

Design and Development of a Robot for Cable Fault Detection beneath Tunnel

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Abstract- In recent times underground cables are monitored manually, due to latest advancement in miniature sensors and signal processing hardware remote fault detection is possible, accurate real time information about the aging status of the power distribution cable network can save the power industry million of dollars lost due to line failures and premature replacement of cables. In this paper, the proposed system proposes development of a robotic platform for fault detection in underground cables. It consists of embedded system for controlled purpose IR sensors for fault detection. The entire system is interfaced to a computer and various operations for fault detections were performed.

Keywords- Embedded system, IR Sensors, fault detection, Ultrasonic Cable Inspector.

I. INTRODUCTION

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. There are many difficulties in laying the cables and once lay 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.

II. LITERATURE SURVEY

In an electric power system, a fault is detected by any abnormal electric current follow. For example, a short circuit is a fault in which current bypasses the normal load.[1]. An open-circuit fault occurs if a circuit is interrupted by some failure. In three-phase systems, a fault may involve one or more phases and ground, or may occur only between phases.[2]. In a "ground fault" or "earth fault", charge flows into the earth. The prospective short circuit current of a fault can be calculated for power systems. In power systems, protective devices detect fault conditions and operate circuit breakers and other devices to limit the loss of service due to a

failure.[3]. In a poly phase system, a fault may affect all phases equally which is also called symmetrical fault. If only some phases are affected, the resulting asymmetrical fault becomes more complicated to analyze because the simplifying assumption of equal current magnitude in all phases is no longer applicable.[4]. The analysis of this type of fault is often simplified by using methods such as symmetrical components. A symmetric or balanced fault affects each of the three phases equally.[5]. In transmission line faults, roughly 5% are symmetric this is in contrast to an asymmetrical fault, where the three phases are not affected equally. An asymmetric or unbalanced fault does not affect each of the three phases equally Power transmission and distribution lines are the vital links that achieve the essential continuity of service of electrical power to the end users. Transmission lines connect the generating stations and load centers.[4].

III. DETAILS OF PROPOSED SYSTEM

A. BLOCK DIAGRAM

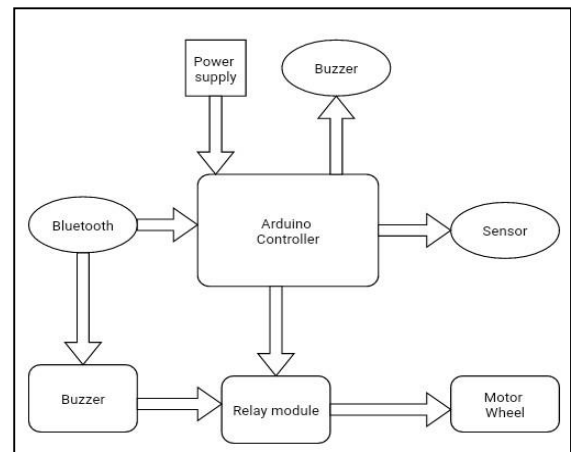


Fig 1. Block Diagram

- Power Supply* – We are using linear regulated power supply having 5V output for microcontroller.
- Ultrasonic Cable Inspector (HC-SR04)*- This HRC-SR04 ultrasonic sensor has two eyes like projects in the front which forms the Ultrasonic transmitter and receiver. The HC-SR04 ultrasonic sensor uses sonar to determine

distance to an object. The ultrasonic sensor module is a transmitter ,a receiver and a control circuit in one unit.the trigger and echo pins of these module and these connects input output pins of arduino. When the receiver detects return wave the echo pin goes high for a particular amount of time taken for the wave to return back to the sensor.It measures the distance within a wide range of 2 cm to 400 cm.



Fig 2 Ultrasonic Cable Inspector

- c) *Geared DC Motor* – A geared DC motor is used in our project to drive the robot. We have used 6-12 V, 60 rpm motor.
- d) *Relay Module (4 Channel 5V)* - It is a 4 channel isolated 5V 10A relay module, A wide range of microcontrollers such as arduino. It also able to control various appliances and equipments with large current.

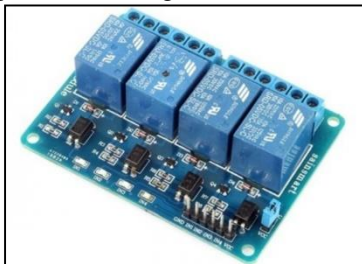


Fig 3 Relay Module

- e) *Arduino Controller*- Arduino is open-source electronics plate form based on easy to use hardware and software arduino boards are able to read inputs light on a sensor.
- f) *Buzzer* –Buzzer is used as an audio signalling device, the buzzer has only 3 pins S-Signal 5V-supply G-ground.

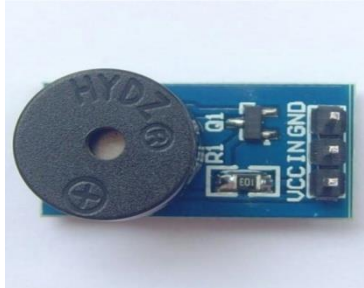


Fig 4. Buzzer Module

- g) *Bluetooth*- Bluetooth is used for exchanging data between fixed and mobile devices over short wavelength UHF radio waves.

B. CIRCUIT DIAGRAM

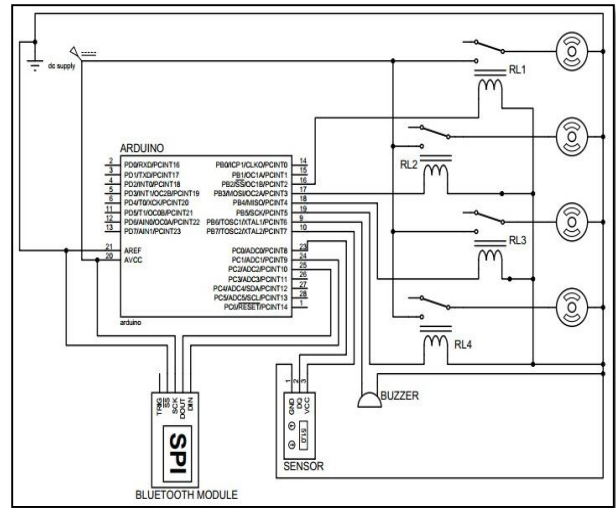


Fig 5 Circuit Diagram

C. ALGORITHM OF THE 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. Ultrasonic cable inspector 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 to indicate that “fault is detected”.
8. Message will be sent through Bluetooth to the user
9. Go to step 2

D. ADVANTAGES OF PROPOSED SYSTEM

1. Suitable for congested urban area
2. Reduced man power.
3. Quick operation.
4. Reliable operation.
5. Ease in finding the actual location of underground cables
6. Unwanted digging can be eliminated
7. Remote fault detection

8. Location of fault can be detected in harmful area for human being.

IV. CONCLUSION

The aim of the project is realized by testing the inspection robot under tunnel cable which can give the fault location and can report to engineers of the fault point. 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.

V. REFERENCES

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