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IOT BASED UNDERGROUND CABLE FAULT DETECTION SYSTEM

ACHAL J.WAKADE[1], NEHA N. BADWAIK[2]

1)Student, B.E., Electrical engineer, KDKCE, Nagpur

1)Student, B.E., Electrical engineer, KDKCE, Nagpur

ABSTRACT: -Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear by rodents, etc. Diagnosing fault source is difficult and the entirecable should be taken out from the ground to check and fix faults. The project workis intended to detect the location of the fault in underground cable lines from the basestation in km using a PIC18F4550 controller. To locate a fault in the cable, thecable must be tested for faults. This prototype uses the simple concept of Ohmslaw. The current would vary depending upon the length of the fault of the cable. Inthe urban areas, the electrical cables run underground instead of overhead lines.Whenever the fault occurs in the underground cable it is difficult to detect the exactlocation of the fault for the process of repairing that particular cable. The proposedsystem finds the exact location of the fault.The fault occurring distance, phase, andtime are displayed on a 16X2 LCD interfaced with the microcontroller. IoT is used todisplay the information over the Internet using the Wi-Fi module ESP8266.

KEYWORDS: -Underground cable system, fault detection circuit, Ohms law,Atmega16 microcontroller, location method, IoT Wi-fi module.

I. INTRODUCTION

In the urban areas, the electrical cable runs underground instead of overhead lines. Whenever the fault occurs in the underground cable it is difficult to detect the exact location of the fault for the process of repairing that particular cable. The proposed system detects the exact location of the fault and by the means of Wi-Fi modem its serially communicated towards the server. Since the problem that occurs in the underground cable is a big problem till now. As it is very difficult to find the exact location ofthe fault location manually, which suddenly affects the efficiency of the cable wire due to the losses occurred. Till now many techniques had already been implemented in order to detect the fault in cable wire. But the problem came up is how to detect the fault in cablewire when it is underground, and how to access or retrieve those data related to faulty location whenever it is required. In order to fill those gaps, we proposed the system which detects the exact location of the fault and through the means of Wi-Fimodem its serially communicated towards the server.

Its main objectives are as follows: -

• To identify the type of fault.

• To detect the fault location.

• To display information regarding the fault on an LCD display.

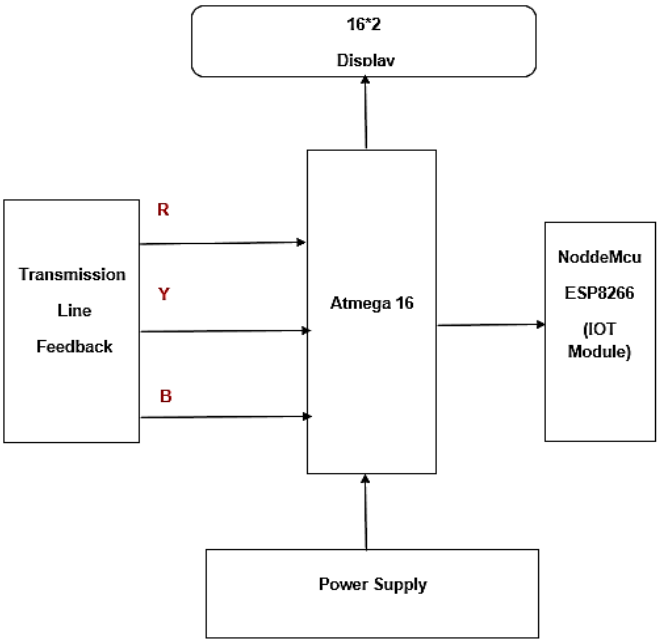
• To Retrieve information using IoT and Wi-Fi module and update information after every 3 Sec.

The electrical power system transmission line is the main function of transferring the electrical energy from the generating module to the consumers. As the overhead cables can get affected due to external weather conditions, we prefer underground cables for fault detection purposes. Though it is difficult to locate the fault in underground cables, it increases the possibility of the system getting damaged. Hence, we will proceed to identify the exact location of the fault.

Fault in cable plays the part as:

- Defect and Deviation of cables.
- Breaking of conductors.
- Insulation failure.
- Current diversion from the contemplated path.
- The performance of cable effects due to weakness or non-homogeneity.

The evaluation of IoT (Internet of Things) in the electrical Power Industry transformed the way things performed in a usual manner. IoT increased the use of wireless technology to connectpower industry assets and infrastructure in order to lower power consumptionand cost.The usage of IoT can make this project more efficient and accurate. The IoT module delivers accurate information regarding the system to the operator from time to time, hence the operator can manage the indifference among the cables. Thus, it leads the Online monitoring of the system and other embedded components along with their working.



II. EXPERIMENTAL

Fig no. 1: Block diagram of the system

The proposed system is an IoT enabled underground cable faultdetectionsystem**.** The basic principle behind the system is Ohm's law. When the fault occurs in the cable**,** the voltage varies which is used to calculate the fault distance. The system consists of a Wi-Fi module, Microcontroller, and Real-Time Clock. The block diagram of the faultdetection system is shown in Figure 1.The power supply is provided using a step-down transformer, rectifier, and a regulator. The current sensingcircuit of the cableprovides the magnitude of the voltage drop across the resistors to the microcontrollerand based on the voltage the fault distance is located.

The project uses the simple concept of OHMs law where a low DC voltage is applied at the feeder end through a series resistor. The current would vary depending upon the length of the fault of the cable in case there is a short circuit of LL or 3L or LG etc. The series resistor voltage drops changes accordingly, whichare then fed to an ADC to develop precise digital data in which the programmed microcontroller would display the same. This is a proposed model of an underground cable fault distance locator using a microcontroller. It is classified into four parts DC power supply part, cable part, controlling part, displays part. DC power supply part consists of an AC supply of 230V is step down using a transformer, bridge rectifier converts AC signal to DC and the regulator is used to produce constant DC voltage. The cable part is denoted by a set of resistors along with switches. The current sensing part of cable represented as a set of Potentiometers is used as fault creators to indicate the fault at each location. This part senses the change in current by sensing the voltage drop. Next is the controlling part which consists of analog to digital converter which receives input from the current sensing circuit, converts this voltage into a digital signal and feeds the microcontroller with the signal. The microcontroller also forms part of the controlling unit and makes necessary calculations regarding the distance of the fault. The microcontroller also drives a relay driver which in turn controls the switching of a set of relays for proper connection of the cable at each phase. The display part consists of the LCD display interfaced with the microcontroller which shows the status of the cable of each phase and the distance of the cable at the particular phase, in case of any fault.

A component used in the system as follows:

- ATmega16 IC
- IoT Module ESP8266
- 7805 IC
- LCD Display
- Resistors,Capacitors,miscellaneous components like Cables, Connectors, diodes, LED, switch, potentiometer
- PCB
- Potential Transformer.

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fiability as a Wi-Fi Shield offers (and that's just out of the box) The ESP8266 module is an extremely cost effective board with a huge, and ever-growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, which is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it containsa self-calibrated RF allowing it to work under all operating conditions and requires no external RF parts.There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the Documents section below you will find many resources to aid you in using the ESP8266, even instructions on how to transform this module into an IoT (Internet of Things) solution.

The potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat. The measuring instrument called a potentiometer is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name. Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick. Potentiometers are rarely used to directly control significant power (more than a watt) since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

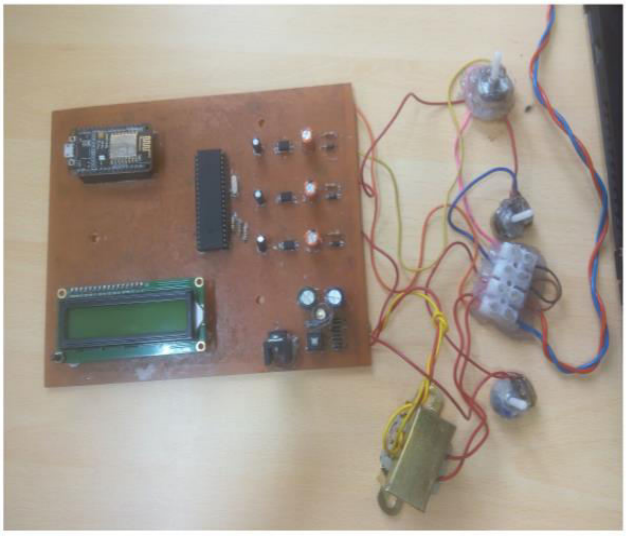


Fig no.2: Hardware Module

- Proteus simulation circuit: -

The various components used in the system are basically a current potentiometer, PIC18F4550, Wi-Fi modem, LCD display. The potentiometer is used for varying resistance of the cable. Here we have used PIC18. PIC18 will receive the input from the optocoupler and according to it, the controller circuit will perform some set operations like displaying of data in LCD display which is interfaced with it or serially communicating the real-time data through Tx-pin of the microcontroller. Wi-Fi module acts as a medium that connects any of the physically assembled systems with the internet and

transmits the data in the server. The wi-Fi module which is usually interfaced with PIC18 is ESP8266. Nowcoming to its pin configurations, it consists of 8 pins but the pins which are actuallyused are Tx pin, Rx pin, CHPD pin, Vic, Ground. CHPD is the enable pin which isan active-high pin and by giving input HIGH it enables Wi-Fi and connects the systemwith the internet and any of the sensed values can be serially transmitted to the server.LCD display used here is 20X 4 which is a flat panel display that uses a groupof LEDs and writes the sensed value in its display screen and in the circuitry itselfthere is a facility through which we can control the LCD brightness and intensity. Atlast when the code was implemented in PIC18 then the real-time data was serially communicated in the server and the information from the server can be retrieved inmobile or laptop through IoT.Single line fault: If this type of fault occurs in a system when cable cuts or breaksto create this fault, we have used potentiometer. If we put its value to high it meansthe line is broken so it indicates a line to line fault. This information will be displayedanLCD and also information is retrieved with the help of the IoT and Wi-Fi module.The line to line fault: To Indicate this type of fault we have to put potentiometers ofany two lines at a high value. It indicatesa line to line fault and displayed on LCD.Earth fault or Three-line fault: This fault is indicated by putting all 3 potentiometersat a high value.All the information regarding fault and cable will be retrieved by using IoT andupdate after every 3 sec.

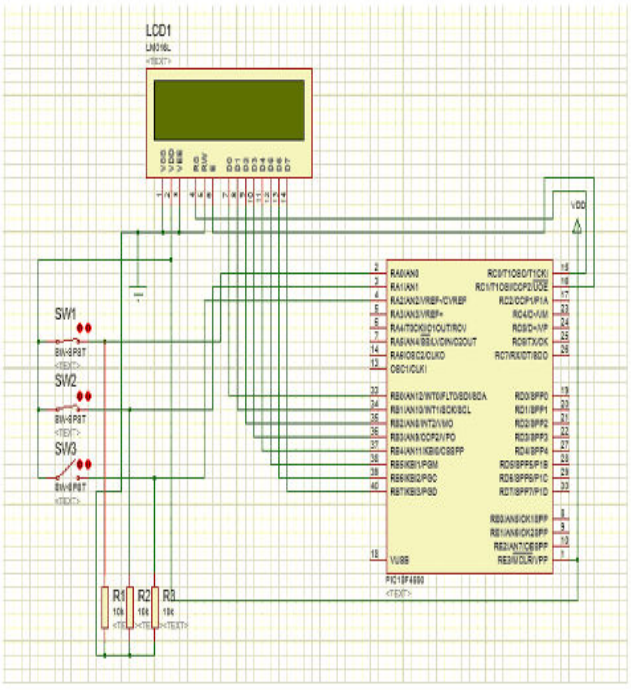


Fig no.3: Proteus simulation circuit

III. FURTHER SUGGESTED WORK

- The receiver will receive SMS through GMS it gives information about cable fault.
- Registers are used as a cable. The fault is created by relay.Relay act as switch it is an open or closed switch.It is connected to the controller unit.ADC is inbuilt in ARM7 which converts analog input in digital format.Where the fault is generated is displayed on LCD in Km.
- If the voltage is not the same at the transmitter and receiver side then the system considers as there is a fault in the cable.It sends the SMS to the receiver where the fault is generated.
- One another option is there to know where the fault in the cable. If the receiver sends the *GET# to the number which is saved in a program then also receiver known about the fault.

IV. CONCLUSIONS

Through this project, we simplified the actual problem of detecting the fault in the underground area. We discover the position or location were the faults will occur and also find the accurate distance of the breaker point.The line to line, single line, line to ground fault in the underground cable is located to rectify the fault efficiently using simple concepts of Ohms law. The work automatically displays the phase, distance and time of occurrence of fault with the help of PIC18F4550 and ESP8266 Wi-Fi module on a webpage. The benefits of accurate location of fault are fast repair to revive back the power system, it improves the system performance, it reduces the operating expense and the time to locate the faults in the field.

V. ACKNOWLEDGMENT

We started this project with an interest in the field of Underground cable faultdetection using IoT. We wish to express our thanks to many people who have helpedduring the completion of the project. Firstly, we would like to thank our projectguide,Sudha S. Shrikant. We are grateful for her kind support and encouragement. She has guided us throughout the project. Her time-to-time guidance has propelledus towards the timely successful completion of the project. We would also like tothank all faculty and staff who have supported us directly or indirectly.

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