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Development of Industrial Wiring Cable Fault Detector Using Microcontroller

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Abstract: The Miniature Circuit Breakers (MCB) are electromechanical devices that protect an electrical circuit from an overcurrent. The overcurrent in an electrical circuit is the cause of a short circuit, overload or fault design. In this project, the interfacing between RCCB, MCB, Microcontroller, LCD Display and relay to detect the actual location fault which is indicated on the LCD. The development of this project begins when people talk about how the precise electricity fault location occurs without taking too much time. So, if waste that time it will affect to people especially for those who need an electrical power supply. The application of the Atmel 80C51 Microcontroller is used to detect the exact location of the defect wiring cable. The LCD will display the important data needed for the fault location value. Furthermore, maintenance

Keywords: Atmel 80C51 Microcontroller, LCD Display, Relay, Wiring Cable Fault Detector

1.0 INTRODUCTION

A Microcontroller connected to the monitoring device and interrupter circuit, microcontroller being programmable to receive and process inputs from the said line monitoring device to determine the occurrence of a fault in load, to operate interrupter circuit when the fault is detected [1] an electrical distribution board that receives an electrical power cable that is connected to an electrical distribution line and a signal cable that is connected to a network, and an outlet box that is connected to the electrical distribution board through in-building complex cables including an electrical distribution cable [2]. A liquid-crystal display (LCD) is a flat-panel display or another electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead of use a backlight or reflector to produce images in colour or monochrome. In this project, the function of LCD is to display where is the fault location or tripping happened [3]. Furthermore, this project is proposed to detect the fault in wiring cable from the MCB or electrical component in distribution board to ensure not be interrupted people for a long time to do their works or activities. Thus, this project is proposed new technology or to detect the fault that occur in the industrial building for wiring cables using a microcontroller instead of Arduino[4].

2.0 MATERIALS AND METHODS

The development of wiring cable fault detector using Microcontroller is divided into two part which is hardware and software. Next, the hardware part required in this project are being discussed in this part and the software that are being used for this project are using Keil µVision 4 IDE and Proteus 8 [5].

2.1 MATERIALS

This section will describe the main material in developing for this project.

a) Atmel 80C51 Microcontroller

ATMEL 80C51 microcontroller function in Figure 1 is to control the system. The 80C51 one of the most popular microcontroller not just IC 80C51 can read and writes more programs from 100,000 times. The product is in the form 40 pin legs out and have internal device in large amounts. Besides that, 40 pin feet is easier to be used. Moreover, the Atmel 80C51 microcontroller has 8K words or program memory. In Additional, there are several types of functions is serial communication such as SPI, I2C and communication series like in pc[7,8].

Figure 1: Microcontroller 80C51

b) LCD Display

A liquid-crystal display (LCD) in Figure 2 is a flat-panel display that modulated optical device using the light-modulating properties of liquid crystals. Liquid crystals do not transfer light directly, instead using a backlight or reflector to produce images. LCDs are available to display arbitrary images or fixed images with low information data, which can be displayed or encrypt, such as preset words, and seven-segment displays. The LCD uses the same basic technology, except that arbitrary images are made up of 65536 binary while other displays have larger elements. LCD display can either be normally in positive or negative states, depends on the polarizer arrangement. For example, the characteristic of image is based on the background of display screen. Optical filters are added to white on blue LCDs to give them their characteristic appearance.

Figure 2: LCD Display

c) Voltage Regulator

Voltage controllers in Figure 3 are Modules used to protect PICs and sensors or actuators that are connected from more Voltage. PIC and related sensors only support 5V DC mover. When more voltage will cause the module will burn. Therefore, LM7805 is used to control the 5 VDC voltage.

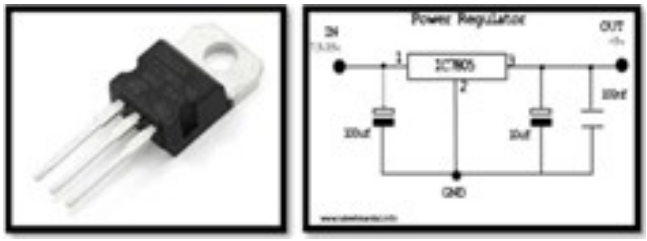

Figure 3: Voltage Regulator

d) Relay

A relay in Figure 4 is an electromechanical device use as control for electric power. Next, a relay has a movable metal part call the armature. Then, the electrical contact or same meaning is contacts connect to the armature. Moreover, when the armature moves, the contact also moves and depending on application this action may open some electric circuit while closing others and many applications of relay are used in industry to control the other switch and to control a high-voltage circuit with a low voltage signal.

Figure 4: Relay

2.1 METHODS

The process flow of block diagram and flowchart is explained below.

a) Block Diagram

The process flow of block diagram for this project shown in Figure 5 and 6.

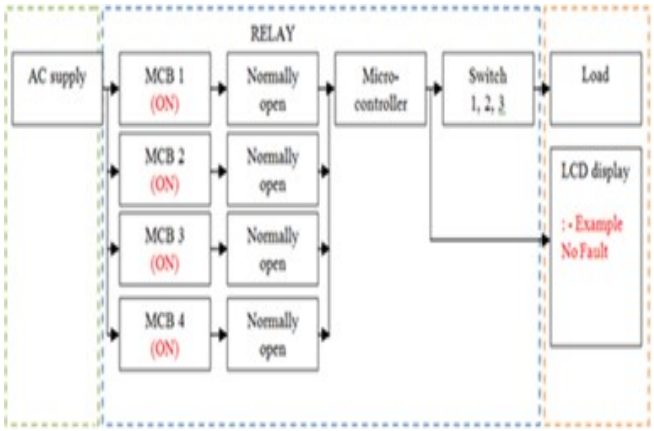

Figure 5: Process flow block diagram before MCB tripping

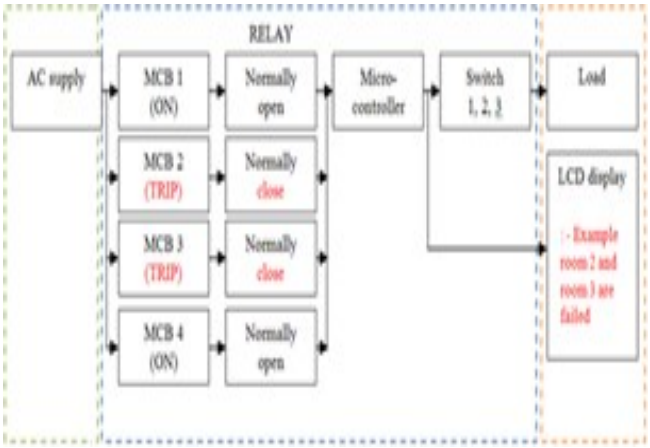

Figure 6: Process flow block diagram after MCB tripping

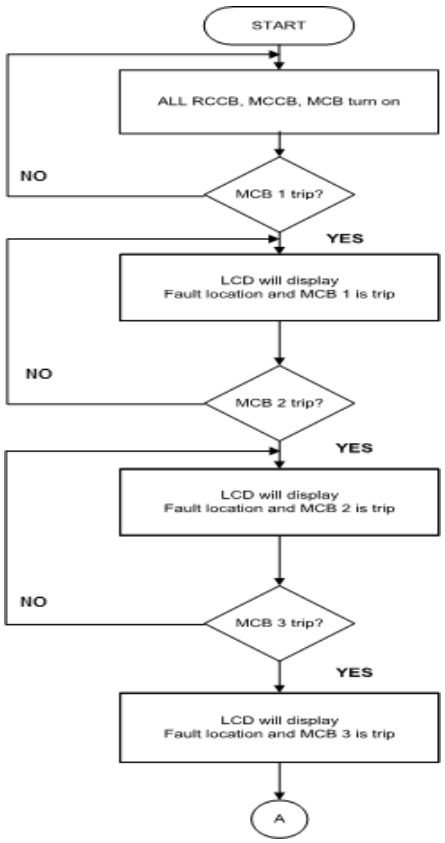

Figure 7: Flow Chart of Project

b) Flowchart of Project

Figure 7 and Figure 8 shows the flow chart and power saving device.

Based on the flowchart of this project, it is shown that the sequence for the development of industrial wiring cable fault detector using microcontroller. The system will begin when this project is connected to 230 voltage supply from electrical power supplied that flows through RCCB, MCCB and MCB.

The relay which are in normally close condition and open condition will act as an input and when there are no current flows through it, the output signal will send the necessary data needed directly to the PIC microcontroller for data analysis purposes.

The signal that analyzed by PIC microcontroller will transmitted the data to LCD for display result. If, the MCB 1, MCB 2 and MCB 3 were tripped as it reacted with the current flow, the LCD will display the fault location occurred.

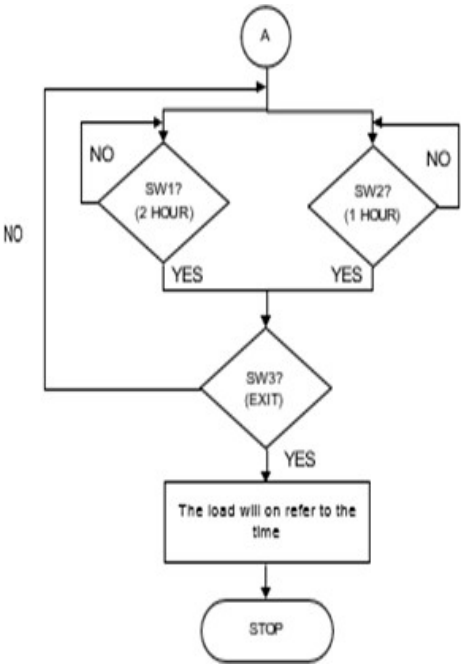

Figure 8: Flow Chart of Power Saving Device

There are three types of switches were used in power saving devices are connected to the electrical wiring. The first switch is set for 2 hours, the second switch is set for one hour and the last switch is intended to cut off timer switches 1 and 2.

c) Circuit diagram

Based on the schematic circuit are using software Keil µVision 4 IDE and Proteus 8. This process begins with assembly of the hardware project. The circuit diagram is shown in Figure 9. The relay which are in normally close condition and open condition will act. as an input and when there are no current flows through it, the output signal will send data to Atmel microcontroller 80C51 for data analysis purposes. Then, the signal will be analyzed by Atmel microcontroller 80C51 and displays at LCD. If switch 1, switch 2 and switch 3 were turn off as it reacted with the current flow, the LCD will detect and displayed the fault location.

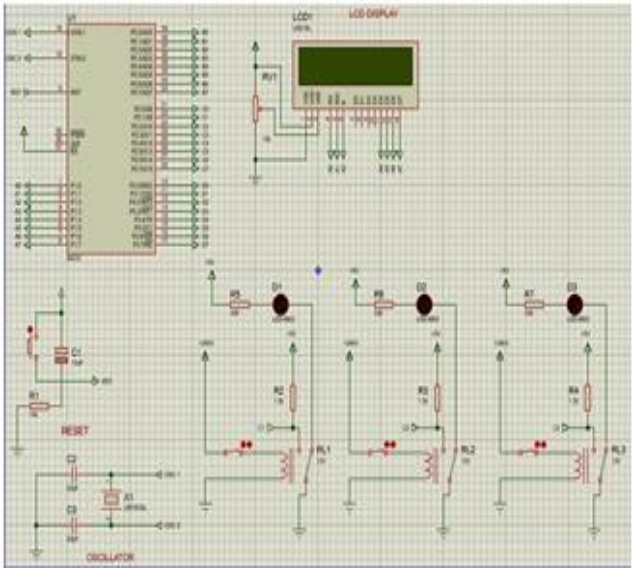

Figure 9: Schematic Diagram of Project

Finally, Figure 10 shows the completed prototype for this project.

Figure 10: The Development of Industrial Wiring Cable Fault Detector Using Microcontroller

3.0 RESULTS

As for this project system, the fault occurs will be displayed every “Meeting Room Failed” on each room of 111, 112 and 113. This project can detect the actual location of the wiring cable occurs error. This condition will operate in at some spot and the system will detect and display the exact location fault error of the wiring cable fault error as the example meeting room or classroom from the LCD display. The results start of the simulation of this project with condition “ No Error ” when no fault occurs of MCB 1, MCB 2 and MCB 3. If, the LCD will display “ Room Failed ” it means that there is fault at any MCB. The simulation results are shown in Figure 11, 12, 13 and 14.

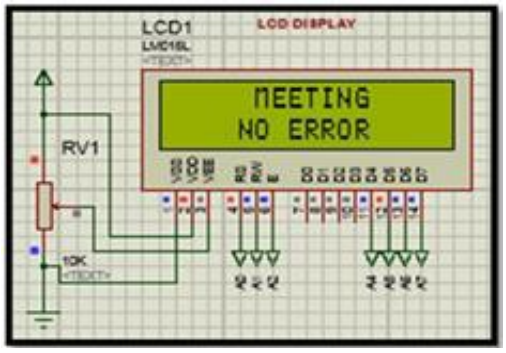

Figure 11: The Simulation “ No ERROR ”

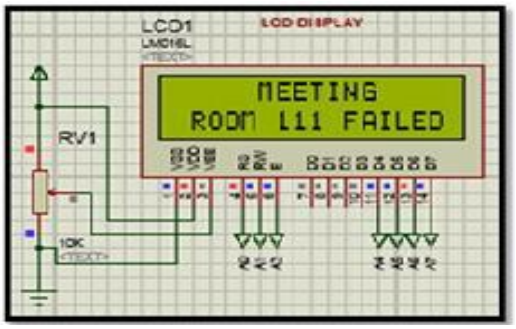

Figure 12: The Simulation " MEETING ROOM 111 FAILED "

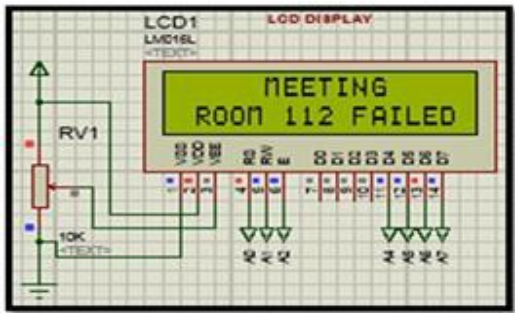

Figure 13: The Simulation " MEETING ROOM 112 FAILED "

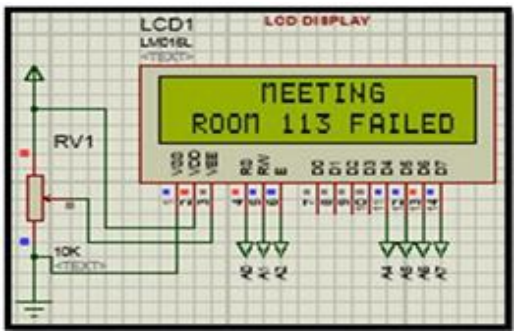

Figure 14: The Simulation " MEETING ROOM 113 FAILED "

4.0 DISCUSSION

The Development of Industrial wiring Cable Fault Detector Using Microcontroller was done and found the exact location for fault occurs in wiring cable by displayed four different detection fault occurs which are " No Error ", " Meeting Room 111 Failed ", "Meeting Room 112 Failed and "Meeting Room 113 Failed". In this project, if there are any fault occurs at any MCB in this project, it can detect the exact fault location by display on the LCD. From that, the fault area can easily be searching on the fault location and save employees or maintenance.

5.0 CONCLUSION

This project is successful where LCD displayed the fault location error in any place such in meeting room. Thus, by using the traditional relay, it can contribute the heat effect to wiring cable. Furthermore, to improve the existing project, it can be suggested using the new solid-state relay.

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