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Department of Electronics – Wayamba University of Sri Lanka

HARDWARE IMPLEMENTATION OF MODULUS OPERATION

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ABSTRACT

This paper describes the hardware implementation of modulus operation. The modulus operation is a basic mathematical operation which has wide range of applications. With the popularity of programmable hardware, it has been exploiting to accelerate m athematical operation in many applications such as cryptography. One of the main mathematical operations in many cryptographic algorithms is the modulus operation. For hardware acceleration of those applications, it is necessary to have hardware-based modulus operators. In this study we develop an algorithm to find modulus operation of two numbers and ported into a Field Programmable Gate Array(FPGA) with Verilog Hardware Description(HDL) language using a Finite State Machine (FSM).Simulation results show the calculation is correct. This hardware algorithm of modulus operation can be used for applications such as cryptography.

Key words: *Modulus, FPGA, Verilog HDL.*

1.0 INTRODUCTION

In computing, modulo (sometimes called modulus) operation finds the remainder of division of one number by another. Given two positive numbers, **a**(the dividend) and **b**(the divisor), **a**modulo**b** (abbreviated as **a** mod **b** is the remainder of the Euclidean division of **a**by**b.** For instance, the expression "5 mod 2" would evaluate to 1 because 5 divided by 2 leaves a quotient of 2 and a remainder of 1, while "9 mod 3" would evaluate to 0 because the division of 9 by 3 has a quotient of 3 and leaves a remainder of 0; there is nothing to subtract from 9 after multiplying 3 times 3. That means “5 mod 2” is 1 and “9 mod 3” is 0[1].

Modulus operation is proposed for FPGAs that addresses the issue of scalability, flexible performance and silicon efficiency for the hardware acceleration of modulus operation. This paper proposes the hardware implementation of the modulus operation and Hardware

Description Language (HDL) uses to FPGA configuration. The novelty and the main interest in this paper is the orientation towards the hardware implementation. The result is hardware implement of the modulus operation for a fast, cheap and efficient. The benefits of hardware implementation were given below.

- Performance

  Taking advantage of hardware parallelism, FPGAs exceed the computing power of digital signal processors (DSPs) by breaking the paradigm of sequential execution and accomplishing more per clock cycle. BDTI, a noted analyst and benchmarking firm, released benchmarks showing how FPGAs can deliver many times the processing power per dollar of a DSP solution in some applications.[2] Controlling inputs and outputs (I/O) at the hardware level provides faster response times and specialized functionality to closely match application requirements.

- Time to market

  FPGA technology offers flexibility and rapid prototyping capabilities in the face of increased time-to-market concerns. You can test an idea or concept and verify it in hardware without going through the long fabrication process of custom ASIC design.[3]You can then implement incremental changes and iterate on an FPGA design within hours instead of weeks. Commercial off-the-shelf (COTS) hardware is also available with different types of I/O already connected to a user-programmable FPGA chip. The growing availability of high-level software tools decreases the learning curve with layers of abstraction and often offers valuable IP cores (prebuilt functions) for advanced control and signal processing.

- Cost

  The nonrecurring engineering (NRE) expense of custom ASIC design far exceeds that of FPGA-based hardware solutions. The large initial investment in ASICs is easy to justify for OEMs shipping thousands of chips per year, but many end users need custom hardware functionality for the tens to hundreds of systems in development. The very nature of programmable silicon means you have no fabrication costs or long lead times for assembly. Because system requirements often change over time, the cost of making incremental changes to FPGA designs is negligible when compared to the large expense of respinning an ASIC.

- Reliability

  While software tools provide the programming environment, FPGA circuitry is truly a “hard” implementation of program execution. Processor-based systems often

involve several layers of abstraction to help schedule tasks and share resources among multiple processes. The driver layer controls hardware resources and the OS manages memory and processor bandwidth. For any given processor core, only one instruction can execute at a time, and processor-based systems are continually at risk of time-critical tasks preempting one another. FPGAs, which do not use OSs, minimize reliability concerns with true parallel execution and deterministic hardware dedicated to every task.

- Long-term maintenance

  As mentioned earlier, FPGA chips are field-upgradable and do not require the time and expense involved with ASIC redesign. Digital communication protocols, for example, have specifications that can change over time, and ASIC-based interfaces may cause maintenance and forward-compatibility challenges. Being reconfigurable, FPGA chips can keep up with future modifications that might be necessary. As a product or system matures, you can make functional enhancements without spending time redesigning hardware or modifying the board layout[2].

2.0 EXPERIMENTAL PROCEDURE

2.1 Modulus Algorithm

This is the algorithm for the modulus function. If mod[a, b]= modvalue, {a=divident , b=divisor}.

```
mod (a, b)
{
        i=0, tb=0;
        while (a>tb)
        {
                i=i+1;
                tb=b*i;
        }
        tb =b*(i-1);
        modvalue=a-tb
}
```

2.2 Status Diagram

The elements that constitute a state diagrams are rounded boxes representing the states and arrows showing transitions to the next state. The activity section depicts the activities the object performs while it is in that state. Every state diagram starts with an initial state, which is the state where the object is created. Right after the initial state, objects change their states, and the next state is determined by conditions based on activities. In some cases, state diagrams represent a super state, which is a condition created when many transitions lead to a particular state. The super state depicts that all states inside this diagram transition to a redundant state, making the diagram more complex. A transition in a state diagram is a progression from one state to another and is triggered by an event that is internal or external to the entity modeled. An action is an operation that is invoked by an entity that is modeled. A very traditional form of state diagram for a finite machine is a directed graph[3].

The below status diagram was related to the 2.1 algorithm.

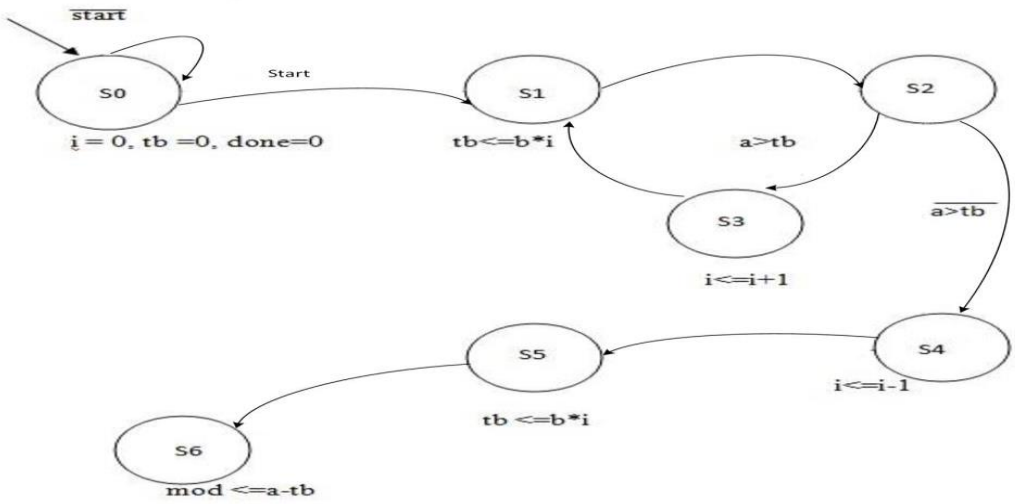

Figure 1: Status diagram for modulus operation

2.3 Hardware implementation

Hardware Description Language (HDL) used for the program FPGA. Programmed the algorithm for modulus function by using Icarus verilog and Spartan 3 Field Programmable Gate Array (FPGA) development board is used for that purpose. Output is displayed in computer. Serial communication was the link from FPGA to computer[4].

3.0 RESULTS AND DISCUSSION

At the highest level, FPGAs are reprogrammable silicon chips. Digital computing tasks in software and compiles them down to a configuration file or bit stream that contains information on how the components should be wired together. In addition, FPGAs are completely reconfigurable and instantly take on a brand new "personality" when recompile a different configuration of circuitry. In the past, FPGA technology could be used only by engineers with a deep understanding of digital hardware design. The rise of high-level design tools, however, is changing the rules of FPGA programming, with new technologies that convert graphical block diagrams or even C code into digital hardware circuitry.

FPGAs provide hardware-timed speed and reliability. Reprogrammable silicon also has the same flexibility of software running on a processor-based system, but it is not limited by the number of processing cores available. Unlike processors, FPGAs are truly parallel in nature, so different processing operations do not have to complete for the same resources. Each independent processing task is assigned to a dedicated section of the chip, and can function autonomously without any influence from other logic blocks[5].

Figure 2: GTK wave form for one of modulus function

4.0 CONCLUSION

In this study we have attempted to implement modulus operation in hardware. Since the modulus operator is one of basic mathematical operations, hardware-based algorithm for modulus operation is necessary to applications such as cryptography where hardware acceleration is concerned. Simulated results show that the hardware algorithm gives the correct results. One drawback of the algorithm is that it takes different clock cycles to calculate the final result for different input values.

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Department of Electronics-Wayamba University of Sri Lanka

VEHICLE SURVEILLANCE CAMERA SYSTEM

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ABSTRACT

A vehicle surveillance camera system is a new addition to the vehicle security components which is used to secure the vehicles and help to assess liability claims when vehicle involve in an accident. The device that developed as a vehicle surveillance camera system, gives more benefits to the user. The image capturing mechanism is used to design the system. The proposed system capture stream of images instead of capturing video and it consists with two major modes for user's selection. Those are Running mode and Parking mode. Running mode captures the image when vehicle moves in the road or in normal situations in daily works and parking mode design to run the system when vehicle is parked. And it joins with vehicle security system. A sensor is used to capture human motion. If it detects a motion it's sending a message to security system and turn on the security grid.

Keywords: *Arduino, Image capturing, Vehicle surveillance, Vehicle security*

1.0 INTRODUCTION

The commercially available vehicle surveillance camera systems were developed using the DVR (Digital Video Recorder)[1,2] concept. The cost of a single multi feature camera unit is very expensive. In this study it was attempted to develop a vehicle camera system with multiple features, which is user friendly, has a low memory usage and low cost. Image capturing system was used to develop the system. It captures stream of images instead of video. The device works under the basic functions as showed in Figure1.

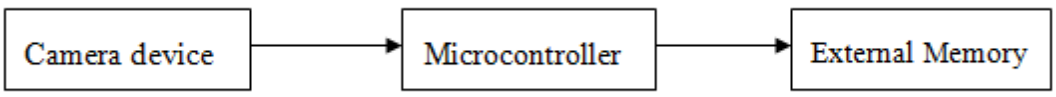

Figure 1: Basic Block diagram of the devise

2.0 EXPERIMENTAL

Arduino[3] supported components were used for the system (Arduino – an open source language with highly available electronics modules). System development started with Arduino Mega2560microcontroller[4] development board, OV7670 Camera module and SD card module. First attempt to interface them failed because of lack of ram memory. Then external interface shield (ArduCam revolution 3 shield[5]) was used to interface modules and OV2670 camera module[6] to develop the device. The final system was developed with two modes, Running and Parking modes that can be used for different environments like daily working environment and during parking. System performs using three layer platforms as showed in Figure 2.

Layer 3: Camera Module
Layer 2: ArduCam camera shield(For Interfacing) + SD card shield
L**ayer 1: Arduino mega2560 development board**

Figure 2: Layered Architecture of the developed system.

3.0 RESULT AND DISCUSSION

Developed system records stream of images according to the user command. It is capable of producing image frames with the maximum size of 2 megapixels. The difference between two continuous image frames is three milliseconds. System uses much less memory to store the image stream.

2megapixel images are much clear compared to other compatible sizes that produce from the system. But it takes more time to write the data in SD card. The matching image frame size range obtained practically was 640x480 to 1024x768 pixel images[6]. The cost around building this unit is Rs. 5000.00.

4.0 CONCLUSION

A vehicle movement detection system (surveillance) was developed at a very low cost. The device record image stream when user commands to record (Turn ON the system). This device is only capable of responding to one camera. But it can be modified to fit for any camera module available in the vehicle. The present system is not capable of real time video processing. However as the further development, this device can be improved to store more details about the vehicle (Black Box concept)[7].

ACKNOWLEDGEMENT

Authors would like to thank all who have supported to make this project a success.

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Department of Electronics – Wayamba University of Sri Lanka

STUDY OF IMAGE PROCESSING ALGORITHMS FOR HARDWARE IMPLEMENTATION

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ABSTRACT

The study presents a hardware implementation of real time Image processing algorithm. Image processing algorithms are usually implemented in software. There is an increasing demand for real-time image processing in applications such as industrial automation and robotics. Software implementations of image processing algorithms are not suitable for real-time applications due to slower processing power. In this study we propose hardware implementation of image contrast enhancement using a Field Programmable Gate Array (FPGA). The results of the study show that a large speed performance can be achieved by hardware implementation than the software implementation.

Key words: *FPGA, HDL, Contrast Enhancement*

1.0 INTRODUCTION

In past decade, image processing has huge improvement and it used for lot of industrial application. But most of image processing application has made using software implementation methods. Software implemented applications consume much considerable time to perform their process[1].So software implementation could not use for the real time application. Hardware implementation is solution for that delay of the software implemented application. FPGA is the one of latest popular hardware device which used for the image processing real time application.

Image processing hardware implementation is used for many applications in modern world. Medicine, space exploration, surveillance, authentication, automated industry inspection and many more areas used hardware implementation application of image processing for real time operation[2].

Contrast enhancement techniques are used to improve the visibility of the image without unrealistic color effect.

Most of the image contrast-enhancement techniquesare applied to grayscale images. However, the evolution of photography has increased the interest in color imaging and consequently in color contrast-enhancementmethods[3].

2.0 EXPERIMENTAL

In past few years FPGA became more popular among researchers who do the experiments using hardware implementation devices. More recently, FPGAs such as a Xilinx has come to rival corresponding ASIC and ASSP solutions by providing significantly reduced power, increased speed, lower materials cost, minimal implementation real-estate, and increased possibilities for re-configuration 'on-the-fly'.Where previously a design may have included 6 to 10 ASICs, the same design can now be achieved using only one FPGA[4].Xilinx sparten 3E development Board is used for that project.

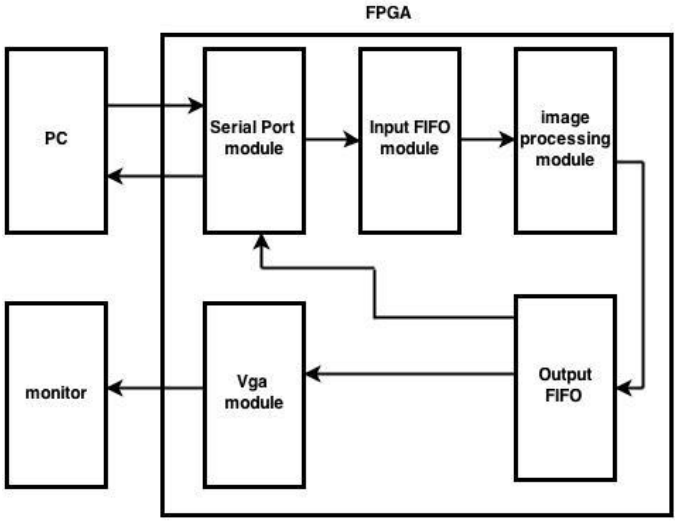

Figure 1: Block Diagram of the Image Processing System (IPS)

Original image exist in the computer and digital information of the image transfer to FPGA board through communication link. Serial communication is used as a communication link. Then FPGA board perform some operation to that digital data for enhance the contrast of the image. After the process, new image display through VGA output. First In, First Out

(FIFO), a method for organizing and manipulating a data buffer that control the flow of the data.

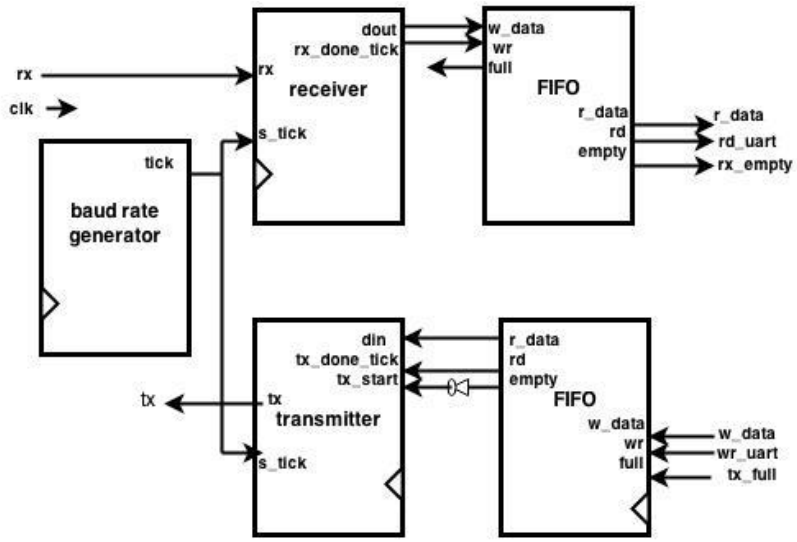

Figure 2: Block Diagram of the Serial Communication Link

3.0 RESULTS AND DISCUSSION

Figure 3 presents Isim simulation related to theinput digital information of the image and output dataafter the process.

Figure 3: simulation results with Isim tool

Field-programmable gate arrays (FPGAs) are non-conventional processors built primarily out of logic blocks connected by programmable wires. Each logic block has one or more lookup tables (LUTs) and several bits of memory[5]. As a result, logic blocks can implement arbitrary logic functions (up to a few bits). Logic blocks can be connected into circuits of arbitrary complexity by using the programmable wires to route the outputs of logic blocks to the input of others. FPGAs as a whole can therefore implement circuit diagrams, by mapping the gates and registers onto logic blocks.

All FPGAs have special purpose I/O blocks that communicate with external pins. Many have on-chip memory in the form of RAM blocks. Others have multipliers or even complete RISC processors in addition to general purpose logic blocks[5].

4.0 CONCLUSION

The industrial applications and robotics require real-time image processing methods. Software implementations of image processing algorithms do not suitable for real-time applications due to slower speed performance. In this study we attempted to implement contrast enhancement algorithm on a Xilinx SpartanFPGA. Results show that the hardware implementation of the algorithm is about ten times faster than the software implementation of the same algorithm.

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Department of Electronics – Wayamba University of Sri Lanka

LOW COST ELECTRONICALLY CONTROLLED DRIP IRRIGATION SYSTEM

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ABSTRACT

Drip irrigation is one of the plant watering methods. And it is also considered as one of most efficient method of irrigating. Drip systems typically are 90% or higher efficient than the other systems and saves water and fertilizer by allowing water to drip slowly to the roots of plants, either onto the soil surface or directly onto the root zone, through a network of emitters. This paper describe about an electronically controlled drip irrigation system. There are lots of drip irrigation systems in use but the proposed system s low cost and very convenient to use. In this system, the sensing mechanism does not have any external threads. It is designed on the principle that water conducts electricity. System is designed to switch ON the valves when the soil moisture is low and switch OFF when the soil moisture is high. The switching levels can be adjusted according to the soil type and the plant type because, different plants required different water levels. This system is capable of maintaining the soil moisture level between temporary wilting point (TMP) and field capacity (FC).

Keywords: *Soil moisture, drip irrigation, temporary wilting point, field capacity*

1.0 INTRODUCTION

In real world almost all the people used automated systems to get their day to day work done efficiently and effectively. The primary objective of irrigation system is to provide plants with sufficient water to obtain optimum yields and a high quality product. The required timing and amount of water that should be applied is determined by the prevailing climatic conditions, the type of crop and its stage of growth, soil properties, and the extent of root development[1].

Automation in irrigation is required when it is inconvenient, if not impossible to correctly irrigate without automation. Most of the time skilled labor may not be available to operate manual drip systems frequently for short durations of time, which in many cases is the

ideal to maximize yields and avoid wasting water and fertilizer. As a solution for those, this electronically controlled drip irrigation system was designed. This automated drip irrigation system uses a soil moisture sensor. The soil moisture sensor can sense the soil moisture level using its probes, which measure changes in the soil resistance. When the probes detect that plant needs water, the LED in the circuit flashes and valve get opened automatically. After the water requirement of the plant is fulfilled, the LED OFF and valve get closed. Other automatically control drip irrigation systems are very expensive. Some commercially available automated drip irrigation systems are Labyrinth belt drip irrigation system, flat dripper irrigation pipe extrusion line drip irrigation system, etc[2]. The proposed system can be used in small gardens to big plantations within a low budget. The main function of the system is to control the soil moisture. Therefore most of the time operation of this systemdepends on the evaporation, raining and other surrounding effects.

2.0 EXPERIMENTAL

2.1 Circuit Implementation

Soil moisture sensors usedin this system, are made from electroless nickel immersion gold (ENIG) are manufactured by DFRobot company[3]. Their working temperature is in between 10°C ~ 30°C. The controlling unit was designed using PIC 16F877A microcontroller and it was programmed using mikro C language. The TWP and FC values can be calculated by according to the soil texture. Soil texture was calculated using the soil texture triangle. The output of the circuit is indicating by the LEDs and wiper water motors. ANHUI JIANGHUAI AUTOMOBILE CO.LTDwas manufactured this wiper motor. When the plant needs water, the LED will flashes and water motorget switchedON. After the water requirement of the plant is fulfilled, the LED get switched OFF and water motor is also get switched OFF.

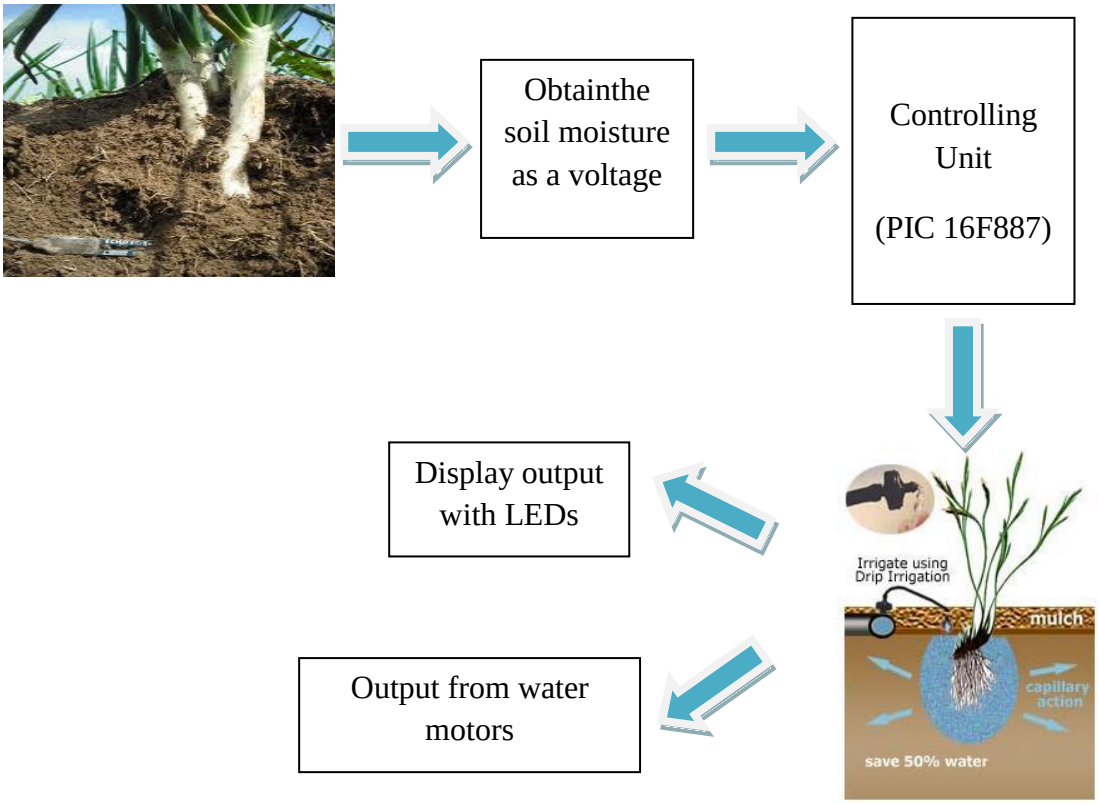

Figure 1: Block diagram of the system

Figure 2: Schematic of the prototype of the electronically controlled drip irrigation system

2.2 Soil texture measurements

Procedure:

First the soil separation tube was filled up to the 10 ml line with soil. The tube was gently taped after each partition is added. The sample was diluted by adding water up to the 40ml line. Then 10 drops of texture dispersing reagent was added. The bottle was hold vertically when adding the drops. Cap the tube and it was being shaking for 2 minutes. The tube was allowed to stand for exactly 30 seconds. The height of the soil particles that have settled at this time was measured. That was the sand portion. That value was recorded. The tube was allowed to stand undistributed for 30 minutes. The ruler was used to measure the height of the particles that have been settled and the value was recorded. The first (30 second) reading was subtracted. That difference is the portion of soil that is silt.The tube of soil was allowed to stand for at least 24 hours. At the 24- hour point, another reading was taken. The height at the 30 minute reading was subtracted. That difference is the clay portion of the soil. If the water is still very cloudy, another reading was taken after it has completely cleared. It was compared to the 24-hour reading. If the level has been raised, the 30-minute reading was subtracted from this value and that was used for the clay reading. In some cases, had been found that the soil continues to settle, and the level actually goes down. If that happened, simply the 24-hour reading was used or a zero value was assumed for clay[4]. Finally, the percentage of each fraction was calculated and lines were drawn on the soil texture triangle according to the values. With that the soil type can be identified.

After 30 seconds | After 30 minutes | After 24 hours

Figure 3: Measurement of soil texture

Table 1: Measurements of soil texture

Height in millimeters after:	Corresponds to fraction of:	Difference in height, or portion: (ml)	Portions expressed as percentage:
30 seconds	sand	4	4/5.25 = 76%
30 minutes	silt	1	1/5.25 = 19%
24 hours	clay	0.25	0.25/5.25 = 4%

3.0 RESULTS AND DISCUSSION

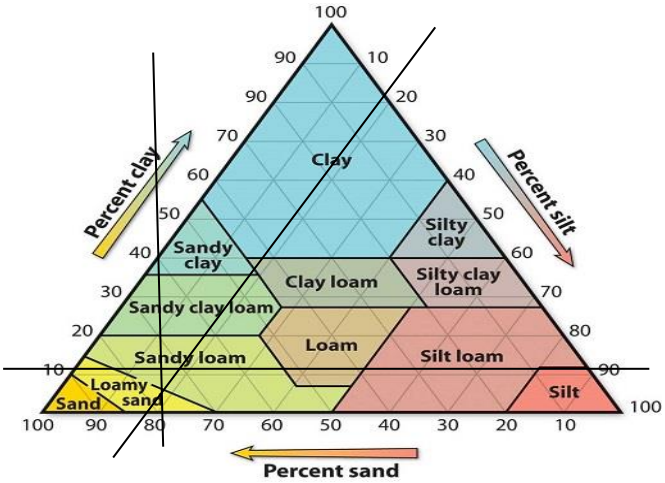

Figure 4: Soil moisture texture triangle

According to the soil texture measurements, the soil which was used for the system is identified as Loamy Sand.

Theproposed electronically controlled drip irrigation works based on the sensing of soil moisture. Soil moisture is sensed using the two probes that are plated with Immersion gold. Therefore it is resist to corrosions. And also its sensitivity is high. The sensors are placed in the field near to the plants. It should be inserted into the soil about 3-4 cm. After that, a small current is passes through probes. Sensors are contacting with the soil and generatea voltage difference between the probes according to the resistance of the soil according to the Ohm's low. When the soil is dry, the voltage difference between two probes is high andwhen the soil is wetit is low. The voltages levels according to temporary wilting point and field capacity belong to the soil textureare measured. The controlling circuit is designed with relevant to the two voltage levels that are calculated.

4.0 CONCLUSION

This paper discusses a preliminary study of an electronically controlled drip irrigation system. It showed acceptable high accuracy because switching levels of the system can be controlled according to the soil texture. Surrounding temperature can be affect to the accuracy of the system. As mentioned the system improved by adding a temperature sensor.

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The authors would like to acknowledge and extend heartfelt gratitude to the persons who have helped to make this project a success.

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Department of Electronics – Wayamba University of Sri Lanka

AUTOMATED AC AND SHUTTER CONTROLLER SYSTEM FOR VEHICLES

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ABSTRACT

Air Conditioning (AC) Controller System is a very important part in automobile industry. Modern vehicles come with complex AC Controller Systems but most of old vehicles have manual AC controller where the use needs to turn on and off the AC. Unnecessarily running the AC affects the poor fuel consumption of the vehicle. Further, keeping the AC on while the shutters are open, wastes energy.This paper proposes a low-cost automated AC Controller System integrated with window shutters to minimize energy wastage. The new system contains a microcontroller, which keeps in track whether the doors and shutters are open or not to turn on the AC. Further, it monitors the temperature inside the vehicle. Considering all these information, the AC controller turns on the AC and helps to minimize fuel wastage due to Air Conditioner of the vehicle.

Keywords: *Automobile air-condition controller, Minimizing energy waste, Microcontrollers*

1.0 INTRODUCTION

Automobile sector is one of the demanding and fast growing sectors. So with the development of the technology the automobile engineers and the technician try to make changes and advanced systems of vehicles. As it is in the technology there are some old vehicles which include Air Conditioning systems controlled manually by the passengers. These systems have switches to control the Air Conditioning system. And also the shutters are controlled by using a liver or a separated switch in the middle age of development of automobile sector.

Nowadays the engineers designed the Air Conditioning system to be controlled automatically. And the shutters are controlled using a switch in a more efficient way. While the Air Conditioning can be set to a desired value and when the passenger turns OFF

the Air Conditioner and again turn it ON the Air Conditioner keeps the pass value in its memory and gives it as the output when the Air Conditioner turns ON.

With this study of the automation and the controlling of the vehicle systems, and since there are no systems developed at the moment connecting the Air Conditioner and the Window shutters we decided to combine these two factors together in order to make a solution to the power usage and the fuel usage. Here in this project we designed a prototype to show the working conditions of the above factors using a Microcontroller and some other components.

2.0 THEORY AND EXPERIMENT

For the designing of the AC and Shutter controller System, a microcontroller was used. This microcontroller is connected to the ULN2803 which is a motor driver IC, a LCD display, LM35 temperature sensor and to a L293D IC. These two ICs control the motor and the fan of the system which is used as an AC fan unit. The details of the components are as follows.

PIC16F877A Microcontroller

This is a common 8 bit microcontroller with a variety of useful peripherals, including 33 I/O lines, eight 10-bit ADCs, two PWM Channels, in-circuit programming, UART, and runs at 20MHz, 5MIPS.This is mostly used in many applications[1,2].

LM35 Temperature Sensor IC

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level[3].

ULN 2803 IC

The ULN2803APG / AFWG Series are high−voltage, high−current Darlington drivers comprised of eight NPN Darlington pairs. All units feature integral clamp diodes for switching inductive loads. Applications include relay, hammer, lamp and display (LED) drivers. This contains of 500mA max current and 50V min voltage[4].

L293D - IC

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits[5].

Designs of the Circuit

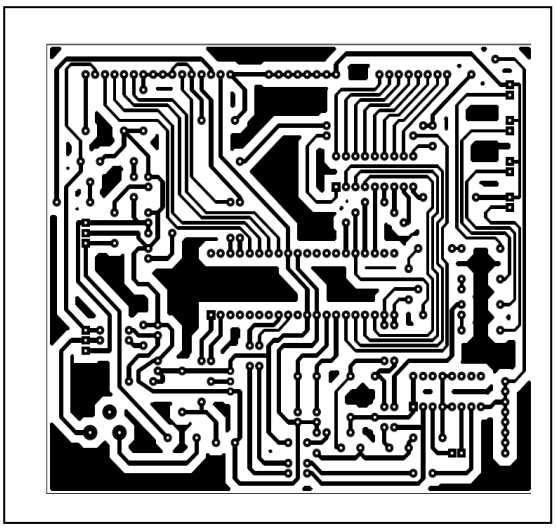

Figure 1:PCB Design of the Circuit

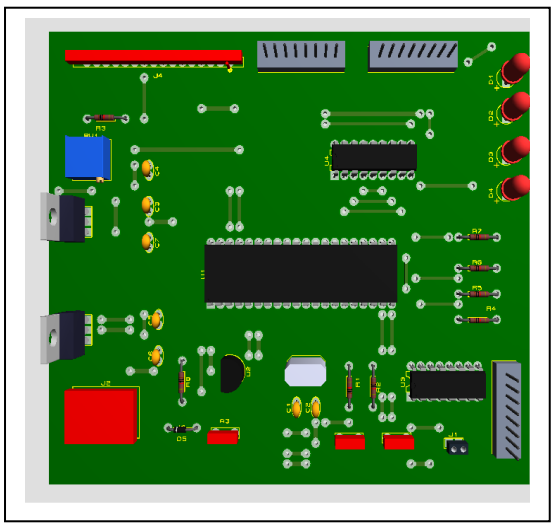

Figure 2: 3D View of the Circuit after Completion

At the beginning of this the program was implemented and the circuit was designed using the Proteus software and the PCB design was taken from the ARES. Finally the circuit board was designed and the components were soldered to the circuit board. The PCB and the 3D view of the circuit are shown above in the last paper gives the idea of the prototype. And shown below is the block diagram of the system and next is the complete circuit diagram of it which was designed using Proteus.

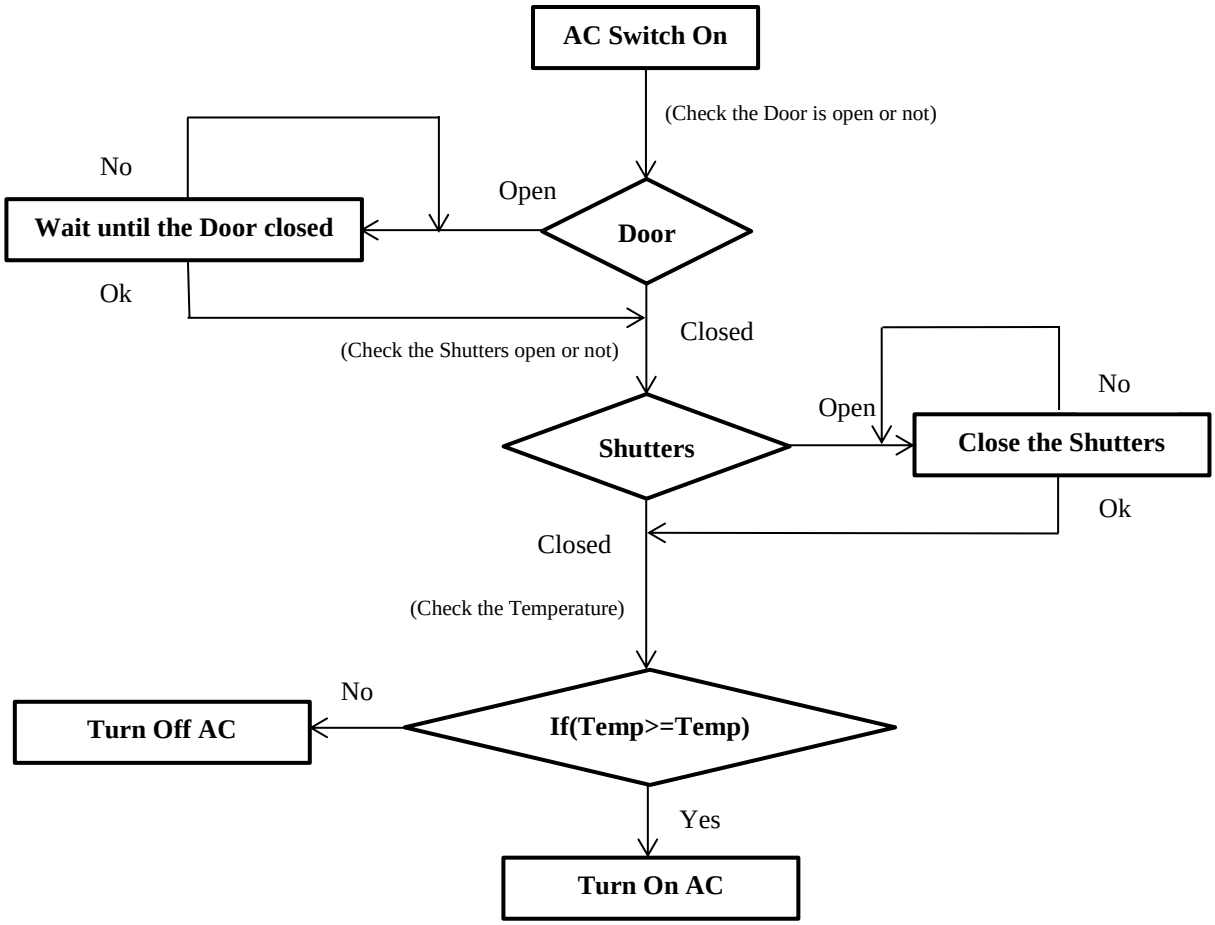

Figure 3: Control Diagram of the System

As it is shown in the block diagram it shows that there are some conditions to check by the system before it turns on the Air Condition of the vehicle. They are as follows.

- First when the switch of the AC turned ON it checks the door.
- If the door is open the AC won't turn ON and waits until the door is closed.
- In the next step the system checks whether the shutters of the doors are closed.
- And if the shutters are open it closes the shutters using the given condition to close the shutters. But, if the shutters are closed at the moment when the door is closed it goes to the next step.
- The next step, it checks the temperature of the vehicle and if the temperature inside is higher than a defined value (eg: 25 C) it turns ON the AC. If the temperature is lower than the defined value the system does not turn ON the AC.

- When the AC is turned on it automatically sets to a defined value if the temperature is changed by the controller or the passenger.
- This system let a manual controlling system to be working for some of the important conditions of the passenger and for his/her ease of access.

The complete circuit diagram of the system is shown in Figure 4.

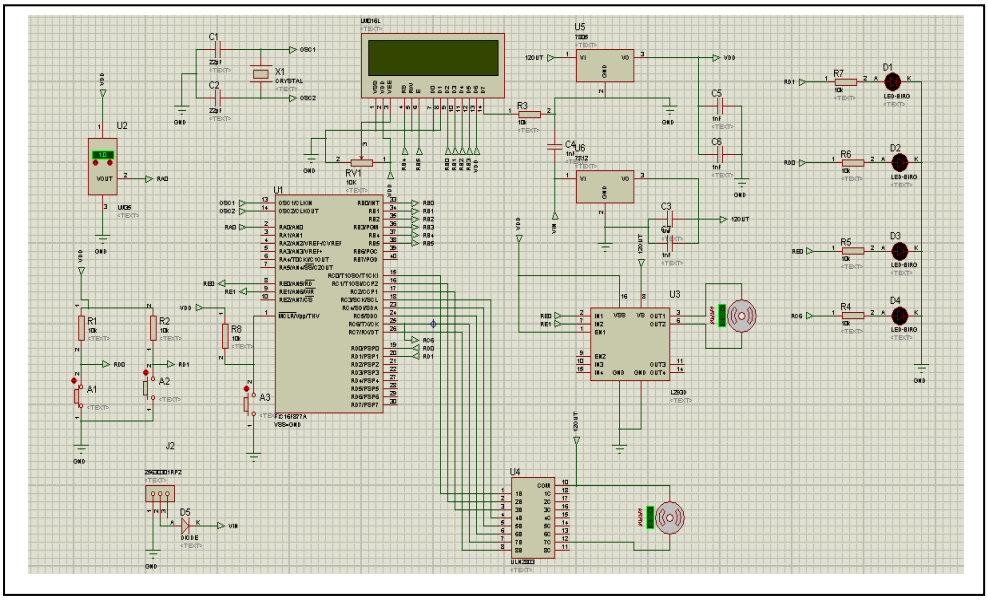

Figure 4: Complete Circuit Diagram of the System

And in this circuit board there are two switches indicating the Door and the Shutter, and when theses switches are pressed the system starts to work considering the necessary conditions.

3.0 DISCUSSION

Since this is a cost effective system it won't take a lot of money to implement this system to the vehicles. And because of that the industry will have that chance of implementing this system easily to the existing system of the vehicles.

When considering from the customers they will be able to have an efficient system for their vehicle since this is specially implemented for the vehicles which are in use now. And this system controls automatically the air conditioner and the shutters and because of that it saves your power and fuel since it turns off the AC and controls it when necessary.

4.0 CONCLUSION

A proper AC Controller System of a vehicle increases the fuel efficiency. Considering the weakness in AC Controller systems in old and new vehicles, we attempted design an automated AC Controller System that integrates window shutters and doors of the vehicle. The system consists of a microcontroller that monitors the internal temperature of the vehicle. In addition, it monitors whether the doors and shutters are open or not. Since the system turns on the AC only after ideal conditions are satisfied, fuel wastage is minimized.

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Department of Electronics-Wayamba University of Sri Lanka

DESIGNING A NETWORK CABLE TESTER

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ABSTRACT

The aim of this project was to design and construct a low cost Network Cable Tester with LCD (Liquid Crystal Display) and more features. Network cable tester is a device which has the ability to test the connections of a network cable. In this work, it was designed at a low cost and as a convenience network tool. It can be used to check whether the eight wires of the network cable are open, short circuited or mismatched. The status of those cables can be displayed using the LCD display. This project required basic designing using about PIC (Peripheral Interface Controller) microcontroller, LCD circuit and electronics simulations. This project also need network installation knowledge and techniques especially on the status and problems of network cables such as continuity, opens, shorts, and mismatches. This project used coding in mikroC language to provide a very efficient algorithm for carrying out the required task. The designed LCD network cable tester is hand-held, can be easily operated and cheap. Also, it does not require pulling the cables out of the place to check the connection because one end of the network cable can be connected to the transmitter part and the other end can be connected to the receiver part. Further, this tester can be developed to check the connectivity of the optical fiber cables.

Keywords: *Network Cable Tester, Liquid Crystal Display, Peripheral Interface Controller*

1.0 INTRODUCTION

Although there exist different types of cable testers, they have some issues[1]. They are very expensive and have some limitations. They can only check whether the network cable is good or bad. It cannot check the cross connectivity of that cable. Also they show the connections using LEDs. The top RJ45 connector sends signals to each of its eight legs. The lower RJ45 connector receives signals from the top RJ45 connector created by the wire. It needs minimum two people to check a network cable using those LED based cable testers. It cannot check a network cable which is wired in a lab without pulling the cable out of that place. By considering these drawbacks, an improved network cable tester was introduced.

2.0 EXPERIMENTAL

The block diagram of the proposed system for the Network Cable Tester is shown in Figure 1.

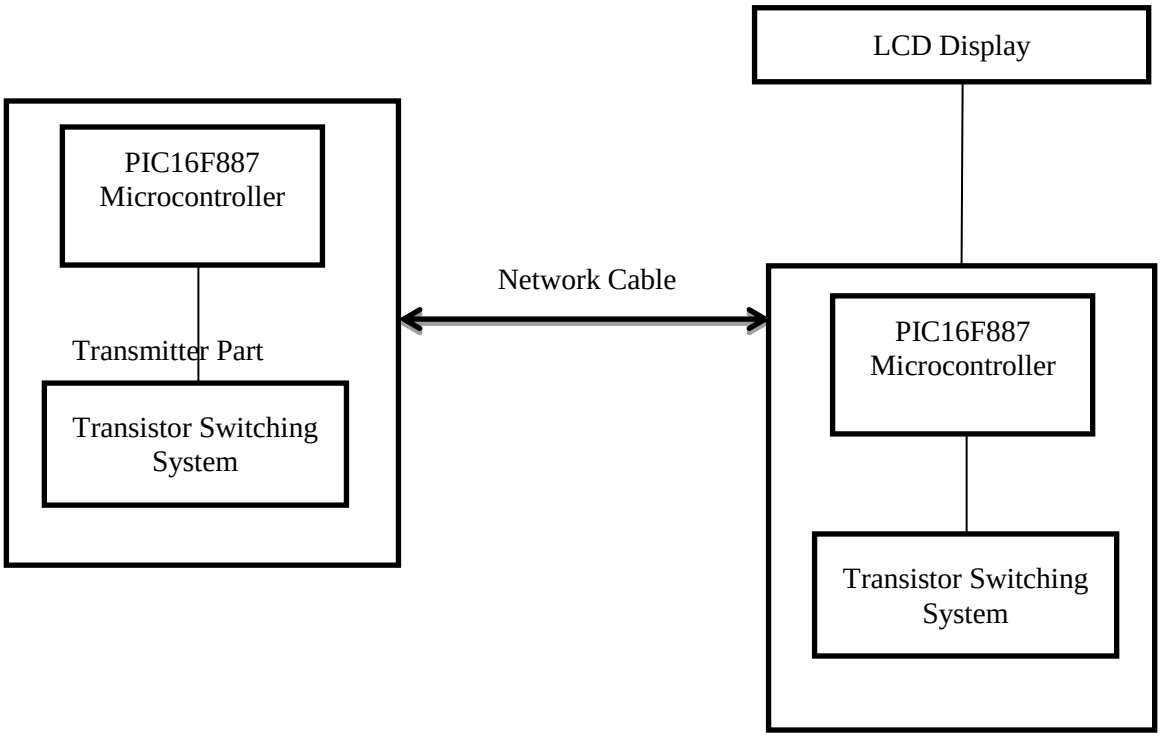

Figure 1: Block diagram of the proposed Network Cable Tester

There should be transmitter and receiver parts to implement this device. The PIC16F887 microcontroller was used as the main control unit of the transmitter side[2]. Also, eight transistors were used as the switching system for this device implementation[3].There should be two RJ-45 connecters at the transmitter and the receiver parts. One end of the network cable which needs to be checked for continuity should be connected to transmitter part and the other end to the receiver part. The two PIC microcontrollers were programmed using mikroC software. The programming language is also called mikroC[4].

To program the PIC 16F887 there need an external hardware part. For this a Multi PIC programmer unit which can programme PIN 18 Microcontrollers and PIN 40 Microcontrollers was used. After connecting PIC to this unit, it should be connected with computer using serial DATA cable.

3.0 RESULTS AND DISCUSSION

The designed Network Cable Tester was checked for properly connected, open circuited and cross connected network cables.

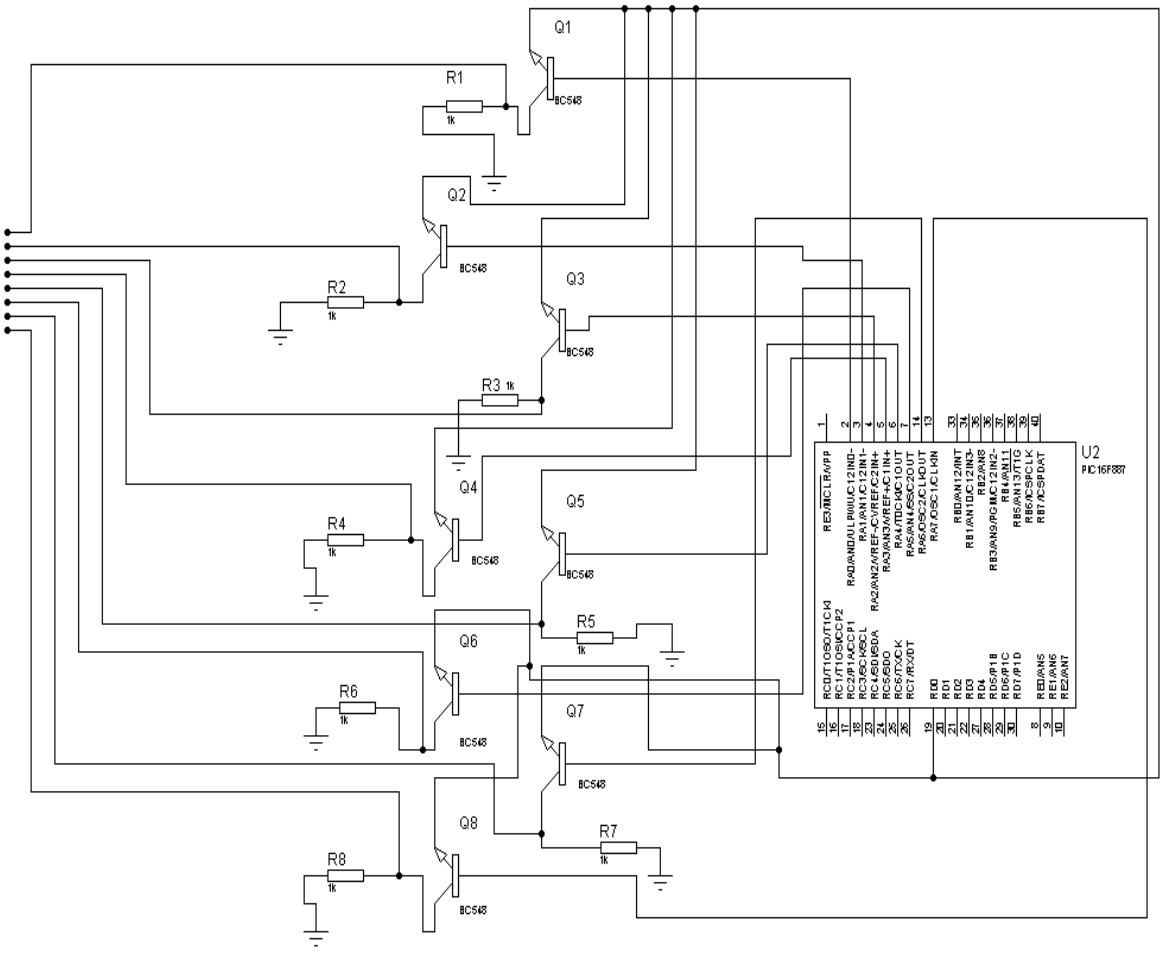

Figure 2: The circuit diagram of the transmitter part of the system

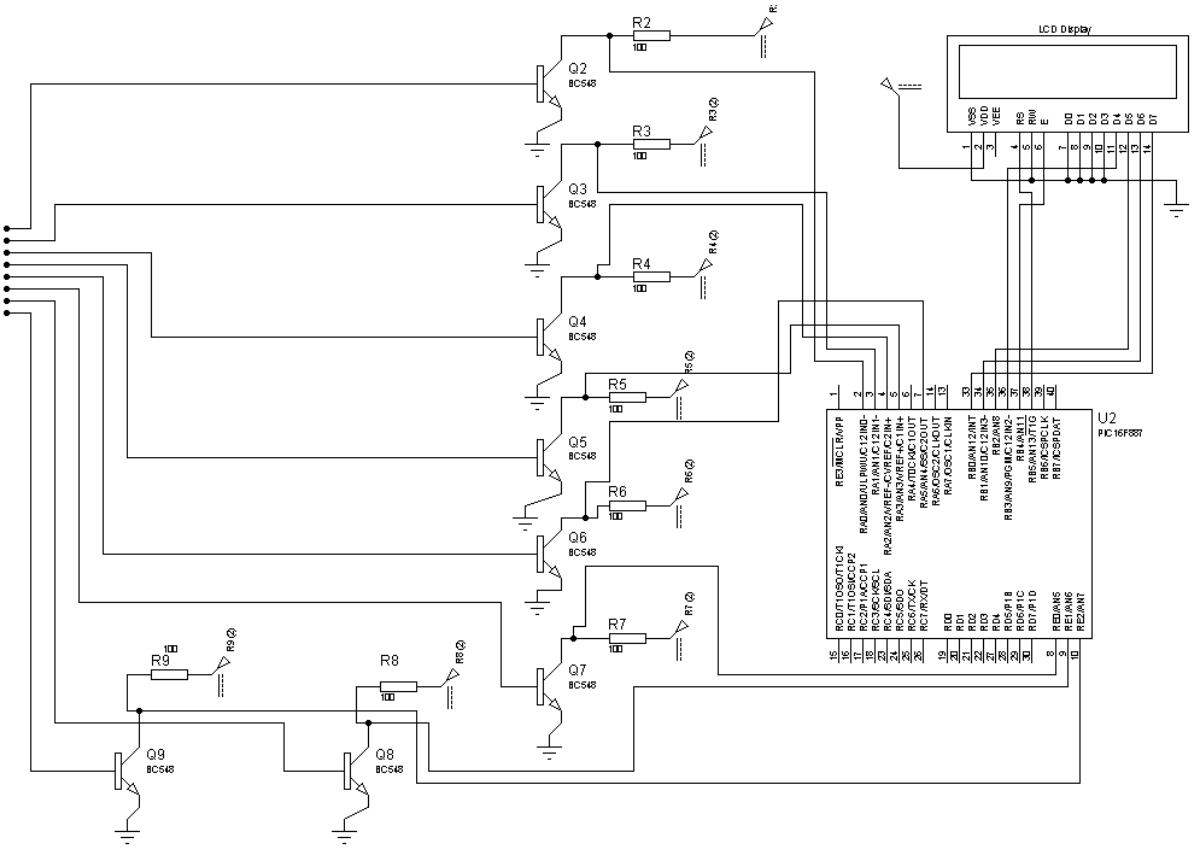

Figure 3: The circuit diagram of the receiver part of the system

When the properly connected network cable was used, LCD Display displayed wires of the network cable are OK one by one. When the open circuited (broken) network cable was used, LCD Display displayed status of the wires of network cable one by one. If the first wire was properly connected, it displayed LINE 1 OK and if the second wire was broken, it displayed LINE 2 BAD. When the cross connected network cable was used, LCD Display displayed status of the wires of the network cable one by one. If first wire was connected to the second pin of the other side, it displayed LINE 1 CROSS 2.

Although there exist various types of cable testers, they have some limitations. Some of them are;

- Very expensive.
- If some of the wires of network cable are broken, it cannot be used to check the status of the other wires because those testers use one wire as the common line.
- No proper display unit.

- Cannot check individually a network cable which ends are far away from each other.

The implemented system was designed to solve the above limitations.

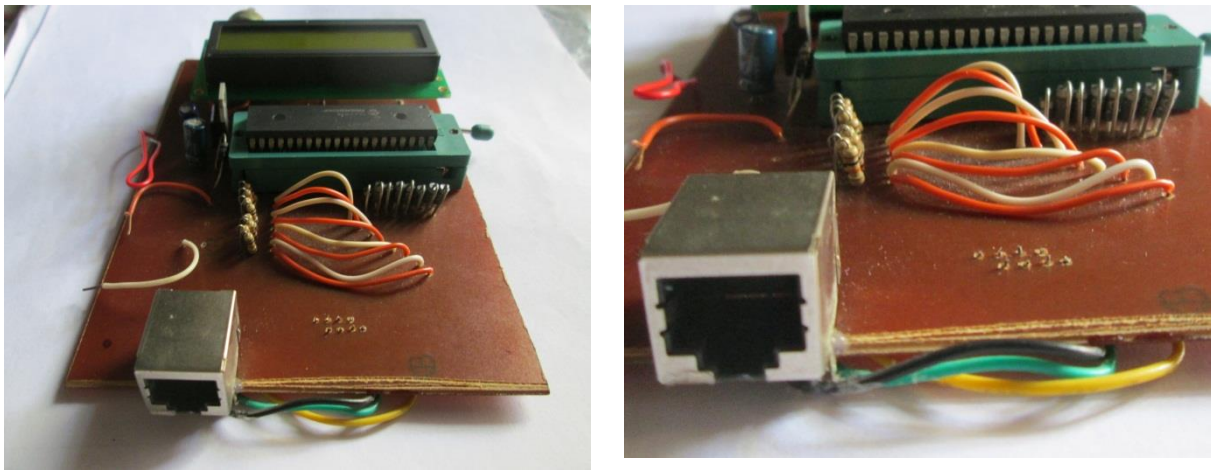

Figure 4: The designed network cable tester

4.0 CONCLUSION

The purpose of this project was to design a simple, low cost but reliable Network Cable Tester. It is intended for use as a troubleshooting tool for basic connectivity testing.By the use of Network Cable Tester we can find all the problems associated with the network cable and the actual fault in our network to make it appropriate. Also it can be used to check whether the wires in a network cable are properly connected, open circuited or wrongly connected.

At this stage, this cable tester was implemented only to test network cables. As further development, this can be improved for testing coaxial cables and optical fiber cables.

ACKNOWLEDGEMENTS

The authors would like to acknowledge and extend gratitude to the persons who have helped to make this project a success.

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Department of Electronics – Wayamba University of Sri Lanka

CLAP SENSITIVE AUTOMATED MULTI SWITCH FOR DAY TO DAY ELECTRICAL POWER SAVING AND SAFETY APPLICATIONS

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ABSTRACT

Electric switch is used as a device for completing and breaking an electric current, or for changing the path of a current. Electric switches are among the most common types of control devices and are in wide use wherever electricity is available. There are two basic types of switches, electromechanical and electronic. The clap sensor switches are mostly available in the normal market. But that switches are only can use for the one purpose. This circuit is used as a multipurpose circuit. The condenser mike picks up from the clap and generates a voltage and it will compare with the reference voltage. When the condenser mike voltage is higher than the reference voltage the comparator output will be high .The comparator output is connected to the PIC microcontroller interrupt pin. After that the PIC program will be run and provide the appropriate output. Using the frequency filter with such enhanced features of this circuit and can be implement the real world applications. The proposed switching circuit is safety and power saving application. The voltage which generates from the clap was observed by using the oscilloscope and noted down.The special noise reduces IC was used to develop the comparator circuit. The various clapping pattern and the response of the proposed circuit was observed by using LED, oscilloscope as output source.

Keywords: *Interrupt driven microcontroller, Electronic switch, Clap sensitive circuit*

1.0 INTRODUCTION

Clapping sound of hand is one of the simplest percussive sounds because its production does not involve any tools or musical instruments[1]. Hand clapping is used as a substitute for language. It is used virtually in everyday aspect of human life, and this form of human expression is found in almost every culture, and in particular as a rhythmic musical instrument. Clapping is also used to indicate agreement and appreciation where it is repeated for a few seconds, and often replicated by the group. From an acoustician's

viewpoint, clapping can be studied individually as a sound generated by the act of hitting both hands together, or collectively, as claps generated by a group of people[2].Clap sensitive switches are available in the market. But they can be used for only one purpose. The multipurpose clap switch can use for many purposes. Generally the clap switch is expensive in the market. But this proposed design is cheap, safety and power saving application for the day to day life.

2.0 METHODOLOGY

It uses very small and very sensitive condenser mic. Received the clap from the environment and generated a voltage by charging and discharging capacitor in the condenser mike .It will compare with the constant voltage by using the LM 358 noise reduce comparator IC. The output of the IC will get from the PIC microcontroller as an interrupt and execute the interrupt program and provide the output.

1.1 Preparation circuit

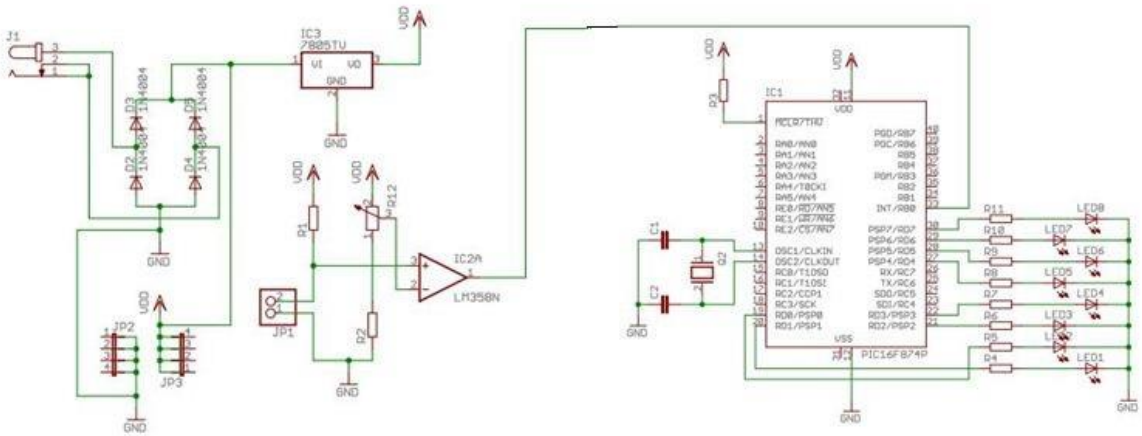

Figure 1: Circuit diagram

In this circuit 22K resistor and condenser mike set the series and the condenser mike was set in the parallel with oscilloscope. The clap was applied with different intensity and then the voltage on the screen was measured.

Moreover the diode bridge is used for the safety of this circuit. J1 pin base is connected to the 12 v power pack. The diode bridge is providing the protection to the circuit when the AC current comings through the switch the diode bridge will convert it into DC current.

The external pin headers apply to the circuit. When we need to get the power to the external circuit this pin header can be used.

Condenser mike has a capacitor. After applying a clap the capacitor will charge and the 3rd pin of the LM358 becomes a higher voltage than the 2nd pin. Such as the output pin(6th) will become higher. The output pin is connected to the PIC microcontroller. When output pin is high, it provides an interrupt to the PIC microcontroller. After that the program will be executed and provide the output according to the instructions.

3.0 OBSERVATIONS AND DISCUSSION

The proposed clap sensitive multi switch was designed to work as, when apply one clap the PIC microcontroller gets it as an interrupt and execute the program. The LED was connected to the PIC microcontroller PORTD as the output. According to the program one clap is applied the RD0 port will high and ON the LED and after applying one clap RD0 will low and the LED will OFF. Also applying two claps the RD1 port will high and the LED will ON and after applying two claps the RD1 will low and LED will OFF.

The one purpose clap sensor switch which is available in the general market cannot be used as multi switch. Hence our proposed circuit designed can be used for the multi purposes.

The usages of the proposed switch mention in following

- The primary application involves an elderly or mobility-impaired person
- It can be used to turn something ON and OFF (e.g. a lamp) from any remote location in the room gets by clapping with hands[3].

The primary advantages are

- Low cost and reliable circuit
- Complete elimination of man power
- Energy efficient and power saving
- It is a safety switch(without touching even switch)[4]

The disadvantages are

- It is generally cumbersome to have to clap one's hands to turn something ON or OFF and it is greatly seen as simpler for most use cases to use a traditional light switch
- Handicaps person without both hands may find problems
- The completed circuit is not only activated by a clap signal. Some it may activated to the high sound like human cough.

4.0 CONCLUSION

The clap sensor electronic multi switch is a switch which activated by a human clap. This can be activated one or more electronic equipment in day to day life. It uses low cost circularly and cheaper than commercially available once.

Most of the clap switches built for a single purpose. But this can be used for the different purpose by developing the PIC program.

Further, this circuit can be developed using following ideas

- The operating range can be increased by using better mike.
- With the use of the frequency filter the clap frequency can be filtered out. Hence the output can be triggered only for the clap
- This circuit can further expand as an advanced multi switch (three, four or five switches) as with the use of the PIC microcontroller.
- This proposed switching device is proposed to the Wayamba University light system and the university street light system as primarily power saving application.

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Department of Electronics – Wayamba University of Sri Lanka

LOW COST HIGHER STRENGTH FM FREQUENCY DETECTOR

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ABSTRACT

This project is based on use of PIC microcontroller programming to design the Low Cost Higher Strength FM Frequency Detector. The PIC microcontroller is a family of modified Harvard architecture microcontroller made by Microchip Technology.PICs are popular with industrial developers due to their low cost, wide availability, larger user base and serial programming capability. Hence, a PIC microcontroller was used for the project to achieve objectives. For this project, PIC 16F877A microcontroller, TEA5767 module, LM358N operational amplifier and LCD were used. This is the first step of design a Low Cost Highest Strength Frequency Detector.

Keywords: *Radio Frequency, Field Strength,*

1.0 INTRODUCTION

This project was related with Very High Frequency of the Electromagnetic Spectrum. The task of this project was developed a device which can detect higher strength FM frequency at a location in instant moment. Also find the low cost solution for fm frequency analyzer. This research project examines higher strength fm frequency detector electronic system to achieve a low cost and reliable prototype. The new device should be a compact, simple and a cheap solution. Field strength meter is actually a simple receiver. After a tuner circuit, the signal is detected and fed to a micro ammeter. The frequency range of the tuner is usually with the terrestrial broadcasting bands. That simple method was used to design this system.[1]

2.0 METHODOLOGY

2.1 Used methods and materials

2.1.1 Used Materials

A PIC16F877A was used to change the frequency of radio module , process the user interface, analog to digital convertor, compare the highest voltage of receiving data .

Figure 1: Pic 16f877A microcontroller

The TEA5767 is a single chip electronically tuned FM stereo radio for low-voltage application with fully integrated IF selectivity and demodulation. It was used for filter the frequency range from 88 MHz to 108 MHz.

Figure 2: TEA576 Module

LCD screen was used to display the result of the system.

Figure 3: LCD Screen

2.1.2 Used Methods

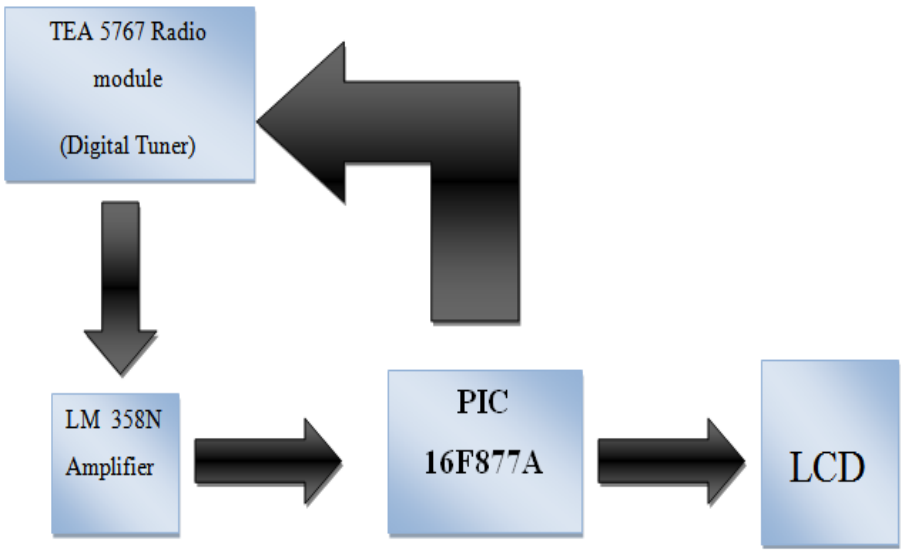

Figure 4: Block Diagram of frequency detector

- The field strength of the radio frequency is depending on the receiving voltage of the frequency wave. Therefore the digital tuner was used to scan the frequency range and get the output voltage of each frequency.
- TEA5767 act as a Digital Tuner it's frequency was changed by 100kHz from 88MHz to 108 MHz through the PIC microcontroller.
- The tuner can output a voltage for each frequency one by one, and the voltage was sent to the PIC microcontroller through the amplifier.
- An output frequency of the tuner was changed to digital by using microcontroller and compare until meet the highest voltage. After that highest voltage and it's frequency display on the LCD screen.

3.0 RESULTS AND DISCUSSION

3.1 Results

The result of the one scan cycle is display on the LCD screen as shown in Figure 3 Max is highest voltage and Freq is Frequency of highest voltage.

Table1: Results of the system observed at Wayamba University of Sri Lanka, Kuliyapitiya.

Frequency	Maximum Voltage
102.5999	4.41568
88.5999	4.45621
90.5999	4.41406
95.5999	4.40917
88.5999	3.39355

Figure 5: The Result of the one scan cycle is display on the LCD screen

3.2 Discussion

Field strength measuring was important factor in communication field. Industrially spectrum analyzer used to measure the field strength. The coverage of a broadcasting station and the technical quality of the service provided are determined by the received signal and field strength. Presently available method of estimating field strengths within the service ranges of estimating field strength often fail to take into account variation due to important local conditions. For operating stations the best determination of station coverage is provided by properly made field strength measurements. The present of trees, buildings, and terrain irregularities often result in the signal from one location to another, even within relatively small areas[2]. The variation in field strength with location must be taken in to account in measuring the field strength as well as in specifying service. Service is usually defined in

terms of the median value of field strength. Fig 4 is a block diagram of a practical field strength meter.

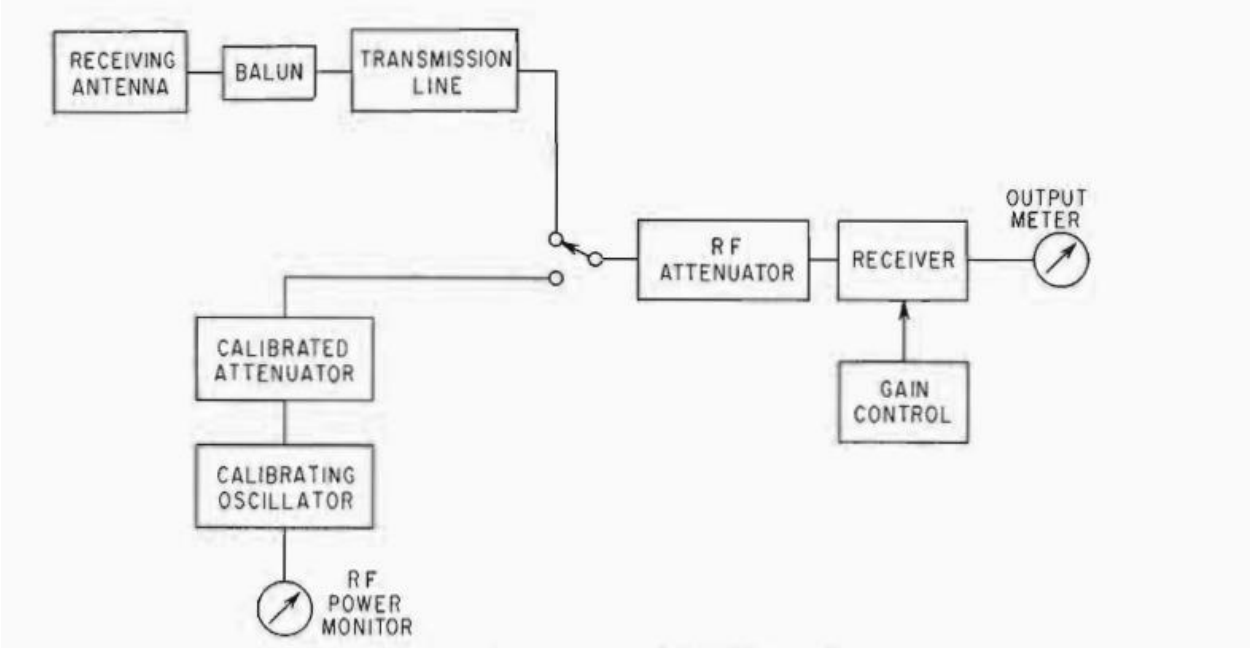

Figure 6: Block Diagram of Practical field strength meter

4.0 CONCLUSION

Even though this is a preliminary study, the results predict the possibility of detect the strength of RF. An antenna factor and total system loss of the circuit were not measured in here hence actual strength cannot calculate. were factors responsible for variations of the strength. Such factors include: Side lobe effects, attenuation and obstacles like buildings, trees, weather conditions, ground reflections etc.[1]

ACKNOWLEDGEMENTS

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Department of Electronics - Wayamba University of Sri Lanka

RAILWAY GATE EFFICIENT CONTROLLING SYSTEM USING RADIO FREQUENCY MODULES AND OPTOELECTRONICS DEVICES

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ABSTRACT

Today railway crossing are everywhere without dedicated railway gate keepers. So accidents in the crossing are increasing day by day. No fruitful preventive steps have been taken to avoid such the accidents. According to statistics from Sri Lanka Railways, there are an increasing number of accidents at level crossings due to increase in human population and vehicles. The number of fatalities from these accidents also increased dramatically. This research study attempts to find out convenient solutions using the knowledge of the microcontroller based automation, optoelectronics and RF devices. This research deals with automatic railway gate at a level crossing replace the gate keepers thus minimizing human mistakes. Also project deals with two things, firstly it reduces the time for which the gate is being kept closed. Secondly, to provide safety to the road users with reducing the accidents. By employing the automated railway gate control at the level crossing hence the signal for arrival of the train is transmitted on that signal is detected by the receiver which is fitted in the gate. Then gate is closed after checking whether the road is clear or not, pass another signal to the train informing the road condition. The gate controlling system will further developed for minimizing almost all the risky. The proto type experimented system with optoelectronics and RF devices based sensing and signaling successfully operated. This system is cost effective and it can be further reduced by using available devices and components.

Keywords: *Rail gate, Transmitter, Receiver, Half duplex, Optoelectronic devices*

1.0 INTRODUCTION

At present scenario, in Sri Lanka level crossings, the railway gate is operated normally by a gate keeper after receiving the information about the train's arrival. When a train starts to leave a station, the station master of a particular station delivers the information to the nearby gate.

The above said procedures are followed for operating the railway gates. This project deals with automatic railway gate operation implemented in unmanned level crossing at remote areas. Detecting techniques of train approaching the gate is Radio Frequency (RF) modules. In this one set of RF modules is used for transmit the data which indicates, train enter the relevant area then the other set of RF module is used for transmit the data which indicates the gate is open or closed. The microcontroller based automation is used for controlling the gate operation of opening or closing. The optoelectronic devices (laser diodes) are used for road condition sensing, clear or not purposes[1].

2.0 METHADOLOGY

2.1 Data transmitting and receiving system

In this railway gate simulation platform radio frequency (RF) transmission module employs Amplitude Shift Keying (ASK) with transmitter and receiver[2]. The transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission[3]. The system allows half duplex communication between two nodes, called transmission and reception. The RF module has been used in conjunction with a set of four channel encoder/decoder ICs. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The RF receiver is detected the signal which transfer from transmitter and send it to the decoder. The decoder is used after the RF receiver to decode the serial format and retrieve the original signals as outputs

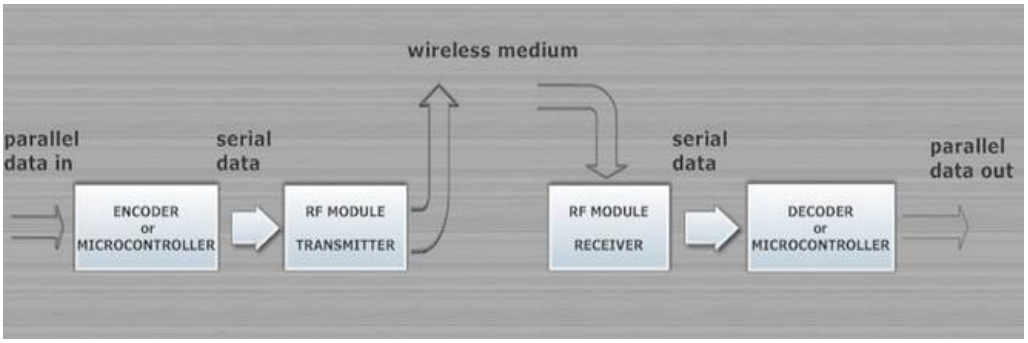

Figure 1: The overall data transmission system[4]

2.2 The railway gate controlling system

When RF receiver received the train arrival indicating signal, it transfers to decoder. Decoder gives the parallel output data to the microcontroller. Microcontroller check whether road is clear or not and if road is clear then pass another signal to the servo motor for close the gate. Also it transfers signal to the train informing the gate is closed and railway path is clear. If road is not clear another signal is sent to the train indicating the information of gate is not close and that the railway road is not clear.

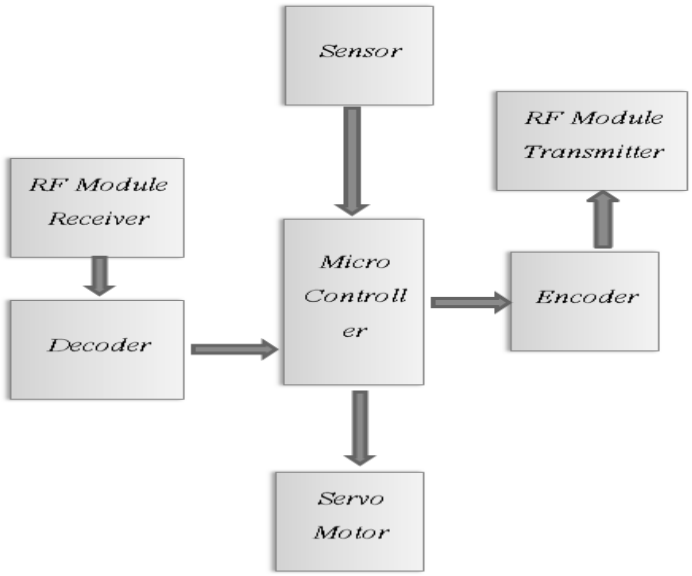

Figure 2: Gate control system

2.3 Complete view of the railway gate efficient controlling system

This Railway Gate Controlling System controls the gate automatically by detecting the relevant signal. When train arrives in a particular direction RF transmitter generate appropriate signal and then RF receiver detect that signal. At the same time after detecting the signal, the condition of the road is checked whether road is clear or not. If road is clear then the gate is automatically closed and another signal is sent to the train indicating the gate closer. If road is not clear RF transmitter which is at the railway station, transmit the signal to the train by indicating the gate is not closed. In such instance the train driver should stop the train manually. Accidentally sometime auto car drivers may enter the vehicles to the rail road when gate is closed. At such instance was be immediately passed a wrong signal from the station transmitter to the train indicating the condition. In such a case railway driver should stop the train before entering the dangerous zone.

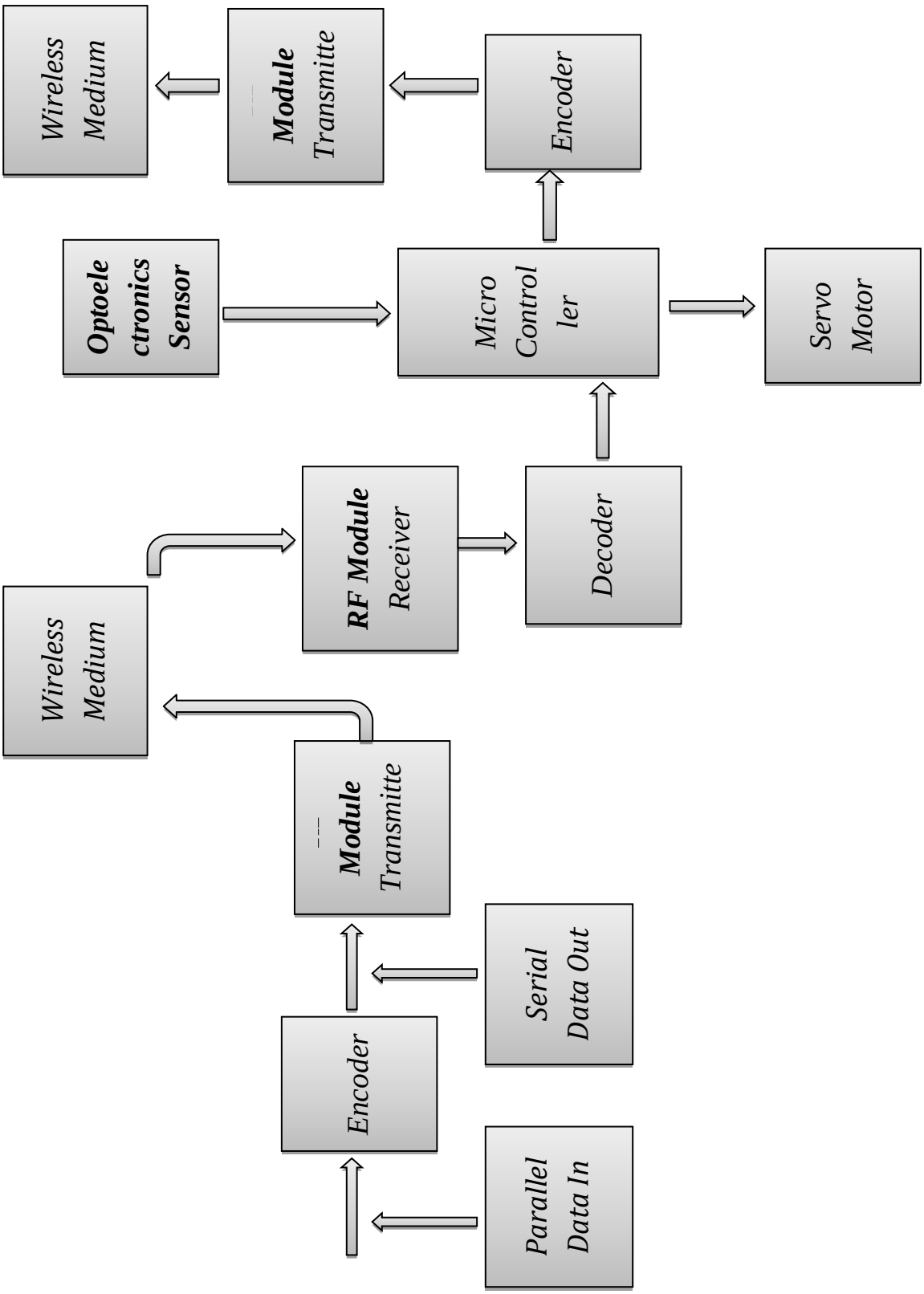

Figure 3: Overall railway gate controlling system block diagram

3.0 OBSERVATIONS AND DISCUSSION

In this proposed railway gate controlling system, when train reaches to the gate then gate is automatically closed. This process was done by using the data transmission system. When design the Railway Gate Controlling System, the safety and reliability of the system must be considered in first place. Hence this system was designed by considering the safety. In the constructed proto type system one sensor part for one side of the road was included for checking whether the vehicles are on the road or not. In order to further increase the safety, the two pair of beams crossing sensor part for each side of the road can be included.

By employing the proposed automatic railway gate controlling system at the level crossing, the gate closing and opening reaction time can be minimized compared to the manually operated gates. Also it reduces the human labor. This type of gates can be employed in level crossing without keepers where the chances of accidents are higher and also reliable operation is required. Since, the operation is automatic; error due to manual operation is prevented. And the implementation railway gate operation system can be centralized. Intern thus well minimizes the train collision accidents.

4.0 CONCLUSION

Nowadays, in Sri Lanka the railway gate is operating by human based manual operation. It is operating in the areas where the railway line junctions with the roads. The railway gate management has to employ gate keeper on duty for controlling the operation. Often the gate keeper has to manually open and close the gate where under his supervision specially. The accidents have to be avoided at places where there is no gate keepers managing the railway crossing gates.

By implementing this prototype system will introduce as a real world. The automatic railway gate operation controlling yet under human supervision the problems occurred while this system was operated can be minimized. Two RF modules were used for transmitting and receiving the data. Laser diode source and LDR sensor were used for sensing the vehicles that are reaching the railway gate. Also the stepper motor was used to open and close the gates automatically when it is rotated clockwise or anticlockwise direction. This is the more economical and reliable solution which could be found to minimize the accident at railway road crossing gates in Sri Lanka.

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Authors would like to thank Prof. C. A. N .Fernando who is the Head of the Department of Electronics and Dr. (Mrs.) G. A. K. S. Perera who is the coordinator of the Research module and all the other lecturers of the Department of Electronics.

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Department of Electronics – Wayamba University of Sri Lanka

EXPOSURE LEVELS DUE TO RF RADIATION AT 900MHz AND 1800MHz BANDS IN HIGHLY POPULATED AREAS

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ABSTRACT

The use of radio-frequency measuring equipment is dramatically increasing, and one consequence is that the levels of radio-frequency radiation are increasing drastically.The most important use for RF energy is in providing telecommunications services. Biological effects that result from heating of tissue by RF energy are often referred to as "thermal" effects. It has been known for many years that exposure to very high levels of RF radiation can be harmful due to the ability of RF energy to rapidly heat biological tissue. Due to that, many research activities are carried out to find out whether there occur any hazards due to the radio frequency radiation. In this research the measurements were taken at the Kuliyapitiya premises of Wayamba University of Sri Lanka as a highly populated area. For this research project, to take the measurements a Handheld Spectrum Analyzer, Portable YAGI Antenna (885-975 MHz), N95 NOKIA cellular phone and NOKIA GPS were used. From the measurements the exposure quotient was calculated. Then the calculated exposure levels were compared with the FCC standards.

Keywords: *Radio Frequency Radiation, exposure quotient, Federal Communication Commission, Spectrum Analyzer*

1.0 INTRODUCTION

Most RF fields found in the environment are due to commercial radio and TV broadcasting, and from other telecommunications networks. RF exposure from radio or TV broadcasting is generally less than from telecommunications networks. RF sources in the home include microwave ovens, mobile telephones, cordless telephones, wireless computer networks, burglar alarms, and remote controls. The RF field background level from household appliances is low. Relatively high levels of exposure to RF fields can occur to workers in the broadcasting, transport and communications industries when they work in close proximity to RF transmitting antennas and radar systems. Some industrial processes

that use RF fields to heat materials can also produce high exposure to workers. Radiation sickness is damage to your body caused by a large dose of radiation often received over a short period of time. The amount of radiation absorbed by the body determines how sick you'll be. Radiation exposure can also increase the probability of developing some other diseases, mainly cancer, tumours, and genetic damage[1].

New cellular antennas and other RF emitting devices are being installed as quickly as possible. There are currently over 100,000 operating devices in the Sri Lanka alone. That number is expected to double in the very near future as the demand intensifies for more powerful wireless devices. Cell phones give off a form of energy known as radiofrequency (RF) waves, so some concerns have been raised about the safety of cell phone use. According to the increasing the number of cell phone users, inherently increase the number of cell phone towers. So inherently increase the amount of the radiations also. The main thing is we can't feel those changes. But it produces lot of issues. The main objective of this research project is aware the general public about the radio frequency radiation. Other than this, can find issues from the mobile phones radiations[2].

2.0 METHODOLOGY

Measurements were taken in Wayamba University of Sri Lanka Kuliyapitiya premises to determine the exposure levels due to EM fields radiated by Mobile cellular base stations. The measurements of field intensity were made at different locations in the university.

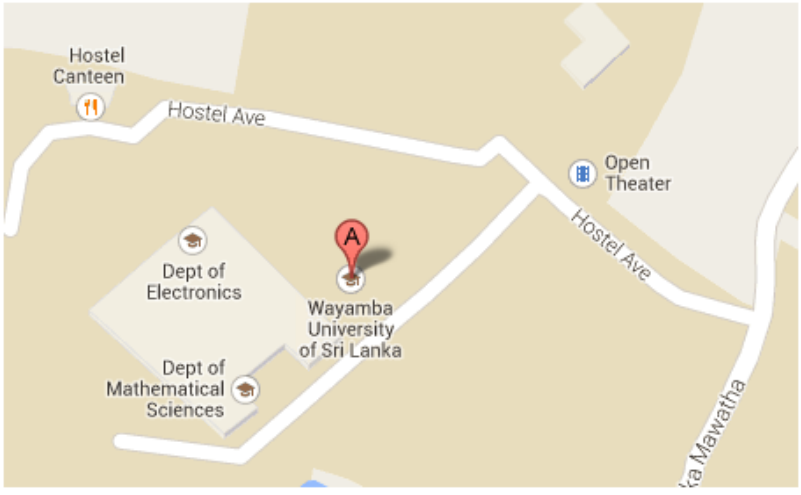

Figure 1: Wayamba University map with RF measured areas

These measurements are spot measurements and particular spot was selected from the most public access places such as canteen, open theatre and Applied Science Faculty building.

All measurements are taken during the daytime when most of the mobile phones are normally in use.

2.1 Used methods and materials

The spectrum analyzer was used to obtain the signal strength received from signals transmitted by mobile cellular base station antennas. The measurement equipments are shown in figure 2 and figure 3.

Figure 2: Spectrum Analyzer Spectrum Master E MS2711E

Figure 3: Adjustable dipole antenna: Portable YAGI Antenna, 885-975 MHz, N (f), and 10dBd

The antenna was mounted 1.4 m above the ground level as it in the average height of a man. For a particular signal, the maximum received voltage, Vm in dBμV, was obtained from the spectrum analyzer, rotating the antenna to the direction of maximum received field strength. This was repeated for five operators such as dialog, mobitel, etisalat, hutch and airtel.

QVoice software installed N95 NOKIA phone and GPS used to take measurements with the distance from base station. COL 200 base station situated at Mobitel (Pvt) Limited - Engineering Division was selected for this purpose.

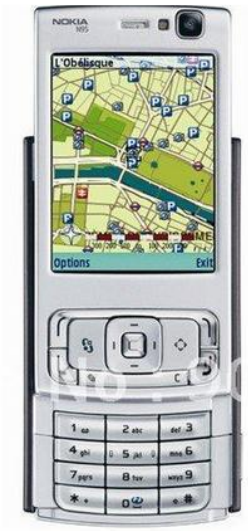

Figure4: NOKIA N95 Cellular phone **Figure5:** NOKIA GPS

To comply with the MPE, the fraction of the MPE in terms of E^2, H^2 or S incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity. This dimensionless quantity is known as the *exposure quotient*. In this investigation, the exposure quotient is expressed in terms of the calculated power density, S^{meas}, from measured results of the field strength and the maximum permissible power density, S^{ref}, for the same frequency. Thus,

Exposure Quotient = S^{meas}/S^{ref} [1]

$$TEQ = \sum_{i=1}^{N} \frac{S_i^{meas}}{S_i^{ref}} = \frac{S_1^{meas}}{S_1^{ref}} + \frac{S_2^{meas}}{S_2^{ref}} + \frac{S_3^{meas}}{S_3^{ref}} + \cdots + \frac{S_N^{meas}}{S_N^{ref}} \quad [2]$$

Where TEQ is Total Exposure Quotient and N is the total number of signals[3].

3.0 RESULTS AND DISCUSSION

Table 1: Total Exposure Quotient of cellular mobile operators

Location	Cellular Mobile Operators				
	Dialog	Mobitel	Etisalat	Hutch	Airtel
Canteen	0.126826	0.109481	0.088722	0.107828	0.092795
Open Theater	0.105387	0.109984	0.110633	0.109184	0.141466
Faculty Building	0.129962	0.106999	0.114815	0.087039	0.099218

According to the table 3.1 total exposure quotients at canteen, open theatre and faculty building are below than unity. So the canteen, open theatre and faculty building are safe from RF exposure. Power density variation with the height is somehow complicated. So we cannot predict about the change of field strength with the height.

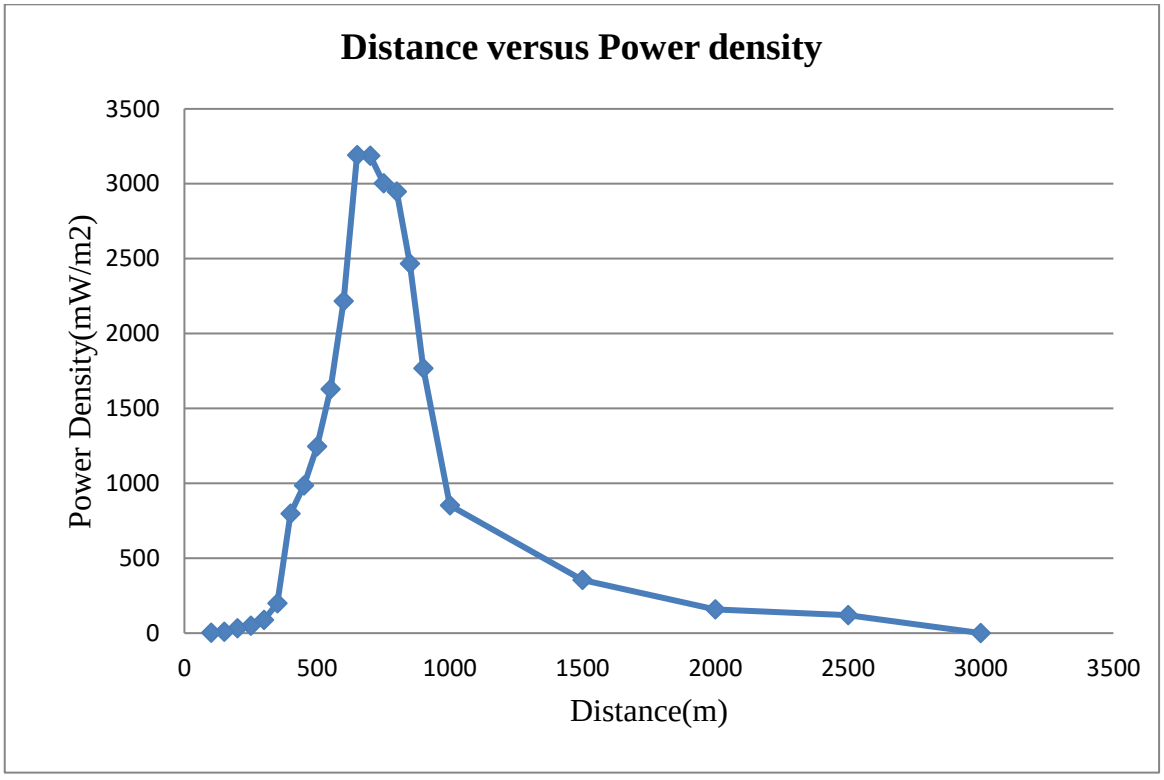

Figure 6: Distance versus Power density

According to figure 3.1, power density was increased up to certain distance and then begun to decrease away from base station.

4.0 CONCLUSION

Even though this is a preliminary study, the results predict the possibility of occurring hazards. There were factors responsible for these variations. Such factors include: Side lobe effects, attenuation and obstacles like buildings, trees, ground reflections etc.

Measurements have shown that ground-level power densities due to microwave directional antennas are normally a thousand times or more below recommended safety limits. Significant exposures from these antennas could only occur in the unlikely event that an individual was to stand directly in front of and very close to an antenna for a period of time[4].

ACKNOWLEDGEMENTS

The authors would like to acknowledge and extend heartfelt gratitude to Department of Electronics.

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Department of Electronics – Wayamba University of Sri Lanka

AUTOMATED SYSTEM TO CONTROL WATER PUMPS WITH REMOTLY MONITORING WATER LEVEL AND CONSUMPTION FOR WUSL KULIYAPITIYA PREMISES

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ABSTRACT

Nowadays everybody has overhead tank at their homes. Such water tank owners face several problems which can be solved with microcontroller based automation system. The comprehensive automation systems are how to online track the water level and way to switch ON/OFF when the tank is empty or full respectively, the way to stop water pumping just after tank is full etc. In this way wastage of electricity, water and managing other resources can be saved. There is wastage of energy as well as wastage of water**.** This is also happened in Wayamba University of Sri Lanka Kuliyapitiya premises. In this Electronic research project and user friendly water supply controlling system was designed for Wayamba which can be easily controlled even by a low level minor employee just clicking on informative Graphical User Interface (GUI) on the controlling CPU. This system used Ultrasonic Sensor to measure the water level, Microcontroller to communicate with personal computer and Graphical User Interface (GUI) to monitors whole systems from one controlling center.

Keywords: *Ultrasonic Water Level Sensor, Microcontroller, Graphical User Interface*

1.0 INTRODUCTION

Presently Wayamba University use manual system to control motor system of the water pumps and unknown water level at the moment. But this manual process leads to more disadvantages. Today people have less time to human monitor control process in home application as well as in industry routine jobs. These microcontroller based automation is a major solution for the above problem. This project aim designing automation system to save resources delay with water pumping system at Wayamba University of Sri Lanka Kuliyapitiya Premises.

2.0 METHOLODOGY

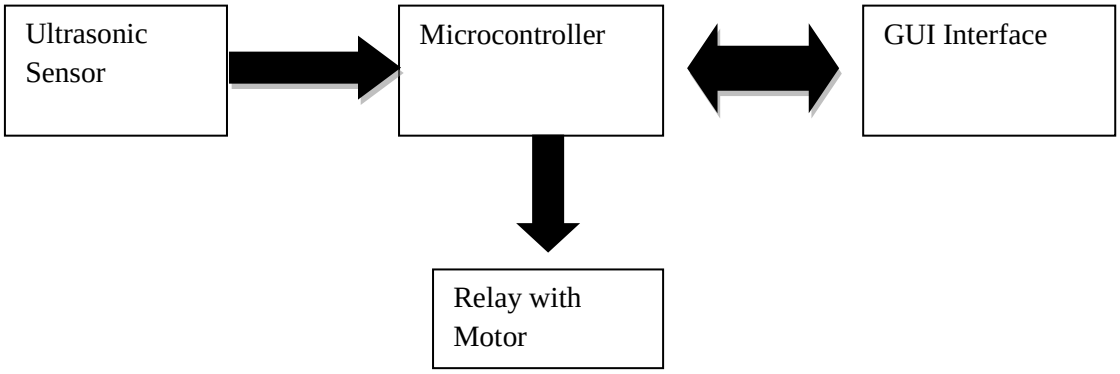


Figure 1: Block Diagram of The water pumps controlling System

The above figure is illustrating the whole project block diagram. The first block is Ultrasonic Sensor module. Ultrasonic waves spread in the air and would return immediately when it encountered obstacles on the way. Then the ultrasonic receiver would stop timing when it received the reflected wave. In this proposed system water act like an obstacle. Ultrasonic spread velocity is 340m/s in the air. The timer is record time (t) to received reflected wave[1]. Then microcontroller is needed to do above calculation according;

$$\text{Distance} = \text{Velocity} \times \text{Time} \quad (1)$$

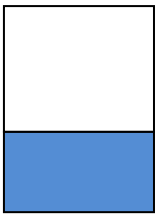
$$S = (340*t)/2,$$

S - Distance between sensors located position and top of water level.

The water level is difference between S and distance of from sensor located point to bottom of tank. Finally water level is send to personal computer through UART (Universal Asynchronous Receiver Transmitter)[2]. GUI is catch the values send from the PIC[3]. Hence the level of water is displayed in GUI. Also water level is checked minimum or maximum[4]. According to above result, Data is automatically sent into the microcontroller. Then related port connected with motor is activated as HIGH OR LOW. Finally relay circuit activated motor.

The water consumption is calculated without any sensor. But mealy with the calculation been done at the GUI application in the microprocessor. Moreover daily consumption also displayed in the text box of GUI[5].

Calculation of the consumption as shown in the following; Let assumed volume of tank is 2000 ltr and the water 30% containing in the tank



Containing Volume of tank = 2000ltr x 0.3
= 600ltr

Figure 2: Water filled Tank

3.0 RESULTS AND DISCUSSION

A person should be with some computer literacy to operate the controlling activity of two water pump at two well. The GUI interface is a unique extra featured to the existing water monitoring systems. If one tank connected with more than one motor can easily control all motors automatically up to 8 motors. As future work development; small data base to be integrated to GUI and daily consumption automatically update into the data base. Then report can be automatically generated weekly or monthly. The quick links related to project attached in GUI Interface so can be easily trouble shoot since the control GUI is linked with the overall system.

3.1 The Advantages of the proposed controlling system

Compare to the other systems this is cost effective and the used equipments are locally available and they are reliable.

Electric energy consumption will be reduced as the result of motor being ON/OFF at the right time. Also the water quantity is not wasting due to above system. Time efficiency of controlling can be achieved with only single computer literacy labor such employed can take care of the system of reliability and smooth functioning. This system can be proposed to Sri Lanka water board to compliment commercially in island wide. This system can be used for the water management and consumption of water level at weekly/monthly basis also can be analyzed.

Diode is used to be protected from the alternative current used. GUI interface shown in following figure 3.

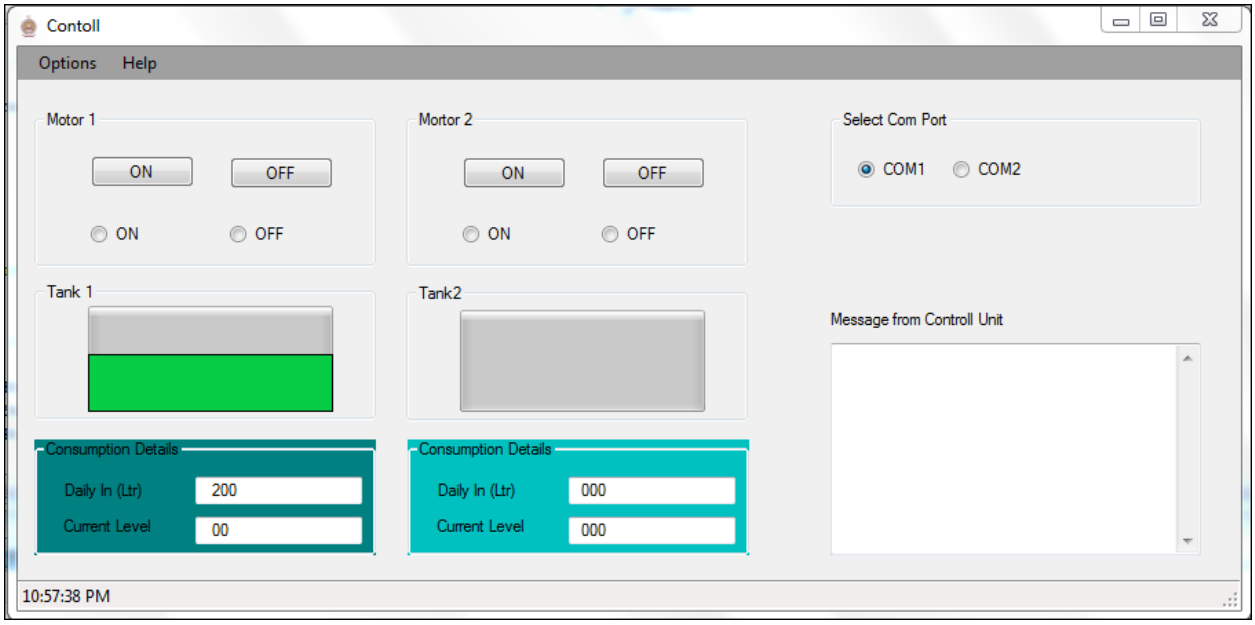


Figure 3: Graphical User Interface

4.0 CONCLUSION

The final outcome of this project is automated water pump controlling and water consumption monitoring system which can also be used to check whether the motor is running or not, current water level etc.

ACKNOWLEDGEMENT

The authors would like to acknowledge and extend gratitude to the persons who have helped to make this project a success.

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Department of Electronics – Wayamba University of Sri Lanka

LIGHTNING PROTECTOR FOR A ROUTER

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ABSTRACT

Lightning travelling through phone lines can damage the modem, Phone. If the computers, TV are connected to the phone lines via a router, there should definitely use a lightning protector to have the phone line plugged into the router and telephone. Computer has multiple voltage-sensitive components that a power surge could damage easily. This damage will shorten the life of the computer, and it could very easily wipe out all saved data or destroy the system. Because when we connect internet through router .And also Peo TV connection is connected to the TV via router. Those are very expensive items, and the data they hold is often irreplaceable, so install in a lightning protector over telephone line. A lightning protector will generally extend the lifetime of these devices. Because there is always a chance that a big power surge will cause damage. Designing a lightning protector for routers is the objective.

Keywords : *Surge, lightning, common grounding, surge arresters, transient overvoltage, MOV(Metal Oxide Varistor)*

1.0 INTRODUCTION

Burning the telephone line equipments such as telephones, routers, STBs(Set Top Boxes) and etc due to lightning is a common issue. Protecting the devices by lightning is very much essential for the areas where heavy lightning occurs frequently.

The aim of a surge or an overvoltage protection system is to assure the continuity of electrical power supply and minimize to an acceptable level for people and equipment any possible damages due to incoming transient surges. The most important feature of surge arresters is its rapid response time. Transient overvoltage could easily reach several kilovolts in a few microseconds. During this raise time, while them protector has not reacted; this increasing voltage reaches the connected equipment. Generally, the response time of the arresters varies between 20 and 100 nanoseconds. Surge arresters can be

installed in series or parallel, but in all cases they must remain inactive under normal conditions. Once the overvoltage starts, the protector will start working, leading the lightning current to ground.[1]

From the investigations, it was identified that the grounding is the major phenomena should be controlled to design the protector. A common ground was used to design the circuit. The device can be installed in between any telephone line connected devices which should be protected.

2.0 EXPERIMENTAL

The circuit implementation of lightning protector is fitted to phone line. The technical specifications and characteristics of the lightning protector were studied in detail. They provide an alternate low resistance path to ground during a lightning strike, and thereby protect the electronic equipment connected to them. That's why it's important to have an excellent site ground. If the site ground is inferior, the lightning protection cannot offer the low resistance ground path, so the lightning will discharge through the electronics, leading to damage. The connection to a ground plane is as important as the surge protection device itself. Following proper installation techniques and attaching to proper grounding planes is required for a workable electrical grounding system.

- Do not sharply bend the surge protection wires during termination. Offer a straight path to ground.
- Keep the surge protection wires as short as possible to improve effectiveness and response time.
- Keep the surge protection device a few feet away from the equipment protected to allow enough response time for the transient voltage to be suppressed.
- Ensure all systems connect to the same grounding point only once. Multi paths to a ground plan create different voltage potentials on the system that can result in transient surges. This simply means only pound one copper rod in the earth for grounding.

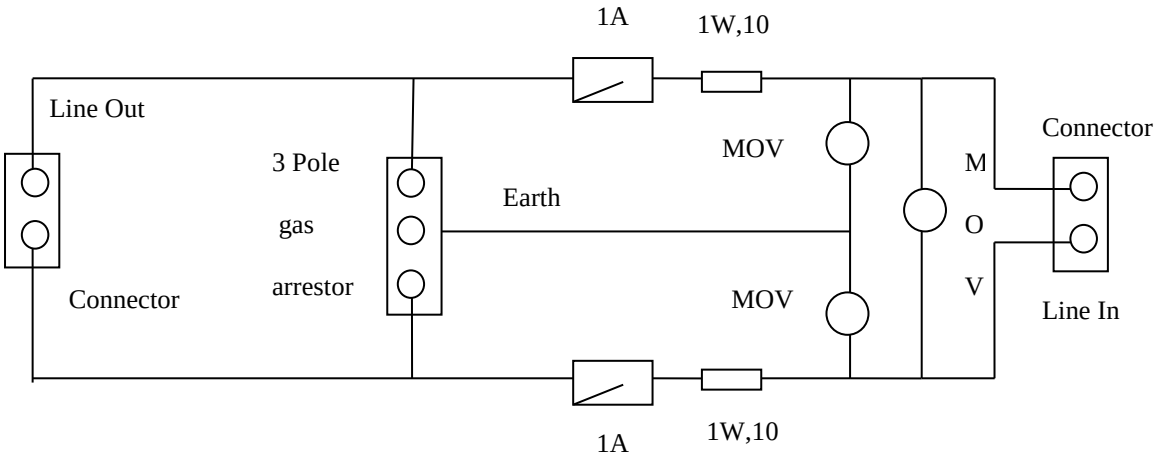

Figure 1: Circuit Design

3.0 RESULTS AND DISCUSSION

The device was tested with an area of heavy lightning occurs. The equipments which were connected to the telephone line, especially routers were safe after using the device series with the equipments. The specialty of this device is that it can be used in between drop wire and the rosette or in between rosette and the splitter or in between splitter and the router. So the advantage of the design is highly valued.

The protection provided by telecom operator and the devices connected to telephone lines is not always enough. Because most of time telephones, routers, arresters are replaced because of lightning. The protection usually is designed so that it minimizes the costs. It is not suitable to protect cheap telephones with expensive protectors, because strong lightning surge is quite rare and telephones are inexpensive to replace if such thing happens. The situation might be different when there is something more expensive than ordinary telephone connected to line. In the cases of having expensive computer systems, PeoTV are usually worth to protect because the damage caused by the lightning strike can cause very terrible damage. For example in computer, lightning strike can not only destroy the router but also something else inside of the PC or Peo TV. That can become very expensive if valuable information is lost and the PC is very important at our business. So sometimes extra protection is needed. If there is enough protection, the damage is avoided or at least minimized.

4.0 CONCLUSION

The major identified drawback is to have extra fuses to use in the case of burning existed fuses by a heavy lightning. But when comparing the price of a fuse with the price of a router and sometimes the consultant fee of the service provider it very much cheaper and negligible price. It is more cost effective than replacing expensive routers, computers, televisions, STBs and etc.

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Department of Electronics – Wayamba University of Sri Lanka

COMPUTERIZED SETUP FOR THE DC POLARIZATION TEST

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ABSTRACT

With various investigations of electrolytes materials, it is very import to identify their various behavior patterns and properties. As far as electrolytes are concerned, their conductivity is a special feature to be studied and also the nature of conductivity whether ionic or electronic or mixed is of prime importance. Transference number measurement is one of the simplest methods of evaluating nature of conductivity. For measurement of transference number, DC polarization test is commonly used. In this study, it was attempted to design a computerized system to DC polarization test. The features that were given priority in the designing are cost effectiveness, better data acquisition and compatibility with most of the PCs and laptops. This system has been designed using ADS1110 (16 bit AD converter with self-calibrating) and pic 16f877a for monitoring the slowly varying signals. Firmware was written in CCS C v.4 compiler and burnt to the microcontroller by using PICkit2 programmer. Another program was also developed in Matlab R1012a which allows to display the graph of current vs. time. From the data represent on the graph we can clearly separate the materials as ionic or electronic.

Keywords: *Electrolytes, transference number, DC polarization test*

1.0 INTRODUCTION

Solid electrolytes are solid-state materials that possess an electric conductivity partially or wholly due to ionic displacements.[1] When solid electrolytes possess conductivity due to both ionic and electronic transport, it is necessary to know the fraction of the conductivity due to ions and electrons.[2]

The parameter that is used to describe the contributions of individual species (ionic or electronic) in a solid or liquid on conductivity is the transference number. This is defined as the fraction of the total electrical current that is carried by a particular species when an

electrical potential difference is imposed upon the adjacent electrodes. The transference number of ions as t_i, and electrons as t_e, can be defined as;

$$t_i = i_i / i_T \quad (1)$$

and

$$t_e = i_e / i_T \quad (2)$$

where $i_T = i_i + i_e$[3] (3)

In most of the liquid / aqueous electrolytes as well as ion conducting polymer electrolytes, cations and anions both contribute significantly to the total ionic conductivity and the electron /hole conduction is negligibly small. Hence, separate cationic/anionic transference numbers are also important parameters which can be mathematically calculated by following equations:

$$t_+ = \sum I_+ / \sum (I_+ + I_-) \quad (4)$$

$$t_- = \sum I_- / \sum (I_+ + I_-) \quad (5)$$

where t_+ is cationic transference number, t_- is anionic transference number and $\Sigma (I+ + I-)$ is the total current expressed as the sum of the partial currents due to mobile cations and anions present in the electrolyte.[4]

Several techniques have been used for measuring the transference numbers of various electrolyte systems. Among them, DC polarization is a widely used method. D.C. polarization technique was used for the first time by Wagner [1975] to determine transference number of ions and electrons separately. A d.c. electric potential is applied across the sample sandwiched between two blocking electrodes and the current is monitored as a function of time. A typical ‘current vs. time’ plot is shown in Fig. 1.

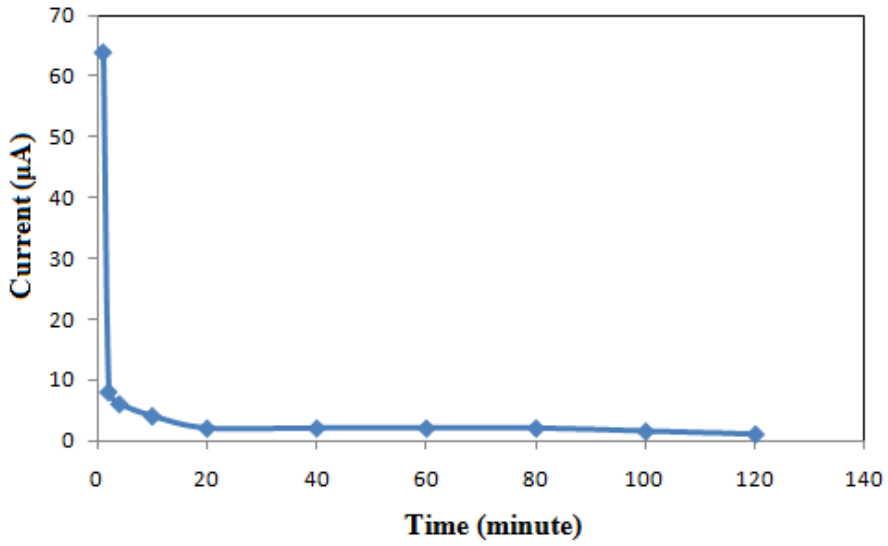

Figure 1: Current vs. time plot obtained by DC polarization test

The peak current obtained initially decreases rapidly with time due to polarization of mobile ions at the electrode / electrolyte interface. Afterwards, the current either approaches zero (for pure ion conductor) or attains a residual constant value (for mixed ionic/electronic conductor). If the sample is a pure electronic conductor, there will be no current reduction. The initial total current (I_T) is either due to ions solely or as a result of combined ionic and electronic conduction, while the constant residual current is only due to electron conduction. From the 'current vs. time' plot the ionic (t_i) and electron (t_e) transport numbers can be determined using equations 1, 2 and 3[4].

Nowadays various methods are used in DC polarization technique. But they are time consuming because parameters resulting from three independent measurements have to be combined for evaluating a single transference number[5]. Also there are advanced systems for transference number measurement such as Autolab potentiostat/galvanostat analyzer. But its maintenance and repair costs are quite high.

The objective of this study is to design a simple computerized system to carryout DC polarization test. It is a cost effective simple system for measuring of the voltage across a shunt resister and converting of analog data into a digital value. An ADS1110 was used to do the analog to digital conversion and a pic microcontroller to get digital values from the ADS1110 via I^2C communication system and they were sent to the serial port. For

microcontroller programming, PIC C was used, Matlab R2012a version was used for graph plotting part. This application responds quickly and automatically to active at the port, without having to waste time checking.

2.0 EXPERIMENTAL

2.1 Data acquisition unit

An ADS1110, 16f877a pic microcontroller, a MAX232 &a RS 232 serial port were used to design the data acquisition unit.ADS 1110 is a continuously self-calibrating, precision analog to digital converter IC with differential inputs and upto 16 bits of resolution. The ADS1110 uses an I^2C – compatible serial interface and consists of an onboard programmable gain amplifier, which offers gains up to 8, allows smaller signals to be measured with high resolution. Two edges of shunt resistor (R_s) was connected to pin no.1 (Vin+) and pin no.6 (Vin-) of ADS1110 and then it read the voltage across the R_s and converted it into a 16 bit binary number. Then pin no. 3 (SCL) and pin no.4 (SDA) were connected to pic16f877a's pin 18(SCL) and pin no. 23 (SDA) respectively. Pic16f877a is a 40 pin DIP microcontroller which reads the output of ADS1110 as two separate bytes, and then it sent them through the serial port (RS232). It also has I^2C facilities inside the chip itself which allows communicating with ADS1110. These operations were controlled by the firmware. Pin no. 25 (Tx) of pic16f877a was used to send the serial data to the PC through the MAX232 driver. The mAX232 converted the TTL signal from the microcontroller into RS232 voltage level.

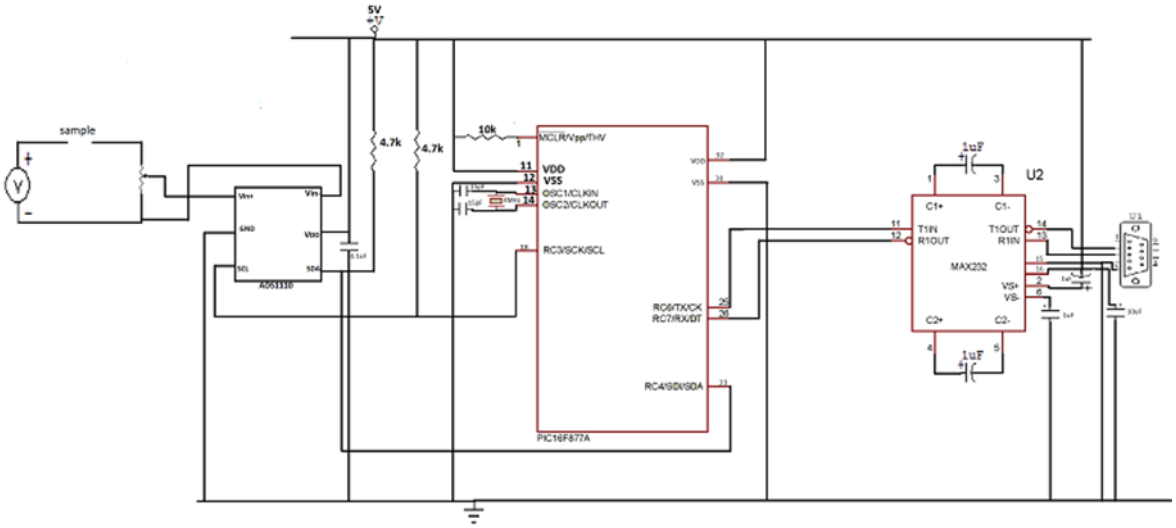

Figure 2: Hardware design of the system

The MAX232 driver IC uses some external capacitors to enhance the voltage level to RS232 level. A DB9 connector was used to connect to the COM port of the PC. The circuit was made into a PCB using TRAX MAKER 2000 software.

2.2 Software implementation

For the proper functioning of the data acquisition system, a firmware was developed and written to the microcontroller and an application program was also developed in Matlab R2012a for data representation.

2.2.1 ***Programming the pic 16f877a***

A simple program was written in CCS C v.4 compiler for proper ADC conversion at a fixed sampling rate in ADS1110 and for sending the digitized data serially. The program was compiled to make HEX file. The generated HEX file was programmed to the pic 16f877a microcontroller using PICkit2 programmer.

The flow chart of the developed pic program is shown in Figure 3.

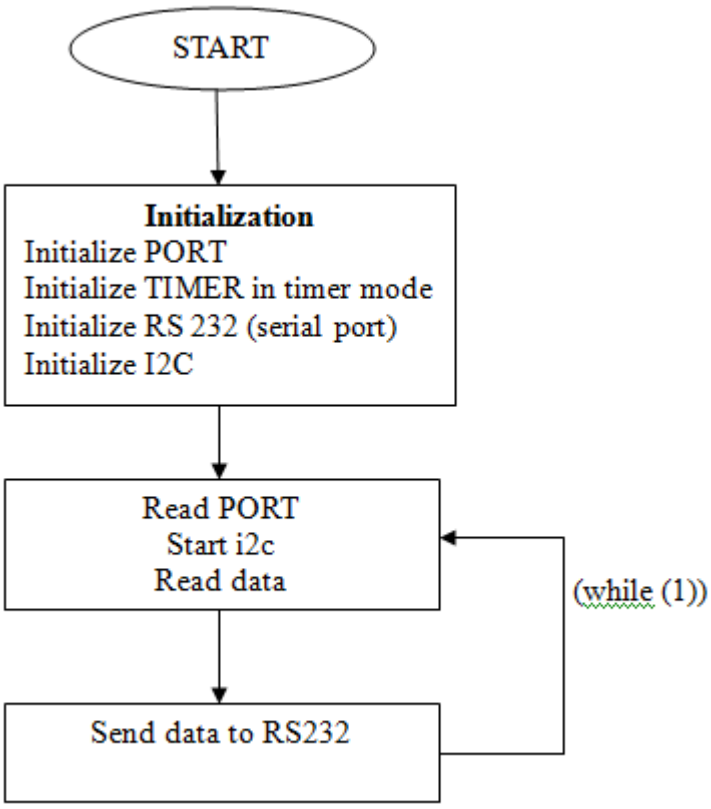

Figure 3: Flow chart of the pic program

2.2.2 Programming in matlab

For graphical display of acquired data with time, a program was developed in Matlab R2012a. It reads the output of the pic 16f877a microcontroller through RS232 serial port. The acquired data then was converted into a decimal value since microcontroller outputs the value as two bytes. According to the given commands a graph was plotted.

3.0 Results and Discussion

For each 20 ms, ADS 1110 converts a value into 16 bit binary number. Then the pic 16f877a microcontroller reads these digital values for every 4 s. the acquired values has been displayed graphically in a graph against time. According to the graph, it is possible to identify correctly and easily whether the new materials are ionic or electronic.

4.0 CONCLUSION

The design is a low cost, simple and compatible to PCs and laptops, as serial port is very common these days. This will be very useful in research and practical laboratories where acquisition of slowly varying conditions are required for measuring, monitoring, analysis and graphical representation of data. It can also be developed with more features and interfaced to the commonly available USB port of a PC or a laptop.

ACKNOWLEDGEMENT

Authors wish to extend their sincere thanks to all who have assisted and helped in numerous ways to make this study a success.

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Department of Electronics – Wayamba University of Sri Lanka

DIGITAL METER TO MEASURE WATER CONSUMPTION

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ABSTRACT

Today the measurement of water usage is very important factor due to the cost of the water bill. Traditional analog meters are having in houses and at the end of the month meter reader would read and give the bill. The main problem was until the bill was received customers couldn't see their monthly bill. The requirement is arise when the water wastage is high compared with the usage of the water. Therefore identifying the unit consumptions house owners can reduce their monthly bill. This digital water meter is a flexible, cost effective and durable water consumption meter. In first,theHall Effect water flow sensorwas usedto sense the water consumption of a house. When water travels from the water flow sensor it emits stream of pulses. Then the microcontroller wascounted the number of pulses came from water flow sensor and it was counted a liter when considerablepulsespassed through the sensor. Those values were displayed in a LCD(Liquid Crystal Display).Screen attached to the microcontroller. The microcontroller was programmed to display the total water liters being used. By using several commands and by using some buttons attached to the water meter house owner can see the water usage and monthly water bill. This meter is very useful to customer to see their water bill and reduce their water usage.

Keywords: *NWSDB, Hall Effect, Proteus, LCD, PIC*

1.0 INTRODUCTION

Around 80% of the Sri Lankan population has access to safe drinking water of which 40% is through pipe water supply systems of the National Water Supply and Drainage Board (NWSDB). Mainly NWSDB obtains their income by charging for the water units they provided for the customers. Each and every regional office of NWSDB has appointed several officers to gather meter readings and to issues bills for the customers[1].

But in the process of acquiring consumed water units NWSDB uses traditional analogue water meter which are likely to be error occurring. These may need continuous repairs due to mud, dirt and due to wear and tear of the wheels included in the meter. The NWSDB like to use digital water meters to measure water units but the price of today digital water

meters in the market are very high (normally 120$).Therefore in my study a low cost digital meter was introduced for the customers with providing some extrafacilities. The main objective of my research was introduced a low cost digital meter to measure water consumption. Thisdigital water meter was displayed total water liters, monthly consumed water liters, monthly consumed water units and price for consumed water units.

2.0 EXPERIMENTAL

2.1 Circuit implementation

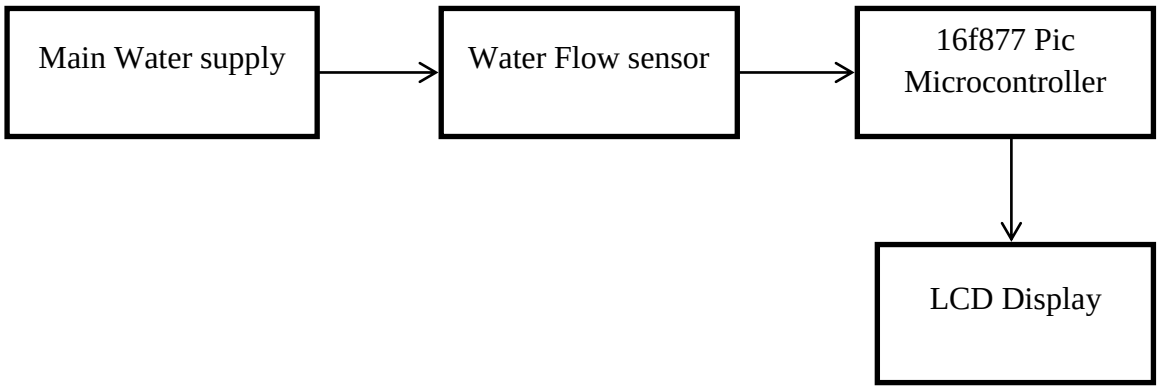

Figure1: Block diagram

A Hall Effect water flow sensor was used to detect the volume of water consumed. TheHall Effect water flow sensorconsists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed was changed with different rate of flow. The hall-effect sensor emits the corresponding pulse Signal When voltage provide for sensor from 3.5v-24v the sensor provide stream of pulse vary from 0v-5v.The frequency of pulse was varied according to the flow rate[2]. Then 16f877 pic(Peripheral Interface Controller).Microcontroller was used for the programming part[3]. After the calculations of microcontroller the output was displayed in LCD display

3.0 RESULTS AND DISCUSSION

First the circuit of the system was tested by the Proteus software. In this case a pulse was given to the pic microcontroller using pulse generator in Proteus software and the programme was written to display total liters, water units and price for water units.

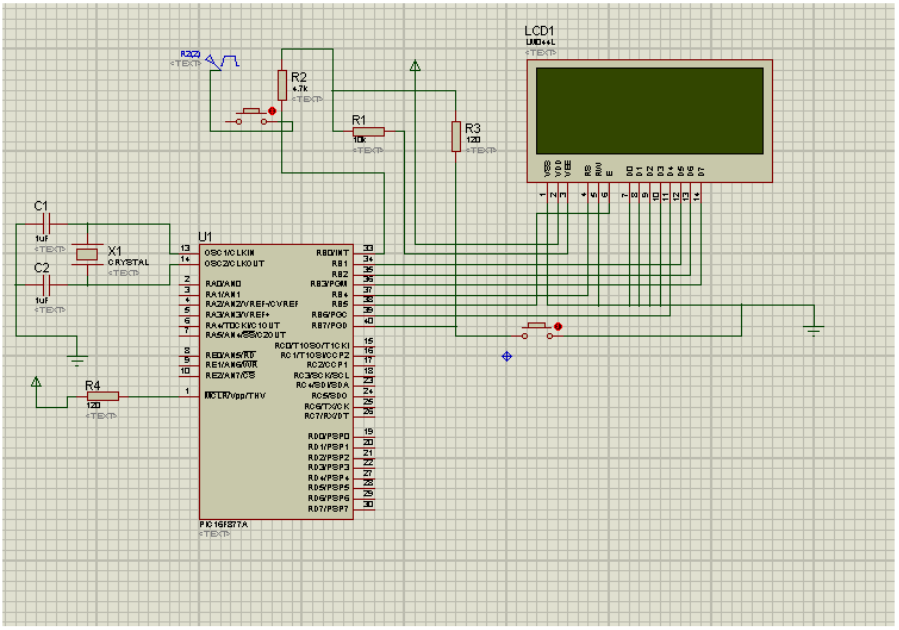

Figure 2: Proteus design

The actual water flow sensor was given pulses according to the water that travel through the water flow sensor. The accuracy of the water flow sensor was $^{+}\_3\%^{2}$.And also there was an equation that is specific for the water flow sensor that gives thefrequency (number of pulses) of the water flow sensor.

$$F = 8.1 * Q \qquad (1)$$

Where,

F = Frequency (Number of pulses), Q = Water flow rate

The sensor was given pulse stream when water travel through the sensor and the pulse depends on the flow rate of water according to the above equation[4]. According to my experiment, it was confirmed that the number of pulses given from the water flow sensor depends on the flow rate of the water. That means number of pulses were increased when water flow rate was increased. Therefore the programme was written to update liters according to the output pulses of water flow sensor. Following table shows the experimental results that were used to calculate water liters which travelled through the water meter.

Table 1: The experimental values of number of pulses

Liters	No of pulses
1L	512
1L	508
1L	503
1L	499
1L	504
1L	502.6

Above table shows the experimental values of number of pulses that emits from water flow sensor for 1 liter of water. The experiment was done by travelling water through the sensor in different speeds. However, finally the results showedthat approximately 500 pulsesshould bepassedby the water flow sensorfor one literof water.These results were taken from travelling one liter of water through the sensor and get number of pulses from programming the pic microcontroller. After calculating the number of liters the programme was extended to display water units and the price according to consumed water units as follows.

Figure 3: Display output of the project

And a reset button was set to reset water bill monthly. When the reset button is pressed the Liter was reset but Total Lt was not reset. Therefore customers can see their monthly water bill in LCD display. A rechargeable battery was used to avoid the disturbances due to power loss.

4.0 CONCLUTION

In this study, a low cost digital water meter was developed to show customer's monthly water bill accurately. It helped the customersto see their water bill monthly, weekly or daily and they can reduce water wastage by considering water bill. My digital water meter is a flexible, cost effective and durable water consumption meter. The future improvement of the research was remote water billing system. In future, the system will be expanded to automatically sending water meter readings to the NWSDB and receive monthly bill for the customer's mobile phone from SMS.

ACKNOWLEDGEMENT

Authorswould like to take this opportunity to thank everyone who helped to complete this study successfully.

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Department of Electronics-Wayamba University of Sri Lanka

CONTROLLING ELECTRONIC DEVICES AND APPLIANCES USING A REMOTE CONTROL

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ABSTRACT

Having the ability to control various electronic items and appliances inside or outside of the house wirelessly is a huge convenience and can make life much easier and safer. In this study, a circuit is proposed for controlling electronic items and appliances by using a remote control. For the wireless communication, a 433 MHz radio frequency (RF) module has been used. A four channel encoder/decoder pair (HT12E/HT12D) and PIC microcontrollers have also been used for the implementation. A RF remote control is used to turn ON / OFF different devices independently and the outputs from the receiver can drive relays connected to any 230 V household appliances such as hot plates, heaters, irons, fans and switches. The remote control utilizes a LCD display to show the status of each switch and it provides long range operating facility and works even through the walls. Therefore, by using this remote control, it is easy to turn ON a particular device when needed and turn OFF it on time without reaching it. Hence, electricity consumption can be saved and any risk from some electrical equipment can be overcome.

Keywords: *Electronic appliances, Remote Control, RF module, Encoder, Decoder*

1.0 INTRODUCTION

There are several instances where wireless communication is of utmost importance for remote controlling purposes. When consider about Infrared (IR), it can be used for operating a device wirelessly only from a short line-of-sight distance. Also for controlling switches via Bluetooth, data is transferred between two Bluetooth enabled devices and a Bluetooth module is very expensive[1]. Therefore, use ofradio frequency is a very ideal and a cost effective solution for wireless communication. For the design implemented in this study, a RF module was used and controlling of appliances is done from a central point.

The device is user friendly since LCD displays the status. Due to possibility of using RF frequency over a wide range, the device can operate any appliance at a certain distance.

2.0 EXPERIMENTAL

The block diagram of the proposed remote controller and receiver is as shown in Figure 1.

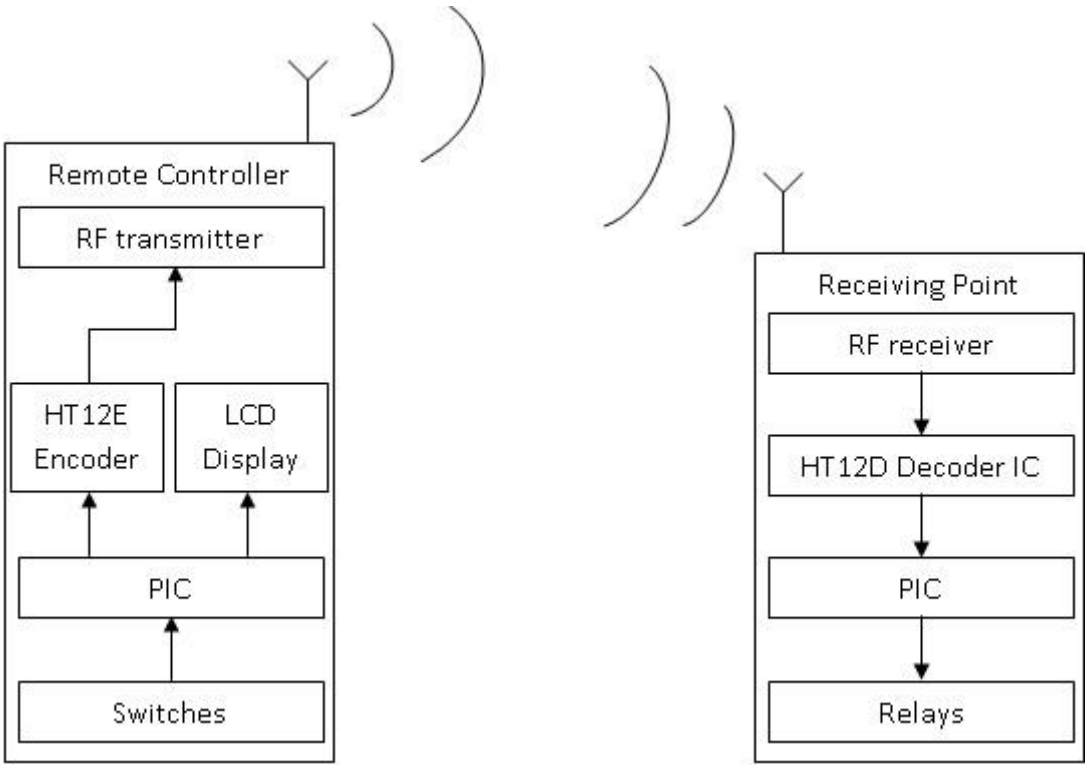

Figure 1: Block diagram of the remote control and receiving point

At the remote control, the input switches are connected to the microcontroller and PIC gives a four bit output to the encoder IC while displaying the status of the switches on LCD display. Then, RF transmitter module transmits the signal through 433 MHz frequency. At the receiving point, the RF receiver receives a signal and decodes it from decoder IC and gives four bit input to the PIC. Relays are connected to the electronic items and appliances and are operated according to the input signal of the transmitter[2, 3, 4].

3.0 RESULTS AND DISCUSSION

With the use of the 433 MHz, RF module the wireless communication is possible for long range of up to 50 m. This can be improved to control any number of devices from a

distance place. The receiving point acts like a hub and it receives signal and directs to the corresponding output device through the relay. These kinds of items are useful to keep home safe and to support the elderly and the disabled people to use and control electronic items and appliances. The LCD which is used at the transmitter displays the status of each and every switch and by using it, electronic items can be turned ON/OFF without reaching it. By using this type of equipment, electricity consumption can be saved and the risk from some of electrical equipments can be minimized.

Currently there are already available similar units for this and most have used IR (Infrared) and Bluetooth. Both technologies are useful only for communication between devices in relatively close proximity to one another[5].

IR uses light for data transmission and it requires a direct line of sight between communicating devices. Due to that, IR is most effectively used by devices that remain close to one another. The effective range for IR wireless is very short, generally no more than five meters. An IR system can work well as long as there are no obstructions between remote and the equipment[5].

Bluetooth wireless uses the particular frequency (2.4 GHz) for data transmission from device to device. Bluetooth has a maximum range of 10 m. This kind of application requires Bluetooth modules for the transmitter and receiver but they are very expensive and the connections between modules are little bit complicated[6].

Therefore radio frequency is the most suitable technique for this kind of application because RF provides long range operating facility and it works even through the walls. And also, cost of using RF is cheaper.

4.0 CONCLUSION

The specific identification code for each and every switch is defined by the PIC microcontroller and also it is used for increasing the number of inputs and outputs to the encoder /decoder ICs[7, 8]. The specialty of this remote control system from other systems is the wide range of coverage as well as the low cost.

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Authors wish to acknowledge all those who have helped in various aspects to complete this study successfully.

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Department of Electronics - Wayamba University of Sri Lanka

FREE DISTRIBUTION POINT(DP) LOOPS IDENTIFICATION UNIT

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ABSTRACT

There is a method for finding free loops in distribution points of Sri Lanka Telecom (SLT), by connecting a test phone. The 3 states of a line data, voice and free loops can be identified by the by checking the dial tone. But this method is less effective and trustworthy. In several scenarios with specific wired telecommunication technologies, this method is severely failing. In most cases data lines are misrecognized as free loops because current method is not sensitive enough to detect the complex behavior of the line. This has become a considerable monetary and time waste for the company. So in this study, a new system was suggested to overcome those issues and enhance the testing methodology. Voice, data and free loops have potential differences consecutively as 48 V, 3 V and 0 V. A programmed PIC IC can evaluate the voltage differences and execute the decision making by displaying detected line property by LED notification system. A voltage divider should connect to the input to reduce voltages to meet the programmed voltages of the IC. And a standard socket has been recommended for inputs to keep port from mismatching. This method will reduce the drawbacks in the current method.

Keywords*: Distribution point, Data line, Voice line, Free loop, Voltage divider*

1.0 INTRODUCTION

When establishing new Sri Lanka Telecom (SLT) telephone connections, there are no relevant distribution point (DP) numbers displayed on every DP panel. So, it is a big problem to find out exact DP numbers easily. This issue mainly affects the subcontractors because they are not provided with enough information by SLT. So DP numbers have to be found out separately from SLT. After finding the relevant DP, the availability of free loops in that DP is checked.

Manual system cannot be used to identify the data lines because the data line doesn't notify with a dial tone. This is the major problem. Due to this, when giving new connections, labourers think data lines as free loops. So they tend to connect the new telephone

connections by disconnecting the remaining data connections. Business places (Banks, etc.) have to face many serious problems due to that. By considering these drawbacks, a new unit was implemented to identify the free loops of the DP.

2.0 EXPERIMENTAL

The block diagram of the proposed system for the free loops identification unitis shown in the following Fig. 1.

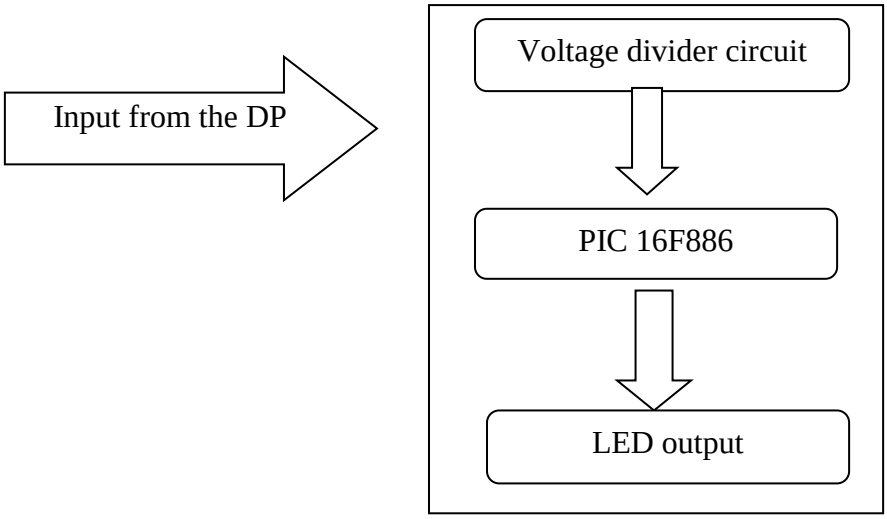

Figure 1: The block diagram of the free loops identify unit.

In a SLT voice line, there is a potential difference of 48 V and in data line there is a 3 V potential difference[1]. The logic behind the proposed design is if there's no voltage in the line that is a free loop. The system measures the voltage of the line and it will notify the state of the line (voice or data or free loop) according to the measured voltage.

The input is taken at analog to digital conversion input of the PIC IC [5]. Then, decision making process flow is as follows.

- If the detected voltage of the PIC input is 4.4 V then the line is a voice line.
- If the detected voltage of the PIC input is 1.5V then the line is a data line.
- If it's not the above mentioned cases then the line is a free loop.

3.0 RESULTS AND DISCUSSION

The main function of the implemented design is to identify existing voice lines, data lines and free loops separately. This project was successfully developed and got the feedback from the site engineer of the SLT project.

3.1 Limitations of Research

1. No stand for all brand of DP product

   Connecting port of the DP can be changed according to the manufacturer. For some standards, this system cannot be connected to the DP using proposed input port.

2. Use only Secondary Data

   For this solution only secondary data were considered because it was difficult to get primary data regarding this matter with high accuracy.

   (To get the primary data, need to interview data personally with proper experimental agenda. But any primary data which is taken may have differed from the preferred standards of the company – SLT with many observation issues and technical state of the testing scenario. So published standard data was taken as secondary data for analysis)

3.2 Problems encountered and Alternative Actions

- (+), (-) connectivity problem :

  In case of misconnecting the ports of the system to DP, the system will be crashed. So it is suggested to use a standard sockets for the connectivity.

- Complexity at detecting and decision making on AC current as input :

  AC current which is running on the line while a voice call is connected should have to be neglected by a capacitor.

4.0 CONCLUSION

Modern communication systems are equipped with a lot of sophisticated devices and the systems must be immune to all critical situations and exceptions to give a reliable and robust service. It is essential to maximize the network availability at all times. In this study, it is suggested a new method to identify free loop lines in DP. In current scenario, there is no efficient method for that purpose. With establishing this proposed method in industry level as a standard, most of negative consequences of contemporary methodology will be diminished.

ACKNOWLEDGEMENT

Authors would like to extend their sincere thanks to all specially Access Engineering PLC staff who helped to perform this study successfully.

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Department of Electronics – Wayamba University of Sri Lanka

AUTOMATED WATER LEVEL CONTROLLING SYSTEM FOR PADDY FIELDS

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ABSTRACT

Paddy cultivation is the main life pattern of ancient Sri Lanka since began of human being. Hence, water irrigation was a vital requirement for sustainable life even during ancient times. Accordingly they always strived to maintain water provision for the cultivation continuously throughout the year. The paddy cultivation have pre-defined epoch upon rice varieties. Rice is held as national crop and excellent varieties of rice, standardized fertilizers and pesticide applications, improved water management have all assured a high and stable productivity of rice. Accordingly water level must be maintained for each epoch in order to receive optimum harvest. But, with the weaknesses of the current irrigation systems and also due to absence of a well patterned rainfall system, it is not easy to manage the required levels of water during different cultivation stages. By the way, the water is wasted in vain. That high wastage of the water irrigation system is emerged as the necessity of a water level sensing and controlling system. In this study, water level of the paddy field is precisely sensed and maintained while controlling the irrigation canal and drainage canal which are the input and output gates of the design respectively. Water level of the paddy is measured by using an ultrasonic sensor and a LCD display is used to display water level height in centimeters. According to the required level of water, irrigation canal and drainage canal are controlled by the system with gates. Furthermore, canals are exclusively controlled by using Radio Frequency (RF) module through RF communication. The systems will automatically proceed until the desired water level for each required epoch (in days) is maintained. This system, water level data is successfully displayed remotely, therefore this prototype can be used as a part of the bigger system, such as, river flow management system which controls the stream to minimize the flood.

Keywords: *Water level height, Irrigation canal, Ultrasonic sensor, RF module*

1.0 INTRODUCTION

Paddy field uses large quantities of water usually under ponded condition. They are artificially controlled by hydrological conditions, namely irrigation. According to the rice

growing calendar, consecutive height of the water level is required to receive optimum amount of harvest. However, water is lost through evaporation from free water surface, transpiration from the crop, seepage and percolation through the soil, bunt leakages and runoff from the field.Bunt leakages and runoff from the field is totally under the farmer's control. Therefore, the main determinants of water requirement are evapotranspiration, seepage and percolation rates. Hence the water balance equation of paddy field can be expressed as follows[1].

$$R + Q_i = ET + P + Q_o + \Delta S \quad (1)$$

Where R is precipitation, Qi is irrigation water, ET is evapotranspiration, P is the percolation and ΔS is change in storage[2].

The water level controlling system gives optimum solution through eliminating abovementioned issues. In designed system, water level is continuously measured by using ultrasonic sensor that can be appeared on 16×2 LCD display. According to measured height of water level, microcontroller makes the decision which canal should be activated either irrigation canal or drainage canal. RF module is used in order to retain communication between microcontroller and both canals. Also, canals are operated using servo motors with gates. Ultimately entire system consists with consecutive transmitter module and two receiver modules.

2.0 EXPERIMENTAL

The following figure illustrate sketch of the design in paddy fields**.**

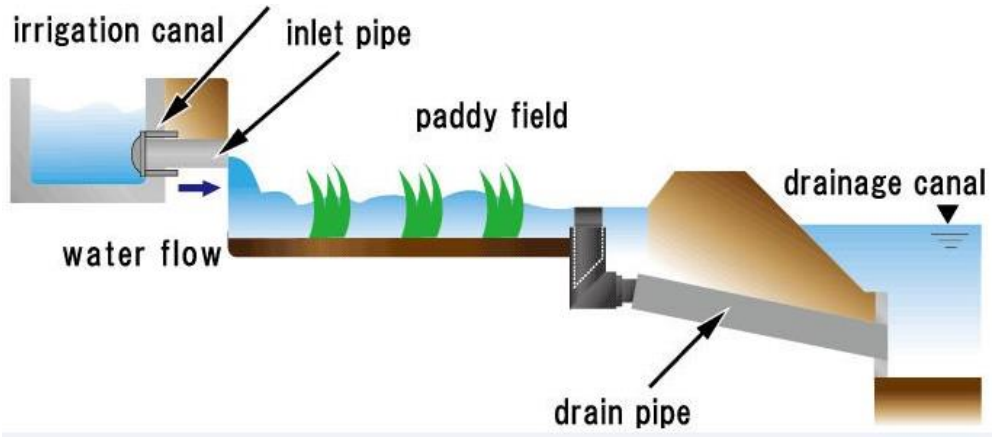

Figure 1: Sketch of design in paddy field

The block diagram of water level controlling system is shown in Figure 2.

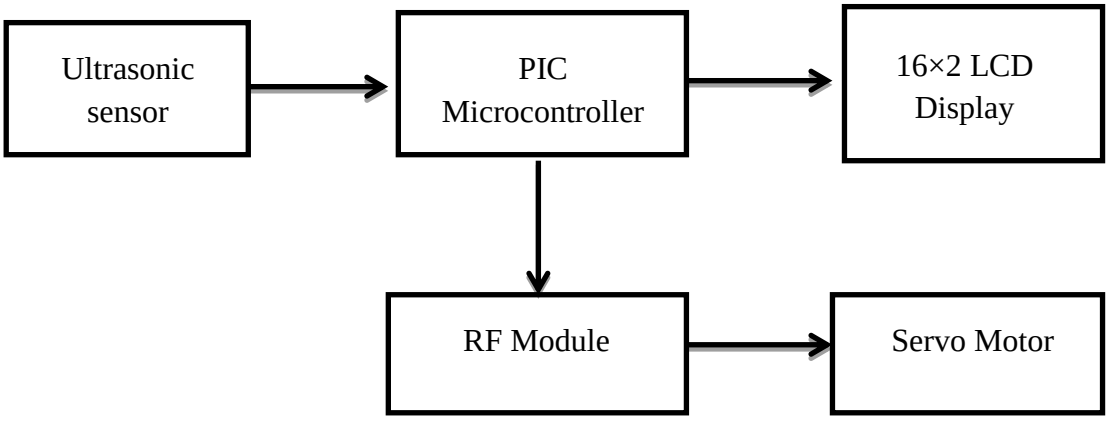

Figure2: Block diagram of water level controlling system

The ultrasonic sensor was connected to the microcontroller using relevant pins. Then the microcontroller was programmed using mikroC language to get thehypotenuse distance. In order to get accurate height of water level, ultrasonic sensor is located on top and underneath of the PVC pipe of a high diameter and that PVC pipe should be established in paddy field according to water level is changed. Thus, it gives distance between sensor and water surface precisely. Hence height of water level should be as follows.

Height of water level (H) = Height that ultrasonic sensor is located (h) –
Measured value from ultrasonic sensor(x) (2)

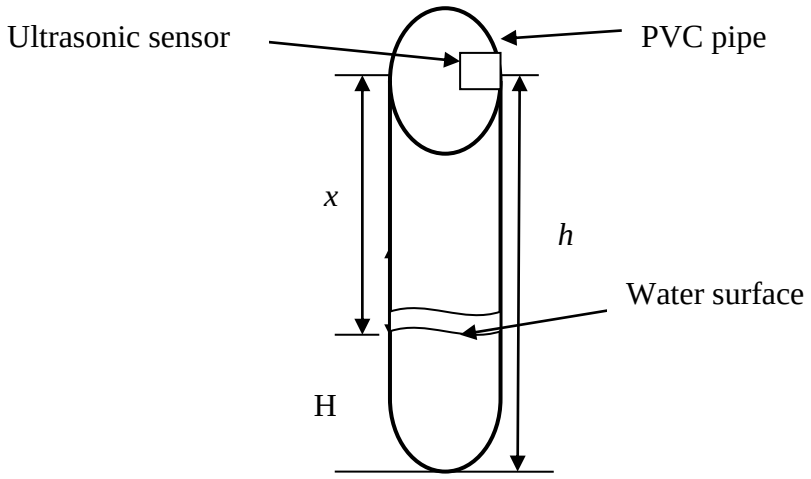

Figure 3: Representation of accurate water level in Paddy Field

Measured distance is appeared on 16×2 LCD display in centimeters. The required water level is configured in the PIC microcontroller upon each pre-defined time epoch of the rice cultivation. According to the configuration of the program, microcontroller determines which canal should be activated. The system is using RF modules with two consecutive frequencies in order to activate canals remotely while avoiding frequency interference.

2.1 Ultrasonic Sensor

This ultrasonic module measures the distance accurately which provides 0cm – 400cm with a gross error of 3cm.The module can easily be interfaced to microcontrollers where the triggering and measurement can be done using two pins.The modules include ultrasonic transmitters, receiver and control circuit. They contain 5 V supply, 0 V ground, trigger pulse output and echo pulse output. The basic principle is using IO trigger for at least 10 μs high level signal, the Module automatically sends eight 40 kHz and detects whether there is apulse signal back, the distance is measured by spending time of pulse signal that reflected from obstacle and to reach the receiver of sensor[4].

2.2 Microcontrollers

Microcontroller is a computer on a chip that is programmed to perform almost any controlling, sequencing, monitoring and displaying the function. Because of its relative low cost, it becomes the natural choice to the designers.Its great advantage is no other external components are needed for its application because all necessary peripherals are built inside. Thus, time, space and money can be saved which are of prime importance for practical applications[5].

2.3 RF Transmitter/Receiver Modules

The RF module operates at radio frequency (RF). The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).Transmission through RF is better than IR (infrared) because of many reasons.This RF module comprises of a RF Transmitter and a RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 433 MHz and 315 MHz most commonly. A RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at one pin[6].

3.0 RESULTS AND DISCUSSION

The system is operated in following manner when the height of water level of paddy field is fluctuating.

- If required height of water level is 5 cm and also value appears on LCD display is 5 cm, both of irrigation canal and drainage canal are closed.
- If required height of water level is 5 cm and also value appears on LCD display is less than 5 cm, irrigation canal is opened while drainage canal is closed.
- If required height of water level is 5cm and also value appears on LCD display is greater than 5cm, drainage canal is opened while irrigation canal is closed.

Hence required height of the water level of the paddy field is continuously maintained until the harvest is collected without any involvement of the farmer. The system is monitoring water level every moment and that will be displayed. As a result, water level is imminently maintained while water level changes due to environmental conditions.

4.0 CONCLUSION

Prototype water level controllingsystem for paddy field has been tested and reasonably good performance is shown based on the test result. The main contribution for this performance is the ultrasonic sensor calibration by adjusting the calculation of distance based on an actual data.The water level data is successfully displayed locally or remotely andhence this prototype can be used as a part of the bigger system, such as, river flow management system which controls the stream to minimize the flood. The receiver acts as a water level data feeder that can transmit data remotely.

When comparing the price of existing system of water level controller for paddy fields, the designed system is constructed as a low cost design. Most of the existing systems are controlling only irrigation canal or drainage canal. But, the designed system controls both canals efficiently and effectively.

ACKNOWLEDGEMENT

Authors wish to convey their profound gratitude to all individuals who extended their helping hand to accomplish the implementation of this project. Specially, the invaluable guidance and enthusiastic encouragement given by Dr. B. Ranaweera, Senior Lecturer of the Faculty of Agriculture and Plantation Management of Wayamba University of Sri Lanka is highly acknowledged.

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Department of Electronics-Wayamba University of Sri Lanka

VOICE CONTROLLED SWITCHING SYSTEM

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ABSTRACT

This research mainly focuses on how to use a person's voice to control a switching system. Specified voice commands are used as the inputs to the system. The designed system has been developed as a user dependent system. But in practice, accuracy of the system may decrease when another person who has not trained his voice with the Artificial Intelligence (AI) unit uses the system. Mainly this system consists of hardware and software implementation. The hardware implementation is used to control the switches in the system that is by using 'Controller circuit', which is the main part of the hardware implementation. Software implementation is to process the voice inputs and send signals to hardware implementation. Neural network concept in AI is used to classify the voice inputs in the software implementation. Specified voice commands were given to the system using microphone. Then light can be switched ON and OFF according to the given two different voice commands by the user. This system can be further minimizing limitations and maximizing the system performance as wireless system or applying by Graphical User Interface to the system or applying accurate technique for filtering.

Keywords: *Neural network, Automatic speech recognition, Power circuit switcher*

1.0 INTRODUCTION

Switching is one of the important operations in the electronics and electrical world. It gives the convenience to real world applications. Switching techniques mainly depend on the device/s which are controlled by the switches. And switching techniques can be changed due to safety, convenience, cost, space, distance etc. A Person has to interact with some switching technique to control the device/s. It may be a physical action or psychological action.

Speaking is probably the most efficient way to communicate with each other. This also means that voice could be a useful interface to interact with machines. For a long time research on how to improve this type of communication has been carried out. This system was going to implement by recognizing the specified words.

Mainly all research and development are focusing on invention of better solutions than currently used solutions. Therefore this solution should be adopted by considering safety of everyone. Remaining other factors are cost effectiveness, ease of control, user friendliness and power efficiencies. Those factors in a new solution may be better than those of a currently used system depending on the conditions and the purpose. As an example researchers and developers may not consider facts like initial cost, easy controlling etc. when developing a switching controller system for the high security purposes. It may depend only on the capability of system security.

In computer science, voice recognition is the translation of spoken words into text. It is also known as "Automatic Speech Recognition" (ASR), “computer speech recognition", "speech to text" (STT)[6]. This system is going to recognize the specified words. In this case specified voice commands are used as the inputs to the system. The current system has been developed as a user dependent system. But in practice, accuracy of the system may decrease when another person who is not train his voice with the AI unit are this system.

This research mainly focuses on how to use a person’s voice to control a switching system. AI system was built to identify a person voice. And the command is given to controller circuit to do the task which is specified by AI. A Computer and a controller circuit were used in this system. Hardware implemented controller circuit was cost effective. System can be used to control specified devices from one place by using voice.

2.0 EXPERIMENTAL

2.1 Major components of the System and relationship between them.

2.1.1 Hardware

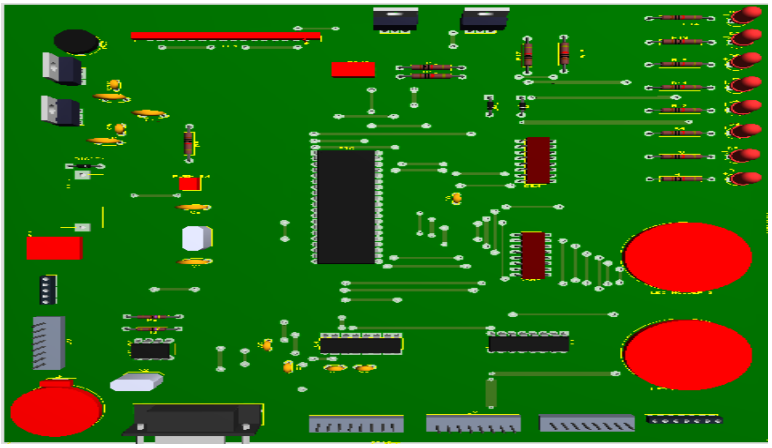

Figure 1: Controller circuit

In this switching controlling system a PIC microcontroller, Optoisolator Traic driver IC, a Traic, IRFZ44 FET and ULN2003 darlington transistor array are used as major components to build the system. Between PIC and computer data transmission was done in serial communication using RS232 protocol. Pin connection of data receive pin (RX), data transmit pin (TX) between them should be connected as the connection between Data communication Equipments(DCE)& Data Transmission Equipments(DTE)[1,2,3].

Table1: DTE and DCE pin connection

DTE Device (Computer) DB9		DTE to DCE Connections	(Controller cct) DB9	
Pin# DB9 RS-232 Signal Names		Signal Direction	Pin# DB9 RS-232 Signal Names	
#1 Carrier Detector (DCD)	CD	←	#1 Carrier Detector (DCD)	CD
#2 Receive Data (Rx)	RD	←	#2 Receive Data (Rx)	RD
#3 Transmit Data (Tx)	TD	→	#3 Transmit Data (Tx)	TD
#4 Data Terminal Ready	DTR	→	#4 Data Terminal Ready	DTR
#5 Signal Ground/Common (SG)	GND	—	#5 Signal Ground/Common (SG)	GND
#6 Data Set Ready	DSR	←	#6 Data Set Ready	DSR
#7 Request to Send	RTS	→	#7 Request to Send	RTS
#8 Clear to Send	CTS	←	#8 Clear to Send	CTS
#9 Ring Indicator	RI	←	#9 Ring Indicator	RI
Soldered to DB9 Metal - Shield	FGND	—	Soldered to DB9 Metal - Shield	FGND

Enough current should be supplied to the controller circuit. Power circuit switchers were connected with PORTD of the PIC. MOC3041 and BT10 Traic IC were used in the power circuit switchers to control the power circuit such as lights[5].

2.1.2 Software

Program in PIC microcontroller was coded using MicroC compiler. And the code was programmed to PIC using pickit2 software. Matlab was used to build AI using neural network concept.

2.2 Methodology & Operation of the system.

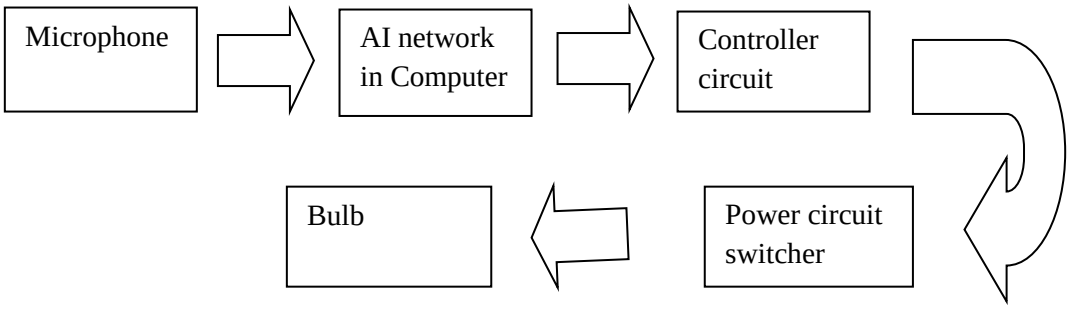

Figure 2: Block diagram of the system

User voice command was given to the computer using microphone. Sound was recorded and recorded voice was given to the AI network. Then voice was classified by the AI. Controller circuit was given signal by AI through the D9 UART port according to the classified voice command. Received signal was checked in PIC program and specified task was done by the controller circuit. As a demonstration of the system IRFZ44 FET may be driven to a light ON or OFF a bulb by the controller circuit interface with DC. Further, power circuits that are connected with AC can be controlled using traic and optoisolator IC. Controller circuit has the facility to connect that kind of power circuit switchers. PORTD can be connected with power circuit switcher.

3.0 RESULTS AND DISCUSSION

Complexities of this system occurred due to voice inputs. Those can be categorized as follows.

i. Speech variation

   Age, sex, automatic variation speed of speech, emotional conditions of the speaker

ii. Noises in the environment

Noise environment can add noise to the signal. Even the speaker himself can add noise by the way he speaks

iii. Continues characters

When we speak, seldom there is a break between words

iv. Other external factors

Position of the microphone in respect to the speaker, direction of the microphone and many others.

Therefore researchers had to reduce those affect of the speech. In this research Neural Network concept is used to classify the voice inputs. Simple technique was used to overcome background noises in the input voice. That is shown in Figure 2. Remaining next three reasons can be reduced by training the network[4].

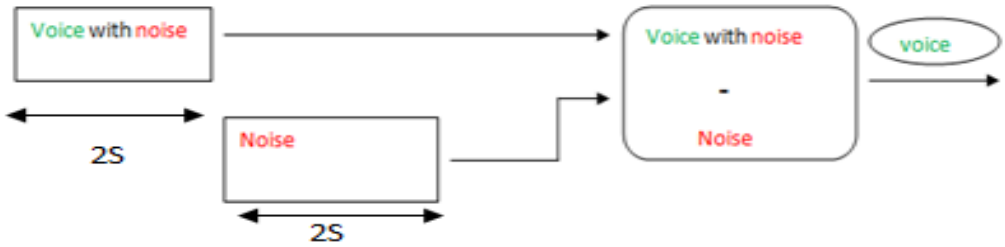

Figure 3: Noise Filtering

System accuracy can be increased by training the network in the place where the system is going to be established. Also can be used more recorded voice command in training data sheet. A light was used to indicate switching operation of the system. Controller circuit received the precise command according to voice and light was switched according to that command. Results are shown below.

Table 2: Results

Voice Command	Light State
ONE	Light is On
TWO	Light is Off

4.0 CONCLUSION

This system implementation is trying to touch some research areas of modern technology. System accuracy can be increased by training the network in the place where the system is going to be established. Also it can use more data in data sheet. System can be implemented practically and problems can be overcome during the troubleshooting.

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Department of Electronics – Wayamba University of Sri Lanka

CUSTOMIZED HIGH GAIN WIFI ANTENNA FOR FACULTY OF APPLIED SCIENCES OF WAYAMBA UNIVERSITY OF SRI LANKA

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ABSTRACT

Wireless Fidelity (Wifi) has become a vital part in networking. When working with a wired local area network, there are issues when it comes to scalability, mobility and troubleshooting. But when it comes to wireless local area network (WLAN) things are much easier. IEEE standard for Wifi is 802.11. Wifi operates in ISM band (2.4 GHz to 5 GHz) but most of the Wifi versions (including the network at University) are operating on 2.4 GHz. Even many methods use the same frequency, all of them have different data rate according to the standard. This study is an attempt to increase the range of the Wifi access point by adding an external antenna to the router without using any more access points and repeaters. By using this antenna the gain is increased and the antenna radiating pattern is changed as required.

Keywords: *Wifi, Antenna, Omnidirectional*

1.0 INTRODUCTION

The existing configuration only included the internal antenna that was integrated to the access point[1]. So the particular range for an access point was fixed. But in commercial level high end access points like cisco aironet 1200 there is an external port for an external antenna[1].Because the current internal antenna in the AP could not provide coverage to the whole geometric area, new external antenna can be fixed to solve the range problem. Previous solutions were to implement more access points and repeaters to the areas, where there was less Wifi signal. Also when increasing the range, antenna gain is also improved.

But the external antennas are expensive and the radiation pattern is not as required. All of these external antennas need to be imported and subjected to inspection by TRC and pay extra taxes[2].

2.0 EXPERIMENTAL

The proposed system was based on an antenna that has a gain of 6 dbi. With the readings that were obtained from the spectrum analyser Anritsu spectrum master EMS2711W, was decided that a gain of 6 dbi would be sufficient with this antenna. To match the impedance and improve gain, only the physical properties of the antenna were changed because of the high frequency impedance matching circuit can change the transmitting signal. Initial requirement was to implement the antenna but after the discussion with the system administrator there was a requirement that the antenna had to be away from the access point at least 5 m. So an antenna was designed to fulfil these requirements. Radiation pattern was changed to the way as required[3]. With this solution it is not needed to have more access points or repeaters, thereby the existing access pointscan be used to get full coverage.

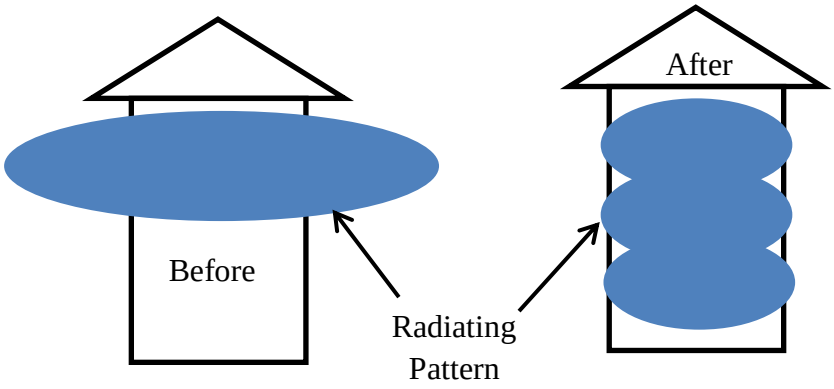

Figure 1: Radiation Pattern before and after the solution

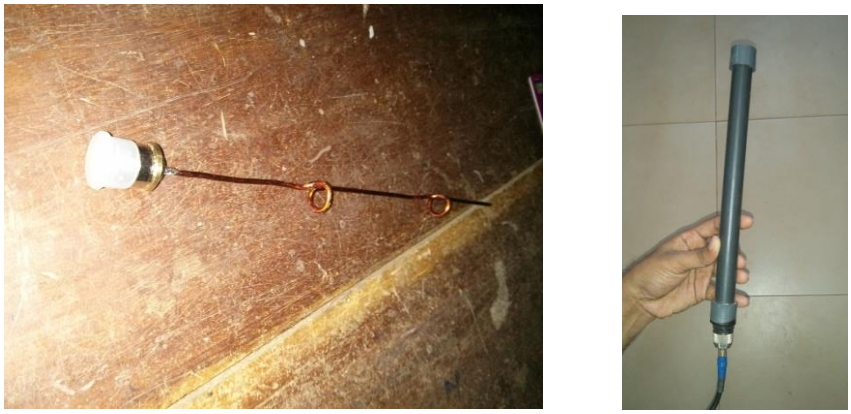

Figure 2: Pictures of Implemented Antenna

3.0 RESULTS AND DISCUSSION

This antenna has changed the radiation pattern and now the lower levels receive more signals (signal greater than -85 dBm). The measured impedance value for 50 ohms at the 2.48 GHz frequency. So in order for this antenna to have the minimum mismatch loss Wifi channels need to be used where it uses required frequency range (channel 10 to channel 12). The channels that are used within the system can be changed by logging into the access point. Maximum results can be obtained by configuring the router to use the channels at the end of Wifi frequency range (channel 6 to channel 14).

4.0 CONCLUTION

With this customised antenna solution cost for implementing Wifi system can be reduced by increasing the range of the Wifi coverage. With impedance matching at Wifi working range this antenna will have the minimum mismatch loss. With the changed in the radiation pattern, now users have the maximum range of coverage of the Wifi network. Increased gain will help the users to receive more signal strength to their devices thus enabling them to use the full services of WLAN. After conducting excessive testing this antenna can be produced for commercial purposes if TRC approval is provided.

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Department of Electronics-Wayamba University of Sri Lanka

A SYSTEM TO DETECT VOLTAGE AND CURRENT FLUCTUATIONS IN AC MAINS SUPPLY

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ABSTRACT

Power producers and consumers, power utilities, transmission and distribution can be considered as the main parties connected to power systems where power quality can be seen as a complex issue. Inadequate power quality has an adverse effect on the dependability of loads in the power supply system and can cause serious financial and environmental consequences. The design is focused on the importance of monitoring the fluctuations of the voltage and current of utility supply and alerting the electrical power distributor and collecting data for analysis for subsequent improvements. It gives an optimal solution for the requirements of the electrical power distributor. It is also a compact and portable device giving accurate data. In addition to these features the measured data can be sent to the electricity provider or distributor via Global System for Mobile Communications (GSM) network. Then they can gather data with the help of a short message service (SMS) Gateway and send them to a database. Knowledge on Microprocessor Based System is used for all the data manipulations and displaying purposes. Voltage and current measuring is done using PIC micro controller based circuits with relevant sensors. Mobile communication strategies were used for data transmission. Additionally, this system can be developed by adding extra features such as secure digital (SD) card to store data itself, real time clock, and Remote controller unit to change the functionality of the system.

Keywords: *Voltage fluctuation, Data acquisition system, Power quality*

1.0 INTRODUCTION

Electronic equipment found at present demand a high level of power quality for their proper functionality. In order to achieve high levels of product throughput and product quality in the manufacturing sector this key element of quality power supply is essential. Hence interest on Power Quality has increased significantly among individuals and organizations. The degradation of Power Quality affects industrial, commercial as well as

residential consumers which in turn has an impact on the economy of the country as well as the quality of life. Thus the increasing expectations of electricity end-users have placed an increasing demand on electricity suppliers and distributors to improve the level of Power Quality to the expected standards. The improvement of Power Quality depends very much on the identification of the nature of disturbances, their duration, the frequency of occurrence and ultimately the impact on the end-user equipment. The role of power quality monitors for effective troubleshooting is therefore undeniable.

Most of the industries depend on local power suppliers where fluctuation of supply would cause severe damage not only to the machinery but also to the employees. Fluctuating voltages bring errors in an electronic controller which can frequently break machines or sometimes working with errors in some environments can lead to process failures. That is a direct impact and damage for operation resulting in major financial loses which would affect the whole country's economy at large scale.

Telecommunication service providers, Steel mills and Textile industry are some of the critical industry areas affected by the voltage and current fluctuating issue. And most of the modern household equipment are also sensitive to such fluctuations. Any interruption in the network results in a loss of revenue that cannot be recovered. This consequently requires the power supply to be uninterrupted and constant. To overcome these issues power quality monitoring and measuring is important.

With the objective of providing increased and efficient service to the consumers the Ceylon Electricity Board's consumer services section has invented several equipment[1] with limited functions. And they are looking for a system which can measure, store and transmit data about fluctuations in AC voltage supply. For this requirement, the present system was developed.

1.1 Existing Products

Three types of instruments are commonly used for collecting and storing data. They are Real-Time Data Acquisition Systems, Chart Recorders and Data Loggers[2]. Chart recorders and real time data acquisition systems are more expensive than data loggers. Data loggers offer more flexible data storage capabilities and are available with a greater variety of input types while data acquisition systems offer a great deal of flexibility and are certainly useful

when high sample rates are required, however, the main disadvantage is that the computer must also be present and active when collecting the data. Its ability to collect and store data independently of a computer makes data loggers ideal for applications requiring portability.

A major drawback in some of the existing devices is the inability to get the voltage and current readings simultaneously. Many chart recorders used in the industry are analog devices, so that the accuracy is not up to the desired level. Another major issue is the difficulty in analyzing such data acquired through an analog device.

Most of the AC power supply fluctuations detecting systems have the feature of sending the measured data to the electricity provider or distributor via local area network (LAN) or serial port interface but not via GSM. Receiving such information as soon as possible is so much important when considering about the critical issues that can occur because of such fluctuations.

2.0 EXPERIMENTAL

The device designed in the present work is a microprocessor based system. The microcontroller was used for all the data manipulations such as measuring voltage and current, controlling the data transmission module and displaying purposes. For programming, a requirement of the microcontroller, mikroC[3]was used while AT commands were used for configuring the GSM module[4]. For data analyzing requirements SMS gateway and database were used. AnLCD display was used for displaying purposes while a GSM module was used to transmit data to the faults handling center. Subunits (figure 1) of the device are:

Voltage Reading unit Current Reading unit[5]
Power supply unit Data displaying unit
Data transmitting unit

Systems installed in the faults handling center are the Database and the SMS gateway.
The above systems were configured according to the requirements.
A Hall Effect sensor and a voltage divider circuit were basically used for measuring current and the voltage respectively. The following equations were designed for the purpose of observing the actual Voltage and the Current measured.

For Voltage reading (Volt) = $\frac{\text{Real value using multimeter (V) X ADC read value}}{\text{ADC converted reading on display}}$ [1]

Current value = $\frac{\text{ADC value - 507.9}}{4.0152}$ **[**2**]**

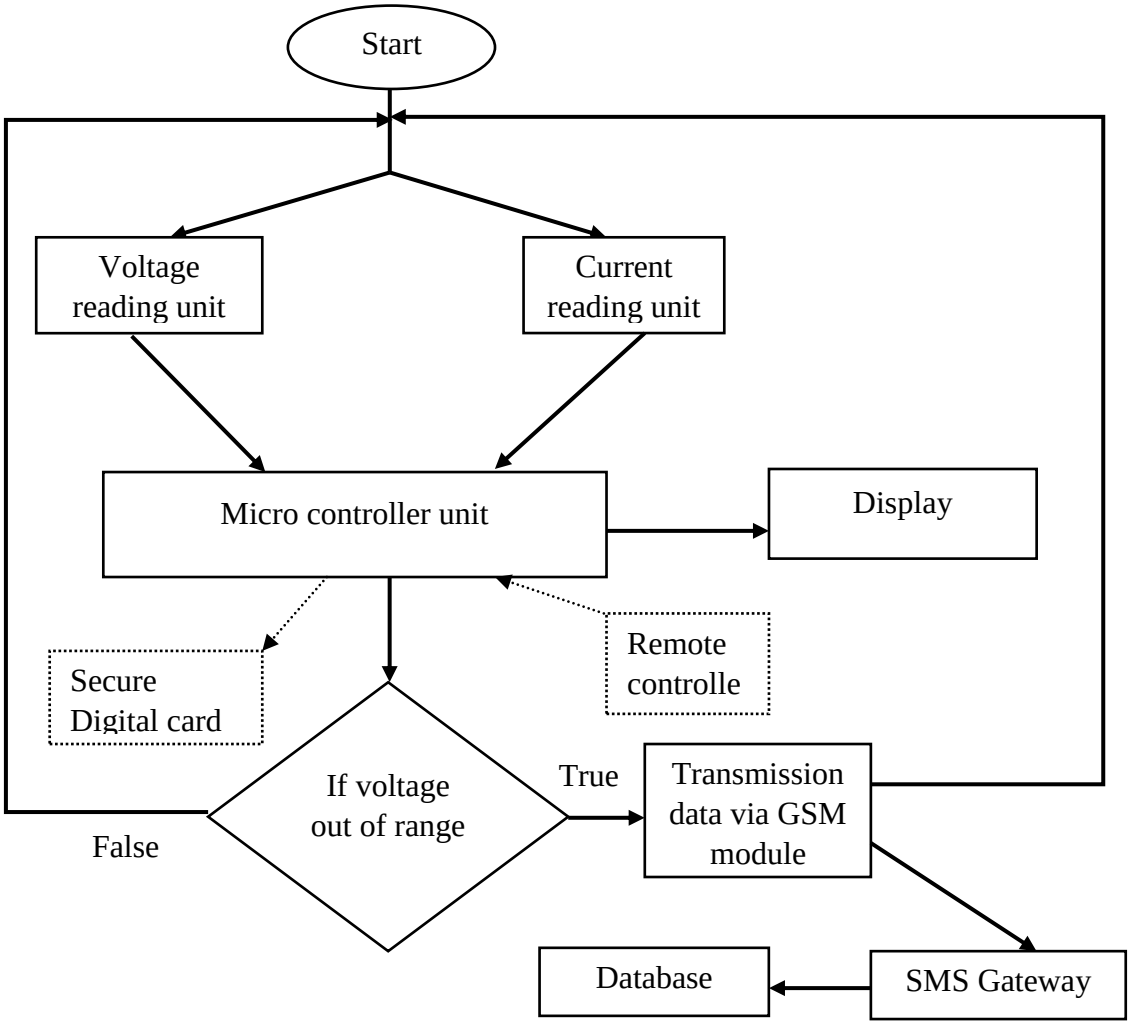


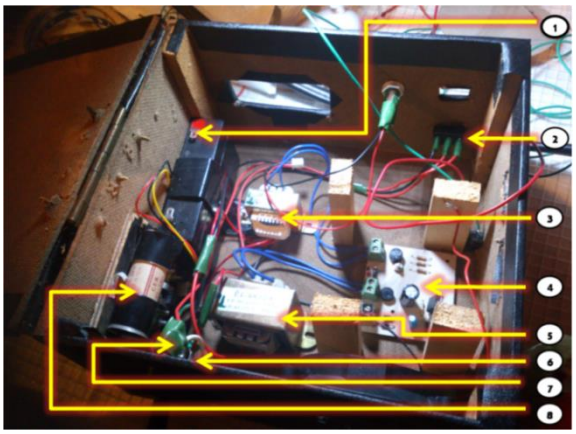
Figure 1 : Block diagram of the system with extended features

3.0 RESULTS AND DISCUSSION

This system fulfils the requirements which were mentioned in the Introduction and also this will be a mature technique of detecting fluctuations in utility supply as well as, a well organized data acquisition system to the modern electronic base environment. The basic circuitry design was also made while considering the future development opportunities. For more accurate readings the system equations were designed after taking the means of

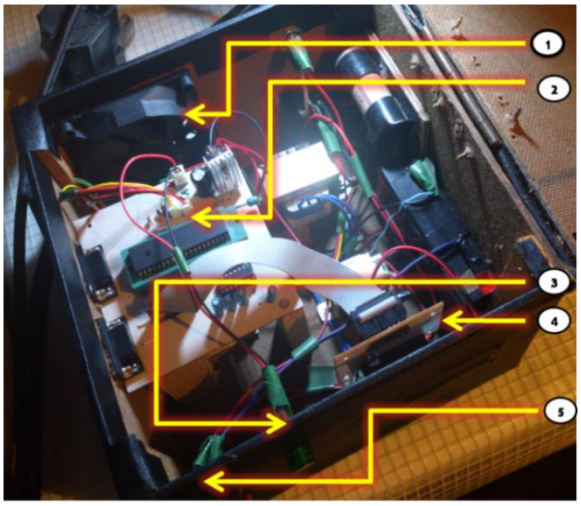
several test observations. Using a real time clock inside the system will add additional efficiency to the system.

3.1 Overview of the final product



1. Battery
2. AC switch
3. Transformer
4. AC to DC converting PCB
5. Transformer 2-Power
6. AC in
7. Fuse for the system
8. Current measuring unit and fuse

Figure 2 : Bottom layer of the final product



1. Fan
2. Main PCB
3. Indicator
4. LCD Display
5. DC switch

Figure 3: Top layer of the final product

a **b**

Figure 4: (a)Outside view of the final product (b)Database

3.2 Further Developments

Without transmitting data via GSM module, it also can store data by itself with a Secure Digital (SD) card. This system was designed with an inbuilt range of voltage values to transmit data but this also can be developed to adjust the range according to the users' requirement using a remote controller. Use of an advanced database will allow filtering the important values and plot drafts for better visualization of the received data.

4.0 CONCLUSION

The study and the implantation presented in this paper was an attempt to fulfill one of many real time data acquisition system requirements existing in the electronic related industry. The concepts in Electronics and computer science were merged together in order to achieve the project goal. This developed equipment will be important to Ceylon Electricity Board (CEB) not only to detect and measure the fluctuations in power supply but also to take relevant steps to overcome faults after studying and analyzing the observed data.

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Authors wish to express their gratitude to the staff of the Department of Electronics, Faculty of Applied Sciences, Wayamba University of Sri Lanka for unwavering support.

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Department of Electronics - Wayamba University of Sri Lanka

DIGITAL METER TO MEASURE HEIGHT OF A COMMUNICATION TOWER

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ABSTRACT

Most of the telecommunication service providers in Sri Lanka use Technical Site Survey Report (TSSR) to decide future installation. During a site survey, it is very important to measure distances to different tower levels with low cost, high speed, high security, high efficiency and accuracy. This site survey is very important to the entire network because fault of the survey information may cause the sites out of control. Measuring distances to different levels of the tower is a difficult task in the technical site survey because it is done using a tape. When measuring the distances using a tape lot of errors may occur. There exist some types of digital height measuring sensors. But they are not been used by most of the telecommunication companies because of their cost and complexity. In this study, it was decided to find a solution to this issue. For that, ultrasonic sensor was used as the distance measuring sensor and PIC microcontroller as the main control system. With this hypotenuse distance can be directly measured and to obtain the real distance, some calculation has to be performed. A laser light is used to point the relevant position of the tower correctly. The digital meter developed displays the relevant angle and the tower height with the help of a LCD (Liquid Crystal Display).

Keywords: *Technical Site Survey Report, Distance measuring sensor, Ultrasonic sensor*

1.0 INTRODUCTION

Presently most telecommunication subcontractors use tapes to measure distances to various location of the tower during the technical site surveys. There exist some types of digital height measuring sensors[1]. But they are not been used by most of the telecommunication companies because of their cost and complexity. In the present method, a trigger should tie one end of the tape at the bottom of the tower and then one should climb the tower with the other end of the tape. The trigger should also note the tape readings to the relevant levels of the tower. But obtaining measurement using the tape is not accurate and also there may be misreading of the values. Also this is a time and money wasting technique. So there exist a

need to enhance the accuracy and the efficiency of the measurements. Also the solution should be a time consuming and cost effective technique. This paper reports construction of a digital meter to measure tower height as a solution to all above.

2.0 EXPERIMENTAL

The block diagram of the proposed system for the digital meter to measure tower height is shown in the Figure 1.

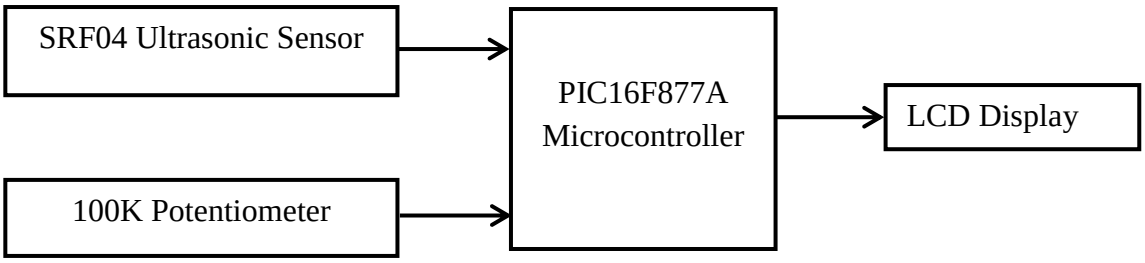

Figure 1: Block diagram of proposed Digital Meter to measure Tower Height

The ultrasonic sensor was connected to the microcontroller using relevant pins[2]. The microcontroller was programmed using mikroC language to obtain the hypotenuse distance. Data analysis was carried out to identify the relationship between the angle and the voltage of a potentiometer. A 100K Potentiometer was connected to Analog to Digital conversion pin of that microcontroller to measure the angle and required programme for the calculation was written with the help of the mikroC programme[3]. A LCD display was connected to the microcontroller to display the angle and the tower height.

3.0 RESULTS AND DISCUSSION

The Figure 1 and Figure 2 show the graphs of the voltage vs. angle for the 10K and 100K Potentiometers.

According to them, there exist a linear relationship between the angle and the voltage. Out those better results were obtained with 100K potentiometer and it was selected for implement the solution.

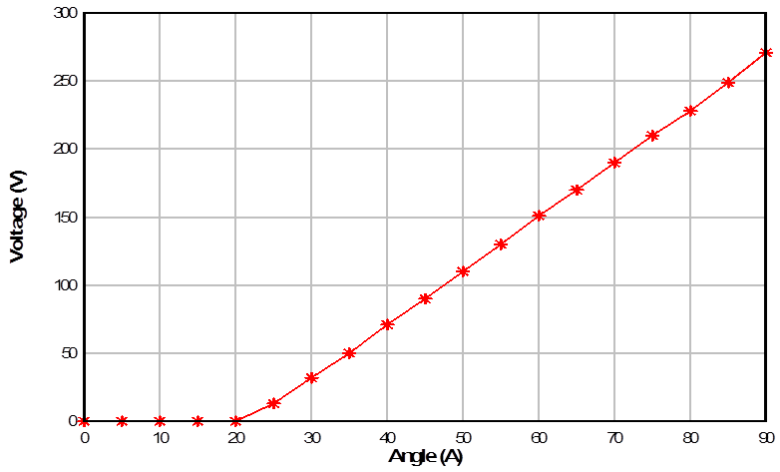

Figure 1: The graph of Angle vs. Voltage for 10K potentiometer

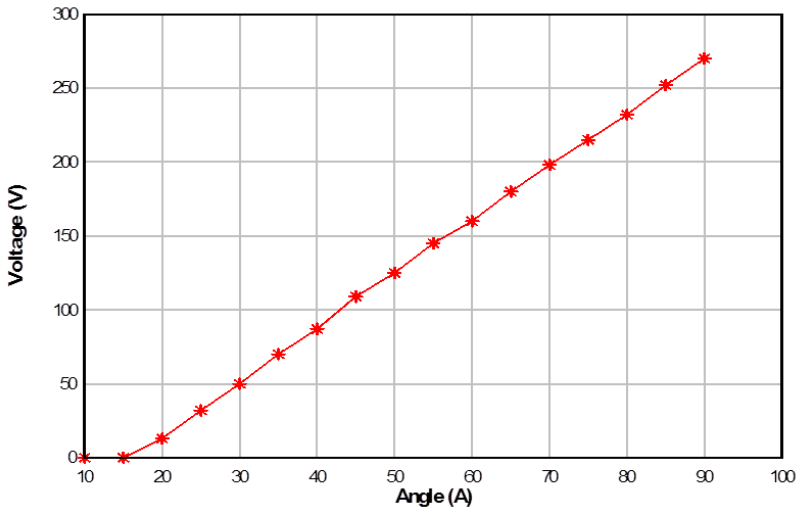

Figure 2: The graph of Angle vs. Voltage for 100K potentiometer

Fig. 2 can be represented by y = mx equation after 15 degrees. Till 15 degrees there is no any variation in the voltage. So the system works properly for angles greater than 15 degrees. The gradient (m) can be calculated for graph with 100K potentiometer and the obtained value for m was 3.667. Then the equation is simplified as y = 3.667x and the angle can be obtained from voltage/3.667.

An ultrasonic sensor was used as the distance measuring sensor and PIC microcontroller was used as the main control system of the proposed device. Using the Analog to Digital conversion ability of the PIC microcontroller, the analog variation of the signal was converted into digital[4]. The conversion of analog signal to PICADC module results in corresponding 10 bit digital number. If the analog voltage is 0V then the digital value relevant to that voltage is 0 and if the analog voltage is 5V then the digital value relevant to that voltage is 1023. Therefore the second pin of the PIC was used to connect the 100K potentiometer to the system.

4.0 CONCLUSION

A low cost, user friendly solution was developed to measure the height of a communication tower. For that, ultrasonic sensors were used even though more accurate laser sensors are available[5]. This was done considering the cost of a laser sensor. Also 100K potentiometer was used to measure angle even though there exists angle measuring sensor since the latter is very expensive[6]. The actual distance is calculated with the help of the mikroC programme. This system can be further developed by replacing ultrasonic sensor with a laser sensor.

ACKNOWLEDGEMENT

Authors would like to thank all at the Wayamba University of Sri Lanka, who have helped for the successful completion of the study. Further, thanks and appreciations also goes to Mr. W. D. T. P. Wickrama who is the external supervisor of the Sierra Telecommunication (Pvt) Ltd for his guidance and constant supervision.

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Department of Electronics - Wayamba University of Sri Lanka

AUTOMATIC STREET LIGHT INTENSITY CONTROLLING SYSTEM

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ABSTRACT

Currently established street light systems, especially in Sri Lanka, causes a considerable amount of energy wastage because they are not automated to act efficiently and effectively. Automated intensity controlling street lamp system will reduce the energy consumption and some other collateral disadvantageous facts as well. Suggesting method has architecture consisting PIR sensor, PIC microcontroller and light-emitting diode (LED) street lamp. Street lamp on time can be configured at the PIC microcontroller. Lamp will lit in general mode with full intensity within the configured to the busy time. And apart from that light will be kept switched to dim mode with less intensity of light. In this system PIC microcontroller uses the Pulse-width modulation (PWM) function decision making. In dim mode PIR Sensor is used to identify the pedestrians and vehicles which are passing away from the sensor. If PIC gets a heat or motion signal from PIR covering the configured criteria, this is the case of detecting a human activity around the lamp; it will be automatically switched to the general mode. Even though the implementation cost is considerable, this system as it will save the power consumption up to 40% than presently available method.

Keywords: *PIR sensor, energy consumption, Light Emitting Diode, Pulse Width Modulation*

1.0 INTRODUCTION

A Street light, lamppost, street lamp, light standard, or lamp standard is a raised source of light on the edge of a road or walkway, which is turned on or lit at a certain time every night. Modern lamps may also have light-sensitive photocells to turn them on at dusk, off at dawn, or activate automatically in dark weather. In older lighting this function would have been performed with the aid of a solar dial. It is not uncommon for street lights to be on poles which have wires strung between them, or mounted on utility poles. Beyond the traditional light controlling method, there are some innovative methods used in today world to control the electricity usage light sources. In this research it's going to be

introducing a new way to save the electricity as well the life time of the light sources by controlling their usage throughout the day by using PIC Microcontroller IC with the help of PIR Sensor.

2.0 EXPERIMENTAL

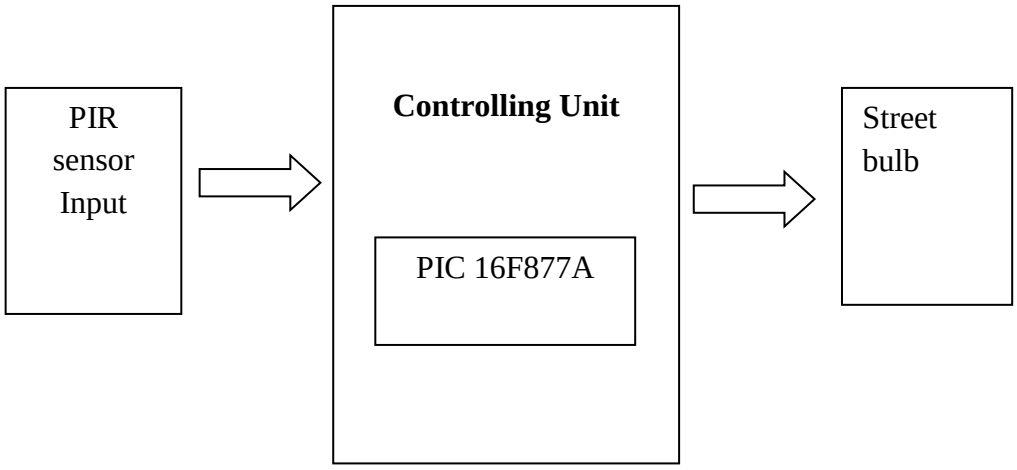

Figure 1: The block diagram of the model traffic light controlling

Initially, the light will be in general mode, after the busy hours (Switching time can be configurable) system will be switched to Dim mode. Whenever the vehicle or pedestrian crosses the sensor, light starts to increase. By this proposed system it can be controlled the power consumption of the street light.

There are two modes in this project for saving power

1. General mode (light be in maximum bright)
2. Dim mode (light be in minimum bright)

In general mode the street lamp will light in its full intensity, assuming that there are human activities on the street. General mode time lapse can be configured to the busy hours. In dim mode, any case of pedestrian or vehicle activity street lamp will be automatically switched to the General mode to give the full intensity of light.

3.0 RESULTS AND DISCUSSION

In the current system CFL lamps or HID lamps working on whole nights there full intensity. If the street light bulb that uses 60 w we have on 12 hours every day of the month (6.00 pm – 6.00 am). So it can calculate how many kWh this incandescent light bulb is using every month.

Kilowatt Hours used that month = 60w * 12 hours / day * 30 days / mo / 1000

= 21.6 kWh per month

So using the 60w incandescent street light bulb, this was using 21.6 kWh /mo. The unit price is Rs 12.50.

Cost per month = 29.28 kWh * Rs 12.50 / kWh

= Rs 270 / mo.

So a single 60w incandescent street light bulb will cost Rs 270/mo.

In my system researcher used LED lamps. Because of that power consuming is less than other lams. If uses 15W LED bulb in same conditions of the previously mentioned 60W bulb,

In General mode,

Kilowatt Hours used on General mode that month = 15w * 4 hours / day * 30 days / mo / 1000

= 1.8 kWh per month

In Dim mode,

Kilowatt Hours used on Dim mode that month = 7.5w * 8 hours/day * 30 days / mo / 1000

= 1.8 kWh per month

* Assume anyone did not use the road at the Dim mode.

Total Kilowatt Hours used that month = 1.8 kWh per month + 1.8 kWh per month

= 3.6 kWh per month

Because of that,

Cost per month while using new system = 3.6 kWh * Rs 12.50 / kWh

= Rs 45/mo.

So, after using the street light intensity controlling system a single 15w incandescent street light bulb will cost only Rs 45 / mo.

Using the proposed Street Light Intensity Controlling System it can save 8.0 kWh per month (21.6 kWh per month - 3.6 kWh per month) from only one bulb. Because of that it can be save 37.04% power from one bulb in single month.

Saving money per month, for one bulb while using new system

= Rs 270/mo - Rs 45/mo

= Rs 225/mo.

Usually initial cost for the one unit of this system is Rs 800.00. It can be covered the initial cost within 4 months as the system saves 225.00 Rs in one month.

For this project it is tried to find a best solution for the object of the project using sensor and street light system. As the existing normal sensors are unable to identify separately the humans and the other objects such as animals, there exist a limitation of this system as it will activate whenever any moving living being moved in front of the sensor. This limitation can be exceeding if the advanced sensor method used.

In the final products there are some advantages such as Low power consumption, Low cost, User friendly and not depend on the environment factors. In the final products there are some disadvantages; PIR can't handle several inputs at the same time etc.

4.0 CONCLUSION

This project of Street Light Intensity Controlling System is a cost effective, practical, ecofriendly and the safest way to save energy. It clearly tackles the two problems that world is facing today, saving of energy and also disposal of incandescent lamps, very efficiently. According to statistical data we can save more than 40% of electrical energy that is now consumed by the streets. Initial cost and maintenance can be the draw backs of this project. With the advances in technology and good resource planning the cost of the project can be cut down and also with the use of good equipment the maintenance can also be reduced in terms of periodic checks. The LEDs have long life, emit cool light, donor have any toxic material and can be used for fast switching. For these reasons my project presents far more advantages which can over shadow the present limitations. Keeping in

view the long term benefits and the initial cost would never be a problem as the investment return time is very less.

ACKNOWLEDGEMENTS
Authors take this opportunity to express my profound gratitude and deep regards who have helped me to make this research success.

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Department of Electronics – Wayamba University of Sri Lanka

REMOTE HEART BEAT MONITORING SYSTEM THROUGH MOBITEL NETWORK

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ABSTRACT

Today mobile phones have become a necessity in human life. Therefore a high competition exists among mobile service providers. Therefore they always try to introduce new additions for customers and to increase the usage of their products. Therefore in this paper a new service was introduced to the mobile service providers, a remote heart beat monitoring system through the mobile network. This remote heart beat monitoring systemprovides a useful tool to patients to assess their own health and manage their personal health information anytime and from anywhere. This design is focused on the people who stay alone at home or suffering from heart diseases. Hardware of the system will sense heart rate of a patient and feed the data to personal computer using serial communication and then send to mobile service provider's server using wireless communication. As future development it is intend to send heart beat value to doctors and get feedback from them andpass it to patients.

Keywords: *Heartbeat, Op-Amps, wireless transmission*

1.0 INTRODUCTION

The concept of this paper is to build upon the integration of wireless communications intomedical applications to revolutionize the personal healthcare. The main objective of this study is to build a wireless heart beat monitoring system using GSM Technology. Remote heart rate monitoringis seen as an effective and low cost method of providing immediate care as it allows for continuous as well as emergency transmission of patient's information to the doctor or healthcare providers. In the recent decade advances in development of mobile health monitoring devices has further enhanced the quality of life[1]. Under this concept, patients are no longer bound to a specific healthcare location where they are monitored by medical instruments.Without a convenient wireless patient monitoring system, the doctor cannot give full attention to the patients at all the times. This

system enables the doctors to remotely monitor multiple patients' condition simultaneously.

Main intention of this study is to introduce a new system to mobile service providers in Sri Lanka. Remote patient monitoring will not only redefine hospital care but also work, home, and recreational activities. This new system will enable doctors to monitor patients on a regular basis and also this brings additional benefits for the patient, saving time in traveling to the local doctor

2.0 EXPERIMENTAL

2.1 Preparation of heart beat monitoring device

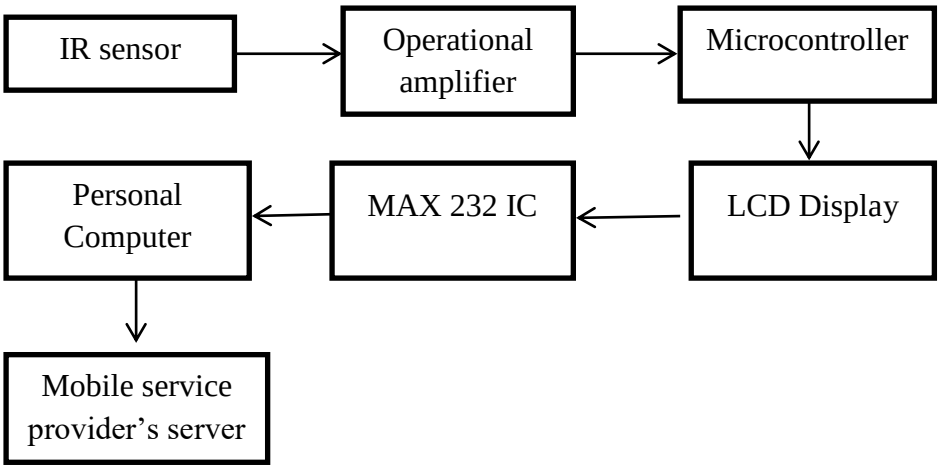

Figure 1: Block diagram of remote heart beat monitoring system

The main task of the study was to build a device to detect heart beat rate of a patient. Heartbeat detecting device was created using an IR sensor. The heart beat sensor designed detects the heartbeat by sensing the change in blood volume in a finger artery while the heart is pumping blood. It consists of an infrared LED that transmits an IR signal through the fingertip of the subject, a part of which is reflected by the blood cells. The reflected signal is detected by a photo diode sensor. The changing blood volume with heartbeat results in a train of pulses at the output of the photo diode, the magnitude of which is too small to be detected directly by a microcontroller. Therefore, a two-stage high gain, active low pass filter was designed using two op-amps to filter and amplify the signal to appropriate voltage level so that the pulses can be counted by a microcontroller. After that the heart rate is displayed on a LCD display.The LM358 dual op-amp with the gain of each

filter stage is set to 101, giving the total amplification of about 10000 to amplify the signal of IR sensor. A 1µF capacitor at the input of each stage wasused to block the dc component in the signal. Some testing was carried out to measure accurate value of the series resistor for the IR diode by using 470k potentiometer in series with the IR diode[2].

3.0 RESULTS AND DISCUSSION

The first section of theheart beat monitoring sensor was developed using TCRT5000 IR sensor[3] and LM358 op-amp[4].The potentiometer was kept in series with the IR diode. After placing a fingertip over the sensor assembly, the potentiometer was slowly varied till the output of LEDs blink with heartbeat. Then this sensor output was connected to 16f877pic microcontroller and the heart beat rate assigned todisplay on LCD display. This heart beat value was fed to a personal computer using max232IC and that value was send to mobile service provider's server using a dongle. This IR sensor based heartbeat rate monitoring system is a low cost solution. The cost of remote heart beat monitoring system was 1200 rupees. There are many sensors to detect heart beat rate but they are costly normally 7500 rupees[5].

4.0 CONCLUTION

In this study, a low cost wireless heart beat monitoring system wasdeveloped to monitor the patient's condition increasing the efficiency of patient's data monitoring procedure. This system is very useful to every one especially for heart patients. As the future development, it is intended to develop the part of sending heart beat rate to a doctor and get feedback from him and finally inform the feedback to patient via a SMS. This can also be further expanded to remotely monitor other health functions.

ACKNOWLEDGEMENT

Authors would like to take this opportunity to thank everyone who helped to complete this study successfully.

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Department of Electronics – Wayamba University of Sri Lanka

IMPROVEMENT FOR ROBOPAC WRAPPING MACHINE USED FOR WRAPPING THE PALLETS LOADED WITH GLASS CONTAINERS

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ABSTRACT

This project is based on use of Programmable Logic Controllers (PLC) to improve the performance of robopac wrapping machine used at a glass company. The PLC is an electromechanical processer used for automation. PLCs are widely used in many industries and machines due to fast process, ability to stay for severe conditions such as dust, moisture, heat and cold, facilitate extensive input and output, ability to connect to sensors and actuators. PLC reads limit switches, analog process variables like temperature and pressure and the position of complex positioning system. PLC can operate electrical motors, pneumatic or hydraulic cylinders, magnetic relays, solenoids or analog outputs. Hence, a PLC was used for the project to achieve objectives. The machine's output sensors were used to control the PLC. Ladder language was used as PLC language. Variable Speed Drives (VSD) are used to control the three phase induction motors.

Keywords: *Programmable Logic Controller, Ladder Language, Variable Speed Drives*

1.0 INTRODUCTION

The Robopac stretch wrapping machine is a material handling system suited for packing operations, large scale handling, storage or transportation of glass containers.

The system consists of

- A turntable for rotating the loaded pallet.
- An elevator for lifting and lowering the film spool carriage along elevator mounting part.
- A film spool carriage for pre -stretching the film prior to its wrapping.

- Programmable logic controller (PLC) for control panel[1] presently, the PLC of the machine is not working and input sensors of machine are also not working. So two variable speed drives are used to operate the turntable and the elevator. Also turntable, elevator and film spool carriage are not working up to the standard. The machine is operated manually. A circuit diagram and a PLC program were designed for proper machine operation.

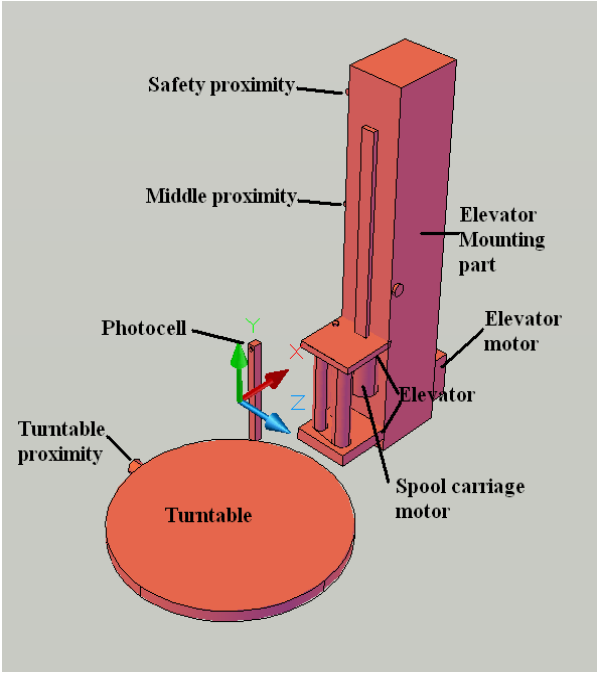

Figure 1: Robopac wrapping machine

2.0 EXPERIMENTAL

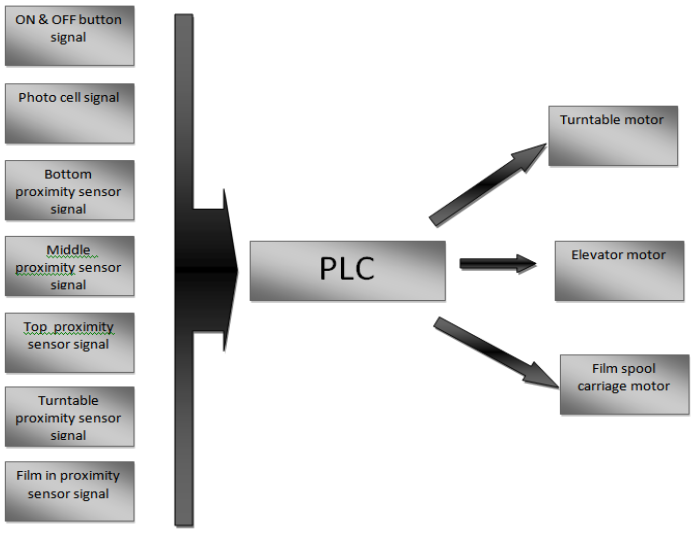

Figure 2: Block Diagram of Robopac machine controller system

Above diagram shows the simple block diagram of Robopac machine controller system. The machine was controlled by using a PLC. PLC has seven inputs and three outputs to operate the machine. The PLC logic was constructed using these seven inputs. After learning about Robopac machine and its operation, a pulse diagram was drawn for the Robopac machine operation. Then, the suitable program was written using ladder language. The circuit diagram was implemented using AutoCAD software. Finally, the circuit was set up and tested by using test bench. Reducing the operation time was the main objective of this project. So then, time for one cycle (Time for wrapping one pallet) was observed to measure the operation time of the system.

3.0 RESULTS AND DISCUSSION

3.1. Results

Table 1: Time Duration for wrapping process

Height of the pallet (m)	Operation time(min) (before)	Operation time(min) (after)
1.64	2.31.24	2.19
1.40	2.12.57	2.02
1.24	1.40.93	1.21
1.05	1.32.01	1.20
1.35	1.59.14	1.36

Time duration for wrapping a pallet depends on its height and therefore, time durations were observed for different heights.

3.2 Discussion

At first the circuit did not work. Two reasons were identified for that situation. One is due to the circuit design which was for both auto and manual operations. Therefore, some technical errors with controller circuit occurred. Both auto and manual current paths for one function connect to the common contactor and so, sometimes current passed through the unnecessary power path. When start push button was pushed then (K2) contactor activated self holding path through the contactor. At that moment, current may be able to pass through the (R6) relay no six (Fig. 3) To avoid that, the circuit was changed as

shown in Fig. 4. Two diodes were connected to block the current path. It provides safety for the circuit[2,3] Other reason is complexity of the controller circuit. In this controller circuit the PLC input signals were handled with using seven contactors and thirteen relays. At the some places more than four signals were controlled using one relay or one contactor. Also one contactor output or one relay output was used more than two places in the controller circuit. It is disadvantage of the controller circuit. That circuit consists of thirteen relays. Electromagnetic relays have fast operation and past reset operating speed which has the ability to operate in milliseconds are also can be possible, so that it is larger advantage for reduced the operation time of Robopac machine[4]. Safety is an important factor for this machine. For ensure the safety of the operator include some safety steps to controller circuit. When a bottle pallet is not present on the turntable a signal send to the PLC from photocell. (Photocell was mounted near the turntable to detect pallet with glass bottles) If the pallet was not presented system cannot active, PLC logic was written to control it. The middle proximity sensor use to detect elevator and then turn off the elevator motor, when it is not working elevator be thrown away from the machine with spool carriage motor. Therefore safety proximity was installed above the middle proximity for detect elevator.

Stretch wrapping was used for wrapping the pallet with lorded pallet. Sometime stretch wrapping was broken but elevator and spool carriage motors not turn off. This system improved to turn off the elevator motor and spool carriage motor when stretch wrapping was broken, also display the error massage on the PLC screen.

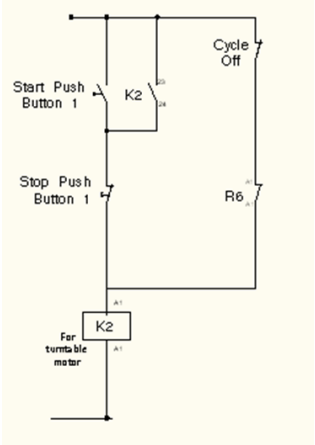

Figure 3: Current path through a contactor

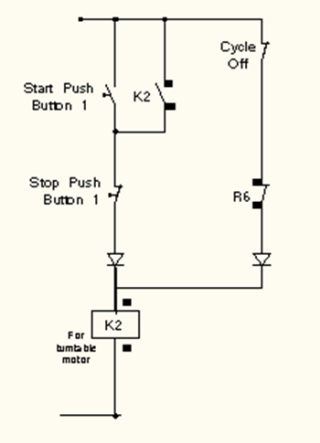

Figure 4: Correct current path through a contactor

4.0 CONCLUSION

The Robopac wrapping machine handles large amount of pallets with glass containers per day (at least about two hundred pallets per day). Therefore the efficiency of the packing division was depending on efficiency of the Robopac wrapping machine. To enhance the efficiency of the machine, the operating time must be kept low. The circuit designed in the study could achieve that target to some extent. That is the operation time of the machine was decreased by approximately from 5% to 10%.

ACKNOWLEDGEMENTS

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POWER LEVEL MONITORING SYSTEM FOR BATTERY BANK AT A BTS USING A GSM MODULE

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ABSTRACT

In mobile telecommunication,a Base Transceiver Station (BTS) is a piece of equipment that facilitates wireless communication between user equipment andthe network. Generally CEB power is used to power BTS and backup generator and battery banks are used as secondary power sources.But power generators are not available at every BTS site as backup power source due to commercial issues. Power issues mainly occurred when a battery bank served as an additional power source in the event of interruption the CEB power or at a breakdown of the backup generator. The power of the battery bank is automatically switched to BTS when CEB power is down. Then battery bank is gradually drained while reducing the voltage level of battery bank.The proposed system monitors the voltage level through voltmeter and transfers the measured data into personal computer by using max232 IC after converting the analog value to digital value using an ADC. Finally data is delivered to relevant site engineer via SMS by using GSM module.This power level monitoring system sends discrete voltage value of the battery bank imminently to the required authorities whereby they can quickly attend to draining of the battery. Thisstudy reflects optimum solution for the above recognized issue with most appropriate and cost effective manner.

Keywords: *Battery bank, Power level, GSM Module, Base Transceiver Station*

1.0 INTRODUCTION

BTS is an instrument that is used to interface mobiletelephone and the operating network. BTS consist with TREs(Transmitter Receiver Equipment), microwave equipment and routers.Therefore power sources are required in order to power telecom equipment in BTS. The power issue in BTS sites mainly occurredduring the interruption of CEB power and also when they have backup generatorswhich are having battery bank as additional power source. The power of the battery bank is automatically switched to BTS when CEB power is down. Then battery bank start to drain while reducing the voltage level. If the voltage level of battery bank is reduced below a certain voltage level,life time of battery bank will go down.Usually the cost of abattery bank is around Rs. 80,000. The service providers

have to spenda lot of money to replace the battery banks. With the introduction of the proposed system, power level of battery bank is continuously monitored by using a voltmeter and the voltage value of battery bank is delivered to site engineer via SMS.The main objective of the study was to develop a system to inform the relevant authorities before any kind of damage to the battery bank take place due to over draining.

2.0 EXPERIMENTAL

Battery bank of a BTS is connected to a rectifier in order to charge the batteries when CEB power is available.Power level of Battery Bank is drained according to capacity of the BTS site and the power from batteries is provided to both microwave link and BTS. The microwave link is given high priority over BTS during the operation with battery bank. Accordingly the disconnection voltages were defined as LVD1 and LVD2 (Low Voltage Disconnector). Maximum charge level of the BTS battery bank is 54 V.

Table 1: Low Voltage Disconnecting status according to voltage range of Battery Bank

Naming System	Range of voltage	Status	
LVD1	53V - 48V	Non-critical	Disconnect BTS
LVD2	48V - 42V	critical	Disconnect Microwave

If the voltage level of battery bank is below 42V it will directly affect to lifetime of battery bank.Voltage of battery bank can be easily measured through connecting probes between battery bank and rectifier[2].

In the proposed system the discrete voltage level of the battery bank is measured using this voltmeter. The observed analog value is then converted in to digital signal by using ADC module. Digital data of the voltage is transferred to personal computer through MAX 232 IC. Finally the data is send to the mobile of the site engineer via GSM mobile network with the help of a personal computer which is connected to GSM network via dongle. The system is generated the SMS at every voltage level of Battery Bank when it is gradually drained.

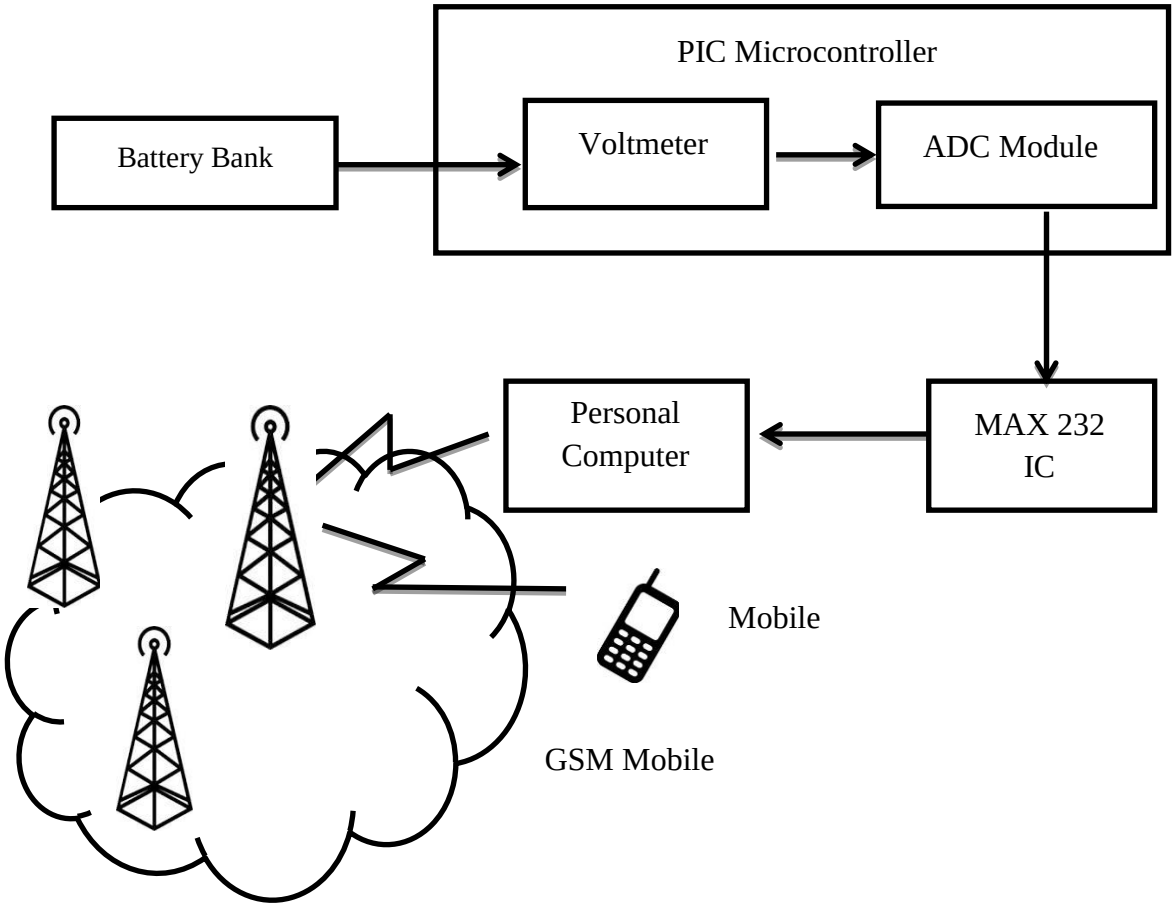

Figure 1: System Diagram of Power Level Monitoring System for Battery Bank at the BTS

3.0 RESULTS AND DISCUSSION

The major task to achieve during the development of this system was to reduce the cost since it has to be implemented to thousands of BTS sites belong to the mobile service provider. In the other hand the company was not willing to spend huge amount of money on the battery security system. Because, this product is not an income generator but onlyan expenditure for the mobile company.The other problem was the reliability.Failure of the CEB power is to be critical reason when considering about the stability of the mobile network. Throughout our country, the breakdowns of CEB power are very frequent. So that as mobile service provider they must adopt solutions to any incident that will affect to the consistency of the service.

The system was tested after completing the designing of and. Itworked successfully. Especially the voltage value was monitored by the voltmeter accurately and that value was passed to the mobile phone as quickly as possible.

4.0 CONCLUSION

By the proposed system, voltage level of battery bank is measured and measured data is transferred to site engineer via SMS. At present site engineer cannot exactly predicted how much time required to stop draining of the battery bank before it down up to critical power level after he was informed the situation by the Network Operation Centre(NOC).This solution makes the work of site engineers easier, thereby he will be able to prevent fully draining of the battery bank which will help to reducethe maintenance cost of the battery bank. When considering the all facts and the technology used, it can be assured that this system can be implemented toany area of the countrywith the guarantee that the system will work properly. To implement this system, a personal computer is required for every BTS site. As the further improvement,GSM dongle can be replaced with a GSM modem to speed up the communication.

ACKNOWLEDGEMENT

Authors would like to thank all at Wayamba University of Sri Lanka who had helped immensely to make this study a success. Special thanks goes out to Mr. Sahiru Chaturanga, Mr. Prasanga Dissanayake and Mr. Ashen Chanaka, senior engineers of Etisalat Lanka (Pvt) Ltd who provide helping hands throughout the cause of stay with sharing wisdom of explicit.

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Department of Electronics – Wayamba University of Sri Lanka

SUBSCRIBER IDENTITY UNIT TO MAIN DISTRIBUTION FRAME IN SRI LANKA TELECOM (PLC)

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ABSTRACT

Sri Lanka Telecom PLC (SLT) is the largest telecommunication service provider in Sri Lanka. The company provides a variety of domestic and corporate services which includes fixed and wireless telephony, internet access and IT services to domestic, public & business sector customers. Main Distribution Frame (MDF) is the main part of the Sri Lanka Telecom PLC. That is the place which connects the customer side and the exchange side. It is the main location that provides the connection to the Public Switching Telephone Network (PSTN) and Asymmetric Digital Subscriber Line (ADSL). Sri Lanka Telecom uses a clarity data base in test room and MDF section which is like a heart of the Sri Lanka Telecom (PLC). This database consists all the data of the subscribers like the Distribution point (DP), the cabinet numbers, the MDF tab block location etc. But unfortunately this database is not accurate. The accuracy of this database is very important to provide the effective and efficient service to the customer. The research area is based on this MDF section and it is attempted to minimize the faults which occurs from incorrect data.

Keywords: *Main Distribution Frame, Clarity, Tab block, Dual tone multi frequency*

1.0 INTRODUCTION

The Sri Lanka Telecom Outside Plant Maintenance Center (OPMC) has many divisions which are important to provide a good service to their customers and they are Code Division Multiple Access (CDMA), Asymmetric Digital Subscriber Line (ADSL), New connection section. Other sections are not directly dealing with the customers. But, they act the most important part to provide a satisfactory service to the customer like Main Distribution Frame (MDF), transmission section and cable development section. All the telecom customers' details are saved in a database which is called as clarity database used in test room and MDF. It is very important to the MDF and maintains section. But sometimes this database is not fully accurate. When a technical person tries to rectify a fault or provides a new connection to customer or disconnects a customer line, he faces

with many difficulties due to the problems in database. One such problem is the wrong customer MDF tab block location. At such an instant, currently, they use the test phone and the MDF Caller Line Identity (CLI) unit to verify the customer location by referring the customer telephone number. In this study, it is aimed to design a call generator which can be replaced for the test phone and planned to connect the CLI unit separately.

2.0 EXPERIMENTAL

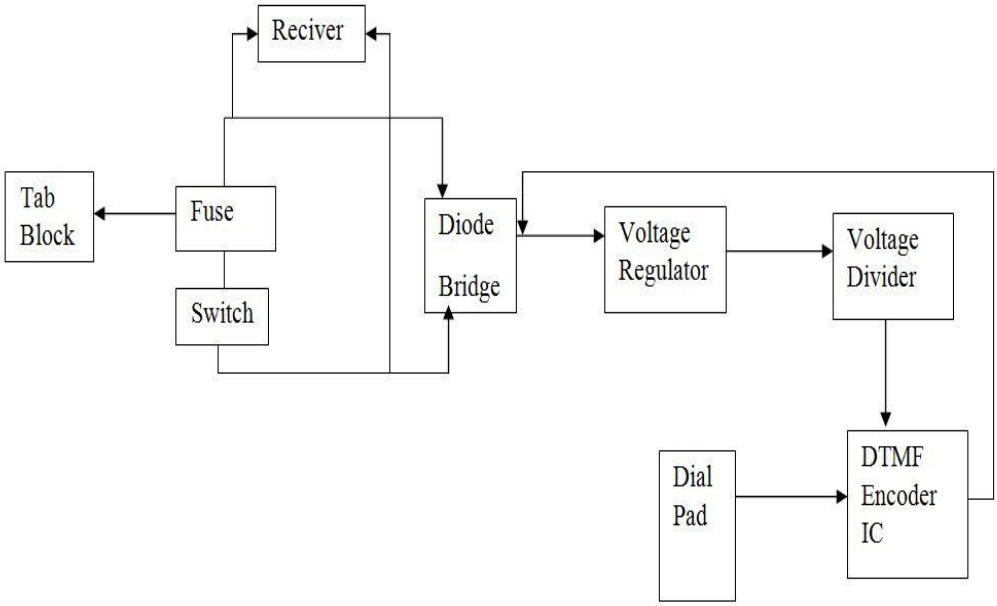

Figure 1: Block diagram of the circuit

Preparing the circuit

The Dual Tone Multi Frequency (DTMF) technology was used all telephones for generating a call. The DTMF frequencies were handled by call switching process[1]. The circuit designed in this study was developed by using the DTMF encoder UM 91214IC and connecting to the dial pad.UM91214 has four series. The UM91214A IC was used in this circuit design[2]. The power that needs to work the IC was supplied from the tab block. The circuit and the tab block was connected using the fuse. The fuse was disconnecting the underground side and it was directly connected with the exchange side. This 8 V AC voltage was converted to the DC voltage by using a diode bridge. The 7805 voltage regulator was reduced the ~8 V line voltage to 5 V. The voltage divider circuit was divided 5 V into ratio of 2:1 and supplied ~3 V to UM91214 IC as an operating voltage. The MDF

telephone number was dialed, DTMF encoder IC was encoded the frequencies according to the dialed number .The DTMF encoder output was connected to the diode bridge. The voltage of the diode bridge was varied according to the DTMF encoder output and it sent to the exchange as the voltage variation. The exchange was switched call for the subscriber. By using the CLI unit which was connected to the MDF it is possible to obtain the subscriber telephone number. The ON/OFF switch was used as the cradle switch which has the telephone. The switch was ON (off hook mode of normal telephone) the dial tone passes through the telephone line and ready to accept a call.

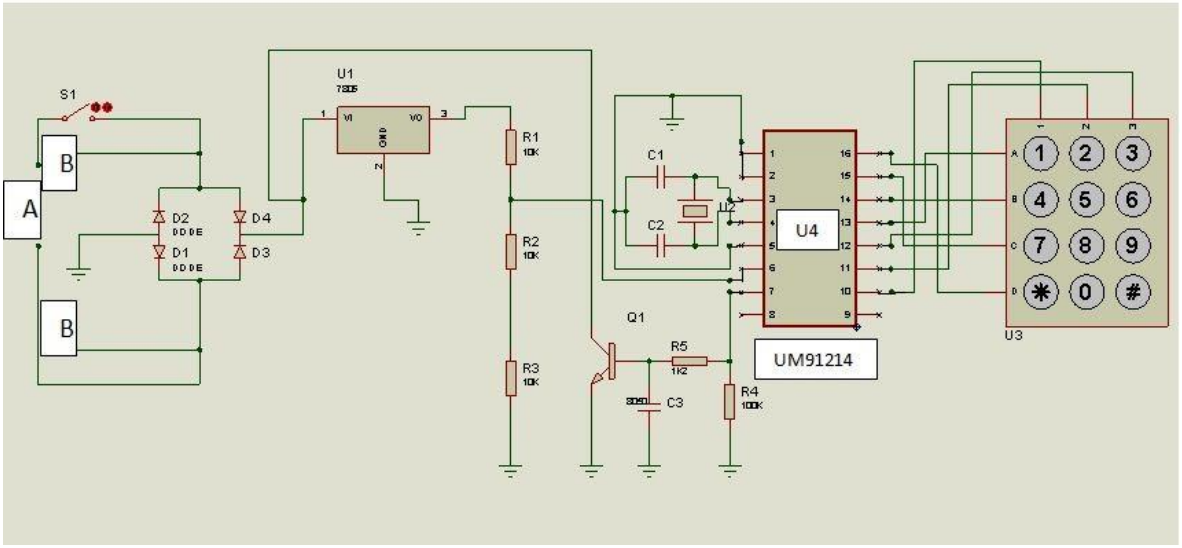

Figure 2: Circuit diagram

S1	-ON/OFF switch	D1,D2,D3,D4	-1N4007 diode
U1	-LM7805	R1,R2,R3	-10 K resistors
R4	-100 K resistor	R5	-1.2 K resistor
C1,C2	-15 µF capacitors	C3	$-20*10^{-3}$ µF capacitor
U2	-3.58 MHz crystal	U3	-Dial pad
U4	-UM91214 DTMF encoder IC	Q1	-8050 transistor
B	-Connected to the receiver	A	-Connected to the fuse

3.0 RESULTS AND DISCUSSION

When a customer reports a fault to 1212, technical people have to identify the correct location of the customer in MDF to repair the fault. In this study, a device was built up which can obtain the customer telephone number standing in one place. By using this

equipment a call can be taken to the MDF telephone & the customer telephone number can be checked by using the CLI unit.

When a telephone is in off hook mode, the telephone line voltage is ~8 V. When it is in on hook mode, the telephone line voltage is ~48 V[3]. The dial tone must available in the telephone line to make a call. The dial tone passes through the telephone line when it is in the off hook mode. The receiver was used to hear the dial tone.

The PIC 16F877A microcontroller can be used as a dial pad after loading a suitable program code which helps it to function as a dial pad. But the problem is writing the program using the unique MDF telephone number. So that program is unique to that particular MDF. In other words, it can be used in one specific MDF only.

3.1 Advantages

- Easier to use than the normal test phone
- Can obtain the customer telephone number standing in one place
- Only one person is needed to identify the customer telephone number
- Smaller than the normal test phone
- More efficient than the previous or present day method

3.2 Disadvantage

- Can only use for one specific MDF

4.0 CONCLUTION

There need to have a sound knowledge about the DTMF technology and the special tones like dial tone, busy tone etc. and the basic telephone call routing process. Because these are the basic concepts that used to develop the circuit designed .The circuit was prepared using DTMF encoding method, call routing process, voltage regulation and diode bridge methods. The circuit designed in the study was very easier to use than the test phone. This design can be developed to get all the customer's telephone numbers in a tab block at one time by using the PIC microcontroller after loading a suitable program.

ACKNOWLEDGEMENT

The authors would like to thank many individuals who helped and guided to complete this industrial training successfully. Mr. T. M. C. B. Abeysinghe and other technical persons are acknowledged for their guidance during the stay at Sri Lanka Telecom (SLT).

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Department of Electronics – Wayamba University of Sri Lanka

POWER DISTRIBUTION CONTROL SYSTEM FOR NETWORK PLANNING DIVISION

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ABSTRACT

This paper describes a solution for the power saving solution for a busy office using a system which enables the users to control main power switches remotely. Most users in a busy working environment forget to switch off power at their workstation. To avoid this power wastage, we propose a web based system with a Wifi module that controls the main power. Using this system, any user can switch off anything connected to the main power. Web interface is designed for users to control the device with a user-friendly graphical user interface. With this system, companies benefits minimizing power wastage and save operational costs.

Keywords: *Power Distribution, Wifi Module, Web Server*

1.0 INTRODUCTION

At Work station there is an initiative to save power. But at network planning division it is not done more regularly. Because most of the employees have to go out suddenly and the duration varies most of the time so they might not come to office again to switch the lights and AC off or there can occur unexpected errors and might have to go out again without any notices also there can be employees that simply forgets to switch it off. When such an event occurs, when the employee remembers that he did not switch it off the employee does not have a way to switch it off. Because almost all the employees at network planning has a smart phone or a device that has internet access and at office their computers are switched on 24 x 7 going for a web based solution was the best option regarding the resources that they have. We can use a computer that is switched on 24x7 as the web server and Wifi network at office so new wire connections are less needed.

2.0 EXPERIMENT

The proposed system was based on a web server and a Wifi module. The Wifi module is implemented to get signals from the web server using whatever the port that the client want and switch equipment in the main power grid using relays[1]. Wifi module is used to communicate with the web server without any cables (using the existing Wifi network). The web server is used to host the web page that we developed. Web server is in the same network with the Wifi module. Web page is developed using basic HTML and PHP for port communications[2].

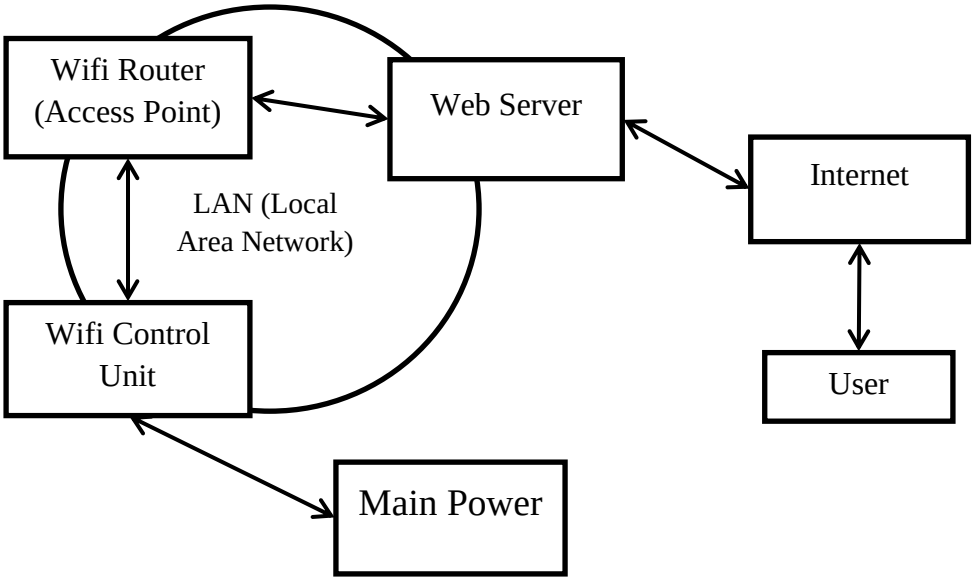

Figure1: Block Diagram

User access the web server using the internet and the web server is in the same local area network. Access point provides the local area connectivity where the Wifi module connects. The Wifi module is connected to a relay shield where it can control switches in the main power[3]. Circuit is built to protect the module using diodes and light emitting diodes are implemented to indicate which relay is switched on[4].

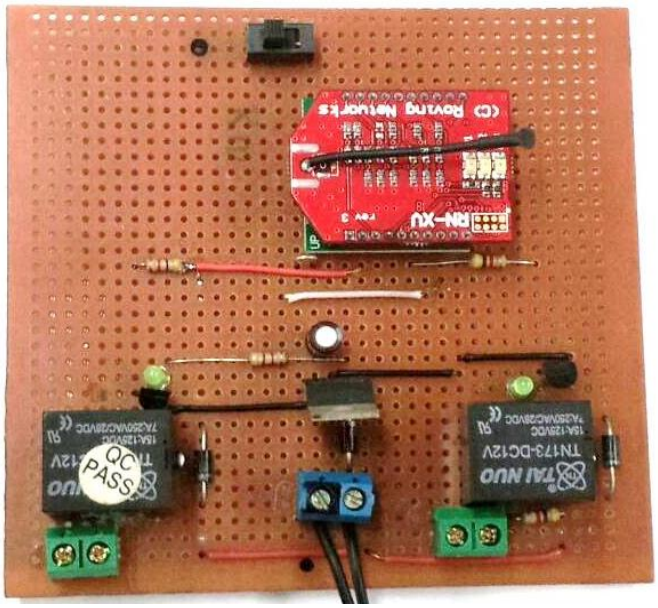

Figure 2: Implemented Circuit

Web page is created using the basic HTML code just to provide the interface needed for the user to interact with the user. When the web server communicates with the Wifi module it uses the port 2000 to pass the plain text message where the module is listening in port 2000 also. The web page is programmed using PHP for port programming[2].

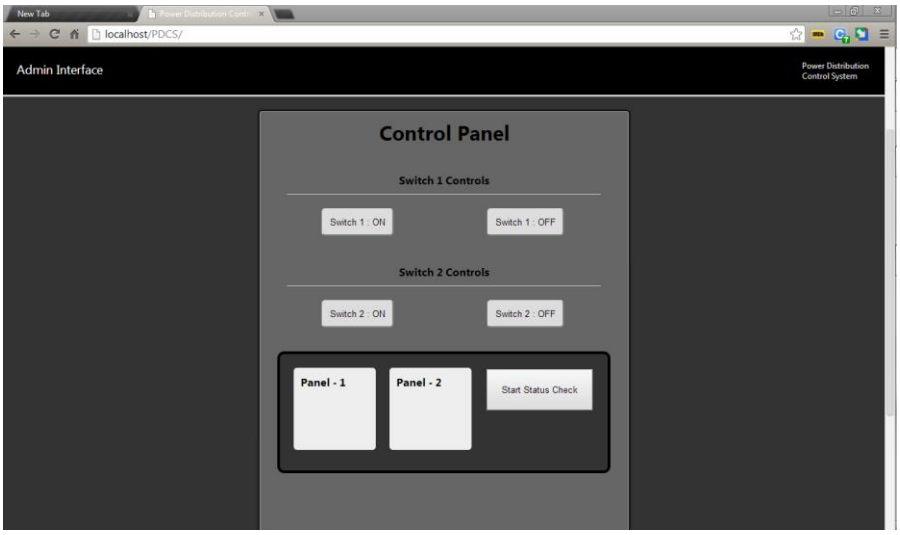

Figure 3: Web Interface

3.0 RESULTS AND DISCUSSION

Using the Roving Network Wifi module with relays main power grid switches could be controlled using the web server. By assigning IP to the Wifi module and using the port 2000 it communicates with the web server. According to the signal received from the web server. Web page is created using HTML and for port programming used PHP[2].Furthermore the system can be more secure by adding a login page. Although we used Ajax multiple browsers need to be more configured in order to perform smoothly in other browsers. When using touch input devices the web page must be able to adapt to gestures that are available in touch devices (viewing size with screen resolution, zooming and scrolling).

4.0 CONCLUTION

There is huge power wastage at working environments due to inability to turn off lights and other electrical equipment, especially when employees are out of office. In this study we attempted to propose a web based solution to minimize power wastage in such an office environment. This system has an interactive user interface to control the equipment which are connected to the main power, far away from the office. Using this system, companies can cut down power wastage and save a lot of money.

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PASSWORD SECURED ACCESS CONTROLLING SYSTEM FOR BTS TO A MOBILE SERVICE PROVIDER IN SRI LNAKA

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ABSTRACT

Mobitel is a mobile phone network in Sri Lanka. It is wholly owned by Sri Lanka Telecom (SLT). To fulfil all requirements Mobitel comprises many elements, each having its own function to complete. The most obvious part of the cellular network is the base transceiver station. The base transceiver station or system, BTS was consisted of a number of different elements. The first was the electronics section normally located in a container at the base of the antenna tower. This was contained the electronics for communicating with the mobile handsets and included radio frequency amplifiers, radio transceivers, radio frequency combiners, control, communication links to the BSC, and power supplies with back up. Mobitel Pvt. Limited was experienced several BTS robberies for a year. Password secured access controlling system was selected as the ideal method to solve the above situations. This system was identified unauthorized entrance from the incorrect password and sent a sms to the relevant site engineer automatically. By this system the company can prevent from robberies, minimize energy consumption and reduction in resources, manpower and maintenance. Meanwhile the company will capable to provide a quality service to the customer continuously.

Keywords: *Base Transceiver Station, Access controlling system, Arduino*

1.0 INTRODUCTION

Access controls was security feature that control how users and systems communicate and interact with other systems and resources. Benefits of access control systems were immense. In this era of technological advancement, access control system has already proved its worth by effectively functioning for the security purposes. Day by day, security and privacy of places, necessary and important areas etc are being critically challenged.

Day by day becoming more and more technology oriented, if there were no real benefits of access control systems, people would never be that persistent in using it[1].

The first and foremost responsibility of access control system was to secure the site where it was being used. By monitoring every single accesses done through the system is taken care of. And access control system shows when person have to remember only one key for accessing through it. As there was no acceptable scope of duplication, this fact results in a superior luxury in maintaining security of the related premise or things. For Mobitel, it was ideal to have remote access facilities for the engineers. This was helped to save precious time of them. In case of a stranger tried to enter the site, a sms sent automatically to the relevant site engineer. The cellular network fulfills many requirements. Not only does the cellular network enable calls to be routed to and from the mobile phones as well as enabling calls to be maintained as the cell phone moves from one cell to another, but it also enables other essential operations such as access to the network, billing, security and much more. The most obvious part of the cellular network is the base transceiver station. This contains the electronics for communicating with the mobile handsets and includes radio frequency amplifiers, radio transceivers, radio frequency combiners, control, communication links to the BSC, and power supplies with back up. The second part of the BTS is the antenna and the feeder to connect the antenna to the base transceiver station itself. BTSs are set up in a variety of places. In towns and cities the characteristic antennas are often seen on the top of buildings[2]. The available security system sent an alarm to the NOC (Network Operation Center) when the door opens in the BTS. It can't detect the entrance is authorized or not. This system provided method to identify the entrance is authorized or not.

2.0 METHODOLOGY

2.1 Used Materials

There were several Arduino shields such as Arduino ADK,Arduino-Compatible Due, Arduino Compatible Mega 2560, Arduino Compatible UNO and etc. For common purpose the UNO was good place to start. The number of inputs in this project was high. The arduino mega 2560 has more hardware serial ports, more timers and more I/O pins. The arduino mega 2560 was bigger both physically and in terms of available FLASH memory and RAM (256kB FLASH/8kB RAM vs. 32kB FLASH/2kB RAM on the UNO).

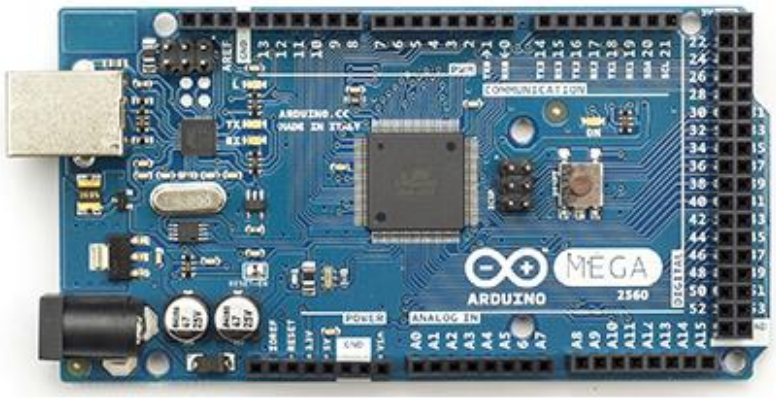

Figure 1: Arduino Mega

Figure 2: Arduino IDE

arduino programs were written in C or C++. The 16×2 LCD Display, 4×4 Keypad, SIM900 GSM Module and Servo Motor were connected by using the arduino IDE software. Pin numbers were defined and above equipments were connected by using the arduino IDE to function according to the below procedure. Software written using Arduino was called sketches. These sketches are written in the text editor. Sketches are saved with the file extension .ino. It has features for cutting/pasting and for searching/replacing text. The message area gave feedback while saving and exporting and also displayed errors. The console displays text output by the arduino environment including complete error

messages and other information. The bottom right hand corner of the window displays the current board and serial port. The toolbar buttons were allowed to verify and upload programs, create, open, and save sketches, and open the serial monitor. The arduino IDE comes with examples, which makes many common input/output operations much easier[3].

In this proposing system first ask to press the start button. Then ask to enter the password. If password was correct, displays "Access granted". Whether the password is incorrect, displays "Access denied" and it given another chance. Likewise the person can try three times. If the person was enabled to enter the correct password, then send a sms to the site engineer and the person can't press any button in keypad for 5 minutes.

If you get the permission, then ask to hold the door. If the person needed to hold the door he/she had to press F3. If that person pressed the F3 door was hold. If not door was closed. If the site engineer wanted to change the password he can do it by pressing F1. Then ask to enter the old password and new password. After changing the password sms will send to the site engineer.

3.0 RESULTS AND DISCUSSION

In this proposing system provide good secure to the BTS. It identifies whether the entrance is authorized or unauthorized. If the entrance was unauthorized, the system sent a sms to relevant site engineer. It made them comfortable to take quick actions. Meanwhile person who tried to enter the BTS can't try for another attempt since the keypad is locked for 5 minutes.

If the entrance was authorized, the system asked to hold the door. Because sometimes need to take some equipments into the BTS. It may take much time. So the system was allowed holding the door.

Someone can change the password. It was very risky situation. This system avoided this type of risks. After every password changing, system will send a sms to relevant site engineer. Finally this system provides good security system than the existing one.

LCD and keypad install near to the door lock. Arduino shield and GSM shield keep near to the door separately. Those equipments were kept in safe places. Because the environment factors such as rain, sun shine and etc might damaged to the system.

4.0 CONCLUSION

Even though this is a preliminary study, the results provide good secure to the BTS. When considering about the monitory value of those equipments is near about Rs. 800,000.00. Most of the time, thieves tried to steal some kind of wires equipped with copper, battery bank and the copper equipped instruments. As mention in the above paragraph company faces big problem from this kind of situations. Because the company was spend lots of money for a single BTS. As well as the maintenance cost. If the thieves steal air conditioner, it may cause another issues. Because by increasing the temperature, the whole BTS may damage. So having this type of access controlling unit the company can minimize the risk or avoid the risk.

ACKNOWLEDGEMENTS

The authors would like to acknowledge and extend heartfelt gratitude to Department of Electronics and Mobitel (Pvt) Limited- (Engineering Division), Colombo 08.

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Department of Electronics – Wayamba University of Sri Lanka

RELAY BASED BACKUP SYSTEM FOR THE VOICE COMMUNICATION CONTROL SYSTEM

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ABSTRACT

Voice communication is an essential part in Air Traffic Management. A Voice Communication Control System (VCCS) handles both air to ground and ground to ground communication. Airport & Aviation Services Sri Lanka (AASL) Limited uses an expensive VCCS system (GAREX220) which is older than a decade. Sometimes this system fails to work due to certain problems and AASL has no backup system. In this study we develop a low-cost VCCS that can be used as a backup system by AASL when the expensive system fails to work.

Keywords: *Voice Communication Control Systems, Push to Talk system (PTT), Audio amplifiers, microphone pre-amplifiers*

1.0 INTRODUCTION

Voice communications is a fundamental part of providing air traffic control services. Both air-to-ground and ground-to-ground voice communications are essential for the en route, flight service and terminal domains of aircraft flights to provide safe, orderly and efficient flow of air traffic. In Sri Lanka also there exists a voice communication control system (VCCS) which can control any air crafts throughout the Sri Lankan Flight Information Region (FIR).

Airport Aviation Services (Sri Lanka) Ltd (AASL) had awarded a contract to Park Air Systems for a Garex 220 voice and communications control system. In 2001 it was installed at the Ratmalana Area Control Centre (ACC). Garex 220 consists of a touchable voice communication switch which allows the operator to communicate over air-to-ground

over radio channels and over ground-to-ground line-based circuits i.e. a combined voice and data switch providing integrated voice communications for radio, telephone and intercom in one unique system, with unlimited conferencing capabilities. The Garex VCCS will provide an integrated airspace communication system, with the ability to speak with any aircraft throughout the Colombo FIR and to communicate with other ground facilities both in Sri Lanka and at other regional centres. The system consists of 50 external communications channels for radio, telephone and intercom connectivity, with 12 user positions featuring touch screen panel interfaces.

1.1 Garex 220

Telephone, radio and intercom functionality recommended by (International Civil Aviation Organization) ICAO; IFATCA, ATCA, IFATSEA, EUROCONTROL as well as additional features to meet national and local requirements are implemented in the open system hierarchical structure of the GAREX 220 VCCS[1].

The radio subsystem ensures routing the communication between controllers and pilots. The actual transmission and reception of radio signal are provided by transmitters and receivers located on different locations.

The telephone part provides voice connections between sites within the ANS. Connection with the adjacent air traffic control centers is realized through leased fixed circuits[2].

The GAREX 220 Compact VCCS offers all the functionality and connectivity required for Air Traffic Control (ATC) communications at installations with up to 36 Controller Working Positions. Controller Working Positions are equipped with one Touch Screen Panel, one loudspeaker and a single two-plug panel for connecting two positions instruments such as microphones, headsets or handsets. The Controller Working Positions are delivered in 6U high 19” frames for mounting in consoles, desktops or racks[3].

In this study, it was attempted to design a backup system for existing VCCS in case of any error occurs in it since the existing system is about 13 years old. VCCS is essential in air traffic management, and since it is a centralized system any failure in the system will affect to lose the communication both air-ground & ground-ground. AASL hopes to use the

existing system for another few years ahead, and designing a backup system which is totally independent of the existing one, is better.

Therefore a simple and cost effective system was designed using basic electronics. A circuit was designed using relay based switching system, basically for 4 channels. It is a simple, cost effective and totally independent of the existing system.

2.0 EXPERIMENTAL PROCEDURE

According to objectives a relay based switching system for 4 essential communication channels was constructed. It consists of microphone preamplifier, power amplifiers, series of relays, a microphone and two speakers; one for master and other for mixer. Microphone preamplifier is used to amplify the audio signals come from the microphone since its signals are often too weak to be transmitted[4]. Power amplifiers or audio amplifiers are electronic amplifiers those amplify low-power audio signals to a level suitable for driving loudspeaker and are the final stage in a typical audio playback chain[5]. For microphone preamplifier, a 741 op-amp and LM 1456 were used and for power amplifiers LM 380 ICs were used. For the conversion of audio signal into current and vise versa, 600 ohms audio transformers were used. Also eight 4 pole double throw relays were used, a pair for representation of each channel with a common ground. A relay consists of a coil, armature and two contacts which one contact is normally open and other is normally closed. In a 4 pole double throw relay there are 4 sets of contacts pair. The microphone preamplifier and also the power amplifiers for master and mixer were connected to each channel. Channel switching was done by using a selector switch which its common pin was connected to +24V. PTT technique was used in the system to talk on half duplex communication lines. Channel indicator LEDs were there to indicate which channel is selected at the moment. From the block diagram in Fig.1, the whole design is described.

To drive relays, 24V supply is needed but to drive some ICs and to activate some parts of the circuit 12V supply and 6V supply are needed respectively. For that I used 7812 regulator and 7806 regulator. The common circuit diagram for them is shown in Fig.2.

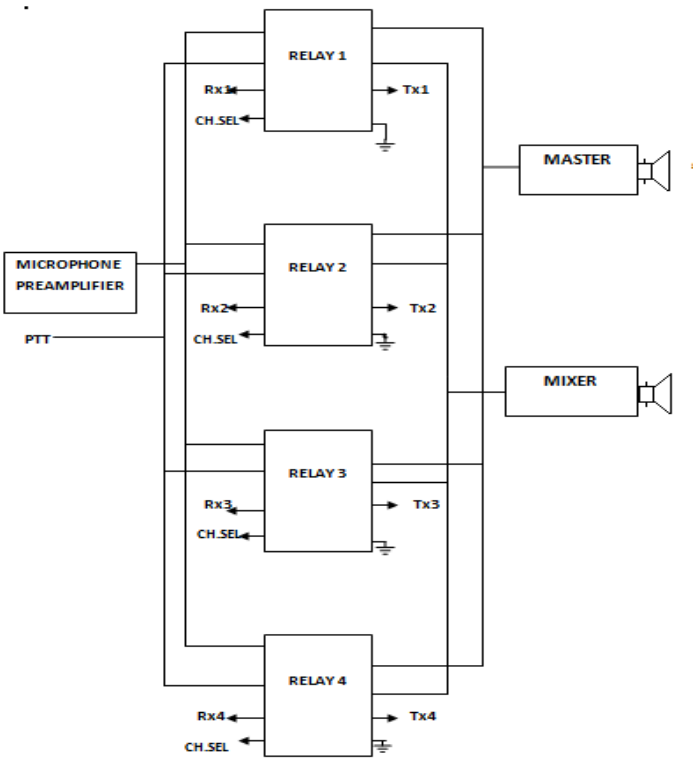

Figure.1: Block diagram of the designed system

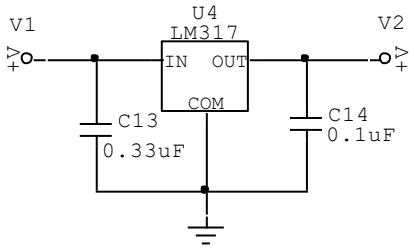

Figure 2: Voltage regulator circuit diagram

For generating of 12V, 7812 regulator is used for U4 and for V1 end 24V supply was connected. Then from V2 end I got 12V output. For generating of 6V, 7806 regulator is used as U4 and 12V for V1 end was connected and from V2 end I got 6V supply as wished.

3.0 RESULTS AND DISCUSSION

When the system is powered with 24V, the whole circuit is powered except relays and audio signals come from all receivers is heard through the mixer speaker. When one channel is selected by rotating the selector switch to necessary position, the relays pair relevant to that channel is powered and all lines of that relay are activated and able to communicate with the transmitters & receivers, connected to that channel. When relevant

relays pair is activated, relay armatures touch Normally Open head from Normally Closed head. Then the voice signals coming from the receiver which is connected to that relays pair was heard through the MASTER speaker. To transmit voice signals we have to push the PTT button and then we can talk to the microphone. Then that voice signals transmit through the transmitter which is connected to that channel.

The existing VCCS provides communication facilities for about 50 external communication channels at the same time. Also it provides external telephone facilities. In this design It is accommodated only for four communication channels and do not provide telephone facilities. Other thing is the existing system is more reliable and accurate than this design. It has designed by Park Air Systems according to recommendations of the (International Civil Aviation Organization) ICAO. And it is a flexible system with many additional features such as enabling changes in Scenarios to be controlled manually, automatically at a set time, or under control of the airspace management system and roles and scenarios can be created and modified while the system is operational. But according to company's necessity this system is made with basic electronics and it can be used as a successful backup whenever AASL needs it in a twinkle.

4.0 CONCLUSION

Since air-ground communication is essential in the Air Traffic Control. AASL depends on an old Voice Communication Control System (VCCS) and exists no backup system. We attempted to develop a low-cost VCCS that can be used as backup system for the existing expensive, old VCCS. The proposed system can connect any four transmitters and their receivers which they mostly needed. It is totally independent of the existing system and easy to handle. The maintaining cost of the new system is very low compared to the old system. Moreover, the new system is simple and need no expert knowledge to use maintain and repair it.

ACKNOWLEDGEMENT

I offer my heartily gratitude to all who have helped in numerous ways to make this study a success.

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Department of Electronics - Wayamba University of Sri Lanka

PORTABLE, MULTITASK, SUBSCRIBER LINE TEST BOARD FOR PUBLIC SWITCHING TELEPHONE NETWORK

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ABSTRACT

Sri Lanka Telecom is the largest telecommunication service provider in Sri Lanka. The company provides the variety of domestic and corporate services to the customer. Customer caring, trustworthy, innovative, responsive, team work, excellence and results driven are the SLT values. Line testing is the main duty in test room and this is the way to provide the SLT values to the customer. Line test board is basically used in line fault detection. In here, the voltage source is connected in series with the local loop and voltage drop across the loop is checked using a voltmeter. Although this is quite an old and bulky equipment, still it is used in SLT Main Distribution Frame (MDF) and it has a very complex circuit arrangement. The other disadvantage of using this equipment is time consuming. Therefore this test board cannot be used for Multi-Service Access Node (MSAN), Distribution Point (DP) and Cabinet. Because it is a bulky equipment and operating voltage is 230 Vac. By considering these problems portable, multitask, subscriber line test board was designed and it can be used for any of MSAN, DP, Cabinet or MDF and also it is a user friendly equipment.

Keywords: *MDF, Line testing, DP, Cabinet, MSAN*

1.0 INTRODUCTION

The Main Distribution Frame (MDF) provides the main point of cross connection between the OSP (Outside Plant Network) cable pairs and the exchange. It provides a great flexibility over the line testing functions as well as electrical protection. This is normally a rack of tag blocks, which is used for line termination. Total of the cable can be categorized as primary and secondary. The primary cable is drawn from cabinet to MDF while the secondary cable is going from cabinet to customers.

Tip (leg A) and Ring (leg B) are the two wire of a telephone line. These wires started from MDF and passes through the Man Hole (MH), Cabinet, Hand Hole (HH), DP, Station protector and Rosette to the telephone line. In this path sometimes wires passes through the underground (UG) or overhead. Therefore many faults can be occurred due to this path and line test board is used to identify these faults. The commonly found faults on telephone lines are earth fault, short fault, disconnection fault, contact faults and current online[1].

The telephone company maintains large battery systems that supply dc line voltage for the operation of analog telephone service at customer locations. The voltage supplied is a compromise between operational needs for reliable service and safety precautions for customers and service personnel.

The length of the line to a customer telephone interface presents a resistance across which the central office voltage experiences a drop and therefore the voltage at the customer site may be vary. The nominal value is 48 V, but the central office common battery is adjusted between 50 and 52 V [2].

Originally, the potentials on the wires are positive with respect to earth (ground). This is called negative ground, since the negative side of the battery is grounded to earth. The Telephone companies discovered that, with positive voltage on the copper wires, copper wires experienced corrosion due to electrolysis. Operating in reverse, positive ground (negative voltage on the wires), the copper is protected from corrosion, this process is called cathodic protection.

During ringing, in place of dc, an ac voltage of 70 to 80 V (at 17 to 25 Hz) is present across the telephone line. When the subscriber lifts the handset, the same is sensed by the telephone exchange and the ringing ac voltage is disconnected and dc is reconnected to the line. Lifting of the handset from the telephone cradle, results in shunting of the lines two wires by low impedance of the telephone instrument. As a result, 48 V dc level drops to about 12 V across the telephone instrument. During conversation, the audio gets superimposed on this dc voltage[3].

2.0 METHODOLOGY

2.1 Telephone line testing

Subscriber line test board was designed by considering the ringing circuit of the telephone internal circuit. A bell and a capacitor were consisted in a ringing circuit.

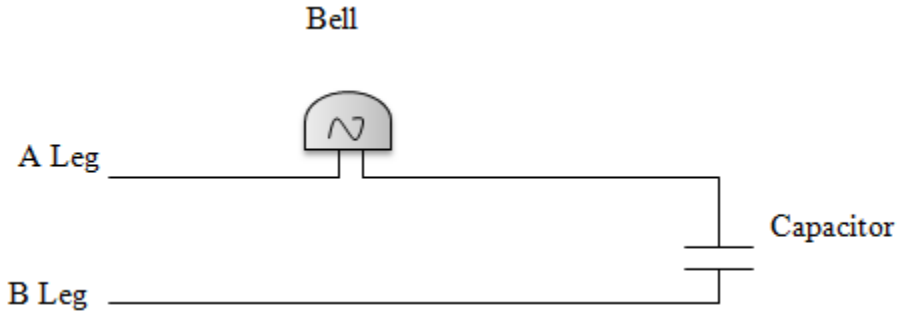

Figure 1: Ringing circuit

The -48 V dc power supplies with current capability of at least 50-60 mA was provided the subscriber telephones line to checked the condition of the line. In here a voltage source was connected in series with the local loop and voltage drop across the loop was checked using a voltmeter.

During ringing, in place of dc, an ac voltage of 70 to 80 V (at 17 to 25 Hz) was presented across the telephone line.

12 V dc battery was used as the supply power to circuit, is an one advantage.

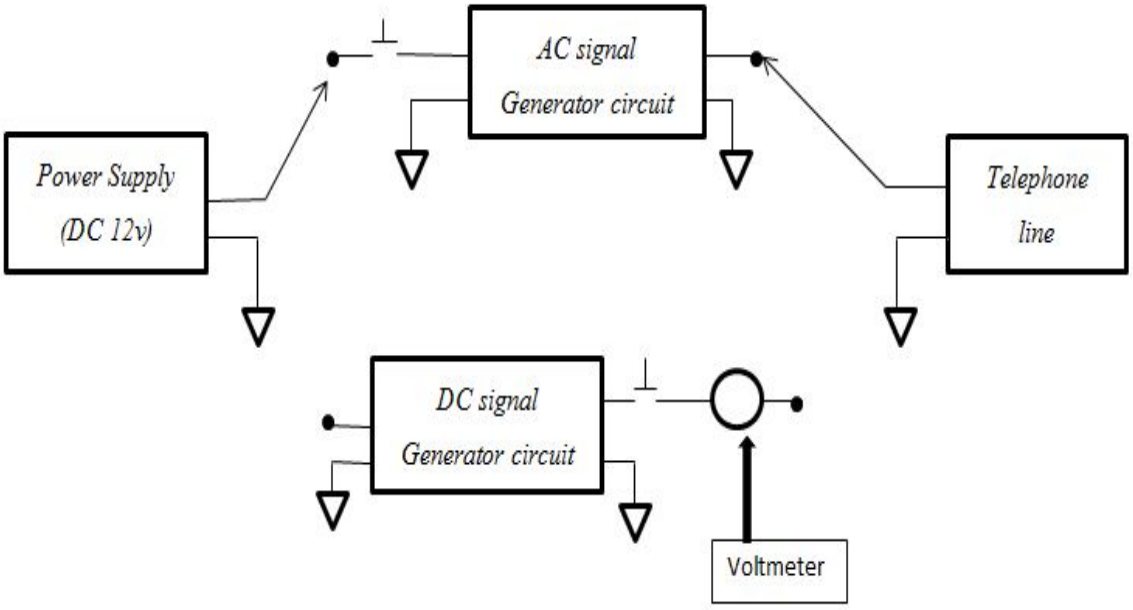

Figure 2: Block diagram of portable test board

3.0. RESULTS ND DISCUSSION

3.1. Results

The set up was arranged as shown in figure 3. This set up was considered as the too far end of the subscriber telephone line the mentioned capacitor was the capacitor of the bell path.

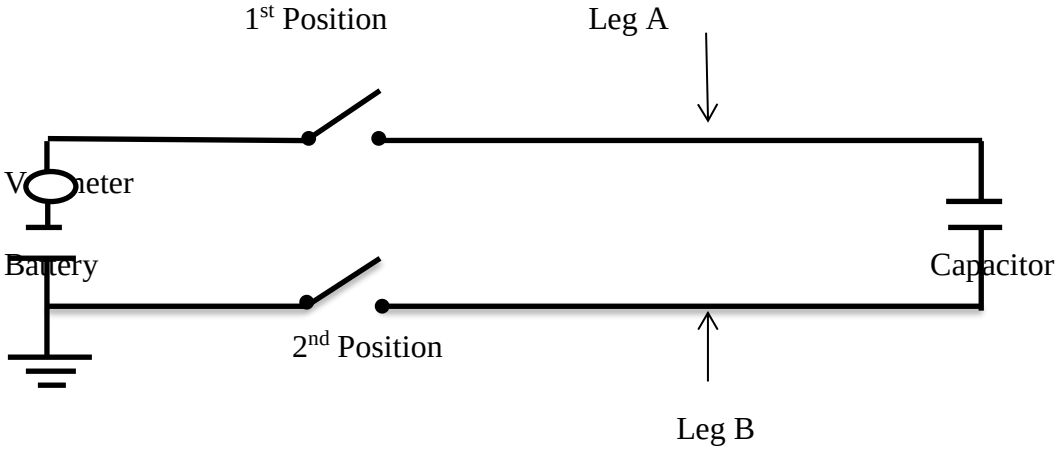

Figure 3: Both legs are open

One leg of the line was connected to the voltmeter (1st position) if the leg had an earth fault, the voltmeter was shown some reading because a path provided the current flows from the battery. If there is no proper earth or disconnecting occurs voltmeter does not show any reading. It was same for leg B as well.

When leg A was connected to 2nd position allowing leg B to be at the 1st position, at this time complete path for the battery will be provided via the condenser. When both legs were in good condition, the voltmeter showed a reading at once and gradually it was become zero, because of the charging of the capacitor.

When the line was short circuited, the voltmeter was shown some constant reading because of the complete path provided for the battery by the short circuit.

3.2. Discussion

Portable multi task subscriber line test board is very important instrument for the Sri Lanka Telecom PLC today. When subscriber line fault occurred, the relevant technical assistant should go to the customer's home and check the telephone. Then come back to the cabinet or MSAN and inform MDF to check the customer line by using current line test board. After identifying the fault, the technical assistant has to repair it. This process takes a lot of time therefore it is a time consuming. This is the disadvantage of the current test board which is using at SLT today

By using portable, multi task line test board the relevant technical assistant can go by step by step. As the first step to recover a fault using portable test board a technical assistant can check the dial tone at DP. If the dial tone is receiving, the fault must have occurred in customers' home side. If not fault is in cabinet or MSAN side. After identifying the path technician can go to the cabinet or MSAN and test the subscribers' line using portable test board which also helps to identify the fault type and identify solution for it. This is advantage of portable test board compared to current line test board

4.0. CONCLUSION

Line test board was used to identify the subscriber line faults for public switching telephone networks. The two types of voltage values were supplied by using the test board to the customer telephone line and their conditions were checked by using the voltmeter. This portable test board was the most important equipment to the Sri Lanka Telecom PLC and it was the law cost, reliable and efficient equipment.

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The authors would like convey their gratitude to the staff of Department of Electronics, Faculty of Applied Sciences, Wayamba University of Sri Lanka.

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Department of Electronics-Wayamba University of Sri Lanka

AUTOMATING VIDEO FEED MONITORING SYSTEM FOR TV BROADCASTING

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ABSTRACT

Uninterrupted Video transmission is a main part of TV broadcasting systems. Most TV broadcasting stations manually monitor the video feed and inform the station if there are any kinds of failure. This paper proposes an effective and low-cost method to automate video monitoring system for TV broadcasting. This system monitors the sync pulse of the composite video signal by using the received off-air signal of a television and if any failure occurs the system warns the relevant technical staff.

Keywords: *Broadcasting, Sync pulse, Phono Jack, Monitoring*

1.0 INTRODUCTION

Independent Television Network (ITN) was the first TV channel in Sri Lanka. It has wide coverage around the country because they broadcast ITN from seven transmitting stations. The transmission section staff should monitor the transmission and if any failure occurs they should setup it as soon as possible. Otherwise it will negatively affect the commercial goals of the company. Therefore the transmission section should fully concentrate on monitoring the video feed of broadcasting transmitters. Here we have designed automating video feed monitoring system for TV broadcasting for transmission sections at a TV channel to monitor the broadcasting video feed.

The reason for this research is currently they do not have any system to detect the video feed automatically. They monitor the transmission with a normal television by receiving signals from a normal off-air antenna and they have to always keep eye on the TV channel to identify failures.

This confirmation of broadcasting feed should monitor at the final receiving point. That means this should monitor by receiving off-air signal using a television. So it is needed an automatic system for the broadcasting feed monitoring and an indication for failures. Then it is more effective and the staff can easily identify if any failures by the indication of the system rather than keep eye on TV as at time it occurs. By considering these we implemented Automating video feed monitoring system for TV broadcasting.

2.0 EXPERIMENTAL

Here the confirmation of broadcasting feed should monitor at the final receiving point. That means this should monitor at the off-air receiving point. This system monitors the sync pulse of the composite video signal by using the received off-air signal of a television. By using a Phono Jack can get the TV composite video output and that would be the input to the circuit[1]. The block diagram of the proposed system is shown in Figure 1.

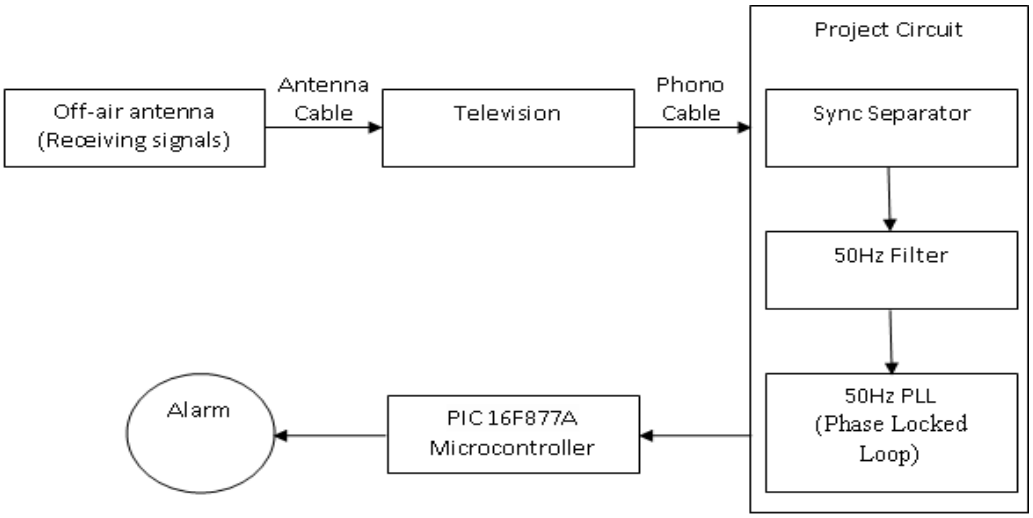

Figure 1: Block diagram of the Automating Video Feed Monitoring System for TV Broadcasting

The process of the broadcasting feed identification is done through the project circuit. The key point for the identification is the sync pulse of composite video signal. When presence the feed can detect the composite signal sync pulse and also when fail the TV does not out a composite signal. So the sync is the key to identify the broadcasting feed[2, 3].

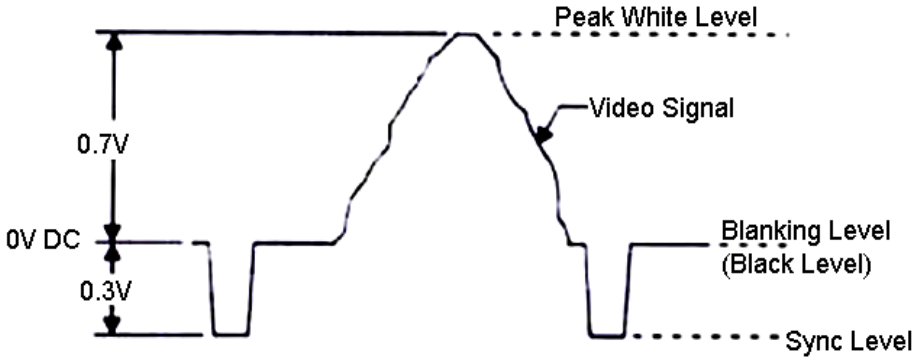

Figure 2: Composite Video Signal with the Sync Pulse

After giving the input to the circuit through the phono cable the first step is to sync separation. It is done by using an LM311 voltage comparator. The second step is 50 Hz filtering circuit (LM3900) and the final step is Phase-Locked Loop (PLL) circuit. The output of the filter is then passed along to an LM567 PLL tone decoder tuned to the vertical sync rate (50 Hz) of the video signal. In the circuit microcontroller gets input from the LM 567 PLL tone decoder [4,5]. From PLL outs logic High(1)when detecting composite video signal and logic Low (0) when distorted the input signal. Microcontroller identifies the status and gives an alarm when detects distorted input signal[6].

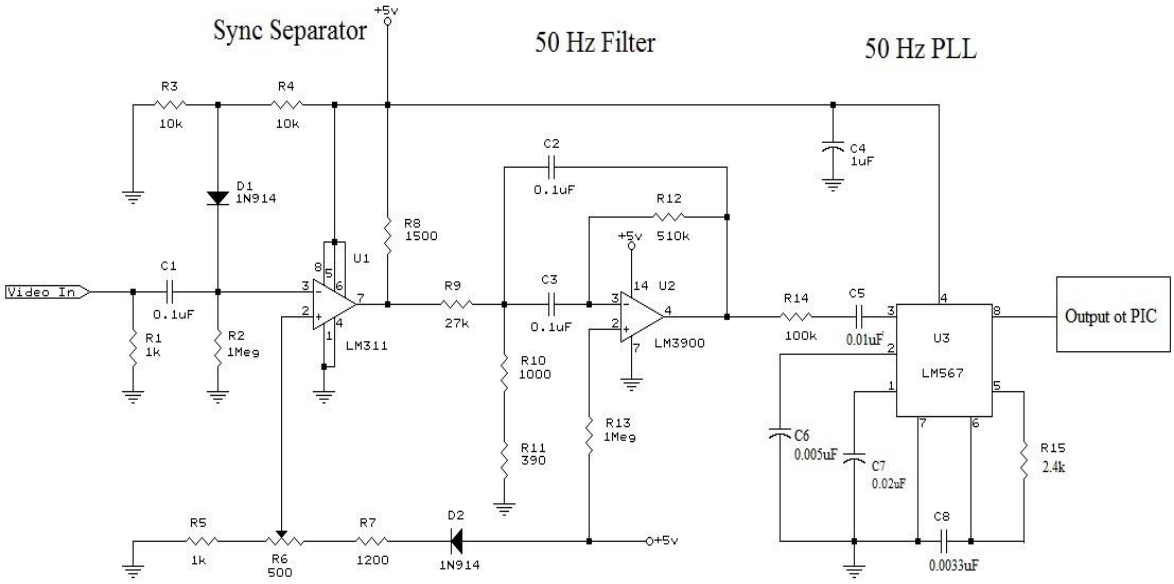

Figure 3: Circuit Diagram

3.0 RESULTS AND DISCUSSION

Rather than watching at the television for the monitoring purpose, the final outcome of this research is an automatic broadcasting video feed monitoring and failures indication system. Then it is more effective and the staff can easily identify if any failures by the indication rather than keep eye on TV as at time it occurs without any delay. This system contributes lot of advantages to TV channels and all the transmission station staffs. By using this can easily monitor the broadcasting feed and minimize the failures identification delay. Also can accurately identify the failures and it is easy to install at the present monitoring points within a low budget.

Currently the system monitors only the video feed and when the system identifies any failure gives an alarm to notice that. This system can be extended to monitor the audio feed as well. Instead of a warning alarm signal, an SMS can be sent to relevant technical staff to address the issue.

4.0 CONCLUSION

This study attempted to automate video feed monitoring system for TV broadcasting. This system is very useful for any TV broadcasting station and transmitting stations around country to automatically monitor particular broadcasting feed. The system effectively identifies any failure when it occurs in the transmission and warns the relevant technical staff to eliminate the problem. Since the system minimizes the fails identification delay which favorably affects the commercial goals of the company.

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SEVER ROOM TEMPERATURE DETECTING AND ALERTING SYSTEM

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ABSTRACT

Temperature controlling or Temperature detecting systems were used in many technical environments. Designing a system which include temperature detecting and also an alerting system with extended features in a single design was identified as a new approach of interconnecting several systems. In some special working environments it requires to maintain a constant amount of temperature, pressure or humidity inside particular working environment regardless of geographical area or whether conditions for the safety of the equipment and tools used in particular work. This type of a developed system not only can applicable with an alerting system but also with a controlling system which will guide the environment turn back to the required state. The knowledge of micro controller based systems serial communication systems, Thermo sensors, data transmitting techniques were used in this system. Mobile communication strategies were used for data transmission. The system consists of several electronic and programming applications and strategies which were merged together in the purpose of proving a perfect solution for the research. The system consists of 16X2 LCD display as the Interface, Alarm light notification facility via Global System for Mobile Communications (GSM) module. Additionally this system can be developed by adding a controlling unit which can control the temperature itself. The knowledge of fuzzy logic in Artificial intelligence can be adopted as extended development theory for this kind of fully automated system. This system was identified as an approachable low cost device which is also the most suitable practical solution for the sever room at Sri Lanka Customs Information and Communication Directorate.

Keywords: *Temperature detecting, Data acquisition system, Thermo Sensor*

1.0 INTRODUCTION

Most working environments in technical world require maintaining the quality of the workshop or office according to the international standards and also some system tools and equipment requires to be used in the specific environment. This design was identified as a major requirement of Sri Lanka Customs Information and communication directorate. Although this design was developed according to their requirements, it can also be applied in any other environment which requires the same functionality in different ranges. The temperature range which can be measured by the sensors changes from sensor to sensor. Therefore referring to the temperature range the sensor was selected. The required temperature range for the sever room was identified as 17-19^{0}C but any value below 17^{0}C were also allowed because with heat generated by severs practically never allows the environment to drop temperature less than 17^{0}C and also lower temperature causes no harm to servers. During cooling system failure sever room temperature increases rapidly therefore the alarming system was designed to be fast and accurate. Temperature measuring system are more common in the office and residential environments but this system was designed to not only to measure the temperature but also to display the temperature itself, alarm and send a notification to the responsible person to reset the system.

1.1 Literature

The existing related studies and experiments were studied not only to identify the most suitable method but also to gain knowledge for identifying the best practical solution for the research problem. The study of LM35[1] temperature sensor with PIC16f877A[2], PIC 16F876A based Temperature (DS1620) / Humidity (HS15p) Display (Hitachi LCD)[3]were done to identify the applicability of thermo sensor. Inapplicability of the sensors was the major drawback of existing concepts.

The concept of Mobile communication strategies were also referred along with several implementations. AT commands in serial communication systems were used along with GSM modules or without GSM modules. Most of those applications were designed to work with and communicate with the computer HyperTerminal.

The study of fuzzy logic in Artificial Intelligence[4] was also referred in some research basic projects. Though it was only suggested as a further development, several systems were identified as applicable with this system concepts which can be used with few modifications.

2.0 METHODOLOGY

The device is a microprocessor based system. The microcontroller was used for all the data manipulations such as identifying the temperature, controlling the data transmission module and displaying purposes. Relevant components were used to stabilize the system power at the required input value. Thermo sensor DS18B20[5] was used to detect the temperature in the environment. For the programming, a requirement of the microcontroller 16F877A; mikroC[6] was used while AT commands were used for configuring the GSM module. A LCD display was used for displaying purposes while a GSM module was used to transmit data to the alerting station. Following block diagram expands the content of the above mention system.

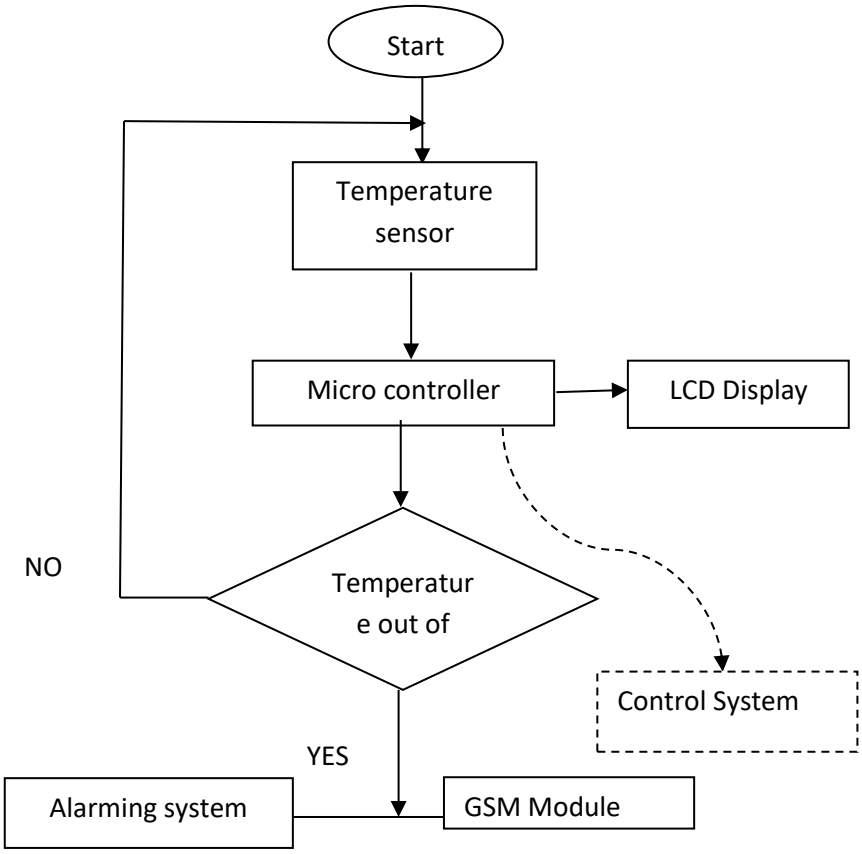

Figure Error! No text of specified style in document.**.1:** Block diagram of the system

Selecting a suitable temperature sensor was the most significant part of this process the active range of the sensor and accuracy were considered to select the sensor.DS18B20 was identified as the suitable sensor which has measuring temperature range of -55^0C to $+125^0$C and also has an a accuracy of ±0.5°C from -10°C to +85°C which also has a unique one port pin for communication which converts temperature to 12-Bit Digital word 750ms (Max)[1].When it comes to the programming LM35 consumes less memory than DS18B20 but LM35 requires to touch the surface to read the correct temperature while DS18B20 can read the environment temperature.

The microcontroller was selected after considering the following major functional capabilities. Should support,

- serial communication
- several I/O ports

And also, wider the opportunities for further developments. The system was divided in to several units in the development process. Each and every unit was designed to have their own troubleshooting and recovering methods.

2.1 Circuits Designing

The following circuit design was developed in order to implement the circuit according to the figure 2.1

Main circuit board was designed including power, sensor, data controlling and handling units. Display unit PCB (Printed Circuit Board) was designed only for the LCD (Liquid Crystal Display).

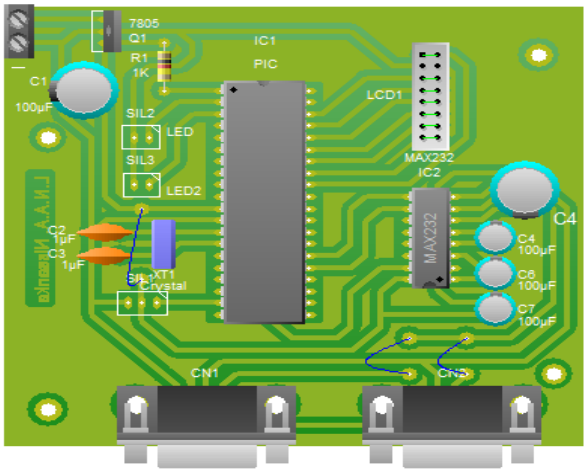

Figure Error! No text of specified style in document.**.2 :** Main circuit design

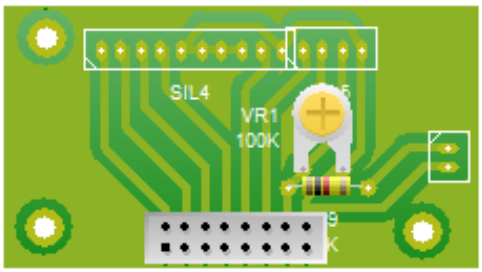

Figure Error! No text of specified style in document..**3 :** Display unit

3.0 RESULTS AND DISCUSSION

The above mentioned system was designed as a solution to overcome the identified problem inside the sever room with an effective and efficient manner within a limited time period and also with a low budget.

Though above mention system seems like it has a basic concept, merge of several concepts has added it a unique way to approach the goal. Further suggested control system adds additional value to the system because it was suggested as a backup system which automatically adjusts according to the requirements. This Artificial Intelligence sections adds upgraded standard to the system.

This research paper also proves that not only the electronic industry requires electronic related knowledge but also other streams interconnect with electronic industry somehow. Therefore the knowledge can be merged and can be used with any field of study.

Though this research was based on a requirement inside Information and Communication Directorate at Sri Lanka Customs author identified that this solution is also applicable with any Industry which requires maintaining a stable temperature in order to have a suitable working environment. As an example Workshops at Sri Lankan Airlines Engineering Division also requires maintaining stable temperature level inside workshops most of these workshops uses a central AC system which makes this case very much similar to the first case.

Also the same concept can be applied for humidity, pressure or any other environmental change with an appropriate sensor.

3.1 Future Developments

A subsystem control system was introduced as shown in fig 2.1as further development concept in this research problem. This system was suggested to work as an auto control unit which works independently in case of increase the temperature inside the server room. It was also suggested to be fully automated and function itself.

Concept of Artificial Intelligence comes along with this suggestion and it requires a study of fuzzy logic[6] to develop controlling unit. Real time clock was also suggested to apply into the system which will conform the time at each temperature regardless of time taken to deliver the message.

4.0 CONCLUSION

The study and the implantation which was included in this paper was an attempt to fulfill one of many real time system requirements exists in the electronic related industry and it also proves that the knowledge of computer studies also can be merge along with many electronics products as well as electronics can be used in any type of an industry as long those industries adopt and moves along with latest technologies.

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REMOTE CONTROLLING STREET LIGHT SYSTEM AND INFORMATIONS DISPLAY ON LCD VIA SMS WITH THE USE OF MICROCONTROLLER BASED AUTOMATION

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ABSTRACT

Remote controlling is a concept which uses to control devices in remote area. That minimizes the time wasting and power consumption instead of manually controlling. In this research study a remote controlling system is implemented with GSM modem for controlling via SMS. This system can be controlled with the case of 'SIM' card and any mobile phone. Main objective was focused on controlling street lights via SMS. Considering main process of this system, wherever a SMS is sent to the GSM modem, the received SMS is taken by the controller panel which consists of a advanced version of PIC microcontroller. After analyzing the SMS the system will take the required actions according to the command given by the SMS. According to user requirements the switches can be controlled by the controller circuit which set the time to automatically ON and OFF lights in everyday usage. Also the constructed prototype system was included with digital clock on LCD that can be remotely controlled by the user. The novel system has data backup plane when main power is cut off. Even power is going fail system will keep the data safely while properly controlling the switches when controller circuit get main power again. With further this system is implemented as a solution to remote controlling and self-adjacent system with reliability.

Keywords: *Remote controlling via SMS, GSM modem.*

1.0 INTRODUCTION

Effective and efficient techniques and devices are needed to make the acumen based controlling routing done works automated. Therefore remote controlling topic has been one of the most important and valuable concept in present day world. Different techniques are used to control the devices placed in remote areas of Sri Lanka.

Wi-Fi, Bluetooth, Infrared, Radio Frequency waves and web applications are used to online station monitory and controlling devices remotely. Expensive and prototype simulators devices are needed to established the system when use Wi-Fi, web application,

Radio Frequencies etc. Nevertheless the distance is limited when using Bluetooth, Infrared technologies for communication using these types of systems.

In this research study has focused on to implement another technique to control street lights system remotely. Therefore controlling switching system using SMS is studied in this research. Power circuit can be controlled remotely using SMS command by power circuit switchers which controlled by the controller circuit. Task can be specified in the system using SMS command. Comparing with other techniques SMS is a better to access devices remotely.

2.0 THE METHODOLOGY

2.1 Major components used in the System and contribution.

In this remote controlling system use GSM modem, microcontroller, Optoisolator Traic driver IC, a Traic, RTC IC and LCD as major components to build the system. PIC and GSM modem data transmission was done in serial communication using RS232 protocol. Pin connection of RX, TX between them should be connected as the connection between DCE & DTE. Pin number 7, 8 and pin number 1, 4, 6 should be connect in short[6]. Then enough current should be supplied to the controller circuit. Power circuit switchers were connected with PORTD of the PIC. MOC3041 and BT10 Traic IC are used in the power circuit switchers to control the power circuit like street light system, motors , and any other electrical and electronic devices. The system is implemented with unique features of digital clock display on LCD which also can be controlled by the SMS commands. PORTB was connected with LCD which displays the digital clock[1,3,4]. Data is communicated in between RTC IC and PIC through I2C protocol. System has data backup plane in the case of main power cut off. Even if the power is going fail the constructed system will keep the data safely and properly controlling wireless the switches when controller circuit get main power again. Data backup plane was placed with RTC to store data safely and for longer backup plane even 50 years if the power failure. Alarm system also was implemented in the system. Alarm details about the lights store in PIC EEPROM. Therefore Switches can be automatically ON and OFF on user predefine time by the controller circuit with a PIC microcontroller.

2.2 Methodology and Operation of the system

The signaling SMS was received by the GSM modem which placed at the controller circuit. Command should be properly typed SMS transmission module in the sending SMS. Else received SMS will be neglected by the controller circuit. Further, the received SMS was analyzed by the controller circuit to identify the command. According to specified task of the command will be done by the controller circuit. Major tasks of the system are ON and OFF the switches, set alarm to automatically ON and OFF the lights at predefined time, remotely setting date or time on the LCD. One of them can be a specified task which included in a command as use requirement. The signal from controller circuit is received on the power circuit switcher control the power circuit. In other words lights will be controlled using power circuit switchers controlling circuit according to the task specified in a command. Then the LCD set new date or time that mention in the received SMS.

3.0. RESULTS AND DISCUSSION

There was a five specified tasks in the proposed System operation this section interpret results according to the specified commands.

Command to set bulb ON is %SOL%. Percentage marks and letters should be typed. 'O' is indicate to controller circuit to set the light ON .Bulb was ON when send this command to the GSM modem.

Command to set bulb OFF is %SFL%. Percentage marks and letters should be typed. 'F' is indicate to controller circuit to set the light OFF. Bulb was OFF when send this command to the GSM modem.

Command to set the bulb automatically ON and OFF is %SAD%093000A093200A. First six digits and letter 'A' describes the time to 'ON' lights on every day. Last six digits and letter 'A' describes the time to 'OFF' lights on every day. This six digits are allocated to indicates the ON and OFF time as follows.

- First two digits for hour
- Second two digits for minutes
- Last two digits for seconds
- Letter 'A' for AM
- Letter 'P' for PM

Percentage marks and letters should be typed. According to the command used here bulb is ON when time is 09.30 am. Also the bulb will be OFF when the time will arrive at 09.32 am.

Command to set the date on LCD is %SDD%140211. First two digits for the year, second two digits for month and the last two digits indicate the date. Date was set as 2014:02:11 on LCD inform the sending command to the GSM modem.

Command to set the time on LCD is %STD%093000A. First two digits for the hour, second two digits for minutes and the last two digits indicate seconds. Last letter 'A' indicate the 'AM' and if it is a 'P' that indicate the 'PM'. Time was set as 09:30:00 am on LCD sending command to the GSM modem.

4.0 CONCLUSION

The proposed system is the system to control remote area than currently used other systems. User is benefited with more features than other remote system and easier to use with their own mobile phone. This system can be implemented not only in remote area but also can be used to full fill user requirements such as Home lights control, at Company electrical devices control systems etc. System can be further developed considering user requirements within the two sections (as hardware and software).

ACKNOWLEDGEMENT

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Department of Electronics-Wayamba University of Sri Lanka

AUTOMATIC SWITCHING SYSTEM FOR GENERATOR AND BATTERY BANK

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ABSTRACT

The Bastation Transceiver Station (BTS) [1, 2] and the related machines at Rideegama station of Sri Lanka Telecom have no power supply by the grid. Therefore a generator (Generator model is DenyoDA-6000SS) is used to power up the station. However, the generator cannot run 24 hours continuously. It needs to switch to battery bank and after two hours switch back to the generator for an electronic microcontroller based Automatic Switching system was developed for the purpose. Additionally, a monitoring system was included for Generator alarms and switching mechanism of the designed system. . But for power problem "Solar power" is good alternative solution for the existing system. The average solar irradiance to the Kurunagala region is 5.69kWh/m^2. This value is much hire when comparing with European countries. This solar power concept is popular due to the green energy concept. The initial coast of solar is high. But with profit it is not negotiable.

Keywords: *Switching, Bastation Transceiver Station (BTS), microcontroller*

1.0 INTRODUCTION

Sri Lanka Telecom Plc, OPMC Kurunegala serves thirty two BTS towers and the Redigama BTS is situated on a mountaintop. To reach the tower jungle areas have to be passed.

The Rideegama BTS power generator can only work for four hours continuously with its present conditions. After four hour running time it shuts down for two hours for cooling process. During this time station is running with 48V battery bank placed in the site. The switching process and is done manually a hired labor our. The Rideegama generator and Battery bank face technical faults daily because of labor our lack of knowledge about mechanical and electrical works. Therefore a system that switched automatically, monitor the switching process and alarms of the generator need to be developed. The developed switching panel and the alarm monitoring system will reduce the technical problems that occur through miss use the generator and battery bank.

2.0 EXPERIMENTAL

The switching System was developed as two units. One unit for controlling and the other one as a sensor to generate alarms and general readings. The main controller uses AVR Atmega32 microcontroller[3]. The sensor is based on Opto-coupler devices. It is to protect the main system from additional currents. The designed systems block diagram is shown bellow.

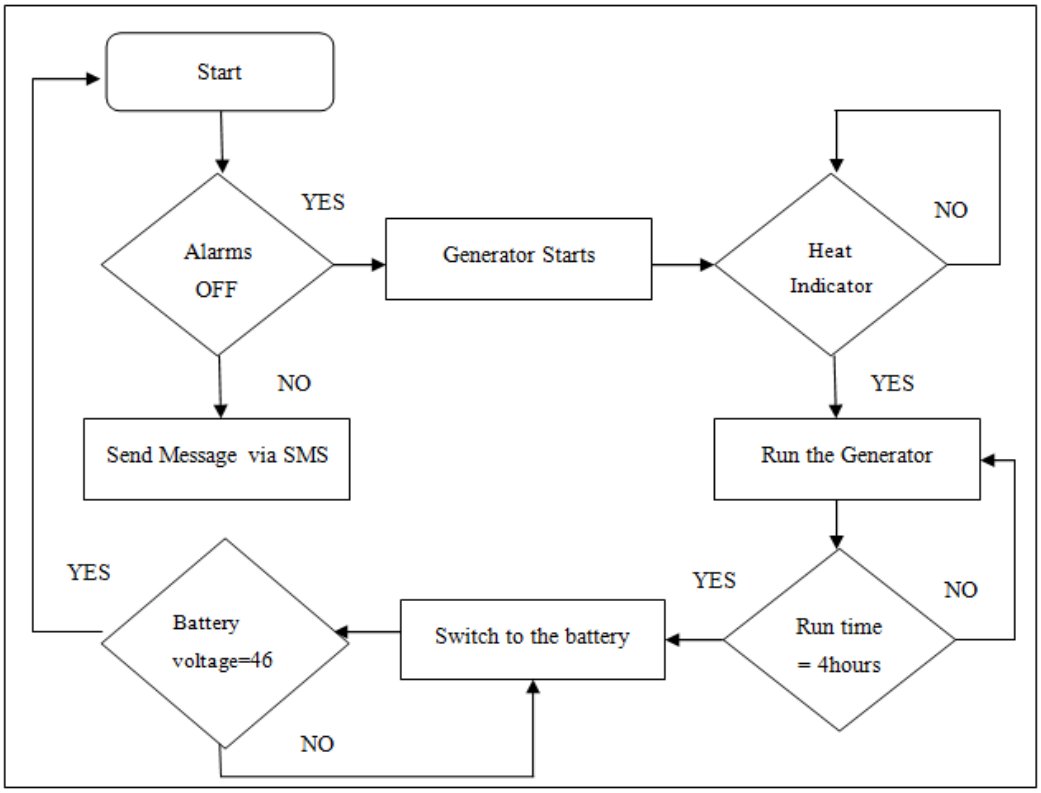

Figure 1: Functional block diagram of the designed switching system

The designed system circuit design includes two units as showed in figure 2 and 3 respetively.

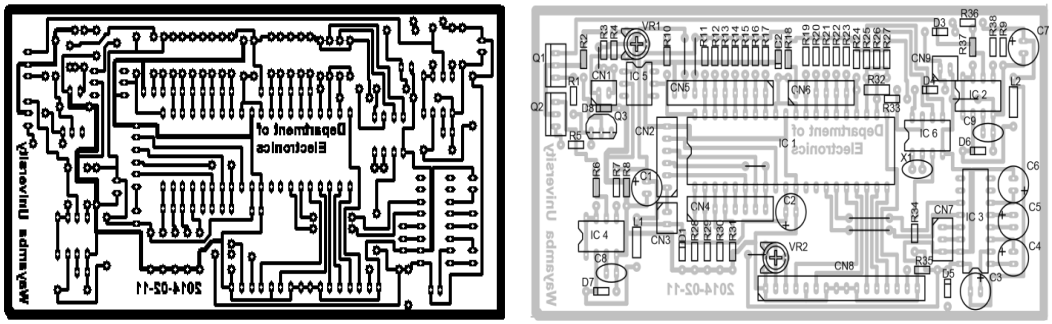

Figure 2: Developed Control panel circuit diagram of the system

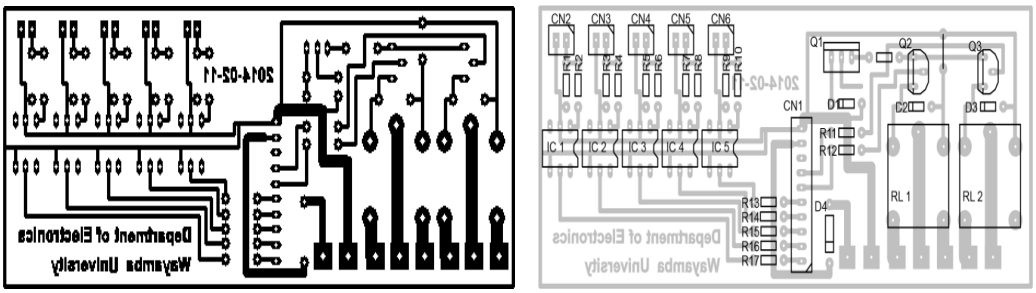

Figure 3: Developed sensor panel circuit diagram of the system

3.0 RESULTS AND DISCUSSION

The major result of this project is Automatic Switching Process without human effort. Generator works for four hours and then it switches to the battery bank placed in Rideegama Sri Lanka Telecom BTS. Site is working till battery power gets reduced to 46V. Then its sending message to start the generator and site is going to work from generator power. Other resulting are authorized officer received daily switching details such as generator on tome and off time and whether any alarm was indicates in the generator system sent a message to the authorized officer.

The objective of the project was to control switching between the generator and the battery bank. This solution was developed for the current system. But for a site running only with fuel (diesel) this is not a matured solution. Figure 4 and 5 shows the developed circuit diagrams with real components.

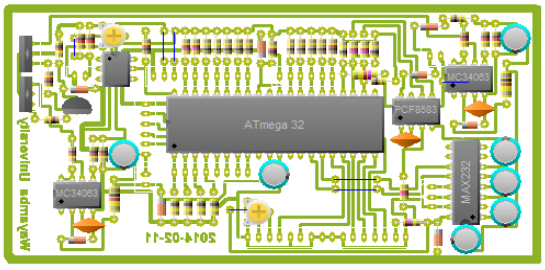

Figure 4: The Circuit diagram of Control panel

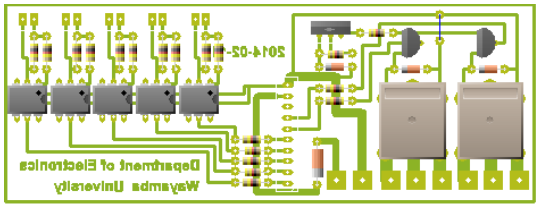

Figure 5: The circuit diagram of sensor panel

4.0. CONCLUSION

In this project final output is electronic microcontroller based advance automatic switching system for the generator and battery bank. With this solution existing systems can run accurately and system down time can be minimized. Also solar power is good alternative solution for the existing system to

ACKNOWLEDGEMENT

Authors wish to extend their gratitude for the assistance given by Department of Electronics, Wayamaba University of Sri Lanka and Sri Lanka Telecom PLC, Kurunagala.

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Department of Electronics – Wayamba University of Sri Lanka

SECURITY SYSTEM FOR PROTECTING EXPENSIVE COPPER CABLES FROM ROBBERS AT ISOLATED TELECOMMUNICATION TOWERS

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ABSTRACT

Telecommunication industry of Sri Lanka contributes significantly towards the development of the country as one of the most demanding and fastest growing industry while playing an important role in everyone's life. In telecommunication, Towers and Base Transceiver Stations (BTS) can be identified as vital components which facilitate wireless communication between user equipment and a network. As a rapidly developing technology, the most significant problem faced by the wireless telecommunication is the theft of expensive copper cable and copper tapes which are widely utilized as earthings and protection method for lightning. Some of the major reasons behind this stealing problem are the unavailability of a well-equipped and effective security system especially in the isolated towers in rural areas and the expensiveness of copper. All the service providers experience this problem and it affects their financial condition, quality of the service, security expenditure and so on. Therefore we have identified the above problem during the industrial training and therefore more convenient security system was designed by considering several systems which is capable to aware the responsible persons whenever the copper tape is cut down.

Keywords: *Telecommunication towers, Piezo sensor, Atmel Microcontrollers, The Vibration based Copper wire cutting sensing circuit.*

1.0 INTRODUCTION

1.1 Piezo Sensor

The LDT0-028K is a flexible component comprising a 28 μm thick piezoelectric PVDF Polymer film with screen-printed Ag-ink electrodes, laminated to a 0.125 mm polyester substrate, and fitted with two crimped contacts.

As the Piezo film is displaced from the mechanical neutral axis, bending creates very high strain within the piezo polymer and therefore high voltages are generated. When the assembly is deflected by direct contact, the device acts as a flexible "switch", and the

generated output is sufficient to trigger MOSFET or CMOS stages directly. If the assembly is supported by its contacts and left to vibrate "in free space" (with the inertia of the clamped/free beam creating bending stress), the device will behave as an accelerometer or vibration sensor [1, 2].

1.2 Arduino Board

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing) [3]. An Arduino board consists of an Atmel 8-bit AVR microcontroller with complementary components to facilitate programming and incorporation into other circuits. An important aspect of the Arduino is the standard way that connectors are exposed, allowing the CPU board to be connected to a variety of interchangeable add-on modules known as shields. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer[4.]

All the above facts contributed for the development of the proposed new vibration sensor based Copper Wire cutting sensing device. Although many other techniques such as "Earthing Ring and potential divider" technique based new method had used as Trial and error technique in order to develop the convenient cupper wire cutting sensor without acknowledging the robbers.

2.0 EXPERIMENTAL

For the implementation of this system a Piezo sensor was used, as the system should be accurate and cost effective. After analyzing the requirements, the sensor circuit was designed by using an Arduino board to give an output via a LED, to indicate the vibration which is detected by the vibration sensor. Next determined how and where to place the circuit and after that decided to give the output to the alarm panel in the BTS.

3.0 RESULTS AND DISCUSSION

As a result of this proposed new sensing device, the problem of stealing the Copper cables and tapes in Telecommunication towers can be prevented into some extent. After

implementing this system on the copper tapes in towers, the service providers will be able to identify when a copper tape is cut down and hence they can react soon.

This project will contributes for gaining profit for the communication sector mainly by saving the money that they are spending for the down conductors and the copper cables (Earth cables) due to such robberies. By this, the organizations will have an effective and accurate system to protect copper and definitely it will provide a better solution for the existing major problem.

4.0 CONCLUSION

During the training period we have identified the expensive copper cable cutting problem in the isolated telecommunication towers as one of the major problems faced by the telecommunication sector. Therefore, we have designed the proposed security system to protect the copper cables/tapes used as down conductors and earth cables from robbers. Also, the technique is implemented in a mini prototype environment. With further development, this system can be applied in isolated towers since the robbers tend to rob the copper tapes in those towers. This design will be giving the necessary alarms to the operations crew at a distance controlling station. Hence, they will be able to react soon in case of robbers on the site.

ACKNOWLEDGEMENT

We would like to thank Mr. Dimuthu Hippola, Engineer Ampara Division and Mr. A. M. Kamis Senior Technical Officer in Mobitel (Pvt) LtdAmpara Region for the valuable support and knowledge given to complete this research a success.

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Department of Electronics – Wayamba University of Sri Lanka

MODEL TRAFFIC CONTROLLING SYSTEM TO FACILITATE ON-ROAD WORK SITES

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ABSTRACT

Traffic control is an outdoors occupation, night or day for long hours in all weathers, and is considered a dangerous occupation due to the high risks. The system proposed to be developed, controls the traffic in road work sites without people attending to it every time. By using the model automated traffic control system, the disadvantages of STOP/GO process can be eliminated.

Key words: *Traffic Control, IR sensor*

1.0 INTRODUCTION

Today's roads are full of fast, heavy traffic. Traffic control is an outdoors occupation, night or day for long hours in all weathers, and is considered a dangerous occupation due to the high risk of being struck by passing vehicles. Drivers have to keep a constant look-out for changing road conditions. Particular attention should be paid to the needs of blind and disabled people, children, elderly people and people with prams. The legislation requires an undertaker, and those working on its behalf, carry out work in a safe manner as regards the signing, lighting and guarding of works. Failure to comply with this requirement is an criminal offence.

In the past a traffic control flagger was a person whose job was to maintain safe conditions on the road when unusual conditions exist on a roadway. The traffic control flagger alerts vehicles of the appropriate action to be taken using standardized symbols and gestures, keeping both motorists and people working on the road as safe as possible. Among the many tools that may be used by a traffic control flagger, some of the most important are the signs and gestures used for notifying motorists of conditions ahead[1]. These include signs instructing drivers to go or stop, cones to guide traffic, and hand signals to communicate more vigorously or in lieu of these other measures. At night, these may be supplemented by lighted signs and signal batons. A brightly colored and often reflective uniform is also important for safety, as it helps drivers to see the flagger. Communication

devices such as hand held walkie-talkies are less visible than other tools, but possibly even more important because they allow coordination between flaggers and quick communication when conditions change. In most situations, a traffic control flagger is only used when the conditions changing the road are not permanent. If the condition were permanent and motorists were not in danger, an electronic signal and signs might be used to alert motorists of that change in the roadway. In some countries, machines designed to fulfill the function of a traffic control flagger are used instead of human workers. This is thought to provide road workers with the same degree of safety as a human worker, but with less human error, lower costs, and no dangerous working conditions created by standing in traffic. In order to achieve these, a model traffic controlling system was developed with Arduino mega 2560 board[2].

2.0 EXPERIMENTAL

Arduino Mega 2560 board was used to design the circuit and the IR sensor circuit used to count vehicles in both sides. The signal coming out from the IR sensor was an analogue output. But the research needs digital output. Therefore it is necessary to use analogue to digital converter (LM 324). Programmed the code for this system and also arranged the input by using 4*4 key boards. The output was displayed by 16*2 LCD display.

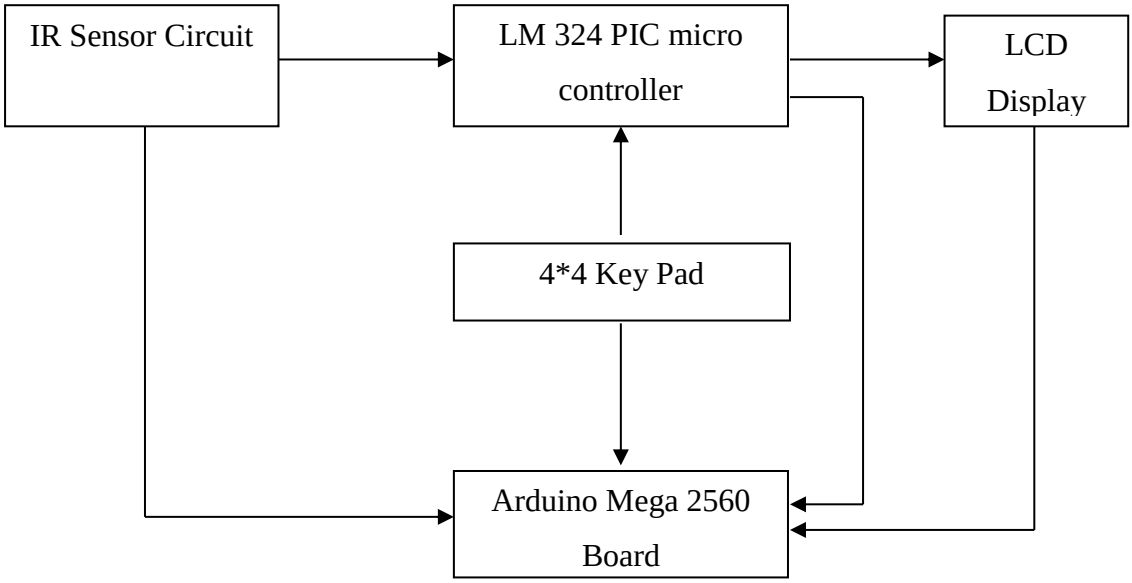

Figure 1: Block Diagram of the System

The IR sensor circuit is used to count vehicles in both sides. The signal coming out from the IR sensor is analogue output. But it needs digital output. Therefore LM 324[3] analogue to digital converter is used.

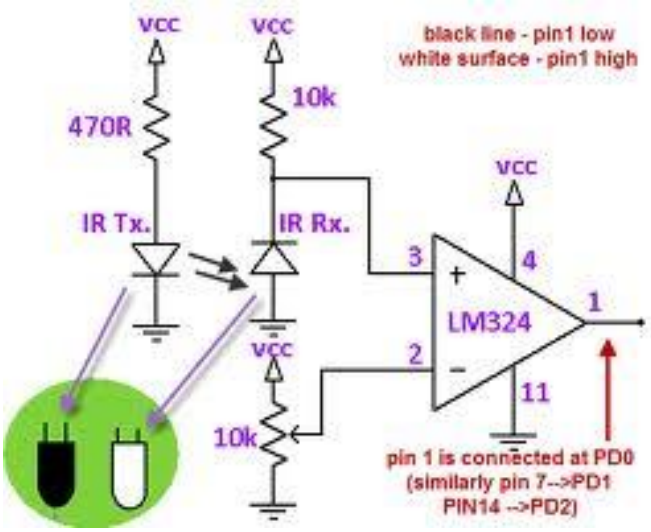

Figure 2: IR Sensor Circuit

Then IR sensors output is to the 38 and 40 pins in the Arduino mega 2560 board and also 22,24,26,28,30,32,34,36 pins are connected to the 4*4 key pad. Four LEDs are connected to 3, 4, 5 and 6 pins such that 3-Red, 4-Green, 5-Red and 6-Green. The LCD display and Arduino board pin connection are given Table (1) below. VEE was preset connection.

Table 1: Arduino and LCD Display Pin Connection

Arduino Board Pin Number	LCD Display Pin Number
8	DB 7
9	DB6
10	DB5
11	DB4
12	EN
13	RS

3.0 RESULTS AND DISCUSSION

At present all vehicle drivers face lots of problems when there is an ongoing road construction. Most of the time two people without proper experience in vehicle traffic controlling will control the vehicle exchanging. This will result in unnecessary traffic. If this can be controlled by an electronic sensing mechanism it allows the construction firm to utilize all the workers to the relevant job. In the designed system the number of vehicles will be detected by IR sensor and will decide to which side it will give the chance and the time for the specific side. Also it will count the number of vehicles which passes through that time and check the vehicle went in the opposite side. It will help to avoid unwanted problems occurring during the controlling. If we have constructed only considering the time then sometimes it will allow other side to go when there are vehicles in other side. This will worsen the case than the manual operation.

In this research IR sensor circuit was used for counting vehicles in both sides. There is an issue when it converted in to the real scenario as it has used an IR sensor for counting the vehicles. In practical situations IR sensors are not suitable for vehicle counting. Because it will count every object which passes in front of the sensor. As the theory of the sensing mechanism is based on reflective of the IR beam it will trigger the signal for all objects. Sometimes it will sense single car as two cars due to the shape of the car. So it would be more accurate if we can use image processing as it will allow us to determine the type of the vehicle. Then it will automatically count the vehicles with its type (for examples it will count and display number of cars, bicycles, Vans)[4].

In the model, IR sensors are used but when practically implementing, appropriate sensors have to be integrated so as to customize the system, according to the requirement. The system can be used at any road work site with that change.

Figure 3: Start up time

Figure 4: Mode selection

Figure 5: No of Vehicles and Direction Select

Figure 6: Manual Mode

Table 2: Manual Mode LED Process Output

	Left	Right
F1	Green on ,Red off	Red on , Green off
F2	Red on , Green off	Red on , Green off
F3	Red on , Green off	Green on ,Red off
F4	Red on , Green off	Red on , Green off

4.0 CONCLUSION

The automated traffic control system can overcome the disadvantages of manual STOP/GO process handled by road workers.

ACKNOWLEDGEMENTS

The authors would like to acknowledge and extend gratitude to the persons who have helped make this research project a success.

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Department of Electronics- Wayamba University of Sri Lanka

LOW COST PORTABLE DIGITAL MEASURING WHEEL FOR TELECOMMUNICATION CONSTRUCTION FIELD

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ABSTRACT

The primary object of this invention is to provide improved measuring device having a ground engaging wheel which has a circumference which is an exact multiple of a measuring unit so that the wheel may be engaged with counter sensor. IR sensor was used as the counter sensor. The IR sensor TX directly in front of the RX, such that almost all the radiation emitted, reaches the RX This creates an invisible line of IR radiation between the IR TX and the RX. The number of circle detected from the IR sensor and to counting number of circle done from the microcontroller. The microcontroller is calculated distance using by their ALU (Arithmetic Logic Unit) and distance send to LCD display. The buzzer indicates the alarm. The Venire caliper should be used to measure the radius of the circle. The 16F887A should be programmed by using MikroC software.

Keywords: *Liquid Crystal Display (LCD), Microcontroller, Transmitter (TX), Receiver (RX), Infrared (IR).*

1.0 INTRODUCTION

Presently construction field rapidly developing in Sri Lanka similarly instrument is should be user friendly. This research relates in general to measuring device, and more specifically to portable digital measuring wheel for rolling along the surface to be measured. In generally many measurements along the ground, it has been customary to utilize tapes, either steel or fabrics, which are awkward to handle, require computation, and necessitates two persons to handle same. Also existing analog wheel meter cannot be used at night. It is readily apparent that there is a need for a measuring device which may be operated by one person and would provide an accurate tabulation of the distance measured[1]. In analog meter reset button not smooth. By considering these drawbacks, an improved digital wheel meter was introduced.

2.0 EXPERIMENTAL

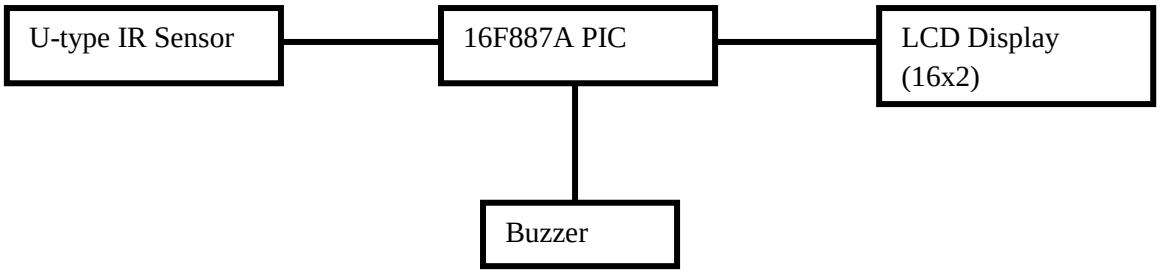

Figure 1: The proposed Digital Wheel meter Block Diagram

The circuit of the project should be connected as above figure. The IR sensor which shows in first box counts the number of rotation. Since the output of the IR sensor is week voltage it should be amplified into logig1 level before send it to PIC. The amplified of IR sensor output should be sent to PIC. The distance was calculated using PIC it was sent according to out of the sensor and to LCD display. The LCD display was connected with microcontroller properly. Then an output distance was showed in units by meter and feet. The alarms were set at 35m one beep and 40m two beeps. Digital Wheel meter was implemented using the circle radius calculation which was done by following equation.

$$Length = 2 \times \pi \times r \times n \quad (01)$$

Where;

π - Constant (22/7)

r – Radius of circle

n – Number of rotation

The designed digital meter measures 50cm (0.5m) when rotates one circle. The radius of designed wheel is 7.9545cm. The Venire caliper should be used to measure the radius. The 16F887A should be programmed by using MikroC software [2].

The meter to feet conversion was done by following equation.

Distance in feet = meter value x 3.280839895 (02)

3.0. RESULTS AND DISCUSSION

The main result of this project was to replace existing analogue measuring meter with electronically developed digital measuring meter cost effectively.

The system was indicated the relevant distance with the help of an alarm. The distance was shown by meter an feet at same time. Especially there should be a circuit to amplify. The week signal which comes from the IR sensor can be amplified to high level voltage. LM358 is the major part of the Amplification. If there is an obstacle between IR transmitter and receiver the output goes to high [3].

The IR sensor TX directly in front of the RX, such that almost all the radiation emitted, reaches the RX This creates an invisible line of IR radiation between the IR TX and the RX. Now, if an opaque object is placed obstructing this line, the radiation will not reach the RX and will get either reflected or absorbed by the obstructing object. This mechanism is used in object counters and burglar alarms. This is also called as direct incidence [4]. U-type IR sensor are also worked as direct incidence.

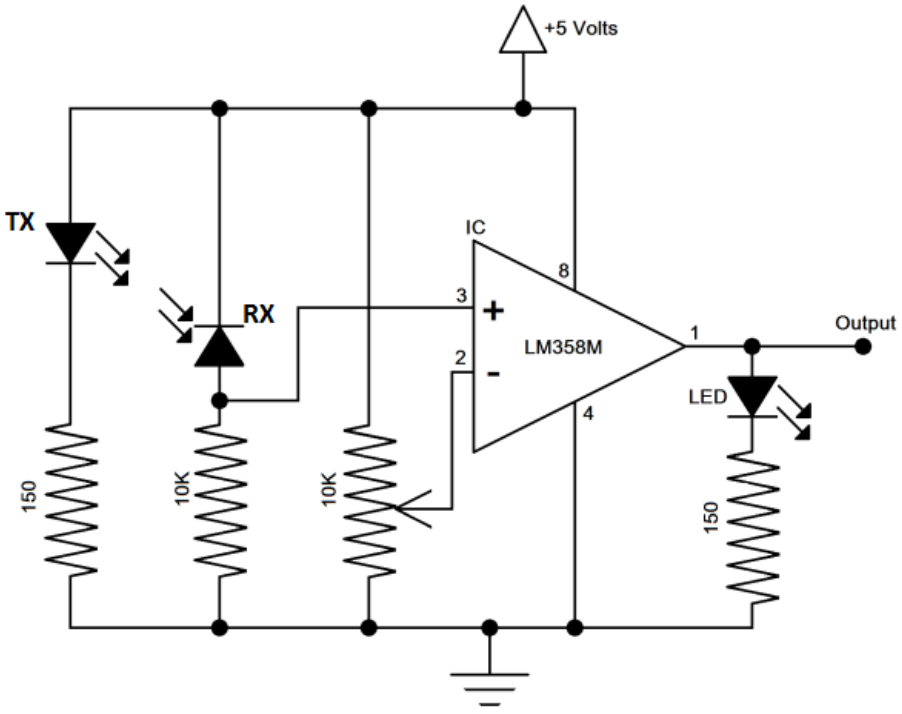

Figure 2: The Amplifier Circuit[5]

The comparison of the Analog meter wheel and Design Digital wheel meter is shown in the following table.

Table 1: Comparison of Digital meter wheel and Analog meter wheel

Design Digital meter Wheel	Analog Meter Wheel
Inexpensive (Low Cost)	Expensive
Resetting smooth	Resetting not smoothing
Suitable for night working site	Need external light source
Low weight	Heavy weight
Indicate distance from several units	Only in meter (m)
Alarm to indicate 40m	No alarm
reduce safety issued	Safety issued

Another advantage of this invention is to provide an improved measuring device for accurately measuring linear distance said device being of a compact and simple construction whereby it may be economically implemented.

Safety first is the main rule in engineering field. When measurements take along the road required more attention to road. But analog wheel meter required attention also for the meter readings as well as the road. Then safety problem occurs. It can be avoid from buzzer alarm.

As a further development, this can be improved to use battery charger with solar panel to be charged rechargeable battery.

4.0. CONCLUSION

The purpose of the project was to design a low cost Digital wheel meter with an alarm unit. It can be also used for the night working sites to get their measurements accurately and user friendly.

ACKNOWLEDGEMENT

The authors would like to acknowledge and extend gratitude to the persons who have helped to make this project a success.

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Department of Electronics – Wayamba University of Sri Lanka

AUTOMATIC MICROWAVE ANTENNA ALIGNING SYSTEM

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ABSTRACT

A microwave connection is very important toa telecommunication network because a fault of the link may drive the sites out of control. Microwave link alignment is a somewhat difficult task in the microwave installation process, because it is done manually. In the installation processa lot of problemsoccur. Sometimes manual alignment cannot find the most accurate aligned position and there is not any proper way to align those antennas. There are two receive signal (RSL) levelmeasuring methods when an antenna is alignedina microwave antenna system. These methodsare DC voltage at the RSLtest point and RSL indication in software/firmware. When align an antenna the first method is suitable. Ringers use that method and they connect voltmeter to RSL test point at OutDoor Unit (ODU). This work focuses on doing that operation most accurately and automatically.

Keywords: Microwave link, Microwave antenna alignment

1.0 INTRODUCTION

In as much as microwave link is a circuit between terminals separated by a sizable distance, it can be considered as a type of transmission line. Terrestrial microwave signals propagate through the lower atmosphere[1].Most of the telecommunication service providers in Sri Lanka use microwave network to enhance their network coverage.

Telecommunication industry currently experiences an exponential growth in technological advancements. New Technologies demand new regulations and the regulator is forced to keep abreast with its regulations, especially with the burden of installation at a level field. A microwave connection is very important to a telecommunication network because a fault of the link may drive the sites out of control. Microwave link alignment is a somewhat difficult task in the microwave installation process, because it is done manually[2]. In the installation process a lot of problems can occur. Sometimes manual alignment cannot find the most accurate aligned position and there is not any proper way to align those antennas.

This research is to propose and design a prototype system to minimize the time delay and to simplify the operator's job in the installation and aligning the Microwave link in the telecommunication field.

2.0 EXPERIMENTAL

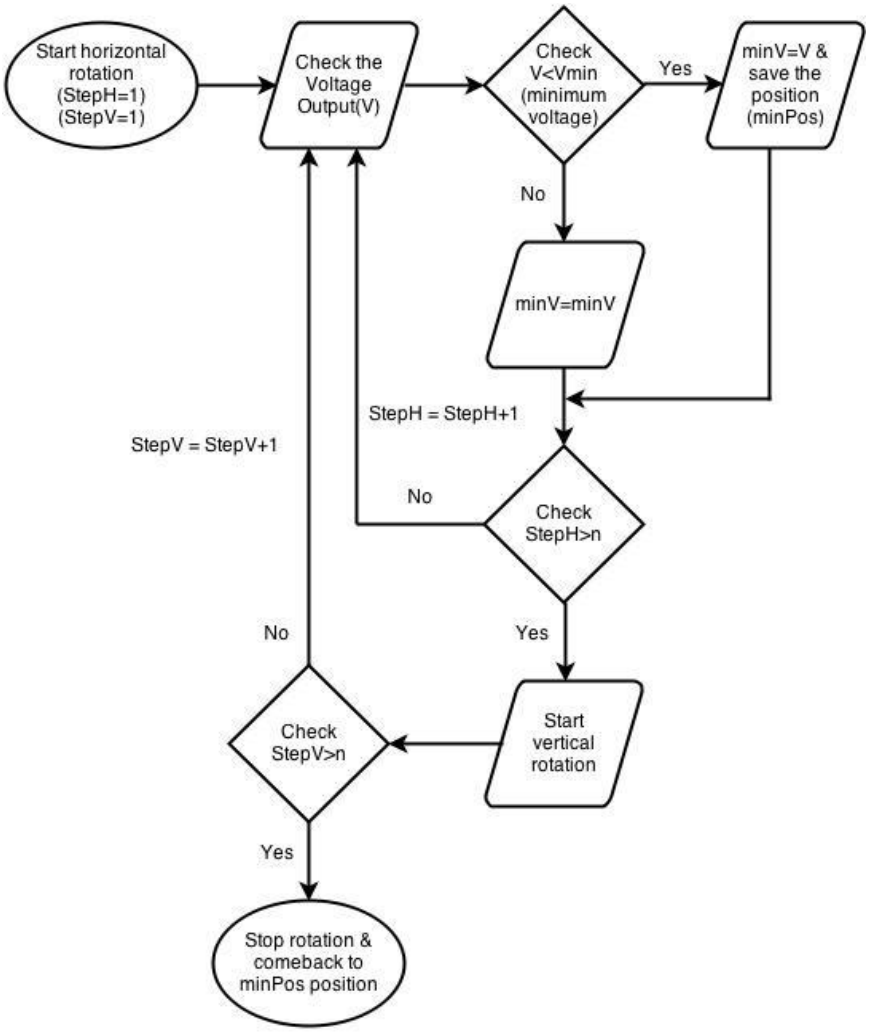

Figure 1: Flow chart of designed system

In this proposed system two stepper motors were used for vertical and horizontal rotation. After each step the voltage output was checked and it was compared with current minimum voltage. If current voltage output is smaller than minimum voltage it was saved as minimum voltage and its position. After a complete full rotation it comes back to the position which has the minimum voltage. PIC16F877A microcontroller was used for

controlling the logic of the system[3].L293D stepper motor driver IC was used to drive the stepper motor[4].Available minimum voltage was displayed in the LCD display.

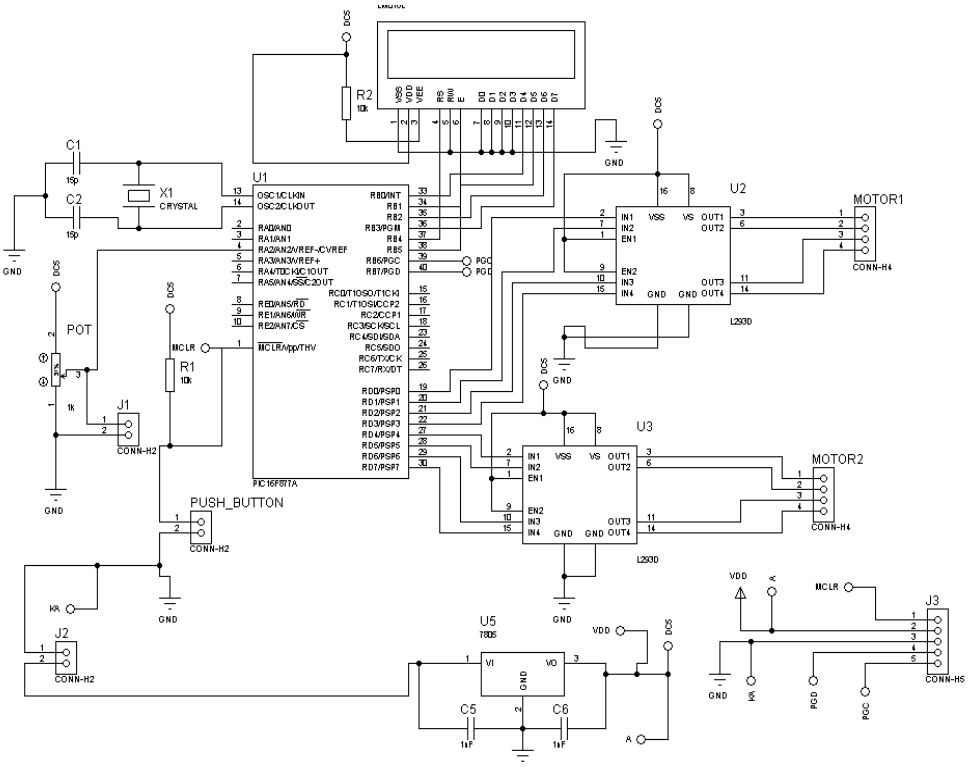

Figure 1: Circuit diagram of designed system

3.0 RESULTS AND DISCUSSION

This system is very useful to any service provider because it decreases their labour cost. Also this is the solution for automatically detecting RX level change due to environmental condition. Technicians can discuss and can get the correct alignment for the link without visiting the site. Thus they can do their work very efficiently and effectively. There are some limitations of the proposed system. They are, when antenna diameter is very large required very large stepper motors are required to tolerate weight of the antenna and additional power supply is also required for the proposed system.

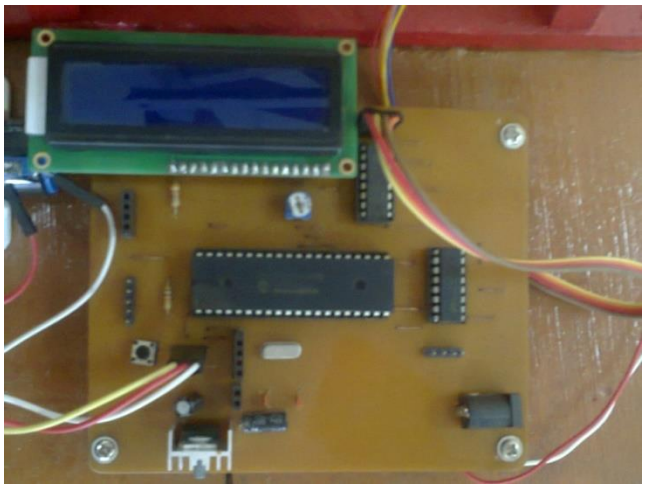

Figure 2: Circuit of the designed system

4.0 CONCLUSION

Even though this is a preliminary study, the results predict the possibility of using this system for automatic alignment of microwave antenna. The proposed system must be included in the antenna as an inbuilt system.

ACKNOWLEDGEMENTS

The authors would like to acknowledge and extend gratitude to the persons who have helped to make this research project a success, especially persons at Sierra Telecom (pvt) Ltd.

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LAND PHONE LOCKER USING DTMF TECHNOLOGY

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ABSTRACT

Land Phone Locker Using DTMF Technology is designed for the necessity of limiting the unauthorized outgoing calls from a land phone. Even though the physical lockers can lock the dial pad, the people who use the phone frequently can find any alternative for unlocking the pad lock. This circuit contains a software programmed microcontroller to identify the password to unlock the telephone. This circuit is designed for making calls only for the people who know the password. This is not affected for the incoming calls.

Keywords: *Dual Tone Multi Frequency, MT8870, 16F628 microcontroller, password verification, unlocking the telephone*

1.0 INTRODUCTION

Telephones are misused by unauthorized people for unessential calls and criminal purposes. Locking the land phone for outgoing calls is essential for these circumstances. A telephone which is not locked can be used by everyone. In a house it can be used by children, each family member, visitors, servants, unauthorized people and everyone. In an office staff can make calls without any limitations. In these cases parents and employers want to control these unwanted outgoing calls. Then they can use a physical lock which covers the dial pad as well as a programmable lock which cannot be directly seen as a locker. If we use a physical locker, the caller may know that and try to remove that hardware. If we use a programmable lock we can trickily trap the unauthorized people make calls from that telephone. In this project, a programmable locker for the land phone was introduced. The technology used for the circuit designing is DTMF (Dual Tone Multi Frequency) technology. From the studies, the locker was designed by programming the 16F628 microcontroller to block the dial tone unless dial the correct password. If the password is correctly dialed, permit to have the current call only.

2.0 EXPERIMENTAL

Pins 7 and 8 of MT8870 are connected to a 3.579545 MHz oscillator/crystal. Pins 1 through 3 are for the op-amp inside of the MT8870 chip. The configuration has a gain of

about 150k/56k = 2.6786 V/V. The amplified signal gets passed through a "Dial Tone Filter" to separate the two frequencies into a high frequency and a low frequency. To calculate the specific frequencies the number of zero crossings are counted for a specific span of time, which is one of the reasons that the oscillator is needed. The two diodes, D5 and D6, are a limiter circuit which protects the chip from large voltage swings. C1 and C2 are decoupling capacitors. Pin 4 outputs the reference voltage which is nominally $V_{DD}/2$. EST (pin 16) is a logic one when a valid tone pair (number) is detected and returns low when the signal stops. This is connected to the steering input (pin 17) so that the new tone pair is registered and the output latch (Q1-4) is updated. When the voltage at pin 17 falls below V_{TSt}, the device is ready to accept a new tone pair. This amount of time is simply an RC time constant determined by R17 and C4. Pin 17 also acts as an output (GT) which resets the time constant whenever necessary. When the latch is updated and a new number is stored, STD (delayed steering, pin 15) goes high and returns to logic low when the voltage on St/GT falls below V_{TSt}. TOE (pin 10) enables the output pins 11-14 and is pulled up internally. Pin 5 inhibits the recognition of the tones for A, B, C and D[1].

When the subscriber off hooks the receiver of the telephone, it has only the power. Dial tone does not appear. The program has a password of four digits. If only the first digit of the password is correct allows the user to dial the second digit. Otherwise should start from the beginning. If all the digits of the password is correct, gets the dial tone and can make the call.

3.0 RESULTS AND DISCUSSION

The telephone could be unlocked only after dialing the password. Once the password is dialed correctly, it is only valid for the current call. When the password is correct, dial tone appeared and gave a signal to the user to dial the telephone number to be called. Incoming calls didn't have any effect from this. Authorized subscribers can only make the calls and can minimize the telephone bill and prevents the misusing of the telephone. Since the circuit design is cost effective, light in weight and small in volume purchasing, installation and usage is easy.

To test the password verification circuit we connected switches to the input of the PIC to simulate the outputs from the DTMF decoder. Then we attached LEDs to output pins so that we could see what was stored in memory and make sure that the numbers we entered

were being stored correctly. Then we had an LED light up when the numbers entered matched the password stored in memory. The drawbacks of the designed circuit are not very much user friendly, cannot make calls even for emergency numbers and danger of bypassing the circuit between the rosette and the telephone.

When the subscriber off hooks the receiver of the telephone, it has only the power. Dial tone does not appear. The program has a password of four digits. If only the first digit of the password is correct allows the user to dial the second digit. Otherwise should start from the beginning. If only the second digit of the password is correct allows the user to dial the third digit. Otherwise should start from the beginning. If only the third digit of the password is correct allows the user to dial the forth digit. Otherwise should start from the beginning. If only the fourth digit of the password is correct the subscriber can get the dial tone. Otherwise should start from the beginning.

When the password is correct and gets the dial tone, subscriber gets a signal after some seconds to inform that to dial the phone number which should be called in10 digits. For the demonstration purposes this is designed only for a call of few seconds and then it will be automatically cut and then the above process should be repeated.

4.0 CONCLUSION

The land phone locker using DTMF technology was designed based on unlocking the telephone by using a password. It has given an automatic locking time by the program by a delay to demonstrate the circuit. This circuit design doesn't have any connection with the service provider when this is available at the market, anyone can purchase and install the circuit equipments following the given guidelines.

ACKNOWLEDGEMENT

Convey the gratitude to Prof. C. A. N. Fernando and other academic and non-academic staff members in Department of Electronics, Faculty of Applied Sciences, Wayamba University of Sri Lanka, Kuliyapitiya.

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DESIGNING A GENERATOR ALARM MONITORING SYSTEM

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ABSTRACT

The options for backup power are varied, but the most often used power source for moderate-sized telecom sites needing extended runtime is a diesel internal combustion generator. They supply 3 phase current to their equipments. But, when power failure was occurred, they set these equipments to automatic transfer switch to the generator. Therefore it should be functioning well. Some faults can occur in power generators due to various causes. Before affect those faults into the whole site we should get acknowledge of the alarms. For that most of the time telecommunication sector used alarm management systems. Alarm management is the application of human factors along with instrumentation engineering and systems thinking to manage the design of an alarm system to increase its usability. This study is basically on the alarm monitoring of the power generators that are placed in telecom sites. All the alarms acknowledged via short message service (SMS).

Keywords: *power generator, short message service (SMS), GSM modem*

1.0 INTRODUCTION

In telecommunication field have fast growth with the new technologies. During the growth of technological advancement maintain the quality of network is very essential. Network Management System is used to monitor all the equipments, maintenance and troubleshooting for network managers, ensuring carrier-class reliability levels for legacy, hybrid and next generation services across the entire network in real-time. This research is supports to maintain the alarm history of generator alarms and get acknowledgments of the alarms in real time from all the generators via short message service (SMS).

2.0 EXPERIMENTAL

In this system used global service mobile (GSM) modem to send the SMSs of the fault alarms to the relevant person. This circuit was designed for the DSE 7210 diesel generator module. The DSE 7210 generator was manufactured by Deep Sea Electronics. [1] It has basically three types of alarms. They are low oil level, high temperature and low fuel level. When the alarm is acknowledged it sends the notification to the relevant person about the

type of the fault occurred. To keep the alarm history, web page was used to store and view the alarms.

2.1.1 Flow of control

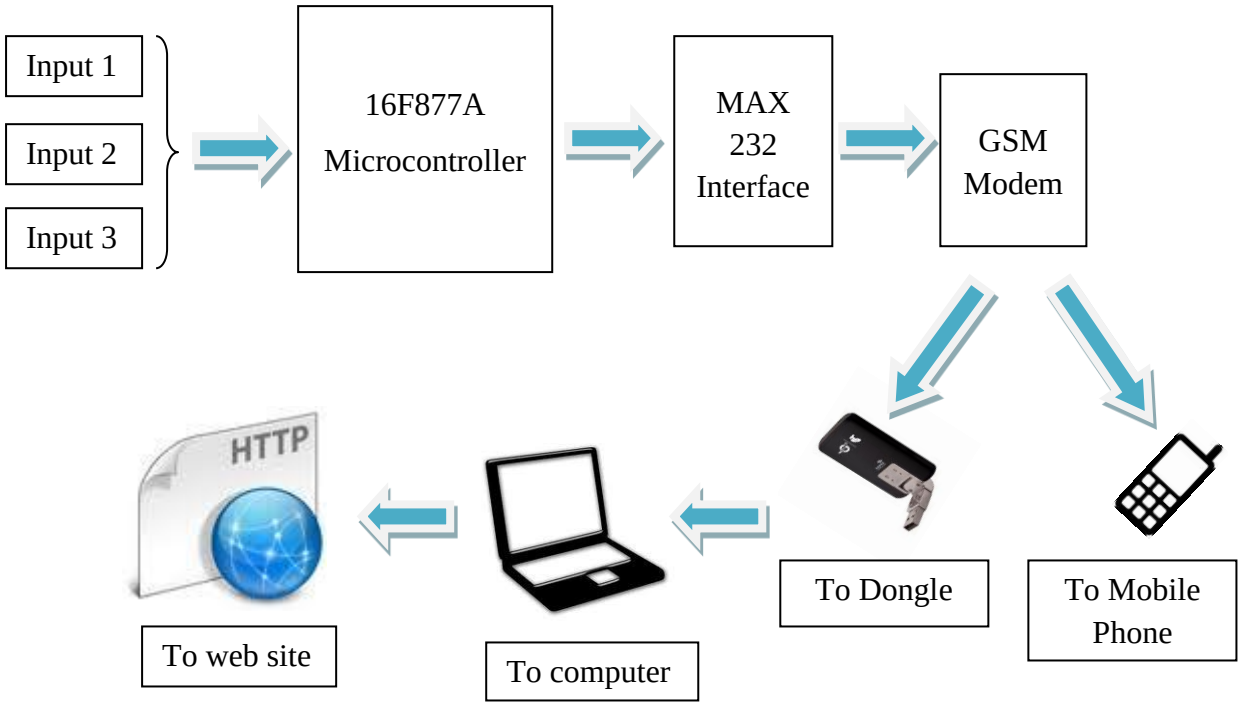

Figure 1: Block diagram of the Generator Alarm Monitoring System

3.0 RESULTS AND DISCUSSION

This generator alarm monitoring system is designed to monitor and maintain the fault alarms of the generators. This was designed to use in two ways. If generator detects any trouble it will send the SMS for the relevant person who was engaged with the generator trouble shooting. In another way is send all the SMS to the desktop computer and it will upload all the SMS into the web page. Then anyone can view the alarms by connecting to the web page.

This will reduce the maintenance cost of the generators. Engineers can discuss about the fault and get the correct solutions for that without visiting to the site. And they can carry away all the required tools for the repair. Therefore they do not need to worry about the requirements after visiting to the site. It is helpful to do their works effectively and efficiently.

This system includes three main sections. There is a controlling part, SMS sending part and web site. The controlling part was designed using the 16f877A microcontroller. It gets the input signals from the power generator and then sends the SMS about the fault and site name to the relevant phone number. To send the SMS this system used GSM modem. The type of GSM modem is TC 35. TC 35 modem is manufactured by SIEMENS (pvt) Ltd. This modem is support for the AT commands. AT commands are the instructions used for controlling a modem. AT stands for Attention. Each and every command line starts with "AT" or "at". Because of this modem commands are called AT commands[2]. After receiving the fault message receiver can identify the type of fault and the site name. It is useful for the technicians to do the repairs. The result is shown in following figure.

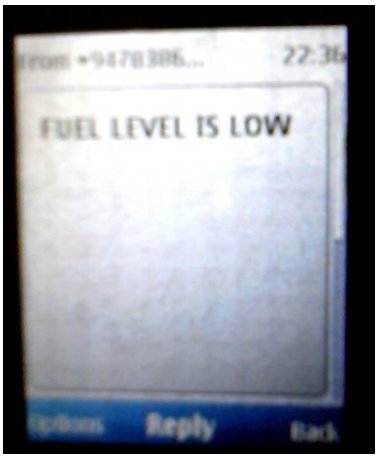

Figure 2: Results

One of the weaknesses of this system is that it requires a computer which runs 24×7. If the computer turns off, the data saving and uploading process has to be completed from the beginning. The reason to start the process from the beginning is the written script to run and save SMS from inbox of the SIM and saved into the file. And also there is another script to upload the file into the web page. This system should require a dongle with the internet connection.

4.0 CONCLUSION

Even though this is a preliminary study, the results predict the possibility of that system use for monitoring the alarms of generators. This system must be connected to the all sites. This is a low cost system comparing with that of other alarm monitoring systems. This is just a proposed model which when implemented would surely give a very big support to the monitor the faults of generators. The time for receiving messages may vary due to the public GSM network traffic but still it is effective.

ACKNOWLEDGEMENTS

The authors would like to acknowledge and extend gratitude to the persons who have made the completion of this research project success.

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