A Project Report

on

"Bluetooth Controlled Robot Car Using Arduino"

by

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ABSTRACT

This project presents the design and development of a Bluetooth controlled robot car using Arduino. The system allows the robot to be controlled wirelessly through a smartphone application using an HC-05 Bluetooth module. An Arduino Uno is used as the main controller to process the commands received from the mobile device. The movement of the robot is achieved using DC motors controlled by an L298N motor driver. The robot can move forward, backward, left, right, and stop based on user input. This project helps in understanding basic concepts of robotics, wireless communication, and motor control. It is a simple and cost-effective model suitable for beginners to learn IoT and embedded systems.

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INTRODUCTION

Robotics and Internet of Things (IoT) technologies are becoming an important part of modern engineering and daily life. One of the basic and effective ways to understand these technologies is by building a simple robot that can be controlled wirelessly. A Bluetooth controlled robot car is a beginner-level project that demonstrates how hardware and software work together to perform real-time actions.

In this project, an Arduino-based robot car is designed and controlled using a smartphone through Bluetooth communication. The HC-05 Bluetooth module enables wireless data transmission between the mobile device and the Arduino. The Arduino processes the received commands and controls the motors with the help of an L298N motor driver. This project helps learners understand microcontroller programming, motor control, and wireless communication. The simplicity and low cost of the system make it suitable for educational and learning purposes.

- **WHAT IS A ROBOT CAR?**
  A robot car is a small mobile robotic system that can move in different directions using motors and wheels. It is controlled by a microcontroller, such as Arduino, which processes commands and controls the movement of the motors. Robot cars are commonly used in educational projects to demonstrate basic concepts of robotics, electronics, and programming. Depending on the design, a robot car can be controlled manually or operate automatically using sensors and wireless communication.

- **WHY BLUETOOTH CONTROL IS USEFUL?**
  Bluetooth control allows the robot car to be operated wirelessly using a smartphone or laptop. It eliminates the need for physical connections such as wires or remote controls. Bluetooth communication is easy to implement, low-cost, and suitable for short-range control. Since most smartphones already have Bluetooth, it makes the system user-friendly and convenient for beginners to understand wireless communication.

- **REAL WORLD APPLICATIONS.**

  Bluetooth controlled robot cars are used in various practical and learning applications. They help in understanding how wireless control systems work and form the base for more advanced robotic systems.

  - **Surveillance**

    Robot cars can be used for surveillance in areas that are difficult or unsafe for humans to access. By attaching a camera or sensors, the robot can monitor restricted or hazardous locations and transmit information wirelessly to the user.

  - **Robotics Learning**

    Robot cars are widely used in educational institutions to teach students about robotics and embedded systems. They provide hands-on experience with microcontrollers, motor drivers, and communication modules, helping students understand theoretical concepts through practical implementation.

  - **Automation Basics**

    A robot car introduces the fundamentals of automation by performing tasks based on programmed instructions. It helps learners understand how machines can be controlled automatically and remotely, which is essential for developing advanced automation and IoT-based systems.

OBJECTIVES

i. The main objectives of the Bluetooth controlled robot car project are:

ii. To design and develop a robot car using Arduino as the main controller.

iii. To control the movement of the robot wirelessly using Bluetooth communication.

iv. To understand the working of DC motors and motor drivers.

v. To learn how a mobile application can be used to control hardware devices.

vi. To gain basic knowledge of robotics, embedded systems, and IoT concepts.

vii. To build a low-cost and beginner-friendly robotic system for educational purposes.

COMPONENTS REQUIRED

- Arduino Uno – Main controller
- HC-05 Bluetooth Module – Wireless communication
- L298N Motor Driver – Controls motor direction and speed
- DC Gear Motors – Movement of the car
- Robot Chassis – Mechanical base
- Wheels & Caster Wheel
- Battery Pack (4 × 1.5V cells)
- Jumper Wires
- On/Off Switch

WORKING PRINCIPLE

The working principle of the Bluetooth controlled robot car is based on wireless communication between a smartphone and the robot using Bluetooth technology. A mobile application sends control commands when the user presses the arrow buttons. These commands are transmitted as characters through the HC-05 Bluetooth module.

The HC-05 receives the data and sends it to the Arduino Uno. The Arduino processes the received command and decides the direction of movement. Based on the command, the Arduino sends control signals to the L298N motor driver. The motor driver then supplies the required voltage and current to the DC motors.

As a result, the motors rotate in the desired direction, allowing the robot car to move forward, backward, left, right, or stop. This process continues in real time as long as commands are received from the mobile application, enabling smooth and wireless control of the robot car.

CIRCUIT CONNECTIONS

- A battery pack consisting of four 1.5 V AA batteries connected in series provides a total supply of 6 V to the system.
- The positive terminal of the battery pack is connected to the +12V terminal of the L298N motor driver through an on/off switch.
- The negative terminal of the battery pack is connected to the GND terminal of the L298N motor driver.
- Two DC motors are connected to the output terminals of the L298N motor driver.
    - Left motor is connected to OUT1 and OUT2.
    - Right motor is connected to OUT3 and OUT4.
- The Arduino Uno is interfaced with the L298N motor driver for motor control.
    - Arduino pin D8 is connected to IN1 of the motor driver.
    - Arduino pin D7 is connected to IN2 of the motor driver.
    - Arduino pin D6 is connected to IN3 of the motor driver.
    - Arduino pin D5 is connected to IN4 of the motor driver.
    - Arduino pin D9 is connected to ENA.
    - Arduino pin D10 is connected to ENB.
- The ground pin of the Arduino is connected to the ground pin of the L298N motor driver to maintain a common ground.

- The HC-05 Bluetooth module is connected to the Arduino for wireless communication.
    - HC-05 VCC is connected to Arduino 5V.
    - HC-05 GND is connected to Arduino GND.
    - HC-05 TX is connected to Arduino pin D2.
    - HC-05 RX is connected to Arduino pin D3.
- The 5V output from the motor driver is connected to the Arduino 5V pin to power the Arduino when USB is disconnected.
- All components share a common ground to ensure stable and reliable operation of the system.

SOFTWARE USED

- Arduino IDE
    - Used to write, compile, and upload the Arduino program.
    - Provides an easy environment for programming the Arduino Uno.
    - Used to communicate with the Arduino board during code uploading.

- Bluetooth RC Controller (Mobile Application)
    - Used to control the robot car wirelessly.
    - Sends control commands such as forward, backward, left, right, and stop.
    - Communicates with the HC-05 Bluetooth module.

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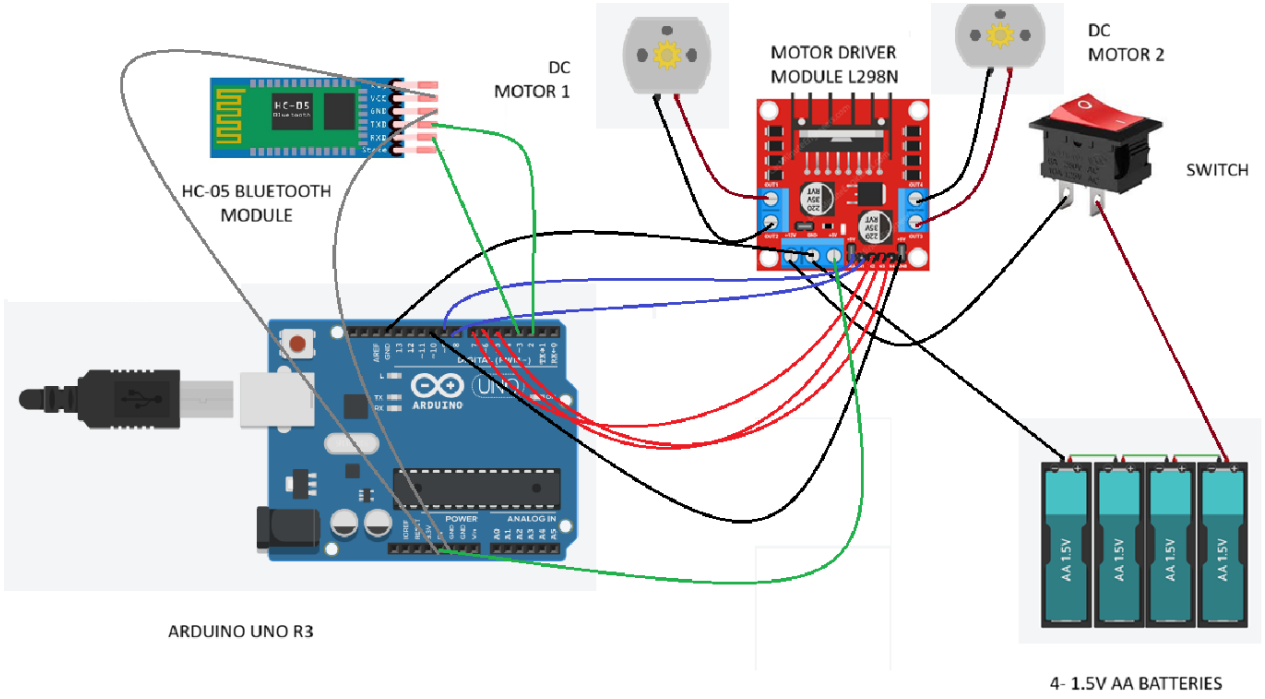
ALGORITHM

1. Start the system.
2. Initialize the Arduino and Bluetooth communication.
3. Wait for a command from the Bluetooth module.
4. If a command is received:
    - If the command is **Forward**, move the robot forward.
    - If the command is **Backward**, move the robot backward.
    - If the command is **Left**, turn the robot left.
    - If the command is **Right**, turn the robot right.
    - If the command is **Stop**, stop the robot.
5. Repeat steps 3 and 4 continuously.
6. End.

FLOWCHART

DESIGN LAYOUT



Circuit layout of Bluetooth controlled robot car using Arduino Uno

ARDUINO CODE

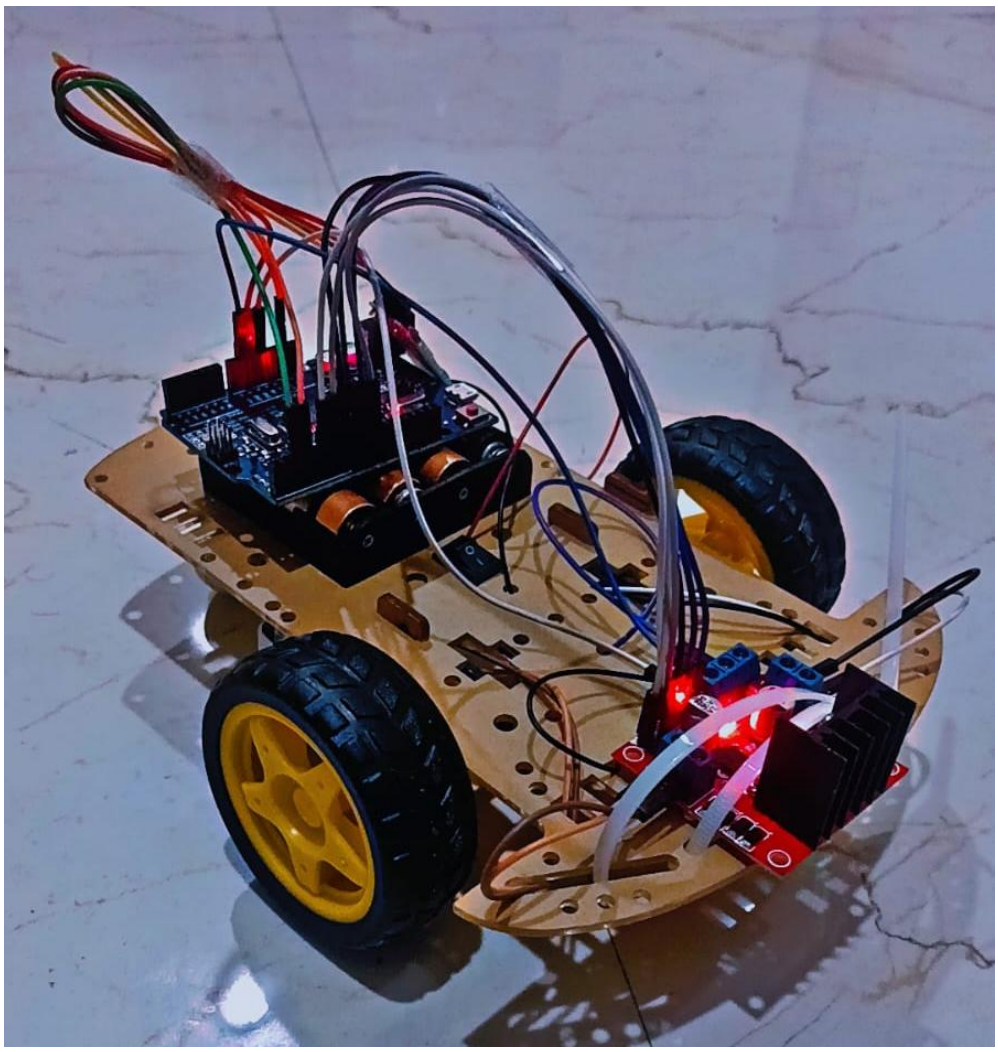
```
#include <SoftwareSerial.h>
SoftwareSerial bt(2, 3); // RX, TX

// Motor driver pins
int ENA = 9;
int IN1 = 8;
int IN2 = 7;
int IN3 = 6;
int IN4 = 5;
int ENB = 10;

char cmd;
void setup() {
  bt.begin(9600);

  pinMode(ENA, OUTPUT);
  pinMode(ENB, OUTPUT);
  pinMode(IN1, OUTPUT);
  pinMode(IN2, OUTPUT);
  pinMode(IN3, OUTPUT);
  pinMode(IN4, OUTPUT);

  analogWrite(ENA, 200); // speed (0–255)
  analogWrite(ENB, 200);
  stopCar();
}
void loop() {
  if (bt.available()) {
    cmd = bt.read();

    if (cmd == 'F' || cmd == 'f') forward();       // Forward
   else if (cmd == 'B' || cmd == 'b') backward();     // Backward
   else if (cmd == 'L' || cmd == 'l') left();   // Left
   else if (cmd == 'R' || cmd == 'r') right();       // Right
   else if (cmd == 'S' || cmd == 's') stopCar();   // Stop
  }
}
```

```
// ---- motor functions ----

void forward() {
  digitalWrite(IN1, HIGH);
  digitalWrite(IN2, LOW);
  digitalWrite(IN3, HIGH);
  digitalWrite(IN4, LOW);
}

void backward() {
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, HIGH);
  digitalWrite(IN3, LOW);
  digitalWrite(IN4, HIGH);
}

void left() {
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, HIGH);
  digitalWrite(IN3, HIGH);
  digitalWrite(IN4, LOW);
}

void right() {
  digitalWrite(IN1, HIGH);
  digitalWrite(IN2, LOW);
  digitalWrite(IN3, LOW);
  digitalWrite(IN4, HIGH);
}

void stopCar() {
  digitalWrite(IN1, LOW);
  digitalWrite(IN2, LOW);
  digitalWrite(IN3, LOW);
  digitalWrite(IN4, LOW);
}
```

RESULT AND OUTPUT

The Bluetooth controlled robot car was successfully designed and implemented using Arduino. After uploading the program and establishing a Bluetooth connection with the mobile application, the robot responded correctly to user commands. The robot was able to move forward, backward, turn left, turn right, and stop as instructed through the Bluetooth controller app.

The wireless control using the HC-05 Bluetooth module worked smoothly within the specified range. The L298N motor driver effectively controlled the DC motors, providing stable movement of the robot car. The system operated reliably using battery power without the need for a wired connection to the computer. Overall, the project achieved the desired outcome and demonstrated successful integration of hardware and software components.



APPLICATIONS

- Used for learning basic robotics and embedded systems.
- Can be applied in remote-controlled vehicles.
- Useful for understanding wireless communication using Bluetooth.
- Can be extended for surveillance purposes by adding a camera.
- Serves as a base model for automation and IoT projects.

ADVANTAGES

- Simple and easy to build.
- Low-cost and beginner friendly.
- Wireless control using a smartphone.
- No need for complex hardware or sensors.
- Helps in understanding practical robotics concepts.

LIMITATIONS

- Limited Bluetooth range.
- Manual control only, no autonomous operation.
- No obstacle detection or safety features.
- Performance depends on battery life.

CONCLUSION

The Bluetooth controlled robot car project successfully demonstrates the basic principles of robotics, wireless communication, and motor control using Arduino. The system allows reliable and smooth control of the robot through a smartphone using Bluetooth technology. This project provided hands-on experience with microcontroller programming, hardware interfacing, and real-time control. Overall, the project proved to be an effective learning model for beginners and can be further enhanced by integrating additional sensors and automation features.

REFERENCES

- Arduino Official Website – www.arduino.cc
  (Used for Arduino board information and programming reference)

- Arduino IDE Documentation – https://docs.arduino.cc
  (Referred for coding, pin configuration, and serial communication)

- Google – www.google.com

- YouTube – www.youtube.com

- ChatGPT – https://chatgpt.com/