

# Arduino based underground cable fault detection

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**Abstract** – *This paper proposes fault location model for underground power cable using microcontroller. The aim of this project is to determine the distance of underground cable fault from base station in kilometers. This project uses the simple concept of ohm's law. When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in cable, since the current varies. A set of resistors are therefore used to represent the cable and a dc voltage is fed at one end and the fault is detected by detecting the change in voltage using an analog to voltage converter and a microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display.*

**Keywords**—*underground, cable fault, micro controller.*

## I. INTRODUCTION

Till last decades cables were made to lay overhead& 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 fault. So we will move to find the exact location of fault. Now the world is become digitalized so the project is intended to detect the location of fault in digital way. The underground cable system is more common practice followed in many urban areas. While fault occurs for some reason, at that time the repairing process related to that particular cable is difficult due to not knowing the exact location of cable fault. Fault in cable is represented as:

- Any defect
- Inconsistency
- Current is diverted from the intended path

### TYPES OF FAULT IN UNDERGROUND CABLES

*Most common types of fault that occur in underground cables are:*

1. Open circuit fault
2. Short circuit fault

1. Open Circuit Fault :When there is a break in the conductor of a cable, it is called open circuit fault. The open-circuit fault can check by a megger. For this purpose, the three conductors of the 3 core cable at far end are short tied and earthed. Then resistance between each conductors 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 a conductor is broken the megger will indicate an infinite resistance.

2. Short Circuit Fault: When two conductors of a multi core cable come in critical contact with each other due to insulation failure, it is so called as short circuit fault. Megger can also be used to check this fault. The two terminals of a megger are connected to any two conductors. If the megger gives a zero reading it indicates short-circuit fault between these conductors.

## II. LITERATURE REVIEW

for electrical usage, transmission lines from the backbone of the power systems. With regard to the reliability and maintenance cost 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 Arduino or microcontroller is a better automatic digital way to locate faults

## III. METHODOLOGY

The Project detects the location of fault in underground cable lines from the base station in kilometers using an arduino board. It uses the standard concept of ohms law i.e., when a low dc voltage is applied at the feeder end through a series resistor to the cable lines, then current would vary depending upon the location of fault in the short circuited cable. When there is a short circuit , the voltage across series resistors changes accordingly and fed to an ADC to develop precise digital data which the programmed arduino would display using lcd in kilometers. The project consists of series of resistors representing cable length in kilometers and fault creation is made by a set of switches/jumpers at every known km.

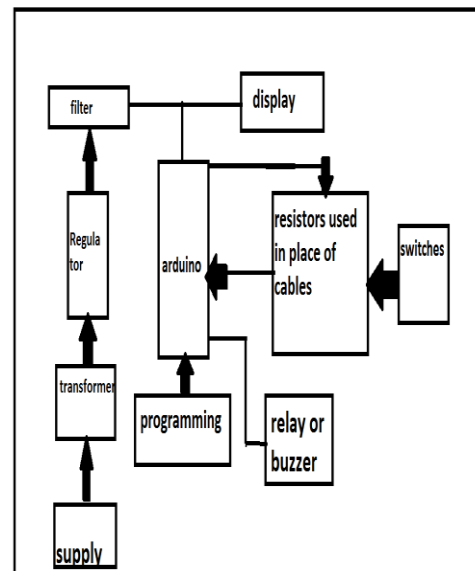


Figure 1. Block diagram for Cable Fault Detector

The hardware requirement of this project are LCD, Crystal, Relays/Buzzer, Transformer, Diodes, Voltage Regulator, Resistors, Capacitors, LEDs, slide switches, Arduino board Power supply- The 230V supply is stepped down to a 12V supply by a step down transformer which is then converted to DC using a bridge rectifier. AC ripples are filtered by using capacitor and filtered supply is then supplied to the input pin of voltage regulator 7805. At the output

of regulator we get a constant 5V DC supply which is supplied to the arduino and other components in the circuit.

1. Arduino- It is a powerful single board computer, an open source hardware platform allowing creating interactive electronic objects. It consists of arduino board, set of various analog and digital I/O pins, serial communication interfaces, including USB on some models, for loading programs from personal computers. Its platform provides an integrated development environment (IDE) based on the processing project, which includes support for C, C++ and Java programming languages. This method features an Atmel Atmega328 operating at 5v with 2kb RAM, 32kb of flash memory for storing programs and 1kb of EEPROM for storing parameters. The clock speed is 16 MHz which translates to executing about of 300,000 lines of C source code per second.

3. Liquid Crystal Display- Most common displays are 16\*2 and 20\*2 display. The standard refers to as HD44780U, which refers to the controller chip which receives data from an external source (LCD) and communicates with the LCD.

4. Rectifier- It converts ac into pulsating dc with the help of a bridge rectifier.

5. Voltage Regulators- It is required to maintain a constant voltage level. Here we use 7805 voltage regulator.

The Software requirement in this project are languages like Arduino programming language, embedded c etc.

#### IV. WORKING

Normally people have been using commercial voltage (230V). This voltage is step-down through step down transformer. Transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Generally, transformers are used to increase or decrease the voltages of alternating current in electric power applications. These stepdown voltage goes to rectifier unit.

Here the Rectifier is being used in the supply which converts the DC voltage to the AC Voltage supply 12V respectively. Now a voltage generated is more than the required so it is converted with the help of the voltage regulator. Here, we are using a

MC7508 voltage regulator as we are in need of 5V this regulator converts the 12V AC supply to 5V AC supply.

This supply is given to the LCD display and Arduino UNO

. Next, we move to the buzzer.

The buzzer plays a vital role that is whenever a circuit is disconnected or short circuited then the buzzer plays a sound or alarm that results in the indication of fault in the wire or junction.

#### V. OBSERVATIONS

From the below figure, we can clearly observe the input and output of the circuit that is the cable fault is given as input and the output is shown on the lcd display.

When the cable (resistors in series) i.e.  $j_1, j_2, j_3, j_4$  are maximum, when there is no short circuit results in maximum output or positive voltage giving an indication of no fault.

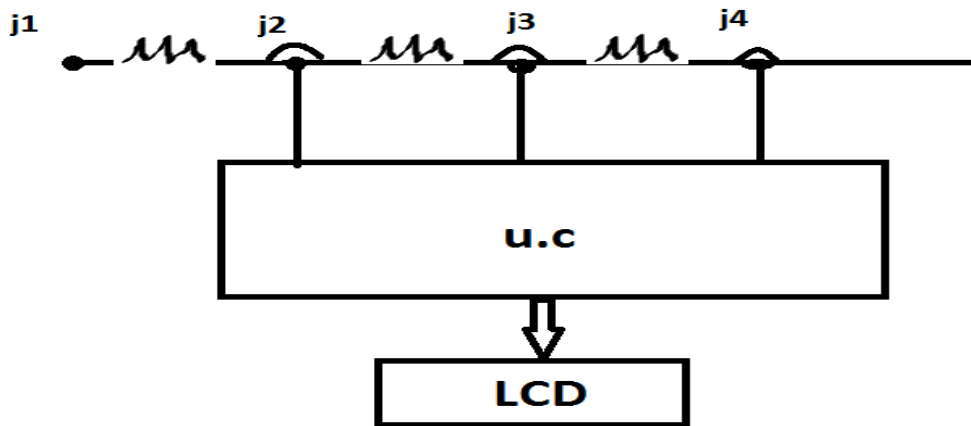
Similarly, when there is a fault in the cable i.e.  $j_1=0$  or  $j_2=0$  or  $j_3=0$  or  $j_4=0$ . Which is nothing but

there is a short circuit in the cable results in no voltage across the junctions which shows there is a fault in the circuit.

Due to the resistors values and voltage values across the junctions  $j_1, j_2, j_3, j_4$  we can calculate the current in the cable which is obtained from the ohm's law i.e.  $V=IR$

#### VI. CONCLUSION

It's a difficult task to identify the faults in underground cables. By using Arduino controller, we can find out exact the fault location. Once faults occur in the cable, the display unit displays the exact fault location that displays which phase is affected in the cable and how long it's affected and buzzer system is used to create an alerting signal which is helpful to the humans. Buzzer system create an alerting sound signal, once if the fault occurs to the underground cable



### Working of underground cable fault

#### References

- [1] Pooja.P.S, Lekshmi.M, 'Fault detection technique to pinpoint incipient fault for Underground cables, IEEE(2015),
- [2] Dhekale.P.M,Bhise.S.S, 'Underground Cable Fault Distance Locator', IJIER,(2015),Vol.2.
- [3] Fakhrul Islam, Md. Amanullah M T Oo, Salahuddin Azadl, . A.—Locating Underground Cable Faults: A Review and Guideline for New Developmentl , 2013 IEEE
- [4] Tarlochan, Sidhu, S., Xu, Zhihan, —Detection of Incipient Faults in Distribution Underground Cablesl, IEEE Transactions on Power Delivery, Vol. 25, NO. 3, JULY 2010
- [5] Darvhankar.G.S,Gharpande.A.S,Bhope.S.D,Mes hram.A.S,Bobad.A, 'Study of 3-ph Underground Cable Fault Locator Using Acoustic Method',SJIF,(2015),Vol. 2.
- [6] E.C.Bascom,—Computerized underground cable fault location expertise, lin Proc. IEEE Power Eng. Soc.General Meeting, Apr. 10–15,1994, pp. 376–382.J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rded., vol. 2. Oxford: Clarendon, 1892, pp.68–73.M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.