

Underground Cable Fault Distance Detector System Using IoT Wi-Fi Module & Microcontroller

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ABSTRACT: The Paper deals with the fault detection in underground cable from the base station to faulty section in km based on IoT. The Paper mainly consist of an ATmega328P Microcontroller and an online monitoring system called Internet of Things (IoT). In Present scenariosIoT based application have come up with its wide importance as digitalization is grown up in every field of Technology. The proposed system finds the exact location of fault and upload the details regarding detected fault on internet through IoT, so that the details of fault can be easily browsed from any place and can provide the guideline to the section engineers to overcome from the problems. In this paper the faults are symbolized by a prototype model used with a set of resistors at every known distance to check the fault location, i.e., if there is a short circuit in the form of line to ground the voltage across the resistors changes, which is then fed to ADC inbuilt in already programmed in microcontroller to create the exact data of location of fault in km from source station, which would send the processed data to the LCD display and simultaneously also upload the exact location of detected fault on internet through IoT. This Paper is mainly based on the Working Principle of Ohm's Law.

KEYWORDS: Underground cables, Ohm's Law, ATmega328P microcontroller, IOT Wi-Fi Module, LCD.

I. INTRODUCTION

The main function of the electrical transmission and distribution system is to transport electrical energy from the generation unit to the consumers. It can be carried out by overhead as well as underground system. When we are coming to the fault detection on the system, it is easy to detect fault in overhead lines, but in case of underground cable it is quite difficult to locate the fault and necessary to detect the fault position accurately to supply efficiently. Hence, study of cable failure and development of accurate fault detection method has been important topics in the past and present however, this fault detection technology for underground power distribution system still in developing stage.

This Paper illustrates how a fault on any phase can be detected in underground cable with the help of ATmega328P microcontroller and upload all the details regarding fault on internet through IoT (Internet of Things) module. Hence, the data can be browsed from anywhere and prevention action can be taken easily.

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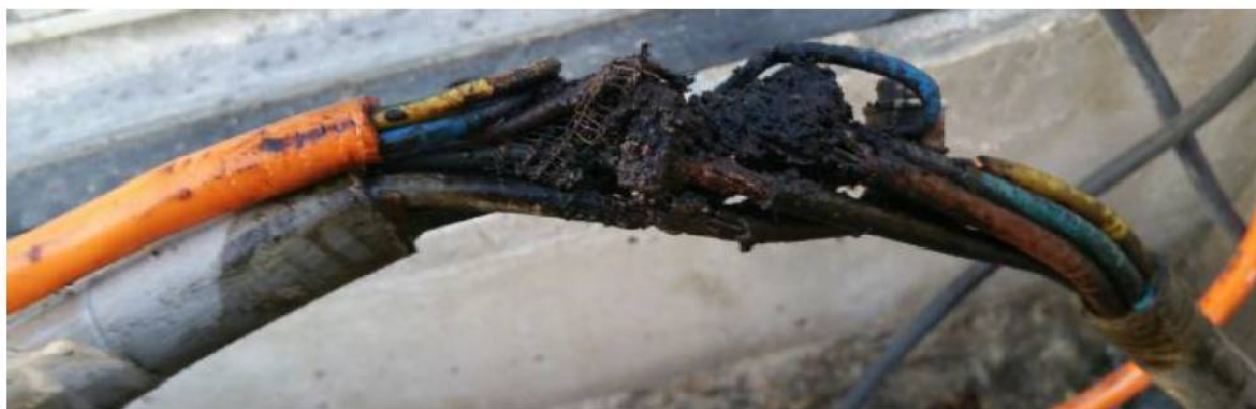


Fig.1: Cable Damaged due to fault occurred

The Paper is based on ground fault that is when the conductor of the cable comes with in contact with earth, it may be a single line to ground fault or double line to ground.

II. LITRATURE SURVEY

Frequent fault in underground cables due to the breakdown of paper plastic insulation due to chemical reaction or poor workmanship during installation and the difficulties in locating the approximate fault area have been a serious problem. Most Underground Faults are located by unearthing the entire length of cable to enable visual inspection to be carried out. In case where visual inspection is not helpful then the entire length of cable is replaced. This manual method is not only expensive but also results in heavy loss of revenue to the power distribution company. This research is aimed at designing an underground cable fault location distance detection to solve this problem. The research work will help in identification and location of underground cable fault without unearthing the entire length of the cable before repair or replacing entire cable due to difficulty in locating the fault.

Blavier's Test – When a ground fault occurs in a single cable and there is no other cable then Blavier's test can be performed to locate the fault in a single cable .In other words, in the absence of a sound cable to locate fault in a cable then measurements of the resistance from one side or and is called Blavier's test. Ground fault of a single cable can be located using Blavier's test. In this kind of test, low voltage supply, an ammeter and voltmeter are used in bridge network. Resistance between one end of cable (sending end) and earth is measured while 'far end' is isolated from the earth.

III. BLOCK DIAGRAM

Fig.4 shows the basic block diagramfor "UNDERGROUND CABLE FAULT DISTANCE DETECTOR SYSTEM USING IOT WI-FI MODULE & MICROCONTROLLER". It shows the directions of input & output of signals as well as the regulated power supply of 5v to the each branch as per the circuit requirement. RPS-1 provide supply to the microcontroller, LCD display, and fault sensing circuit. Similarly, RPS-2 and RPS-3 give supply to relay driver & relays and IOT module respectively.

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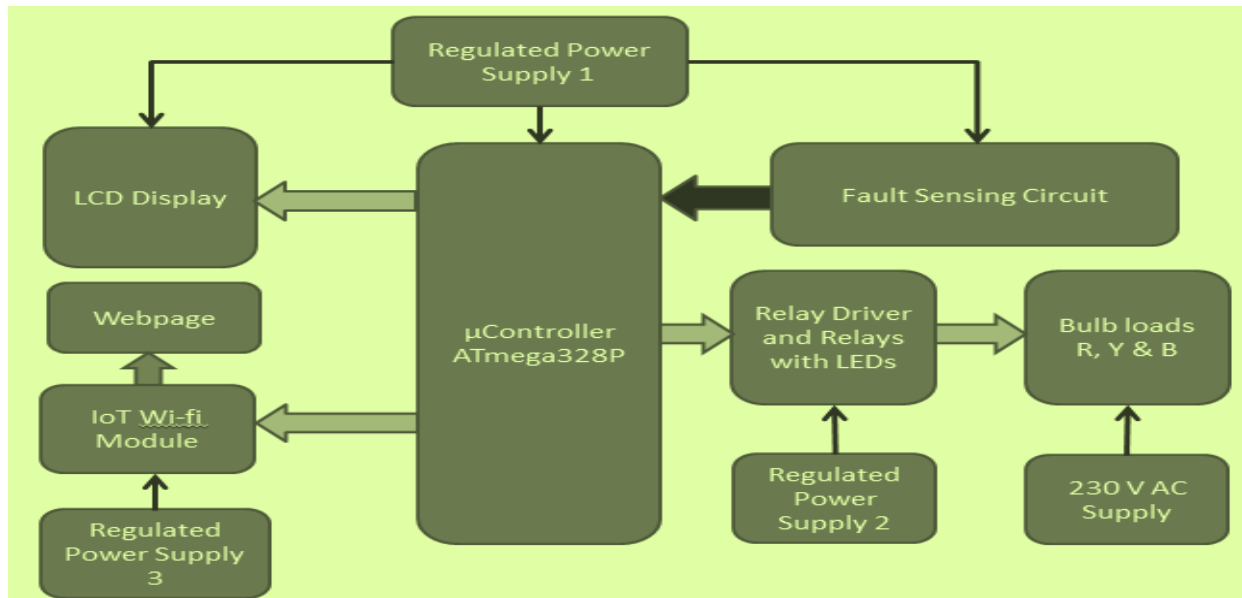


Fig.2: Block Diagram

IV. CIRCUIT DIAGRAM

It shows the actual working circuit diagram of entire system. In this, two nos..of adapter rating of 12 V are used to provide supply to the entire circuit through three nos. of voltage regulator for dc power supply of 5V. The working is self-explanatory.

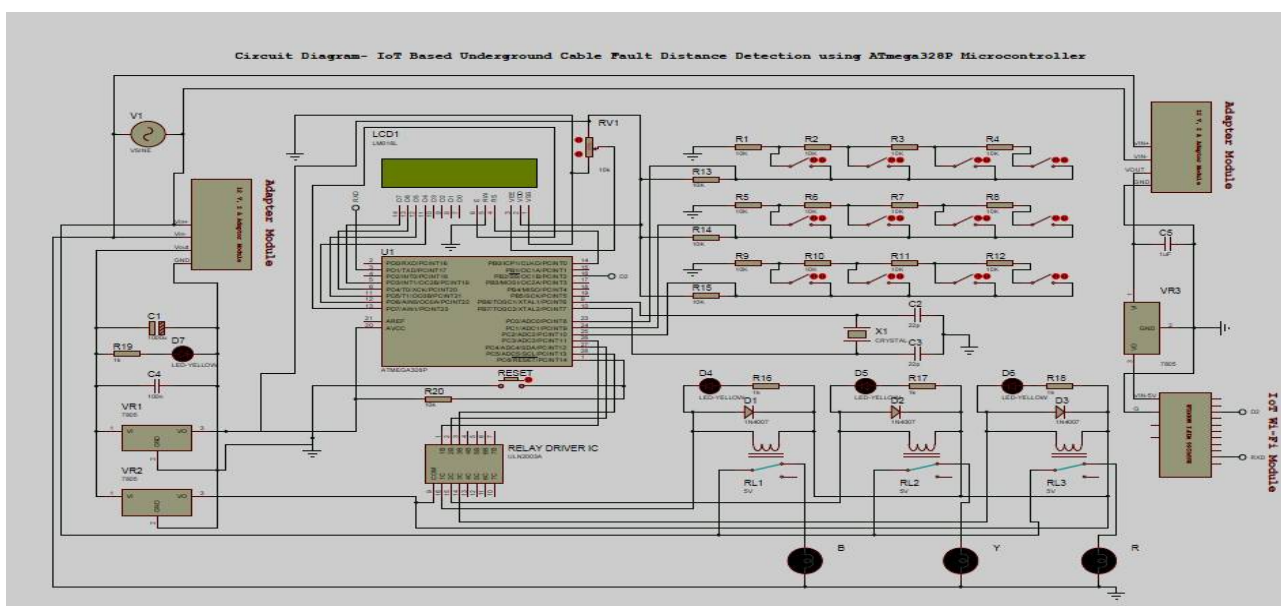


Fig.3: Circuit diagram

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V. WORKING OPERATION

The Paper is mainly based on the working principle of Ohm's Law. According to which, if a low dc voltage is applied at the feeder end through a set of series resistors in cable lines. The current would vary depending upon the location of fault in the cable, that is in case, there is short circuit in the form of line to ground, the voltage across series resistor change accordingly. Which is then fed to the ADC inbuilt in already programmed microcontroller to create the exact data, which would display the exact location of fault in Km as well as upload in the web page through IOT module. Hence we can browse the fault details from anywhere and the prevention action can take against it.

The Paper consist of two power supply adapter .This adapter is rating of 12V, 2A which provided a continuous power supply and there are three RPS is used to provide 5 V supply to the circuit as per the circuit requirement ^[6]. The first adapter is further connected to the first RPS. That will provide 5V supply to microcontroller, LCD as well as the set of register of fault sensing circuit. The second adapter is further connected to RPS2, RPS3. The second RPS is connected to the relay driver IC ULN2003A and the third RPS is connected to IOT module. The microcontroller ATmega328P consist of one input that is from the fault sensing circuit and three output that is to the LCD, IOT module and relay driver. One of the output of microcontroller connected to relay driver and further to the bulb load, which is use to indicate the fault in RYB phase. The other output of microcontroller fed to the LCD and IOT module, which is used to display the fault result on LCD and web page respectively.

In this Paper fault creation is made by a set of switches at every known distance in kilometre, As indicated by the set of register used to check accuracy of the same. When fault occurred at any distance in a phase (or 2 phase or 3 phase), current flows through the shorted line and developing drop across the corresponding phase register. This drop is sensed by the ADC inbuilt inside the microcontroller through port and process it into equivalent digital data. The microcontroller ATmega328P then process these data according to fault condition preprogramed into the microcontroller and then sends out display signal about the location of fault to LCD as well as to IoTWi-Fi module which finally displays the location of fault in kilometre and simultaneously send the signal to relay driver IC which further drives the bulb load connected to the relay. The microcontroller transmits the processed information to the IoT Wi-Fi Module through TxD-pin. The transmitted data is then received by IoT Wi-Fi module through RxD-pin which will upload the detected fault details onto the web page.

Fault Detection System Development:

The system shows Design and Development of hardware part of the fault detection system. Here we can absorb the Top and Bottom view of system during the development. The paper is designed to achieve monitoring of underground cable and provide information about detected fault.

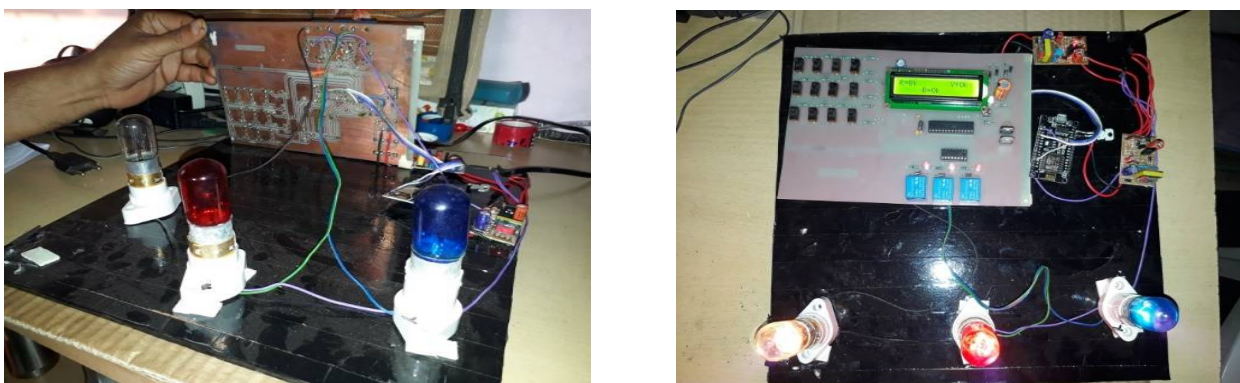


Fig.4: Top and Bottom View of Fault Detection System

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VI. RESULTS

Different outcomes of different fault sensed in the fault detecting system of LCD &IoT Connected PC are shown below:

Case 1: When a single line to ground fault detected at 2 Km in Y phase. Then the outcome is as follows:



Fig.5(a): LCD View for Fault at 2 Km

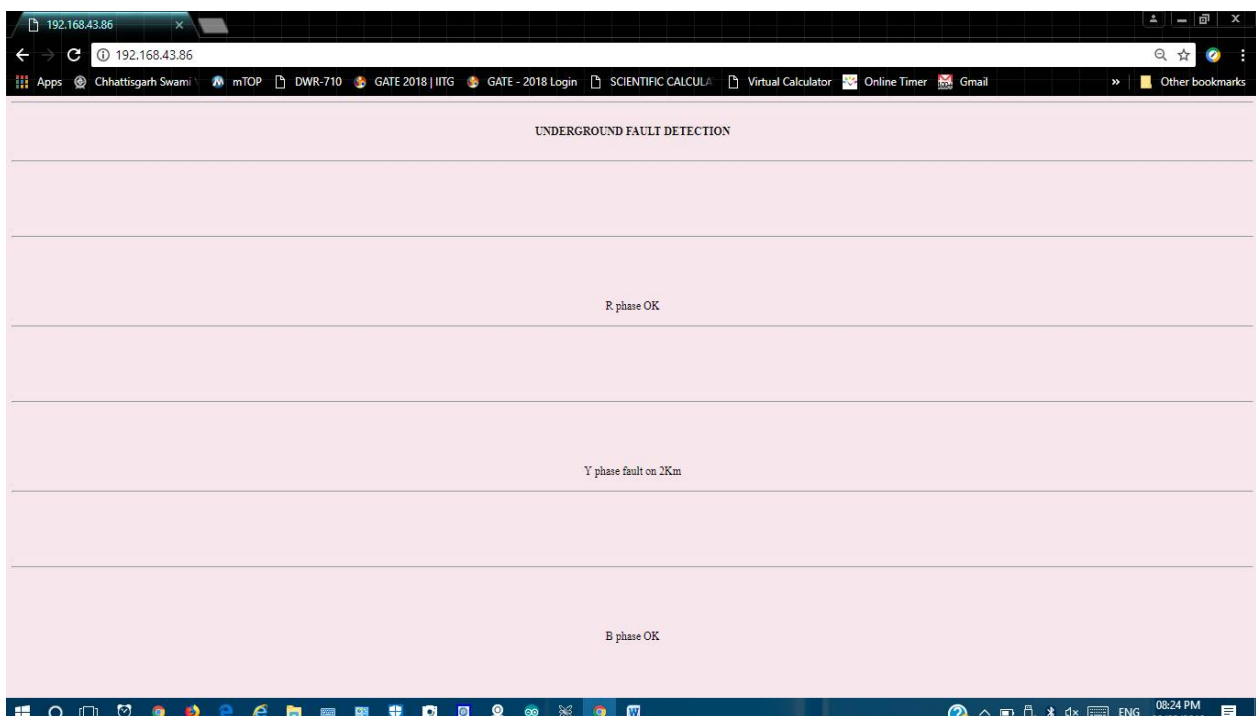


Fig.5(b): IOT Connected PC View for Fault at 2 Km

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Case 2: When a three phase fault is detected at 3 Km in R, Y, & B phase. Then the outcome is as follows:



Fig.6(a): LCD View for Fault at 3 Km

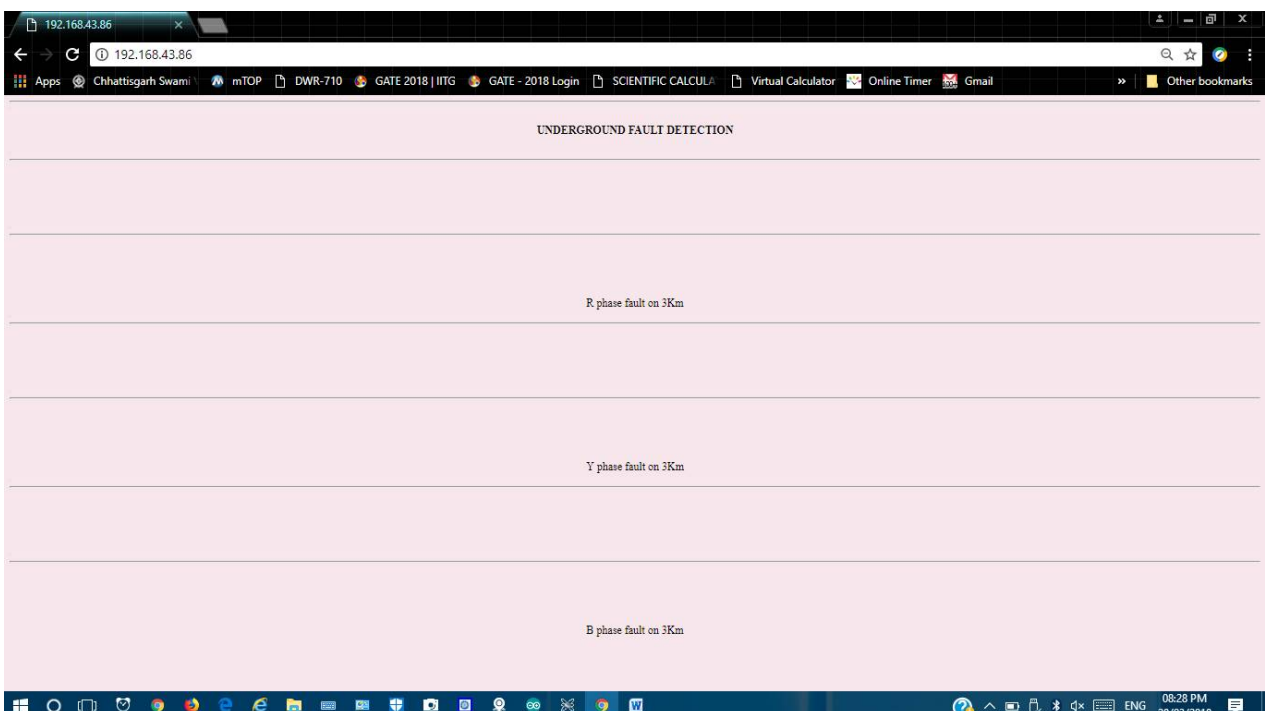


Fig.6(b): IoTConnected PC View for Fault at 3 Km

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VII. CONCLUSION

This paper explained the basic concept of fault detection through Ohm's Law so that the fault which are to be occurred in fault line can be easily and efficiently detected with the help of above stated system. The fault results are uploaded to the web page through IoT Wi-Fi Module. So it is easy to browse the fault details and can easily take action for repair and maintenance to ensure the continuity of power supply, it improves the system performance and help to reduce the operating expense as well as maintenance time.

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