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Underground Cable Fault Distance Locator

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ABSTRACT

This project proposes fault location model for underground power cable using microcontroller. The aim of this project is to determine the distance of underground cable fault from base station in kilometers. This project uses the simple concept of ohm's law. When any fault like short circuit occurs, voltage drop will vary depending on the length of fault in cable, since the current varies. 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 a analog to voltage converter and a microcontroller is used to make the necessary calculations so that the fault distance is displayed on the LCD display.

1. INTRODUCTION

Till last decades cables were made to lay overhead& currently it is lay to underground cablewhich 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. Fault in cable is represented as: Any defect,

- Inconsistency
- Weakness or non-homogeneity that affects
- Current is diverted from the intended path
- Caused by breaking of conductor& failure of insulation

Need for underground cable fault distance locator: Till last decades cables were made to lay overhead& currently it is lay to underground cablewhich 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. To repay the costs of building, operating and maintaining the facility. Road pricing is becoming a more engaging means of funding transportation. Moreover, toll financing allows projects to be built in or after a short time instead of waiting for tax revenues to accumulate.

2. LITERATURE SOURCES

Finding the location of an underground cable fault doesn't have to be like finding a needle in a haystack. The common methods of locating faults are 1. Sectionalizing: This procedure risks reducing cable reliability, because it depends on physically cutting and splicing the cable. Dividing the cable into successively smaller sections and measuring both ways with an ohmmeter or high-voltage insulation resistance (IR) tester enable to narrow down search for a fault. This laborious procedure normally involves repeated cable excavation. 2. Time domain reflectometry (TDR): The TDR sends a low-energy signal through the cable, causing no insulation degradation. A theoretically perfect cable returns that signal in a known time and in a known profile. Impedance variations in a "real-world" cable alter both the time and profile, which the TDR screen or printout graphically represents. One weakness of TDR is that it does not pinpoint faults 3. Murray loop test: It is a bridge circuit used for locating faults in underground or underwater cables. It uses the principle used in potentiometer experiment. One end of the faulted cable is connected through a pair of resistors to the voltage source. Also a null detector is connected. The other end of the cable is shorted. The bridge is brought to balance by changing the value of RB [1]. The proposed system uses RFID tags that are mounted on the windscreen of vehicles, through which information are read by RFID readers; the proposed system eliminates the need for motorists and toll authorities to manually perform ticket payments and toll fee collections, respectively. Data information is also easily exchanged between the motorists and toll authorities, thereby enabling a more efficient toll collection by reducing the traffic and eliminating possible human errors.

However, this proposed system requires major changes in the basic physical and organizational structures of the existing toll roads. In contrast, the Electronic Toll Collection system proposed in this paper will require only minimum changes. Moreover, the existing toll plaza could be re-used with only small modifications. RA/RB=r=RC/RD= (2l-x)/x (1) And hence x= 2l/(r-1) (2) Where l is the length on each segment of wire, r is the ratio RA/RB and x is the length of faulty segment. The main disadvantage of this method assumes that only a single fault exists, a low resistance when compared with UG cable resistance and cable conductors have uniform resistance per unit length 4.Varley loop test: If the fault resistance is high , the sensitivity in Murray bridge is reduced and Varely loop may be more suitable but only a single fault exists. Except that here the ratio arms are fixed and a variable resistance is connected to the test end of the faulty cable. The drawbacks of the above methods can be overcome to certain extent by this method in which the concept of OHM's law is applied.

GSM Technology

Most of the Electronic Toll Collection (ETC) systems around the world are implemented by Dedicated Short Range Communication (DSRC) technology. The concept of proposed system is of automatic toll tax payment and the amount transaction information sends to the mobile phone of the motorists through the GSM modem technology.

It is an innovative technology for expressway network automatic toll collection system. In this paper, the frame formulates and working flow of the system is described and data information is also easily exchanged between the motorists and toll authorities. It is more efficient and the automatic toll collection system by reducing traffic and eliminating possible human errors.

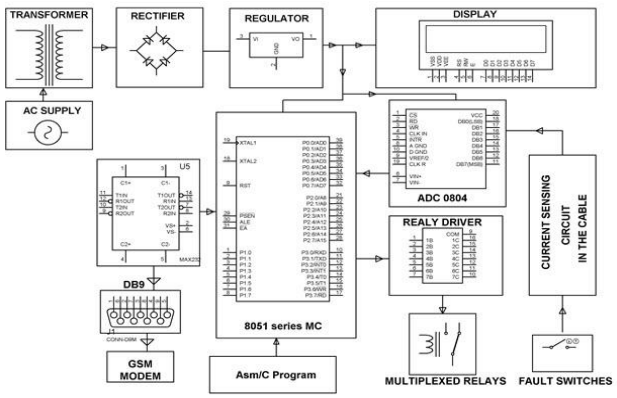

Fig.1. Block Diagram

3. DESIGN OVERVIEW

A block diagram is the total blue print of the proposed project. The total essence and functioning of the project is represented in a single block diagram. It depicts the pictorial representation of working function of a project. Block diagram is something which gives the overview of a project. The block diagram consists of the following components:

- 3 POWER SUPPLIES
- MICRO CONTROLLER
- GSM MODEM
- GPS MODULE
- LCD
- KEYPAD

Microcontroller

The AT89S52 it consume low-power, high-performance. It is a CMOS 8-bit microcontroller with 8K bytes of programmable Flash memory. The device is manufactured by using Atmel's high-density nonvolatile memory technology and is compatible with the 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in the system or conventional nonvolatile memory programmer. It will combine a versatile 8-bit CPU within system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller. It is highly-flexible and cost-effective solution to many embedded control applications.

GSM

GSM is the acronym for Global System for Mobile Communications, originally Group Special Mobile, is a standard which was developed by the European Telecommunications Standards Institute (ETSI).Which describes a protocols for second-generation (2G) digital cellular networks was used by mobile phones. GSM supports voice calls and data transfer. The GSM speeds of up to 9.6 kbps, and also with the transmission of SMS (Short Message Service).GSM uses a time division multiple access (TDMA).It is the most widely used of the three digital wireless telephony technologies which is TDMA, GSM, and CDMA. GSM digitizes and compresses the data, and then it sends down a channel with two other streams of user data, each in its own time slot.

It operates at 900 MHz or 1800 MHz frequency band. Many GSM network operators have operates with roaming agreements with the foreign network operators, often users can also continue to use their mobile phones when they travel to other countries. SIM cards (Subscriber Identity Module) containing home network access configurations, it may be switched to those will meter local access, significantly reducing roaming costs while experiencing no reductions in service.

Fig.2. GSM Module

GSM can also operate together with other technologies; this is the part of the evolution of wireless mobile telecommunications. This also includes HSCSD (High-Speed

Circuit-Switched Data), GPRS (General Packet Radio System), EDGE (Enhanced Data GSM Environment), and UMTS (Universal Mobile Telecommunications Service). Using TDMA is a narrow band process; it is 30 kHz wide and 6.7 milliseconds long within the range. This split time-wise into three time slots.

Narrow band means channels (in the sense traditional). Each conversation gets the radio for one-third of the time. This is possible because of the voice data that has been converted into digital information, which is compressed so that it takes up significantly less transmission space. Finally the TDMA has three times the capacity of an analog system which using the same number of channels. TDMA is the main access method used by the GSM module. GSM systems provide a many useful features: Uses encryption to make phone calls more secure within the network, Data networking, SMS (Short Message Service) for text messages and paging, Call forwarding, Caller ID, Call waiting and Multi-party conferencing.

SIM 300

This is a plug and play GSM Modem with a simple to interface with serial interface. It is used to send SMS, make and receive calls, and do other GSM operations by controlling it through simple AT commands from PIC micro controllers and computers. It uses the popular SIM300 module for its operations. It comes with a standard RS232 interface which can be used to easily interface the GSM modem to micro controllers and computers. The modem consists of all the required external circuitry which is required to start Experimenting with the SIM 300 module like the power regulation, external antenna, SIM holder etc.

Features

- It uses the extremely popular SIM300 GSM module
- It provides the industry standard serial RS232 interface for easy connection to computers and other devices.
- It provides serial TTL interface for easy and direct interface with microcontrollers.
- The Power, RING and Network LEDs for easy debugging
- Onboard 3Volt Lithium Battery holder with appropriate circuitry for providing backup to the module's Internal RTC.
- It can be used for GSM based Voice communications, Data/Fax, SMS, GPRS and TCP/IP stack.
- It can be controlled through standard AT commands.
- It also comes with an onboard wire antenna for better reception.
- The board provides an option for adding an external antenna through SMA connector.
- The SIM300 allows serial baud rate from 1200 to 115200 bps (9600 default)
- Low power consumption during normal operations.
- The Operating Voltage: 7 – 15V AC or DC (board has onboard rectifier.

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 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 is housed in panel in the control room.

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 act. Components present even after rectification. The filtered DC voltage is given to regulator to produce 12v constant DC voltage

4. PROJECT OUTCOME

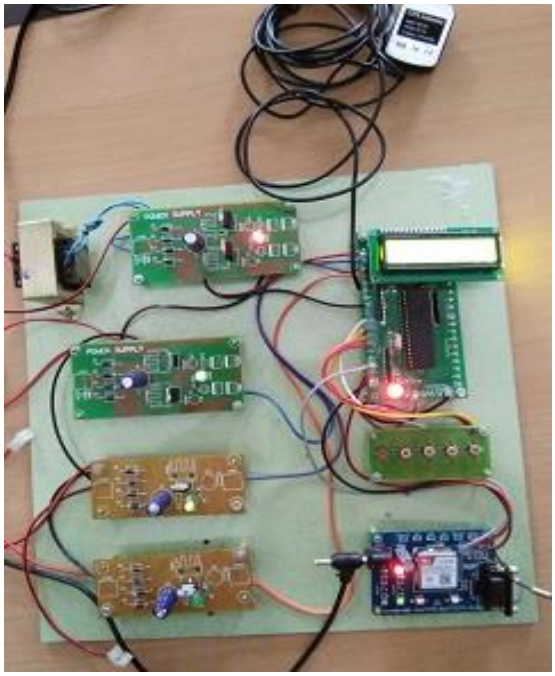

Fig.3. Underground cable fault distance locator

5. CONCLUSION

The hardware model of Underground Cable Fault Locator is implemented and favorable results were brought forward. This hardware model can locate the exact fault location in an underground cable. Further this project can be enhanced by using capacitor in an AC circuit to measure the impedance which can even locate the open circuited cable, unlike the short circuited fault only using resistors in DC circuit as followed in the above proposed project.

6. FUTURE SCOPE

This includes aesthetics, higher public acceptance, and perceived benefits of protection against electromagnetic field radiation (which is still present in underground lines), fewer interruptions, and lower maintenance costs. Failure rates of overhead lines and underground cables vary widely, but typically underground cable outage rates are about half of their equivalent overhead line types. Potentially far fewer momentary interruptions occur from lightning, animals and tree branches falling on wires which de-energize a circuit and then re- energize it a moment later. Primary benefits most often cited can be divided into four areas: Potentially-Reduced Maintenance and Operating Costs: • Lower storm restoration cost. Improved Reliability: • Increased reliability during severe weather (wind- related storm damage will be greatly reduced for an underground system, and areas not subjected to flooding and storm surges experience minimal damage and interruption of electric service. • Less damage during severe weather • Far fewer momentary interruptions • Improved utility relations regarding tree trimming Improved Public Safety: • Fewer motor vehicle accidents • Reduced live-wire contact injuries • Fewer Fires Improved Property Values: • Improved aesthetics (removal of unsightly poles and wires, enhanced tree canopies). Fewer structures impacting sidewalks. In this project detect only the location of short circuit fault in underground cable line, and also detect the location of open circuit fault, to detect the open circuit fault capacitor is used in ac circuit which measure the change in impedance & calculate the distance of fault. For future research, proceed with similar neural networks structure for fault section and fault location estimation.

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