Underground Cable Fault Detector Using Arduino and GSM

Mrs. N.Lakshmipriya[1],M.Ayyappan[2],A.Ganeshan[3], N.Surya[4], T.Ravikumar[5]
[1] AP, Dept of Electrical and Electronics Engineering
[2, 3, 4, 5]Dept of Electrical and Electronics Engineering
[1, 2, 3, 4, 5] Jai Shriram Engineering college,Tirupur.

Abstract- *In urban areas underground cables are used over than that of over head line. In cables faults are generally caused by excessive internal test, accident, excessive external stress, mechanical stress and others. When a cable is faulty the resistance of such cable is affected and Detecting fault source is difficult and entire cable should be taken out from the ground to check and fix faults. The challenge with the existing methods used for locating faults in underground cables is the inaccuracy calculating the distance where the fault is located and the low durability of such equipment. The fault occurring phase, distance, time is displayed on a 16X2 LED interfaced with the microcontroller and buzzer used to indication purpose.*

Keywords- Underground cable, Arduino kit, LCD, buzzer.

I. INTRODUCTION

The objective of this project is to determine the distance of underground cable fault from base station in kilometers using an Arduino board. The underground cabling system is a common practice followed in many urban areas. A digital method is used to trace out the precise location of the fault. The data is interconnected with a website and on board LED display, GSM module and internet of things. Usually occurring faults are open circuit fault, short circuit fault, earth fault. As soon as the fault occurs, the repairing associated with that exact cable fault is incredibly tough. The system relies on finding the exact distance of underground cable fault from the base station. A low voltage DC is applied to the feeder end through cable lines. The voltage varies based on location of the fault occurred in the cable. The variation of voltage depends upon the resistance values of that cable. The signal is fed to the Arduino microcontroller that is preprogrammed and also the fault distance is send to the individual through SMS.Unlike the overhead cables, the underground cables are made to curb electromagnetic induction and to withstand various soil conditions. In order to serve its purpose, the underground cables are manufactured in thick protective layers, and with varying diameters depending on the depth of earth it is buried, and its volts-amp rating. Generally, underground cables for transmission are of less diameter than those for distribution. If allowed to persist, this can lead to a voltage breakdown. To locate a fault in the cable, the cable must first be tested for faults. This prototype uses the simple concept of OHMs law. The current would vary depending upon the length of fault of the cable. This prototype is assembled with a set of resistors representing cable length in Kilo meters and fault creation is made by a set of switches at every known Kilo meters (km's) to cross check the accuracy of the same. The fault occurring at what distance and which phase is displayed on a LCD interfaced with themicrocontroller.When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in cable, since the current varies CT is used to calculate the varying

II. DIFFERENT CABLE FAULTS AND SOLUTIONS

Open circuit fault

An open conductor fault is where the conductor of a cable is completely broken or interrupted at the location of the cable fault. It is possible to have a high resistance shunted fault (to ground) on one or more sides of the faulted conductor's location.

We know resistance of cable per meter, Rx/meter,

Cable capacitance per meter = Cx/meter
Total cable length = Lx
Total capacitance of cable = Ct = Cx+Lx
Fault location = measured capacitance / (Cx/meter).

Short circuit fault

A shorted fault is characterized by a low resistance continuity path to ground (shunted fault). The resistance from the conductor to ground is lower than the surge impedance of the cable for a shorted low resistance fault.

If fault occurs as short circuit,

Rm = Ry+Rp

Rm = measured resistance
Ry = resistance of shorted cable1
Rp = resistance of shorted cable2
Cable fault distance = (Rm/Rx)/2.

III. EXSISTING METHOD

- Online method
- Offline method
- Tracer method
- Terminal method

From the above researches we made a conclusion that when we are talking about underground fault it really becomes a tough job.

ONLINE METHOD

From this method we need to take sample voltage and current. After respective calculation fault point identified.

OFFLINE METHOD

In this technique special instrument used to trace fault point of cable. There is two major types,

1.Tracer method
2.Terminal method

TRACER METHOD

The fault of the cable is detected by walking on the cable in this technique. Magnetism or perceptible signal is applied on the cable to identify the fault.

This system helps in location of fault accurately.

TERMINAL METHOD

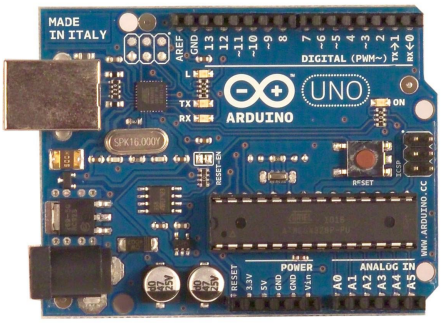
In this system is utilized to chase general areas of the fault on buried cable. The above method gives solution for dealing with the problems only to alert the personnel.

IV. PROPOSED SYSTEM

Whenever we press the switch, fault is created, and the arduino which is already preprogrammed senses the voltage changes and The fault distance is calculated. Arduino coding is done by using embedded C language and Arduino software. The LCD which is interfaced with the Arduino displays the fault occurring region and the fault distance is sent to the respective person through mobile. Also, these data is sent to a dedicated website by using a GSM. A webpage is created by usingFreeboard.io open source software. The fault is indicated to the personal by an alarming signal using a buzzer system.

ARDUINO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.



It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

GSM MODEM

In this project as we have explained that consumer and the service provider will be informed about the energy consumption whenever the threshold value of energy is exceeded. So, for this purpose we have used Global System for Mobile communication (GSM). GSM is a standard for wireless communication and one can send data through this in the form of SMS..

There are many types of GSM modems are used.It working different frequency of operation and it depends upon the residing country. Here in this project we have selected GSM900A GSM module. Quad band 850/900/1800/1900MHz.).Which is compatible with our network. It is used for the purpose of sending message from the hardware we have designed to the consumer .

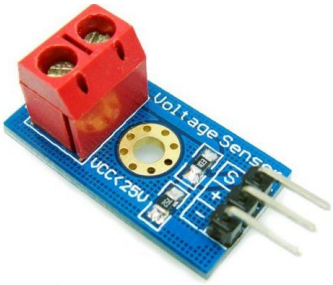
GSM has been selected for communication due to the following advantages

1. It is reliable.
2. It is economicaly low cost.
3. Data is sent in encrypted form thus secure.
4. It is more efficient.
5. Supply voltage 3.4-4.4V
6.Low power
7.Operating temperature -40+85C

Below is the figure of GSM modem which we have used.

VOLTAGE SENSOR

Ideal for situations where power quality is an issue, Voltage Watch sensors facilitate monitoring of supply voltage levels



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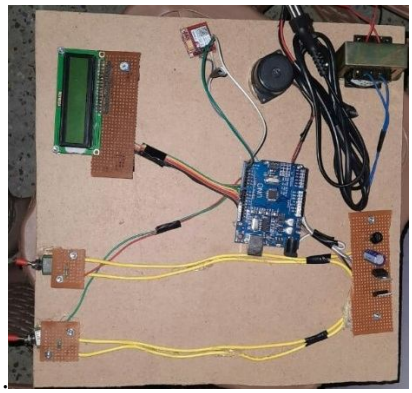
They identify under voltage or overvoltage concerns and help protect critical motors and electronics. Because they have an industry-standard 4–20 mA output, they are easily coupled to a data logger, panel meter or PLC for real-time monitoring and reporting.

CURRENT SENSOR

A current sensor is a device that detects electric current (AC or DC) in a wire, and generates a signal proportional to it. The generated signal could be analog voltage or current or even digital output. It can be then utilized to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system or can be utilized for Control purpose



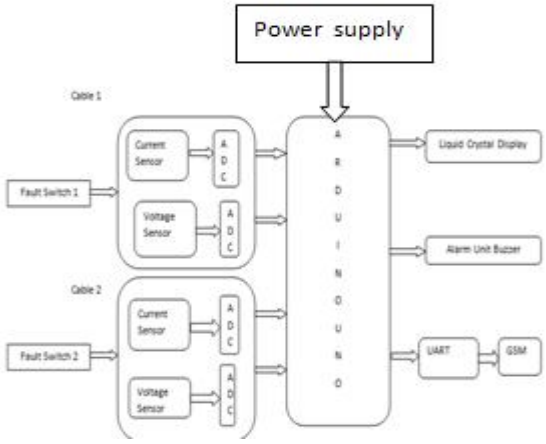
Output Kit

LCD

The liquid crystal material may be one of the several components, which exhibit optical properties of a crystal though they remain in liquid form. Liquid crystal is layered between glass sheets with transparent electrodes deposited on the inside faces.

When a potential is applied across the cell, charge carriers flowing through the liquid disrupt the molecular alignment and produce turbulence. When the liquid is not activated, it is transparent. When the liquid is activated the molecular turbulence causes light to be scattered in all directions and the cell appear to be bright.This phenomenon is called dynamic scattering

V. BLOCK DIAGRAM



VI. CONCLUSION

Detecting the exact location of the fault in underground cables is a difficult task. The exact location of the open circuit fault and short circuit faults are identified from the proposed system. The data is sent to a dedicated website and alert the respective person through SMS by using a GSM module. On account of fault in the cable, the Buzzer alarm is used to alert the person if he is not using the mobile. The following are the merits of the proposed system

- Less Maintenance
- This method is applicable to all types of cables
- Cost-effective
- Less complexity
- More safety

This prototype can be able to sense the exact location of different faults like earth, short and open circuit fault in UG cables from the feeder end. In future, this project may be intended to detect even minute faults occurring in any region. This work can also be extended to detect faults by calculating impedance at each phase.

VII. FUTURE SCOPE

This project prototype detects the exact fault location of various faults like earth short and open circuit fault in underground cables from feeder end of line. In future this project a may be intended to detect even minute faults occurring in any region . Also this prototype can be extended to detect faults over large area. The future scope of this projects are find the insulation of the cable, emf generation in the cable, check the power quality at instantly line.

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