# IOT Based Underground Cable Fault Detector

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***Abstract-*** *Cable faults are damage to cables which affect the resistance in the cable. If allowed to persist, this can lead to a voltage breakdown. To locate a fault in cable, the cable must first be tested for faults. This prototype uses the simple concept of ohm's law. The voltage drop can vary counting on the length of cable since the current varies. Detecting the fault is difficult and whole cable should be taken out from the ground to check and fix faults. While a fault occurs for some reason, such as due to ageing, wear and tear, rodents, underground condition. The project work is deliberate to detect the location of fault in underground cable lines from the base station using Atmega16 controller. This IOT technology is used to find the location of fault of the cable and send data in digital format to our website using an Wi-Fi module ESP8266. At the same time it display on the LCD screen.*

***Keywords***- Underground cable, Detection of fault, Atmega16 IC, IOT module ESP8266, 16X2 LCD display.

## I. INTRODUCTION

The objective of this project is to determine the distance of underground cable fault from base station. The underground cable system is a common practice followed in many urban areas. While a fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to unknown location of the cable. The proposed system is to find exact location of the fault in cable. Till last decades cables were made to lay overhead and currently it is lay to underground cable which is superior to earlier method. Because the underground cable are not affected by any adverse weather condition such as storm, snow, heavy rainfall as well as pollution. But when any fault occur in cable then it is difficult to locate the fault. Now the world is become digitalized so the project is intended to detect location of fault in digital way. When the fault occurs, the process of repairing related to that particular cable is very difficult. The fault of the cable mainly occurs due to many reasons. They are: inconsistent, any defect, weakness of the cable, insulation failure and breaking of the conductor. To overcome this problem, here is a project namely underground cable fault distance locator, used to find the location of the fault for underground cable. The proposed system detect the exact location of the fault and by the means of IOT its serially communicated towards server. As it is very difficult to find exact location or faulty location manually, which suddenly affects the efficiency of the cable wire due tolosses occured. Till now many techniques had already been implemented in order to detect fault in cable wire. But the problem came up is how to detect fault in cable wire when it is under grounded 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 IOT its serially communicated toward server.

Fault in cable can be classified into different types:

**1)Open circuit fault:** When one or more cable conductors (cores) break, it leads to discontinuity. This discontinuity also occurs when the cable comes out of its joint due to mechanical stress. This is known as open circuit fault.

**2)Short circuit fault:** When two or more conductor of the same cable come in contact with each other, then this is called a short circuit fault. It is impossible to detect visually without taking a cable apart. A short circuit fault occurs when the individual insulation of the cable is damaged.

**3)Earth fault:** When any of the conductors of the cable comes in contact with the earth, it is called an earth fault. This usually occurs when the outer sheath is damaged due to chemical reaction with soil or due to vibration and mechanical crystallization. It is somewhat similar to short circuit fault as the current again takes the least resistive path and flows through earth.

**Different Methods of Fault Location:** Free location methods can be classified into different types that are discussed below.

**1) Online Method:** Online method uses and process the sampled current and voltages to determine the fault points. This method for underground cable are less than above lines.

**2) Offline Method:** This method uses a special instrument to test out service of cable in the field. Offline method is classified into two methods such as tracer method and terminal method.

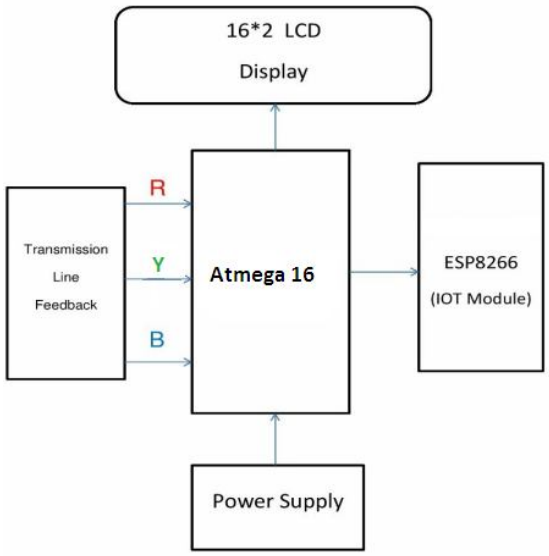
**3)Tracer method:** In this method fault of the cable can be detected by walking on the cable lines.Fault location is denoted from electromagnetic signal or audible signal. This method is used to find the fault location very accurately.

**4)Terminal Method:** Terminal method is used to detect the location of the fault in a cable from one end or both the ends without tracking. This method is used to findgeneral areas of the fault to accelerate tracking on buried cable.

## II. LITERATURE SURVEY

For electrical usage, transmission lines form the backbone of power systems. With regard to reliability and maintenance costs of power delivery, accurate fault location for transmission lines is of vital importance in restoring power services and reducing wastage of time as much as possible. Underground power cables have been widely implemented due to reliability and environmental concerns. To improve the reliability of a distribution system, accurate identification of a faulted segment is required. In the conventional way of detecting fault, an exhaustive search in larger scale distance has been conducted. This is time consuming and inefficient, Not only that the manpower resources are not utilized, but also the restoration time may vary depending on the reliability of the outage information. Hence an efficient technique to locate a fault can improve system reliability. Power systems need an accurate and automatic fault location method due to number of key factors namely: reliability of supply, quality of supply, reducing operating costs of repairs and charging staff works practices, and low tariff charges to maintain a competitive edge. The trend of transmission line construction from overhead to underground is increasing even though the underground system costs more for initial construction. However, the underground system requires faster detection and correction of accidental faults along the lines for more reliable service. Various methods have been developed to reduce damage and inference. But most of fault detection methods have shortcomings. Some have low accuracy, some are difficult to apply because of surrounding environment, and some give unwanted damage to healthy neighboring cable and facilities . Another method that is pulse echoing method is also used. This method use time difference between incident and reflected pulse to calculate fault location detection and it has relatively high accuracy because it use short period pulse. Although it has high accuracy, pulse echoing method has some drawbacks. When we apply this method to low impedance accident, the error will be increased. If cable is not open circuit and there is no impedance change, there are no reflected pulse waves, and it is difficult to find fault location. Because it is also very expensive system, on-line monitoring and fault location detection of cable using IOT is a better automatic digital way to locate faults.

## III. METHODOLOGY




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 fault of the cable in case there is a short circuit of LL or 3L or LG etc. The series resistor voltage drop changes accordingly which is then fed to an ADC to develop precise digital data which the programmed microcontroller would display the same in Kilo meters.The project is assembled with a set of resistors representing cable length in KMs and fault creation is made by a set of switches at every known KM to cross check the accuracy of the same.This is proposed model of underground cable fault distance locator using microcontroller. It is classified in four parts DC power supply part ,cable part,controlling part, display part. DC power supply part consist of ac supply of 230v is stepdown using transformer, bridge rectifier converts ac signal to dc & regulator is used to produce constant dc voltage.Next is controlling part which consist of analog to digital convertor which receives input from the current sensing circuit, converts this voltage into 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 display part consists of the LCD display interfaced to 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.

## IV. HARDWARE DESCRIPTION

The Hardware required for this system are as following.

1. Atmega 16
2. ESP8266 IOT module
3. 16x2 LCD display
4. Potential transformer
5. Bridge rectifier
6. Voltage regulator

## V. SOFTWARE DESCRIPTION

The Software required for this system are as following:-

1. AVR studio 4
2. Proteus 8

## VI. CONCLUSION

Through this project we simplified the actual problem of the detecting the fault inthe underground area. We discover the position or location were the fault will beoccur and also find the accurate distance of breaker point.The line to line, single line, line to ground fault in the underground cable is locatedto 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 helpof Atmega 16and ESP8266 Wi - Fi module in a webpage. The benefits of accuratelocation of fault are fast repair to reviveback the power system, it improves the system performance, it reduce the operating expense and thetime to locate the faultsin the field.

## VII. FUTURE SCOPE

1. 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.
2. GPS or GPRS can be also used to know the location of fault.

## VIII. ACKNOWLEDGEMENT

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