Abstract

The basic principle of Electromagnetic theory is used to detect discontinuity in the cables laid below the ground. These underground cables are used for many applications. It may be telephone, cable service or may be for internet and data services. Companies prefer laying the cables underground because the climatic adversities don’t affect this. With advantages come challenges. There are many difficulties in laying the cables and once laid in case of any complaints, it is difficult and costly to fix it. We have come up with a solution, where the robot that we design in this project is capable of finding where the complaint lies, so that the engineer can directly get the exact location of fault with the help of GPS and notification on respective mobile with the help of GSM technology.

I. INTRODUCTION

Defect in its electrical circuit takes place due to the current is diverted from the certain intended path and a fault occurs due to this. Faults are generally occurring due to mechanical failure, accidents, excessive internal and external stresses etc. When a fault occurs the power flow gets diverted due to this and supply of neighbouring zone gets affected voltages become unbalanced. Thus, it is of utmost important to detect the fault sooner. In last decade cables were made for overhead laying and currently underground cables are used because of superiority. The biggest advantage is that they are not
affected by adverse weather conditions. Neither hot sunny day nor the rain influences it. But its biggest drawback is to locate the breakage of cable due to any reason. Currently approximate locations are found and the cables are dug out from location and checked manually to find exact point of discontinuity.

Cable maintenance practices are of two categories: unplanned maintenance or planned maintenance. Unplanned maintenance is caused due to a power outage. Planned maintenance is a time to time inspection of power cables. Planned maintenance delivers reliable services, but it is not economical. Premature replacement of cables leads to economic losses, which can be avoided by replacing decision based on the specific site data rather than on generic estimates. The cable inspection is a very costly process. A broad spectrum of sensing is used for the inspection of cables. Some of these sensing methods are like acoustic detection, are greatly enhanced by the ability to make measurements along the cable, as opposed to relying on measuring parameters at the ends of the cables. The goal of this project is to develop an autonomous robotic platform that can inspect underground power distribution cables, thus providing utilities with accurate information regularly and at a lower cost. Currently developed robot can be used to locate break from an external point. When an underground cable is broken or short circuited then our robot will work over it and locate the exact point of discontinuity.

II. PREVIOUS WORK

1. The model of a mobile robot is made that can inspect the conditions in an underground cable tunnel even in dangerous environmental conditions where human presence is harmful. Hence, this robot substitutes the inspection of a human in the underground cable tunnel. The robot does online inspection through the tunnel travelling from one end to other end and all the information about the underground tunnel with respect to temperature, presence of harmful gases, obstacles, fire accidents, failure in supply etc. is transmitted wirelessly to a device on the ground [1].

2. The robot is made which is capable of finding the location where the complaint lies, so the engineer can directly get the hole dug at that point and fix the issue. The fault detection robot consists of a signal generator part and robotic part. Short circuit cable is checked for its continuity by passing a 3 KHz low frequency signal. The AC signal passing through wire produces a magnetic field around it. This magnetic field is sensed by the robot using an inductor circuit. The AC signal sensed by robot is then amplified using an LM386 circuit. This amplified signal is then rectified and converted to DC. DC level is provided to the analog input of microcontroller. Microcontroller converts this analog input to digital signal. When the robot reaches the point where the discontinuity lies, the magnetic field will be zero. In such case the input signal at the analog input port will be substantially low. When the input signal strength is less than 10 (binary reading), the PIC is programmed to display, short circuit Detected and is displayed in LCD [2].
3. A robot is designed who will find out correct location of fault then by using GSM technology message will send to main control room. So, the engineer can directly dig at that point & fix the issue. The rising demand for electrical energy increases the importance and priorities of uninterrupted service to customer. The current sensing circuit is interfaced to the microcontroller. The 16*2 LCD display connected to the microcontroller is used to display the information. GSM will send SMS to the control room as fault detected [3]

III. DESIGN OF ROBOT

Figure 1: Block diagram of underground cable fault detection

1. POWER SUPPLY – We are using linear regulated power supply having 5V output which will be useful for driving the other components in the circuit like microcontroller, gsm module and GPS module.

2. LIVE WIRE SCANNER CD4017 –When we hold the sensor (metallic conductor or copper wire) close to the live wire, electric field from mains activates the circuit. As the input impedance of the CMOS IC is high, the electric field induced in the sensor is sufficient to clock it. The output obtained at pin 11 of CD4017 drives the LED. Flashing of the LED (LED2) indicates the presence of mains, while LED1 indicates that the scanner is active.
3. RF TRANSMITTER (HT12E) - They are capable of encoding information which consists of N address bits and 12N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E enhances the application flexibility of the 212 series of encoders.

4. RF RECEIVER (HT12D) - The decoders receive serial addresses and data from a programmed 212 series of encoders that are transmitted by a carrier using an RF medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins.

5. BRUSHLESS DC MOTOR - The BLDC motor is widely used in applications including appliances, automotive, aerospace, consumer, medical, automated industrial equipment and instrumentation. The BLDC motor is electrically commutated by power switches instead of brushes. Compared with a brushed DC motor or an induction motor, the BLDC motor has many advantages. Motors convert electrical energy into mechanical energy using electromagnetic principles. The energy conversion method is fundamentally the same in all electric motors.

6. MICROCONTROLLER AT mega 328 - Arduino Uno microcontroller board based on the ATmega328. It is Open-source hardware, open source software. Boards are available commercially in preassembled form. Large number of PWM pins available. Pins can be configured as I/O and o/p as per requirement.

7. LCD - When the voltage is zero, the robot displays “fault is detected” on the LCD.

8. GSM MODULE (SIM-900) - GSM/GPRS RS232 Modem from rhydoLABZ is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz it is very compact in size and easy to use as plug in GSM Modem. The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Auto baud mode. This GSM/GPRS RS232
Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface.

9. GPS MODULE - The GXB5005 is a 12-channel GPS (Global Positioning System) receiver module. This small module includes all the functions required for GPS and is designed for using an active antenna. The GXB5005 can support the various kinds of the portable applications as well as the car navigation system.

IV. ALGORITHM OF SYSTEM

1. START.
2. Power is given to the circuit.
3. RF transmitter transmits the signal to RF receiver wirelessly.
4. RF receiver gives signal to motor driver and Robot moves in respective direction.
5. Live Wire Scanner will detect the discontinuity in the cable.
6. If there is no discontinuity, then Robot will move in the respective direction.
7. If there is discontinuity, then microcontroller will send stop signal to the motor and motor will be stopped and LCD displays a message that “fault is detected”.
8. Message will be sent through SMS on respective mobile phone by GSM.
9. And the location of the fault detected by by Robot will be sent on respective mobile phone by GPS.
10. Go to step 2.

V. SIMULATION RESULT

MOTOR DRIVER-LS293D: Condition 1-

![Figure 5.1: OFF Condition for motor driver module](image)

Condition 2-When condition 01 is applied i.e. first push button is untouched and 2nd button is closed.
Condition 3-When condition 10 is applied i.e. 1st push button is pushed and 2nd one is untouched.

VI. EXPERIMENTAL TESTING

Figure 5.2: Clockwise movement of motor driver

Figure 5.3: Anti-clockwise movement of motor driver

Figure 6.1: Photo of the proposed system
Currently designed robot can be used to locate fault in underground cable system. When an underground cable is broken or short circuited then our robot will work over it and locate the exact point of discontinuity. This robot works on the principle of electromagnetic theory. We can directly get the exact location of fault with the help of GPS and notification of fault location on respective mobile with the help of GSM technology [2].

VII. CONCLUSION

1. The aim of the project is realized by testing the inspection of a mobile robot in a virtual environment conducive in producing real time operating atmosphere of an underground cable which can accurately spot the fault point and can report the coordinates of the fault point, which is novel attempt by using a GPS tracker.

2. Current scenario of digging along the cable laid and then pulling the cable out and checking whether the fault exists in the cables is a tedious work. This is not only being wastage of manpower and money for the companies, but this also causes a lot of inconvenience to the normal public. We believe that our cable fault detection robot will solve this issue to a great extent and will be really helpful for such application. The robot that we have designed is very much user friendly and can be easily controlled.

VIII. ACKNOWLEDGEMENT

We wish to thank the head of the department of electronics and telecommunication, Modern college of engineering. We would like to express special appreciation and heartfelt thanks to our guide Mrs. V.P.Kodgirwar for giving helpful guidance, suggestions and directions for the preparation of the project work. We also sincerely thank all our teachers for the valuable support.

IX. REFERENCES


TO CITE THIS PAPER