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UNDERGROUND CABLE FAULT DETECTION USING GSM ALERT MODUL

Jayashree Bera[1], Mayur Mangate[2], Ritik Ankar[3] ,
Sahil Meshram[4], Dr. G. H. Agrawal[5]

[1,2,3,4]Students of Electrical Engineering Department in KDK College of Engineering, Nagpur
[5]Professor of Electrical Engineering Department in KDK College of Engineering, Nagpur

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Abstract - Power cables are used to supply electricity. We put them underground so there won't be any interference. Finding the exact position of the occurring faults becomes quite difficult as a result. There are numerous causes of faults, including construction, earthquakes, and excavating. Due to the fact that the fault's position within the line is unclear, the maintenance procedure for that particular line is challenging. The project's goal is to identify and locate the underground cable fault. This system is based on the concept of Ohm's law. The suggested method involves identification, sending information about the problem to the appropriate authorities through GSM, and cutting off the power supply for everyone's safety. It will be also able to detect the exact location where the fault has been occurred. GSM module, it is capable of sending notification via SMS which consists of fault type and its location to authorized person. In this way the system minimizes the time as well as money.

Keywords: GSM, Underground cable fault, Electricity, Location.

1. INTRODUCTION

The underground cable fault detection and identification system demonstrated in this paper based on power electronics and embedded systems that is used to identify two different types of faults that can occur in underground or on-surface power transmission lines[1]. Finding the precise position and nature of a problem requires a lot of work and time when maintaining underground electricity transmission lines or cables. This system is created to address this issue. It has the ability to recognize and locate defects like short circuit and leakage issues. It has the ability to locate flaws as well as identify them. It employs a differential op-amp and microcontroller to monitor current fluctuations while using current sensing across all three phase lines[4]. For current sensing it uses four shunt resistors and dual differential op-amps attached in series with R & B phase lines.

When a fault is found, the system alerts the appropriate person through SMS message alert with the type of fault and its position as well as by displaying the fault and its type on an LED panel and beeping it with a buzzer[3]. This device can sense current flowing across phase lines with the aid of differential op-amps and shunts thanks to some internal calculations performed by the microcontroller. The microcontroller then continuously monitors this current to detect faults and their types. The LED panel has four LEDs; one of them is used to identify the fault type (open-circuit or leaking), and the other three are used to display the location of the fault in 3-phase lines as a binary pattern.

Underground cables are widely utilized in power distribution networks thanks to the benefits of underground connection, involving more security than overhead lines in inclemency, less susceptible to damage by storms or lightning. It is less costly for shorter distance, eco- friendly and low maintenance. But if any fault occurs in cable, then it is difficult to locate fault[2]. So, this system is employed to detect the situation of fault in digital way. The main purpose of locating the faulty point in an underground cable in order is to ease quicker repair, improve the system stability and reduced blackout period. The underground cable system is very convenient for distribution mainly in urban areas such as, metropolitan cities, airport and defense services.

2. LITRATURE REVIEW

This system makes use of the simple idea of Ohm's law, where a low DC voltage is delivered at the supplier end through a series resistor. If there is a short circuit, LL fault, 3L fault, LG fault, etc., the current will vary based on the length (in km) of the cable fault. According to the defect, the series resistor voltage drops vary, which is then passed to an analogue to digital converter to create digital data, which is then displayed in KMs by the programmed microcontroller. In order to test the accuracy, faults are generated by a set of switches at each known KM using a set of resistors that indicate cable length in KMS.

This is a recommended microcontroller-based model for an underground cable problem. DC power, supply, cable, controller, and display sections comprise its four divisions. Bridge rectifiers convert alternating current to direct current, regulators generate constant dc voltage, and a 230-volt ac supply is employed as part of the DC power supply. Switches and a group of resistors depict the cable's component. To demonstrate the defect at each point, a series of resistors and switches representing the current detecting portion of the cable are employed as fault generators[6]. The current change is detected by this component via detecting the potential drop. Next is controlling part which comprises of analog to digital converter which receives input from the current sensing element, converts this voltage into digital signal and feeds the microcontroller with the signal[7]. The microcontroller is also a part of the controlling unit and makes necessary computations regarding the distance of the fault.

The microcontroller also operates a relay driver which controls the switching of a set of relays for interconnection of the cable at each phase. In case fault occur, it sends messages through GSM and display the distance on LED screen KMs and

cellphone. The proposed technique is used not only for identification but also it is used to send the detail information about the fault to the authority using GSM and also it cut the power supply on that particular location for the security of the people. It also used to display the type of the fault in LCD display. Whenever a fault occurs in a cable the buzzer produces the sound to alert and to take an immediate action.

3. PROPOSED METHODOLOGY

The objective of this system is to determine the distance of underground cable fault from base station in kilometers using AVR microcontroller. 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 not knowing the exact location of the cable fault. The proposed system is to find the exact location of the fault.

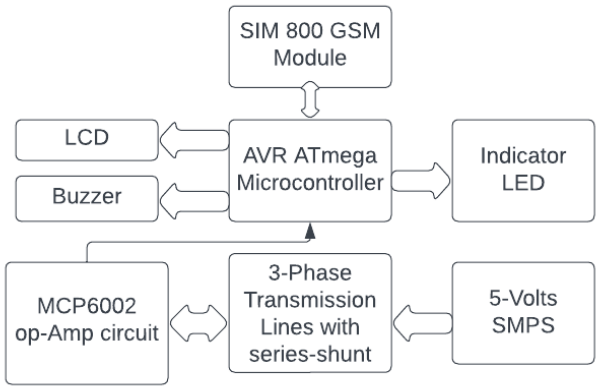

Fig -1: Block Diagram

The Underground Cable Fault Detection & Identification circuit consists of various electronic & electrical components and devices as shown in circuit diagram. The circuit is mainly divided into three units which are made up of various passive and active electronics components and devices such as microcontroller, operational amplifier IC, GSM module, buzzer, regulator IC, transformer, LEDs, resistors, capacitors, etc. The complete circuit is powered through a power supply unit mainly consisting a step-down transformer, a full bridge rectifier, filter capacitors, and a 5v voltage regulator. The step-down transformer is used to convert high-voltage AC of 220v into low-voltage AC of 12v.

A GSM (Global System for Mobile Communications) modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone which is helpful to send information about the fault to the user. Hence user will get update of occurrence of fault in kilometer from base station[6].

In this system GSM module, for sending notification via SMS which consists of fault type and its location to authorized person

4. COMPONENT DETAILS

AVR AT-Mega Controller

The advanced version of a microprocessor is a microcontroller that includes a CPU, Interrupts controller, RAM, ROM, I/O unit, etc. A microcontroller is mainly used for the operation of high-speed signal processing in an embedded system. So, it performs like a major component while designing an embedded system. There are different kinds of microcontrollers available which are used based on requirements like 8051, PIC, AVR, etc. So, this article gives brief information on one of the types of microcontrollers namely the AVR microcontroller.

Fig -2: AVR atmega328P

LCD

Fig -3: LCD 16x2

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely,

Command and Data. The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

SIM 800 GSM Module

Fig -4: SIM 800 GSM Module

The SIM800L is a GSM module from Simcom that gives any microcontroller GSM functionality, meaning it can connect to the mobile network to receive calls and send and receive text messages, and also connect to the internet using GPRS, TCP, or IP. Another advantage is that the board makes use of existing mobile frequencies, which means it can be used anywhere in the world. The SIM800L is a GSM module with a serial interface. It can send and receive text messages and receive phone calls. It can also connect to the internet and receive FM signals.

The SIM800L GSM/GPRS module is a miniature GSM modem that can be used in a variety of IoT technology. You can use this module to do almost anything a normal cell phone can do, such as sending SMS messages, making phone calls, connecting to the Internet via GPRS, and much more.

Buzzer

Fig -5: Buzzer

A buzzer is a small yet efficient component to add sound features to our system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications.
There are two types of buzzers that are commonly available. The one shown here is a simple buzzer which when powered will make a Continuous Beep. sound, the other type is called a readymade buzzer which will look bulkier than this and will produce a Beep. Beep. Beep. Sound due to the internal oscillating circuit present inside it.

Power Supply

Fig -6: Adaptor Power Supply

The onboard circuit is not very complexed, it uses minimal and basic components in order to perform its operation. The circuit contains a step-down transformer which lowers down the 220V AC(input) to 5V AC, once the voltage is stepped down to 5V it is then passed through four diodes which act as a rectifier and convert the AC voltage into DC voltage. After which a series of capacitors and resistors are used to filter out the AC components and provide a pure 5V DC output.

5. RESULT

After getting the Fault location data it is sent to Mobile Number using GSM Module. The SMS includes distance of location and its coordinates as link and using this link the Fault location can be clearly monitored using Google Maps.

6. CONCLUSION

It is discovered that the subterranean power cable's short circuit defect may be efficiently corrected utilizing a fault switch, the simple understanding of Ohm's law, and the voltage divider rule. On the LCD panel, the error is visible and the user receives a notice. Due to the circumstances beneath the ground, including wear and tear, rats, etc., underground cables are prone to a variety of problems. Additionally, it might be challenging to locate the cause of a defect. To see the complete line and correct flaws, the entire line must be dug. Consequently, in order to identify the precise location of the fault, we now suggest subterranean

cable fault detection. The ability to service underground cables more quickly is made possible by money and effort.
With the use of a voltage divider network installed across the cable, the system can identify faults. A certain voltage is produced whenever a defect happens according to the resistor network configuration. The PIC microcontroller detects this voltage and uses GSM to alert the user of a problem.

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