Underground Cable Fault Distance Conveyed Over GSM

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Abstract: This paper proposes fault location model for underground power cable using microcontroller. The aim of this work is to determine the distance of underground cable fault from base station in kilometers. It uses simple concept of ohm's law. When fault occurs, there will be a variation in current and hence voltage drop also vary depending on the length of fault in a cable. 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. Microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display and the same is conveyed to the remote mobile using GSM module.

Key words: Underground cable, fault distance, ADC, microcontroller, GSM module.

I. INTRODUCTION

UNDERGROUND 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 order to reduce the interruption time during fault, i.e., to restore services by determining a faulted segment in timely manner. In the conventional way of detecting a fault, an exhaustive search in larger-scale distance has been conducted. This is time-consuming and inefficient. Not only that the manpower resource is not utilized, but also the restoration time may vary depending on the reliability of the outage information. As such, deriving an efficient technique to locate a fault can improve system reliability. Use of underground power cable is expanding due to safety considerations and enhanced reliability in the distribution and transmission systems in recent times .Due to safety reasons and high power requirements in densely populated areas, use of underground cable has seen a sharp hike in recent times .Till last decade's 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.

II. FAULT LOCATION TECHNIQUES

In general, fault location techniques for underground cable network can be categorized in two groups:

1) Tracer method:- The tracer method is an exhaustive way to locate a faulted segment by "walking" through the cable circuits. A faulted segment can be determined from audible or electromagnetic signals and requires dispatching crew members to the outage area. There have been various techniques largely used in the industries, including the tracing approach through acoustic, electromagnetic or current.

2) Terminal method:- The terminal method is a technique used to determine a fault location of a distribution cable network from one or both ends without tracing exhaustively. A bridge technique is one of the most popular terminal methods that links with a resistor to determine a fault location .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.

FODT Sensor (Fiber Optic Distributed Temperature Sensor**) To Fault Detection Of XlPE Insulated Underground Cable**

The FODT sensor, which is applied to fault detection of XLPE insulated underground cable in resistance grounded power system, can find fault point immediately.

If a fault occurs in an underground power cable it is necessary to find the fault point as quickly and accurately as possible. Although Murray loop method and pulse radar method have been extensively used for cable fault locating, the fault line needs to be removed from service and connected to detection equipment, which will take much time and effort. In the present paper, a new fault location method, which integrates fiber optic distributed temperature (FODT) sensor into cable, is introduced.

Principles Of Fodt Sensor Fiber optic distributed temperature (FODT) sensor, Which is used for fault detection in XLPE insulated Underground cable, is one of functional type optic fiber sensors. The principle of FODT sensor is that the intensity of the Raman back-scattering light varies with the temperature of the cable.

III. BLOCK DIAGRAM OF UNDERGROUND CABLE DISTANCE CONVEYED OVER GSM

In this paper we have used the simple 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 3L 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.

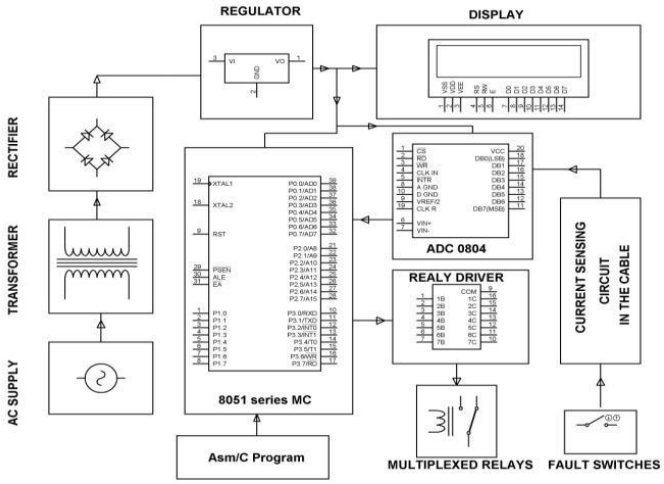

Fig.1: Underground Cable Distance Conveyed Over GSM

Fig 1 represent proposed model of underground cable fault distance locator using microcontroller. It is classified in four parts –DC power supply part, cable part, controlling part, display part. DC power supply part consist of ac supply of 230v is step-down using transformer, bridge rectifier converts ac signal to dc & regulator is used to produce constant dc voltage. The cable part is denoted by set of resistors along with switches. Current sensing part of cable represented as set of resistors &switches are used as fault creators to indicate the fault at each location. This part senses the change in current by sensing the voltage drop. Next is controlling part which consists of analog to digital convertor which receives input from the current sensing circuit, converts this voltage into digital signal and feeds the microcontroller with the signal. The microcontroller also forms part of the controlling unit and makes necessary calculations regarding the distance of the fault. 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.

IV. ALGORITHM AND COMPONENTS

Algorithm:
Step1:Initialize the ports, declare timer, ADC, LCD functions.
Step2:Begin an infinite loop; turn on relay 1 by making pin 0.0 high.
Step3:Display "R:" at the starting of first line in LCD.
Step4:Call ADC Function, depending upon ADC output, displays the fault position.
Step5:Call delay. Step6: Repeat steps 3 to 5 for other two phases.

Power Supply The power supply circuit consists of step down transformer which is 230v step down to 12v.In this circuit 4 diodes are used to form bridge rectifier which delivers pulsating dc voltage & then fed to capacitor filter the output voltage from rectifier is fed to filter to eliminate any a.c. components present even after rectification. The filtered DC voltage is given to regulator to produce 12v constant DC voltage.

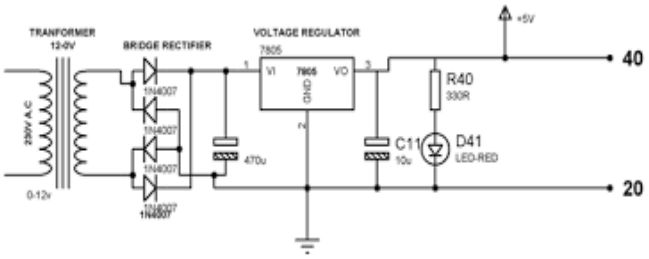

Fig.2 Power Supply

8051 Microcontroller 8051 is an 8-bit family of microcontroller developed by Intel in the year 1981. This is one of the most popular family of microcontroller being used all across the world. This microcontroller was also referred as "system on a chip" because it has 128 bytes of RAM, 4Kbytes of ROM, 2 Timers, 1 Serial port, and four ports on a single chip. The CPU can work for only 8bits of data at a time because 8051 is an 8-bit processor. In case the data is larger than 8 bits then it has to be broken into parts so that the CPU can process conveniently. Most manufacturers have put 4Kbytes of ROM even though the quantity of ROM can be exceeded up to 64 K bytes.

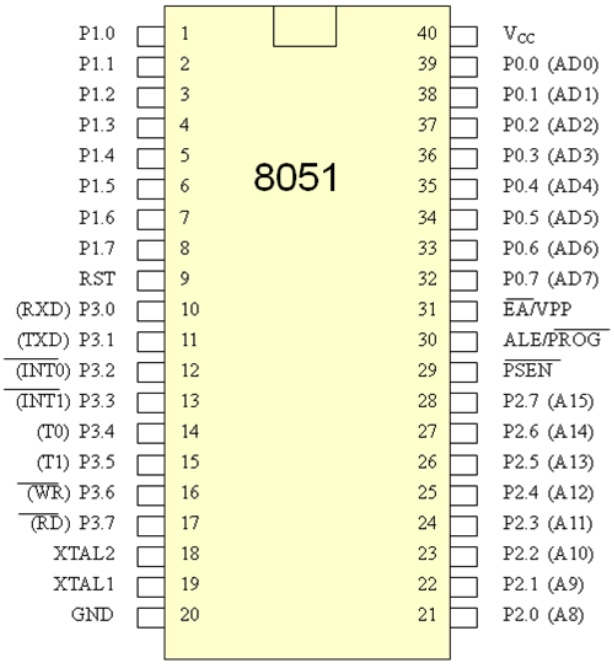

Fig.3: 8051 Microcontroller

Rectifier
The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability .The circuit has four diodes connected to form a bridge. A **rectifier** is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), which

flows in only one direction. The process is known as rectification.

Rectifiers have many uses, but are often found serving as components of DC supplies and high-voltage direct current power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power.

LCD Liquid crystal display are interfacing to microcontroller 8051.Most commonly LCD used are 16*2 &20*2 display. In 16*2 display means 16 represents column & 2 represents rows.

LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements.

Voltage Regulator

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required output voltage levels. The L78xx series of three-terminal positive regulators is available.

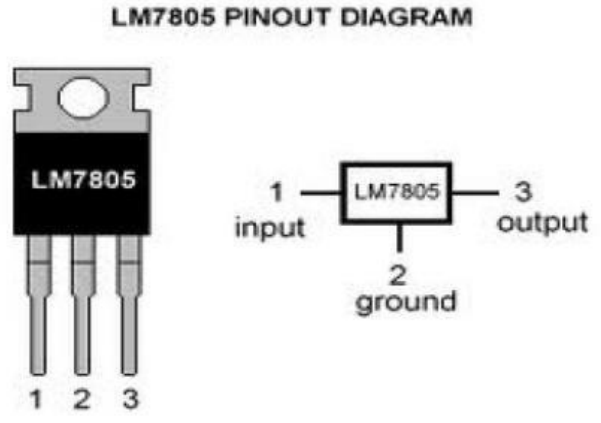

Fig.4: Voltage Regulator

Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric system, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line.

Relay

Relay is sensing device which senses the fault & send a trip signal to circuit breaker to isolate the faulty section. A relay is automatic device by means of which an electrical circuit is indirectly controlled & is governed by change in the same or another electrical circuit. There are various types of relay: Numerical relay, Static relay & electromagnetic relay. Relay are housed in panel in the control room.

Advantages

1. Less maintenance
2. It has higher efficiency
3. Less fault occur in underground cable
4. Underground cable fault location model are applicable to all types of cable ranging from 1kv to 500kv&other types of cable fault such as-Short circuit fault, cable cuts, Resistive fault, Sheath faults, Water trees, Partial discharges.

V. RESULTS AND DISCUSSIONS

The distance of underground cable fault from the base station in kilometers is determined and the same is sent through an SMS with detail to a remote phone using GSM module.

The work is assembled with a set of resistors representing the cable length in km and the fault creation is made by a set of switches at every known kilometer to cross check the accuracy of the same the fault occurring at a particular distance respective phase along with distance is displayed on LCD

VI. CONCLUSIONS

In this paper detect the exact location of short circuit fault in the underground cable from feeder end in km by using microcontroller8051.For this used simple concept of OHM's law so fault can be easily detected and repaired.

FODT sensor used in fault detection of cable lines is Suitable to a low resistance grounded system, long distance line and multi-circuit line. The maximum detectable distance is 10 km with the accuracy of lm and the time needed is 15-30sec.Back propagation learning algorithm was used for training the system and the number of units in the hidden layer, learning.

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