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UNDER GROUND FAULT DETECTOR CABLE

Mr. Aadesh Kiranao Ghule[1], Mr. Omkar Dadaso Sature[2], Prof. Santosh Lavate[3]
Student, Electronics and Telecommunication Engineering, AISSMS IOIT PUNE[1, 2]
Asst. Professor, Electronics and Telecommunication Engineering, AISSMS IOIT PUNE[3]
aadeshghule01@gmail.com@gmail.com , omkarsature.4567@gmail.com , santosh.lavate@aissmsioit.org

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Abstract: ***Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents etc. Diagnosing fault source is difficult and entire cable should be taken out from the ground to check and fix faults. The project work is intended to detect the location of fault in underground cable lines from the base station in km using a PIC16F877A controller. To locate a fault in the cable, the cable must be tested for faults. This prototype uses the simple concept of Ohms law. The current would vary depending upon the length of fault of the cable. In the urban areas, the electrical cables run in underground instead of overhead lines. Whenever the fault occurs in underground cable it is difficult to detect the exact location of the fault for process of repairing that particular cable. The proposed system finds the exact Location of the fault. The prototype is modelled with a set of resistors representing cable length in km and fault creation is made by a set of switches at every known distance to cross check the accuracy of the same. In case of fault, the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data to a programmed PIC IC that further displays fault location in distance.***

The fault occurring distance, phase, and time is displayed on a 16X2 LCD interfaced with the microcontroller. IoT is used to display the information over Internet using the Wi-Fi module ESP8266.A webpage is created using HTML coding and the information about occurrence of fault is displayed in a webpage.

Keywords: *Underground Cable, Fault Location, Location Methods, Microcontroller, Webpage.*

I INTRODUCTION

Power supply networks are growing continuously and their reliability getting more important than ever. The complexity of the whole network comprises numerous components that can fail and interrupt the power supply for end user. For most of the worldwide operated low voltage and medium voltage distribution lines, underground cables have been used for many decades. Underground high voltage cables are used more and more because they are not influenced by weather conditions, heavy rain, storm, snow and pollution. Even though the cable manufacturing technology is improving steadily; there are still influences which may cause cable to fail during test and operation. A cable in good condition and installed correctly can last a lifetime of about 30 years. However cables can be easily damaged by incorrect installation or poorly executed jointing, while subsequent third party damage by civil works such as trenching or curb edging.

Types of Faults in Cables

Open Circuit Fault

When there is a break in the conductor of the cable, it is called open circuit fault of the cable. The open circuit fault can be checked by megger. For this purpose, the three conductors of the 3-core cable at the far end are shorted and earthed. Then resistance between each conductor and earth is measured by a megger. The megger will indicate zero resistance in the circuit of the conductor that is not broken. However, if the conductor is broken, the megger will indicate infinite resistance in its circuit.

Short Circuit Fault

When two conductors of a multi-core cable come in electrical contact with each other due to insulation failure, it is called short-circuit fault. The two terminals of the megger are connected to any two conductors. If the megger gives zero reading, it indicates short-circuit fault between these two conductors. The same step can be repeated for other conductors taking two at a time.

Earth Fault

When the conductor of the cable comes in contact with earth, it is called earth fault or ground fault. To identify this fault, one terminal of the megger is connected to the conductor and the other terminal connected to earth. If megger indicates zero reading, it means the conductor is earthed. The same procedure is repeated for other conductors of the cable [4,6].

This project is used to detect the location of fault in digital way. Locating the faulty point in an underground cable helps to facilitate quicker repair, improve the system reliability and reduced outage period. The article has been organised as follows. Section 2 discuss about different methods used to detect the location of fault in underground cables. Section 3 describes the basic principle of the proposed fault locating method. Section 4 briefly explains the working of the proposed system with a help of flow chart. Section 5 presents the circuit which is a prototype model for the proposed system. Section 6 gives the simulation of the work using Proteus 8.5 Professional software. The section also explains the hardware implementation and the results. Section 7 Provides conclusion and future scope of the work.

II PROBLEM STATEMENT

Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents etc.

Diagnosing fault source is difficult and entire cable should be taken out from the ground to check and fix faults. The project work is intended to detect the location of fault in underground cable lines from the base station in km using a controller. To locate a fault in the cable, the cable must be tested for faults.

III PROPOSED SYSTEM

The proposed system is an IoT enabled underground cable fault detection system. The basic principle behind the system is Ohms law. When fault occurs in the cable, the voltage varies which is used to calculate the fault distance. The system consists of Wi-Fi module, microcontroller, and Real-Time Clock. The block diagram of the fault detection system is shown in the Figure .The power supply is provided using step-down transformer, rectifier, and regulator. The current sensing circuit of the cable provides the magnitude of voltage drop across the resistors to the microcontroller and based on the voltage the fault distance is located.

IV WORKING PRINCIPLE

Underground cables are prone to a wide variety of faults due to underground conditions, wear and tear, rodents etc. Diagnosing fault source is difficult and entire cable should be taken out from the ground to check and fix faults. The project work is intended to detect the location of fault in underground cable lines from the base station in km using a PIC16F877A controller. To locate a fault in the cable, the cable must be tested for faults. This prototype uses the simple concept of Ohms law. The current would vary depending upon the length of fault of the cable. In the urban areas, the electrical cables run in underground instead of overhead lines. Whenever the fault occurs in underground cable it is difficult to detect the exact location of the fault for process of repairing that particular cable. The proposed system finds the exact location of the fault. The prototype is modeled with a set of resistors representing cable length in km and fault creation is made by a set of switches at every known distance to cross check the accuracy of the same. In case of fault, the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise digital data to a programmed PIC IC that further displays fault location in distance. The fault occurring distance, phase, and time is displayed on a 16X2 LCD interfaced with the microcontroller. IOT is used to display the information over Internet using the Wi-Fi module ESP8266.A webpage is created using HTML coding and the information about occurrence of fault is displayed in a webpage.

V SYSTEM TESTING AND RESULTS

The fault detection system is simulated using Proteus 8.5 professional software and the fault information is displayed in the LCD. The Fault display message is shown in the table 2. The work “IoT Based Underground Cable Fault Detector” is an efficient system as it reduces the time to detect the exact location of fault.

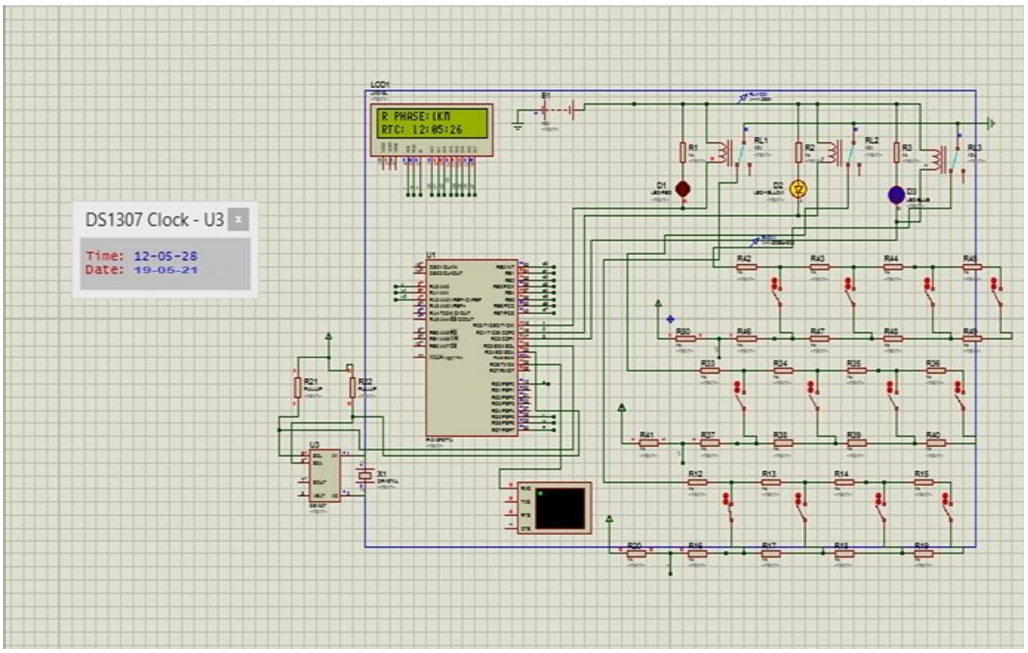

Figure 1 Simulation of the System using Proteus

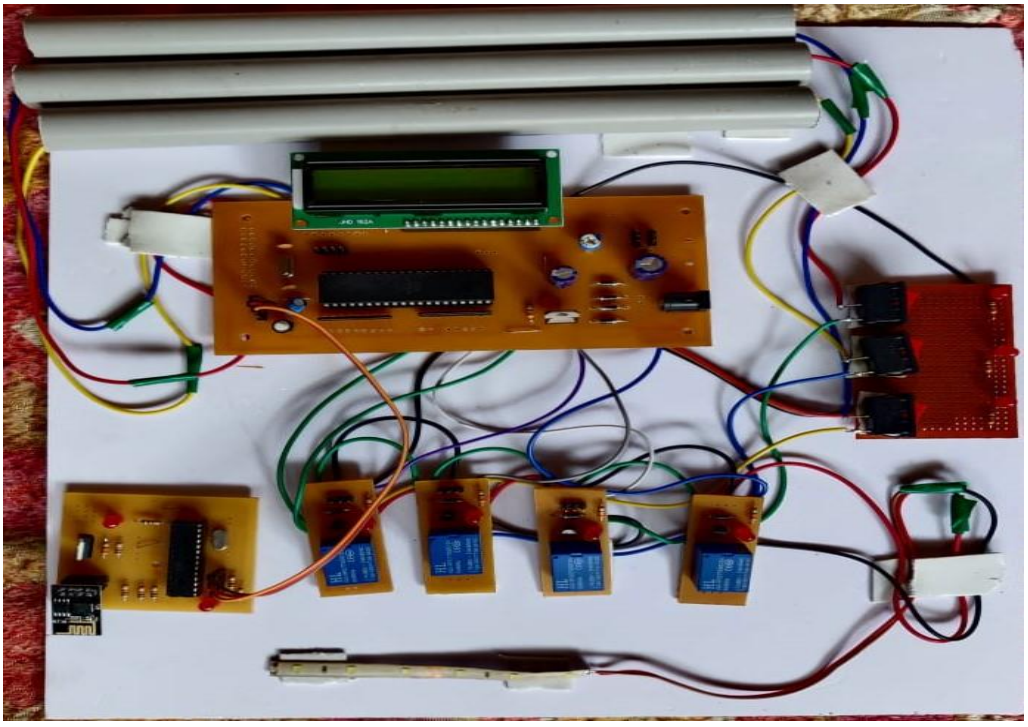

Figure 2 Hardware Setup of the System

VI CONCLUSION

The short circuit fault at a particular distance 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 PIC 16F877A and ESP8266 Wi - Fi module in a webpage. The benefits of accurate location of fault are fast repair to revive back the power system, it improves the system performance, it reduce the operating expense and the time to locate the faults in the field.

VII FUTURE SCOPE

The work can be extended for open circuit fault, short circuit Line to Line Fault (LL) and double Line to Ground Fault (LLG). The open circuit fault can be detected using a capacitor in ac circuit which measures the change in impedance and calculate the distance of fault.

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