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UNDERGROUND ROBOT FOR HIGH POWER CABLE FAULT DETECTION USING WIRELESS SENSOR WITH GPS NETWORKS

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Abstract:

This paper presents the model of a mobile robot 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. Hence this knowledge of situation at tunnel sent by the robot enables us to estimate the danger level and accordingly plan the measures to address the problem in a fastest way possible. Though there were several approaches made to enable this online monitoring system, this paper presents the functioning of robot with a GPS tracker which gives the co-ordinates of the fault location and this helps us to locate the exact fault location reducing the time and work to replace the faulty part. This enables zero downtime of supply, interruption free supply.

Keywords - GPS tracker, online inspection, robot, underground cable, zero downtime.

1. INTRODUCTION

The LM35 [4, 3] series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling the discharge sensor circuit which can detect the invisible fields of voltage which surrounds all electrified objects. It acts as an electronic "electroscope. “Regular foil-leaf electroscopes deal with electrostatic potentials in the range of many hundreds or thousands of volts. Its sensitivity is very high.

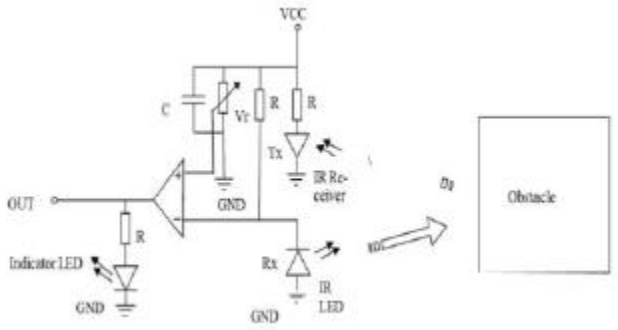


Fig.1. The IR Sensor Schematic

Since "static electricity" in our environment is actually a matter of high voltage, this device can sense those high-voltage electrically charged objects at a great distance. If a metal object is lifted up upon a non-conductive support and touched against the sensor wire, the sensor can detect whether that object has an electrostatic potential of as little as one volt. Inductive proximity sensors operate under the electrical principle of inductance. To amplify a device's inductance effect wire is twisted into a tight coil. This inductive proximity Sensor M12PNP has four components; the coil, oscillator, detection circuit and output circuit. The oscillator generates a fluctuating magnetic field the shape of a doughnut around the winding of the coil that is located in the device's sensing face object, magnetically push back, and finally reduce the Inductive sensor's own oscillation field. The sensor's detection circuit monitors the oscillator's strength and triggers an output from the output circuitry when the oscillator becomes reduced to a sufficient level.

2. PROPOSED REVIEW

This High Speed CC2500 Based Wireless module is a plug and play replacement for the wired Serial Port (UART) supporting baud rates up to 38400.Commercially available Remote Control (R/C) units use small microcontrollers in the transmitter and receiver to send, receive and interpret data sent via radio frequency (RF). The receiver box has a PCB (printed circuit board) which comprises the receiving unit and a small servo motor controller. RF communication requires either a transmitter matched/paired with a receiver, or a transceiver (which can both send and receive data). RF does not require line of sight and can also offer significant range (transmission distance). Standard radio frequency devices can transfer data between devices as far away as several kilometers and there is seemingly no limit to the range for more professional RF units [9].

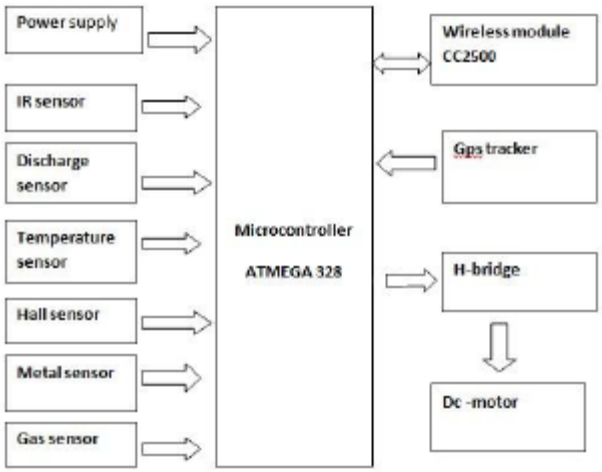


Fig.2.Block diagram

The robot used is made semi-autonomous robot with RF capability since it allows the robot to be as autonomous as possible, provide feedback to a user and still give the user some control over some of its functions. Range 60+ meters, Line of Sight 30 meters range indoors. Direct Replacement for wired Serial Cable for and serial communication can be achieved. The Transistor or MOSFET H-bridge as shown in Fig 6 is probably one of the most commonly used type of bi- directional DC motor control circuits[5] which uses both NPN and PNP in each branch with the transistors being switched together in pairs to control the motor. Control input Aoperates the motor in one direction i.e., Forward rotation and input B operates the motor in the other direction (Reverse rotation). Then by switching the transistors "ON" or

"OFF" in their "diagonal pairs" we can achieve directional control of the motor. For example, when transistor TR1 is "ON" and transistor TR2 is "OFF", point A is connected to the supply voltage (+Vcc) and if transistor TR3 is "OFF" and transistor TR4 is "ON" point B is connected to 0 volts (GND). Then the motor will rotate in one direction. If the switching states are reversed so that TR1 will be "OFF", TR2 will be "ON", TR3 is "ON" and TR4 is "OFF", the motor current will now flow in the opposite direction causing the motor to rotate in the opposite direction. Then, by applying opposite logic levels "1" or "0" to the inputs A and B the motors rotational direction can be controlled as follows.

3. ANALYSIS

The Fastrax UP501 is a GPS receiver module with embedded antenna and tiny form factor 22.0 x 22.0mm x 8mm. The Fastrax UP501 receiver provides very fast enhanced navigation accuracy by utilizing WAAS/EGNOS corrections, which may be enabled via NMEA command. The Fastrax UP501 module provides complete signal processing from internal antenna to serial data output in NMEA messages.

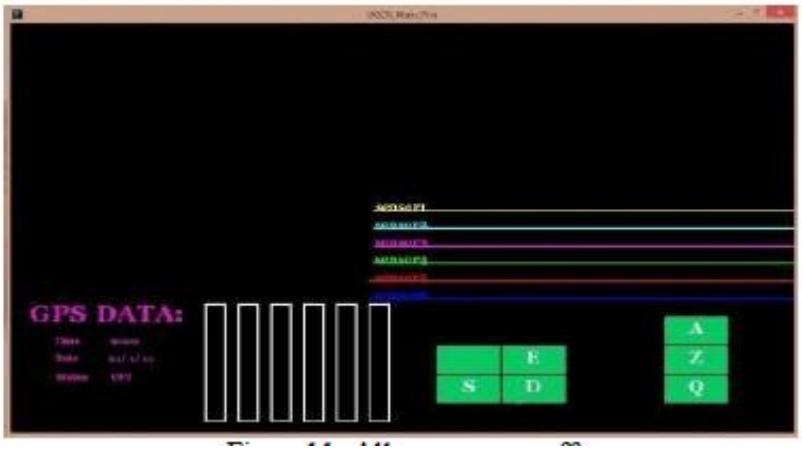
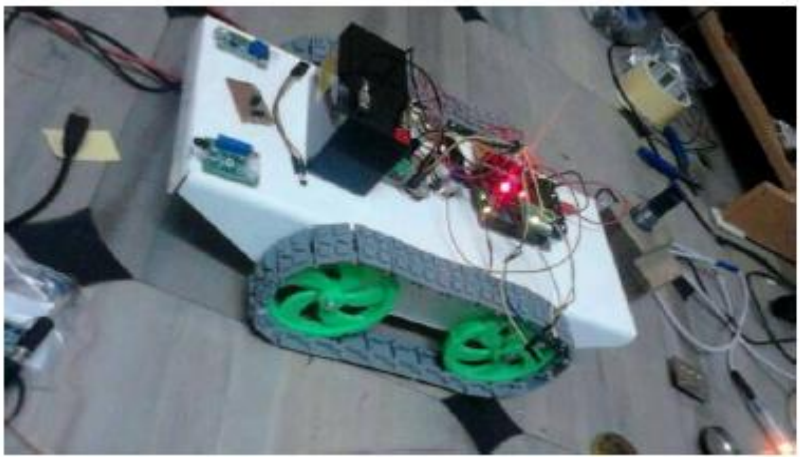


Fig.3.Result analysis



Fg.4.Hardware struture

Fastrax UP501D. The Dual-SAW filter is targeted for telematic applications where a radio transmitter is placed close to the GPS receiver. The dual filter design will provide higher attenuation outside of the GPS band and it helps to reduce the risk of EMC issues that are sometimes present when high-gain systems (GPS receiver) that are in strong signal field. National Marine Electronics Association NMEA is a standard protocol, use by GPS receivers to transmit data. NMEA 0183 sentences are all ASCII. Program is developed to make the data obtained from the controller into the computer to be user- friendly. This

program is built on java language and it converts the raw data into graphs, tables, danger indicating marks etc. This helps us to understand the data in a very easy and a fast way. Two 10 RPM motors are fixed at the back end of the platform to drive the robot Chains are installed onto these wheels to enable the even distribution of robot's weight and to reduce the slip value All the sensors, transceiver, GPS tracker, H-bridge and power supplying battery are connected to the microcontroller according to the pin diagram. Each sensor is tested by a sample program to make sure of its functioning. Then the GPS module is connected to the transmission and receiving pins of the microcontroller and the tracker is tested. The presence of multisensory and additional devices may lead to drain voltage conduction. To protect the micro controller from this, external voltage is supplied besides which an external hardware Arduino Sensor Shield V.5 is used.

CONCLUSION

The results below are taken when the environment around the cable is safe and when artificially created faults are present their respective results are obtained. The result in Fig 11 is shown when the environment is safe and hence when all the sensors are in off state. 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 co-ordinates of the fault point, which is novel attempt by using a GPS tracker.

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