

Automatic and Obstacle Avoidance in Metal Detector Robot

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Abstract - This project aims to develop a mobile robot that can sense metals ahead of its path. Usage of this robot is reserved only in the house and on the flat surfaces. The metal detector robot is controlled by a microcontroller; Arduino Uno R3. Ultrasonic sensor detects the presence of objects or obstacles and the robot will avoid the obstacles. The metal detector uses inductive proximity sensor to detect metals. Also, it will be able to alarm user when metal is detected.

Keyword-- Robotics, Microcontroller, Embedded System, Metal Detector

1.0 INTRODUCTION

The robotic metal detector is a basic principle of robotics to detect metals without any human control. This form of metal detection is very important due to its effectiveness as compared to later forms of metal detection techniques which are manually operated and very slow in carrying out metal detection effectively. Metal detector robot is the advance innovation of the metal detector. This project is designed to develop a mobile robot that can sense metals ahead of it on its path. The robot consists of a combination of mechanical, electrical & electronics and computers. The design of the robotic metal detector involved the application of microprocessor based programming to provide a more effective form of metal detection; various microprocessors were studied in order to narrow down a simpler, economical and more flexible microprocessor to meet with the challenging task. The main usages of this robot are reserved only in the home and on the flat surfaced areas.

The metal detector robot is controlled by a microcontroller, PIC16F877A. Infra-red sensors detect the presence of objects or obstacles and the microcontroller activates the required search algorithm to detect the metallic property of the metal sensed. The metal detector makes use of inductive sensor to detect metals. This robot not only can detect the tools of elemental metals, but it will be able to attract metal that is detected using a magnet that is placed on the body of the robot.

2.0 RELATED WORK

2.1 Metal Detector Robotic Vehicle

It was designed to develop a robotic vehicle that can sense metals ahead of it on its path similar to sensing land mines. The robot is controlled by a remote using RF technology. It consists of a metal detector circuit interfaced to the control unit that alarms the user behind a suspected land mine ahead. An 8051 series of microcontroller is used for the desired operation (Amol, (2013)). A metal detector circuit is mounted on the robot body and its operation is carried out automatically on sensing any metal underneath. As soon as the robot senses this metal it generates an alarm sound. This is to alert the operator of a possible metal, for example, land mine that ahead on its path. The robot still uses 8051 series and not using the newer version of microcontroller. For example, PIC18F4550 is used for the fast calculation. They were using dc motor but not using stepper motor for more accuracy on the calculation.

2.2 Robot Rangers

The Mine Detecting Robot system consists of two main parts which is the robot itself and the remote control system used to drive the robot and display information to the user (Andersen, B., Berry, J., Boehler, G., & Setter, A. (2011)). The two parts communicate with each other through a wireless connection that sends control information to the robot and returns sensor information to display on the remote. This robot use wireless capable of locating the mines and marking them for future removal. The core of the robot system is a microcontroller that receives input from the metal detecting sensors as well as from the wireless transceiver. The wireless information is processed and sent to the motor driver circuits and the marking system, while any information from the metal detectors is sent back to the remote through the wireless transceiver.

Robot rangers were using PWM (Pause Width Modulation) software. To test the PWM software, testing the SPI connection between the microcontroller and the Atmel chip, and testing the

wireless transmission to ensure that all data was being properly sent and received by both the control board and the robot board.

The wireless must maintain connection out to 50 meters and must have battery life at least 30 minutes. The problem that still not to be solve is about receiver or the gap between the wireless receiver and device is still short. For further enhancement it would have digital copy of mines and creating map.

2.3 Mine Detection and Marking Robot

This designed robot was capable of detecting a buried mine, marking the exact location of the buried mine, and controlling itself from stepping over it and detonating the mine. The marking of the location of the possible buried mine area will be done by spraying distinctive colour paint onto that location. Moreover, with the use of interchangeable four pairs of wheels, the avoiding of the possible buried mine location can be executed without requiring the robot to dodge. This robot was using CAD software known as Pro-E to design the whole part of the robot. All the components were integrated according to the 3D model and tools were purchased and installed according to the last stage of design. Then, several tests were carried out at in-between stages to ensure the workability of each mechanism inside the robot.

2.4 Controlled Metal Detector Mounted on Mine Detection Robot

Landmine detection capability of metal detectors is very sensitive to the gap between buried landmines and the sensor heads. Therefore, human demines manually scan ground surface with the metal detectors in such a manner that the sensor heads follow the ground surface. In case of robots assisted landmine detection, this function can be performed accurately and safely by controlling the gap and attitude of the sensor heads. In this investigation, the effectiveness of the gap and attitude control of the sensor head by some mechanical manipulator on the landmine detection performance has been addressed quantitatively. To this end, the paper describes the development of a Controlled Metal Detector (CMD) for controlling the gap and attitude of the sensor head.

2.5 Remote Controlled Metal Detecting Robot With Image Transmission

This project deals with RF controlled robot. This robot prototype is for the "Path Finder". This robot is controlled by a RF remote. This can be moved forward and reverse direction using geared motors of 60RPM. Also this robot can take sharp turnings towards left and right directions. This project uses AT89S52 MCU as its controller. A high sensitive induction type metal detector is designed using Colpitts oscillator principle and fixed to this robot. Also a wireless camera with voice is interfaced to the kit. When the robot is moving on a surface, the system produces a beep sound when metal is detected. This beep sound will be transmitted to

remote place. Simultaneously the images around the robot will be transmitted to remote place. User can monitor the images and metal detection alarms on Television. The encoder continuously reads the status of the switches, passes the data to the RF transmitter and the transmitter transmits the data. This project uses 9V battery. This project is much useful for mines detection and surveillance applications.

3 METHODOLOGY

RAD model is Rapid Application Development model. It is a type of incremental model. RAD refers to a development life cycle designed to give much faster development and higher quality systems than the traditional life cycle. It is designed to take advantage of powerful development software like CASE tools, prototyping tools and code generators. In RAD model the components or functions are developed in parallel as if they were mini projects. The developments are time boxed, delivered and then assembled into a working prototype.

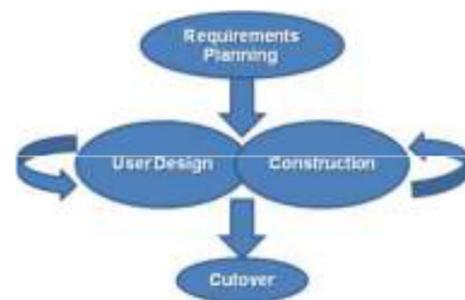


Figure 1: Rapid Application Development model

4 DATA ANALYSIS

TABLE 1 ; THESE WERE ANALYSIS TAKEN FROM TESTING THE ROBOT WITH ALL SMALL METAL ITEMS

ITEMS	DISTANCE (cm)
Pin	1.0
Needle	0.5
Ring	1.0
Coin	0.7
Key	1.0
Watch	1.0
Nail Cutter	2.0
Spoon	1.0
Nails	0.5
Copper stick	1.0

5 DISCUSSIONS

From observations, tests, and calculations by the project, a discussion that can be made is precision metal are difficult to detect if there is only one metal during this robot move. To get a proper output, the robot should move in an area with many small objects that metal elements. Furthermore, these robots provide output to the user along with the robot movements during the detection of metal objects as it could not be stopped after the detection of metal objects. However, this robot can detect metal objects next in line after the detection of metal robot movement occurs. To stop this robot after the detection of a metal object is to press the lid switch robot.

6 CONCLUSIONS

From this project, the Metal Detector Robot has successfully able to move forward, avoid the obstacles in front of it and has the ability to notify users when it detects metal.

7 REFERENCES

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