



Underground Line to Ground and Open Cable Fault Detection

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ABSTRACT

The main objective of this project is to detect the underground cable fault. This proposed system is based on standard ohm's law. In many urban areas the underground cable system is followed in common practice. This proposed system us to determine the distance of underground cable fault from base station in kilometres by using arduino. This system in not only find the exact location of the fault but also open cable fault detection. The project is a set of resistors representing cable length in kilometres. The fault creation is made by a set as switches at every known KM to cross check the accuracy of the same. In a particular distance the fault occurs and the respective phase is displayed on a LCD .The LCD is interfaced with arduino. The ohm's law used in this project which describes the when the dc voltage applied to the feeder end through a series resistors (cable lines), then current vary depending upon the fault location of the cable. In short circuit case,(line to ground) the voltage across series resistors is accordingly changes, which is fed to inbuilt ADC of arduino board to develop precise digital data for display in kilometres . In this project capacitor in an ac circuit to measure the impedance which can even locate the open circuited cable and short circuited fault only using resistors in DC circuit.

Keywords: Cable Fault Detection, Arduino,

1. Introduction

The transmission line is mostly used in large scale. To find the fault of transmission line by underground method and its use and application over a large area. The installation cost of underground cable is more as compared to the overhead cable; but the reliability of underground cable is more as compared to overhead cable. Underground cables give more benefits than the overhead cable , it ensures safety, unaffected by adverse effects like rainfall, thunder, snowfall, storms. The possibilities of more fault is less in underground cable. In underground cable, to find out the exact location of fault is very difficult because it is deep in the soil. When we don't know the exact location of fault which is result in waste of time and manpower. So it is necessary to find out the exact location of the faults in underground cables.

Types of faults in underground cables can be classified as:

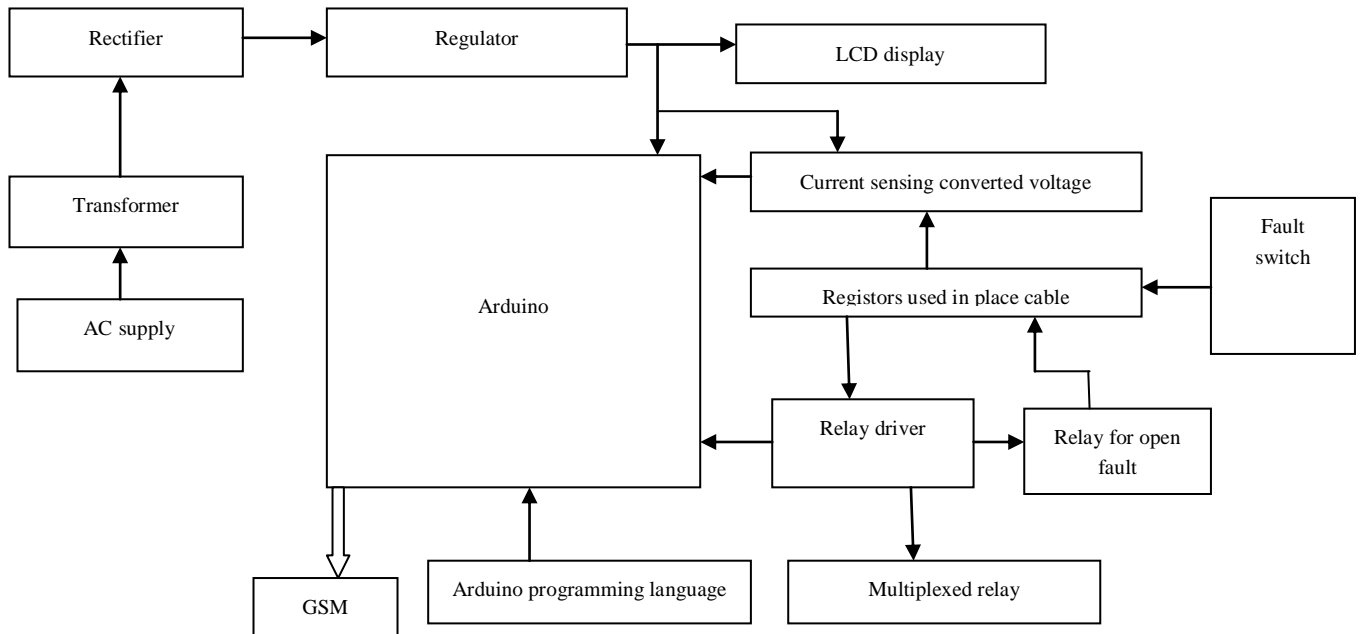
1. Open circuit faults
2. Short circuit faults

A. Open circuit fault: Open circuit fault happens when one or more phase conductor wire break .The value of current such faults becomes zero and the load signal gets isolated from the generation side. The failure of one or more conductors such faults are occurs. Most common causes of this faults is joint failure of conductors and overhead lines , and failure of one or more phase of circuit breaker due to melting of fuse or conductor. This types of faults are also called as series fault.

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2. Block Diagram



Working

This project is used to determine the underground cable fault distance from base station in kilometers using arduino board. When fault is occurs due to some reason, the processing process is related to that particular cable is very difficult due to unknowing the exact location of the cable fault. This project is used to detect short circuit fault, low voltage fault and high voltage fault. This proposed system is used to identification and also to send the detail information of the fault in the cable.

This developed project is works on the basis of standard ohm's law i.e., when a low voltage DC supply is applied to the end of the feeder through a series resistor (cable lines), then current is vary depending upon the fault location in the cable. In the case of short circuit fault or line to ground fault, the voltage across the series resistors changes accordingly, then it is fed to inbuilt ADC of arduino board to develop precise digital data for display in kilometers. To find out the open fault we have arranged some relay set at two stages as per the user requirements. At the first step, the first stage of relay set is present in the middle of the cable becomes on and providing ground to all cables. Due to ground is connected to the middle , the beginning point of voltage is changed. If voltage is not changed it means the open fault is present between the starting point to the middle relay point. To find out the open fault between the second stage relay and middle point first stage there are some concepts is applicable for the second stage relay.

- (a) Short circuit fault detection
- (b) Open circuit fault detection

- (a) Short circuit fault detection

The work has been carried out assuming a 3 core cable i.e. one that comes with 3 conductors. Three conductors are indicated as red, green and blue. The resistance of fault cable is different from faultless cable. In a place of cable some resistors are used as switches to create faults in a cable. When the fault is occurs in a cable so resistance of a cable will be change, by the use of voltage divider rule distance cab be calculated. Each resistor represents a 2 km distance, so here 4 resistors are present. In this proposed system maximum 8 km distance will be considered. Whenever the fault will be created in a cable then by using voltage divider rule the switch divides the voltage at particular location and it will sends to the microcontroller, which is integral part of the arduino board. To detect this voltage code has been written in the form of analog signal. The ADC is inbuilt in the arduino which used to convert the analog value into digital. Then finally value will be displayed on the LCD in the digital form.

- (b) Open circuit fault detection

Open circuit fault can be detected by the measuring the capacitance between the two wires. Accordingly to the length of the cable capacitance will be change. The length of a cable varies based on the location of the cable. When the cable is open then the parallel wire capacitance of the cable will be reduced. On this basis we calculate the exact fault location. All these information will be send through a SMS and data over GSM network the product has SIM card holder to which activated SIM card is inserted for normal use. To receive the SMS and alert to the EB person and take the immediate action to the drop the power fault.

2.1 Transformer

In this system we used voltage transformer. One of the main reason that we use alternating AC voltages and currents in our homes and workplace's is that AC supplies can be easily generates at a convenient voltage, transformed into much higher voltages and distributed. The reason for transforming the voltage to a much higher level is that higher distribution voltages implies lower currents for the same power and therefore lower I^2R losses along the networked grid of cables. The voltage transformer can be thought of as an electrical component rather than an electronic component. Basically transformer is a static device which works on Faradays law of electromagnetic induction by converting electrical energy from one value to another. In the mutual induction transformer operates on the principle of electromagnetic induction.

2.2 Rectifier

Rectifier converts A.C. into pulsating D.C. The output of the transformer is fed to the rectifier. The rectifiers are half wave or full wave rectifier. In this proposed system bridge rectifier is used. Bridge rectifiers are used because of its advantages, it should have good stability. In the rectification process, rectifier is an electrical device which converts alternating current which periodically reverse direction into direct current which flow in one direction. Rectifiers have many uses but they are serving as components of DC supplies and high-voltage direct current power transmission systems. The bridge rectifier circuit is a common part of the electronic power supplies.

2.3 Arduino

Arduino is a open source platform. It is used for building electronic projects. The Arduino platform is quite popular with people just starting out with electronics, and for good reason. Arduino is consists of physical programmable circuit board and a piece of software or IDE that runs on your computer. It is used to upload and write computer code to the physical board.

2.4 Relay

A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts. A relay is electrically operated as a switch. The solid state relays controls the power circuits with no movable parts. Sometimes relay is used to protect electrical circuits from faults or overload.

2.5 Relay driver

In order to drive the relay, we use transistor and only less power can be possibly used to get the relay driven. If the base once gets power that is sufficient current to make more current flow from emitter to collector of transistor. Relay driver plays important role in this project. Driver circuit is used to boost or amplify signals from micro-controller to control power switches in semi-conductor devices.

2.6 LCD

LCD (Liquid Crystal Display) screen is an electronic display module. It is used to find a wide range of applications. In this proposed system 16*2 display that means per line 16 characters and there are 2 such lines. Command and data type registers are used in this system. The data registers are used to stores a data and it will display such data on LCD screen. In the display screen of LCD ASCII value of the character is displayed.

3. Advantages

- 1) Low maintenance of project.
- 2) Less consumption of water.
- 3) Easy to handle.
- 4) Improved public safety.
- 5) It absorbs emergency power loads.
- 6) Require a narrower band of land to install.

4. Disadvantages

- 1) Relay requires 12 V dc.
- 2) In rural areas network problem is occur.
- 3) The arduino and other component require 5 V dc supply.
- 4) Angular value required time to read so some delay will be occur.

5. Application

- 1) In communication systems.
- 2) It is used in those areas where overhead cables become impossible.
- 3) Using these cables we transmitted and distributed the electrical power.
- 4) Less fault is occurs in underground cable.

6. Conclusion

Thus the project on underground cable fault detection using arduino was done and the distance of the fault from the base station in kilometers was displayed for three individual phases R, Y and B. When the fault switches are operated to fault condition then the phase corresponding to that particular switch is considered as the faulty phase. So the fault can easily located . Circuit can be tested with the different resistors values to simulate various fault conditions. In this project up to 4 km faults can be detected.

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