Fault Detection Robot for Bus-duct and Underground Cables

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Abstract- This paper represents a robot which can be used to detect and monitor any abnormal conditions occurring in at the underground cable location. These abnormal conditions may be sometimes harmful for humans. Hence, we can make use of this robot in places where humans cannot go or is within out of human reach. This robot will detect any kind of temperature rise, gas leak, fire, short circuit etc., and send the collected date to the hand held device. Hence, the fault is cleared efficiently and in less time. We have also used a GPS tracking device, which will help us in finding the exact fault location of fault occurred underground.

Keywords: Robot, fault detection, GPS

I. INTRODUCTION

Transmission of electricity is basically done by two methods, overhead and underground. The overhead method I sold but relatively dangerous. They are vulnerable to lighting stroke, storm or any other type of natural or artificial misfortunes. The other method of transmission of electricity is the underground method. In this method, as the cables are laid underground and hence is much safer than the overhead method of transmission as it cannot be damaged easily by natural misfortunes. But there subsist one dilemma of underground method that, the location of the occurred fault cannot be identified exactly. Thus the robot in our project will be very helpful in eliminating this dilemma. Until this technology was introduced in the cable inspection, the fault analysis and locating the fault was made by roughly finding the location of the fault occurred and then makes a hole by digging up at the place. But this method would take long time and also cost more labour charges. Occasionally the location of the fault that was located would be off beam or far-flung from the actual fault site. All of this chore was done physically and thus took a great deal of time. Hence, to overcome this inconvenience the robot has been prepared. The same ideology is used to detect any fault occurred on the bus duct as well. A bus duct is also similar to cable but more advanced technique, various types of bus ducts are available. Some are installed overhead, in ducts or underground as well. The simple type of fault that may occur in the bus duct is insulation failure. This insulation failure causes heating i.e. temperature mount and achievable short circuit fault as well. The same robot can be used for fault detection of a bus duct and of a cable. Thus multiple applications are possible with one cost effective robot. This model provides decrease in the overall fault detection and analysis cost and also increases productivity of the workers and the fault is cleared more efficiently.

II. WORKING PRINCIPLE

The entire project consists of the robotic platform and a remote that is used to control the robot. The robotic platform is manufactured from Fibre Reinforced Polymer (FRP) material. The chassis is made from MS. The FRP is used in order to avoid conduction of electricity through the platform and also to avoid short circuit condition. The idea is that the robot works underground along with the cable and detect the fault occurred. An opening would be dug in order to let the robot in the underground trench; the robot will then be driven down the trench and will detect the fault on the way. A mixture of variety of sensors is installed on the crown of the robot in order to indicate the fault occurred. All these sensors are all interfaced to the microcontroller chip that is programmed to control all the robotic occupation. Any fault detected will be indicated by buzzer and also it is indicated on the display screen. The remote that is used to manage the performance and working of the robot used consists of microcontroller, trans-receiver, LCD display and a keypad. The keypad will control the path of the robot; it can make the robot go in forward course or in reverse course. The fault that is occurred is demonstrated on the Liquid Crystal Display (LCD) screen that is set up on the remote. DC motor is used on each wheel of the robot to steer the robot in forward or reverse course.

Fig.1 Robotic platform

III. COMPONENTS

The following is the list of the components used in the project.

A. Microcontroller-ATmega2560

This microcontroller is used for the controlling and working of the robot. All of the installed sensors are interfaced to this microcontroller chip and it will sense the information offered by the sensor and the result will be displayed to us. It has 54 pins digital input-output, out of which 14 pin are used for PWM output, 16 analog input pin. The operating voltage is 5V.

B. Microcontroller- ATmega328P

This microcontroller is used on the remote; it reins the course of the robot and functioning of the remote. It is interfaced with the LCD display screen and keyboard that are installed on the remote. The remote will control the robot. The microcontroller chip has 14 digital input and output pins, from which 6 pins are utilized for PWM output, 6 analog input pins. The operating voltage is 5V.

C. Transreceiver- CC2500

The transreceiver is a wireless high speed module. This element is used on the robot and on the remote a well. A small controller is used to convey or obtain the data through radio frequency (RF). It has a baud rate of 38400. It also comes with a control, which is used to convey or collect data back and forth. The communication is done with the help of RF, which requires a matched transmitter to the receiver. The data can be passing on over few kilometres of dist

D. H-bridge- L293

This H-bridge is a device that is used to control the direction of the DC motor in two different directions under computer control. In this project two H-bridge are used on the robotic platform, one is used to aid the movement of robot in forward course and the second is used to stir in the backward course. This element is effortless in construction and economical in value. The IC is a 16 pin module and it can drive inductive loads like solenoid, relay, DC motor.

E. GPS- SIM 28,25

The GPS module is used to locate the robot underground. When the robot is working in the underground trench, it becomes impossible to exactly locate the position of the robot. The functional voltage is of 5V, and it also has RS 232 port, which enables connection of the GPS module to the computer. It also consists of an exterior mast to convey indication.

F. DC motor

The DC motor is used to drive the robot in forward direction or in backward direction. Four DC motors are utilized in our project; each of the motor is installed near each one of the wheel. A 12V, 60rpm motor is used which rotates in step manner. Two 6V batteries are coupled in series to command the motors.

G. LCD display- 20x4

A 20x4 LCD display is installed on the remote. The information that is composed by the sensor is put on view on the LCD screen. The values of a variety of factors i.e. calculated are put on show on this screen; this display screen is interfaced with the microcontroller chip.

H. Temperature sensor- LM35

The LM 35 is a temperature sensor that is mounted on the robot to sense any temperature rise in the trench or in the cable. The output voltage produced by the sensor is linearly comparative to the temperature calculated in Celsius or in Kelvin. The temperature range is around -55˚C to 150˚C.

I. IR sensor

The IR sensor is a general type of proximity sensor. It is installed on the robot to steer clear of impact with any type of obstruction. Two IR sensors are installed on the robotic podium.

J. Gas sensor- MQ 135

The gas sensor is mounted on the platform in an elevated manner; it is used to become aware of any type of burn or injurious gas that may have produced in the trench. The sensor would become aware of it and the bell would turn on and make a beeping sound. This sensor has 4 pins, Vcc- input voltage, GND- supply ground, AOUT- analog output, DOUT- digital output. The functional voltage is 2.5V to 5V. The gas identifying range is 100-1000 ppm; it is more sensitive to ammonia, sulphide and other harmful gases.

K. Platform and chassis

The robotic platform is made up of Fibre Reinforced Polymer (FRP). The FRP material is used to avoid any type of conduction or short circuit occurring. The chassis is made from MS.

L. Wheels

Four tractor wheels are used for moving of the robot. DC motor is coupled to each of the wheels to steer them in a path. The wheels have diameter of 78mm.

IV. BLOCK DIAGRAM

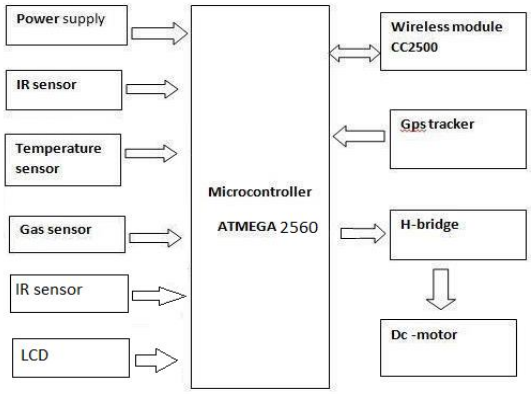

Fig.2: Block diagram

As shown in the block diagram, all of the senor and other equipment are interfaced to the microcontroller. The intact controlling action of the sensors is completed by the programmed microcontroller chip. The wireless module i.e. the transreceiver is connected in bidirectional method to transmit as well as receive the data obtained.

Advantages and Disadvantages

(a) Advantages

- Used for short circuit fault exposure in the underground cable employed.
- Reduced manual labour
- Cost effective
- Useful of detection of busduct fault as well.

(b) Disadvantages

- Not self-reliable.
- Tricky to replace a section in case of collapse.

V. CONCLUSION

We believe that digging up holes for repairing or maintenance of underground cable and busduct causes a lot of trouble. It expenses further in terms of labour also. Thus this project is helpful in sinking the extra cost associated and other struggle related with it as well. Hence this project is a ground-breaking and cost helpful solution to many inconveniences, which is user friendly and easily controllable.

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