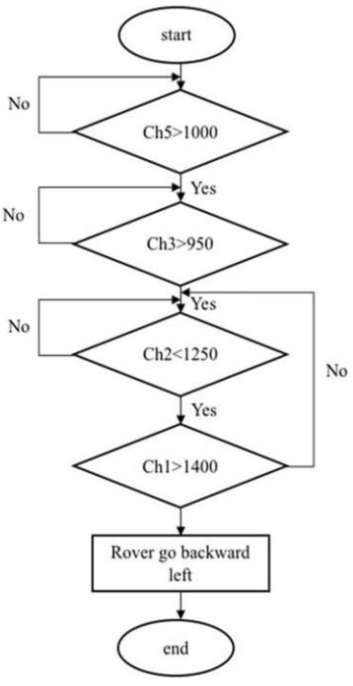

Figure 5. (f) Go backward left movement

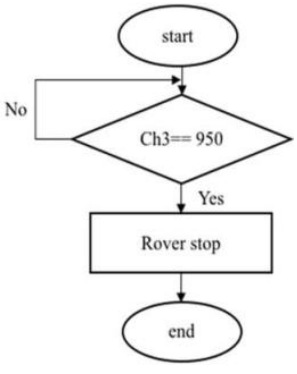

Figure 5. (g) Flowchart for rover stop

3. DESIGN AND IMPLEMENTATION

The 10-channel radio controlled transmitter is used for rover movement, robotic arm and switching on/off data storing and sending. The required channel mode (channel-5 throttle at center, or up or down position) can be selected to drive the rover or controlling the robotic arm or store and send data. For rover driving (throttle down), while channel-2 is used for forward and backward movement, channel-1 is used for turning left and right. Channel-3 is used for speed control for rover movement. When the rover is reached to the specific destination, robotic arm is used to collect the object.

For robotic arm controlling, after making selection mode with channel 5 (throttle up), channel-1 is used to rotate the robotic arm, channel-6 and channel-8 are arranged for up/down movement of robotic arm of upper axis and lower axis, channel-2 is assigned for gripper up/down movement, and channel-3 is assigned for gripping objects. Channel-9 is used to switch on and off for data sending and storing.

For stop position of the rover, channel-5 throttle must be placed at the center.

With the help of sensors: gas, temperature and humidity sensors, the user has to be aware of the environment condition that is possibly difficult to be accessible for people. If channel-9 is switched on, these sensing data are transmitted. When transmission process of sensor data is interrupted with out of long range, the data has already stored in SD card as backup system.

3.1 Rover Design and Selection of Wheels

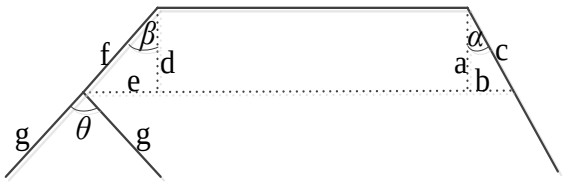

Figure 6. Proposed frame design of rover

For $\theta = 90^{\circ}$, let the length of g make equal. Let a = 7 in, b = 5 in, d = 7 in and e = 7 in. To find the joint angle of α and β, it must be known the lengths of the rover frame. By Pythagoras theorem, the length of c is 8.6 in and f is 9.9 in which make the joint angle $\alpha = 35.5^{\circ}$ and $\beta = 45^{\circ}$.

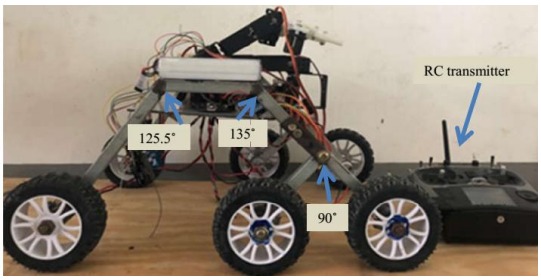

Figure 7. Ground rover

Selection of wheel is the case of consideration in rover mobilization system. Wheels used in the rover must be light weight, less friction and durable. Point design of tire is the important for passing over the terrain and hilly condition. In this project work, wheels that are reliable with this rover have been implemented. Wheels in this rover are tubeless type and there is no pressure between tire and ring. Diameter of wheel used in this rover is about 4.5 inches and width of the wheel is about 1.5 inches.

3.2 Robotic Arm Design

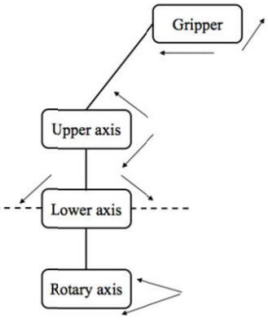

Figure 8. Robotic arm design

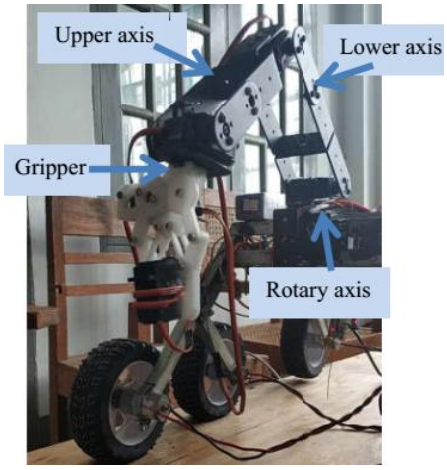

Figure 9. Robotic arm design

For the robot arm design, the length of lower axis is approximately 15.5 cm and the length from the upper axis to the gripper is 25.5 cm. When the Metal Gear (MG 996R) servo motor is used, the torque is 9.4 kg-cm [11]. To calculate the required torque for axes, the following equation can be used.

Torque = weight x length (distance) (1)

The total weight of upper axis (including servo motors associated with servo brackets and accessories) to gripper = 302 g

The total torque = 302 x 25.5 = 7.7 kg-cm

Torque of MG 996R servo motor (9.4 kg-cm) has greater torque required for upper axis.
Total weight of lower axis and upper axis to gripper = 360 g
Torque required for lower axis = weight x length
= 360 x 15.5
= 5.58 kg-cm (no load condition)

4. TEST AND RESULTS

The test weight of picking the object can be considered as the following.
Torque required for lower axis (no load condition)
= 5.58 kg-cm
Servo torque = 9.94 kg-cm
Net torque (Load) = 9.94 – 5.58
= 3.82 kg-cm
Net Weight = net torque/robot arm length (lower + upper axis)
= 3.82 kgcm/41 cm = 93.17 g

Thus, robot arm supports 93.17 g of load. In this project work, testing weight for robot arm is 55g of servo as a sample object.

Figure 10. Picking up the mass of 55 g

For the climbing test, it has been observed the rover can climbling up and down the stairs with the height of 6 in each. In addition, this rover can travell through rough path as shown in Figure 11.

Figure 11. Travelling through the rough path

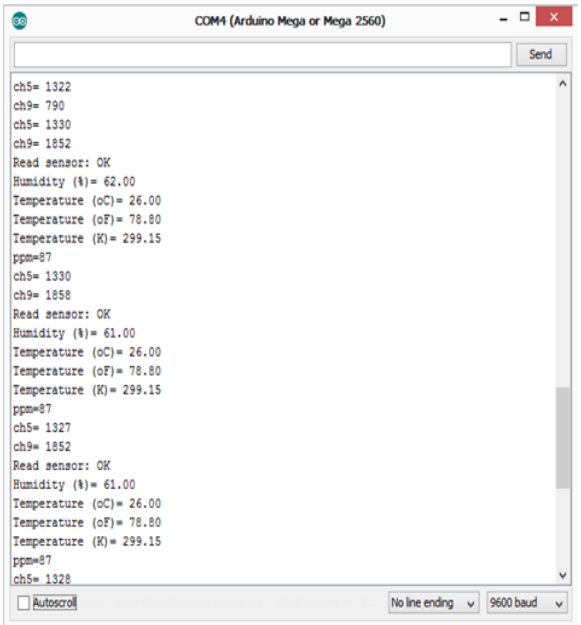

Figure 12. Storing and transmitting data test

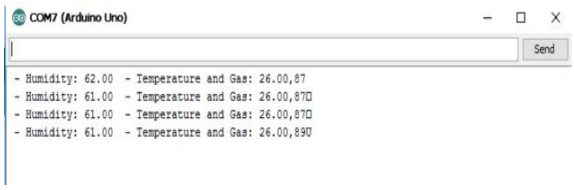

Figure 13. Receiving sensing data at base station

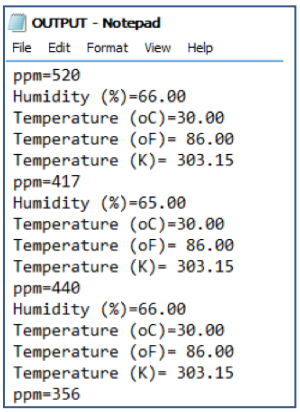

Figure 14. Record sensing data in SD card

Figure 12 shows the sensing information of the environment condition from the gas sensor, temperature and humidity sensor which is implemented in the rover. Receiving data of sensing at the base station is shown in Figure 13 and storing data file as the notepad format has been recorded as back up data system in Figure 14.

5. DISCUSSION AND CONCLUSIONS

This project work is the innovative result of combinations the rover, robotic arm and data handling system of exploration research. Especially, rover design is referenced to the simplex rocker-bogie suspension system and it has been implemented six wheels which is more reliable for cruising rough terrain than conventional four-wheel drive system. This rover can easily climb up stairs or obstacle higher than about 8 inches.
This rover operates not only sensing data with the help of sensors but also collecting objects with the help of robotic arm. On According to testing on picking up object, the robotic arm on this rover can lift up to the mass of 90 g. Then, temperature, moisture and gas data can be provided in sensing system. In addition, it has been designed that the sensing data can transmit to the base station in real time.

6. ACKNOWLEDGMENTS

The author wishes to express his deepest gratitude to graduate students of Avionics, MAEU for their collaboration with this project work. Also, I am greatly indebted to Dr. Khin Trar Trar Soe, for her guidelines. Then, I would like to thank to my parents for their noble support and encouragement.

7. REFERENCES

[1] D. S. Chinchkar, S. S. Gajghate, R. N. Panchal, R. M. Shetenawar, P. S. Mulik, “Design of Rocker Bogie Mechanism”, *International Advanced Research Journal in Science, Engineering and Technology*, 2017.

[2] Yoji KURODA, Teppei TESHIMA, Yoshinori SATO, Takashi KUBOTA, “Mobility Performance Evaluation of Planetary Rover with Similarity Model Experiment”, *IEEE ICRA* 2004 -Final Paper.

[3] http://ardupilot.org/rover

[4] eLAB PEERS: “*Robotic Arm Set Manual”*, https://www.elabpeers.com/robotic-arm.html

[5] *“How to use DHT11 Temperature-Humidity Sensor with Arduino”*, https://www.brainy-bits.com/dht11-tutorial/

[6] Random Nerd, *“Complete Guide for RF 433MHz Transmitter/Receiver Module with Arduino”*, http://randomnerdtutorials.com/rf-433-mhz-transmitter-receiver-module-with-arduino

[7] *“MQ-135 Gas Sensor”*, https://tinkerfest.in/ mq-135-gas-sensor/

[8] *“MQ-135 Gas Sensor User Manual”* https://www.robotshop.com

[9] Random Nerd, *“Guide to SD Card Module with Arduino”*, https://randomnerdtutorials.com/guide-to-sd-card module with arduino

[10] “*Rocker Bogie System”*, https://en.m.wikipedia.org/wiki/Rocker-bogie

[11] *“Servo Motor Datasheet”*, http://www.electronicoscaldas.com/ datasheet/MG996R_Tower- Pro.pdf

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Comparative Study of Two Sources of Sugarcane Bagasse Ash (SCBA) as partial replacement of Cement

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Abstract: Cement industries give rise of the carbon dioxide in our social environment. The air is not fresh near cement industry and its parts affect the breathing system. To reduce air pollution and carbon dioxide, the alternative materials like cement are needed to find out as admixture or partial replacement. The industrial and agricultural wastages in concrete partly as cement replacement not only reduce the cost of making concrete but also reduce environmental pollution and minimize the waste emissions. In this paper, two sources of sugarcane bagasse ash were used as partial replacement of cement. Sugarcane bagasse ash (SCBA) sample was collected from NwayDay and Oatkan sugar factories. Untreated bagasse ash has been partially replaced in the ratio of 0%, 5%, 10% and 15% by weight of cement in concrete and compared with water cement ratio 0.4, 0.5 and 0.6. Fresh concrete test and hardened concrete test at the age of 7, 14, 28 and 56 days are investigated. And then two sources were compared at 56days compressive strength to get the Grade 40. The result shows that the strength of Oatkan SCBA is better than NwayDay SCBA.

Keywords: carbon dioxide, air pollution, SCBA, alternative material, sources, strength

1. INTRODUCTION

Ordinary Portland Cement (OPC) is used as main components in the construction works. The increase in carbon dioxides emissions in cement industry leads to vast effect in our environment. Therefore alternative material like cement should be used to reduce air pollution and carbon dioxide emissions. Some of the industrial wastes like fly ash, blast furnace slag, silica fume was successful used as admixture and partial replacement of cement. Some of the wastes like maize combs, palm kennel shell, coconut shell and groundnut shell etc. are not easily decomposed and accumulation in the environment. Cementitious materials need little or no direct energy related costs, so it is cheaper than OPC. From the economical point of view, cement is known to be more expansive as its production is highly energy intensive.

Sugarcane mainly grows in tropical and subtropical regions. The most planted areas in Myanmar was Sagaing, HtiChike and Kathar regions. Sugarcane is the products of sugar. After extraction sugar from sugarcane, 30% fibrous residue of bagasse by weight of sugarcane was obtained. It was used as fuel in sugar mills. Sometimes the bagasse was used in making the paper. The combustion yields sugarcane bagasse ash (SCBA) containing silica contents. The burning temperature of sugarcane bagasse varies from 700 to 1200° C. It effects on chemical composition of SCBA. The properties of sugarcane depend on the nature of soil and its species. It also effects chemical composition of SCBA and its reactivity on concrete.

2. OBJECTIVE of THIS STUDY

The goal of this study is to reduce the cost of construction and to find the alternative material for cement as admixture or partial replacement. The main objective is to inspire the use of the wastes as construction materials.

3. MATERIALS AND METHODS

3.1 Cement

The most commonly used material is Ordinary Portland Cement (Type I). Apache Cement brand (Type I) was used in this study. The physical tests of cement were made on High Tech Lab and Technological University (Thanlyin) according to the American Society for Testing and Materials (ASTM), and Indian Standard (IS) procedures. The specific gravity of cement is 3.15.

3.2 Aggregates

The river sand passing through 4.75 mm sieve was used as fine aggregate. The sand is free from debris and organic impurities. The maximum size of crushed aggregate 20mm was used as coarse aggregate. The results of specific gravity, fineness modulus and bulk density of coarse and fine aggregates are shown on Table 1.

Table 1. Physical Properties of Aggregates

Physical Test	Coarse Aggregate	Fine aggregate
Fineness Modulus	3.74	2.2
Specific gravity	2.8	2.7
Bulk density (kg/m^3)	1505	1560

3.3 Water

Tube well water in Tharkayta was used in the concrete works. Water test was carried out on ISO tech laboratory. PH level in water is 7.2, so it is accessible to use in concrete works.

3.4 Sugarcane Bagasse Ash (SCBA)

In the present study two kinds of sugarcane bagasse ash were used. It can be obtained from NwayDay (NA) and OatKan

(OA) sugar factories. NwayDay SCBA (NA) mainly contains silica content, but it is lack in alkali content. But silica content of over 70% is a good pozzolanic material. The total amount of silica, aluminum oxide and ferrous oxide is over 70% in OA. Specific gravity of NwayDay and OatKan SCBA was 1.79 and 1.92. Chemical test was carried out in Chemistry lab by using EDXRF at West Yangon University. Chemical compositions of NA, OA and Ordinary Portland Cement (OPC) were compared and shown in Table 2.

Table 2. Chemical Composition of NA, OA and OPC

Oxide Composition	NA	OA	OPC
Silica	85.1	87.2	21.47
Aluminum Oxide	-	5.3	4.61
Ferric Oxide	2.2	1.4	3.32
Calcium Oxide	4.6	2.9	64.61
Potassium Oxide	5.1	2.1	-
Phosphorous Oxide	0.7	1.6	-
Sulphide Oxide	1.2	0.5	-

4. EXPERIMENTAL WORKS

In the experimental works, total of 48 mortar cubes 50mm×50mm×50mm were prepared for 0%, 5%, 10% and 15% at the age of 3, 7 and 28 days. NA and OA was summarized for NwayDay and OatKan SCBA. N0 and AO were denoted as control mix that is no added SCBA, N5 and A5 as 5% of cement replacement with NA and OA, N10 and A10 as 10% of cement replacement with NA and OA, and N15 and A15 as 15% cement replacement with NA and OA.

The water/cement ratio was 0.4, 0.5 and 0.6 to attain the Grade 40 at 56 days curing. Mix design was based on ACI and high tech procedure. Total of 288 no's of cubes mould 150mm×150mm×150mm were casted with w/c 0.4, 0.5 and 0.6 for compressive strength test after 7, 14, 28 and 56 days curing. Two samples are compared in compressive strength at 56 days curing and their workability.

5. TEST RESULTS AND DISCUSSIONS

5.1 Consistency and Setting Time

The results of consistency and setting time of NA and OA were shown in Table 3 and 4. The test for consistency and setting time was carried out according to ACI. The water requirement of NA replacement increased with the additional percent level of SCBA. It means more water needs for proper consistency in NA. But the water requirement decreased in 5%, 10% and 15% replacement of OA in cement when comparing the control mix. Water requirement in OA is less than control mix (0%). As ashes are hygroscopic in nature, it needs more water for proper consistency.

Increasing the NA and OA level considerably increased the initial and final setting time. Therefore addition of SCBA retarded the setting time. But the results of OA and NA replacement are within the permissible limits. It means that bagasse ash paste was slow the hydration of cement.

Table 3. Consistency and Setting time of NA replacement

% Replacement of Cement with NA	Consistency (%)	Initial Setting Time (min)	Final Setting Time (min)
N0	28	145	240
N5	30	150	260
N10	33	177	290
N15	35	183	313

Table 4. Consistency and Setting Time of OA replacement

% Replacement of Cement with OA	Consistency (%)	Initial Setting Time (min)	Final Setting Time (min)
A0	28	145	240
A5	26	155	270
A10	27	165	275
A15	27.5	147	265

5.2 Compressive Strength test for Mortars

According to ASTM C 109, cubes were casted with w/c 0.485. Comparison of the data for 3, 7 and 28 days of curing time shows that compressive strength increases with OA up to 5% replacement. The strength depends on the surface area and fineness of SCBA. The results are shown in figure 1 and 2.

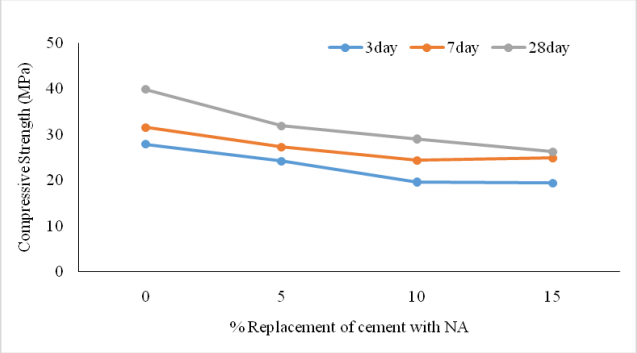

Figure 1. Compressive Strength of OPC-NA mortars

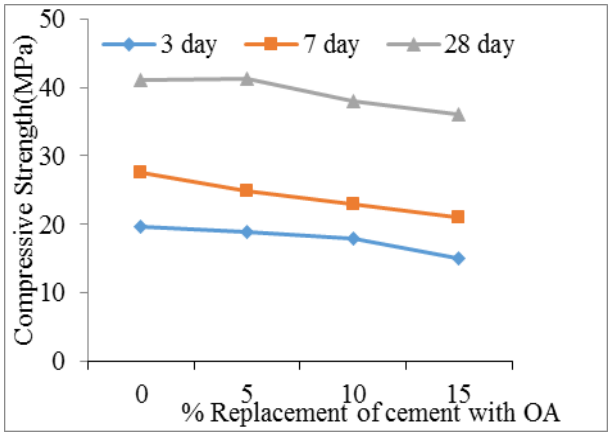

Figure 2. Compressive Strength of OPC-OA mortars

5.3 Effect of SCBA on Workability

The results with water cement ratio 0.4, 0.5 and 0.6 for all mixes are shown in Table 5 to 7. With w/c 0.4, slump values decreased in the partial replacement of NA when the percentage of SCBA increased. However slump values in 10% partial replacement of OA increased. Water cement ratio, temperature and times affect the workability. In general SCBA absorbs more water than cement. But slump values in OA replacement has not significantly changed.

Table 5. Workability of Fresh Concrete with w/c 0.4

% Replacement of cement with SCBA	Slump of NA (mm)	Slump of OA (mm)
0%	215	190
5%	195	180
10%	160	190
15%	60	175

Table 6. Workability of Fresh Concrete with w/c 0.5

% Replacement of cement with SCBA	Slump of NA (mm)	Slump of OA (mm)
0%	235	190
5%	235	190
10%	230	180
15%	190	160

Table 7. Workability of Fresh Concrete with w/c 0.6

% Replacement of cement with SCBA	Slump of NA (mm)	Slump of OA (mm)
0%	180	190
5%	200	190
10%	160	180
15%	115	160

5.4 Compressive Strength of SCBA replacement on Concrete

Cubes mould were casted with w/c 0.4, 0.5 and 0.6 at the partial replacement of NA and OA for the period of 7, 14, 28 and 56 days curing. When comparing two sources of SCBA in compressive strength, OA replacement got the strength of 56.6MPa in 5% replacement at 56 days curing. NA replacement got the required strength at water cement ratio 0.4 at 56 days. 5 to 15% replacement of OA on concrete with w/c 0.4 got the required strength. The silica and aluminum content in OA supported to increase the strength. The strength values are shown in Table 8to 13. Fig. 5 to 7 shows the comparison of NA and OA replacement with varying w/c on compressive strength.

Table 8. Compressive Strength of NA replacement with w/c 0.4

Age (days)	Compressive Strength (MPa)			
	N0	N5	N10	N15
7	35.15	27	26.9	26.4
14	39.4	30.3	30.5	29.1
28	50.7	40.5	39.2	37.2
56	61.5	50.5	49.8	43.9

Table 9. Compressive Strength of NA replacement with w/c 0.5

Age (days)	Compressive Strength (MPa)			
	N0	N5	N10	N15
7	23.6	18	16.4	13.8
14	32.2	24.4	19.6	17.6
28	37.2	29.6	24.4	21.1
56	44.6	36	30.9	27.9

Table 10. Compressive Strength of NA replacement with w/c 0.6

Age (days)	Compressive Strength (MPa)			
	N0	N5	N10	N15
7	21.9	14.5	14.7	14.5
14	25.6	19.2	18.3	18.1
28	30.7	21.6	20.7	20.1
56	34.1	25.8	24	23.1

Table 11. Compressive Strength of OA replacement with w/c 0.4

Age (days)	Compressive Strength (MPa)			
	A0	A5	A10	A15
7	36.7	33.1	29.6	28.7
14	48.7	43.1	41.2	36.8
28	57.4	49.7	47.5	45
56	60.5	56.6	51.3	48.5

Table 12. Compressive Strength of OA replacement with w/c 0.5

Age (days)	Compressive Strength (MPa)			
	A0	A5	A10	A15
7	29.6	25.8	23.2	21.5
14	36.7	32.1	29.8	26.5
28	41	36	32.9	30.7
56	43.2	41.35	36.1	32.6

Table 13. Compressive Strength of OA replacement with w/c 0.6

Age (days)	Compressive Strength (MPa)			
	A0	A5	A10	A15
7	25	22.5	19.8	17.8
14	27.4	25.4	21.6	18.9
28	32.6	29.2	25	22.4
56	38.8	35	31.3	26.5

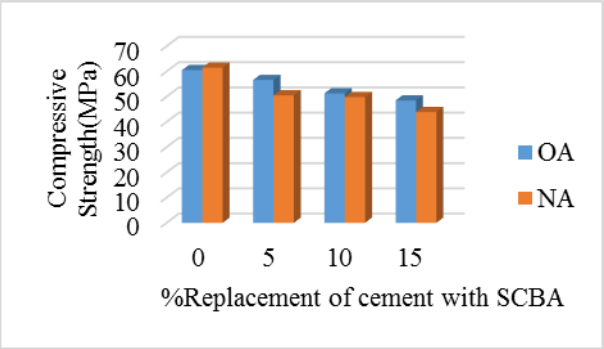

Figure 3. Compressive Strength of NA and OA replacement with w/c 0.4 at 56 days curing

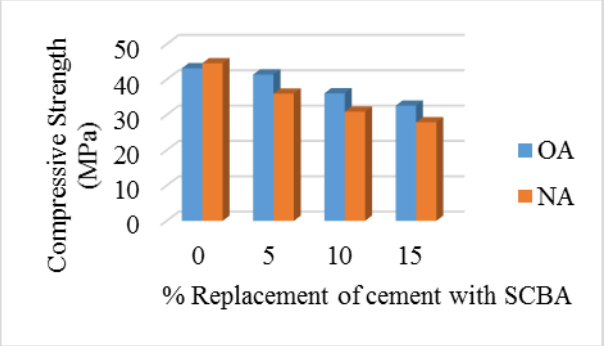

Figure 4. Compressive Strength of NA and OA replacement with w/c 0.5 at 56 days curing

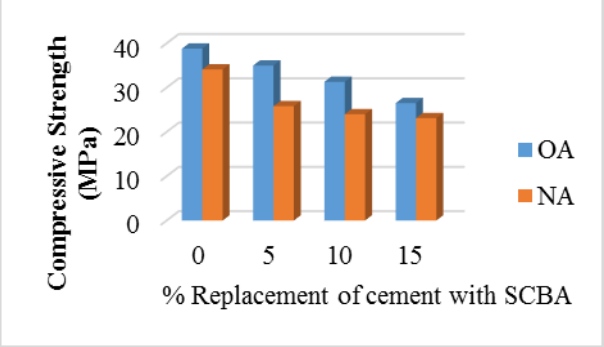

Figure 5. Compressive Strength of NA and OA replacement with w/c 0.6 at 56 days curing

6. CONCLUSIONS

From the above results, the following conclusion can be drawn. OatKan bagasse ash is better than NA. Up to 5 to 15% replacement of OA with w/c 0.4 reached the required strength at 56 days curing. In the NA replacement, 5 to 15% replacement with w/c 0.4 got the required strength. But when w/c ratios were changed, the strength decrease in NA replacement. In the mortar test results, 5% replacement of OA increase the compressive strength when comparing to control mix (0%). When compared two sources in compressive strength, the strength of 5% to 15% replacement of OA relatively more increased than that of NA replacement. With w/c 0.5, only 5% replacement in OA got the required strength, but NA replacement does not attain the required strength. Although it can't compared the control mix, OatKan SCBA can be replaced on concrete without chemicals to get higher strength. Wet concretes are more workable than dry concretes therefore OA gets the good slump values. And also the application of SCBA reduce the environmental problem and use of cement.

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8. REFERENCES

[1] A.M Neville, J.J Brooks, *Concrete Technology*, 2nd ed., 2010.

[2] Johy F.Ryan., *Story of Portland Cement*, Journal of chemical education, 1929, vol. 6 Issue 11.

[3] Shilpa Raju, "Effect of Using Glass Powder in Concrete" vol.3, Issue 5, July. 2014

[4] Maung Hein Min Htet, "Feasibility study on application of sawdust ash for cement replacement in structural concrete" 2017 International Conference

[5] R.Srinivasan Senior Lecturer, Department of Civil Engineering "*Experimental Study on Bagasse Ash in Concrete*" International Journal for Service Learning in Engineering Vol. 5, No. 2

[6] [2014] Research Gate website [online]. Available: http://www.researchgate.net

[7] [2013] MAST home page [online]. Available: https//matsel.matse.illinois.edu/home.html

[8] John Newman, Ban Seng Choo , , "*Advanced Concrete Technology*" 1st Edition 2003

[9] A.M Neville "Properties of Concrete" 5th edition 2011

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Comparison of Feature Extractions for Iris Recognition

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Abstract: Iris Recognition is one of the most biometric identification systems that identify people based on their iris. In this paper the iris recognition system is implemented by using Hough Transform and Canny edge detection techniques. In this paper the iris recognition via many steps, these steps are image acquisition, edge detection, localization, feature extraction, and matching. Two types of extractions: eight sub-images and sixteen sub-images are used to divide the iris images. The implemented system uses CASIA iris database. This paper provides an efficient iris identification system and the software to perform this research developed using the Matlab programming language.

Keywords: Iris Recognition, Canny, Localization, Feature Extraction, CASIA

1. INTRODUCTION

Iris recognition is a reliable biometric system that can be used to identify a person by analysing the patterns found in the iris. Various methods have been intended by different researchers. But this system described accurate iris preprocessing using canny edge detection, efficient extraction of features in an eye image and generate iris feature vector from iris sub-images after feature extraction. First, the system acquires, through a video camera, a digitized image of an eye of the human to be identified. But the system applies the CASIA iris image database to classify iris features and pupil detection. The original image needs to be preprocessed. After edge detection, iris features are extracted with statistical based feature extraction method. This method based on angular orientation form and it divides the 8 potions and 18 portions. It is successfully applied as feature extractors for feature extraction stage in practical test. After applying this method on an original image, a set of sub-images is obtained at different resolution levels. The mean and dispersion of each sub-image are extracted as texture features. Finally, mean square distance is used to perform the identification stage, iris matching, and this new method achieves much higher identification rate.

The iris is highly protected, non- invasive and ideal for handling applications requiring management of large user groups, like voter ID management. The iris recognition techniques potentially prevent unauthorized access to ATM, cellular phone, desktop PCs, workstations, buildings and computer networks. The accuracy of iris recognition systems is proven to be much higher compared to other types of biometric systems like fingerprint, handprint and voiceprint.
Since biometric authentication is a very up to date technique being used for security and identification purposes, plenty of work is done on it, *T*ieniu *T*an and *Z*henan *S*un has proposed that the iris acknowledgment calculation taking into account PCA (Principal Component Analysis) is initially presented and after that, iris picture combination technique is displayed. *K*efeng *F*an has proposed a productive procedure on iris limitation, and quality appraisal. *L*ye *W*i *L*iam proposed a system consisting of two parts: Localizing Iris and Iris Pattern Recognition. They used digital camera for capturing images; from that captured images, iris is extracted. *V S*aishanmuga *R*aja, proposed a method for personal recognition based on iris recognition using Genetic algorithm and Neural Network. The process of iris recognition consists of localization of the iris region and age group of data set of iris images followed by iris pattern acknowledgement. *D*r.*E*kta *W*alia has worked on comparing the different biometric techniques and has given the clear view of accuracy received each by one of them. *Z*haofeng *H*e, *T*ieniu *T*an has given a detailed study on segmentation of image which extracts the required features.

2. IRIS RECOGNITION SYSTEM

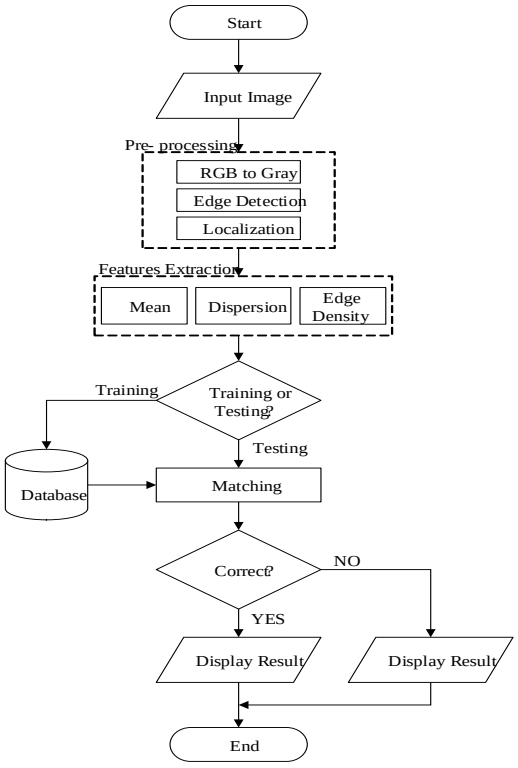


Figure. 1 System Design for Iris Identification System

2.1 Image Acquisition

Image acquisition is the main critical in iris recognition system. For image acquisition, the iris image must have an

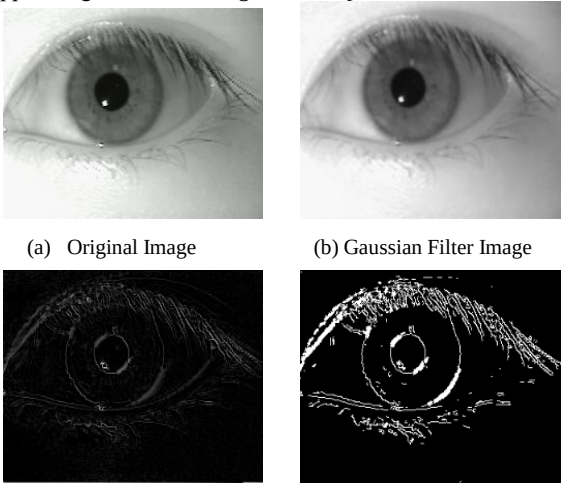
average diameter of 12mm and the camera used should have enough resolution to capture the details of the iris pattern. The proposed system uses CASIA iris database. CASIA iris database image uses a special camera that operates in the infrared spectrum of light, not visible by the human eye. This paper is based on the CASIA image database. Images are 320x320 pixels grayscale taken by a digital optical sensor designed by NLPR (National Laboratory of Pattern Recognition) of Chinese Academy of Sciences. There are 108 classes or iris in a total of 756 iris images.

2.2 Image Pre-processing

2.2.1 Edge Detection

Edge detection is used for the edges in an eye image. It consists of three major steps. The proposed system uses canny edge detection algorithm. The Canny edge detection algorithm is widely known as the optimal edge detector. The first and most apparent is low error rate. It is important that edges occurring in images should not be missed and that there be no responses to non-edges. The second criterion is that the edge points will be well localized. In other words, the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum. A third criterion is to have only one response to a single edge. This was applied because the first two were not substantial enough to completely eliminate the possibility of multiple responses to an edge.

It is a multi-step detector which performs smoothing and filtering, non-maxima suppression, followed by a connected-component analysis stage to detect "true" edges, while suppressing "false" non-edge filter responses.



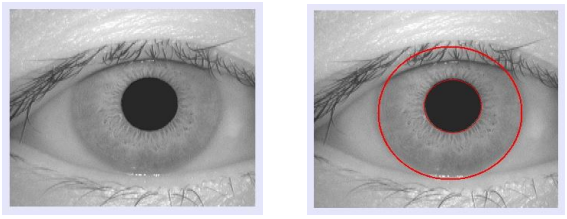
(a) Original Image (b) Gaussian Filter Image

(c)Non-maximum Suppressed Image (d) Final Canny Image

Figure. 2 Example of an image with acceptable resolution

2.2.2 Localization

Iris localization is very important for an iris recognition system and it is crucial for the performance of that system. Hough circle transformation method in the font named Times. Right margins should be this research aims to find the parameters, centers and radii, of the two iris boundaries, detecting the lower and upper eyelid and isolating eyelashes. Localizing the iris outer boundary, an approach based on boundary point detection and curve fitting is adopted. First, a set of radial boundary points is detected by performing the image integral projection along angular directions within specified image blocks.



(a)Original Image (b) Localized Image

Figure 3. Iris Region Boundary Localization: (a and b)

2.3 Feature Extraction

Feature extraction is the most important stage in the iris recognition system. The success or failure of identification system highly depends on the utility of the information that the feature extraction stage provides. Feature extraction involves selecting the significant features from an input pattern, and transforming them through some function that can provide some informative measurements for the input pattern. There are many different methods in feature extraction. Various methods have been proposed by different researchers. Important features are extracted from an eye image.

3. COMPARISON OF FEATURE EXTRACTIONS

Eighteen sub-images and eight sub-images values were calculated for the comparison of the eye image.

Table 1. Eighteen Sub-Images of Iris Feature Values

18 Sub-Images	Edge Density	Dispersion	Mean
Part 1	0.1564	11.5941	95.4757
Part 2	0.2954	11.7722	97.9030
Part 3	0.3511	9.7574	96.3957
Part 4	0.2603	14.1467	106.2335
Part 5	0.2342	12.2321	102.5084
Part 6	0.27770	7.8647	88.3298
Part 7	0.3449	5.9610	82.3341
Part 8	0.3087	6.3256	80.3383
Part 9	0.1755	5.8858	75.8266
Part 10	0.1818	6.1078	75.1924
Part 11	0.3333	5.6751	76.1350
Part 12	0.3404	5.9255	79.1681
Part 13	0.2700	7.7473	84.9417
Part 14	0.2215	8.9747	89.4705
Part 15	0.2622	13.0465	97.2135
Part 16	0.3362	12.6356	101.7636
Part 17	0.3129	13.0233	102.0211
Part 18	0.1697	11.9636	97.1495

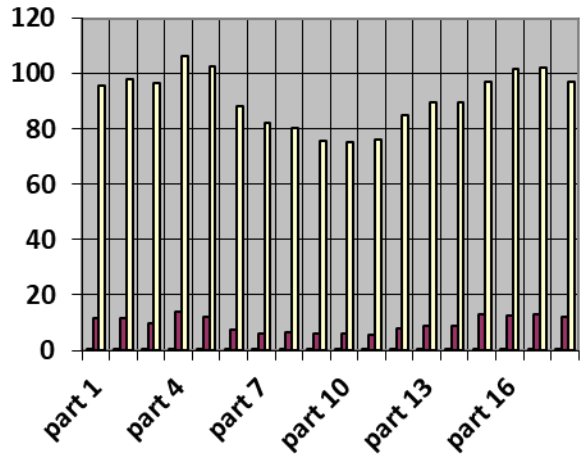


Figure 4. Eighteen Sub-Images of Iris Feature Values

Table 2. Eight Sub-Images of Iris Feature Values

8 Sub-Images	Edge Density	Dispersion	Mean
Part 1	0.2270	6.4949	76.1352
Part 2	0.2164	6.6338	84.0064
Part 3	0.2361	6.9559	90.5629
Part 4	0.2507	7.0209	85.4034
Part 5	0.2568	6.4472	85.0665
Part 6	0.2776	4.9611	82.9079
Part 7	0.2340	4.9591	76.1535
Part 8	0.2344	6.4510	74.0331

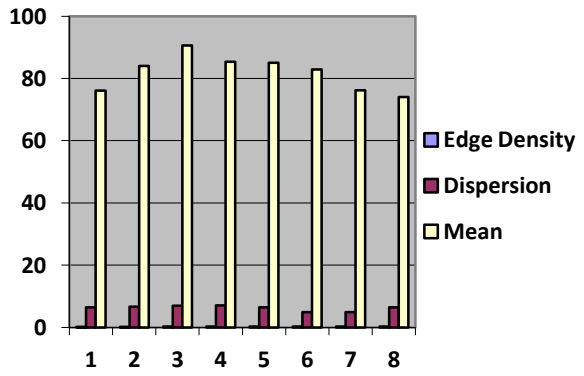


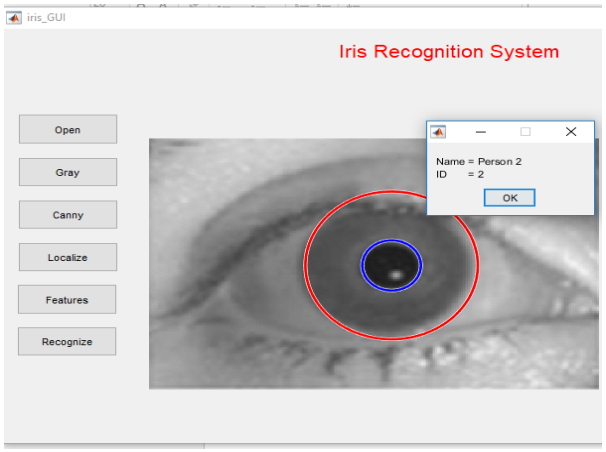
Figure 5. Eight Sub-Images of Iris Feature Values

4. CLASSIFICATION

For the comparison of the two iris images, mean square distance measure method is used. Mean square distance is one of the techniques that measures the distance with eye vector. It defines as:

$$d_i = \sum_{k=1}^{N} (I_k - X_{ik})^2$$

If d_i measurements of I known samples of feature vectors and X samples of each, then N features space that contains the $I \times X$ points according to the Equation. If the point is selected, in the feature space, which is closest to the current sample, then it is selected the sample's nearest neighbor.



5. CONCLUSION

This paper has proposed on iris identification system, which has been tested using different types of feature extraction. The purpose approach drives data from CASIA database and iris recognition system shows that the approach is secure and privacy-preserving. The system also shows the experimental results on iris. Experimental results show that the proposed approach has good recognition performance and speed. In the feature, it would be necessary to experiment on a larger iris database in various environments to make the system more reliable.

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7. REFERENCES

[1] Omran S.S., and A. A. Al-Hillali, "Quarter Of Iris Region Recognition Using the RED Algorithm",17th UKSIM-AMSS International Conference on Modelling and Simulation, pp. 66-72, 2015.

[2] Ajay Kumar and Arun Passi: Comparison and Combination of Iris Matchers for Reliable Personal Authentication, Pattern Recognition, (43) (2010) 1016-1026.

[3] Viriri S. and Tapamo: Improving Iris-based Personal Identification using Maximum Rectangular Region Detection, IEEE Computer Society, Digital Image Processing Proceedings, (11) (2009) 421-425

[4] Anonymous: *SQL (Structure Query Language)*, 2007, http://en.wikipedia.org/wiki/SQL.html

[5] Bringer J., Chabanne H., Cohen G., Kindarji B. and Zemor G.: Optimal iris fuzzy sketches in Biometrics: Theory, Applications, and Systems, (2007).

[6] Hannu Ylonen, Raine Hortet and Anssi Vanikka: Predator odor recognition and antipredatory response in Human body, (2007), www.elsevier.com/locate/actoecTavel, P. 2007 Modeling and Simulation Design. AK Peters Ltd.

[7] Dr.S.Vijayarani, Mrs.M.Vinupriya :Performance Analysis of Canny and Sobel Edge Detection Algorithms in Image Mining, in International Journal of Research in Computer and Communication Engineering, vol.1, Issue 8, October 2013

[8] Kefen FAN, Qingqi Pei, Wei MO, Xinhu Zhao, and Qifeng Sun, "An Efficient Automatic Iris Image Acquisition and Preprocessing System", Proceeding of the 2006 IEEE International Conference on Mechatronic and Automation, Jun 25-28 ,2006 Luoyan, China,pp 1779-1784.

[9] Parteek Verma, Maheedhar dubey, Aomak Basu, Praveen Verma "Hough Transform Method for Iris Recognition- A Biometric Approach", International Journal of Engineering and Innovative Technology (IJIT), ISO 9001:2008 Certified ISSN: 2277-3754, volue 1, Issue 6, Jun 2012.

[10] Rechu Sharma, Vaneet Mohan, :Biometric Identification Using Iris Recognition System", International Journal of computer Application (2250-1797), Volume 6 No 2, March- April 2016.

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Signature Verification for Bank Processing System

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Abstract: Signing documents is something that most everyone is familiar. The verification of handwritten signatures is one of the oldest and the most popular biometric authentication methods in our society. As technology improved, the different ways of comparing and analyzing signatures became more and more sophisticated. Since the early seventies, people have been exploring how computers may aid and –may be one day –fully take over the task of signature verification. Based on the acquisition process, the field is divided into online and offline parts. In online signature verification, the whole process of signing is captured using some kind of an acquisition device, while the offline approach relies merely on the scanned images of signatures. Feature extraction stage is the most vital and difficult stage of any offline signature verification system. The accuracy of the system depends mainly on the effectiveness of the signature features use in the system. Inability to extract robust features from a static image of signature has been contributing to higher verification error-rates particularly for skilled forgeries. The proposed system has 1% error in rejecting skilled forgeries and 0.5% error in accepting genuine signatures. These results are better in comparison with the results obtained from previous systems
Keywords: Verification, Signature, Signing, Forgeries, Genurine

1. INTRODUCTION

The widespread use of bank cheques in daily life makes the development of cheque processing systems of fundamental relevance to banks and other financial institutions. Bank transactions involving cheques are still increasing throughout the world in spite of the overall rapid emergence of electronic payments by credit cards. However, fraud committed in cheques is also growing at an equally alarming rate with consequent losses. Automatic bank cheque processing systems are hence needed not only to counter the growing cheque fraud menace but also to improve productivity and allow for advanced customer services. The automatic processing of a bank cheque involves extraction and recognition of handwritten or user entered information from different data fields on the cheque such as courtesy amount, legal amount, date, payee and signature. A system that is able to read cheque automatically would be very helpful, especially if it is fast and accurate. Even if misclassification occurs, the mistake could potentially be detected during the recognition process; however it is more desirable that the system rejects a cheque in case of doubt so that it can be directed to manual processing from the beginning. In order to produce a successful cheque processing system, many sub-problems have to be solved such as background and noise removal, recognition of the immense styles of handwriting and signatures, touching and overlapping data in various fields of information and errors in the recognition techniques.

The proposed scheme of the present research is to provide a system for verifying signature based on automatic bank cheque processing systems. Various methods have been proposed by different researchers. But this thesis described accurate signature preprocessing using color conversion methods and median filter method. The original image needs to be preprocessed.

The main purpose of this is to implement for Signature Verification using K-Nearest Neighbor Classification Algorithm applying MATLAB image processing functions. The name MATLAB stands for matrix laboratory. MATLAB is a high-performance language for technical computing. MATLAB is an interactive system whose basic data element is an array that does not require dimensioning. It integrates computing, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Different features extraction techniques have been reported for offline signature verification systems. Discrete Radon Transform (DRT) method [04JCo], Discrete Wavelet Transform (DWT) technique [09SGh] and Inverse Fourier Transform (IFT) [09JFV] are used to extract global features from a static image of signature in previous systems. Also graph metrics features: Axial slant angle, pixel distribution, pixel density, centre of gravity and stroke curvature are extracted from a static image of signature using grid segmentation method [03FVJ], [00EYa], [02EJR], [01EJu], [05EJu], [00EJu], [94RSa].In [06MBa], vertical and horizontal centre points are extracted from a static image of signature using vertical and horizontal points splitting technique whereas in [04KKM], gradient, structural and concavity features are extracted from a binary signature image for verification. Verification decision is usually based on local or global features extracted from signature under processing. Excellent verification results can be achieved by comparing the robust features of the test signature with that of the user's signature using appropriate classifier [00RPL], [94Fle]. Researches in online signature verification have been reported with high success rates. However, offline signature verification researches are relatively unexplored; this apathy can be attributed to the inherent limitation of available features from a static image of signatures. Nevertheless, offline signature verification systems are still largely in use; major areas of application of offline signature verification systems include: authentication of bank cheques, attendance register monitoring and visa application [97RSa], and [02JPE].

2. SYSTEM DESIGN

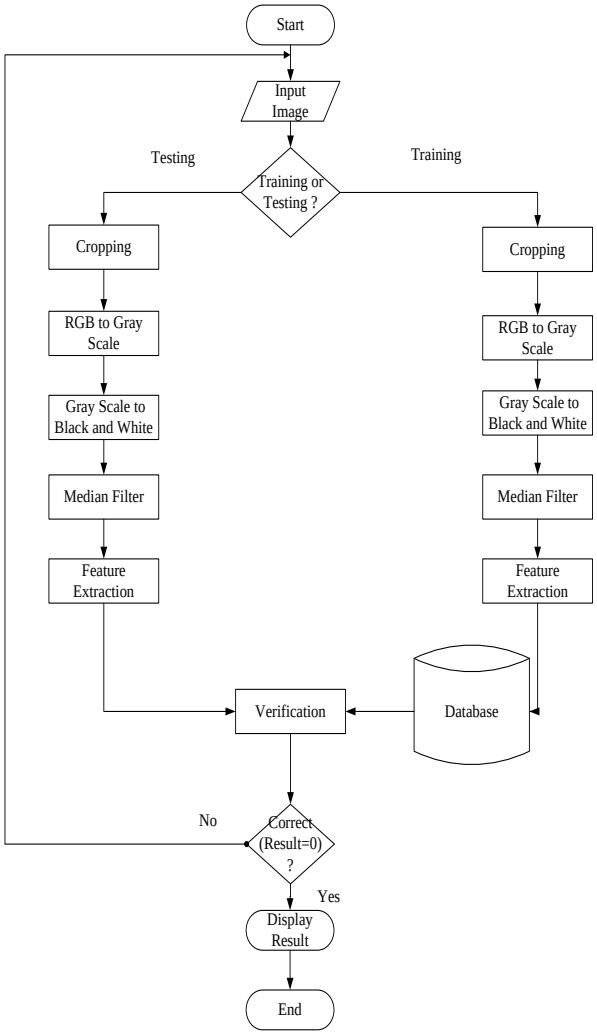


Figure. 1 System Design for Signature Identification System

2.1 Image Acquisition

Image acquisition is the first phase in bank cheques signature begins with the image acquisition. The acquisition step converts a number of paper sheets to a set of digital images, each of them containing one or more signatures. Image acquisition is the process of obtaining or capturing image before image will be process to another stage. There are several ways to obtain image. The followings are the ways to acquire image of signature:

Using a conventional analogue camera and scanner.

Using the digital camera.

Using a video camera and frame grabber (capture card to select).

Image can be acquired using an analog camera with scanner. Using a conventional analogue camera and scanner method is clearly not appropriate for verification system. It is due to the procedure to follow need a lot of time or on other words, its time consuming. It is also tedious and impractical. Using a video camera with frame grabber is the one that has been applied in the real life system as everything can be automated through the computer and it suitable for the real time processing. But that method is expensive. Using a digital camera is more convenient, cost effective and reliable. The proposed system uses a high resolution digital camera. In general, the acquisition step converts a number of paper sheets to a set of digital images, each of them containing one or more signatures. It is essential to note that scanning paper sheets with written signatures is not the only way to acquire digital images.

2.2 Data Area Cropping

In this stage the Region of Interest (ROI) is determined using auto cropping approach. Region of Interest (ROI) is the signature object itself. Signature cropping process is less complexity in process and time, since the area under process will be reduced. Two types of cropping technique were used; manual and automatic cropping. Manual cropping is achieved using Matlab® function (imcrop), but it may cause false cropping rectangle and it is tedious work. While automatic cropping is saving more work and it is reducing a processing time over and above the cropping rectangle is truly detecting.

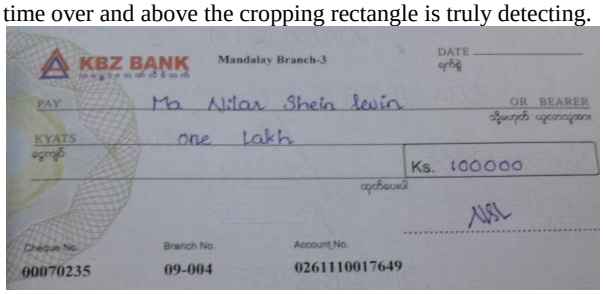


Figure. 2 Input Image

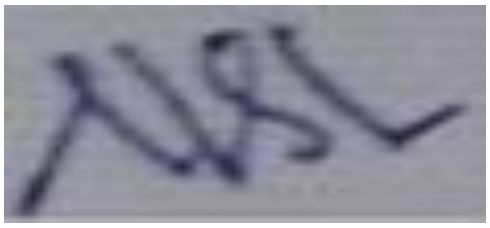


Figure. 2 Cross Image

2.3 Image Pre-processing

2.3.1 Grey Scale Image

A grayscale or grey scale digital image is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort, also known as black-and-white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest. The range of pixel values is from 0 to 255. These images can provide some sorts of noise [09Sat].

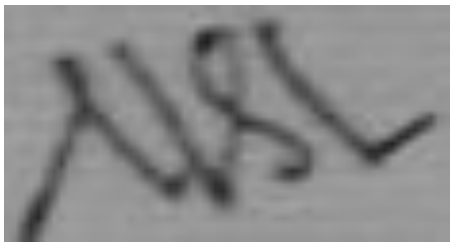


Figure. 3 Grey Scale Image

2.3.2 Binary Image

A binary image is a digital image that has only two possible values for each pixel. Typically the two colors used for a binary image are black and white though any two colors can be used. The color used for the object(s) in the image is the

foreground color while the rest of the image is the background color. Binary images are also called *bi-level* or *two-level*. This means that each pixel is stored as a single bit (0 or 1). In a binary image, each pixel assumes one of only two discrete values. Essentially, these two values correspond to on and off. A binary image is stored as a two-dimensional matrix of 0's (off pixels) and 1's (on pixels).

A binary image can be considered a special kind of intensity image, containing only black and white. Other interpretations are possible, however; you can also think of a binary image as an indexed image with only two colors. A binary image can be stored in an array of class double or uint8. An array of class uint8 is generally preferable to an array of class double, because a uint8 array uses far less memory. In the Image Processing Toolbox, any function that returns a binary image returns it as a uint8 logical array. The toolbox uses a logical flag to indicate the data range of a uint8 logical array: if the logical flag is "on" the data range is [0, 1]; if the logical flag is off, the toolbox assumes the data range is [0,255].

Figure. 4 Black and White Image

2.4 Feature Extraction

The purpose of feature extraction is to extract information about the environment from an image or sequence of images. Feature extraction is the most important stage of signature verification system. The success or failure of identification system highly depends on the utility of the information that the feature extraction stage provides. Feature extraction involves selecting the significant features from an input pattern, and transforming them through some function that can provide some informative measurements for the input pattern. There are many different methods in feature extraction. Various methods have been proposed by different researchers. Important features are extracted from a bank cheque signature images.The extraction of features can be implemented through several different techniques. However, the choice of the feature, as well as of the technique to be used, should take into account the contribution in terms of information that can be obtained from it.

After preprocessing step is finished, the next step of the work is feature extraction. In the proposed system the segment signature portion in bank cheque image with angle orientation. And the system extracted t values (Magnitude and Orientation Values) are shown in Fig. 5 and Fig. 6.

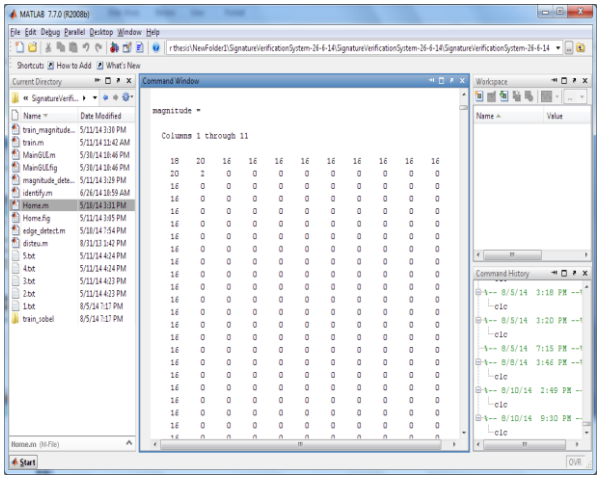


Figure. 5 Magnitude Values of Signature

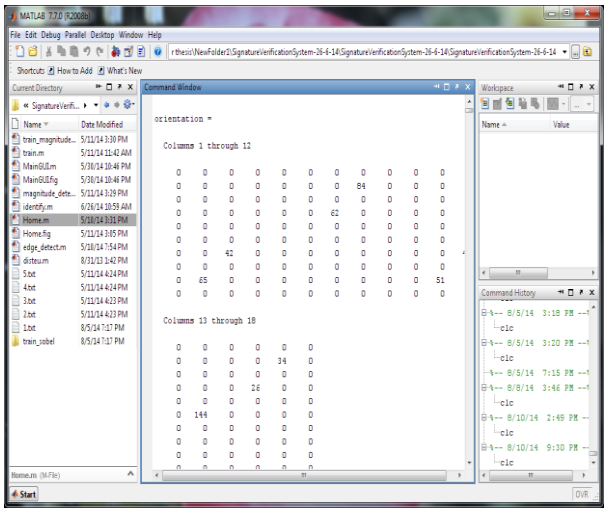
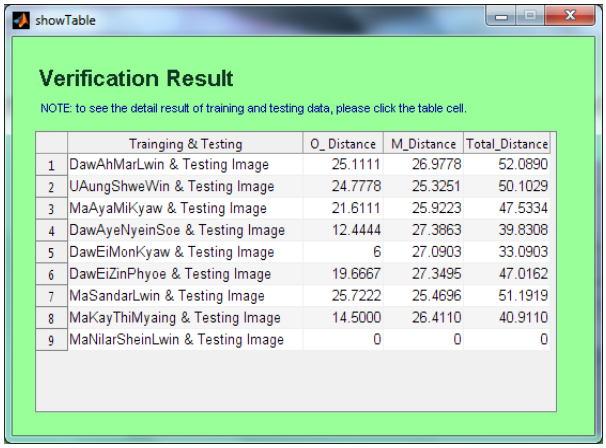


Figure. 6 Orientation Values of Signature

3. VERIFICATION

After feature extraction, a signature image is represented as a feature vector of complex valued coefficients. Two signatures are determined whether from the same class by comparing the similarity between the corresponding feature vectors. In the literature review of the signature recognition system, there is a need to match the calculated signature template with the stored template to identify a person. It is a trivial task for image matching.

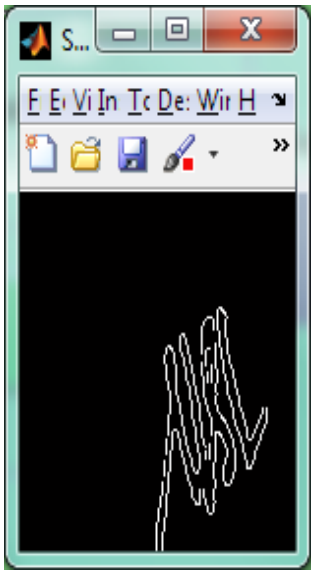


	Trainging & Testing	O_Distance	M_Distance	Total_Distance
1	DawAhMarLwin & Testing Image	25.1111	26.9778	52.0890
2	UAungShweWin & Testing Image	24.7778	25.3251	50.1029
3	MaAyaMiKyaw & Testing Image	21.6111	25.9223	47.5334
4	DawAyeNyeinSoe & Testing Image	12.4444	27.3863	39.8308
5	DawEiMonKyaw & Testing Image	6	27.0903	33.0903
6	DawEiZinPhyoe & Testing Image	19.6667	27.3495	47.0162
7	MaSandarLwin & Testing Image	25.7222	25.4696	51.1919
8	MaKayThiMyaing & Testing Image	14.5000	26.4110	40.9110
9	MaNilarSheinLwin & Testing Image	0	0	0

Figure 7. Verification Results

4. OUTPUT RESULT FORM

This is the result of output windows form for signature identification system. In this form testing stage expresses with detail signture information. The testing process matches an incoming input signature image with feature database signature image. The output result shows the same signature.



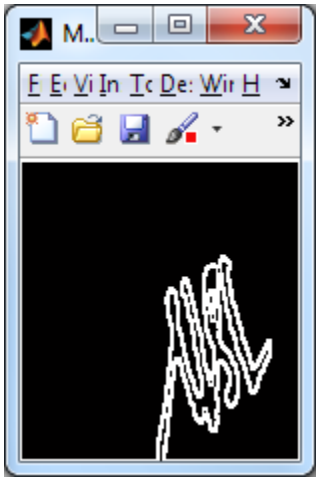


Figure 8. Output signature

5. Conclusion

Typical signature verification using implement of sobel edge detection method and k nearest neighbor algorithm is designed. The first part is a feature extractor that finds features within the data which are specific to the task being solved (finding pixels within an image for signature verification).). When the feature extract program is tested with various operators, implement of sobel edge operator is found that it is the best one for Digitized Signature. In order to verify a new point, the distance to the nearest training point is calculated. The class of this nearest point determines the verification of the new point.

It may be concluded that the results which was tested using database give good results. In the experiments, the images from signatures of 150 writers were tested, the result is absolutely true. Then the image from signatures of more than 150 writers are tested, the result is accurately given.

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7. REFERENCES

[1] Omran S.S., and A. A. Al-Hillali, “Quarter Of Iris Region Recognition Using the RED Algorithm”,17th UKSIM-AMSS International Conference on Modelling and Simulation, pp. 66-72, 2015.

[2] Ajay Kumar and Arun Passi: Comparison and Combination of Iris Matchers for Reliable Personal Authentication, Pattern Recognition, (43) (2010) 1016-1026.

[3] Viriri S. and Tapamo: Improving Iris-based Personal Identification using Maximum Rectangular Region Detection, IEEE Computer Society, Digital Image Processing Proceedings, (11) (2009) 421-425

[4] Anonymous: *SQL (Structure Query Language)*, 2007, http://en.wikipedia.org/wiki/SQL.html

[5] Bringer J., Chabanne H., Cohen G., Kindarji B. and Zemor G.: Optimal iris fuzzy sketches in Biometrics: Theory, Applications, and Systems, (2007).

[6] Hannu Ylonen, Raine Hortet and Anssi Vanikka: Predator odor recognition and antipredatory response in Human body, (2007), www.elsevier.com/locate/actoecTavel, P. 2007 Modeling and Simulation Design. AK Peters Ltd.

[7] Dr.S.Vijayarani, Mrs.M.Vinupriya :Performance Analysis of Canny and Sobel Edge Detection Algorithms in Image Mining, in International Journal of Research in Computer and Communication Engineering, vol.1, Issue 8, October 2013

[8] Kefen FAN, Qingqi Pei, Wei MO, Xinhu Zhao, and Qifeng Sun, "An Efficient Automatic Iris Image Acquisition and Preprocessing System", Proceeding of the 2006 IEEE International Conference on Mechatronic and Automation, Jun 25-28 ,2006 Luoyan, China,pp 1779-1784.

[9] Parteek Verma, Maheedhar dubey, Aomak Basu, Praveen Verma "Hough Transform Method for Iris Recognition- A Biometric Approach", International Journal of Engineering and Innovative Technology (IJIT), ISO 9001:2008 Certified ISSN: 2277-3754, volue 1, Issue 6, Jun 2012.

[10] Rechu Sharma, Vaneet Mohan, :Biometric Identification Using Iris Recognition System", International Journal of computer Application (2250-1797), Volume 6 No 2, March- April 2016.

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Maize Grain Classification System using Neural Network

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Abstract: This presents a system for automated classification of maize grain varieties using Artificial Neural Network. Maize Grain is the most important food crop in Myanmar. This system can classify the types of maize grain such as Butter Corn, Sweet Corn, Kalar Corn, Shan Corn. An input image of maize grain is acquired firstly by using a digital camera. The image is segmented by using threshold function and is needed to perform image processing techniques such as converting gray scale, resizing and changing to binary image. To remove the noise of an image the median filter has been used. The important features of the image are needed to be extracted according to morphological features. The seven important morphological feature extracted from images were used as input for developed ANN. This system is implemented by using MATLAB programming language.

Keywords: - Maize grain, Artificial Neural Network, Threshold Function, Feature Extraction, median filter

1. INTRODUCTION

Grains are the prime crop for our country's peasants to increase their agricultural income. Maize grain is one of the most important cereal crops. The automation level of testing grain quality is low and most work is done by manpower. Although most of the maize produced around the world is used for animal feed, its use for human consumption and the manufacture of industrial products have grown rapidly in recent decades. The process of manual classification of maize grains is slow, has low reproducibility, and possesses a degree of subjectivity hard to quantify, both in its commercial as well as in its technological implications. In the present grain-handling system, grain type and quality are rapidly assessed by visual inspection. This evaluation process is tedious and time consuming. The decision-making capabilities of a grain inspector can be seriously affected by physical condition such as fatigue and eyesight, mental state caused by biases and work pressure, and working conditions such as improper lighting, climate, etc. Hence, these tasks require automation and develop imaging systems that can be helpful to identify maize grain [1].

Artificial neural networks (ANN) is a mathematical tool, which tries to represent low-level intelligence in natural organisms and it is a flexible structure, capable of making a non-linear mapping between input and output spaces. This method can be trained with numerical sample data concerning only inputs and corresponding outputs, they have promise in solving the problems of agriculture, especially grain identification. The inputs to the ANN can be given in terms of data obtained from digital images, which provide quantitative estimate of morphological features of grain and offer scope to bring objectivity in the process of identification [2]. Fortuna pointed a neural network is constructed by highly interconnected processing units (nodes or neurons) which perform simple mathematical operations Lippmann summarized neural networks are characterized by their topologies, weight vectors and activation functions which are used in the hidden layers and output layer. So the standard classification of maize grain is one of the most important factors that farmers interested in. To implement this system, artificial neural network is applied. Backpropogation neural networks are useful for various types of pattern recognition system. MATLAB software, like any other computer vision software, implements the use of training patterns or the training sets to test the performance of a specific geometric pattern recognition approach, is mainly applied. It is simple to understand and it works well for practical problems. A basic machine vision system used in agricultural applications for classification of various maize grains consists of a digital camera, and computer software for capturing, classification, sorting, analyzing and processing the image.

The morphological features of grains are heritable characters and play an important role in wheat variety recognition. In the current grain grading systems, grain type and quality are inspected through visual assessment by experts and trained inspectors which is subjective, and tedious. Computer vision system offers an objective and quantitative method for estimation of morphological parameters and quality of agricultural products to obtain quick and more reliable results. Image processing based on morphology, colour and textural features of grains is necessary for different applications in the grain industry including assessing grain quality and discrimination of wheat classes [3]. Various grading systems have been reported in literatures which use different morphological features for the classification of different cereal grains and cultivars.

In grain classification process, several techniques such as statistical, artificial neural networks and fuzzy logic have been used. Classification performances of different neural network topology were compared by using morphological features of Canada Western Amber Durum (CWAD) wheat, Canada Western Red Spring (CWRS) wheat, oats, rye and barley [4].

This paper is organized as follows: related works of the system are described in section two. In section three, result and discussion is explained. Finally, in section five, the paper has been concluded.

2. MATERIALS AND METHODS

Overall five steps including image acquisition, pre-processing operations, feature extraction, neural network and classification were performed to classify maize grains [fig. 1]. Maize grains classification steps are explained in following;

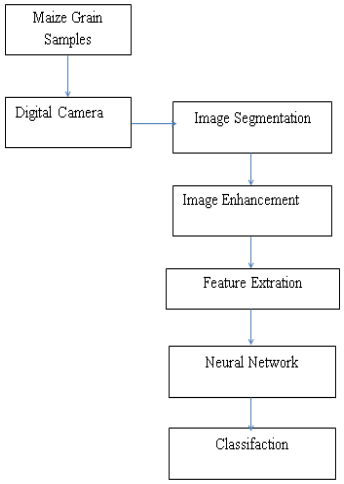

Fig. 1. Flowchart of maize grains classification process.

2.1 Maize Grain Samples

In this study, identification of four Maize Grains were carried out. Butter corn, Kachin corn, Kalar corn, and Shan corn are maize grains widely grow in Myanmar. Fig.2 show the maize grain samples;

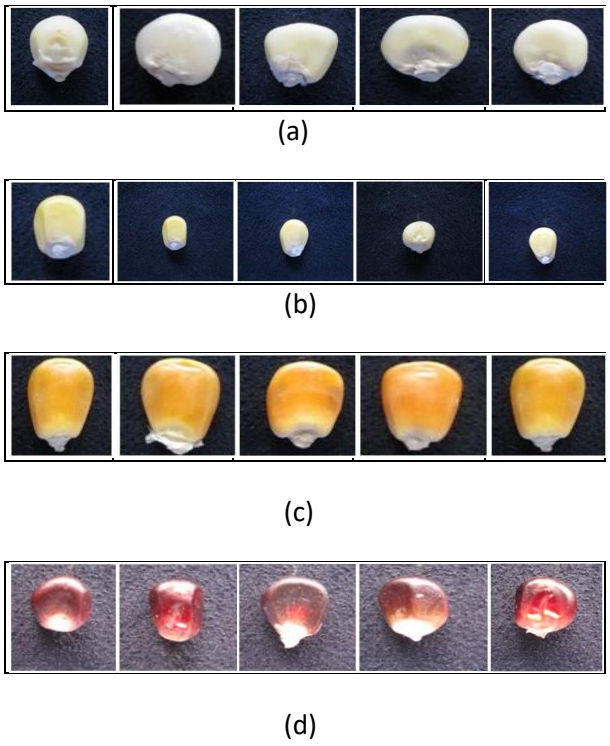

Fig. 2. Sample of Maize Grains: (a) Butter Corn, (b) Kachin Corn, (c) Kalar Corn, (d) Shan Corn

2.2 Image Acquisition

An image capturing system was designed to take some standard pictures from the samples. Resolution 640 x 480 pixels of Nikon camera are used as image acquisition devices. In this system, off-line image acquisition is used and the images are *.jpg format.

2.3 Pre-Processing

In the pre-processing step, changing colour space, resizing, median filter and morphological feature extraction are performed.

1) Changing Color: The color is changed from RGB into Grayscale image and Grayscale image was converted to binary image.

2) Resizing: The black and white image is resized into 108x 108 pixels to get a uniform size of maize grain image.

3) Median Filter: The median filter is a best known to remove salt and pepper noise in image processing. Median filter techniques abound in many image processing applications. Median filter has tend to blur sharp edges, destroy lines and other fine image detail .

2.4 Feature Extraction

The morphological features were extracted from images of maize grain varieties. Geometry related features including area, perimeter and major and minor axis lengths were measured from the binary images [5]. The below equation (1) and (2) are area and equivalent diameter.

Area: It was the number of pixels inside and including the image boundary.

$$\text{Area} = \iint_R dxdy \quad (1)$$

Perimeter: It was the total number of pixels around the Boundary of each region in the image.

Bounding Box: It was the smallest rectangle containing the region.

Length: It was the length of the rectangle bounding the image.

Width: It was the width of the rectangle bounding the image.

Equivalent Diameter: It was the diameter of a circle with the same area as the image region.

$$\text{Equadial} = \text{sqrt}(4\text{xArea}/\text{pi}) \quad (2)$$

Convex Area: It was the number of pixels in the smallest Convex polygon that can contain the image region

2.5 Intelligent Classification

Classifying Four maize grains was done using artificial neural network (ANN) based on morphological features using Neuron Solutions software. A multi-layer perception (MLP) network which is commonly used to classify objects was designed. MLPs often have one or more hidden layers of linear or non-linear neurons followed by an output layer.

Several layers of neurons with nonlinear transfer functions allow the network to learn nonlinear and linear relationships between input and output vectors. Based on trial and error method, networks with one or two hidden layers with different number of neurons for hidden layers were developed. Number of neurons in output layer was four and the number of neurons in input layer was equal to number of input features. In the developed MLP models, the tangent sigmoid which is a non-linear transfer function was used for hidden layers. 60% of all samples were used for training the network to adjust the network weights. 15% of samples were used for validating the structure of network and remaining samples (25%) were used for evaluating the network in the testing step. In total, the training was performed 3 times and continued to minimize the mean squared error (MSE) between targets and outputs.

To classify maize grains based on morphological features, artificial neural networks were used. ANN was trained using 20 samples and validated by 5 samples. Network evaluation was done using testing data (14 samples). Seven morphological features were used as input data. The best ANN was determined based on trial and error method. The number of hidden layers and the number of neurons in hidden layers are important factors in developing a MLP. Results showed that the developed MLP with one hidden layer in this study could successfully recognize most maize grains. When the number of hidden layer was increased from one to two layers, the MLP's performance did not improve, this can be due to over fitting problem in which the MLP memorize the input patterns. Therefore, ANN architecture with one hidden layer was selected for further investigation.

To find the optimum number of neurons in the hidden layers, trial and error method was used. Mean squared error (MSE) of test data was used for comparing MLP models with different number of neurons in hidden layer. The best model was selected based on the minimum value of MSE. The performance of different MLP models is presented [Fig 3.]. Trends of network MSE with number of neurons in hidden layer shows a decreasing pattern up to 10 neurons and increasing pattern for MSE after 10 neurons. Then to prevent overtraining, the best number of neurons in the hidden layer is 10. Hence the best topology of ANN was obtained as 7-10-4.

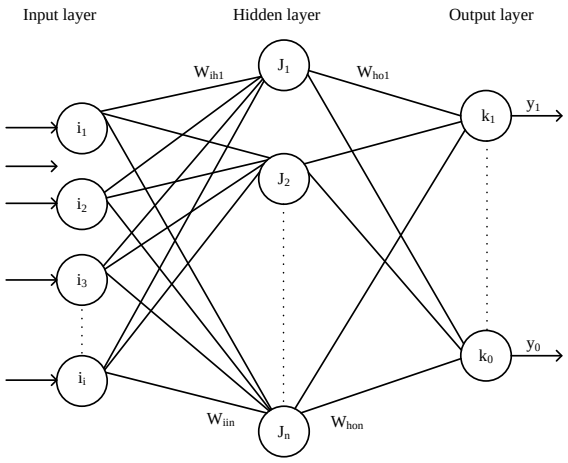

Figure 3:ANNtopology: xi is the xth input feature; ii is the ith input node; ji is the jth hidden layer; ki is the kth output layer neuron and yi is the yth output; wij is weight between input and hidden layers and who is weight between hidden and output layers.

3. RESULTS AND DISCUSSIONS

Morphological features were computed from individual kernel images using image processing techniques. Some of morphological features were highly correlated with another and they did not contribute significantly to the morphology model.

Confusion matrix and classification accuracy of ANN classifier are presented in table 1 and table 2, respectively. The overall accuracy of maize grain identification was 86.25%. The acceptable classification accuracies were obtained for 'Butter Corn', 'Kachin Corn' and 'Kalar Corn' (Table. 4). 'Butter Corn' and 'Kachin Corn' grains were classified with the highest accuracy and the lowest classification accuracy was obtained for 'Kalar Corn' and 'Shan Corn' grains. It may be because there were several morphological features that were able to make a significant difference between 'Butter Corn' and 'Kachin' with other grains (Table 4). For this reason, ANN was able to detect them with high accuracy. Whereas, a significant difference was not observed between 'Kalar Corn' and 'Shan Corn' grains for robust features.

Overall, the results show the developed computer vision system can identify wheat cultivars satisfactorily. Although the morphological features were not suitable for describing 'Kalar Corn' grain. Further studies must be explored for finding suitable features such as, colour, texture, wavelet and Fourier transform for improving classification accuracy of 'Kalar Corn' grain.

Table 1. Confusion matrix of ANN classifier for grain identification

Output/ Desired	Butter Corn	Kachin Corn	Kalar Corn	Shan Corn
Butter Corn	20	4	3	4
Kachin Corn	0	16	0	0
Kalar Corn	0	0	17	0
Shan Corn	0	0	0	16

Table 2. The ANN classification accuracy for grain identification

Maize Grain	Accuracy
Butter Corn	100
Kachin Corn	80
Kalar Corn	85
Shan Corn	80
Average	86.25

4. CONCLUSION

This paper described the basic approaches, techniques, and applications of artificial neural networks as a start of the development of comprehensive recognition systems. Artificial neural network method are proves better. It gives the best classification accuracy of 86.25% In this paper, the developed system is maize grains classification system that gives the great effect on the consumers, merchants and farmers in Myanmar. So, the system is able to classify the various types of particular maize grains. But the system can classify only one seed a time.

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6. REFERENCES

[1] Choon Young Lee, “Intelligent Classification Methods of Grain Kernels using Computer Vision Analysis”, 2011.

[2] M.Mohamad, M.Y.M. Saman and M.S. Hitam, “Parallel Pattern Back propagation Neural Network Training of Multilayer Perceptron”, Presented in Postgraduate Seminar CAIT2010 UKM 2010.

[3] Mrs. Uzma Ansari, “Identification of Food Grains And Its Quality Using Pattern Classification”, 2010 for International Conference [ICCT-2010].

[4] Oludele Awodele and Olawale Jegede, “Neural Networks and Its Application in Engineering”, Proceedings of Informing Science and IT Education Conference (InSITE), 2009.

[5] J.Paliwal, M.S. Borhan and D.S. Jayas, “Classification of cereal grains using a flatbed scanner”, Volume 46, 2004.

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Real-Time Vehicle Tracking System Using Arduino, GPS, GSM and Web-Based Technologies

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Abstract: Vehicle tracking system is a well-established technology in this era which is used by fleet system and owner of vehicle all over the world. It is a very safe and reliable technology. In this paper a real time tracking system is proposed. It is going to design a system which is used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global System for Mobile Communication (GSM). The design is an embedded application, which will continuously monitor a moving vehicle and report the status of vehicle on demand. Tracking device used in real time vehicle location tracking is made up with Arduino Uno R3, SIM800A module and NEO 6M GPS module. For doing so the Arduino Uno R3 is interfaced serially to a GSM module and GPS module. The GSM module is used to continuously send the position of the vehicle from remote place. The GPS module that uses satellite technology for its navigation system will continuously give data like longitude, latitude, speed, distance travelled etc. Google map is used to view the position of vehicle on a digital mapping. For this work the software XAMPP and Google Map API are used. XAMPP is a free and open source cross-platform web server solution stack package consisting mainly of the Apache HTTP Server, MySQL database and interpreters for scripts is written in PHP and Perl programming languages. The Google Maps API allow for the embedding of Google Maps onto web pages using a JavaScript interface which is designed to work on desktop browser application. The MySQL database is used to store all the data of the GPS and Google Map API is used to display the location information through a Google Map.

Keywords: Vehicle Tracking System, GPS, GSM/GPRS Technologies, HTTP Service, Google Map

1. INTRODUCTION

The vehicle tracking system is a total security and fleet management solution. It is the technology used to determine the location of a vehicle using different methods like GPS and other navigation system operating via satellite and ground based stations. Modern vehicle tracking system use GPS technology to monitor and locate the vehicle anywhere on earth, but sometimes different types of automatic vehicle location technology are also used. The vehicle tracking system is fitted inside the vehicle that provides effective real time location and the data can even be stored and downloaded to a computer which can be used for analysis in future. This system is an essential device for tracking car any time the owner wants to monitor it and today it is extremely popular among people having expensive cars, used as theft prevention and recovery of the stolen car. The data collected can be viewed on electronic maps through internet and webpage.

2. OVERVIEW OF PROPOSED SYSTEM

The following block diagram of vehicle tracking system shows how the proposed system actually works. For the implementation of the proposed real time vehicle tracking system, navigational technologies such as GPS, GPRS and database technologies are used. The system is installed in a vehicle to allow the owner to track the vehicle's location, this system will use GPS and GPRS module. Global Positioning System can determine the precise location of a vehicle. The GPS antenna attaches with the GPS receiver module receives the information from the GPS satellite in NMEA (National Marine Electronics Association) format and this information is transmitted to a server using GPRS module. GPRS provide HTTP connection with tracking server. Tracking server has received vehicle location information through the network and stores this information in database. This information is available to users of the system over the internet on map. GPS is a satellite based navigation system**;** it is made up of 24 satellites, these satellites placed into the orbit. These satellites transmit coded information towards GPS receiver, this information use to identify vehicle locations on earth by measuring the distance from the satellites. GPRS network is an "always on", private network for data. It uses the existing GSM network to transmit and receive HTTP based data to and from GPRS device/module. It supports packet switched data services such as email and web browser. The GPRS can transfer data at the maximum rate of 115.2 kbps. It is most suitable for a real-time tracking management system [4].

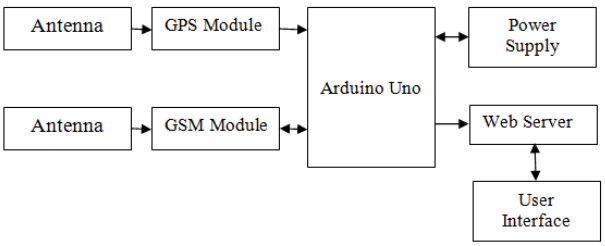

Figure 1. Block Diagram for Overall Proposed System

3. CONFIGURATION OF REAL TIME VEHICLE TRACKING SYSTEM

The development of the real time vehicle tracking system will be described in details in this section. The two main parts of the system are the hardware and the software components. The hardware component consists of tracking unit. Tracking

device used in real time vehicle location tracking is made up with Arduino Uno R3, SIM800A module and NEO 6M GPS module. The core part of vehicle tracking is microcontroller Arduino Uno. The geo location of vehicle can be captured through GPS module and that data is transmitted to the web server by using GSM technology. The implementation of the tracking unit is shown in Fig.2

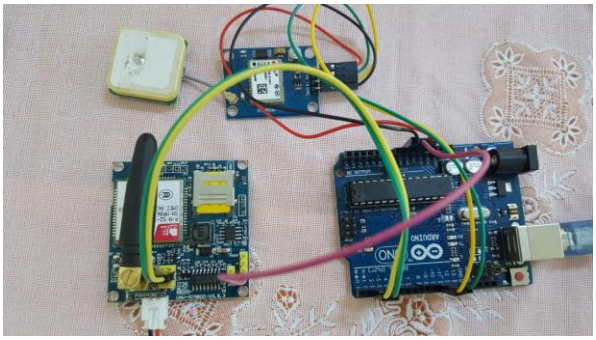

Figure 2. Tracking Unit For real Time Vehicle Tracking System

SIM800A module requires 2A peak current. So, external power supply like 12V-2A battery is used to provide the power. GPS module and GSM module are connected to the microcontroller. Firstly, the GPS module is connected easy to digital input/output pins in Arduino Uno. One thing to note was that the TX pin of the Ublox GPS module was connected to the RX pin of the Arduino Uno. The main reason for this was, TX stands for Transmit where data is send out and RX stands for Receive where data is received. Therefore, the GPS-TX sends data to the Uno RX and the GPS RX receives data from the Uno TX. GPS RX (receive) is connected to the Uno TX (transmit) and GPS TX (transmit) is connected to the Uno RX (receive).

Secondly, the GSM module is connected with digital input/output pins of Arduino Uno. The TX pin of the GSM module was connected to the RX pin of the Arduino Uno. This is because the Uno (TX) D3 transmits data to the GSM (RX) and conversely the Uno (Rx) D2 receives from the GSM (TX) shown in Fig.2. The modules and Arduino have a common ground. The tracking unit collects the location information via the GPS, formats this information into a system-specific packet format and sends it to the server via GPRS. After establishing the GPRS connection it tries to connect to the service provider's server using the HTTP protocol. After successful connection, the GPS data is sent to the server as a string. Then after a certain time period it checks the availability of GPRS and connects to the HTTP server. The current location of the device is sent to the HTTP server. In this way the device communicates with the server and sends the location.

The software components consist of Arduino IDE and web server software. Arduino Integrated Development Environment (IDE) is a cross platform application written in self-installable java. The C/C++ languages are used to program Arduino. The Arduino IDE provides a powerful yet user-friendly programming environment. It is used for compilation and uploading codes to the Arduino board through a USB connection. In this system, the coding which consist of two libraries SoftwareSerial.h and TinyGPS++.h is written C programming Language. TinyGPS++ is a new Arduino library for parsing NMEA data streams provided by GPS modules. Like its predecessor, TinyGPS, this library provides compact and easy-to-use methods for extracting position, date, time, altitude, speed, and course from consumer GPS devices [5]. In Fig.3, arduino IDE sketch of coding for the proposed real time tracking system is described.

Figure 3. Arduino IDE Sketch of Coding for the Proposed System

For sending Vehicle location GPS data and other information received from GPS module through GSM network, SIM800A module connected with Arduino Uno microcontroller is used. AT command has been used in programming for communication with connected server and SIM800A module. AT commands are instructions used to control a modem. AT is the abbreviation of ATtention. Every command line starts with "AT" or "at". That's why modem commands are called AT commands [6].

For using GSM network the response of SIM card is checked by using AT commands firstly. Then it checks the response of network status. After the confirmation of network status is available, it checks the GPS status and acquires the GPS information of the bus. Then it checks the HTTP request for internet. Initially, the network registration is done by using AT+CGATT command and set Access Point Name (APN), user name and password. After getting the data of vehicle's location, the data are sent to the web server by using HTTP request. AT+SAPBR command has been used for setting the configuration of GPRS. To access the internet HTTP service, AT+HTTPINIT command is used to initialize HTTP service, HTTPPARA command is used to set the parameters value.

To check the GPRS parameters, the following steps are shown:

1) sending "AT+SAPBR=3,1,\"Contype\",\"GPRS\" " and the response "OK"
2) sending "AT+SAPBR=3,1,\"APN\",\"mptnet\" " and the response "OK" (where MPT SIM card APN = mptnet)
3) sending "AT+SAPBR=3,1,\"USER\",\"\" " and receiving the response "OK" (where MPT SIM card USER = blank)
4) sending "AT+SAPBR=3,1,\"PWD\",\"\" " and receiving the response "OK" (where MPT SIM card USER = blank)

5) sending “AT+SAPBR=1,1” and receiving response “OK”
6) sending “AT+HTTPINIT” and receiving response “OK”
7) sending “AT+HTTPPARA= \”URL\”, \”\” ” and receiving response “OK”
8) sending “AT+HTTPACTION=0” and receiving response “OK”

In Fig.4 shows serial monitor of the Arduino IDE when running the proposed tracking system.

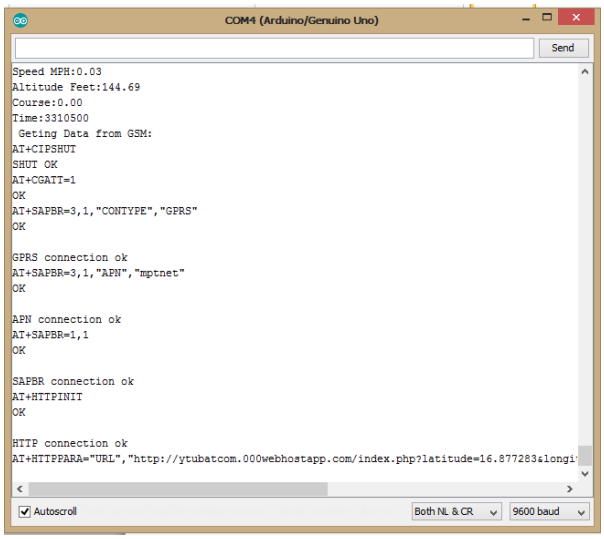

Figure 4. Serial Monitor of the Arduino IDE during Running the Tracking System

After the activation of the GPRS service, the HTTP protocol starts work directly [2]. This is used to send the vehicle’s position to a web server. A free web hosting service is used for a web server construction. In this system, the 000webhost.com is used as an unlimited free web hosting and an account is created for website of real time vehicle tracking system. The FileZilla client software is used for connecting to an FTP or SFTP server. The required files for website is uploaded or downloaded by using it. To implement the website for the proposed vehicle tracking system, PHP with MySQL has been integrated together with Apache web server is used.

4. SIMULATION AND RESULTS

For visualization of the location of vehicle into the Google map, HTML is written in web application which is developed with PHP script to show the web page into the browser [1]. In this script Google Map API is embedded. MySQL database is used for storing the data into database. By using GET and POST function in the PHP script, GPS data which is transmitted by GPS module through HTTP connection are stored in database and fetched into the Google map to show the location of bus.

The API automatically handles access to Google Maps servers and display map [7]. API calls also are used to add markers. For setting the center location of map google.maps.LatLng ( ) method is used. As Google Maps API provides different kind of maps view, ROADMAP is used for this web application. For fetching the data into the Google Map, getElementByID ( ) method is used. JQuery and Google Map API are embedded into the script which helps to show the location of the vehicle into the Google Map in real time.

The web page shown in Fig.5, user can get vehicle information such as latitude, longitude, satellites, speed and course and vehicle’s current location is pointed in Google map with maker.

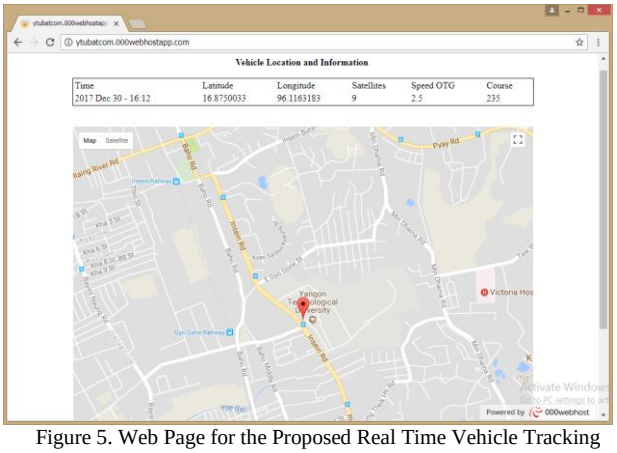

Figure 5. Web Page for the Proposed Real Time Vehicle Tracking System

5. CONCLUSION

This paper presents an efficient real time a vehicle tracking system that is flexible, customizable and accurate using GPS and GPRS of GSM network, suitable for wide range of applications all over the world. The combination of the GPS and GPRS provides continuous and real time tracking. To display the position on Google map Google map API is used. The Arduino is the brain of the system and the GSM module which is controlled by AT commands that enable data transmission over GSM network while the GPS provide the location data. Whenever the GPS receives a new data it is updated in the database and hence it is able to see the location on the Google map [3]. In the case of vehicle tracking, the proposed system gives the vehicle location information include latitude, longitude, altitude, date, satellites, speed OTG and course. The outcomes of the system are good like the results of the industrial devices. For the future work, a variety of services can be added to this system by using sensors or actuators.

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7. REFERENCES

[1] S.Bharthepudi, Dr.S.Umar, S.Sanakkayala and S.Nismitha, “A Review of Low Cost Object Tracking System”,International Journal of Computer Science Engineering and Technology, Vol.3, Issue 11, November 2013, 423-426.
[2] O .A. Mohamad and R. T. Hameed, “Design and Implementation of Real Time Tracking System Based on Arduino Intel Galileo”, International Conference and Artifical Intelligence, 30 June-02 July,2016.

[3] L. SeokJu, G. Tewolde and K. Jaerock, “Design and Implementation of Vehicle Tracking System Using GPS/GSM/GPRS Technology and Smartphone Application”, IEEE World Forum on Internet of Things (WF-IoT), Seoul, March 2014.
[4] S. A. Salunke, V. B. Jagtap and A. D. Harale, “Vehicle Tracking System for School Bus by Arduino”, International Research Journal of Engineering and Technology, Vol.04, Issue 03, March 2017, 2395-0072.
[5] http://arduiniana.org/libraries/tinygpsplus/
[6] https://www.codeproject.com/Articles/85636/Introduction-to-AT-commands-and-its-uses
[7] https://developers.google.com/maps/

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Study on Chitin Extraction from Crab Shells Waste

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Abstract: Chitin is the second most abundant natural polymer after cellulose. It occurs as a component of crustacean shells, insect exoskeletons, fungal cell walls and plankton. In this work, chitin was extracted from crab shells waste by chemical method. It includes two major steps such as demineralization and deproteinization step. These two steps were crucial for the elimination of calcium carbonate and other minerals as well as protein which are present in the shells. To extract the successive chitin, the sequence of these two treatment steps were varied in these experiments. In this study, the chemical compositions of crab shells waste were analyzed by X-ray fluorescence (XRF), the resultant chitins were characterized and analyzed by X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR).

Keywords— Crab shells waste, Chitin, XRF, XRD, FTIR

1. INTRODUCTION

Chitin, poly(β-(1→4)-N-acetyl-D-glucosamine is a natural polysaccharide of major importance, first identified in 1884 (see. figure 1)[1].Chitin is the major structural component of the exoskeleton of invertebrates and the cell walls of fungi[2].The amount of chitin with respect to dry weight is the highest in crustaceans. Hence, crustacean shells are regarded the main source of chitin for the chemical industry[3].The main components of crustacean shells are chitin (15-40%),protein(20-40%),calcium and magnesium carbonate (20-50%)[4]. Chitin is insoluble in water, in every common organic solvent and in acidic, basic and neutral aqueous solutions[3].Chitin found in nature is normally packed into an orderly crystalline structure which made it strong and able to serve the exoskeleton purpose of the shells of arthropods. Chitin exists in three structural forms called alpha-,beta- and gamma- chitin. The packing and orientation of the chitin strands are different in each of the different types. Alpha-chitin, found in shrimp and crab shell, has anti parallel chitin stands that are packed tightly with both inter and intramolecular hydrogen bonding with makes it the strongest structure in all the three chitin structures found. Beta-chitin, found in squid pens, has parallel chitin strands that are pack looser and lack the intermolecular hydrogen bonding making it weaker. Gamma chitin found in the stomach lining of some mollusk, have a randomly orientated chitin stand. Of these three structural types alpha- and beta-chitin are the most abundant[5].Traditional methods for the preparation of chitin include demineralization and deproteinization of the raw materials with strong acids and bases (e.g. HCl and NaOH)[3].

Chitin is non-toxic, odorless, biocompatible with living tissues, biodegradable, presenting antibacterial, moisture retaining and healing characteristics. Chitin and chitosan can be utilized in water purification, additives in cosmetics, antibacterial agents, pharmaceutical adjuvants, paper production, textile finishes, heavy metal chelating agents, membranes and biomedical applications such as wound dressings, separation membranes, antibacterial coatings, since they are harmless for the human body[6]. The objectives of this study are to determine the optimum condition of chitin extraction from crab shells waste and to investigate the XRD and FTIR analysis of chitin.

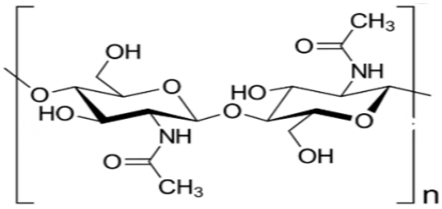


Figure 1. Chemical structure of Chitin

2. MATERIALS AND METHODS

2.1.Materials

In this work, the crab shells waste and chemicals were used as raw materials. Crab shells waste were collected from Crab World Company in Kyauktan Township. Hydrochloric acid (analytical grade) and sodium hydroxide (analytical grade) were used in chitin preparation process. Distilled water were also used to prepare desired concentration of chemical solution and to wash the sample.

2.2. Extraction of Chitin by Chemical Methods

In this investigation, the two experiments were carried out for extraction of chitin from crab shells by chemical method. This method is rather uncomplicated and simple chemicals such as NaOH and HCl can be used. Because NaOH is the preferential reagent and it is applied at concentration ranging from 0.125 to 5.0 M, at varying temperature (up to 160˚C) and treatment duration (from few minutes up to few days) at chemical deproteinization step. Demineralization is easily achieved by using dilute hydrochloric acid because it involves the decomposition of calcium carbonate into the water-soluble calcium salts with the release of carbon dioxide. Demineralization treatments are often empirical and vary with the mineralization degree of each shell, extraction time, temperature, particle size, acid concentration and solute/solvent ratio. The latter depends on

the acid concentration, since it needs two molecules of HCl to convert one molecule of calcium carbonate into calcium chloride[7]. The experimental procedure of extracted chitin was described in Figure 2.

In experiment I, crab shells waste were washed out with water to remove dirt and body tissue, then sun-drying. Twenty grams of dried shells were treated with 1N of NaOH solution at 80˚Cfor 3 hrs in deproteinization. Then, deproteinized sample was treated with 0.5N of HCl and 1N of HCl at room temperature for 3 hrs. The purified chitin was dried in an oven at 60˚C until it was constant weight.

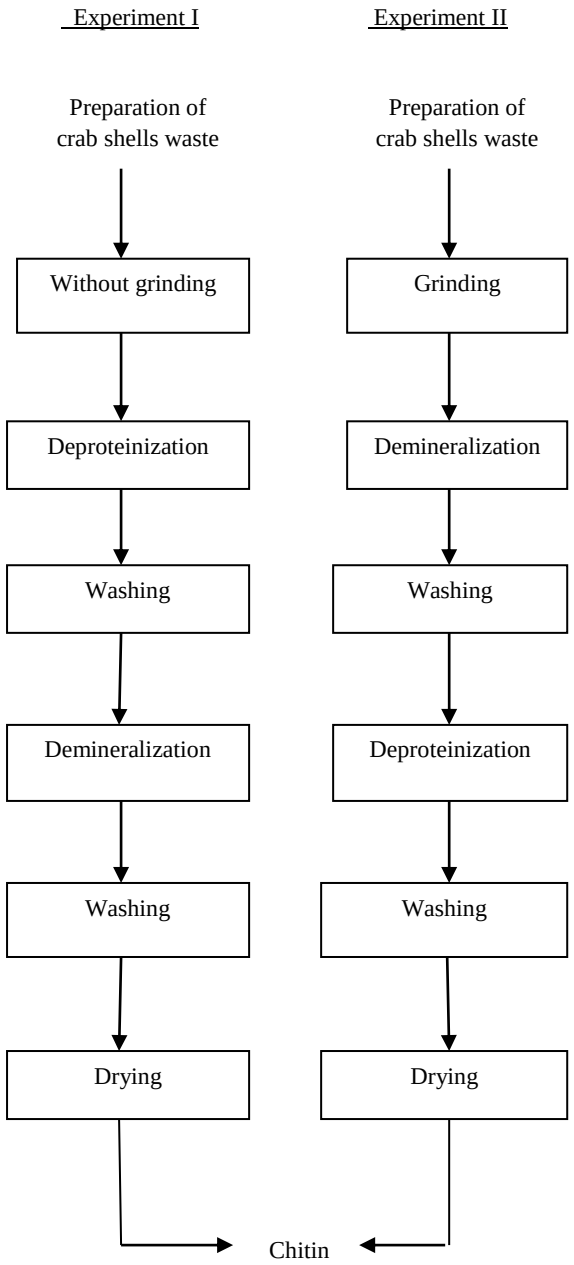


Figure 2. Extraction of Chitin from Crab Shells Waste

and pestle, then sieved into the size of 50 mesh. Thirty grams

of crab shells powder were treated with 7% HCl with continuous stirring and heated at 60˚C for 3 hrs to remove mineral content and then treated with 5% NaOH to reduce nitrogen content of protein. After that the sample was filtered, washed repeatedly with distilled water to remove any traces of chemicals and soluble impurities. The filtered sample was dried in an oven at 70˚C for 3 hrs. Finally, the dried demineralized, deproteinized and deodorized sample of chitin was obtained**.**

3. RESULTS AND DISCUSSION

3.1. Analysis of Crab Shells Waste

The chemical compositions of crab shells waste was analyzed by X-ray Fluorescence at Land Use Division (Yangon) .The results was as shown in Table 1.

As the result, the component of calcium was the highest content of this composition in raw crab shells.

Table 1.Chemical Compositions of Crab Shells Waste

Composition	Percent (%)
Moisture	1.097
Nitrogen	0.78
P_2O_5	2.777
K_2O	0.045
Ca	28
Mg	2.4
Fe	0.087
Cu	0.007
S	0.41
Na	0.778

3.2. Conditional Results of Extracted Chitin in Experiment I

The conditional results of extracted chitin in experiment I were shown in Table 2. In this experiment, the two samples were treated with same concentration of NaOH solution in deproteinization at 80˚ C and different concentration of HCl solution in demineralization at room temperature. The demineralization step, the solute and solvent were used as the same ratio for these samples. The resultant samples from this experiment were analyzed and characterized by XRD and FTIR as shown in Figure 3 and Figure 4. In XRD results, the sharp peak intensity of S_1 at two-theta(degree) is 28.9 and the sharp peak intensity of S_2 at two-theta(degree) is 19.22. So, it indicates that although S_1 was formed as calcium carbonate but also S_2 was formed as chitin. In standard FTIR

of chitin, the wavelength pattern of all the functional groups express as amide I groups were 1660-1680 cm^{-1},amide II groups and amide III groups were 1560-1530 cm^{-1} and 952cm^{-1}, the hydroxyl group was 3448 cm^{-1}. From the results of FTIR for S_1, the wavelength pattern of amide I group was 1795cm^{-1} , amide II group was 1626 cm^{-1} and amide III groups was 1035 cm^{-1} respectively. So, the over range of wavelength pattern indicates that the resultant product cannot be determined as chitin. FTIR results for S_2, amide I group was 1672 cm^{-1}, amide II group 1550 cm^{-1} and amide III was 952 cm^{-1}. The range of wavelength pattern indicates that the resultant product can be determined as chitin.

Table 2. Results of Experiment I

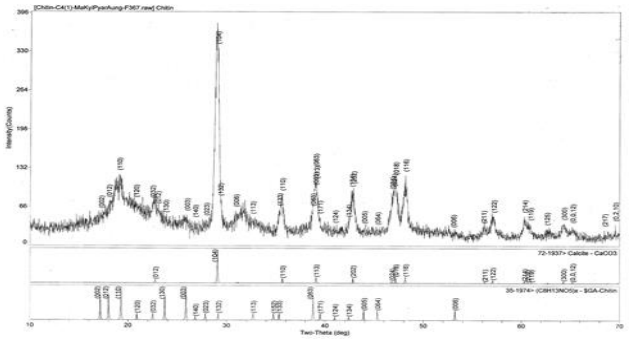
No.	Concentration of deproteinization at 80˚C	Concentration of demineralization at R.T	Sample to solvent ratio(w/v)	Color
S_1	1N NaOH	0.5N HCl	1:15	Pink
S_2	1N NaOH	1N HCl	1:15	Pink

3.3. Conditional Results of Extracted Chitin in Experiment II

The conditional results of extracted chitin in experiment II were shown in Table 3. In this experiment, the two samples which had 30 mesh size were treated with the same concentration of HCl solution in demineralization and NaOH solution in deproteinization at the same temperature. In demineralization step, the solute and solvent were used different ratio. The resultant samples from this experiment were analyzed and characterized by XRD and FTIR as shown in Figure 5 and Figure 6. As all of the results of XRD, the sharp peak intensity of chitin was19.22 at two-theta (degree) .Therefore, all the samples such as S_3, S_4 were determined as chitin. According to the standard FTIR pattern, the ranges of wavelength in FTIR results for all the samples indicate that the resultant product can be determined as successive formation of biopolymer.

TABLE 3. RESULTS OF EXPERIMENT II

No.	Concentration of demineralization at 60˚ C	Sample to solvent ratio(w/v)	Concentration of deproteinization at 60˚C	Color
S_3	7%HCl	1:10	5% NaOH	White
S_4	7%HCl	1:15	5% NaOH	White



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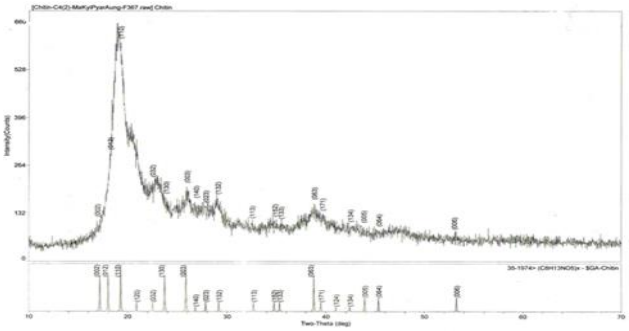
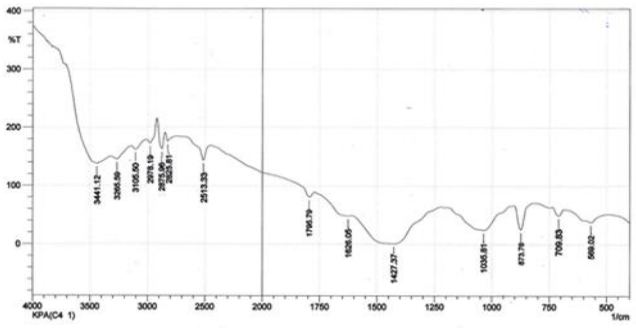


(b)

Figure 3. XRD pattern of Chitin (a) S_1 (b) S_2



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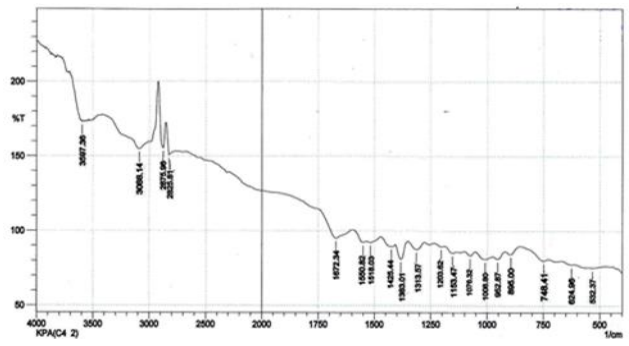
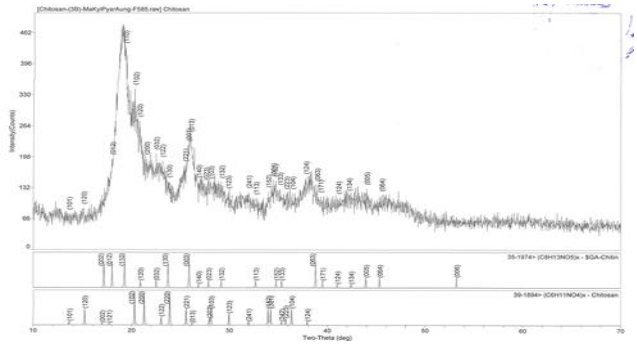


(b)

Figure 4. FTIR pattern of Chitin (a) S_1 (b) S_2



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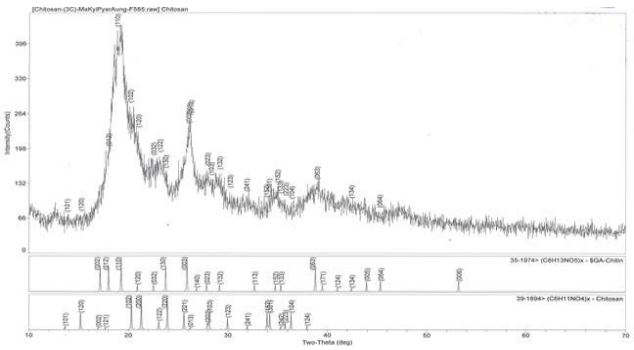
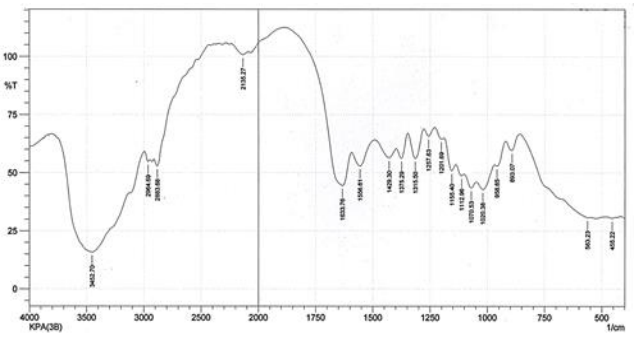
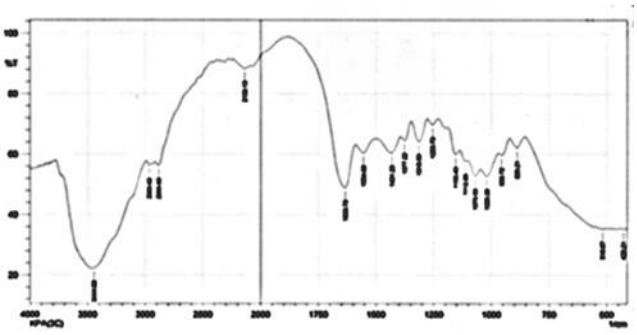


(b)

Figure 5. XRD pattern of Chitin (a) S_3 (b) S_4



(a)



(b)

Figure 6. FTIR pattern of Chitin (a) S_3 (b) S_4

4. COMPARISON OF CHITIN YIELD

The comparison of chitin yield in experiment I and II were shown in Table 4.

Table 4. Chitin Yield

Sample	S_2	S_3	S_4
Yield	0.97 g	1.8 g	1.5 g
Yield%	4.9%	6%	5%

The yield of extracted chitin from crab shells was between 4.9% and 6.%. Although sample (S_3) was the highest yield percent of chitin product but also S_2 and S_4 were not acceptable in percentage of yield. Therefore, S_3 was better than other samples in yield percent of product chitin. Among the results, it can be said that S_3 was favorable result for prepared chitosan because it was obtained the highest yield percent.

5. CONCLUSION

In this study, the two experiments were carried out to extract chitin. When increasing the acid concentration, the results of experiment II were better than experiment I in the chitin formation. The sharp peak intensity of XRD patterns for all samples in experiment II were formed as chitin at two-theta. From the results of FTIR, all the functional groups which have been identified in the form of peak that include amide, carbonyl and hydroxyl groups successfully. According to the experimental results, it can be investigated that the successive formation of chitin depend on the process parameters such as degree of each shell, extraction time, temperature, particle size, acid concentration and solute/solvent ratio. Among the results, sample (S_3) was the highest percentage of yield was obtained at 6%.In conclusion, the extracted chitin which is the highest percentage of yield can be used to produce chitin –derived product, such as chitosan.

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REFERENCES

[1] Marguerite Rinaudo,“ Chitin and chitosan: Properties and applications”,ScienceDirect, Prog.Polym.Sci.31(2006) 603-632

[2] Fereidoon Shahidi, Janak Kamil Vidana Arachchi and You-Jin Jeon“,Food applications of chitin and chitosans”,Trends in Food Science & Technology 10 (1999) 37-51

[3] D. Sakthivel, N. Vijayakumar and V. Anandan, “Extraction of Chitin and Chitosan from Mangrove Crab *Sesarma plicatum* from Thengaithittu Estuary Pondicherry Southeast Coast of India”, Human Journals, Research Article. August 2015 Vol.;4 Issue:1

[4] Rayane Santa Cruz Martins de Queiroz Antonino, Bianca Rosa Paschoal Lia Fook,“Preparation and Characterization of Chitosan Obtained from Shells of Shrimp (Litopenaeus vannamie Boone)”, Mar.Drugs 2017,15, 141;doi:10.3390/md 15050141

[5] RITH PICHYANGKURA, “APPLICATION OF CHITN-CHITOSAN FROM MARINE BY-PRODUCTS IN THAILAND”.

[6] M.Mincea, A.Negrulescu and V. Ostafe, “PREPARATION, MODIFICATION AND APPLICATIONS OF CHITIN NANOWHISKERS:A REVIEW”, Rev.Adv.mater.sci.30 (2012) 225-242

[7] Islem Younes, Marguerite Rinaudo. “Chitin and Chitosan Preparation from Marine Sources. Structure, Properties and Applications”. Mar. Drugs 2015,13, 1133-1174;doi:10.3390/md 13031133

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Using Dijkstra's Algorithm for Public Transportation System in Yangon Based on GIS

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Abstract: In modern life, everyone needs to reach their destinations in time. For people who rely on the public bus transportation requires to get the reliable bus information that can help them to reduce their waiting time at the bus stops. In the age of digital transformation, smart phones, laptops, other digital devices are changing the world very day lives. Among them, GIS is one of the players. In a modern urban region, public transportation network such as bus, train, taxi and etc. are become so large that why passengers lack sufficient information. In order to solver that we will app that will guide user shortest route to reach the destination. In this paper, we will use GIS and Dijkstra's Algorithm to calculate the shortest path. The system is implemented using free and open source technologies including open source GIS tools. A prototype application is designed and implemented based on short distance bus routes in Yangon city bus routes.

Keywords: Dijkstra's Algorithm, GIS database, GIS, Shortest path, Public Transportation

1. INTRODUCTION

The traffic problem of Yangon area has been directly affecting the quality of the citizens of the area. The effects of the traffic of Yangon area are the pollution in every aspect such as air, sound, the time wasting on the road and also the hydro-carbon fuel. Even though the numbers of the roads are increasing, the traffic problem in Yangon area is still occurring. In advanced public transportation systems, the shortest path computation plays an important role and has been extensively studied. This paper helps in showing the best way to travel from one point to another and in doing so, the shortest path algorithm was made. The shortest path and the alternative path is computed based on the problem of getting the shortest path based on traffic conditions and it also gives alternative paths and the traffic count. This plays an important role in navigation systems as it can help to make sensible decision and time saving decisions. To solves the shortest path problem of a graph with nonnegative edge costs, gives shortest path tree, Dijkstra's Algorithm is used. This algorithm is mostly used in routing and other network connected protocols. For a given vertex in the graph, the algorithm gets by finding the costs of shortest way from one source vertex to one destination vertex, once the shortest path reach to the destination vertex has been found the algorithm is then stopped. For example, if the edges show driving distances of connected cities by a direct road and vertex of the graph shows cities, to find the shortest path between one city to other cities, Dijkstra's algorithm can be used.

Through abstract large number of works is done on finding shortest paths. Dijkstra's algorithm is used to find shortest path, which can be apply on a graph which is directed and got the edges with non-negative weights. If we implement Breadth First Search algorithm (BFS), it can solve the problem of undirected graph with edges un weighted or with negative weight. We will later know that with unbound nonnegative weights, Dijkstra's algorithm is the fastest well known for directed graph sin shortest path algorithm. These are the basic things that will help to know further more about the Dijkstra's algorithm. Yangon public transportation was changed to new system (called YBS). The eleven agencies (YRTA, OMINIFOCUS etc.) is operating the over 100 bus line. YBS bus network is getting bigger and bigger so that in this paper, we will give information to passenger, we will develop mobile application to give information very the internet by using GIS.

This study prototype provides sufficient information required by a passenger to decide which bus routes to take when travelling from a known source to a destination, considering such constraints. Possible bus route combinations, the travel bus stop and travel distance are provided by using Dijkstra's Algorithm.

2. RELATED WORKS

In navigational assistance for such type of client presents more challenges not seen by guidance systems, due to the self-nature of the interactions [3]. The algorithms are part of all Navigation Indoor Models that provide guidance to indoor environments that are unknown. To work on an "Intelligent Map" path planning uses the Dijkstra's shortest path algorithms, that is based on a new data structure termed "cactus tree" which is shown on the relationships between the different objects that show an indoor environment. They need to design an application for the visually impaired when to-date 'positioning and tracking' system cannot offer proper position information that is mostly required by this type of application as this research find. We saw that the nature of transfer is that it needs more costs from one edge to its adjacent edge , this is the best-path problem for public transportation systems [4]. To store the scattered information related to transfer in indirect adjacent edges lists, it brings the space storage structure. Thus, it solves the issue of complex network graphs storage and to solve transit issue of the data model so it designs a new shortest path algorithm. We introduce a prior to simple graph depends on the Dijkstra's algorithm in terms of space and time as algorithm analysis exhibits. The complex road network finds a better route [5] from one location to another location by a non-trivial task, as now a day there is increased in traffic. There are many search

algorithms that have been proposed to solve the problem of shortest path, and the most well-known algorithm are Dijkstra's algorithm.In this paper, both uninformed and heuristic search to examine depend on some major cities. To decrease the travelling distance and transportation costs, routing algorithms is used effectively. The proposed model is tested with sample dataset and we have simulated this on different working and traffic conditions. Several algorithms exit for finding suitable paths between two known locations, based on different requirements. Shortest path algorithm like Dijkstra's algorithm, A* algorithm etc. is used in most of the application. Although these algorithms are optimum, they are not capable of dealing with certain real scenarios. Dijkstra's algorithm is very efficient as it works only with a smaller subset of the possible paths through a graph. After each node is solved, the shortest path from the start node is known and all subsequent paths build upon that knowledge. Dijkstra's algorithm is often used to find real-world shortest paths, such as for navigation and logistics. It is better performance than Depth- and Breadth-First Search.

In this paper, the way of finding shortest path is provided by using Dijkstra's algorithm. The remainder of this paper is structured as follows. Section 3 describes road network representation. Section 4 describes system methodology used in the proposed system in details. The System Overview is described in section 5 and in section 6 shows the experimental result. Finally, we conclude this paper in section 7.

3. ROAD NETWORK PRESENTATION

A public road network is composed by some nodes (bus stop) in this paper, the links connecting two nodes and bus lines. Define a public road network as G, G= {N, E, R}, where N={0,1,2,..,n, n ∈ N} denotes the set of all nodes, and n is the number of nodes; the origin node and the destination node is O, D respectively. E= {0 ≤ e ≤ m} is the set of all transit links, and m is the number of links; R= {0,1,2,..,n, n ∈ N} is the set of all bus lines and u is the number of links. In this paper, algorithm employs two functions that relate bus stops and bus routes. We use the distance on the road network as the cost in this paper. In Yangon, roads are made up of one-way, two-way roads. To design system, data structure that will used in this prototype is graph data structure unlike tree structure, graph there can be more than one path i.e. graph can have uni-directional or bi-directional paths (edges) between nodes. The overall graph data pattern is as following figure 1.

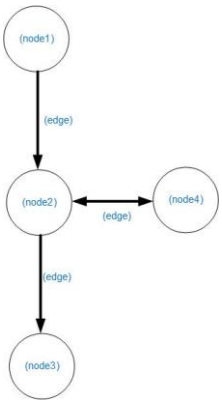


Figure 1. Overall Graph Data Pattern

A geographic information system (GIS) may be a computer system designed to capture, save, treatment, analyze, manage, and display all kinds of spatial or geographical data [1]. Geographic information system (GIS) is a robust tool and has the capability to handle and treatment spatial data in a massive volume. GIS becomes a common technique that may produce maps, integrate info, visualize and solve issues, and develop valuable solutions [2]. Network analysis remains one in all the foremost important and protracted analysis and application areas in the geographic data system. Networks can perform an alternative datum for locations in the context of linear referencing and support a set of tools for the graphical present. Many network location problems are the most troublesome to solve in terms of their combinatorial complication. The shortest path analysis is not only one of the major network operations in GIS analysis, transportation manufacture and many other fields but also the foundation of other network analysis, such as the most credible path problem, maximum capacity path problem etc. The graph nodes are link with GIS spatial data, also known as geospatial data or geographic information is data that identifies the geographic location of features and boundaries on Earth. Spatial data describes the physical location and shape of geometric objects such as countries, roads, or lakes. Two classes of GISs in term of data structure, the raster-based systems and the vector-based systems. Vector is mainly used in this system.

4. SYSTEM METHODLOGY

4.1 Dijkstra's Algorithm

Dijkstra's Algorithm was developed by Dutch computer scientist Edsger Dijkstra in 1956 and published in 1959. It is based on graph search, the edge and vertex, gives the shortest path between two vertex .For a given source vertex (node) the graph, the algorithm finds the path with lowest cost (i.e. the shortest path) between that vertex and every other vertex. It can also be used for finding costs of shortest paths from a single vertex to a single destination vertex by stopping the algorithm once the shortest path to the destination vertex has been determined [6].

The algorithm is represented in brief as below:
G = (V, E)
Where, **V** is a set of vertices and **E** is a set of edges.

Dijkstra's algorithm keeps two sets of vertices:
S = the set of vertices whose shortest paths from the source have already been determined.
V-S = the remaining vertices.

The other data structures needed are:
D = array of best estimates of shortest path to each vertex
Pi = an array of predecessors for each vertex

The basic mode of operation is:

1. Initial is **d** and **pi**,
2. Set **S** to empty,
3. While there are still vertices in **V-S**,
    a. Sort the vertices in **V-S** according to the current best estimate of their distance from the source,
    b. Add **u**, the closest vertex in **V-S**, to **S**,
    c. relax all the vertices still in **V-S** connected to **u**

Pseudo code for Dijkstra's Algorithm:

Distance [s] ←0 (distance to source vertex is zero)

for all v ∈V–{s}
do distance [v] ←∞ (set all other distances to infinity)
S←∅ (S, the set of visited vertices is initially empty)
Q←V (Q, the queue initially contains all vertices)
while Q ≠ ∅ (while the queue is not empty)
do u ← min distance (Q, distance) (select the element of Q with the min. distance)
S ← S ∪ {u} (add u to list of visited vertices)
for all v ∈ neighbors[u]
do if distance [v] > distance [u] + w(u, v) (if new shortest path found)
then d[v] ← d[u] + w(u, v) (set new value of shortest path)
(if desired, add trace back code)
return dist

4.2 Haversine Formula

Haversine formula is suitable in calculating distance for spatial data because it provides better accuracy. It assumes the earth to be spherical and ignores the ellipsoidal effects. It provides the good results in mathematically and computationally.

Let lat1, lon1 be latitude and longitude of current location of bus and lat2 , lon2 be latitude and longitude of the nearest bus stop respectively.

deta(lat)=lat2-lat1
deta(lon)=lon2-lon1
a=(sin(deta(lat)/2))^2+cos(lat1)*cos(lat2)*(sin(deta(lon)/2))^2
c=2*atan2(sqrt(a),sqrt(1-a))
d=R*c

Where,

a=the square of half of the straight-line distance between the two points
c=the great circle distance in radians
d=the distance between the two points
R=radius of the earth(R=6371.01km)

In the proposed system, Haversine distance formula is used for measuring the distance form source or target to its nearest bus stop. The reason of choosing haversine is the calculation based on ellipsoid geometry. The calculation result is more precise than Euclidian geometry calculation distance on earth's surface.

5. SYSTEM OVERVIEW

The system is allowed to be accessed via mobile access on android mobile phones. This is aimed at reaching wide audience. Mobile phone is considered as the most suitable mode to reach the general public due to its wider acceptance of general public. The prototype will design to search shortest path from source to destination that user want to go with the YBS route. The source is user location anywhere within the Yangon and destinations is anywhere that user want to go. The user can search the suggested shortest route can get by mobile smart. The mobile will send the latitude and longitude of source and destination to web server using (REST API). Several processes of calculation the shortest path are nearest bus stops measure form source and destination. The google map is used as the based map of the system. For the web API, ASP.NET MVC framework is used for implementing system. For the mobile side, android platform is used. The database store and act as the centralized database.

With so many handheld devices such as smart phone, digital watch, GIS , IoT supporting applications that include GPS and mapping functionality, geographic data often needs to be stored in a relational database. There are several types of enterprise geo databases such as Oracle, Microsoft SQL Server, IBM DB2, Postgre SQL that are support spatial data type supported. In this paper, MSSQL is used as geo database because it is very easy to use.

In Figure 2 system design for proposed system is described. The proposed system is composed with four main layers. Data layer stores spatial and non–spatial data relates to routes and services. Server logic layer is web server. Application logic layer Dijkstra's, searching and other core functionalities are handled by this layer. User interaction handing layer is Android application user interaction mode works based on the results issued by application logic layer.

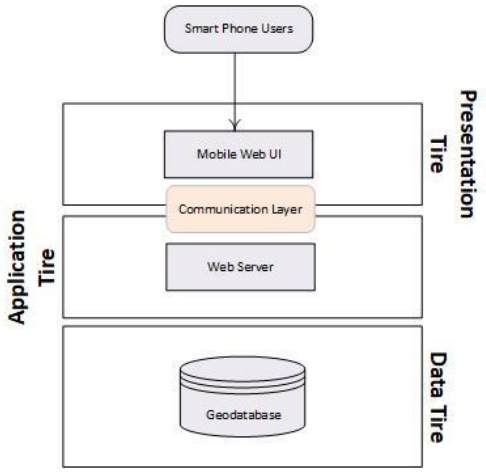


Figure 2. System Design Layer For proposed System

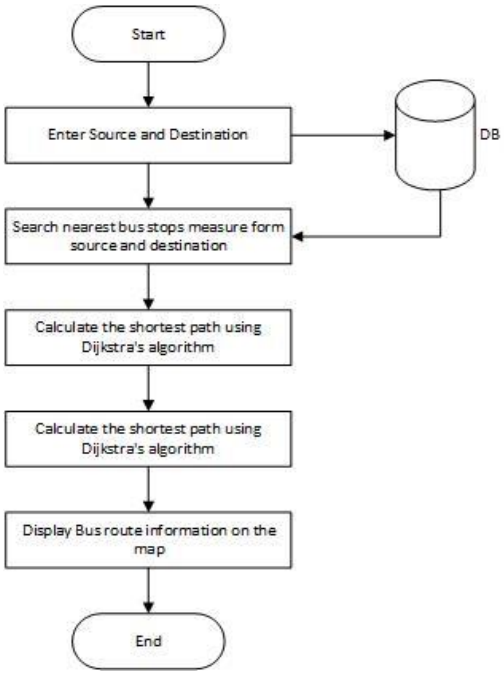


Figure 3. Flowchart for Proposed System

The flow chart of the proposed system is as shown in figure 3. Android will post the source and destination that user want travel to the server. The application layer will accept data and process it.

Taking a nearest bus stop from sources and destination using have rsine distance. The result of nearest bus stops used to search the shortest route by Dijkstra's algorithm within Yangon complex bus stop connection network.

The result route and sum all the distance between each transit send back data the presentation layer as xml format. The result will display on the base map.

5. EXPERIMENTAL RESULT

5.1 Study Area

For study area, Yangon public transportation was changed to new system (called YBS). There are eleven agencies (YRTA, OMINIFOCUS etc.) which are operating the over 100 bus lines. YBS bus network is getting bigger and bigger so that in this thesis, we will give bus line, bus route and bus stop information which the bus user wanted to know to passenger. We will develop mobile application to give these information very the internet by using GIS. The map shown in Figure 4 is the Yangon map for study area.

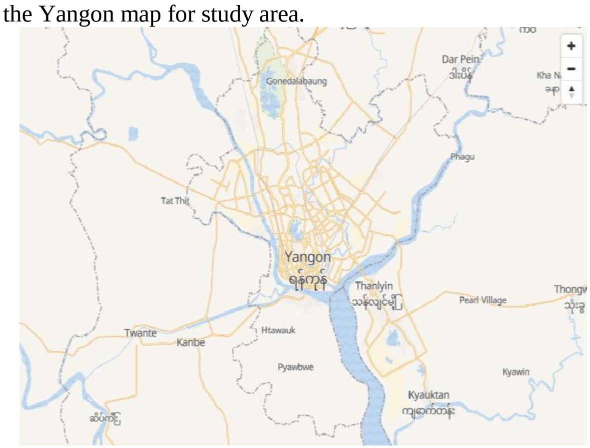


Figure- 4. Yangon Map for Study Area

5.2 Data Processing

When the bus lines dataset shown in Figure 6 is loaded on Google Map, all bus route of the Yangon Region can be shown in Figure 5.

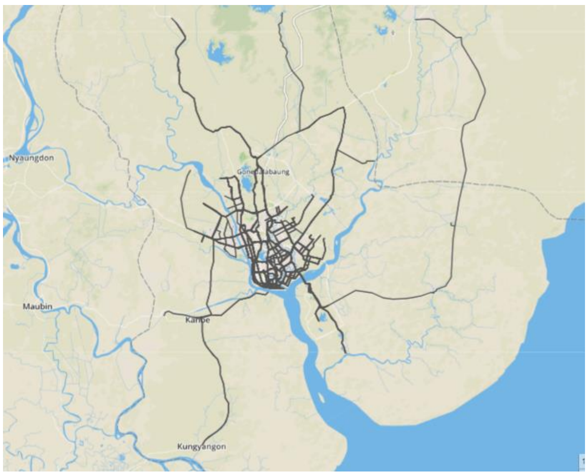


Figure- 5. All Bus Lines in Yangon for Study Area

	route_id	agency_id	route_long_name
1	route_id	agency_id	route_long_name
2	R1	YRTA	(၁) လှည်းကူးဈေးရှေ့ - ဝဝန်
3	R2	YRTA	(၂) ယုဇန(ခိုင်ရွှေဝါလမ်း) - အောင်မင်္ဂလာအဝေးပြေးဝင်း
4	R3A	YRTA	(၃ တာမွေ) ယုဇနဥယျာဉ်မြို့တော် - မင်္ဂလာဈေး - လမ်း၅၀
5	R3B	YRTA	(၃ သုဝဏ္ဏဈေး) ယုဇနဥယျာဉ်မြို့တော် - လမ်း၅၀
6	R4	YUPT	(၄) ယုဇနဥယျာဉ်မြို့တော် - ဆူးလေ
7	R5	YRTA	(၅) ရိုးမရိပ်သာ - ဗိုလ်ချုပ်အောင်ဆန်းလမ်း
8	R6A	GYCT	(၆-က) တောင်ဒဂုံ သိမ်ချောင်း - လှိုင်သာယာ
9	R6B	GYCT	(၆-ခ) တောင်ဒဂုံ (၇၀/၇၁) ဈေး - လှိုင်သာယာ
10	R7A	YUPT	(၇ စက်မှုဇုံ (၂)) တောင်ဒဂုံ (၇၀/၇၂)ရပ်ကွက် - မဟာဗန္ဓုလလမ်း
11	R7B	YUPT	(၇ မောင်မကန်လမ်း) တောင်ဒဂုံ (၇၀/၇၂)ရပ်ကွက် - မဟာဗန္ဓုလလမ်း
12	R8	YUPT	(၈) လမ်းမတော် - တောင်ဒဂုံအင်းဝသိမ်မရှာ
13	R9	YRTA	(၉) တိုင်းရင်းသား နည်းပညာတက္ကသိုလ် - ကျောက်တိုင်
14	R10	YUPT	(၁၀) တိုင်းရင်းသားကျေးရွာ - ဒဂုံတက္ကသိုလ်
15	R100	GYCT	(၁၀၀) မင်းရဲကျောင်းပုံလမ်း - ဗိုလ်တစ်ထောင်
16	R11	YRTA	(၁၁) အောင်မင်္ဂလာအဝေးပြေး - ရွှေတိဂုံဘုရား
17	R12	BDL	(၁၂) အရှေ့ဒဂုံ - ဆူးလေ
18	R14	BDL	(၁၄) ပါရမီ (ညောင်ပင်) - သခင်မြပန်းခြံ
19	R15	YRTA	(၁၅) ဒဂုံတက္ကသိုလ် - တညင်းကုန်း
20	R16A	YRTA	(၁၆ တောင်ငူလမ်း) ရွှေပေါက်ကံ - ဒဂုံဧရာအဝေးပြေးဝင်း
21	R16B	YRTA	(၁၆ ဗိုလ်တေဇလမ်း) ရွှေပေါက်ကံ - ဒဂုံဧရာအဝေးပြေးဝင်း

Figure 6. Sample Bus lines Data

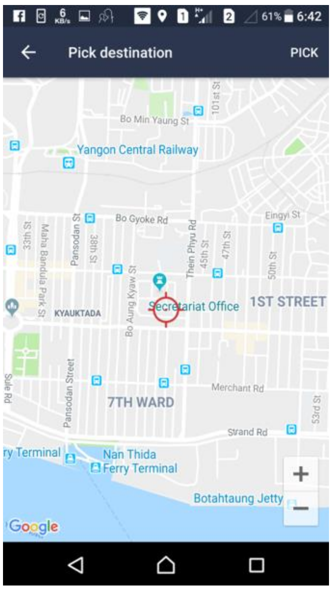
id	svc_name	sequence	stop_id	name_en	name_mm	road_en	road_mm	township_en	township_mm	lat	lng
105	2	26	929	Kone Padayth	ကုန်ပဒေသာ	Pyi Htaung S	ပြည်ထောင်စု	North Dagon	မြောက်ဒဂုံ	16.8842	96.2006
106	2	27	881	Yone Shae	ရုံးရှေ့	Pyi Htaung S	ပြည်ထောင်စု	North Dagon	မြောက်ဒဂုံ	16.8875	96.1988
107	2	28	927	Khun/ Shit Lai	(၇/၈) လမ်းဆုံ	Pyi Htaung S	ပြည်ထောင်စု	North Dagon	မြောက်ဒဂုံ	16.8923	96.196
108	2	29	935	Lay-sae-nga H	(၄၅) မှတ်တိုင်	Pyi Htaung S	ပြည်ထောင်စု	North Dagon	မြောက်ဒဂုံ	16.8948	96.1947
109	2	30	1019	Lay-sae-chauk	(၄၆) မှတ်တိုင်	Pyi Htaung S	ပြည်ထောင်စု	North Dagon	မြောက်ဒဂုံ	16.8984	96.1927
110	2	31	931	Kyar Hmat Tai	ကြားမှတ်တိုင်	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8977	96.1907
111	2	32	903	Ba Htoo Zay	ဗထူးဈေး	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8958	96.187
112	2	33	905	Banyardala	ဗညားဒလ	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8948	96.1851
113	2	34	917	Kyaung Lay Sh	ကျောင်းလေးေ	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8937	96.183
114	2	35	919	Lay-sae-lay La	(၄၄) လမ်းဆုံ	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8927	96.1811
115	2	36	915	Kyan Mar Yae	ကျန်းမာရေး	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8915	96.1787
116	2	37	899	Kyaung Kwae	ကျောင်းကွေ့	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8895	96.175
117	2	38	901	Phyo Sabei	ဖြိုးစံပယ်	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8875	96.1709
118	2	39	897	Khay Mar	ခေမာ	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8858	96.1677
119	2	40	894	Gandar Yon	ဂန္ဓာရုံ	Bo Hmu Ba H	ဗိုလ်မှူးဗထူးဝ	North Dagon	မြောက်ဒဂုံ	16.8866	96.1641
120	2	41	1822	Gate Haung	ဂိတ်ဟောင်း	Industrial Ro	စက်မှုဇုန်လမ်း	North Okkalapa	မြောက်ဥက္ကလာပ	16.8938	96.1576
121	2	42	891	Yone Thit	ရုံးသစ်	Khaymarthi I	ခေမာသီလမ်း	North Okkalapa	မြောက်ဥက္ကလာပ	16.8959	96.1559
122	2	43	797	May Dar Wi	မေဒါဝီ	Khaymarthi I	ခေမာသီလမ်း	North Okkalapa	မြောက်ဥက္ကလာပ	16.8991	96.155
123	2	44	801	Oakkar	ဥက္ကာ	Khaymarthi I	ခေမာသီလမ်း	North Okkalapa	မြောက်ဥက္ကလာပ	16.9026	96.1546

Figure 7. Sample Dataset used in System Database

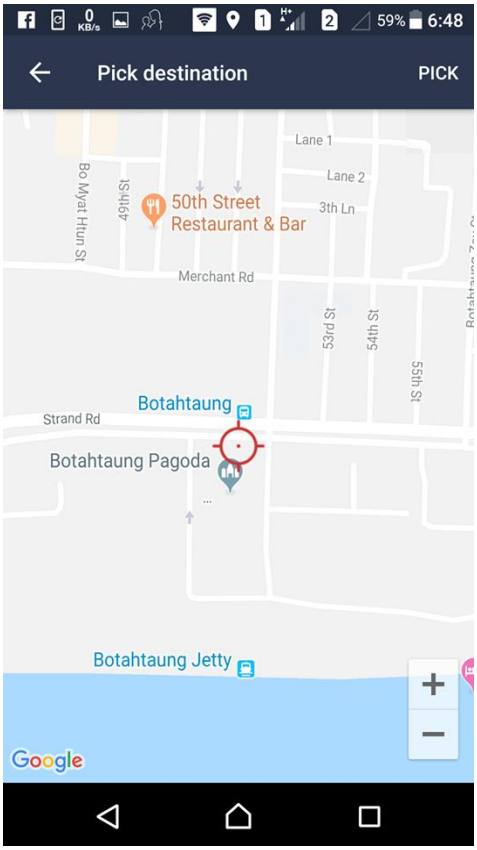
This bus lines, bus stops and bus sequences data are pre-processed to use in the proposed system. The some sample datasets are shown in Figure 7. These datasets required for the proposed system are stored in MSSQL database.

5.3 Result

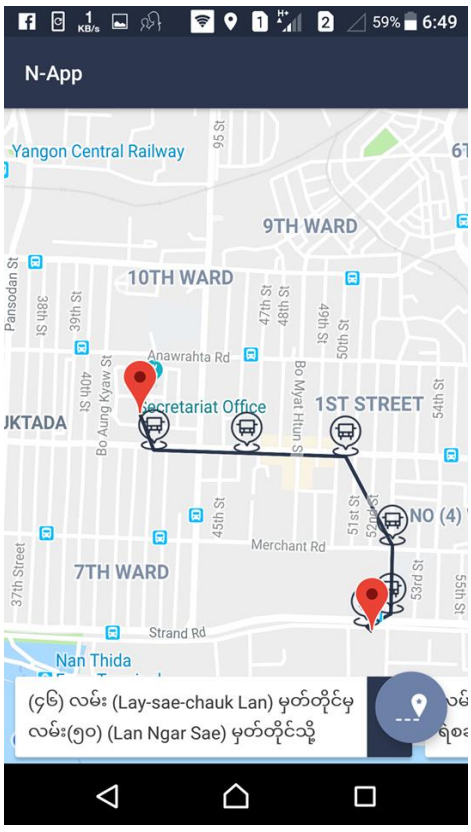
The user can get the information for the shortest path from his location to his desired destination easily, by opening the android application of the proposed system.The proposed system was tested in which user's desire for the data in Yangon Bus Transportation System.



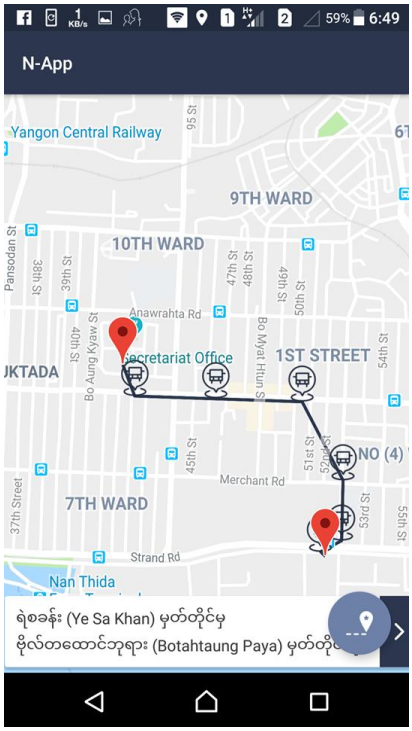
(a)



(b)



(c)



(d)

Figure 8. (a)user location, (b)user destination, (c)user's location nearest bus stop and (d)user's destination nearset bus stop

In the system, the user's location is Secretariat Office in Botahtaung Downship. And he want to go to Botahtaung Pagoda. By using the system application shown in figure, he may know his nearest bus stop (Lay-sae-chauk-Lan) of his location and shoretest path to arrive the Botahtaung Pagoda. And then shown in Figure he may know the nerest bus stop (Ye-sa-khan) of his desired location.

6. CONCLUSION

Public bus transportation system by Dijkstra's algorithm apply in Yangon downtown area will assist the bus transportation user to the information and data which is essential for them and also provide the planning system to plan the route and transportation mode with the fare. Dijkstra's algorithm is better when we know both starting point and destination point. As a future work, the time or other factors such as waiting time at the bus stop, walking time to the bus stop will be used as weight for road network in the whole Yangon area.

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8. REFERENCES

[1] Dabhade, Amrapali C., and K. V. Kale, "GIS Based Health Care Information System for Aurangabad City", International Journal of Engineering and Innovative Technology, 2014.

[2] Bhanumurthy, V., et al. , "Route analysis for decision support system in emergency management through GIS technologies", Int. J. Adv. Eng. Glob. Technol, 2015. 3(2):P. 345-350.

[3] Hua Wu; Marshall, A.; Yu, W., "Path Planning and Following Algorithms in an Indoor Navigation Model for Visually Impaired", Internet Monitoring and Protection, 2007. ICIMP 2007. Second International Conference on, Vol., No., pp.38, 38, 1-5 July 2007.

[4] Hongmei Wang; Ming Hu; Wei Xiao, "A new public transportation data model and shortest-path algorithms", Informatics in Control, Automation and Robotics (CAR), 2010 2nd International Asia Conference on, Vol.1, No., pp.456,459, 6-7 March 2010.

[5] F. B. Zhan and C. E. Noon, "Shortest Path Algorithms: An Evaluation Using Real Road Networks", Transportation Science. Vol.32, pp.65-73, February 1, 1998.

[6] R. Somalia and M. B. Potdar, "Shortest path algorithms on GIS dataset using geotools ", International Journal of Scientific & Engineering Research, Volume 4, Issue 10, October-2013 637 ISSN 2229-5518.

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Preparation of Silica from Agricultural Leaves waste by Organic Acid Leaching Treatment

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Abstract: In this paper, two types of raw material, Toddy leaves and sugarcane leaves were used. Leaves are an inexpensive raw material that can be used to extract silica from agricultural wastes, due to silica as a useful raw material for industrial application. In this study, the environmentally benign and economically effective process to produce SiO_2 materials from toddy leaves and sugarcane leaves have been established by using citric acid leaching, not the conventional strong acids. The silica content of the product samples was characterized using X-Ray fluorescence (EDXRF), X-Ray powder diffraction (XRD), scanning electron microscopy (SEM), and Fourier transform infrared (FTIR) analysis. The highest silica content (83.9%) was produced by Toddy leaves.

Keywords: Toddy leaves, sugarcane leaves, acid leaching, calcination, Silica

1. INTRODUCTION

In Myanmar, they are largely grown in middle region of the country. Myanmar is an industrial based on agricultural country. The agricultural wastes have a huge content of silicate materials and the cheapest source for silica production. The reasons which are responsible for agricultural waste to be considered as good silica source and have potential for the large scale production are

(a) Low cost of the raw material
(b)Height silica content in agricultural waste
(c) Comparable silica quality [1], [2].

Silica (SiO2) is one of the valuable inorganic multipurpose chemical compounds .It can exit in gel, crystalline, amorphous forms and variety of other forms. Silica has played a continuous part in development of technology and been one of the basic raw materials supporting the industrial revolution. [3], [4].

Silica in elemental form is used as a component for building material. Silica in amorphous form used as absorbent, catalyst, refining agent etc. Silica in crystalline form is widely used in glass and ceramic industry. [5]

The objective of this study is to produce silica from Toddy palm leaves and Sugarcane leaves and to study the silica content from different raw types using thermo chemical leaching method. Citric acid is an organic acid and more environmentally friendly, economic and ecological compared to inorganic acids.

2. MATERIALS AND METHOD

A. Materials

Toddy palm leaves were collected from the Thanlyin Township, Yangon Division and sugarcane leaves were collected from the market, Yangon Division. The raw material was cut, cleaned, and dried before undergoing the treatment process. Citric Acid ($C_6H_8O_7$) was used for acid leaching treatment and was bought from market. Pure water was also used for acid washing.

B. Leaching Methods

Leaching generally refers to the removal of the substance from a solid via a liquid extraction media. The desired component diffuses into the solvent from its natural solid form. There are three important parameters in leaching which are temperature, contact time per unit area and solvent selection. The temperature can be adjusted to optimized solubility and mass transfer. Leaching can be divided into two categories which are percolation and dispered solid. For percolation , the solvent is contacted with solid in a continuous or batch method and widely used for extreme amount of solids. In dispersed solids, the solid are usually crushed into small pieces before being contacted with solvent. In simple words, percolation is for liquid added into solid while dispersed solid is for solid added into liquid [6], [7], [8].

C. Preparation of silica from leaves (Toddy & Sugarcane)

Leaves and citric acid were mixed by 2:2(m/m) in beaker. These mixture was heated at 80℃ and stirred by magnetic stirrer for 2hrs.After acid leaching, these leaves were washed with pure water to removes the leaching acid. And then, they were dried in oven about (50-60℃) for 24hrs.

After drying, these were subjected to sequential burning in a carburizing furnace. The burning program consisted of different temperatures and holding times, as follows: 30minute at 310℃, 60minutes at 450℃, 210minutes at 510℃ and, 30minutes at 600℃.After the calcination, the treated ash became white ash to get product silica [9].

3. RESULTS AND DISCUSSION

A.X-Ray Fluorescence Analysis

The chemical analysis result from XRF analysis is shown in Table 1. Silica is absent in raw leaves because leave contains a high amount of organic volatiles. The organic material

consists of cellulose and lignin which can be turned to carbon dioxide (CO_2) and carbon monoxide (CO).

Table-1. Chemical composition of raw and product silica

Component	Raw (%)		Product Silica (%)	
	Toddy leave	Sugarcane leave	from Toddy leave	from Sugarcane leave
SiO_2	-	-	83.875%	67.806%
K_2O	97.199 %	88.041%	9.895%	22.401%
CaO	-	7.299%	3.547%	5.501%
Cl	0.404%	-	-	-
Fe_2O_3	1.853%	1.603%	2.288%	2.643%
MnO	0.229%	2.178%	0.3%	0.84%
Rb_2O	0.093%	0.346%	-	0.031%
SO_3	0.174%	0.250%	-	0.213%
LOI	0.048%	0.283%	0.095%	0.565%

After acid leaching and calcination processes, the products are high in silica content and significant reduction of the other metal oxides and chlorine, which are regarded as impurities [12].Chlorine was almost completely remove from both the samples while the other impurities were significantly reduced .The organic material in biomass are hydrolyzed by the citric acid[13].

B. Phase Identification by XRD

X-ray diffraction were recorded from products of raw toddy palm leaves and sugarcane leaves. The product from raw Toddy palm leaves exhibited sharp crystallinity peaks at 2Ɵ values of 20.86º, 21.348º, 26.524º, 35.377º, 36.191º, 39.186º, and 40.12º. These peaks indicated d-values of 4.2548, 4.1587, 3.3577, 2.5352, 2.48, 2.279, and 2.2457 respectively.

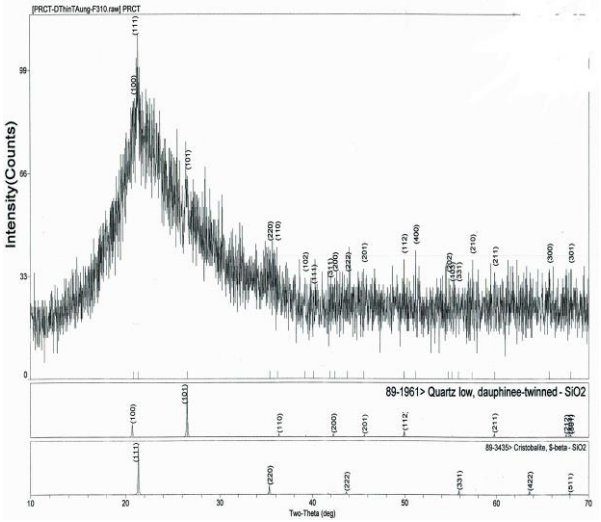

Figure -1 .XRD pattern of product silica from Toddy leaves

The sharpest crystallinity peaks at 2Ɵ values of 20.687º, 26.380º, 38.582º, 42.539º, 45.631º, 49.639º, and 54.290º were obtained after calcination of raw sugarcane leaves. These peaks resulted in d-values of 4.2901, 3.3757, 2.3316, 2.1234, 1.9865, 1.8351, and 1.6883 respectively.

An XRD analysis was used to identify the two different phases of the product silica. The pattern of Toddy palm leaves confirmed that the quartz low silica formed and the pattern of Sugarcane Leaves confirmed that the quart silica formed [10].

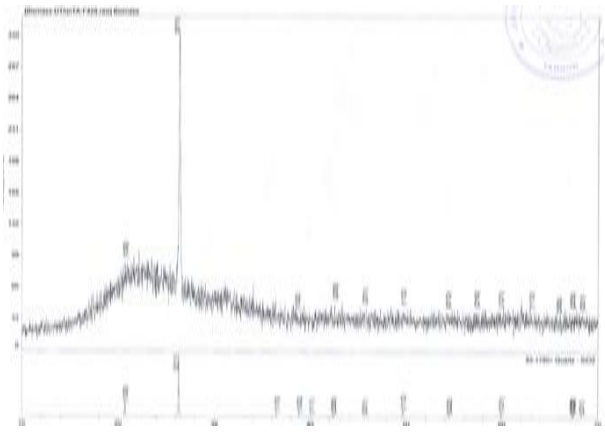

Figure-2 . XRD pattern of product silica from Sugarcane leaves

C. Surface Morphology of Products (SEM)

After sample has been leached with citric acid, the particle became spongy and porous structure of varied shape [14].

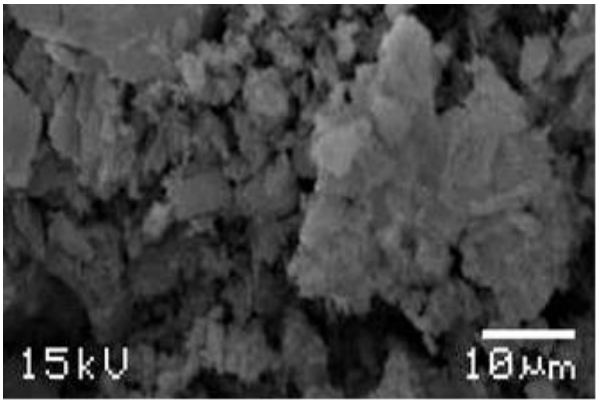

Figure-3. SEM image of product silica from Toddy leaves

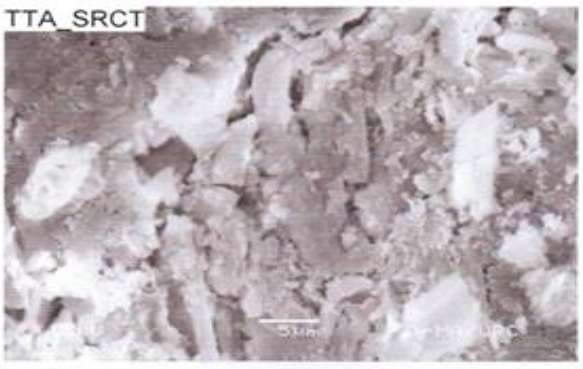

Figure -4.SEM image of product silica from Toddy leaves ash

As observed in Figs. 3 and 4, various sizes and geometry , tubular-shaped porous aggregates and spherical or and fibrous particles. The spherical particles contain mostly silica (Si) but also potassium (K), calcium (Ca), ferum (Fe) and manganese (Mn) [15].

D. Identification of results by FTIR

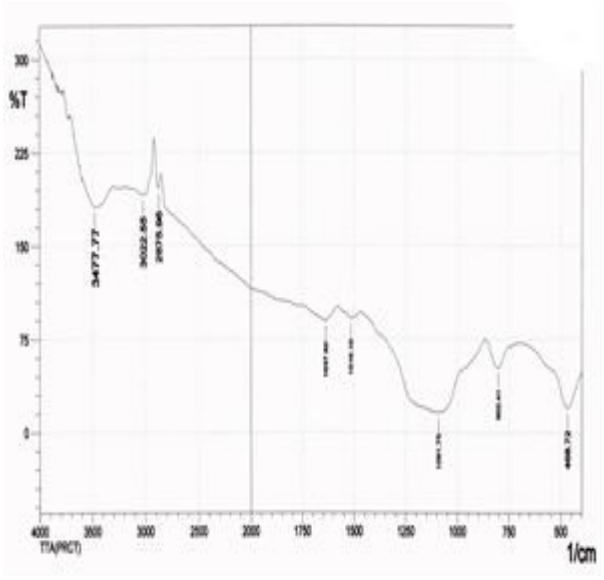

Figure-5. FTIR image of product silica from Toddy leaves

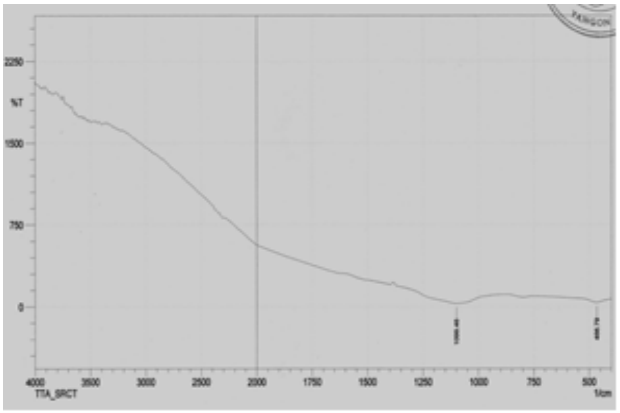

Figure- 6 . FTIR image of product silica from Toddy leaves

The silica powders obtained were confirmed by FTIR examination in Figure 3.The peak from 450 to 600 cm^{-1} corresponds to the O-Si-O bending vibration [16].

This extracted, product silica characterization and position of the peaks were identical with pure silica. Peak number of two samples is 468.72cm^{-1}.

The vibration modes of the gel network are appeared in spectrum between 700and 1200cm^{-1}[17].

The bonds from 1630 to1647cm^{-1} belongs to C-O group [16].The broad band between 2850 and 3700$cm^{-1}$is due to absorbed water OH and silanol OH groups[17].In all figures, IR images describe the major chemical groups present in leaves (Toddy& sugarcane) and extracted silica.

4. CONCLUSION

Citric acid is seen as a viable alternative to replace strong acid in the leaching process. This is because, as an organic acid, it has low level of hazardous effect comparing to the usage of a stronger acid. This study is in line with other research all over the world that is focusing on ways to establish environmentally benign process to produce silica from agricultural wastes.

This study had shown that it is possible to extract crystalline silica from toddy palm leaves and sugarcane leaves using organic acid leaching method. It consists of a citric acid leaching and calcination process. Citric acid leaching treatment is significantly useful and effective to remove the impurities and increased the purity of silica in toddy palm leaves.The silica content can be raised by studying the optimum extracting conditions (solution temperature, reaction time and concentration of citric acid).

5. APPENDIX

A. Preparation of 6%citric acid solution

500ml amount of 6% citric acid solution would be made from 30.8g of dry powder citric acid and 480.8ml of distill water.

B. Determination of moisture

$$\text{Percent of moisture Content} = \frac{(\text{initial mass}) - (\text{final mass}) \times 100}{(\text{initial mass})}$$

C. Determination of Ash content

$$\text{Percent of ash Content} = \frac{(\text{initial mass}) - (\text{final mass}) \times 100}{(\text{initial mass})}$$

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7. REFERENCES

[1] G. O. Young, “Synthetic structure of industrial plastics (Book style with paper title and editor),” in *Plastics*, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw-Hill, 1964, pp. 15–64.

[2] W.-K. Chen, *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135.

[3] H. Poor, *An Introduction to Signal Detection and Estimation*. New York: Springer-Verlag, 1985, ch. 4.

[4] B. Smith, “An approach to graphs of linear forms (Unpublished work style),” unpublished.

[5] E. H. Miller, “A note on reflector arrays (Periodical style—Accepted for publication),” *IEEE Trans. Antennas Propagat.*, to be published.

[6] Junko Umeda & Katsuyoshi Kondoh, 2008. High-purity Amorphous Silica Originated in Rice Husks via Carboxylic Acid Leaching Process, Journal of Materials Science, 43: 7084-7090.

[7] Junko Umeda & Katsuyoshi Kondoh, 2010. High-Purification of Amorphous Silica Originated from Rice Husks by Combination

of Polysaccharide Hydrolysis and Metallic Impurities Removal, Industrial Crops and Products, 32: 539-544.

[8] Umeda Junko, Imai Hissashi & Kondoh Katsuyoshi, 2009. Hydrolysis and MetallicImpurities Removal Behavior of Rice Husks in Citric Acid Leaching Treatment, Transaction of JWRI, 38(2): 13-18.

[9] J. Wang, "Fundamentals of erbium-doped fiber amplifiers arrays (Periodical style—Submitted for publication)," *IEEE J. Quantum Electron.*, submitted for publication.

[10] C.P .Faizul, Abdullah & B.Fazlul" Extraction of Silica from Plam Ash via Citric Acid Leaching Treatment"Adv.Environ.Bol.7 (12), 3690-3695,2013

[11] Leonardo Electronic Journal of Practices and Technologies, ISSN 1583-1078, Issue 20, January-June 2012, p. 193-205

[12] H.Alyosef,A. Eilert ,J.Welscher , S. Ibrahim, R.Denecke, W.Schwieger andD. Enke (2013). Characterization of Biogenic Silica Generated by Thermo Chemical Treatment of Rice Husk.Particulate Science and Technology,31(5),pp.524-532

[13] J .Umeda and K. Kondoh (2010).Hight-purification of aphrous silica originated from rice husks by combination of polysaccharide hydrolysis and impurities removal.IndustrialCrops and Products,32(3),pp.539-544

[14] P.Chindaprasirt, S. Rukzon and V. Sirivivatnanon, 2008. Resistance to chloride penetration of blended Portland cement mortar containing palm oil fuel ash, rice husk ash and fly ash, Construction and Building Materials, 22: 932-938

[15] V.Hariharan, and G.Sivakumar, (2013). "Studies on synthesized nanosilica obtained from bagasse ash," *International Journal of Chemical Technology and Research* 5(2), 1263-1266.

[16] H.Syed.Javed, S.Tajwar, M.Shafaq,M.Zafar,M.Kazmi, "Characteri-
zation of Silica from Sodium Hydroxide Treated RiceHusk,"Journal of Pakistan Institute of Chemical Engineers,2009'vol.XXXVII

[17] P.K.Jal,M.Sudarshan,A.Saha, P.Sabita, and B.K. Mishra,"Synthesis and characterization of nanosilica precipitation method,"Colloid.Surf.240,(2004),173-178

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Design and Simulation of 250kW Mini-Hydro Power

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Abstract: At present, electrical energy is one of the most useful forms of energy for human beings in the world. Energy in various forms is essential to sustain human life and pursue economic growth. Electrical is to sustain human life and pursue economic growth. Electrical energy can be derived from various sources of energy such as coal, diesel, nuclear, water, steam, wind, solar, heat and so on. The collected data allows for parameter optimization, suitable turbine choice and the design of generator. This paper analysis the turbine selection and generator design of mini-hydropower of Myin War Taung in Hinthada Township Ayerwaddy Division. This is done throughout design and analysis of the electrical generator aspects of the (250 kW) synchronous generator, which was connected to propeller turbine. Modelling and simulation of the system also described by using MATLAB software.

Keywords: Hydro location, Flow rate , Head, turbine, synchronous generator,MATLAB/Simulation

1. INTRODUCTION

There are various source power to produce electricity in Myanmar. Among them, water resources are suitable for Myanmar because there are many streams and rivers in Myanmar[1]. One kind of renewable energy, water is plentiful, clean and will never run out. Where water resources are available, hydro-electric power stations are used to supply electrical energy to consumers. The hydro-electric power generation is relative cheap. Moreover, it is a renewable and relatively clean power source[5]. In the other hand, most of villages in Myanmar are still living without electricity. Thus Ministry of Irrigation and Water Utilization Management Department is trying to supply electricity to nearby villages of mini-hydropower plant is presented for rural electrification. The detail study is carried out at Mamya dam, Myin War Taung in Hinthada Township Ayerwaddy Division. The calculated generator data and simulation result are also present[6].

2. MAIN COMPONENTS OF HYDROELECTRIC POWER PLANT

Hydroelectric Power plants convert the hydraulic potential energy from water into electrical energy. Such plants are suitable where water with suitable head is available. The different part of a hydroelectric power plant are dam,forbay,spillway,penstock and tunnel, surge tank, power house[3].

(i) Dam

The dams collect water during the rainy season and store it, thus allowing for a steady flow throughout the year. Dams are also used for controlling floods and irrigation.

(ii) Forebay

Forebay is incoming water from the head race flows into this tank at the head of the penstock. It is a storage basin in front of intake.

(iii) Spillway

A spillway as the name suggests could be called as a way for spilling of water from dams. It is used to provide for the release of flood water from a dam. It is used to prevent over toping of the dams which could result in damage or failure of dams.

(iv) Penstock and Tunnel

Penstocks are pipe which carry water from the reservoir to the turbine inside power station. They are usually made of steel and are equipped with gate systems.

(v) Surge Tank

Surge tanks are tanks connected to the water conductor system. It serves the purpose of reducing water hammering in pipes which can cause damage to pipes.

(vi) Power House

Power station contains a turbine coupled to a generator. The water brought to the power station rotates the vanes of the turbine producing torque and rotation of turbine shaft. This rotational torque is transferred to the generator and is converted into electricity[3].

3. DESIGN THEORY FOR MINI-HYDRO POWER PLANT

The plant is installed at the conduit, which has enough water head and flowing water flow rate to generate hydro turbine. A water control gate, penstock, control valve, turbine, generator, and related equipment are to be constructed to each unit. The flowing water from the conduits the main source of energy to convert electricity with the help of hydro turbine which connected to the generator. The generator power could be calculated as following[6].

$$P = \eta\gamma QH$$

Where, P = Generated Power(kW)

η = Overall efficiency of the turbine
γ = Specific weight of water (KN/m^3)
Q = Flow rate of water (m^3/s)
H = Head of water(m)

(i) As the discharge formula

$Q = AV$

$Q = \pi R^2 V = 3.14\times(0.3)^2\times 3.27 = 0.92 m^3/s$

(ii) As the Head formula

$Output = 9.81\times\eta\times Q\times H$

$$H = \frac{output}{9.81\times Q\times\eta} = \frac{500}{9.81\times 0.81\times 1.84} = 34.19 \text{ m}$$

We must be chosen hydro turbine according to the Head and Flow rate.

(iii) Hydraulic Turbines

Hydraulic or water turbine are the machines which uses the energy of water (Hydro power) and convert into mechanical energy. In general a water turbine consists of a wheel called or rotor, having a number of specially designed vanes or blades or buckets. The water processing a large amount of hydraulic energy when strikes the runner, it does work on the runner and causes it to rotate, the mechanical energy so developed is supplied to the generator coupled to the runner, generates electrical energy. The selection of the best turbine for any particular hydro site depends on the site characteristics, the dominant factors being the head available and the power required. Selection also depends on the speed at which it is desired to run the generator or other device loading the turbine[7].

(iv) Types of Turbines

The classification of hydraulic turbine is based on the predominant direction of fluid flow through the runner. Turbines are also divided by their principal of operation. The se are Impulse Turbine and Reaction Turbine. In this journal, reaction turbine is commonly used at low head site[7].

Also, the turbine may be classified into high, medium or low-head machines. These are shown in the following table.

Table.1Group of Turbine

Turbine runner	High-Head	Medium-Head	Low-Head
Impulse	Pelton Turgo Multi-jet Pelton	Multi-jet Pelton Cross flow Turgo	Cross flow
Reaction	-	Francis	Kaplan Propeller

Impulse Turbines

These turbines are most efficiency for high head low flow site. A narrow water jet impulse the blades of the turbine creating momentum. A system using an impulse turbine drives the water into a pipeline[7].

Reaction Turbine

Reaction turbines have a better performance in low head and high flow sites. In reaction turbines, there are no nozzles. The efficiency of thereactiion turbines is higher than the impulse turbines, and has slower operation speed[7].

The usual range of head, flow rate and specific speeds for various types of turbine are also shown in following table[5].

Table.2 Relationship between water head and turbines

Type of Turbine	Limit Head (H) (m)	Flow rate (Q) m^3/s	Specific speed
Pelton turbine	300 to 2000	0.2 to 3	4 to 70
Cross turbine	10 to 100	0.1 to 10	40 to 200
Francis	2.5 to 450	0.4 to 20	60 to 400
Kaplan	1.5 to 70	0.5 to 20	300 to 1100

According to flow rate and head,we can be chone turbine from turbine selection chart as shown in following figure.1.

Selection of Turbine Chart

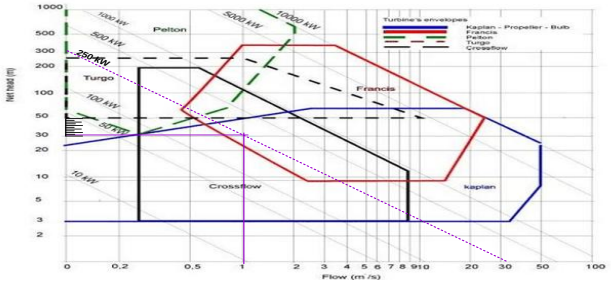

Figure.1.Turbine Selection chart according to flow rate and head

According to flow rate we can get turbine efficiency from turbine efficiency chart as shown following figure.2.

Selection of Turbine Efficiency

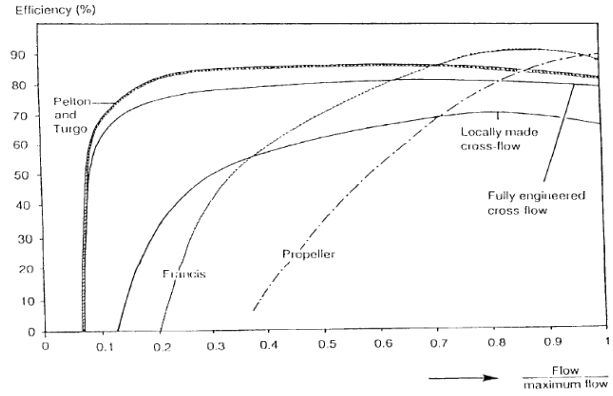

Figure.2.Turbine Efficiency according to flow rate

The required flow rate to operated turbine is 1.84m^3/s and 2 unit of Horizontal Francis type turbine was selected low head plant.But,according to analysis the various types of turbines, In this journal suitable Propeller turbine choice and design of generator. Because the Propeller turbine will rotate faster than Francis turbine. These high speed have the very important implication that reaction turbine can often be

directly coupled to an generator without any speed increasing drive system. The Propeller turbine is suitable for low heads. The reaction turbine need more sophisticated fabrication than impulse types because these involve the use of large more intricately profiled blade[7].

4. SYSTEM UNDER STUDY

A Mamya Dam was constructed mainly to supply irrigation water for multiple crop cultivation. The design of mini hydro power plant by using irrigation water was created to coincide with the constructed conduit structures and the locally available materials except turbine and generator. After studying the design of conduit structure and site investigating the location for installation of hydro power plant is selected with the basic criteria such as water discharge from conduit depended on water storage and diameter; of penstock ,water head depended on dam height ,vicinity of villages, number of households and possibilities of power transmission line[6].

The electrification with the mini hydro power plant(0.5 MW) installed at the conduit outlet of Mamya Dam is the second biggest of its kind producing electricity utilized the constructed irrigation facilities for irrigation water in Myanmar. By this successful implementing of mini hydropower plant at Ma Mya Dam Project, nearby (4)villages also located near dam site with efficient water . They all get the electricity at present and have chances of creating opportunities for cottage industry development[6].

Once the mini hydro power plants are installed at the conduit outlet the power generating is available as 24 hrs 335 days a year as irrigation water is flowing continuously and another 30days are under maintenance of irrigation system.24hrusage.

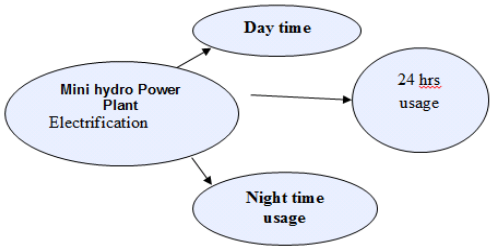

Figure.3. Daily Power Usages

5. DESIGN CALCULATION FOR 250 kW SYNCHRONOUS GENERATOR

Hydro-electric generator is the energy converter of the mechanical energy into electrical energy. Generator is classified into two main type; the synchronous generator and an induction generator[4]. This paper represents the design of a mini-hydro plant with 250 kW synchronous generator.

$$\text{Output capacity(kVA)} = \frac{\text{kw} - \text{rating}}{\text{power factor}}$$

(i) Main Dimension of Stator Winding [2]

Output coefficient , K' $= 11 \text{ Bav q kW} \times 10^{-3}$

Output of alternator ,Q $= K' D^2 \times L \times n_s$

Number of turn per phase ,

$$Tph = \frac{Eph}{4.44 \times f \times \varphi \times Kw}$$

$$Iph = \frac{kVArating}{Terminal\ voltage}$$

Outer diameter of the stator core , Do = D+2hs +dc

(ii)Length of Air Gap

$$ATa = \frac{1.35 \times Tph \times Iph \times Kw}{p}$$

AT_{fo} = S.C.R×ATa

ATg = 0.75×AT_{fo}

Rotor diameter, Dr = D- 2Lg

(iii)Dimension of Rotor

Axial Length of the pole, Lp = L-1cm

$$\text{Width of the pole, bp} = \frac{Ap}{Lp}$$

$$\text{Height of the pole, hf} = \frac{IfTf}{10^4 \sqrt{dr \times Sf \times Pf}}$$

$$\text{Depth of rotor core, dc} = \frac{Ac}{Lc}$$

According to above equation, design calculation of (250kW) synchronous generator.This is shown in the following table.

Table.3 Design Data Sheet for 290.69 kVA Salient Pole Alternator

Specification	Symbol	Unit	Value
Full load output	Q	KVA	290.69
Line Voltage	V	Volt	400
Phase	-	-	3
Frequency	F	Hz	50
Speed	N	r.p.m	750
Main Dimensions			
Output coefficient	K'	-	135.77
Internal diameter of stator	D	m	0.6
Gross length of stator	L	m	0.471
Peripheral speed	V	m/sec	23.55
Stator Winding			

Flux per phase	ø	Wb	0.061
Turn per phase	T_{ph}	-	16
Number of slot	S	-	96
Conductor per slot	Z_s	-	1
Teeth per pole	N_t	-	12
Conductor C.S.A	a_s	mm^2	140
Size of conductor	-	mm ×mm	10.39×13.47
Width of slot	b_s	m	0.01139
Depth of slot	h_s	m	0.01527
Resistance of winding	R_{ph}	Ω	0.004
Effective resistance	-	p.u	0.009
Effective reactance	-	p.u	0.3062
Field Winding			
Short circuit ratio	S.C.R	-	1
Air-gap length	Lg	m	1.525×10^{-3}
Arial length of pole	Lp	m	0.461
Width of pole	b_p	m	0.116038
Height of pole	h_p	m	0.07826
Total no load Ampere turns	AT	-	1498.232
Full load field Ampere turns	AT_{fl}	-	3099.85
Sectional area of field conductor	a_f	mm^2	27.999
Field current	I_f	A	88.19
Field turn per coil	T_f	-	20
Resistance of field winding	R_f	a	0.01935

Performance calculation of (250 kW) synchronous generator ass following table.

Table.4Analysis of Performance generator
Losses and efficiency.

	Losses	W
(a)	Stator copper losses	3107.31
(b)	Iron losses	2961.54
(c)	Rotor losses	1204.52
(d)	Exciter losses	164.2532
(e)	Fic &windge losses	2500
	Total	10223.85

Output of the alternator =290.69 x 0.86

=250 kW

Input of the Alternator =250kW+10.223kW

$\therefore \quad \eta = \frac{250 \times 10^3}{250 \times 10^3 + 10.223 \times 10^3}$

= 96.5%

6. MODELING OF THE SYSTEM

This model incorporates the models of the synchronous generator, hydro turbine governor, excitation system and three phase RLC load are now connected together to the complete block diagram of mini-hydro power plant as shown in (figure.4).

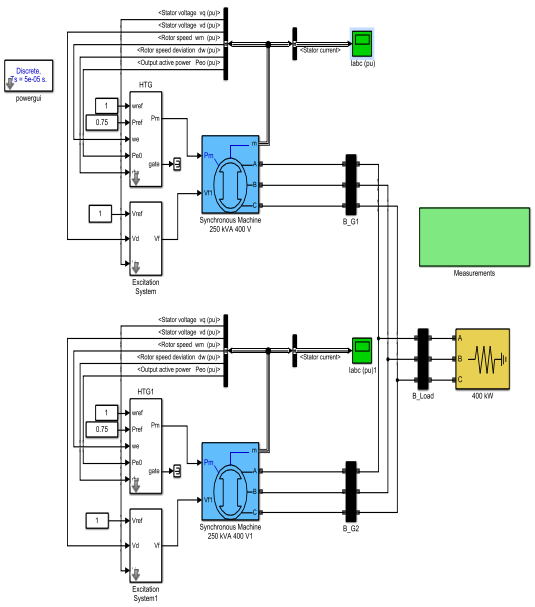

Figure 4.Simulation Model for Designed System

(i) Components of Mini-hydropower system

The main component of mini-hydropower system with synchronous generator are-

1. Hydraulic turbine
2. Excitation system
3. Synchronous generator

Measurement System in simulation model as shown in following figure(5).

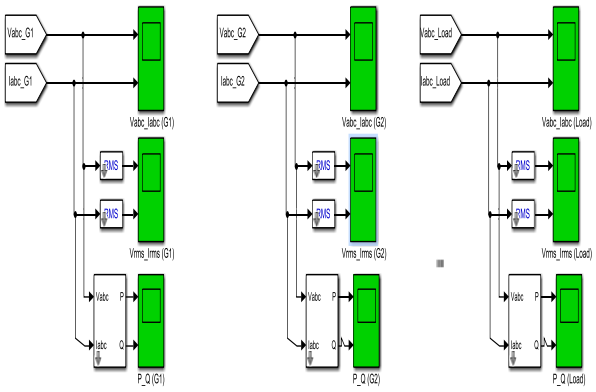

Figure.5. Measurement System in Simulation Model

7. SIMULATION AND ANALYSIS

At first author has to simulate the response of synchronous generator for single machine infinite bus system at normal operation. The system is simulated to study about dynamic characteristics of synchronous generator with its own transient condition. Figure 6.show the simulation results of stator current for phase a, b, and c of generator G_1 and G_2 in mini-hydro power system.

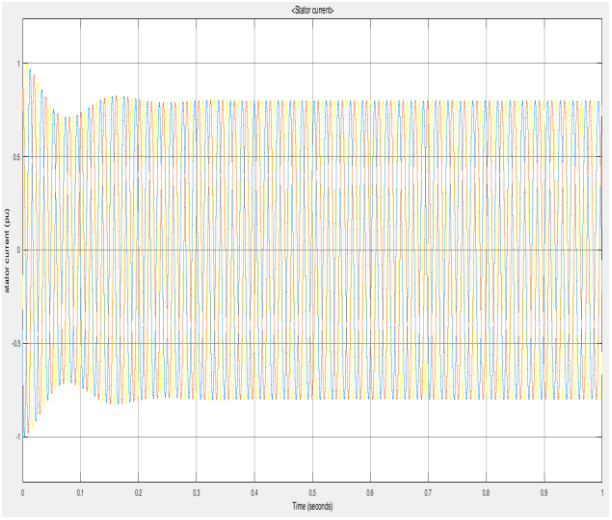

Figure 6. Simulation Results of Stator Current for Phase a, b and c of Generator $G_1$and G_2

(ii) Simulation Results of Generator (G_1 and G_2)

By this simulation, the transient condition of synchronous generator. In this section, the simulation result of Phase Voltage (V) and Phase currents,RMS voltage (V) and RMS currents, and Real power and Reactive power of G_1 and G_2 as shown in following figure.

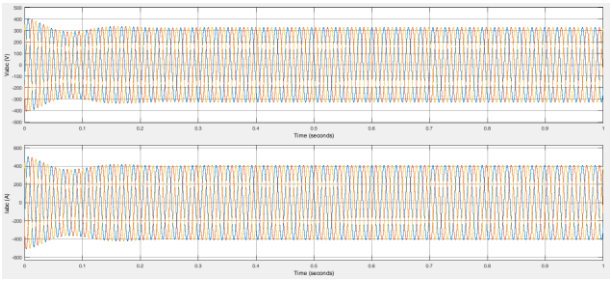

Figure7.Simulation result of Phase Voltages (V) and Phase Currents of Generator G_1 andG_2

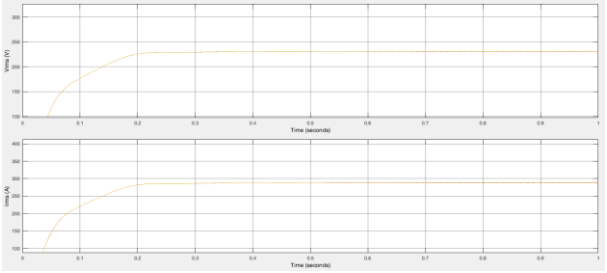

Figure.8.Simulation result of RMS voltages (V) and RMS currents of Generator $G_1$and G_2

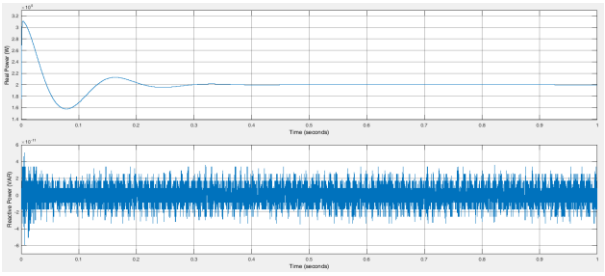

Figure.9.Simulation Result of Real Power and Reactive Power of Generator $G_1$and G_2

(iii) Simulation Results of Load

In this section, the simulation result of the mini-hydropower system with synchronous generator designed (400 kW) for three phase load. All simulation results of mini-hydropower system can be seen in below figures.

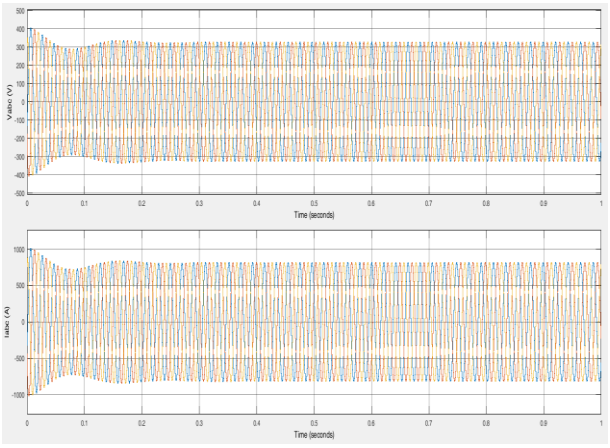

Figure10. Simulation result of Phase a,b,c voltage (V) and Phase a,b,c current of Load

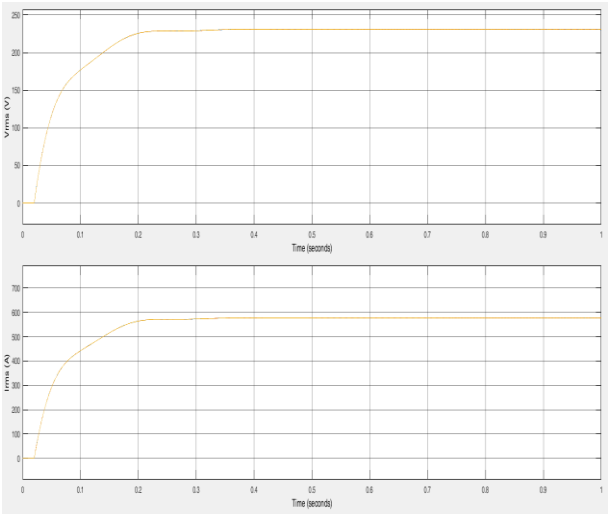

Figure.11. Simulation result of RMS voltage (V) and RMS currents of Load

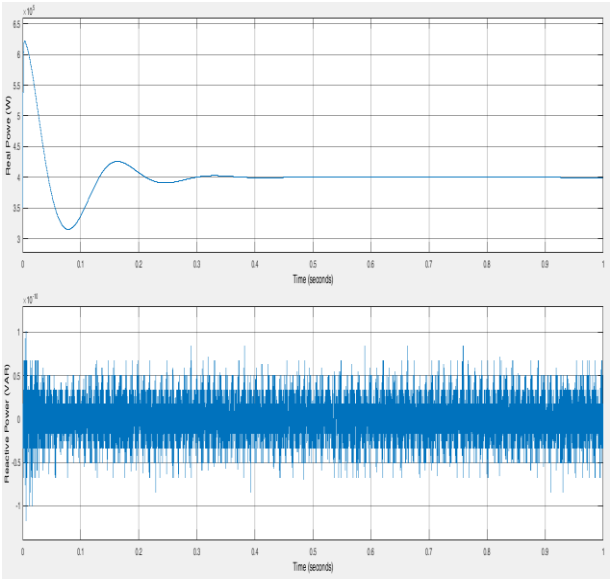

Figure112. Simulation result of Real Power (W) and Reactive Power (VAR) of Load

8. CONCLUSION

In this paper, detail generator design data, simulation model for designed system , simulation result and turbine selection are presented. According to selected case, condition propeller turbine is selected. The generator input is 250 kW and the efficiency of the generator is 96.5%,it is satisfactory for 250 kW generator size. And then, the overall model and results of mini hydro power system are analyzed by Matlab.

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REFERENCES

[1] Adam Harvey,"MICRO-HYDRO DESIGN MANUAL", a guide to small-scale water power schemes,by . with Andy Brown,1993 Priyantha Hettiarachi and AllenInversin.

[2] Mittle, V.N, and Mittal, A.: Design of Electrical Machines, 4th .ed.1996, Delhi: Standard Publishers Distributors.

[3] European Small Hydropower Association..How to Develop a Small Hydro Site.2000,Layman's Guidbook.

[4] Agarwal, R.K.: Principle of Electrical Machine Design, 4^{t} .ed. Delhi:2000, Standard Publishers Distributors.
[5] Guilherme A. Caxaria, 'Small scal hydropower: generato analysis and optimization for water supply systems',2011,Linkoping Sweden.
[6] "Minstry of Irrigation and Water Utilization Management Department'2017Hand Book.
[7] Prof.Q.H.Nagpurwala, 'Design of Hydralic Turbine

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Comparison for Loss and Cost Reduction in Power System Distribution by Utilization of Larger Conductor Size and Voltage Upgrading

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Abstract: The reduction of distribution line losses and costs reduction is one of the most important sections in electrical power distribution system. Throughout the world, electrical power are becoming as one of the need in the growth of any country and as the area spreading of power increasing day by day the losses occurred transmission and distribution of power from generating station to consumer consumption location also increasing. Due to the distribution system line losses, the consumer cannot use the fully electrical power energy. So, now a days every one also thinking and focusing on the elimination of both kind of constant and variable losses and competition for reducing losses in transmission and distribution lines is being introduced to increase efficiency of the electric power in the industries. In the transmission and distribution of electrical power there are many different types of losses which takes place during the transmission and distribution of electrical power some of them are taken as constant and some are variable losses and the value of variable losses can be increase or decrease as per the handling or maintenance of transmission and distribution system. The main aim is to identify all the losses in the transmission and distribution system. Distribution power losses can be divided in two groups. These are technical losses and non-technical losses. To reduce these losses, can be used different types losses reduction techniques. In this journal, the distribution losses are reduced by using voltage upgrading method and changing the larger conductor size. So, the distribution losses are reduced half of the existing system and cost of lost can be saved for annual in millions kyats.

Keywords: power distribution system, losses reduction, cost saving, voltage upgrading, larger conductor size

1. INTRODUCTION

Electrical distribution systems are an essential part of electrical system. In order to transfer electrical power from an alternating current or direct current source to the place where it will be used, some type of distribution network must be utilized. However, the method used to distribute power from where it is produce to where it is used can be quite simple. More complex power distribution systems are used, however, to transfer electrical power plant to industries, homes, and commercial building [2]. Electric power distribution is the portion of the power delivery infrastructure that takes the electricity from the highly meshed, high-voltage transmission circuits and delivers it to customers. Primary distribution lines are “medium-voltage” circuit, normally thought of as 600 V to 35 kV. At the distribution substation, a substation transformer takes the incoming transmission level voltage (35 to 230 kV) and step it down to several distribution primary circuit, which fan out from the substation. Close to each end user, a distribution transformer takes the primary distribution voltage and step it down to a low-voltage secondary circuit, commonly 400/230 V [3]. The distribution segment continues to carry electricity from the point where transmission leaves off, that is, at the 66/33 kV level. The standard voltages on the distribution side are therefore 66 kV, 33 kV, 22 kV, 11 kV and 400/230 volts, besides 6.6 kV, 3.3 kV and 2.2 kV. Depending upon the quantum of power and the distance involved, lines of appropriate voltages are laid [1]. Since distribution systems account for up to 90% of all losses reduction problems, improving loss reduction of distribution system is the key to improving system stability. To make effective improvements, a basic understanding of distribution system functions, subsystems, equipment, and operation is required. The main distribution equipment comprises HT and LT lines, transformers, substation, switchgears, capacitors, conductors and meters. Distribution systems consist of distribution substations, primary distribution systems, distribution transformers, and secondary distribution systems [4].

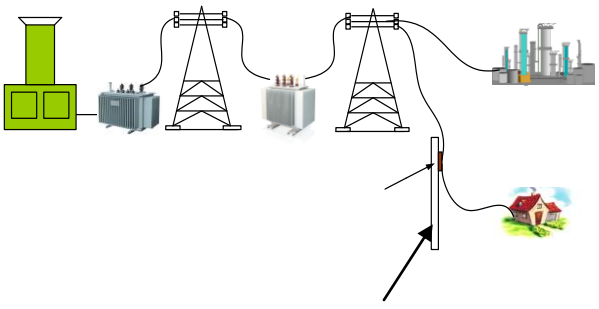

Figure.1 Electrical Power Distribution Network

The distribution of electrical power in Myanmar is normally in the form of alternating current (AC) and constant frequency of 50-Hz.The three-phase power is generally used for commercial and industrial factory. The single-phase power is used for residential such as small appliances and residential

equipment. The Figure.1 illustrates the electrical power distribution system. Normally, power system is transferred electric power to customers along transmission and distribution lines without power losses and heating equipment. However, 20% of the total electrical energy is lost between generators and consumers and most of these losses occur in the distribution system.

2. LOSSES IN DISTRIBUTION SYSTEM

The key role of an electrical distribution system is to deliver electricity to specific client sites. Distribution of electric power to various clients is completed with much minimum voltage point. The distribution of electric power from bases to the end levels is complemented with power losses at all times. Power losses arise in distribution systems due to Joule's effect which can calculation for as much as 13% of the produced energy. Such major quantity of losses has a straight effect on the economic subjects and the total efficacy of supply utilities [5]. Distribution power losses can be shared into two

1. Technical losses.
2. Non-technical losses

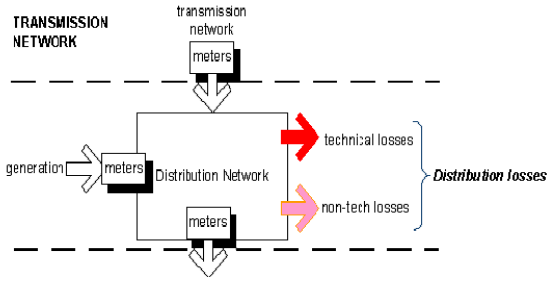

Figure.2 Losses in Distribution System

3. LOSS REDUCTION TECHNIQUES

In recent year, these has been a continuous need to accommodate higher loads and overcome delays in the construction of new generating facilities arising from environmental concerns and higher investment costs. Various losses arise in the power system foe overload conditions and voltage drop. There are three basic methods to reduce system losses in the distribution system. Among various loss reduction techniques in distribution system, the most common losses reduction techniques are:

1. Demand Side Management,
2. Distribution transformer Load Management,
3. Reconfiguration,
4. Capacitors Installation,
5. Reconductoring and
6. Voltage Upgrading.

Generally, loss reduction techniques on the transmission network are not as effective as those on the distribution network. Hence, this thesis focuses only on the reduction of power losses and voltage profile to improve in distribution networks. In the end, this study introduces an optimization technique based on exhaustive method for voltage upgrading and reconductoring method to reduce the network losses to minimum. Simulated results are drawn to show the accuracy of the technique. Generally, loss reduction techniques on the transmission network are not as effective as those on the distribution network. Hence, this thesis focuses only on the reduction of power losses and voltage profile to improve in distribution networks. In the end, this study introduces an optimization technique based on exhaustive method for voltage upgrading and reconductoring method to reduce the network losses to minimum. Simulated results are drawn to show the accuracy of the technique.

3.1 Demand Side method

The effectiveness of the demand side management program depends on the participation of the customer. Using certain household appliances at off-peak times may not be convenient for some customers. Furthermore, the producers of electricity are likely to only have a kWh rate and on kW rate for the demand. The municipal utilities have recently experienced a lowered demand charge. So, from the economic savings perspective, there is less motivation for the promotion of demand side management programs.

3.2 Distribution Transformer Load Management

Distribution transformer load management involves balancing the load between phases and resizing over-and under-utilized transformers to reduce losses. Ideally, phase currents and voltage of all distribution transformers would need to be monitored in order to practice distribution transformer load management properly. However, for most utilities, such measurements are only available at the substation level. To monitor every pole and pad mounted transformer downstream from the substation would prove to be costly. At the very least, distribution transformer load management can be practiced at the planning stages of a distribution system by sizing transformers for maximum energy efficiency.

3.3 Reconfiguration

Network reconfiguration is a process of changing the topological structures of distribution feeders by changing the opened or closed of the sectionalizing and tie switches. Most electric distribution systems are normally operated radically; however, there are usually several interconnecting tie switches available, especially on the underground medium voltage (6 to 35kV) networks. An effective reconfiguration strategy takes advantages of the large degree of load diversity that exist on some distribution systems. With the introduction of remote control of switches, online configuration management becomes an important part of distribution automation. As the operating condition change, the network is reconfigured for two purposes:

1. To reduce the system energy losses and
2. To relieve the overloads in the network.

It will refer to the first problem as network reconfiguration for loss reduction and to the second as reconfiguration for load balancing [6].

The advantages of system reconfiguration are:

1. High quality of supply,
2. Considerable reduction in line losses and consequent saving in energy cost and
3. Power can be supply to additional loads without any further investment on infrastructure.

The disadvantage of system reconfiguration

1. Involve approximation and
2. Exact switching is essential for effectiveness

3.4 Capacitor Installation

Capacitors are extensively used in distribution system s one solution to reactive power compensation, power loss reduction

and voltage regulation problems. For capacitor placement general considerations are:

1. The number and location,
2. Type (fixed or switched) and
3. The size.

Capacitor banks can be the series or parallel combinations. They can be installed in distribution system or in substations on different voltage levels. Distribution capacitor can be pole mounted or pad mounted. The optimal placement of the capacitor is 2/3 of the distance from the substation to the end of the line [7].

The advantages of reactive power compensation are:

1. Improve voltage stability,
2. Simple in construction,
3. Reduces line losses,
4. Frees up feeder capacity and
5. Lower cost.

The disadvantages of Reactive Power Compensation are:

1. Compensator Cost,
2. In case of fixed VAR compensator, correct switching is necessary according to load condition,
3. More difficult to control reliably and
4. Size and placement important.

3.5 Network Reconductoring

Network reconductoring is the technique in present conductor on the feeder is replaced by conductor of optimum size for optimum dimension of feeder. This technique is used when present conductor is no more optimum because of quick growth of load. This technique is good for the emerging nations where annual account growing rates are great and the conductor is selected to reduce the preliminary financial investment. Moreover, feeder upgrade with heavier conductor can only be economically justified for older networks that are operating close to their design capacity.

3.6 Voltage Upgrading

This technique is most effective and efficient in minimizing the technical losses and refining the power quality in distribution system. In this technique, transformation of previous Low Voltage Distribution System to High Voltage Distribution System is done. This technique aims at extending high voltage lines as nearer to the load as possible and replacing large transformer with various small rating transformers. By using high this method, we can reduce the losses as current is low in high voltage system. By increasing the primary distribution system voltage, the same amount of power can be delivered at lower currents, thus lowering losses. In the past decade, many utilities have upgraded their primary distribution system voltage. As result of a recent voltage conversion, the utility estimates much of savings for each year [8]. Voltage upgrading is one of the system reconfiguration techniques. Voltage level improvement for the distribution system depends on many factors:

1. Maximum power demand (i.e., maximum load current),
2. Voltage profile during normal operating conditions and large motor starting,
3. Maximum fault current,
4. Power losses and
5. Capital cost [9].

4. RESULT AND DISCUSSION

In this section the results obtained from the simulation model by substituting the data. There are four conditions for comparison of loss reduction and cost optimizing.

4.1 Studies on Existing System

Table 1. Line Data of Kyauktan Distribution System

Feeder Name	Type	Line Length (km)	Conductor size (mm^2)	Total Connected Load	Primary Voltage (kV)
Pu Zune Kan	ACSR	31.76	70	6.28	6.6
Outside of the Township	ACSR	15.76	95	7.88	6.6
Inside of the Township	ACSR	5.61	95	5.53	6.6

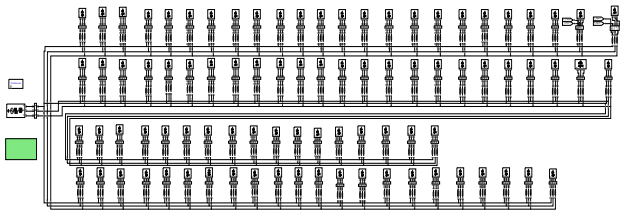

Figure 3 Simulation Model for Kyauktan Distribution System

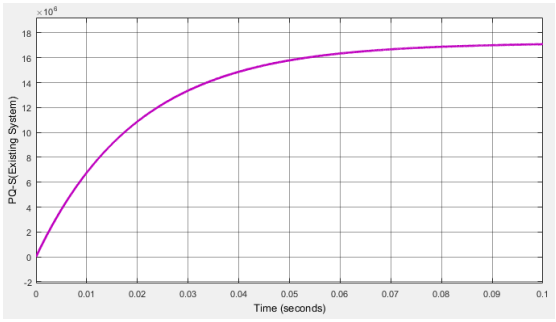

Figure .4 Simulation Result for PQ-S of Existing System

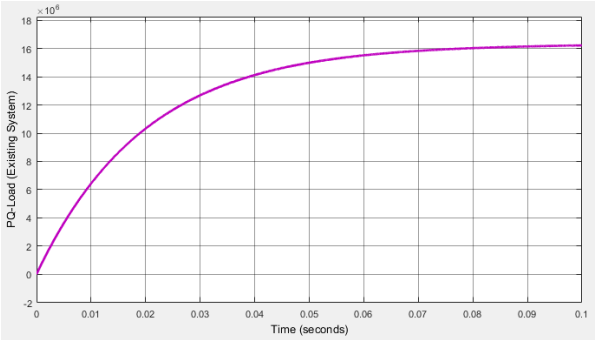

Figure .5 Simulation Result for PQ-Load of Existing System

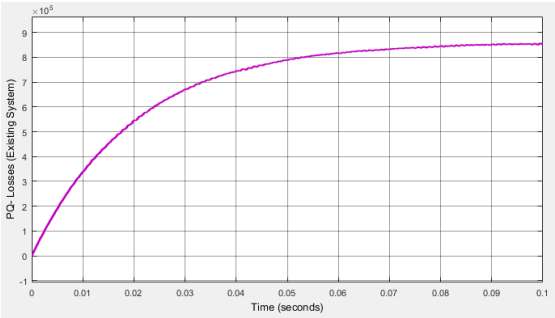

Figure .6 Simulation Result for PQ-Losses of Existng System

4.2 Losses Reduction by Using Voltage Upgrading Method

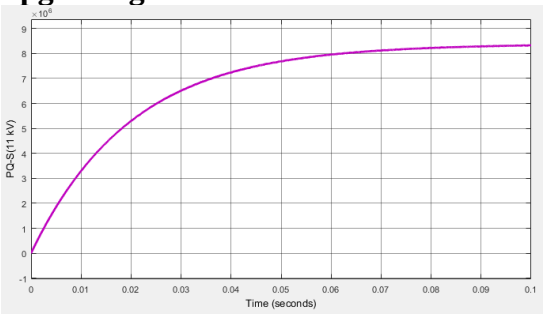

Figure .7 Simulation Result for PQ-S of 11-kV System

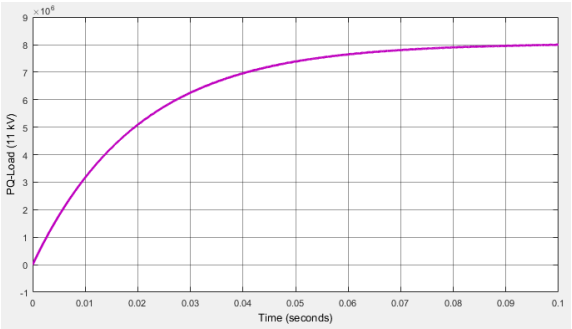

Figure .8 Simulation Result for PQ-Load of 11-kV System

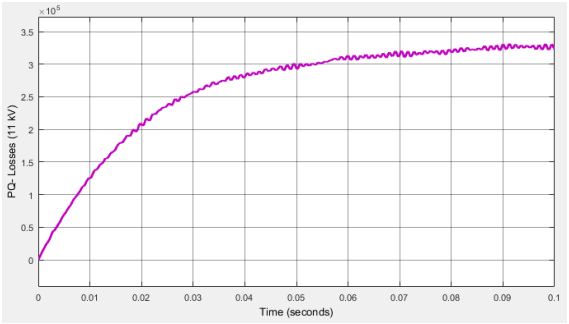

Figure .9 Simulation Result for PQ-Losses of 11-kV System

4.3 Losses Reduction by Using Larger Conductor Size

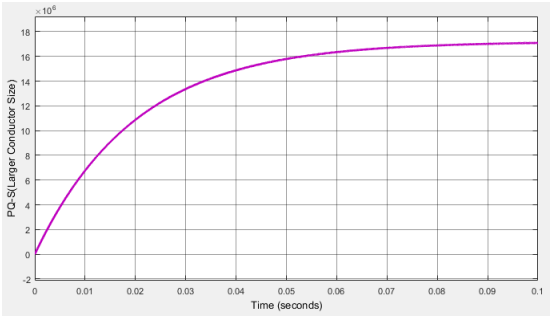

Figure .10 Simulation Result for PQ-S by Using Larger Conductor Size

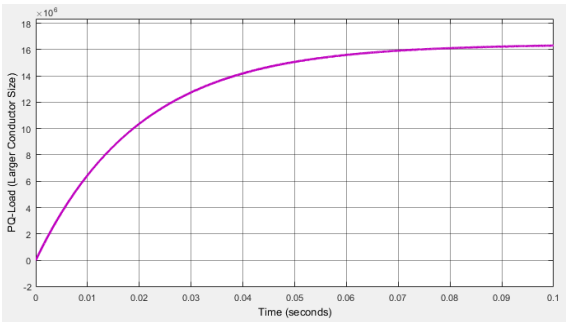

Figure .11 Simulation Result forPQ-Load by Using Larger Conductor Size

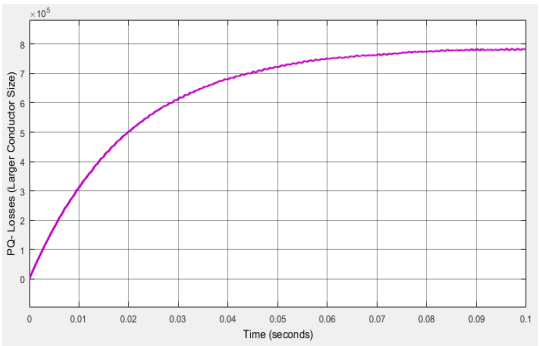

Figure .12 Simulation Result for PQ-Losses By Using Larger Conductor Size

4.4 Losses Reduction by Using Larger Conductor Size with 11-kV

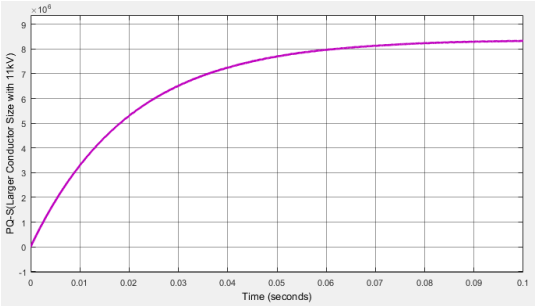

Figure .13 Simulation result for PQ-S by Using Larger Conductor Size with 11-kV

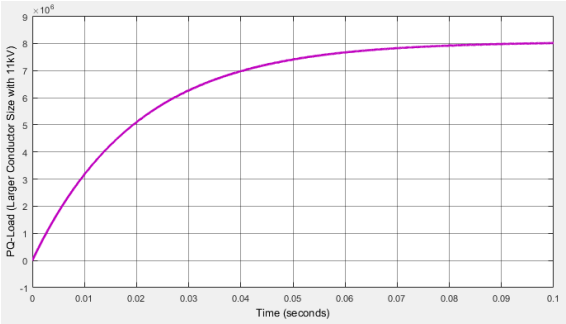

Figure.14 Simulation result for PQ-Load by Using Larger Conductor Size with 11-kV

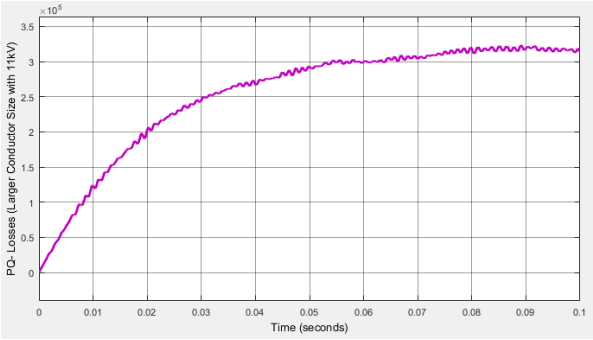

Figure.15 Simulation result for PQ-Losses by Using Larger Conductor Size with 11-kV

4.5 Comparison for the result of Losses Reduction

Table 2. Comparison for the result of Loss Reduction

	Existing System	Voltage Upgrading (11-kV System)	Larger conductor Size	Larger Conductor Size with 11-kV
Source(MW)	17.08	8.32	17.1	8.325
Load (MW)	16.2	8.00	16.3	8.01
Loss (MW)	0.852	0.325	0.782	0.317
Loss (%)	5.26	4.06	4.79	3.96

According to the simulation result, using the larger conductor size with 11-kV is the best result for loss reduction and only the voltage upgrading is nearly the best result. So, choosing only the voltage upgrading method for loss reduction is the best.

4.6 Comparison for the Result of Annual Cost Saving

Table 3. Comparison for the result of Annual Cost saving

	Existing System	Voltage Upgrading(11-kV System	Using Larger Conduct -or Size	Using Larger Conductor Size with 11-kV
Loss (MW)	0.852	0.325	0.782	0.317
Cost of loss for each hour(MMK)	29820	11375	27370	11095
Cost of loss per day (MMK)	715680	273000	656880	266280
Cost of loss per annual(MMK in millions)	261.22	99.64	239.76	97.19
Cost of saving Compared to Existing System(MMK in millions)	0	161.58	21.64	164.03

According to the simulation result, when losses are reduced, it is equivalent to a reduction in demand. Evaluation of cost of losses in power distribution system will provide energy cost of saving for annual. The improvement of voltage will provide cost saving for annual more than the using of larger conductor size but the using of larger conductor size with 11-kV will provide cost saving for annual is nearly the improvement of voltage upgrading. So, only the voltage upgrading method for cost saving for annual is the best.

5. CONCLUSION

In Kyauktan Township, the distribution loss% of the power distribution utilities is very high. The power utilities are facing power shortage, huge amount of losses in millions of cores, poor and unreliable power etc. Power system losses comprises of technical losses, non-technical losses & revenue losses. The reasons for the technical losses are lack of inadequate distribution capacity, too many transformation stages, improper load distribution and extensive rural electrification etc. For the proper and accurate measurement of power losses in the power distribution utilities, we have to identify and found different power losses like technical and non-technical losses. This is the today's need of our developing country is more important where total distribution loss % are high. The power distribution utilities should estimate the losses where the data for computing the technical and non-technical losses are generally not available. In this

paper, three loss reduction scenarios are presented as voltage upgrading, using larger conductor size and combination of these. Results are also shown from loss and cost saving point of views. Applying the methods presented in this paper, the losses in the practical distribution system can really be reduced.

6. ACKNOWLEDGMENTS

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7. REFERENCES

[1] Priya Kant Bansal. 2009. Maximum Loss Reduction by Optimal Placement of Capacitor on Radial Distribution System, Patiala-147004.

[2] Tom Short. 2004. Electric Power Distribution Handbook, Boca Raton, New York Washington, D.C, London.

[3] Moses Peter Musau. 2003. Transmission and Distribution in India, report initiative of WEC-IMC and Power Grid Corporation, India.

[4] Harlow, J. H. 2004. Electrical Power Transformer Engineering, (The Electric Power Engineering Series ; 9), India.

[5] Kour, Gurpreet, and R. K. Sharma. "Different Technique of Loss minimization in Distribution system." (2013).

[6] Vivekananda Haldar. 2004-2005. “Power Loss Minimization by Optimal Capacitor Allocation and Network Reconfiguration using Modified Cultural Algorithm” . M.Sc. Thesis, Jadavpur University (Salt Lake Campus), India.

[7] Jovitha Jerome. 2004. Distribution Network Reconfiguration and Reactive Power Compensation, P.O Box 22, Thammasat-Rangsit Post Office, Pathunithani 12121, Thailand.

[8] Anomymous. 2009. Photovoltaic Systems Interconnected onto Secondary Network Distribution System, Success Stories, Technical Report, NREL/TP-550-45061, London.

[9] Mohamad izwan Bin Hussien.June 2012, “ Distribution System Reconfiguration for Loss Reduction”, Bachelor of Engineering. Project Paper, University of Technology Malaysia.

[10] S. Kirkpatrick, C. D. Gelatt Jr., and M. P. Vecchi, “Optimization bySimulated Annealing”, IBM Research Report RC 9355, 1982.

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Normal and Whispered Speech Recognition Systems for Myanmar Digits

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Abstract: Nowadays, Automatic speech recognition (ASR) technology comes as the popular innovation in human machine interaction. This technology allows a computer to recognize the spoken words and convert them to text data. In designing the computer systems that recognize spoken words, one of the challenging tasks is to be recognized spoken Myanmar digits. In this paper we focus on recognizing Myanmar digits spoken by normal voice and whispered voice. Myanmar digits recognition system for both types has been developed by using Hidden Markov Model in HTK tools and Mel Frequency Cepstral Coefficients (MFCC) technique has been used to convert the speech waveform into a set of feature vectors for recognizing the vocalization of a word. In our experiments, HMM-based acoustic and language models are used to evaluate the performance of speech recognizer for both speaker dependent and speaker independent. According to the experimental results, the performance of speaker dependent speech recognition system for normal voice and whispered voice are 90% and 88.7% respectively. The performance of speaker independent speech recognition system for normal voice and whispered voice are 67.3% and 65.7% respectively. We found that the performance of both type of speaker dependent is higher than those of speaker independent.
Keywords: Automatic Speech Recognition, Hidden Markov Model, HTK tools, MFCC, Dependent and Independent Speakers

1. INTRODUCTION

Spoken language is used to communicate information from a speaker to a listener. Thus, speech is a communication method among people. In our daily life, we communicate each other for doing our work via a telephone or using various applications on internet. Moreover, in machine interaction system human can communicate machine and vice vasa. To communicate between machine and human, we need to train the machine to know what we say. Nowadays, ASR technology is emergence in a lot of applications and services in our daily life such as banking system, telephone system, and web-based application system. ASR is a technology that recognizes the spoken words. ASR technology is not yet the ultimate goal that is to allow a computer to recognize in real-time, with 100% accuracy, all words that are intelligibly spoken by any person, independent of vocabulary size, noise, speaker characteristics or accent. In developed countries, ASR for different languages have been developed by many researchers using different approaches of methods [3]. There is a few researcher to develop the ASR system for Myanmar language and there are some papers which showed auspicious accuracy results. Myanmar ASR system is still in research and the existing work are not far-reaching adequate. The main aim of this paper is to train and test a Myanmar speech recognition system which can recognize the speech signals of isolated digits of Myanmar language, in Linux environment using HTK and MFCC as the feature extraction method and self-recorded database for speaker dependent and independent approach. To build the self-recorded database, we collect the voice data from six persons, five female and one male, for 10 digits spoken by two types of voice: normal voice and whispered voice. 10 sample files for each digit are recorded from them. Thus we collect 1200 files for both voice type. In speech recognition system, there are three speech recognition systems, speaker dependent system, speaker independent system, and speaker adaptive system. The speaker dependent systems are trained and learnt based on a single speaker and can recognize the speech of that trained one speaker. The speaker independent systems can recognize any speaker. Thus these systems are more flexible than the speaker dependent systems, but difficult to develop and get the better accuracy than speaker dependent systems. According to the characteristics of new speakers, the processes of speech recognition system are adapted to become a speaker adaptive system. In this paper, we study and evaluate the performance of speaker dependent and independent systems. There are two types of speech recognition system: continuous speech recognition system, and isolated-word speech recognition system. An isolated-word recognition system performs single words at a time – requiring a pause between saying each word. A continuous speech system recognizes on speech in which words are connected together, i.e. not separated by pause. In this study, we develop the isolated-word recognition system especially for Myanmar digit.

The remaining sections of this paper are organized as follows. Section 2 discusses the related works of the speed recognition systems that have been developed by many researchers using different approaches of methods. Hidden Markov Model (HMM) and MFCC used in this research are described in Section 3. Section 4 presents the overview of speech recognition system and how to build the acoustic model for Myanmar digit speech recognition system. Section 5 describes the experimental results of our system. In section 6, we describe the conclusion of our experimental results.

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2. LITERATURE REVIEW

In many countries, speech recognizers for their languages have been developed by many researchers using different approaches and methods. In Myanmar, some researcher has studied and investigated to build a speech recognizer for Myanmar language. But this system does not completely finish to cover 100% accuracy. In this section, we describe some researcher's works that are relevant with our study.

Shaikh Naziya et al. presented the speech recognition system for Urdu digits and they used Linear Predictive Coding (LPC) and Hidden Markov Model (HMM) techniques to analyze the performance of Speech Recognition System for Urdu Digits [4]. They developed the digit corpus for Urdu language and collected Urdu digits spoken by 50 native speakers that contain 50% female and 50% male speakers whose age is above 18 years to develop this corpus. Three utterances are taken from each person and two utterances were used for training phase and one utterance was used for testing. Their performance accuracy is 74% for zero to nine (0-9) digits and when they tested six and nine, they got 100% performance accuracy for them.

P. Prithvi et al. analyzed the recognition rate of English digits ("one" to "ten") in noisy environment and speaker independent recognition system [2]. In this paper, they used Hidden Markov Models is one of the best pattern recognition approaches. In their previous paper, they presented the recognition rate 67% for speaker independent in noisy environment. In this paper they used hybridized model of Vector quantization and Hidden Markov Model to improve the recognition rate. Their experimental results also show the improvement in recognition rate is up to 81.8 % in noisy environment for speaker independent.

MarutiLimkar et al. proposed an approach to recognize spoken English digits zero to nine in an isolated way by different male and female speakers. To accomplish the recognition system, they used the endpoint detection, framing, normalization, Mel Frequency Cepstral Coefficient (MFCC) and DTW algorithm are used to process speech samples and implemented the algorithm to test on speech samples [1]. Their system can recognize the recorded isolated word English digits, that is 'one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight' and 'nine'. Their algorithm's recognition rates are 80.0% for zero, 95% for one, 80% for two, 100% for three, 90% for four, 100% for five, 80% for six, 100% for seven, 100% for eight and 80% for nine. According to their experimental results the average accuracy test is about 90.5%.

Shabnam Ghaffarzadegan et al. proposed the model and feature based strategies for automatic whispered speech recognition. Their goal is to compensate for the mismatch between neutral-trained recognizer models and parameters of whispered speech and to avoid the degrading performance of speech recognizer [5]. They used Vector Taylor Series (VTS) algorithm to produce a pseudo-whisper generation from neutral speech samples for efficient acoustic model adaptation. In this study they analyzed the efficiency of frequency-based spectral transformations vocal tract length normalization (VTLN) and Shift for whisper speech recognition and proposed a novel approach to pseudo-whisper generation for acoustic model adaptation, requiring only a small amount of whisper samples. It was found that both the spectral transformations and the VTS approach can considerably improve the recognition performance and also perform well when combined together. They described VTS approach can give the better performance only we have small amount of whisper samples.

In this paper, we emphasize to build the Myanmar digit speech recognition system for two types of speech: whispered speech and normal speech and compare their recognition accuracy rates. In future, when we build ASR for Myanmar language, the results acquired from this experiment can be applied in adaptation of ASR to get the better accuracy of recognition system for Myanmar language. The following section shows the methods used in Myanmar digit speech recognition system.

3. METHODS USED IN SPEECH RECOGNITION SYSTEM

In this section we describe the methods used in speech recognition system and these methods can be used to extract the feature from voice signal and build the acoustic model. There are many different techniques to extract the voice feature such as Linear Predictive Coding (LPC), Perceptual Linear Predictive Analysis (PLP) and Mel-Frequency Cepstral Coefficients (MFCC). In this research we use MFCC feature extraction method. To do the speech recognition process, we need to create acoustic model, language model and a pronunciation dictionary that is used to match the speech signal. To create these models we use Hidden Markov Model (HMM) toolkit (HTK) and HMM can hold the statistical representations for phoneme. The following subsections describe the MFCC feature extraction method, HMM and HTK.

3.1 Mel-Frequency Cepstral Coefficients (MFCC)

In 1980's, Davis and Mermelstein introduced Mel Frequency Cepstral Coefficents (MFCCs) which are the main feature type for automatic speech recognition (ASR). Features extraction is to identity the shape of vocal tract in the audio signal. The shape of the vocal tract establishes itself in the envelope of the short time power spectrum, and the work of MFCCs is to exactly characterize this envelope. The characteristics of speech between linearly at low frequencies and logarithmically at high frequencies are captured as the important feature. Each tone in speech has been defined with frequency f (Hz) and a subjective pitch (Mel scale) for describing as a feature. Power spectrum based on the center frequency and bandwidth is used to calculate the cepstral coefficients. MFCCs are commonly used as features in speech recognition systems. The following equation is used for converting the Mel-frequency (m).

$$m=2595\log 10\ (1+\frac{f}{700}) \qquad \text{Equation (1)}$$

3.2 Hidden Markov Model (HMM)

Many scientific and engineering applications can be represented as mathematics to implement these applications in computer. In speech recognition systems, we use HMM that applies the probability theory in mathematics to recognize the speech signal. In this system, the speech signal message is coded as a sequence of one or more symbols as shown in Figure 1 [7]. To recognize the symbol sequence specified a spoken utterance, firstly we need to convert the

continuous speech waveform to a sequence of equally spaced (10ms) discrete parameter vectors. The parameter vectors represent the speech waveform. Thus, the work of speech recognizer is the mapping between sequences of speech vectors and the sequences of symbols.

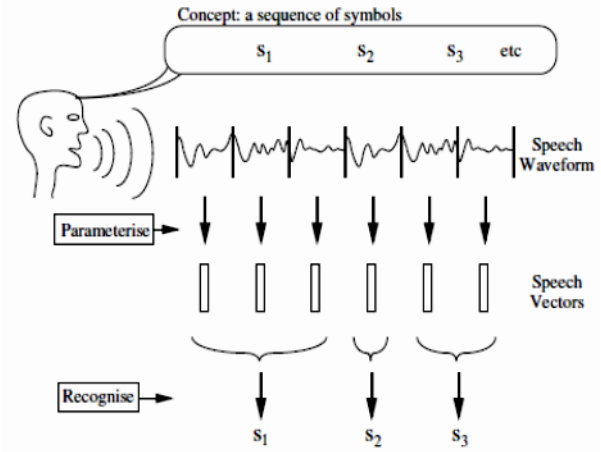

Figure 1. Message Encoding/Decoding

Each spoken word can be represented by a sequence of speech vectors or observations Ot (observed at time t) and the vocabulary word is represented by wi (i'th vocabulary word). In HMM based speech recognition, the sequence of observed speech vectors corresponding to each word is generated by a Markov model as shown in Figure 2 [7]. A Markov model is a finite state machine which changes state once every time unit and each time t that a state j is entered, a speech vector Ot is generated from the probability density bj(Ot). Furthermore, the transition from state i to state j is also probabilistic and is governed by the discrete probability aij.

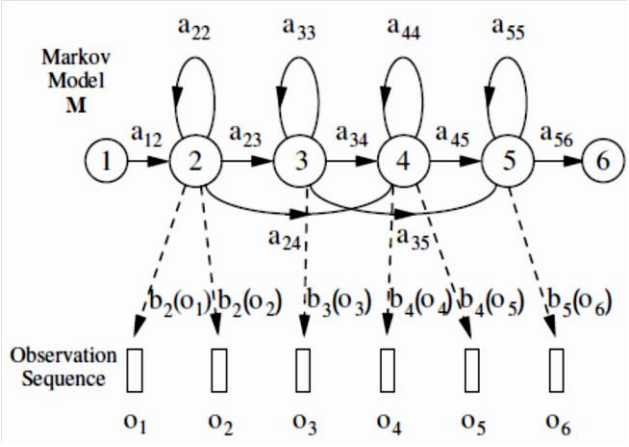

Figure 2. The Markov Generation Model

The following equations (Equation 2 and 3) are used to calculate the values of probability required in Hidden Markov Model. In this HMM, the state sequence X is hidden and observation O is known value so it is called Hidden Markov Model.

$$P(w_i|O) = \frac{P(O|w_i)P(w_i)}{P(O)} \qquad \text{Equation (2)}$$

$$P(O,X|M) = a_{12}b_2(O1)a_{22}b_2(O_2)a_{23}b_3(O_3)... \qquad \text{Equation (3)}$$

3.3 Hidden Markov Model (HMM) Toolkit

Cambridge University Engineering Department (CUED) developed the Hidden Markov Model (HMM) Toolkit that is a HMM-based speech recognition tool for modelling time series. This toolkit can support to build and manipulate Hidden Markov Models (HMMs) and contains many library modules and tools that can be used not only in speech recognition research but also in a lot of potential applications such as speech synthesis, character recognition and DNA sequencing. HTK training tools can be used in estimating the parameters of a set of HMMs based on training utterances and their associated transcriptions. HTK recognition tools can be used to recognize the unknown utterances. Figure 3 shows the software architecture of Hidden Markov Model Toolkit [7].

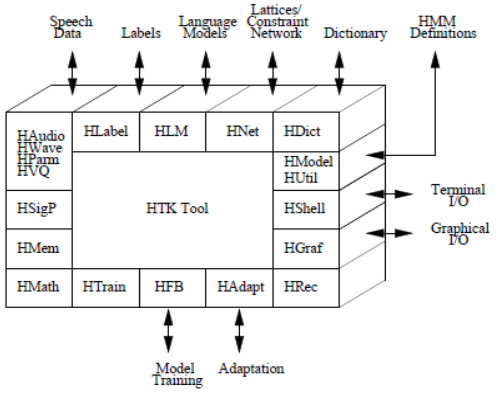

Figure 3. Software Architecture of HMM

In this architecture, there are many library modules such as HShell, HMem, HMath, HSigP, HLabel, HLM, HNet, HDict, HVQ and HModel. HShell controls the interaction between the user input/output and operating system. HMen manages the usage of memory. HMath supports the operations based on mathematics and HSigP supports the required operations in signal processing for analyzing the speech. HLabel provides the interface for label files, HLM for language model files, HNet for networks and lattices, HDict for dictionaries, HVQ for VQ codebooks and HModel for HMM definitions.

4. MYANMAR DIGITS SPEECH RECOGNITION SYSTEM

Myanmar digits speech recognition system is built to recognize the speech signals of isolated Myanmar digits. This system is run and tested in Linux environment using HTK toolkit. To implement this system, we recorded the two types of voice such as normal voice and whispered voice from six persons, five female and one male and 10 sample files for each digit with each type are recorded from them to build the self-recorded database that contains 1200 files for training and testing the Myanmar digits speech recognition system.

Figure 4 shows the overall diagram of Myanmar Digit Speech Recognition System. In Myanmar Digit Speech Recognition System, it contains four main phases: data preparation phase, training phase, testing phase and analysis phase. In data preparation phase, the set of speech data files and their associated transcriptions are required to build a set of HMMs. Thus, we use 1200 recorded speech data files and convert the

recorded voice data files (.wav) to (.ad) file with the help of SOX (Sound eXchange).

In this study we use MFCC to extract the features from speech data files. To accomplish the feature extraction process, we use the set of speech data files that are stored in speech folder and configuration file containing configuration parameters that are stored in script folder.

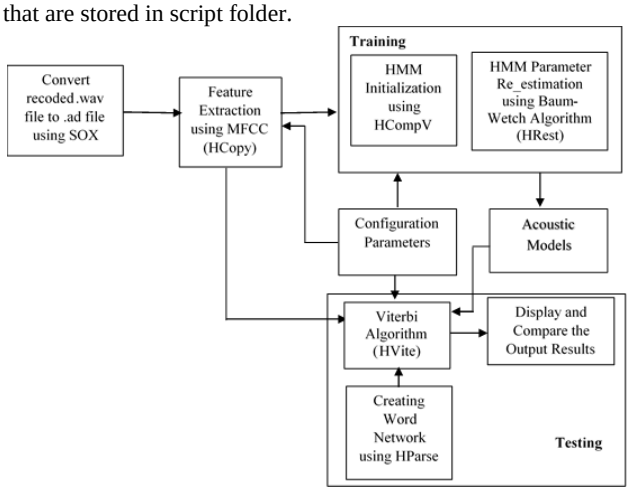

Figure 4. Myanmar Digit Speech Recognition System

We also need to write the script file that contains speech data files path (source folder) and destination folder path to store the feature files. This script file is shown in Figure 5. In data preparation phase, the tool HCopy is used to extract the features from speech data files by setting the appropriate configuration parameters. When HCopy is run all speech data files are converted to mfc files under the specified folder. In data preparation phase, the language model, dictionary and word network are needed to build. To accomplish them, the tool HParse can be used.

```
/root/speech/S0001.wav   /root/script/ train/S0001.mfc
/root/speech/S0002.wav   /root/ script//train/S0002.mfc
/root/ speech/S0003.wav  /root/script//train/S0003.mfc
/root/ speech/S0004.wav  /root/script/train/S0004.mfc
```

Figure 5. Script File Containing Speech Data Files Path

In training phase, two processes such as parameter initialization and parameter re-estimating processes are needed to perform. In first process, we need to define the HMM initialization parameters to create acoustic model for each digit. Thus, we use proto definitions to initialize HMM model for each digit. Proto definitions are shown in Figure 6. To train the speech data files, proto_8states, 25 vector size, 8x8 transitional matrix under <TRANSP> and some optional parameters are well-defined in HMM definition. Each state contains mean and variance initialize values.

In initialization process, the tool HCompV can be used to compute the global speech variance and mean values. This command is run with the script file containing the path of mfc files, the configure file containing appropriate configuration parameters and the proto definition file to produce the HMM files for each digit.

In second process, we need to re-estimate the parameters of speech by using Baum-Welch Algorithm. The tool HRest can be used to refine the parameters of existing HMMs using Baum-Welch Algorithm. HRest, a training tool, is used to produce the acoustic model for each digit.

```
<STREAMINFO> 1 25
<VECSIZE> 25 <NULLD><MFCC_E_D_N_Z> <DIAGC>
~h "proto_8states"
<BEGINHMM>
        <NUMSTATES> 8
        <STATE> 2
        <MEAN> 25
        <VARIANCE> 25
        <GCONST>
        <STATE> 3
        <MEAN> 25
        <VARIANCE> 25
        .
        .
        .
<TRANSP> 8
<ENDHMM>
```

Figure 6. Proto Definition for HMM 8_States

In testing phase, HVite, a recognition tool, is used to get the recognition results for each digit. When HVite is run, the configuration file, the language model, dictionary and word network are used to match with the trained data files produced in training phase. In analysis phase, we analyse the output results of testing phase. The following section discuss these output results.

5. EXPERIMENTAL RESULTS

In this experiment, two types of speech (Normal and whispered speech) data files are recorded from six persons for each digit. Thus, we get 1200 speech data files for both types. In this experiment, we test the four ways: normal speech for speaker dependent (NSSD), normal speech for speaker independent (NSNID), whispered speech for speaker dependent (WSSD), and whispered speech for speaker independent (WSSID). In testing and evaluation processes, 600 speech data files are used for each system. The following Table 1 shows the tested results for each digit and their correct percentages for each type.

Table 1. Experimental Results

Type	No. of File	No. of Correct for each digit										Tot	Correct (%)
		0	1	2	3	4	5	6	7	8	9		
NSSD	600	52	53	57	51	54	52	55	58	56	52	540	90
WSSD	600	54	51	53	46	54	51	57	53	60	53	532	88.7
NSSID	600	49	52	52	44	46	38	32	35	31	25	404	67.3
WSSID	600	50	46	38	32	30	31	43	40	52	32	394	65.7

According to the experimental results, the performance of speaker dependent speech recognition system for normal voice and whispered voice are 90% and 88.7% respectively. The performance of speaker independent speech recognition system for normal voice and whispered voice are 67.3% and 65.7% respectively. We

found that the performance of both type of speaker dependent is higher than those of speaker independent.

6. CONCLUSIONS

In this research, we use HTK toolkit that supports to build the speech recognizer for Myanmar digits. HTK supports both isolated whole word recognition and sub-word or phone based recognition. Many researcher also use it for the speech recognition research of various languages. According to the studied papers, MFCC and HMM techniques can give higher recognition rate than other methods [6]. In this experiment, we also use MFCC and HMM to recognize Myanmar digits. According to the experimental results, the recognition rates for normal and whispered voice speaker dependent are 90% and 88.7% respectively. The recognition rates of speaker independent system for normal voice and whispered voice are 67.3% and 65.7% respectively. As a conclusion, the performance of both type of speaker dependent is higher than those of speaker independent and the tested results are depend on the way of speaker's utterance. This experiment can be extended for the recognition of alphabets and words.

7. ACKNOWLEDGMENT

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8. REFERENCES

[1] MarutiLimkara, RamaRaob and VidyaSagvekarc, *Isolated Digit Recognition Using MFCC AND DTW*, International Journal on Advanced Electrical and Electronics Engineering, (IJAEEE), ISSN (Print): 2278-8948, Volume-1, Issue-1, 2012.

[2] P. Prithvi, Anil Kumar and Dr. T. Kishore Kumar, *Speaker Independent Speech Recognition of English Digits using Hybridized VQ-HMM Model in Noisy Environment*, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181 Vol. 3 Issue 4, April – 2014.

[3] Pooja Prajapati and Miral Patel, *A Survey on Isolated Word and Digit Recognition using Different Techniques*, International Journal of Computer Applications (0975 – 8887) Volume 161 – No 3, March 2017.

[4] Shaikh Naziya S. and R. R. Deshmukh, *LPC and HMM Performance Analysis for Speech Recognition Systemfor Urdu Digits*, IOSR Journal of Computer Engineering (IOSR-JCE) e-ISSN: 2278-0661, p-ISSN: 2278-8727, Volume 19, Issue 4, Ver. IV. (Jul.-Aug. 2017), PP 14-18.http://www.iosrjournals.org.

[5] Shabnam Ghaffarzadegan, Hynek Boril and John H. L. Hansen, "Model and Feature Based Compensation for Whispered Speech Recognition", Fifteenth annual Conference of the International Speech Communication Association, Singapore, September 2014.

[6] Vimala.C and Dr.V.Radha, *A Review on Speech Recognition Challenges and Approaches*, World of Computer Science and Information Technology Journal (WCSIT) ISSN: 2221-0741 Vol. 2, No. 1, 1-7, 2012.

[7] Steve Young, Gunnar Evermann, The HTK Book (for HTK Version 3.4) Available: http://htk.eng.cam.ac.uk/docs/docs.shtml.

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Design of Control Circuit, Power Circuit And Tap-Changing Circuit for Cycloconverter Fed Induction Motor Drive

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Abstract: A cycloconverter is a power electronic device used to convert constant voltage constant frequency AC power to adjustable voltage adjustable frequency AC power without a DC link. Among all the methods, the method controlled by cycloconverter, is simple, reliable and economical. The various speed of induction motor is obtained by varying the supply frequency using cycloconverter. A SCR controlled cycloconverter drive works on the principle of variable frequency drive, when the frequency is changed then the speed is also changed. The objective of this paper is to design control circuit, power circuit and tap-changer circuit for cycloconverter fed induction motor drive, using rectifier, Op- amps and SCR.

Keywords: cycloconverter, induction motor, control circuit, power circuit, tap-changer

1. INTRODUCTION

With the increasing motor loads for industrial applications the concept of energy saving has become vital. About 70% of the electrical loads are motor loads. Hence, the requirement of energy savings in electric drives is achieved through power electronic converters.

Variable frequency drives are mostly used for controlling either the torque or the speed of the AC motor. Applications such as pumps, centrifugal fan use the technique of variable frequency to achieve variable speed and variable torque. Variable frequency in AC drives can be achieved by inverter fed or cycloconverter fed drives. The advantage of cycloconverter over inverter fed drive is its single stage conversion.

This research project is designed to control the speed of a single phase induction motor by using cycloconvertor technique by traics. Induction motors in particular are very robust and therefore used in many domestic appliances such as washing machines, vacuum cleaners, water pumps, and used in industries as well. A.C. motors have the great advantages of being relatively inexpensive and very reliable. The induction motor is known as a constant-speed machine, the difficulty of varying its speed by a cost effective device is one of its main disadvantages. The speed of the motor can be varied in two ways, one is by changing the number of poles and the second method is by changing the frequency. The speed control through the first method is uneconomical and the number of poles can't be varied under running conditions and the size of the machine also becomes bulky. These problems can be overcome by the second method. In this method, the frequency can be varied under running conditions also and there is no change in the size of the motor. In this method, the frequency changing device is cycloconverter. A cycloconverter is a power electronic device used to convert constant voltage constant frequency AC power to adjustable voltage adjustable frequency AC power without a DC link. In among all the methods this method is simple, reliable and economical. A pair of slide switches is provided to select the desired speed range (f, f/2, f/3, f/4 and f/5) of operation of the induction motor. These switches are interfaced to the microcontroller. The microcontroller used for this project is from PIC18 family (PIC18F4550). The status of the switches enables the microcontroller to deliver the pulses to trigger the traic in a dual bridge. Thus, the speed of the induction motor can be achieved in five steps i.e. (f, f/2, f/3, f/4 and f/5).

2. CYCLOCONVERTER

Cycloconverters are the direct type converters used in high power applications for driving induction and synchronous motors. Cycloconverters are usually phase-controlled device. Cycloconverter is a device which converts the AC power at one frequency input to a AC power at different frequency output.

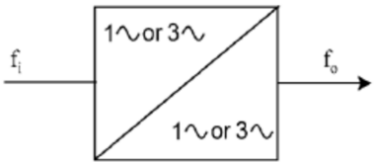

Figure. 1 Cycloconverter

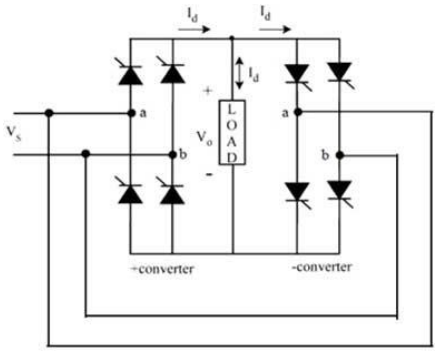

Figure. 2 Single-Phase to Single-Phase Cycloconverter

A cycloconverter is a type of power controller in which an alternating voltage at supply frequency is converted directly to an alternating voltage at load frequency without any intermediate DC stage. The cycloconverter also allows power to flow freely in either direction [3].

There are three types of cycloconverter: 1.Single Phase to Single phase cycloconverter. 2.Three Phase to Three Phase cycloconverter. 3.Single Phase to Three Phase cycloconverter

3. CYCLOCONVERTER FED INDUCTION MOTOR DRIVE

Cycloconverter is a power electronic circuit that converts fixed voltage fixed frequency input AC voltage to variable voltage variable frequency output AC. The output frequency may be greater than input frequency (step up cycloconverter) or the output frequency may be less than the input frequency (step down cycloconverter).

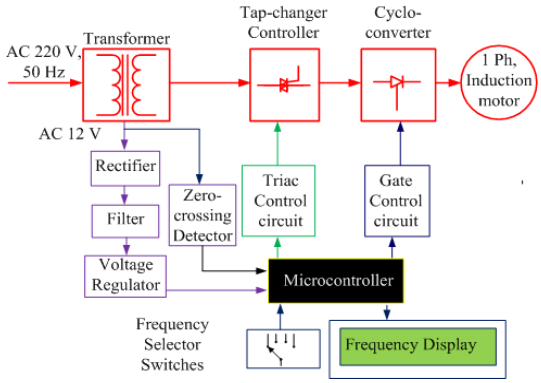

Figure. 3 Block Diagram of Proposed Cycloconverter Controlled Induction Motor Drive

The block diagram for the traic controlled cycloconverter drive for controlling the speed of induction motor is shown in Fig. 3.

This traic controlled cycloconverter drive has following components: transformer, rectifier, filter, voltage regulator, zero-crossing detector, tap changer controller, triac control circuit, cycloconverter, microcontroller, frequency display and single phase induction motor.

Transformer: In this traic controlled cycloconverter drive, the transformer is used for step down the AC voltages and works on the principle of mutual induction. In this case, this would be step down the 220 VAC into 15 VAC.

Bridge Rectifier: This cycloconverter drive consists of electronics components which are operated on DC voltages therefore the AC voltages are converted into DC through bridge rectifier, which consists of four diodes and connected at the output of transformer.

Voltage Regulator: In this traic controlled cycloconverter drive, the voltage regulator is used for regulator the DC voltages which comes from the bridge rectifier. It regulates the 15 VDC into 5 VDC and for this purposes, the LM7805 voltage regulator are used.

Microcontroller PIC 18F4550: In this traic controlled cycloconverter drive the PIC 18F4550 microcontroller are used for the intelligent control of this drive. This microcontroller controls the firing angle of the traic voltages for controlling the speed of motor in five steps. It is powered up with 5 VDC and interfaced with the optocouplers. It is 40 pins microcontroller and programmed in C language with the help of mikro/C software.

Zero-Crossing Detector: The microcontroller has been programmed i.e. C program to give output to optical isolation with zero cross detection circuit. It compares two signals in order to get zero crossing whenever the zero crossing occurs it gives an output.

Mode Selection: In this drive the selection mode is basically the switch, which is used for the selection of frequency and this drive is designed for five frequency steps.

Motor: In this traic, controlled cycloconverter drive, the single-phase AC induction motor is controlled through this drive which is basically the inductive load.

The working principles of the traic controlled cycloconverter drive for controlling the speed of induction motor are as follows.

This traic controlled cycloconverter drive works on the principle of variable frequency drive, when the frequency is changed then the speed is also changed. In this paper, first the single-phase induction motor is driven at fundamental frequency which is 50 Hz, then at f/2 Hz and then f/3 Hz, f/4 Hz and f/5 Hz respectively. At fundamental frequency, the motor runs at its full speed which could be checked by the tachometer, then it would be drive at f/2 then the motor runs at half speed and then motor is drive at f/3, at this frequency the motor speed could be quarter. This drive consists of switch which is for frequency selection mode.

The microcontroller basically increase or decrease delay time of the trigging signal, which is inversely proportional to the speed of the single-phase motor. The delay time is set in microcontroller through programming.

4. DESIGN OF CONTROL CIRCUIT, POWER CIRCUIT AND TAP-CHANGING CIRCUIT FOR CYCLOCONVERTER

Overall circuit design of cycloconverter is divided into three sections as follows;

1. Control circuit
2. Power circuit and
3. Tap-changing circuit

4.1 Control Circuit Design

Fig. 4 shows the control circuit diagram of cycloconverter, It consists of power supply circuit, zerocrossing circuit and positive and negative half signal circuit.

For designed and calculation of power supply circuit,

Maximum design current of both voltage regulator =1A

Required minimum input voltage > 12V + 3V

Limited maximum input voltage = 25V

Minimum input AC voltage = (12V + 3V)/ √2 = 10.6V

Maximum input AC voltage = 25/ √2 = 17.7V

Therefore, 220:12 V step down transformer is selected.

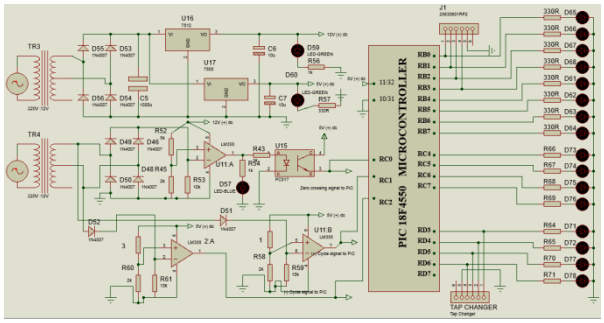

Figure. 4 Control Circuit Diagram for Cycloconverter

According to the maximum voltage 25V and maximum current 1A, 1N4007 (1A, 1000V) diodes are selected for bridge rectifier.

The maximum ripple voltage present for a full-bridge rectifier circuit is not only determined by the value of the smoothing capacitor but by the frequency and load current, and is calculated as:

n = number of pulse per cycle

n = 2

Ripple factor RF is

$$RF = \frac{\sqrt{2}}{(n^2 - 1)}$$

$$RF = \frac{\sqrt{2}}{(2^2 - 1)} = 0.816$$

Form Factor FF is

$$FF = \sqrt{n} = \sqrt{2} = 1.414$$

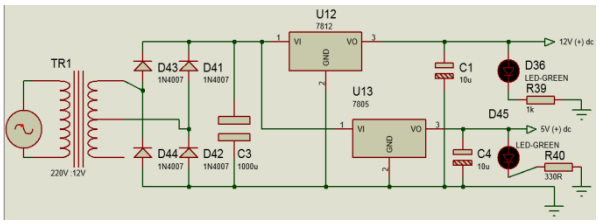

Figure. 5 Power Supply Circuit Diagram of Control Circuit

Fig. 5 shows the circuit diagram of DC supply. The output voltage of high power DC supply circuit can be calculated as the follow;

V_{dc} (max) = $\sqrt{2}$ V_{ac} (in) = $\sqrt{2}$ x 17.6 = 25 V

where, V_{ac} (in) = AC line voltage

$$V_{dc}\,(avg) = \frac{2 \times V_{dc\,(max)}}{\pi} = 0.637 \text{ x } 17.6 = 11.2V$$

$$n = \frac{f_{ripple}}{f_{source}} = \frac{f_r}{f_s}$$

$$f_r = n f_{source} = 2 \times 50 = 100\,hz$$

$$P_{DC} = \frac{P_L}{\eta} = \frac{12}{0.95} = 12.63W$$

$$R_L = \frac{V_{DC}{}^2}{P_{DC}} = \frac{25^2}{12.63} = 49.99 \approx 50\Omega$$

$$C = \frac{1}{RF \times R_L \times f_r} = \frac{1}{0.816 \times 50 \times 100} = 245\mu F$$

So,

$C = 1000\,\mu F$ is selected and greater than $C = 245\mu F$

To eliminate the noise at the output of LM7805 and LM7812, 0.1 - 100 µF capacitor can be installed across the output terminals.

The operating voltage of LED = 2 - 3.5V

The standard voltage of LED = 3V

The operating current of LED= 10 mA

The resistance of LED= 3V/ 10 mA = 300 ohm

So, required series resistor for 12V supply

R = 9 × 300/3 = 900 ohm ≈ 1000 ohm

So, required series resistor for 5V supply,

R= 330 ohm

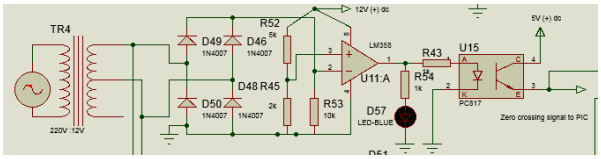

Figure. 6 Zero Crossing Circuit of Control Circuit

For design and calculation of zero crossing circuit,

The non-inverting input voltage = (12/7k) 2k = 3.43V

10k ohm resister is selected for grounding of inverting input.

For design and calculation of positive and negative half signal circuit,

The non-inverting input voltage= (12/7k) 2k= 3.43V

10k ohm resister is selected for grounding of inverting input.

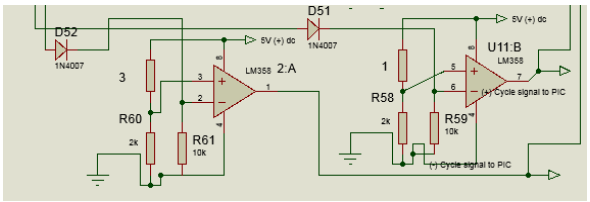

Figure. 7 Positive and Negative Half Signal Circuit of Control Circuit

4.2 Design Calculation of Power Circuit and Tap-Changer Circuit

For 1 HP load,

The maximum voltage across SCR = 220 x √2= 311V

The rated current of SCR for 1HP = 1HP / (√2V cos Φ)

= (746)/ (220 × √2 × 0.8) = 3A

At the starting the motor starting current increases 5 times of rated current.

So, the maximum current of SCR = 5 × 3= 15A

TYN 616 SCR is selected for both power circuit and tap-changer circuit because its voltage is 600V and current is 16A. Both are more than the required rating.

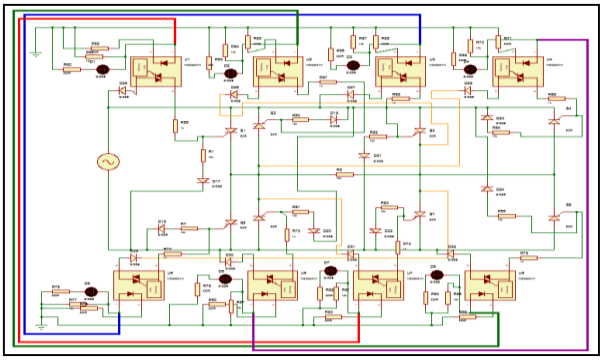

Figure. 8 Power Circuit Diagram of Cycloconverter

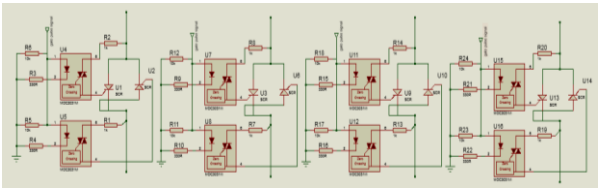

Figure. 9 Tap-changer Circuit Diagram of Cycloconverter

According to the data sheet of TYN 616 SCR, minimum gate current is 2 mA and maximum gate current is 25mA.

1N4007 (1A, 1000V) is selected for all diodes in the power circuit.

According to the guide of zero crossing optocoupler (MOC 3041) datasheet, 1kΩ, 1W resisters is selected for all gate signal of SCR.

1kΩ, 1W resisters is selected for all gate signal of SCR.

5. CONCLUSION

Many of the domestic and industrial applications require variable frequency. The cycloconverter plays a pivotal role in achieving this task. In this paper, the control circuits, power circuit and tap-changing circuit for cycloconverter have been designed using rectifier, Op- amps and SCR. By applying this design calculation results, a speed control of single phase induction motor by using single phase cycloconverter, can be implemented.

6. ACKNOWLEDGMENTS

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7. REFERENCES

[1] M. H. Rashid, “Power Electronics Circuits, Devices and Application”, 6th edition, Copy right 2009, Prentice Hall, Inc Upper Saddle River, NJ.

[2] T. Salzmann, “Cycloconverters and Automatic Control of Ring Motors Driving Tube Mills”, Siemens Rev., vol. XLV, no. 1, pp. 3-8, 1978.

[3] W. A. Hill, G. Creelman, L. Mischke, “Control Strategy for an Icebreaker Propulsion System”, IEEE Trans. Ind. Appl., Vol. 28, no. 4, pp. 887-892, 1992.

[4] Rajib Baran Roy, Md. Ruhul Amin, “Design and Construction of Single Phase Cycloconverter”, International Journal of Recent Technology and Engineering, ISSN: 2277-3878, Volume-1, Issue-3, August 2012.

[5] J. Millman and Taub, “Pulse, Digital and Switching Waveforms”, 4th Edition, 2008, The McGraw Hill-Companies Inc. USA.

[6] Vasquez M, Ponti J, Arrendono V, “Cycloconverter Inter harmonics Current Analysis under Unbalanced Load based on a Real-time Simulation”, IEEE International Conference on Industrial Technology (ICIT), March 2015.

[7] Castro, P. Valenzuela, M.A. “Modelling and Evaluation of Cycloconverter Fed Two Stator Winding SAG Mill Drive—Part I: Modelling Options” IEEE Transactions on Industry Applications, Volume: 51, Issue: 3, December 2014.

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Modelling and Simulation of Protection for Power Transformer at Primary Substation by Using Differential Protection

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Abstract: The word "Protection" is used to describe the whole concept of protecting a power system. Transformer protection is the vital significance to provide reliable operation of power system. The main challenge in transformer protection is to find a fast and efficient differential relay algorithm that isolates the transformer from the system causing least damage. Digital differential protection is a developed idea of the old system of conventional differential protection, which had made perfect solution to the problems that the old system suffer. In this paper, differential protection using relay is presented. MATLAB/SIMULINK platform were used to analyze differential protection relay for a large power transformer.

Keywords: Power Transformer, Transformer Differential Protection, Substation, MATLAB/SIMULINK

1. INTRODUCTION

Power transformers are the most important equipment in substation and power stations. Thus protection of the power transformers are vital important for proper operation of power system. Among various power transformer operations, the differential operation is the most common method. In this paper, the differential protection of 230/33/11 kV transformer of Thanlyin substation is studied using MATLAB/SIMULINK. The contents of each designed block are illustrated in separate figs. 7 to 14.There are some coefficients are kept hidden for the reader to find them. These coefficients can change the behavior of the design.

2. POWER TRANSFORMER

Power transformer is a static piece of apparatus with two or more windings which, by electromagnetic induction, transforms a system of alternating voltage and current into another system of voltage and current usually of different values and at the same frequency for the purpose of transmitting electrical power." (Definition of Power Transformer; taken from IEC 600761 standard).Power transformer is one of the most important components in power system, for which many kinds of protective and monitoring schemes have been developed for many years. A power transformer is a very expensive electrical device, and its operation directly affects the performance of other equipment to which it is connected.

3. Differential Protection for Power Transformer

Differential protection is applied on busses, generators, transformers, and large motors. Specialized relays exist for each of these applications, and their settings are described in the manufacturer's literature. Differential relays require careful selection of current transformers. The full winding should be used when multi ratio CTs are used in differential schemes, and other relays and meters should be fed from different CT circuits. Transformer differential protection requires CTs with limited mismatch. Generally, differential protection is applied to transformer banks of 10 MVA above. The key is the importance of the transformer in the system, differential may be desirable for smaller units to limit damage in critical interconnections. The fundamental operating principle of transformer differential protection is based on comparison of the transformer primary and secondary winding currents. For an ideal transformer, having a 1:1 ratio and neglecting magnetizing current, the currents entering and leaving the transformer must be equal. The differential relay actually compares between primary current and secondary current of power transformer, if any unbalance encountered in between primary and secondary currents the relay will actuate and inter trip both the primary and secondary circuit breaker of the transformer as shown in Fig (1).

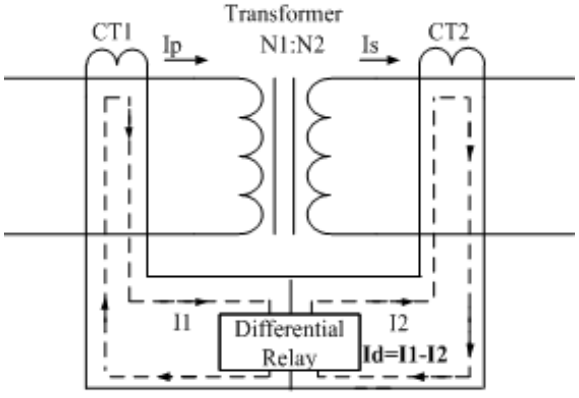

Figure.1 Differential Protection for Single-Phase Two Winding Transformer

Basis of the conventional percentage differential relay is that the differential current (I_d) is more than a predetermined percentage of the restraint current (I_r) is shown in Fig (2).

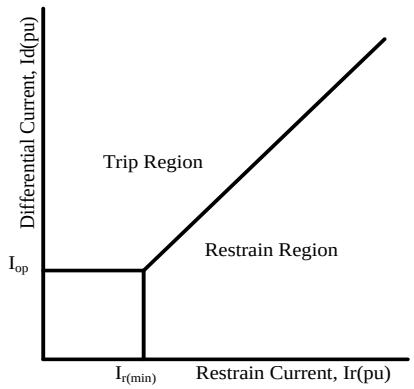

Figure.2 Percentage differential relay characteristics

4. Study on Power Transformer at 230/33/11 kV Thanlyin Primary Substation

The substation is an assemblage of equipment for the purpose of switching, regulating and changing the level of supply voltage from transmission level to primary distribution level. Fig (3), (4) and (5) are denoted by the necessary equipment for power transformer differential protection in Thanlyin Substation

Figure .3 Three Single- Phase Transformer in Thanlyin Primary Substation

Figure.4 Current Transformer for 230kV side

Figure.5 Differential Relay using for Thanlyin Substation

5. Modelling For Differential Protection of 100MVA, 230/33/11kV Transformer

Figure.6 illustrates Matlab/Simulink Model of the proposed system. Since the transformer under study is connected in YY connection, the primary and secondary CTs are connected in delta connections. The single line to ground fault is applied at low tension side of the power transformer. All CTs are connected to differential relays connected as shown in figure. The differential relay block contents is shown in Figure 7. The comparator block contents, the amplitude comparator block contents, the harmonic comparator block contents, and the ratio block contents are shown in Figure 8 through Figure 11. The current transformer block diagram is shown in Figure 12. The current transformer turn ratio is set as 300/1 as in actual condition. The burden is selected as 30 VA.

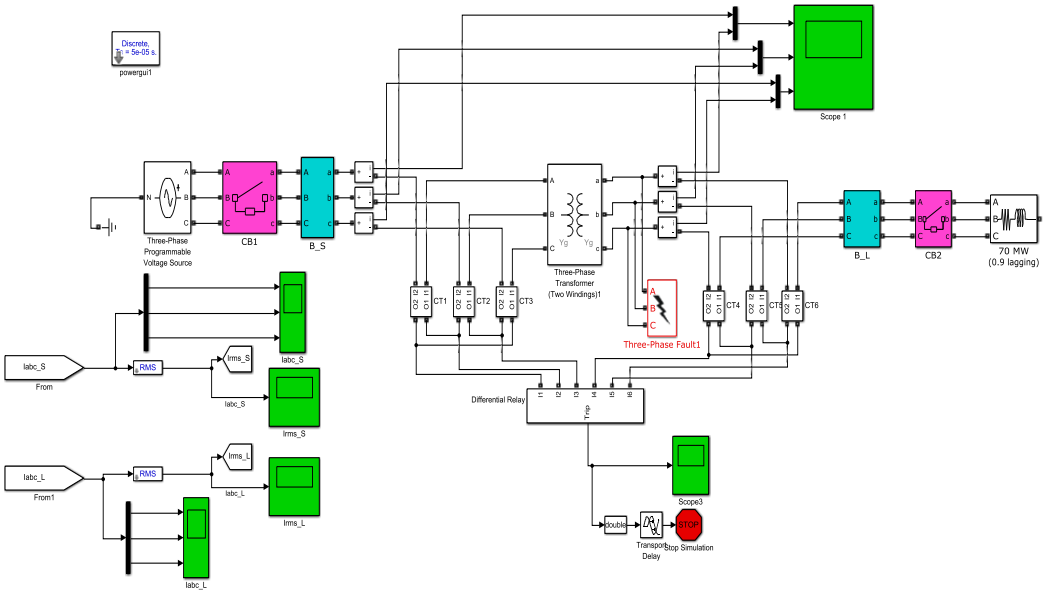

Figure.6 Matlab/Simulink Model of the proposed system

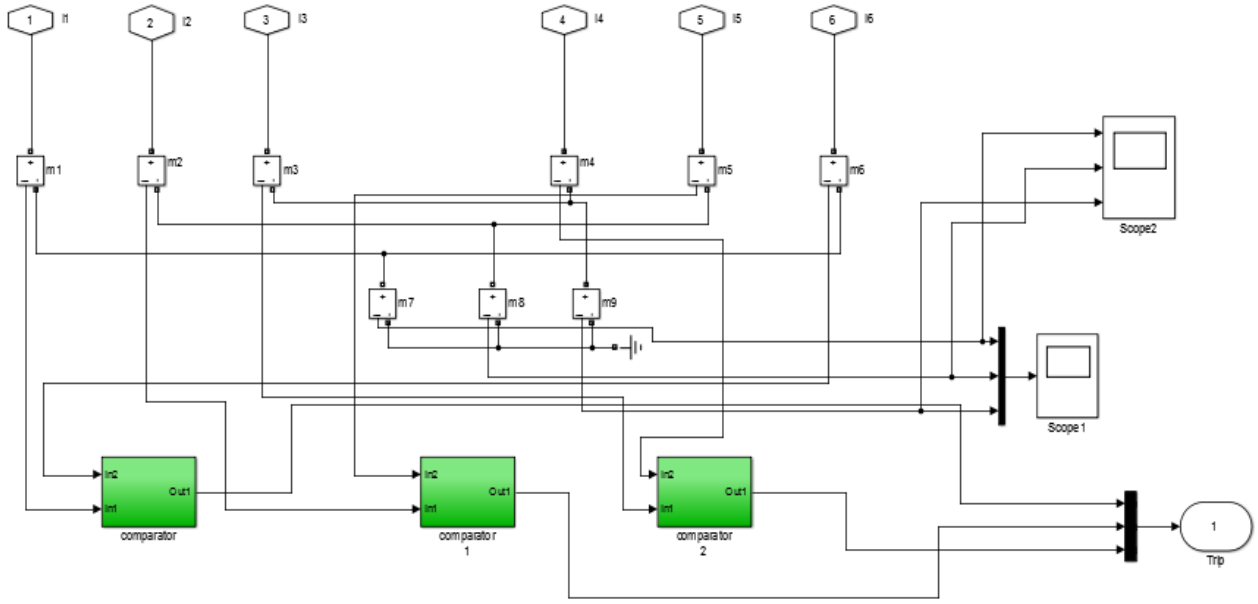

Figure.7 The differential relay block contents

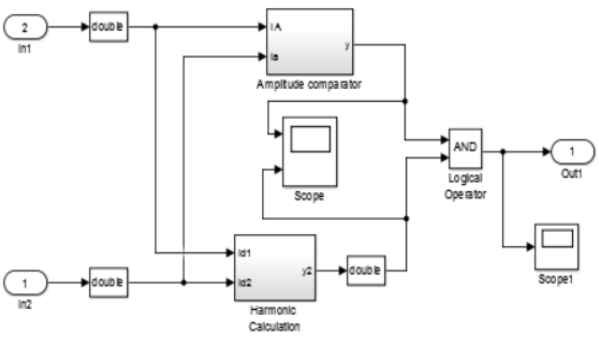

Figure.8 The comparator block contents

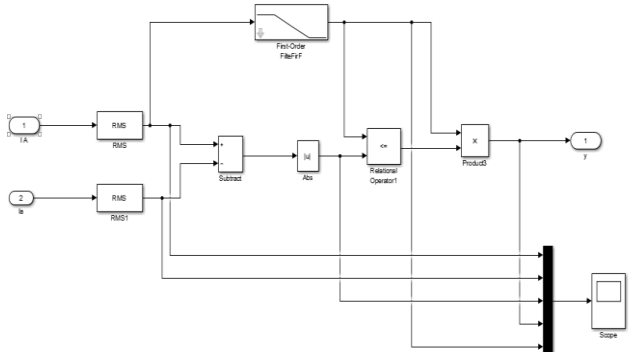

Figure.9 The amplitude comparator block contents

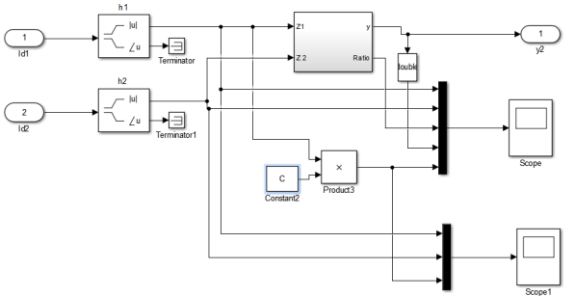

Figure.10 The harmonic comparator block contents

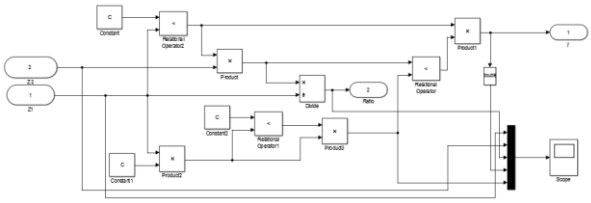

Figure.11 The ratio block contents

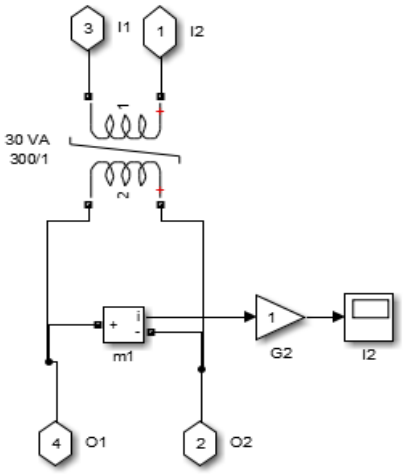

Figure.12 Current transformer block contents

6. SIMULATION RESULTS

To analyze the performance of designed differential relay, phase 'A' to ground fault is applied at low tension side of transformer. The fault duration is set as 2 second to 2.1 second. The simulation results are shown in the following figures. Ths results consists of trip signal, source currents, and load currents. As the fault occur at 2 second, the trip signal become one, i.e. sent signal to breaker to turn off. Thus, after some time delay, breakers are trip and simulation is stop as shown in Figures.

At the source side, phase 'A' currrent is increased and phase 'B' and 'C' currents are decreased. At the load side, phase 'A' current is very reduced and phase 'B' and 'C' currents are slightly reduced as shown in Figure 15. In all aspect, The designed differential relay work properly and protect the transformer effectively.

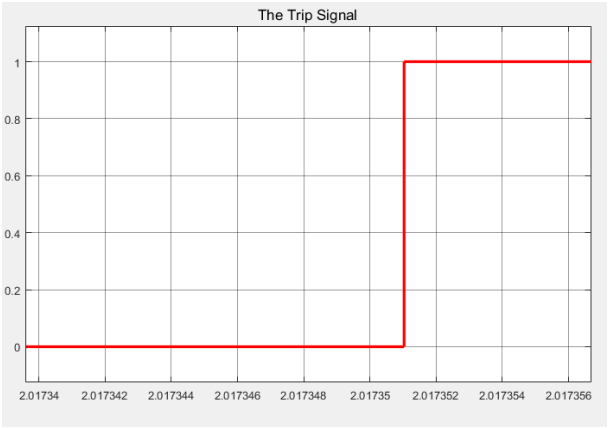

Figure.13 Zoomed trip signal,trip time is around 2.02 sec

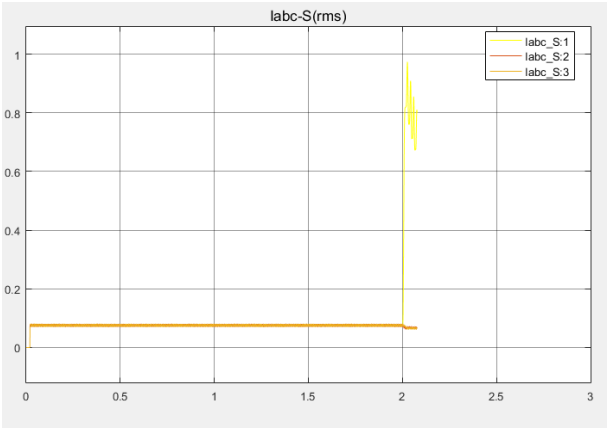

Figure.14 Simulation results for three-phase source currents

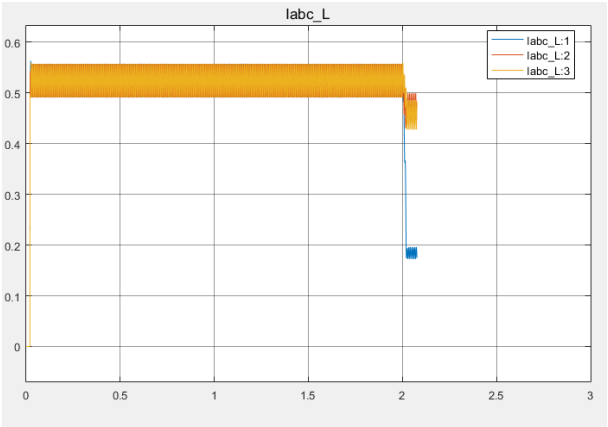

Figure.15 Simulation results for three-phase load currents

7. CONCLUSION

In this paper, modelling and simulation of differential protection for power transformer at primary substation is presented.The detailed studied is carried out at 230/33 /11kV Thanlyin Primary transmission substation. The implementation is shown in step by step. This simulation is tested for various cases and for all cases it gave satisfactory results. There are some difficulties are faced in the implantation of this system such as the lack of some toolbox in the Sim-power-system. For example there is no current transformer in the toolbox. To solve this case, by using a

regular single phase and make some changes in its specifications to fit the current transformer specifications. The complete differential relay design model is presented in this paper. According to simulation results, the designed model work correctly and simulation results are quite reliable.

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9. REFERENCES

[1] P.M.,"Power System Protection", Piscataway, NJ: IEEE Press, 1999.

[2] Thin Le Yee,"Design Criteria on Substation Protection by using Instrument Transformers " Department of Electrical Power Engineering (M.T.U), GMSARN International Conference on Sustainable Development; Issues and Prospects for the GMS, 12-14 Nov.2008.

[3] Adel Aktaibi and M. Azizur Rahman"Digital Differential Protection of Power TransformerUsingMatlab "Memorial University of Newfoundland, Canada.

[4] M.S.EI-Bages"IMPROVEMENT OF DIGITAL DIFFERENTIAL RELAY SENSITIVITY FOR INTERNAL GROUND FAULTS IN POWER TRANSFORMERS " Electrical Engineering Department ,Faculty of Engineering ,Benha University, cario, Egypt ISSN 2077-3528, Issue 8, Volume 3, Sep.2011