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Robotic Cable Inspection System

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Abstract - *This paper presents the model of a semi-autonomous robot for the inspection of underground electric cables. This robot can be employed in the underground tunnels to know accurate, real time information about the underground cable status even in harmful environments. The GPS module installed in the robot gives us the exact location of the fault. With this knowledge we can estimate the danger level and prepare accordingly. Hence this robot substitutes the inspection of human in the underground cable tunnel. The design platform consists of a microcontroller, 2.4 GHz wireless communication module, hall sensor, ultrasonic sensor, gas sensor, temperature sensor, AV camera and GPS module. Though there were several approaches made for the monitoring of underground cable, this paper indicates that a low cost robotic system embedded with GPS module can improve the efficiency of the cable inspection system.*

Key Words: **GPS tracker, online inspection, robot, underground cable, zero downtime.**

1. INTRODUCTION

Apart from generation, transmission of electrical energy stood as a challenging task due to various constraints since the inception of using electrical energy. It is common to have transmission lines held along the road side being mounted on poles. But the idea of having an underground cable to transmit power is also another alternative. Overhead lines are vulnerable to lightning strikes which can cause service interruption. Overhead lines use bare conductors and can cause damage if they break. They are considered to be unsightly as they mar the scenery of the landscape [1]. The maintenance cost of overhead lines is more and the voltage drop in overhead lines is more. Hence, underground cable for power transmission stood as second thought apart from the overhead lines. There are several challenges to be addressed in implementing this technology [3]. To make the tunnel environment safe enough for functioning and maintaining zero downtime of supply we need to check and correct the faults taking place in the underground cable. However, it is a difficult task to locate the fault in underground cable when compared to overhead lines [2]. This mobile inspection robot is one endeavor to check online the condition of tunnel using mobile inspecting robot. This approach gained momentum and there are many experiments being conducted and tested for the online monitoring.

2. BLOCK DIAGRAM

The project mainly consists of two units: Robot unit and Remote Control unit. Robot unit moves over the cable and Remote control unit is connected to the PC.

2.1 Robot unit

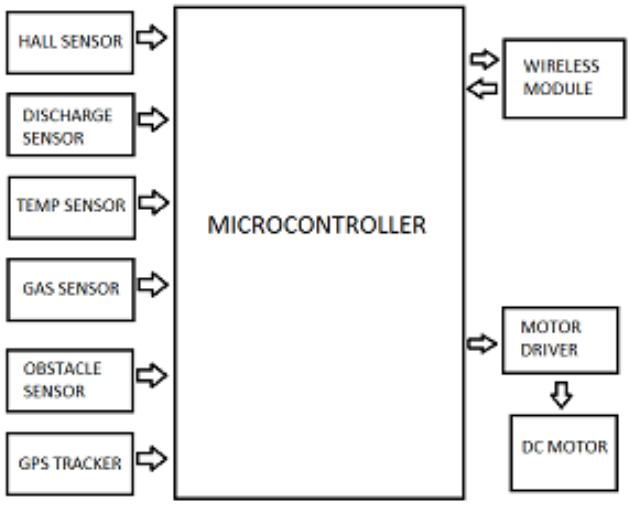

Fig -1: Block diagram of robot unit

Robot unit consists of a microcontroller, sensors, wireless module, GPS module and motors. Microcontroller is the main part of this unit. Hall sensor, discharge sensor, temperature sensor, obstacle sensor, and gas sensor are the various sensors connected to the microcontroller for measuring various parameters. GPS tracker is used for determining the exact position of the fault. Wireless module is used for the wireless communication between the robot unit and the remote control unit. Motor driver helps in bi-directional control of the DC motor.

2.1 Remote control unit

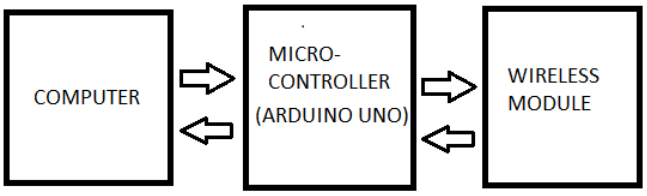

Fig -2: Block diagram of remote control unit

Remote control unit consists of a microcontroller and a wireless module. Microcontroller is connected to the computer and information regarding the cable condition can be displayed on the computer. Wireless module helps in the transfer of information between the remote control unit and the robot unit.

3. CIRCUIT DIAGRAM

3.1 Robot unit

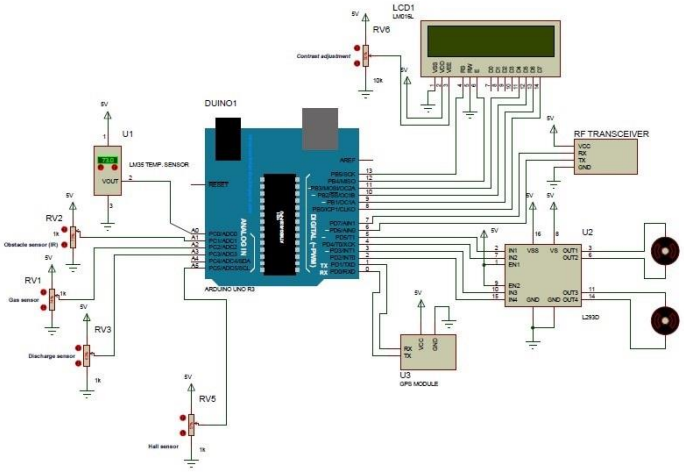

Fig -3: Circuit diagram of robot unit

3.1 Remote control unit

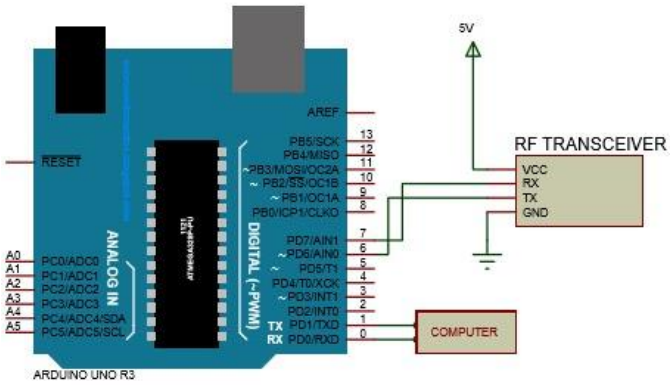

Fig -4: Circuit diagram of remote control unit

4. WORKING

The robot platform is free to move in any of the direction and can move inside the tunnel with ease. The information regarding the environment around the robot is transmitted wirelessly through wireless transceiver which is connected to the microcontroller. The data is thus transmitted by the transceiver on the robot to the transceiver connected to the microcontroller on the remote control unit. This microcontroller on the remote control unit is interfaced to a computer and the data can be seen on the computer screen in the form of analog values. The robot can be controlled from the operator end when the robot cannot make a decision regarding the next step to be taken. It can thus be halted and brought back, when it is not safe for the robot to navigate in the tunnel. The signal from the transceiver near the operator is sent to the transceiver on the robot to control the robot functioning.

5. CONCLUSIONS

This paper presents the model of a semi-autonomous robot for the inspection of underground electric cables. This robot can be employed in the underground tunnels to know accurate, real-time information about the underground cable status even in harmful environments. Inspection of cable can be done online thereby maintaining zero downtime of supply. The GPS module installed in the robot gives us the exact location of the fault. With this knowledge we can estimate the danger level and prepare accordingly. Though there were several approaches made for the monitoring of underground cable, this low cost robotic system embedded with GPS module can improve the efficiency of the cable inspection system.

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