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Bluetooth Controlled Robotic Car with Wireless Camera & Metal Detection

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Abstract

An Arduino UNO-controlled robotic car is equipped with a metal detector and a wireless camera, which are connected via Bluetooth. The car moves using a DC motor and an L293D Motor Drive Module, powered by a 7.4V Li-Po battery. The HC-05 Bluetooth module facilitates wireless communication with an Android application for real-time control. The metal detector detects metal and sends signals to the Arduino UNO, which directs the movement of the robot. The wireless camera captures live video footage of the surrounding area, which is then transmitted to the Android application. This prototype has numerous real-world applications, including security, archaeology, search and rescue, and industrial inspection. Overall, it is an adaptable and innovative project that can be used for a wide range of applications, demonstrating the potential of combining different technologies to solve complex problems.

Keywords: Arduino UNO, Metal Detector, L293D motor drive module, Bluetooth Module, Real time control, Wireless camera, Live video footage

I. Introduction

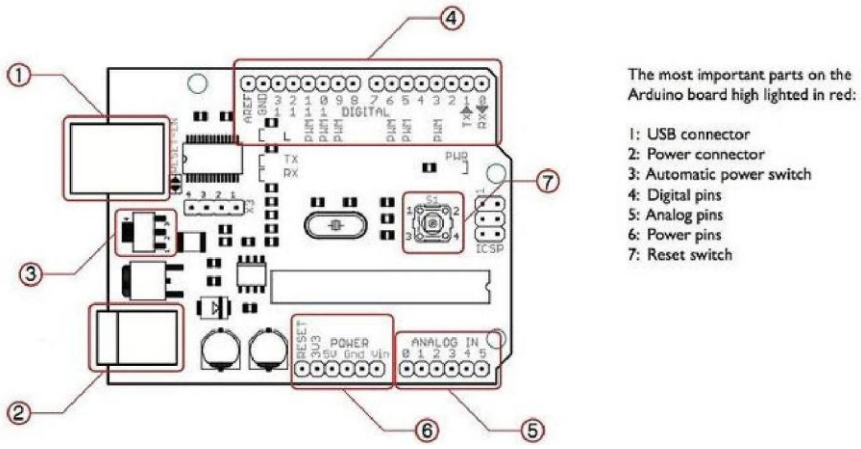
The advancement of technology has revolutionized the way we live, work, and solve problems. With the development of new technologies, we have seen the creation of innovative solutions that can address complex challenges across various fields. The robotic car equipped with a metal detector and wireless camera controlled via Bluetooth using an Arduino UNO is a prime example of one such solution.

The combination of a metal detector and wireless camera provides a comprehensive approach to detecting and examining the environment, which can be crucial in many situations. The robotic car is powered by a 7.4V Li-Po battery and uses an L293D Motor

Drive Module and DC motor for motion. The HC-05 Bluetooth module enables wireless communication with a serial Bluetooth terminal Android application, allowing real-time control of the car. The metal detector sends signals to the Arduino UNO, which then controls the robot's movement, making it a highly efficient and accurate device. The wireless camera captures live video footage of the surrounding environment, which is transmitted to the Android application, enabling a user to monitor the environment in real-time. This feature is especially useful in situations where human access may be limited, such as in hazardous areas or underground tunnels Overall, the robotic car equipped with a metal detector and wireless camera is a testament to the power of combining various technologies to create innovative solutions. Its ability to be adapted to a wide range of applications highlights its potential to address some of the most challenging problems facing industries and communities. As technology continues to advance, the possibilities for such solutions are endless.

II. Arduino UNO

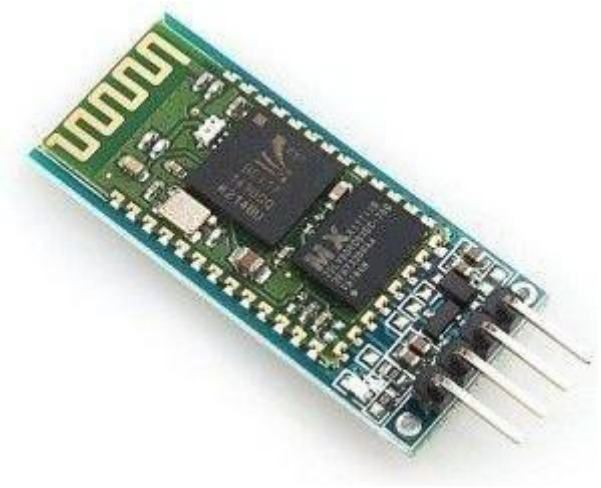
Arduino UNO acts as the central control unit that receives input from the metal detector and Bluetooth module and uses this information to control the movement of the car and the wireless camera. Specifically, the metal detector sends signals to the Arduino UNO which then analyzes and processes these signals to determine the presence and location of metal objects. The Arduino UNO then uses this information to control the movement of the robotic car by sending signals to the L293D motor driver module and the DC motor, allowing the car to move towards or away from the metal object. Additionally, the Arduino UNO is connected to the HC-05 Bluetooth module, which enables wireless communication with an Android application. This connection allows the user to send commands to the robotic car via the Android application, allowing for remote control of the car and the wireless camera. The Arduino UNO plays a crucial role in the functioning of the prototype by receiving input from various sensors and devices, analyzing this input, and using it to control the movement of the car and the wireless camera.



Arduino Pin Diagram

III. Bluetooth Module

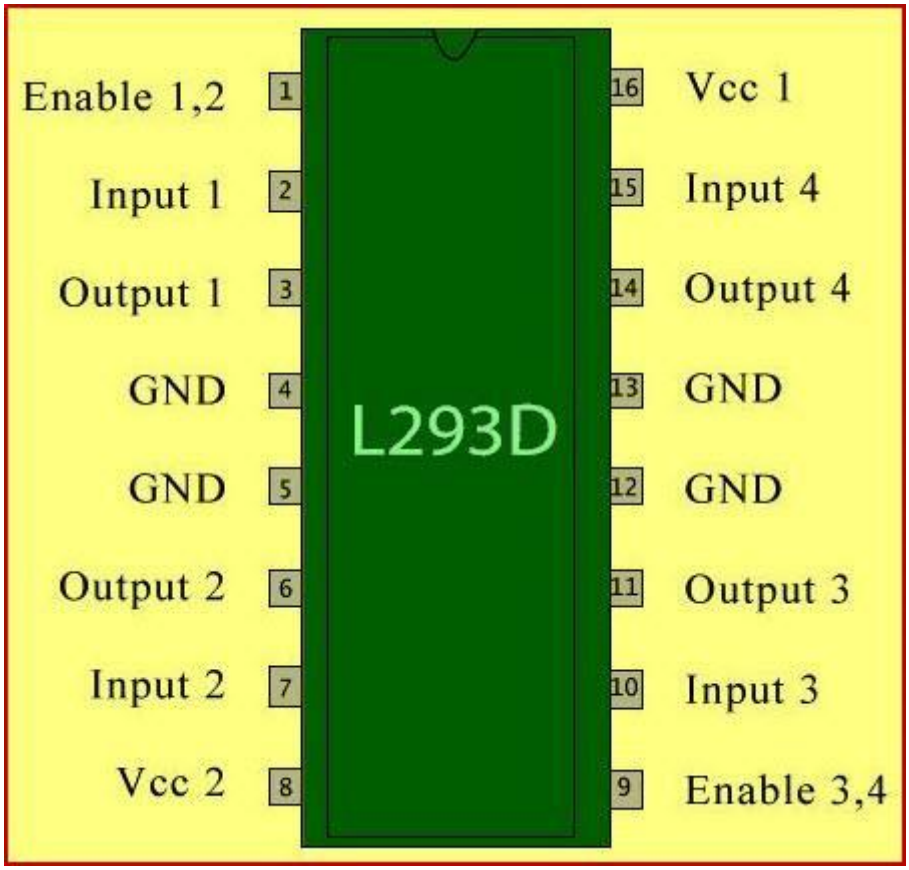
The HC-05 is an easy-to-use Bluetooth module. It works under the master or slave configuration which is very feasible for wireless communication. The HC-05 module supports Bluetooth version 2.0+EDR, which provides a stable and fast wireless connection. The module operates on a frequency of 2.4GHz, which is the standard frequency for Bluetooth communication. The HC-05 module has a maximum range of 10 meters (33 feet) in an open environment. However, the range may vary depending on the surrounding environment and other factors that could interfere with the Bluetooth signal. The module requires a 3.3V power supply to operate, making it compatible with most microcontrollers and development boards. The HC-05 Bluetooth module is responsible for establishing a connection between the robotic car and an Android device, such as a smartphone or tablet, through Bluetooth technology. This connection allows the user to send commands to the robotic car via the Android application, which then receives and processes these commands through the Arduino UNO.



Bluetooth Module

IV. L293D Motor Driver Module

This module is used to control the motion of the car's DC motor, enabling the robot to move in different directions. The L293D motor driver module is a dual H-bridge motor driver, which means it can control the speed and direction of two DC motors simultaneously. The module allows the motor to be driven in both forward and backward directions. It is a 16 pin IC with 2 enable pins 1 and 9 and 4 input pins 2,7,15,10. When pin 1 in enabled high motor with left H- bridge activates and when pin 9 is enabled high motor with right H- bridge is activated. If anyone of the either pin goes low then the motor in the corresponding section stops working. The pins 2,7 are on the left and will regulate the rotation of motor connected across left side and the pins 15,10 are on the right and will regulate the rotation of motor connected across the right side. The motors are rotated on the basis of inputs pins as LOGIC 0 or LOGIC 1.



L293D Motor Driver Module

V. Wireless Camera

The wireless camera is mounted on the car and is connected to a microcontroller, which receives the video signal from the camera and transmits it wirelessly to the Android application via Bluetooth. It has 360-degree rotation and HD quality. This allows the user to view the video feed in real-time and control the car's movement based on what they see on their device.

Wireless Camera

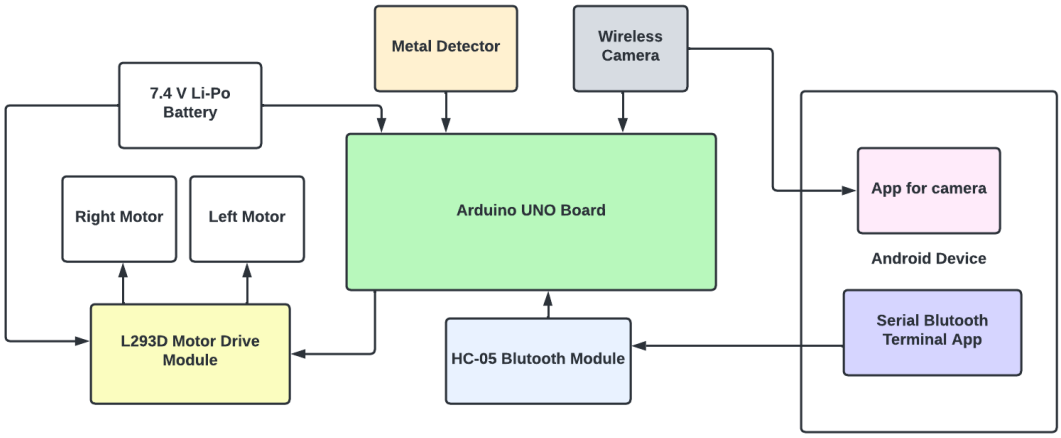
VI. Metal Detecting Sensor

A metal detecting sensor is an electronic device that can detect the presence of metal objects in its vicinity. Inductive proximity sensors work by generating a magnetic field, which induces eddy currents in any nearby metallic object. These eddy currents cause a change in the magnetic field, which is detected by the sensor. The sensor then sends a signal to a control system, which can be used to trigger an alarm, activate a machine, or perform other actions based on the detected metallic object.

Metallic Sensor

The sensor sends signals to the Arduino UNO board, which then controls the movement of the car based on the detected metal object. The red LED checks the state of the proximity sensor.

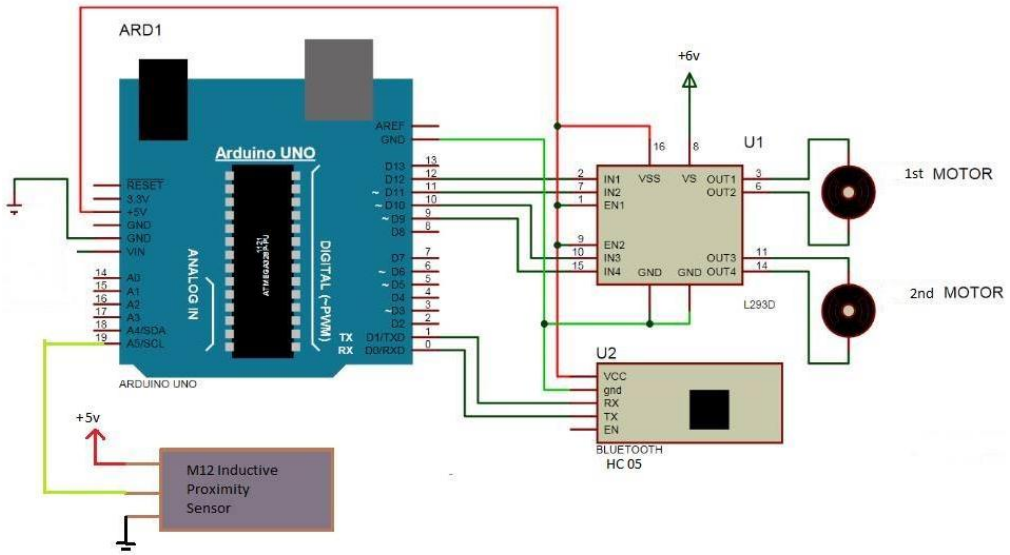
VII. Block Diagram & Circuit Diagram



Block diagram of the prototype

The metal detector sends signals to the Arduino UNO, which processes the signals and sends commands to the motor driver module. The motor driver module controls the DC motor's speed and direction to move the robot in the desired direction. The camera

captures the live video footage of the environment, which is transmitted to the Android application via the Bluetooth module. The Android application displays the video footage and allows the user to control the robot's movement via the metal detector.



Circuit Diagram of the project

Vcc and GND of Bluetooth module are connected to 5v pin and GND of Arduino. Tx and Rx pin of Arduino are connected to Rx and Tx pin of Bluetooth module. OUT1 and OUT2 of the motor driver are connected to motor 1 and OUT3 and OUT4 are connected to motor 2. The terminals of battery pack are connected to 12v and GND of motor driver module. GND pin and 5v pin of motor driver module is connected to 5v and GND of Arduino. The Digital wires of Arduino are connected with input1, input2, input3 and input4 of the motor drive. Pin 8, Vin and GND are connected to metal detecting sensor.

VIII. Operation and Working

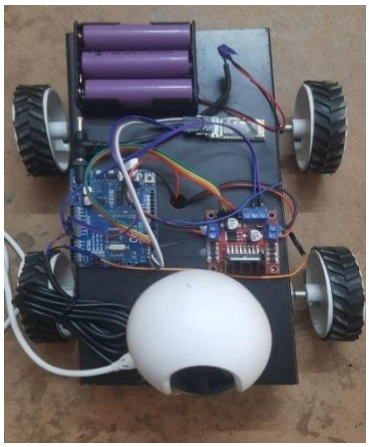
The Bluetooth module is paired to the android device and the Bluetooth module is connected to the phone using a app called Serial Bluetooth Terminal. The keys in the app are named as Forward, Backward, Right, Left and stop and the values are given as F, B, R, L and S.

The circuit is powered by a 6V power source, which is connected to the 12V pin of the L298 Motor Drive and the ground of both the Motor Drive and Arduino UNO. The digital wires of the Arduino are connected to the input pins of the Motor Drive and the output terminals are connected to the motors. The HC05 Bluetooth module is powered by the 5V pin of the Arduino UNO, with the Vcc of the Bluetooth Module connected to the 5V pin of the Arduino UNO. The Transmitter and Receiver pins of the Arduino UNO are connected to the RXD and TXD pins of the HC05 respectively. The Metal Detecting Sensor is connected to the 5V, GND, and 8 pins of the Arduino UNO. The program is uploaded to the Arduino before the Bluetooth module is connected.

After all the connections have been made, the power source is switched on, and the correct connections are indicated by the lights at the Motor Drive, Arduino UNO, and HC05. Once the Bluetooth module is connected to an Android device, the device can be controlled using the keys Forward, Backward, Left, Right, and Stop, which correspond to the values F, B, L, R, and S. When a command is passed, such as 'F' for moving forward, it is transmitted to the Bluetooth module, which sends it to the Arduino UNO. The Arduino UNO receives the command and passes it to the Motor Drive through its digital pins, which then controls the output pins connected to the motors.
The metal detector sends signals to the Arduino UNO when it detects the presence of metallic objects. The Arduino UNO receives these signals and adjusts the movement of the robot accordingly. The wireless camera captures live video footage of the surrounding environment and transmits it to the app.

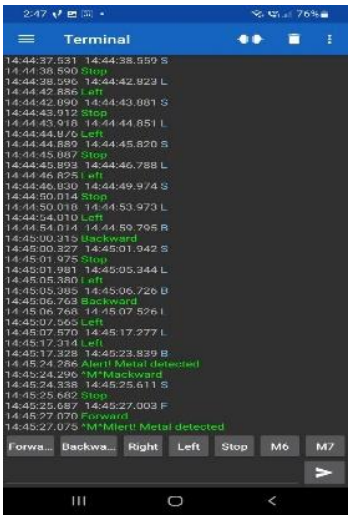
XI. Results

The below is the prototype of the project and the screenshot the message alert when the metal is detected.



Project Model Top Vie

Project Model Front View



Screenshot of the Message Alert

CONCLUSIONS

In conclusion, the prototype of the robotic car equipped with a metal detector and wireless camera controlled via Bluetooth using an Arduino UNO has proven to be a versatile and innovative device that can be used for a wide range of real-time applications. The project's success can be attributed to the efficient and effective integration of various electronic components, including the L293D Motor Drive Module, HC-05 Bluetooth module, and metal detecting sensor. The wireless camera also adds to the functionality and versatility of the device, making it useful for industrial inspections, search and rescue operations, archaeology, and security applications. Overall, this project showcases the potential of integrating different technologies to create novel and practical solutions for real-world problems.

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