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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.

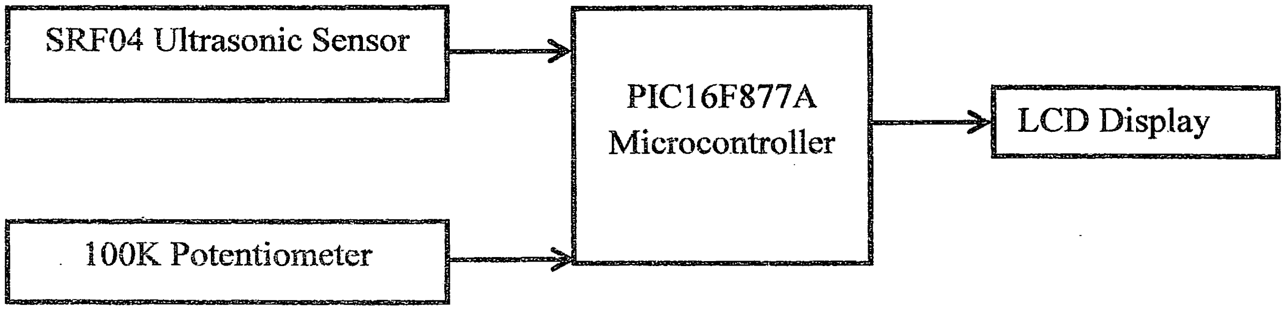

Figure 1: Block diagram of proposed Digital Meter to measure Tower Height

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.

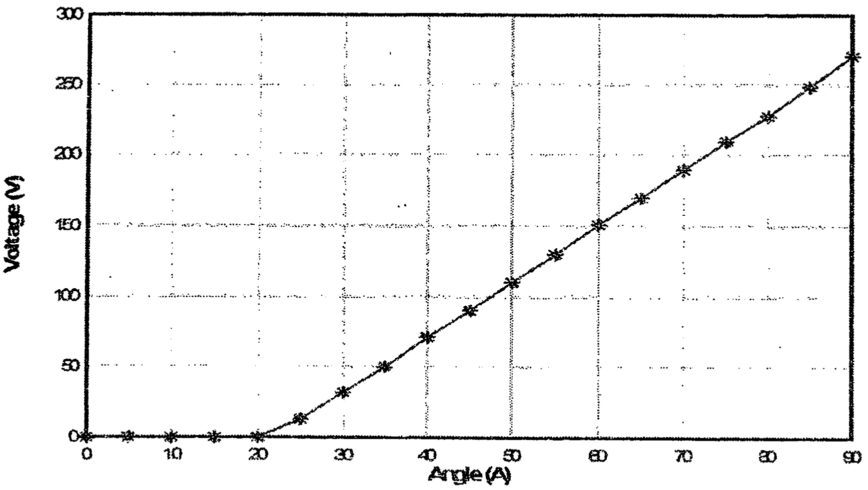

Figure 1: The graph of Angle vs. Voltage for 10K potentiometer

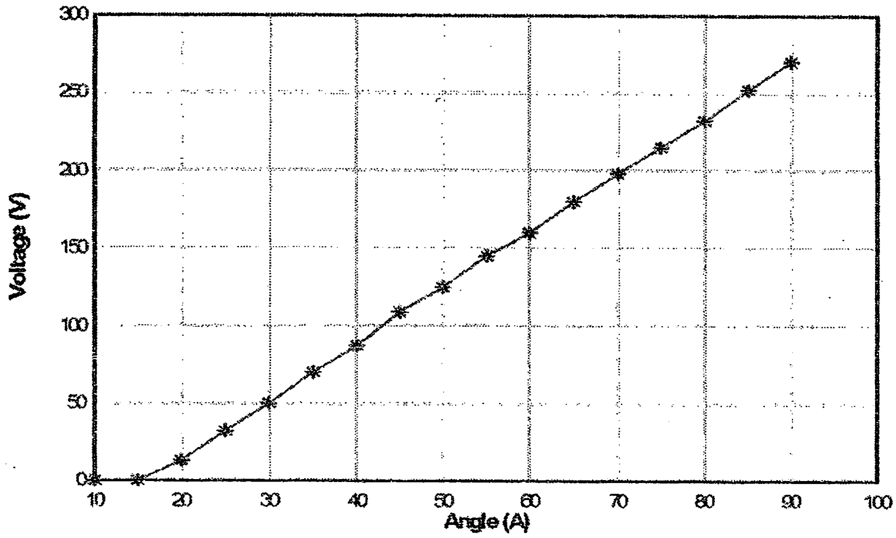

Figure 2: The graph of Angle vs. Voltage for 100K potentiometer

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.

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