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Modern Technique to Detect under Ground Cable Fault using Robot

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Abstract: Robot an automatically operated machine that replaces human effort, though it may not resemble human beings in appearance or perform functions in a human like manner. Robot can made to work on hazardous condition and it can be used in places where human can reach instantly. In this project, we are using a robot that is capable of moving inside the pipelines and detect the fault. This paper tells us about the role of robot in detecting the open circuit fault in underground cable and locating its exact location. Eddy current or Non-destructive testing of electromagnetic theory is used for the testing, various equipment like IR sensor, probe, wireless camera are mounted on the Robot and with wide range of future extension the most considerable application of this robot is that it can be used to monitor the underground geographical region.

Keyword: Robot, hazardous condition, pipelines, Equipment's, future extension.

I. INTRODUCTION

In today's world with the advancement of technology power distribution plays an important role in the economic Growth of the country, current mean of distribution is through overhead line but they are not reliable during bad weather conditions also many organization will phase problem during the cut-out of power supply, therefore we moved to underground cables but with great advantages there are also a lot of challenges with the underground cables, if fault occur in underground cable then finding its exact location and isolating it is very difficult and hole pipeline in which underground cable is place is to dig out and it is very costly and time taking. To overcome such difficult task and to make in easy working condition, here our robot is taking place, it is made to run on a platform mounted inside the pipeline where cables are placed, current our robot is detecting the open circuit fault only when it moves over the cable it detect the fault from the external point there is no requirement of any connection from the cable

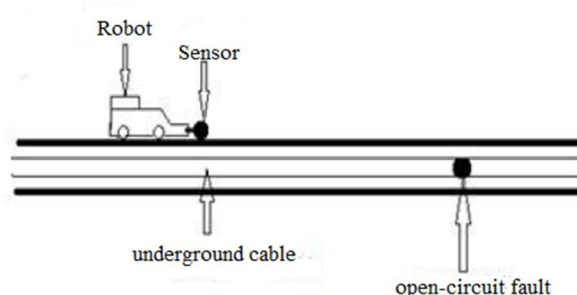


Fig1.1 Simplex model of robot.

A. Working

[1] The working of the robot is simple, it consists of the robot in which all the sensors, Bluetooth connection, eddy current probe, IOT panel, IR sensors, battery are mounted on the robot.

Eddy current testing or electromagnetic non-destructive testing is used; this test have wide range of application among them we are using eddy current testing for the detection of fault at the surface of conductor or testing material.

In non-destructive electromagnetic testing a test probe or eddy current probe is used in which an alternating current is made to flow due to which the alternating electromagnetic field is created which induces the circulating eddy current in the conductor or test part.

[3] These current reach with the various properties of the test material and in turn create their own electromagnetic field which gives the test coil a unique impedance for a given set of instantaneous test condition. A conductor or test object change in eddy current create change in the test coil impedance from which electromagnetic field changes from which we will get difference if instantaneous eddy current field and change of eddy current field at the fault location.

B. Architecture and Hardware

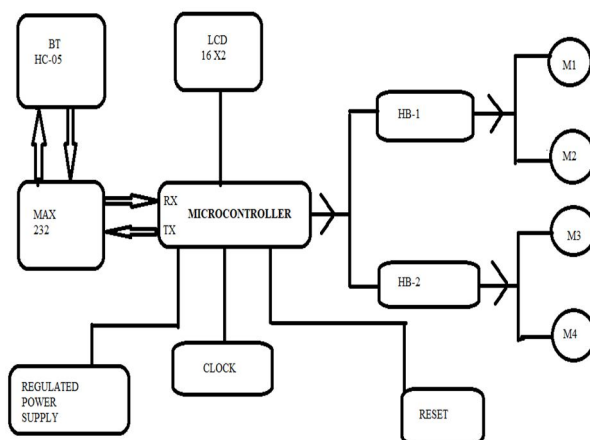


Fig1.2 Block diagram without IOT

- 1) We are using HC-05 Bluetooth serial module.
- 2) Max 232 is used for the conversion of voltage level required to make device compatible with interfacing units.
- 3) Regulated power supply is used to provide a stable voltage
- 4) Clock is used to make the signal from high to low state or ON – OFF.
- 5) Microcontroller is a processor with memory and can be programmed to perform various operations.
- 6) HB is switch that reverse the polarity of voltage.
- 7) M1, M2, M3, M4 are the geared motor for the movement of the Robot.

C. Bridge

H Bridge is a switching circuit whose main use to change the polarity of voltage by which a motor is operated and robot moves in forward direction, backward direction, braking the motor to stop the robot, rotating it toward left or right direction.

In our robot we built H Bridge using relay board. Four relay are used for the operating of motor.

One way to make H bridge is to use an array of relays from the relay board.

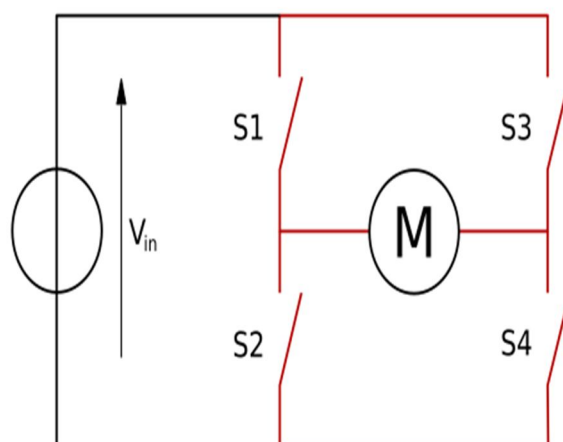


Fig1.3 Switching diagram of H-bridge relays

Two relay are used to make One H Bridge, which control two motors connected at the same side of the robot. For forward and backward direction, all four motor moves at one direction while for rotating it toward left or right motor at same side moves at on direction while motor at another side moves at opposite direction.

D. Relays

A "double pole double throw" (DPDT) relay can generally achieve the same electrical efficiency as an H pull (considering normal functions of the device). [8] Although a semiconductor-based H pull will be better for relay where a small physical size, high speed switching, or less driving voltage (or less driving power) is required, or where worn by mechanical parts is undesirable. Another option is to set a current DPDT relay and a transistor to enable current flow to determine the current flow direction. This relay can extend life, because the relay will be switched on when the transistor is closed and there is no flow in this way. It also enables the use of PWM switching to control the current level.

E. Operation

H-Bridge arrangements are usually used to overcome the polarity / direction of the motor, but the motor can also be used to 'break' where the motor suddenly stops, because the terminals of the motor is reduced, or the motor 'free run' at a stop, because the motor is effectively disconnected from the circuit.

The following table summarizes the operation with the S1-S4 related to the below diagram.

S1	S2	S3	S4	Result
1	0	0	1	Motor moves right
0	1	1	0	Motor moves left
0	0	0	0	Motor coasts
1	0	0	0	Motor coasts
0	1	0	0	Motor coasts
0	0	1	0	Motor coasts
0	0	0	1	Motor coasts
0	1	0	1	Motor brakes
1	0	1	0	Motor brakes
1	1	0	0	Short circuit
0	0	1	1	Short circuit
0	1	1	1	Short circuit
1	0	1	1	Short circuit
1	1	0	1	Short circuit
1	1	1	0	Short circuit
1	1	1	1	Short circuit

Fig1.4 summarize operation

F. Distance Location Using IR

There are mainly four units: SST 89 E 54 RDA-40-C-PIE of Microchip Technology, [2] one sensor unit, one ADC 0804 ADC component and LCD module. With detection, its exact distance is also calculated and interfaces on micro controller at 16×2 LCD. [9] The IR receiver detects IR radiation reflected by the object being measured. The output voltage level of this IR sensor depends on the intensity of the IR rays received by the receiver. The intensity, in turn, depends on the distance between the sensor module and the obstacle. When the distance between IR pair and obstruction is low, then more IR radiation falls on the receiver, and vice versa. With a resistant receiver creates a voltage divider whose output is provided as an input of ADC0804. [5] Calculation of distance is achieved by processing the output of the IR sensor through the ADC 0804 analog for digital converter. It's calibrated to get the exact distance measurement.

During Power-On Reset, the SST89E54RDA-40-C-PIE can be configured as a master for external host slots for source code storage or as a master for external host for an in-application programming (IAP) operation. The Microcontroller is designed to program programmatically and programmatically on printed circuit boards for maximum flexibility. Pre-programmed with the example of the bootstrap loader in the device memory, [7] the initial user performs the subsequent user code updating the program code loading or via the IAP operation. Sample bootstrap loader is available only for user's reference and convenience; SST does not guarantee its functionality or utility. Chip-erase or block-erase operation will erase pre-programmed sample code.

This design has many applications using ADR0804LCN / NOPB and SST89E54RDA-40-C-PIE microcontroller using infrared sensors. [4] It can also be used for automatic guided vehicles, conditions of robots as well as measuring the normal distance, liquid level in tanks and depth of ice banks. In addition, the device can work as a speed detector in production lines.

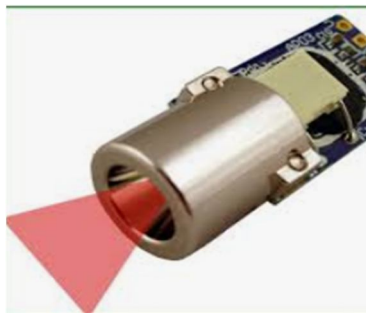


Fig1.5 IR sensor

G. Internet of Thing

- 1) *What is the Internet of Things?:* In essence, the Internet of things is the concept of connecting any device (as long as it is a on / off switch) on the Internet and other connected devices. IOT is a huge network of connected things and people - all of which collect and share data about the methods used by them and their surroundings. It contains an extraordinary number of all sizes and sizes - from smart microwave, which automatically cooks their food in self-driving cars for the right time, whose complex sensors are used to measure wearable fitness devices in their path Find out your heart rate and the number of steps that you have taken that day, then use the information that is ready for you Suggestion. There are even football associated with those who can track how far and fast they are thrown away, and for future training purposes, those figures are recorded through an app.
- 2) *How Does it Work?:* The devices and objects created in the sensor are connected to the Things Platform's Internet, which integrates data from different devices and applies the analysis to share the most valuable information with applications designed to solve specific needs. These powerful IOT platforms can accurately detect which information is useful and can be safely ignored. This information can be used to detect patterns, make recommendations, and to ascertain potential problems before they occur. With the insight provided by advanced analysis, it has the power to make processes more efficient. Smart objects and systems mean that you can automate some tasks, especially when they are repetitive, worldly, time consuming or dangerous. Let's look at some examples of what it looks like in real life. All the data that the robot is carrying can be check and analysis from anywhere using IOT and controlling of robot can also be done using it instead of using it with Bluetooth, using Bluetooth limits it performance.

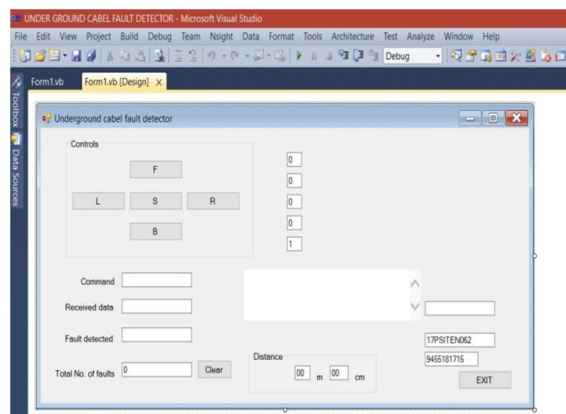


Fig1.5 Layout of IOT panel with controlling of robot

H. Social Impact Of The Project

As it was said that the next world war happen it would be because of the crises of water as the under water level is going down day by day and with this rate our future generation is going to face lots of problem.

Therefore, GPR (ground penetrating radar) technology, that uses radar pulses, which gives the images of the sub surface. It is implemented in robot that monitor the ground water level and aware the people of that region about there ground water level so that they can minimize the use of water. Ait is also use for mapping the underground geographical region for finding the underground canals and water sources. [10] Also if there is parallel sewage line running though the underground cable pipeline it can be used to find out the location of blockage of sewage line.

II. PROBLEM ANALYSIS

The actual practice of the robot is fields where the cables are laid. In our case, the robot is bulky in size. Hence, [6] for the presentation point of view, model of actual robot is developed and the fault detections is done on a wire that is laid on the cylindrical platform. For heavy load, a geared motor can be used. However, the cost of motor, motor drive and equipment is costly. In addition, testing of Short circuit can be conducted.

A. Future Scope

- 1) The robot will have an artificial intelligence and machine learning capability.
- 2) System that can detect, locate and isolate the fault remotely from any location.
- 3) Can be used in hazardous condition.
- 4) The robot can also detect other types of faults.
- 5) Ground penetrating radar (GPR) technique can also be implemented.
- 6) Advance GPS technology enables the robot with highly accurate fault location
- 7) Can be employed to detect the short circuit fault

III. CONCLUSION

- A. The main objective of the project is understand 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 provide the necessary plotting.
- B. We believe that our underground cable fault detection robot will provide the necessary solution about this fault issue to a great extent and will be really helpful for such application. The robot that we have designed to locate the fault is very much user friendly and can be easily monitor and controlled.

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