METALDETECTION ROBOTIC VEHICLEPROJECT

John Wesley[1], Richa[2], Swati Patil[3], Aishwarya[4], Ankita Patil[5]
Department of Computer Science and Engineering
Guru Nanak Dev Engineering College Bidar
Visvesvaraya Technological University Belagavi

Abstract- The goal of the study is to develop a robotic vehicle that, like a land mine detector, can identify metals on its path ahead of it. RF technology is used in a remote control to operate the robot. It is comprised of a control unit-interfaced metal detector circuit that alerts the user to a potentially dangerous land mine ahead. The desired operation makes use of a microcontroller from the 8051 series. Commands to drive the robot forward, backward, right, or left are transmitted to the receiver by pressing the transmitter's buttons. Two motors are interfaced to the microcontroller at the receiving end and used to move the vehicle. Similar to an RF remote control, the RF transmitter.
Keywords: Buzzer, Land mines, Microcontroller, Metal Detector circuit, RF Technology.

I. INTRODUCTION

The goal of the research is to construct a robotic vehicle that, like a land mine detection device, will detect metals on its path ahead of it. The main purposes of this project are to use radio frequency bands for remote control of robot using Radio Frequency technology. It comprises of a control unit along with a metal detector circuit that produces alarm sound to warn the user behind it about a doubted landmine ahead. An 8051 series of microcontroller is used for the preferred operation. As this uses radio frequency signals for the movement of robot, transmitter circuit transmit signals through air and the receiver communicate to the transmitter through these signals from the air. This robotic vehicle makes use of the transmitter and receiver at 433 MHz i.e.at radio frequency that is available at low cost hence making it very beneficial. The Radio Frequency based control is more useful as compared to the Infrared based control that limits the operating range to only a few meters of distance. Commands for controlling the movement of the robot to move forward, backward and left or right etc. are sent to the receiver circuit by using push buttons of the transmitter circuits. For the movement of the vehicle at the receiving end two motors are interfaced to the microcontroller. The RF transmitter acts as a RF remote control that has the advantage of sufficient range (upto200meters) with proper antenna, while the receiver decodes before serving it to another microcontroller to drive DC motors via motor driver IC for necessary work. A metal detector circuit is attached on the robot body and its operation is carried out automatically on sensing any metal beneath. The instant the robot senses this metal it produces an alarm sound through buzzer .This is to aware the operator about a probable metal(eg: landmines or presence of metals) onward on its path. Further the project can be enhanced by mounting a wireless camera on the robot so that the images around the robot will be transmitted to remote place and user can monitor the images and metal detection alarms on Television.

II. BLOCK DAIGRAM

This robotic vehicle uses a transmitter and receiver circuit based on radio frequency. The transmitter circuit sends the signals needed to move the robot, and the receiver circuit receives them via the radio frequency communication channel that connects them. The robot then moves in response to the commands it receives. The receiver side of the controller is interfaced with a metal detector circuit. When any metal is identified, the robot halts its progress and sounds a buzzer. The way a metal detector circuit operates is that metals in the electromagnetic field will become strengthened and resend their own electromagnetic signal when the electromagnetic field is transferred from the search coil into the earth. The search coil in the metal detector collects the retransmitted.

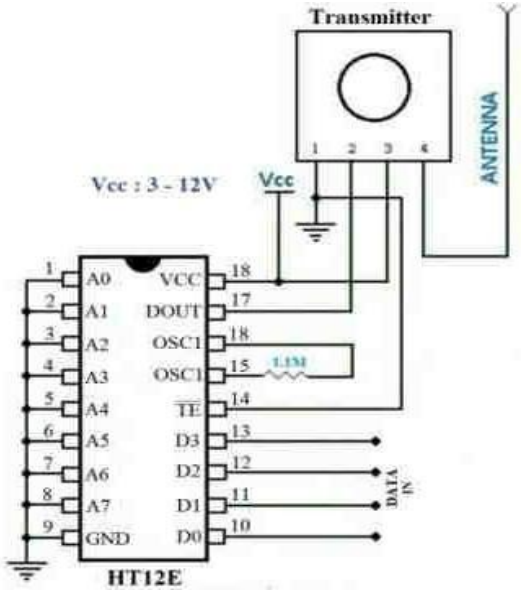

Fig.1: Block diagram of RF Transmitter

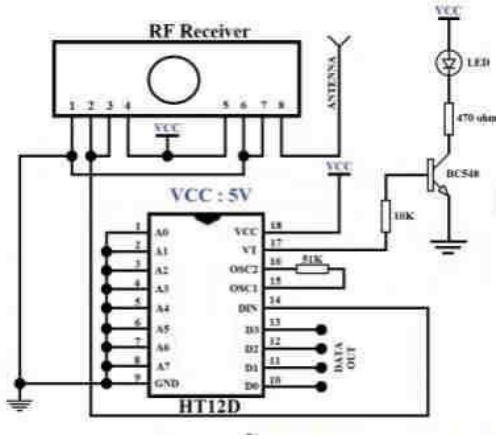

Fig.2: block diagram of RF Receiver

III.COMPONENTS:

A. Metal detector:

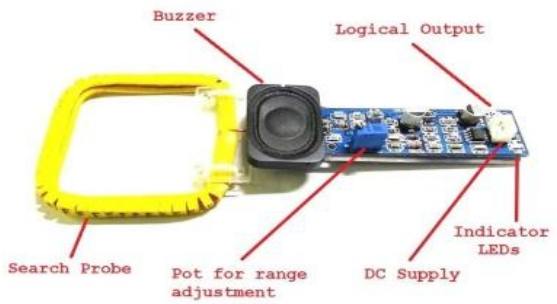

Fig. 3: Metal detector

Metal detectors offer several useful applications. A few examples include:
Security checks
Positioning detection for production equipment
Elevator floor control
Mineral prospecting
Unearthing relics and artifacts

Collecting traffic statistics
Metallic waste detection

- **How metal detectors work**

Although different designs exist, a metal detector essentially consists of two coils of wire (where one is a transmitter and the other is a receiver). When current flows through one coil, a magnetic field is generated around it.
In a metal detector, current spikes pass through the transmitter coil. As the detector moves over the ground or objects, the magnetic field also moves around with it[6].
When the transmitter coil is near a metallic object, an eddy current is induced in the metallic object due to the magnetic field of the transmitter coil. This current produces another magnetic field around the metallic object, which is detected by the receiver coil.

B. The RC-A-354 sensor:

The RC-A-354 sensor is a popular metal detector that uses an RLC circuit. It can search metals up to a distance of 3cm. At this range, it's useful for security checks or collecting metallic trash.
This sensor has a copper coil about one-meter-long that serves as the inductor. It has:
Two capacitors: 100 and 47uF
A NE555 IC
A 5K potentiometer
Two IN4148 diodes
LED indicators
A buzzer

The RC-A-354 operates via a DC 5V~9V power supply, which means it can be powered by a battery or a microcontroller, such as Arduino.

The NE555 IC works as a square-wave generator, which produces pulses. The sensor's circuit is responsible for metal detection and is an RLC network that's formed by the inductor coil, a resistor, and a capacitor. The sensor's module includes a 5K pot that's used to adjust the range (of up to 3cm)[7].
When the RC-A-354 sensor is powered on by the DC supply, a green LED is turned ON, and the NE555 generates current spikes in the transmitter coil. These alternating pulses create a magnetic field in the transmitter coil. When the sensor is near a metallic object, this magnetic field induces an eddy current.

The metallic object produces another magnetic field — when near the coil, but not directly at the center of it (or detection will not occur). This secondary magnetic field is detected by the receiver coil, which actuates the buzzer. The NE555 IC works as a square-wave generator, which produces pulses. The sensor's circuit is responsible for metal detection and is an RLC network that's formed by the inductor coil, a resistor, and a capacitor. The sensor's module includes a 5K pot that's used to adjust the range (of up to 3cm). When the RC-A-354 sensor is powered on by the DC supply, a green LED is turned ON, and the NE555 generates current spikes in the transmitter coil[14]. These alternating pulses create a magnetic field in the transmitter coil. When the sensor is near a metallic object, this magnetic field induces an eddy current. The metallic object produces another magnetic field — when near the coil, but not directly at the center of it (or detection will not occur). This secondary magnetic field is detected by the receiver coil, which actuates the buzzer. The sensor module has an additional transistor circuit that drives the LED indicator. The indicator turns RED when metal is detected. Otherwise, it stays off.

Next, connect an LED at Arduino's pin 3 with a 330Ω current-limiting resistor in series. Remember to adjust the pot on the sensor module according to the required range.

- **How it works**

When the search probe moves near a metallic object, the RC-A-354 sensor outputs a "beep" through the onboard buzzer and a green LED begins flashing. The buzzer is already connected within the sensor module, so there's no need to connect it with Arduino to receive this indication.

The sensor has a logical output, which is active HIGH. This output is used to blink the LED whenever the sensor detects a metallic object. The LED on the breadboard is

connected so that it turns ON when it sinks current from Arduino's pin through a HIGH logic. It turns OFF when Arduino's pin has a LOW logic output.

C. Ultrasonic sensor:

Fig.4: ultrasonic sensor

The widely used HC-SR04-Ultrasonic Range Finder sensor is used in numerous applications where object detection and distance measurement are necessary. The ultrasonic transmitter and receiver are formed by the module's two eyes-like projections at the front. Like bats or dolphins, the HC-SR04 ultrasonic sensor employs sonar to measure an object's distance. This ultrasonic sensor module comes in a single pack that functions as a transmitter, receiver, and control circuit! It is incredibly small and convenient to use. It comes in an easy-to-use packaging with reliable readings and great range accuracy. Unlike Sharp rangefinders, it is unaffected by sunshine or dark materials (but acoustically soft materials like cloth can be challenging to identify). The SetPoint and the.

Connection:
+5V (positive)
Trig (control)
Echo (receive)
GND (negative)

D. Arduino:

An open-source microcontroller board built around the ATmega328 chip is called the Arduino Uno. This board contains six analog input pins and fourteen digital input/output pins.A microcontroller reset button, an ICSP header, an onboard DC power jack, a USB port, and a 16 MHz ceramic resonator are all included. Everything required to sustain the microcontroller is contained in it. The board is also incredibly simple to use; just plug it in using a USB cord to a computer, or power it with a battery or DC converter, to get going. The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. Rather, the Atmega16U2Atmega8U2 is featured up to version R2) programmed as a USB-to-serial converter. The power source for the Arduino UNO is chosen automatically, though it can also be powered by an external power source via a USB connection. Batteries or wall-warts that convert AC to DC can supply external (non-USB) power. To connect the adapter, insert a 2.1mm center-positive connector into the power jack on the board. It is also possible to put leads from a battery into the Power connector's Gnd and Vin pin connectors. An external supply of 6 to 20 volts can power the board. However, the 5V pin may only give five volts, and the board can become unstable, if the supply is less than seven volts. The voltage regulator may vary.

Since DC motors could be powered from existing direct-current lighting power distribution systems so they were the first type widely used in robotic vehicle. By using either a variable supply voltage or by changing the strength of current in its field windings the speed of DC motor can be controlled over a wide range. Small DC motors are used in tools, toys, and many other appliances.

Fig.6: DC motor

E. Push Buttons:

A push-button or simply button is a simple switch mechanism for controlling some feature of a machine or process. Buttons are usually made out of hard material, usually plastic or metal. The surface is generally flat or shaped to hold the human finger or hand, so as to be easily depressed or pushed. Buttons are generally of two types. The most often are biased swiches, though even many un-biased buttons (due to their physical nature) require a spring to return back to their un-pushed state. Different terms are used by different people for the "pushing" of the button, such as press, depress, mash, hit, and punch. These push buttons are mandated by the electrical code in many jurisdictions for increased safety and are called emergency stop buttons.

Fig. 5: Arduino Uno Board

Fig. 7: Push Buttons

F. DC motor:

This group of electrical devices transforms electrical power supplied by direct current into mechanical power. The common DC motor types are dependent on the forces generated by magnetic fields. Almost all types of DC motors contain some internal mechanism, either electromechanical or electronic, to periodically alter the direction of current flow in a portion of the motor. A linear motor creates force and movement in a straight line without wavering; most other types of DC motors produce rotating motion.

IV. WORKINGPRINCIPLE:

This robotic vehicle makes use of an HT12E encoder, which converts 4-bit data to a serial output. The serial output is then fed to a radio frequency transmitter module, which transmits the data to be received by a receiver radio frequency module. The serial decoder IC (HT12D) receives the output and feeds it to pins 1-4 of the microcontroller. The controller's transmitting end is fastened to a number of pushbutton switches. A meticulous button is hit, and the software that runs provides subsequent 4-bit data that are transferred one after the other.As needed, the data obtained at port 1's receiver end controls the motor via motor driver IC L293D, which is interfaced from port 2 of the microcontroller.A 6 volt battery powers the transmitter.

V. SOFTWARE REQUIRED

Arduino IDE:

Written in Java, the Arduino integrated development environment (IDE) is a cross-platform tool available for Windows, macOS, and Linux. It is used to write and upload programs to boards that are compatible with Arduino, as well as other vendor development boards when third-party cores are utilized. The GNU General Public License, version 2 governs the publication of the IDE's source code. The Arduino IDE has specific code architecture

guidelines to support the languages C and C++. A software library from the Wiring project, which offers numerous standard input and output operations, is provided by the Arduino IDE. The only two fundamental functions that user-written code needs are to start the sketch and the main program loop. These methods are built and coupled with a program stub called main.

VI.CONCLUSION

This paper describes a metal-detecting robot that uses wireless audio transmission and radiofrequency communication. It is conceived and implemented in the embeddedsystem area using an Atmega328p Arduino. Switches are used to move the robot along a precise track, and a beeping sound is produced. Prudent work has been done in the experimental domain. The result demonstrates that employing the embedded system does in fact lead to improved effectiveness. It is shown that the suggested approach is quite advantageous for both industrial and security goals.

The mine sensor endeavor at a constant speed without any problem notwithstanding its extension, meeting the specification required for the mine recognition sensor. It contributes to the enhancement of detection rate, while upgrading the operability as verified by completion of all the detection job as scheduled. The tests confirmed that the robot would not preteens any performance problem for setting up of the mine detection sensor.

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