Automatic underground cable fault locator using GSM

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ABSTRACT

The main aim of the project is to detect and locate the fault in underground cable . In the urban areas,the electrical cable runs in undergrounds instead of overhead lines.Whenever the fault occur the repairing process becomes difficult.It is very difficult to identify the exact location of the fault in underground power cable line. This project will ensure a shorter response time for technical crew to rectify these faults . Fault occur due to short circuit fault, low voltage fault , high voltage fault. Previously proposed technique is used to identify short circuit fault only. This project is used to detect not only detect short circuit fault but also detect ,low voltage fault, high voltage fault.The system developed here works on the basis of Ohm's law.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

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 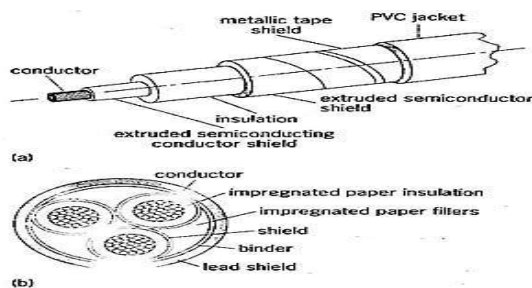is time-consuming and inefficient. Not only that the manpower resource is not utilized, but also the restoration time may vary depending on the reliability of the outage information. As such, deriving an efficient technique to locate a fault can improve system reliability. Use of underground power cable 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 and currently we use underground cable. 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.

Fault in the cable can caused by
• Any defect,
• Inconsistency,
• Weakness or non-homogeneity that affect performance of cable .
• Current is diverted from the intended path .
• Caused by breaking of conductor& failure of insulation.

RELATED WORKS

The system uses the standard concept of derived from Ohms law i.e., if low DC voltage is applied at the feeder end through a series resistor assumed to be Cable lines, then voltage or current would vary depending upon the location of fault in the cable. In case there is a short circuit as if Line to Ground, then the voltage across series resistors changes accordingly, which is then fed to an ADC to develop precise data which the microcontroller of **ARM 7** family would display in kilometers.

Underground cable construction

The system is assembled with a set of resistors representing cable length in KM''s and fault is created is by a set of switches at every assumed distant KM to cross check the accuracy of the same. The fault occurring at an unknown distance and the respective line (R or Y or B) is displayed on a LCD interfaced to the microcontroller. Further it can be improved by placing capacitor in an AC circuit so as to measure the impedance which can even locate the open circuited cable, similarly to that of the short circuited fault only using resistors in DC circuit as followed in the above proposed project

TYPES OF FAULTS

Faults has many types. Frequently occurs the faults are given below

 - ➤ ☐ Short Circuit Fault
 - ➤ ☐ Open Circuit Fault
 - ➤   High voltage fault
 - ➤   Low voltage fault

Short Circuit Fault

A short circuit fault occurs when there is an insulation failure between phase conductors or between phase conductor(s) and earth or both. An insulation failure results into formation of a short circuit path that triggers a short-circuit conditions in the circuit.

Open Circuit Fault

An open-circuit fault occurs if a circuit is interrupted by some failure. If the circuit is notclosed that is called open circuit fault.
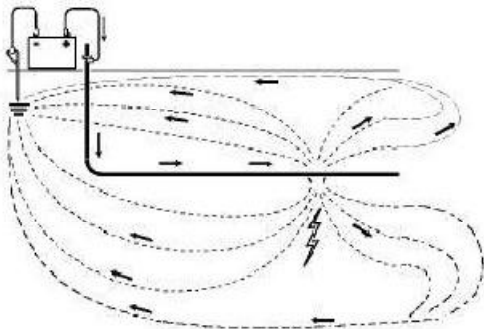
High voltage fault

High voltage fault occur due to the increases in the voltage above 240 V

Low voltage fault

Low voltage fault occur due to the decreases in the voltage below 220 V

EXISTING SYSTEM

In A-frame method, a pulsed direct current (DC) is injected into the faulty cable and earth terminal to locate the ground fault. The DC pulse will flow through the conductor and return via earth from the earth fault location back to the ground stake as shown in Figure 1.The flow of pulsed DC through the ground will produce a small DC voltage. A sensitive voltmeter is used to measure the magnitude and direction of the DC voltage in segments of the earth along the cable route .Analyzing the results of the measuring voltage along the route, the location of the fault in the cable can be pinpointed A-Frame is an accurate method but it is not the fastest one, since the operator has to walk along the length of the cable from the transmitter to the ground fault. This method may face a problem if the return DC finds some easier path back to the earth stake of transmitter instead of returning through the ground. If the ground is sandy, paved which provides high resistance and consequently, less current flows through the ground. In that case, the voltmeter fails to measure the voltage and fault detection becomes complicated.
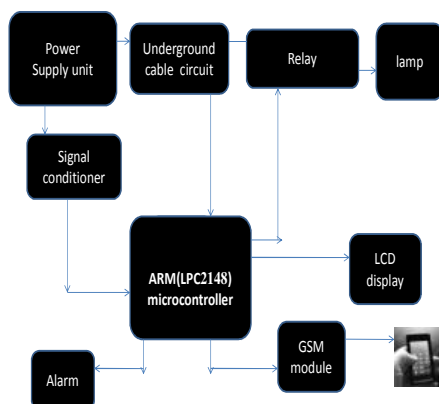
PROPOSED SYSTEM

Underground fault detector deals with finding of exact fault location from the base station itself.

Cables have some resistance. We are mainly focusing that resistance. Resistance can vary with

respect to the length of the cable. If the length of the cable is increase, the value of the resistance

will also increase. If any deviation occurs in the resistance value, we will call that is fault point and finding that place through **ARM LPC2148** microcontoller technology. That fault point is represents the standard of distance (kilometer) from the base station. This value displayed by display unit. It also sends the detailed information about the fault to the control room using GSM and it also cut the power supply on that particular location for the safty of the people.

BLOCK DIAGRAM:

Working

Normally people have been using commercial voltage (230V).This voltage is step-downthrough step down transformer. Transformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. Generally, transformers are used to increase or decrease the voltages of alternating current in electric power applications. These step down voltage goes to rectifier unit .Rectifier is nothing but an electronic device which used to convert an AC supply into DC supply. This project we were using bridge rectifier.12V AC supply is converts into 12V DC supply. These voltage moves to the regulator unit. Regulator is an electrical device which is used to maintain a constant voltage. Here we were using two voltage regulator. Namely voltage regulator 7812 and voltage regulator 7805.7812 voltage regulator maintains the 12V DC supply. These voltage is enough to operate relay unit and 7805 voltage regulator maintains the 5V DC supply .These voltage is used to handle the **ARM 7microcontroller** .We uploaded the program in the kit. . We create fault manually. If any fault occur in the cable, immediately will open the relay terminal and disconnect that faulty line only. Rest of the other lines operates normally. . 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 .And also over voltage and under voltage protection is monitored then rectified .All the Details to send 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 persons and take immediate action to drop the power fault
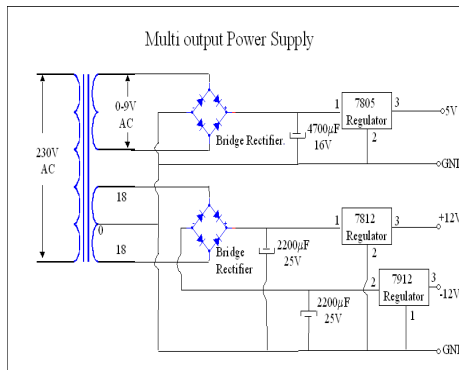
Hardware module

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POWER SUPPLY

The power supply circuit consists of step down transformer which is 230v step down to 12v.In

this circuit 4diodes 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

Transformer

It is used to step down 230V to 9V AC supply and provide isolation between power grid and circuit

Rectifier

It is used to convert AC supply into DC supply

Filter

It is used to reduce ripple factor of DC output available from rectifier end
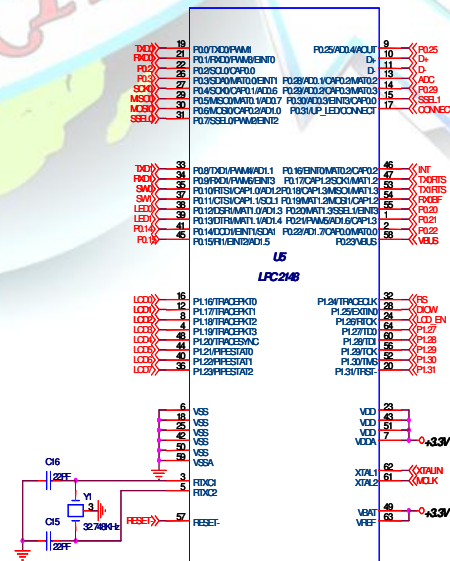
Regulator

It is used to regulate DC supply output .here regulator IC7805 used to provide fix 5V DC supply

ARM LPC2148 microcontroller:

The LPC2142/2148 microcontrollers are based on a 32/16-bit ARM7TDMI-S CPU with

real-time emulation and embedded trace support, that combines the microcontroller with 64 kB and 512 kB of embedded high-speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty.

Due to their tiny size and low power consumption, LPC2142/2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of16 kB/40 kB, make these devices very well suited for communication gateways andprotocol converters, soft modems, voice recognition and low end imaging, providing bothlarge buffer size and high processing power. Various 32-bit timers, single or dual 10-bitADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins. [5] discussed about a system, GSM based AMR has low infrastructure cost and it reduces man power. The system is fully automatic, hence the probability of error is reduced. The data is highly secured and it not only solve the problem of traditional meter reading system but also provides additional features such as power disconnection, reconnection and the concept of power management. The database stores the current month and also all the previous month data for the future use. Hence the system saves a lot amount of time and energy.

make these microcontrollers particularly suitable forindustrial control and medical systems

LM7805 PINOUT DIAGRAM

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
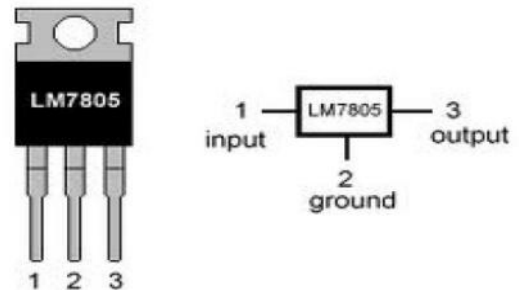
LCD:

Liquid crystal display are interfacing to microcontroller .Most commonly LCD used are 16*2 &20*4 display. In display means 20 represents column & 4 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.

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.

GSM MODULE

A GSM modem is a wireless modem that works with a GSM wireless network .The GSM modem is slightly different from the conventional modem. This utilizes the GSM standard for cellular technology. Here, one end being a wired connection ,receives and transmits data. The other end is connected to a RF antenna.The GSM modem acts like a cellular phone and transmits text and voice data.it communicate GSM through SIM.

ADVANTAGE

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

CONCLUSION

In this work the short circuit fault , low voltage fault ,high voltage fault at a particular distance in the Underground Cables can be detected using Ohm's Law which enables to rectify fault efficiently. This system can be beneficial to the underground cables fault finding as it is cost effective and can be accessed remotely. This system will help to implement the system to regulate the industrial use of underground cables and avoid power losses. GSM method is use to convey the information of fault from the Base station to the control room.It gives the new dimensions in the field of underground cables fault finding with minimum cost and less time.

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