Fault Identification of an Electrical Cable Remotely using IOT

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Abstract

Now a days in most of the metropolitans cities underground electrical cable system is commonly followed for electricity as well as for telephone line in major areas. Due to underground wiring it is very very difficult task to find the exact unknown location in cable whenever the fault occurs. Also it becomes cumbersome process to fix it. The aim of the paper is to detect proper locations of the fault in the cable and send data to website with help of IOT module and simultaneously it will get displayed on LCD display for continuously monitoring purpose of the system by using IOT technology [1]. Research work has been focused on dealing with the faults in underground electrical cables which has to be identify correctly and displaying information of source, destination and fault on display screen. Use the basic important concepts of Ohm's law has been used for implementation of idea. Basically the use of Ohms law is that the current get varies according on the length of the fault of the underground electric cable. The system which is proposed is able to find the proper location of fault. A successful results has been received.

Keywords: *Microcontroller, ADC, IoT, Fault sensing*

I. INTRODUCTION

Due to rapid development growth everywhere there are different types of construction activities are going on. During the road work, there are many possibilities of damage to underground cable used for various purposes. Generally, underground cables meet unexpectedly different types of problems due to aging and faults also. It is very necessary to maintain reliability of system which used underground power cables [3]. To overcome the issues there is requirement to reduce faults which occurred in underground cables and to remove these faults using different methods. Recently in distribution systems because of safety considerations and also enhanced reliability use of underground electrical cable is increasing day by day. Use of underground electrical cables has increasing widely in populated areas only because of safety issues and highly power requirements. The benefit of using underground electrical cables are not getting affected by any type of atmospheric conditions like storm, heavy rainfall, and also pollution. Immediately tracking of fault in underground electrical cable lines is its own drawback [2]. Day by day there is a improvement in cable manufacturing technology but still there are many failures occurred in testing and operation. A cable has lifetime of about 30 years when it is get installed correctly however, cables get damaged by incorrect installation or poor workmanship

A. Different Types of Fault Occurrence

Open Circuit Fault:

Open circuit fault in the electrical cable is nothing but the breaking of the electrical cable in the conductor. Open circuit fault in cable is checked by megger. Megger is also called Megohmmeter which is kind of ohmmeter is used to measures the electrical cable resistance of insulating components. The indication of zero resistance in circuit of conductor indicates that cable is not broken. If megger is indicating very very high resistance in the circuit that means cable in conductor is broken.

Short Circuit Fault:

Short circuit fault occurs due to insulation failures when pair of conductors of multi-core cable are comes into electrical contact with the each other. The both terminals of the megger are connected to any of two conductors. Indication of megger giving zero reading is that short circuit between two conductors.

Earth Fault:

If the conductor of the cable is comes into contacts with earth, which is also called as earth fault in cable or ground fault in cable. To recognize this type of fault, one type of the megger's terminal is connected to ground and one is conductor. Indication of zero reading provided by megger is that conductor is earthed.

B. Classification of Fault Location

Online Method:
By using this method, the sampled voltages and current is used to determined the fault point easily. The online method for electrical cable is very less than over-head lines.
Offline Method:
In offline method special type of instrument is used for testing out services of the electrical cable in that field. There is offline method which has two types as follows:

Tracer Method:
In such a kind of method by walking on cable lines fault point is detected. This method is used for searching the fault's location accurately.
Terminal Method:
This method is used for search out the fault location of electrical cable from one end or both the ends without tracing. This method used for locating the general area of fault.

II. PROBLEM STATEMENT

The certain frequents faults in underground electrical cables because of the breakage of the plastic insulation because of the chemical actions, reactions or also poor workmanship at the time of installation and difficulty in indicating the appropriate fault area have a very serious problem. Most underground electrical cable faults, that are situated by without earthing the whole length of armored cable to enable the visual inspection to the carried out. In this way, visual inspections are not helpful, then the whole length of the cable which is replaced. These type of solution is not only economically expensive but also long outage of electrical cables from services results in the more heavy losses of revenue for the company which distributes power, the production losses in the industries as well as critical conditions for the general public, hence the consumers can left it without the electricity for entire period taken to the unearth the electrical cable and carried out necessary repairs.

A. System Architecture

The system is mainly based on the principle of the Ohm's Law where the less DC voltage is supplied to the feeding terminal from fault sensing circuit. The working of the system states that when the current flows through the fault sensing circuit module the current will changes as per depending on the length of the electrical cable from the place of fault that occurred if there any short circuit fault with Single to ground fault, or Double to ground fault, or three phases to ground fault. The voltage drops at the series resistors which changes according and then the fault signal goes to internal ADC of the microcontroller to develop digital data. Then microcontroller will process the digital data and the output is being displayed in the LCD displayed as per fault conditions.

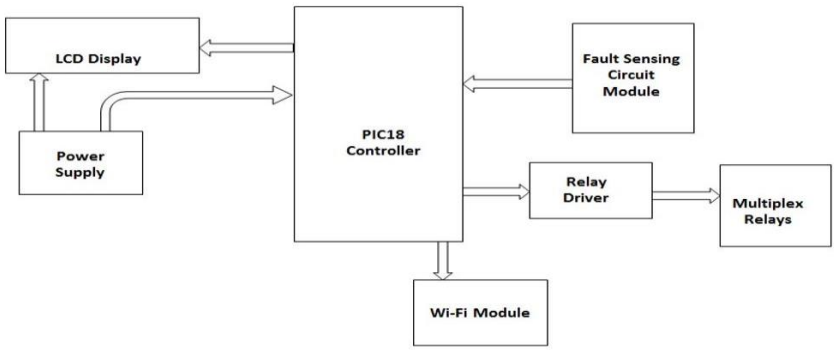

Fig. 1 *System block diagram*

B. *Fault Sensing Circuit Module*

The fault sensing circuit module is the combination of set of series resistors which is used for the cross checking the accuracy and set of the switches at each known distance[7]. There are four sets of a resistors in series in the circuit for each phase of the cable line. As shown in fault sensing circuit module for phase R there are series of R1, R2, R3, R4. Similarly for phase Y and B there are series of resistors R5, R6, R7, R8 and R9, R10, R11, R12. Also for supply line of

each phase, series resistors of R13, R14, and R15 are used as shown in module. The resistance values of the underground electrical cable for specific distance is representing by each set of four series resistors. Those resistors which are used in supply line of each phase develop a voltage drops corresponding to the occurrence of ground fault in one phase or two or three phases. The inbuilt ADC in PIC IC is used to sense the voltage drop. Figure 2 gives the fault sensing network module implemented.

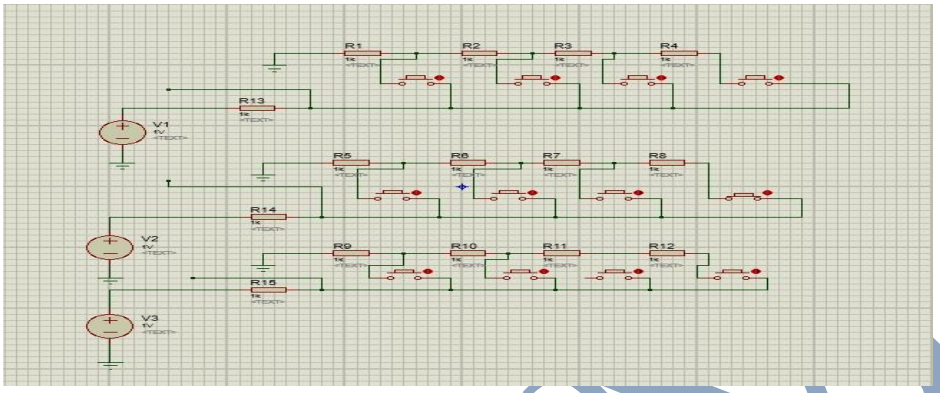

Fig. 2 *Fault sensing network module*

C. IOT – Internet of Things

The networking of physical devices, home appliances, vehicles and the other items combined with the electronics, , actuators, sensors, software and connectivity which active these objects to connect and exchange of data. The main objective or aim of IoT isn't only connecting the things such as devices, machines and appliances but also provides the authority to communicate, exchanging control of data and the other important information while executing applications. The IoT allows all the objects which is to be recognized or handled remotely across the existing network also creates an opportunities for direct integrations of physical network into computer based systems. IoT improves efficient quality, proper accuracy and economically benefits for reducing human intervention. Equipments and objects with in built sensors which are linked to an IoT system, which collects the data from the various devices and applies analytically to provides the most important informations with applications which built to address particular needs. These powerful IoT platforms [4] points appropriately that what information is useful and which can be safely be avoided. This information can be useful to find out the possible problems before they occur. The IoT consists of three different layers as shown in architecture of IoT namely perception layer, application layer, and network layer, [5].

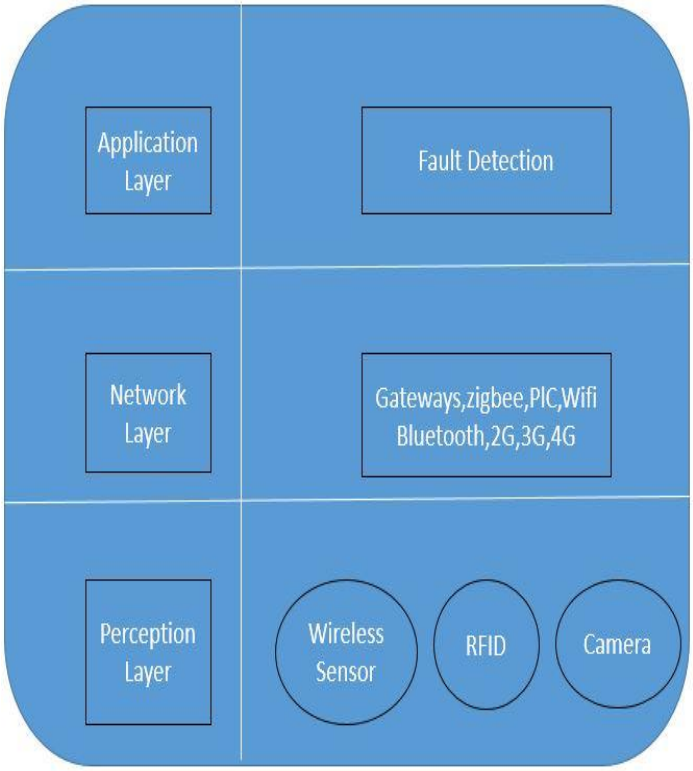

Fig. 3 *Architecture of IOT*

D. How IOT Works:

IoT consists of sensors and web enables smart devices that uses interactive hardware to integrate, send, embedded processors and behaves on information they acquired from their environmental conditions. IoT devices are used to transmits the sensor data in which they collects it by strap to an IoT passage or any other devices where data can be sent on the cloud system to be analyzed locally. Sometimes, this types of devices communicates with other connected devices and act on the informations they get from another. These devices completes most of the work without human interaction, although people can also communicate with these devices, at the instant, to set up these devices, access the data and give them instructions. The networking, connectivity and communication protocols used with these web enable devices mostly depending on the particular IoT applications implemented.

Benefits of IOT

The IoT provides various types of benefits:

- To monitor the overall business process.
- IOT required less time and also less money.
- To improves the customer's experiences;
- To making better business decisions.
- To generates more and more revenue.
- IoT provides ease of integrated and adapted business models.

Advantages of System

- Less maintenance.
- It has higher efficiency.
- Less fault occurrence in underground electrical cable.
- Underground electrical cable fault identification system is applicable to all the various types of electrical cable's range starts from 1kv to 500kv.
- Improved public safety.

III. CONCLUSION

The prototype modeled with fault sensing circuit module which contains the set of resistors represents the electrical cable linear measure in km and set of the switches representing the fault creation which is made by set of the switches at each known distance to checking the accuracy. When fault occurs, at that time voltage changes across the resistors which are in series accordingly, this is then applied to ADC to get proper digital data. Then, the precise digital data obtained from ADC is applied to a programmable PIC controller IC. Finally, it displays the fault locations in distance on 16X2 LCD which is interfaced with PIC microcontroller. In this project IOT is used by using Wi-Fi module ESP8266, which is used to displays the all information over internet. A page of website is generated through Wi-Fi module and the fault occurrence about information is displayed on created page of website. The barricade electrical cable fault at specific interval in the below the surface electrical cable is indicated to repair the fault without any difficulties using basic concepts of Ohm's law. The work displays the fault generated in electrical cable by using PIC18F458 on LCD.

IV. REFERENCES

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