

Under Ground Cable Fault Detection using IOT

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Abstract—This paper proposes fault location model for underground power cable using microcontroller and the thing which is based on the internet means the information will transfer through the internet access. The purpose of this project is to get the location of underground cable using internet through the base station in kilometers. The concept is directly based in the Ohm's law, voltage drop can vary counting on the length of fault in cable because of the variation of the current. Here we use a group of resistor to represents the length of the cable in kilometers and a dc voltage is applied at one end and the fault is detected by changing the voltage using analog to voltage converters. The fault occurring at what distance is shown on LCD which is interfaced with the microcontroller that is used to make the necessary calculations.

Keywords: Underground cable, fault location, fault detection, location methods, Microcontroller.

1. INTRODUCTION

The main function of the electrical power system transmission line is to transfer electrical energy from the generation unit to the customers. We prefer underground cable instead of overhead for the transmission because the underground cable are not affected by any weather condition like lightning, high-speed, winds, earthquake earth tremors, snow, frost etc. But when a fault is occur at underground cable, it is difficult to find the location of the fault to clear the fault before it increases the damage to the power system. So we will move to detect the exact location of fault. Now the world 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 [1].

Fault in cable is represented as:

- Any defect and inconsistency.
- Caused by breaking of conductor & failure of insulation.
- Weakness or non-homogeneity that affect performance of cable.
- Current is diverted from the intended path.

Fault in cable can be classified in two groups:

- a. Open circuit fault: These faults occur due to the failure of one or more conductors. The most common causes of these faults include joint failures of cables an overhead lines, and failure of one or more phases of circuit breaker and also due to melting or conductor in one or more phases. Open circuit faults are also called as series faults and better than short circuit fault, because when these fault occurs current flows through cable becomes zero.
- b. Short circuit fault: Short circuit faults are also called as shunt faults. These faults are caused due to the insulation failure between phase conductor or between earth and phase conductors or both. Further short circuit fault can be categorized in two types:

Symmetrical fault: A symmetrical fault give rise to symmetrical fault current that are displaced 120° each other. Symmetrical fault is also called balanced fault. This fault occurs when all the three phases are simultaneously short circuited [2].

Unsymmetrical fault: The most common fault that occur in the power system network are unsymmetrical faults. This kind of fault gives rise to unsymmetrical fault current (having different magnitudes with unequal phase displacement). These faults are also called as unbalanced faults as it causes unbalanced current in the system.

2. FAULT LOCATION METHODS

Fault location methods can be classified as:

- a. Online method: This method utilize & process the sampled voltages & current to determine the fault points. Online method for underground cable are less than overhead lines.
- b. Offline method: In this method special instrument is used to test out service of cable in the field. There are two offline methods as following

Tracer method: In this method fault point is detected by walking on the cable lines. Fault point is indicated from audible signal or electromagnetic signal. It is used to pinpoint fault location very accurately.

Terminal method: It is a technique used to detect fault location of cable from one or both ends without tracing. This method use to locate general area of fault, to expedite tracing on buried cable.

3. SYSTEM DESCRIPTION :

The project depends on the 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 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 [3].

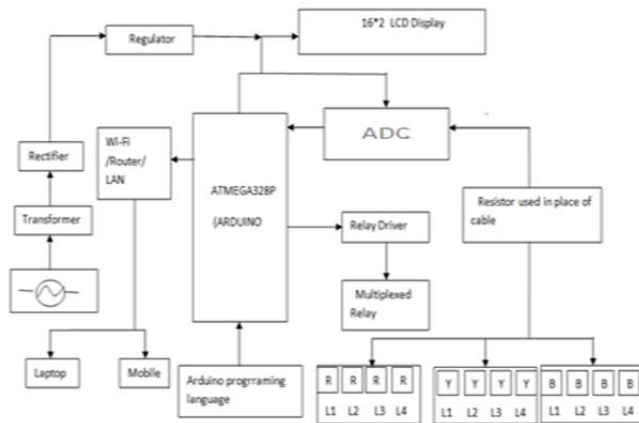


Fig. 1

This is proposed model of underground cable fault distance locator using Arduino . It is classified in four parts –DC power supply part (230v step down transformer, bridge rectifier converter and regulator), cable part, controlling part, display part. When a supply is applied to the step down transformer, its convert into low voltage. Then this low voltage is applied to bridge rectifier which convert ac signal to the dc signal and we used a regulator which produce constant dc voltage. In the cable part we use a set of resistor along with switches. Current sensing part are used as fault creators to indicate the fault at each location. This part senses the change in current by sensing the voltage drop [4].

After that there is a controlling part which consists of analog to digital converter that receives input signal from the current sensing circuit and converts this input signal into digital signal and send it to the microcontroller. The microcontroller also a part of the controlling units and makes a necessary calculation regarding the distance of the fault[4.. The microcontroller also drives a relay driver which in turn controls the switching of a set of relays for proper connection of the cable at each phase.

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.

POWER SUPPLY

A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to another and as a result, power supplies are sometimes referred to as electric power converters. A DC power supply is one that supplies a constant DC voltage to its load. Depending on its design, a DC power supply may be powered from a dc source or from an ac source such as the power mains[3].

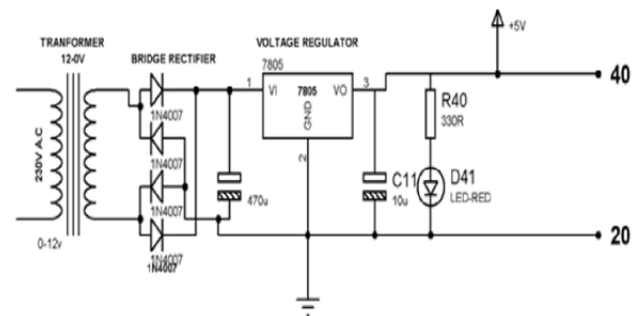


Fig. 2

TRANSFORMER

A transformer is a static device that transfer electrical energy from one circuit to another circuit through a medium of magnetic field and without changing frequency.

RECTIFIER

The bridge rectifier is used to convert an ac in to dc voltage using both half cycles of the input ac voltage. The circuit has four diodes connected to form a bridge. The ac input voltage is applied to the diagonally opposite ends of the bridge. The load resistance is connected between the other two ends of the bridge.

VOLTAGE REGULATOR:

A voltage regulator is used maintain a constant voltage level. In this project, we require 5V and 12V power supply. To get this voltage level 7805 and 7812 voltage regulator are use. Here the first number 78 represents the positive supply and 05 and 12 represents the output voltage levels.

LCD

Liquid crystal display are interfacing to microcontroller ATMEGA328P. We are using 16*2 liquid crystal display. Here 16*2 represents 16 rows and 2 column.

RELAY

A relay is an automatic device by means of which an electrical circuit is indirectly controlled and is governed by a change in the same or another electrical circuit.

Relay is a sensing device which senses the fault & send a trip signal to circuit breaker to isolate the faulty section.

MICROCONTROLLER

Microcontroller is on chip true microcomputer. Atmel atmega328p (Arduino) is most popular microcontroller producing in world market . it increases reliability. Hardware is less because of single chip microcontroller. Smaller access time and speed is high.

4. RESULT AND CONCLUSION

In this paper we detect the exact location of short circuit fault in the underground cable from feeder end in km by using microcontroller ATMEGA328P (ARDUINO).For this we use simple concept of OHM's law so fault can be easily detected and repaired.

Underground Cable Fault Detector

LINE 1 **OK** LINE 2 **OK** LINE 3 **OK**

Case 1 (If there is no fault)

Underground Cable Fault Detector

LINE 1 **2km** LINE 2 **OK** LINE 3 **OK**

Case 2 (if there is a fault at line 1 within 2 km)

Underground Cable Fault Detector

LINE 1 **2km** LINE 2 **2km** LINE 3 **2km**

Case 3 (if there is fault at all three cable within 2km)

5. FUTURE SCOPE

In this project we detect only the location of short circuit fault in underground cable line, but we also detect the location of open circuit fault, to detect the open circuit fault capacitor is used in ac circuit which measure the change in impedance & calculate the distance of fault.

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