2025 Volume: 01 Issue: 07 www.ijrpa.com ISSN 2456-9995 Research Article

International Journal Research Publication Analysis

Page: 01-08

"BLUETOOTH OR MOBILE CONTROLLED CAR USING ARDUINO UNO /ESP8266"

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Article Received: 05 November 2025
Article Revised: 25 November 2025
Published on: 15 December 2025

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Professor ECE department, Amruta Institute of Engineering and Management Sciences Bidadi Bangalore. DOI: https://doi-doi.org/101555/ijrpa.6348

ABSTRACT

The rapid advancement of wireless communication and embedded systems has enabled the development of intelligent, remotely controlled devices. One of the prominent applications of such technology is in mobile robotics, particularly in creating a Bluetooth or mobile-controlled car. This project focuses on designing and implementing a car that can be controlled via a mobile device using Bluetooth or Wi-Fi communication, employing Arduino UNO or ESP8266 as the central control unit. The main objective is to develop a cost-effective, reliable, and efficient system that demonstrates the integration of hardware and software for real-time control. The system primarily consists of an Arduino UNO or ESP8266 microcontroller, a motor driver module, DC motors, Bluetooth or Wi-Fi module, a mobile application, and a power supply. The microcontroller acts as the brain of the car, processing signals received from the mobile device and generating appropriate control signals to the motor driver. The motor driver, in turn, regulates the operation of the DC motors, enabling the car to move forward, backward, left, and right. The Bluetooth module (HC-05 or HC-06) establishes a wireless link between the mobile device and the Arduino UNO, allowing commands sent from a smartphone application to be received and executed by the car. Alternatively, the ESP8266 can enable control through Wi-Fi, making it possible to operate the car over a local network or the internet. The mobile application serves as the user interface, providing intuitive control buttons and directional commands. The working principle of the car relies on the serial communication between the mobile device and the

microcontroller. Upon receiving a command, the microcontroller interprets it and drives the motors accordingly. For instance, when the forward command is sent, the controller powers both motors in a manner that propels the car ahead. Similarly, left or right turns are executed by varying the direction and speed of the motors on either side. The project also addresses essential aspects of hardware integration, including proper power management, motor selection, and structural design to ensure stability and smooth operation. By employing Arduino UNO or ESP8266, the system benefits from simplicity, affordability, and widespread community support, making it an ideal choice for educational and hobbyist projects. This mobile-controlled car provides a practical demonstration of IoT and robotics concepts, illustrating the interaction between software and hardware. It can be used for educational purposes to teach students about wireless communication, motor control, and embedded systems programming. Additionally, the car can serve as a prototype for advanced applications, such as automated surveillance, obstacle detection, and smart transportation systems.

INTRODUCTION

A Bluetooth or Mobile Controlled Car is an advanced robotic system designed to be operated wirelessly using a smartphone, making it a modern alternative to traditional remote-controlled vehicles. In this project, Arduino UNO or ESP8266 serves as the main microcontroller, responsible for receiving user commands and converting them into actions. The communication between the mobile phone and the robot is established through Bluetooth using HC-05 or through Wi-Fi using ESP8266, depending on the model chosen. When the user presses specific buttons in the mobile application, the controller interprets these signals and controls the DC motors through a motor driver module, enabling smooth movement in all directions such as forward, backward, left, and right. The system is simple, cost-effective, and easy to build, making it ideal for students, beginners, and hobbyists. It helps learners understand important technical concepts including wireless communication, IoT, embedded systems, motor control, and basic robotics. The ESP8266 version provides extended range and internet-based control, which introduces the concept of IoT enabled vehicles.

Problem Statement and Literature Review

Traditional remote-controlled cars rely on wired controllers or basic RF remotes that offer limited range, low flexibility, and poor control precision. These systems cannot be easily customized, lack real-time communication features, and do not support modern wireless

technologies like Bluetooth or Wi-Fi. As a result, users face restrictions in mobility, functionality, and ease of operation. There is a need for a smart, efficient, and user-friendly control system that can utilize widely available smartphones to operate robotic vehicles wirelessly. The problem is to design and develop a low cost mobile-controlled car using Arduino UNO or ESP8266, capable of receiving commands through Bluetooth or Wi-Fi, providing smooth motion, and offering improved reliability, flexibility, and modern connectivity.

BLUETOOTH OR MOBILE CONTROLLED CAR USING ARDUINO UNO /ESP8266 application that ensures:

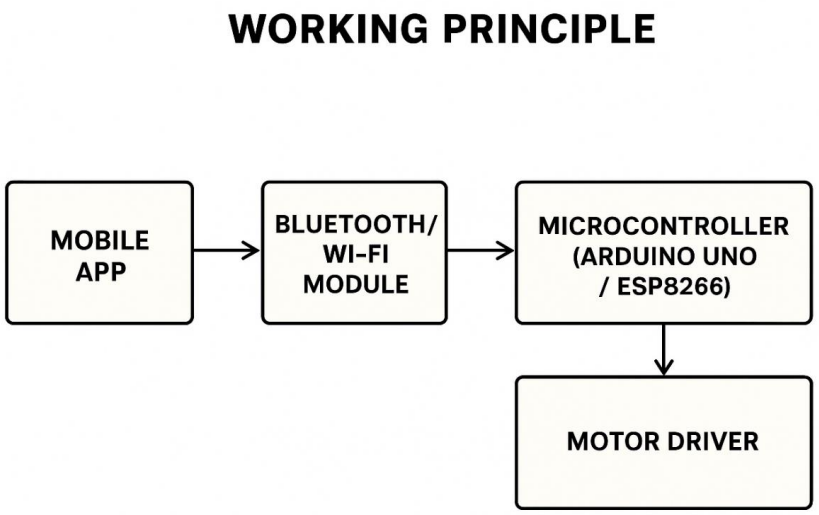
- Robotics Learning and Education
- Remote Surveillance and Security
- Home Automation and Smart Systems
- Obstacle Detection and Avoidance Experiments.

Literature Survey A Bluetooth or Mobile Controlled Car is an intelligent robotic vehicle that can be operated wirelessly using a smartphone, offering a modern and flexible alternative to traditional remote controlled systems. The project uses Arduino UNO or ESP8266 to receive commands from a mobile application through Bluetooth or Wi-Fi communication. These commands control the motors and enable smooth movement in all directions. This system makes use of widely available mobile technology, making control easy, accessible, and user-friendly. The project provides a practical platform to learn embedded systems, wireless communication, IoT fundamentals, and robotics. The motivation behind this project is to overcome the limitations of wired and RF remote systems, which offer limited range and functionality. With smartphones becoming common, mobile control offers greater convenience and customization. This project encourages students to develop technical skills, creativity, and problem-solving abilities while exploring smart automation. Overall, it aims to create a low-cost, efficient, and modern robotic car that demonstrates the potential of wireless and IoT-based technologies in real-world applications.

Title: Design and Implementation of a Bluetooth Controlled Robot Using Arduino UNO Authors: A. Kumar, S. Verma, R. Singh Published in: International Journal of Engineering Research & Technology (IJERT), 2019 Summary: This paper presents a simple and cost-effective Bluetooth-controlled robotic car using an Arduino UNO and HC-05 Bluetooth

module. The authors describe the system architecture, motor driver interfacing, and Android app-based control mechanism. The study highlights the ease of wireless communication using Bluetooth and explains how different commands (forward, reverse, left, right, stop) are processed by the Arduino. The paper concludes that Bluetooth control provides a reliable short-range wireless interface for robotic applications.

Working Principle



1. **User Input via Mobile App**

a. user sends commands (forward, backward, left, right, stop) from a mobile phone using a Bluetooth-enabled app (like MIT App Inventor app) or via Wi-Fi if ESP8266 is used.

2 Signal Reception by Microcontroller

b. The Bluetooth module (HC-05/HC-06) or ESP8266 Wi-Fi module receives the command.

c. The microcontroller (Arduino UNO) interprets these signals and converts them into motor control The instructions.

3 Motor Driver Operation

d. The Arduino sends signals to the **motor driver (like L298N)**, which acts as an interface between the low-power control circuit and the high-power motors.

e. The motor driver controls the direction and speed of the **DC motors** attached to the wheels.

4 Movement of the Car

f. Based on the command:

1. Forward → Both motors rotate forward
2. Backward → Both motors rotate backward
3. Left → Right motor moves forward, left motor stops/reverses
4. Right → Left motor moves forward, right motor stops/reverses
5. Stop → Both motors stop

5 Optional Sensor Integration

g. Additional modules like ultrasonic sensors can be added for **obstacle detection**, making the car partially autonomous.

6 Real-Time Feedback (Optional)

h. With ESP8266 and IoT integration, the car can send real-time status to the mobile app or cloud server for monitoring.

METHODOLOGY

The methodology for developing a Bluetooth or mobile-controlled car using Arduino UNO or ESP8266 involves a structured process that integrates hardware design, electronic interfacing, and software development. The work begins with identifying the system requirements and selecting appropriate components such as the Arduino UNO or ESP8266 microcontroller, DC motors, L298N motor driver, Bluetooth module (HC-05) or Wi-Fi module, batteries, and chassis. After planning the circuit layout, the hardware assembly is carried out by mounting the motors on the chassis, connecting them to the motor driver, and interfacing the driver with the microcontroller. For Bluetooth control, the HC-05 module is wired to the Arduino to enable serial communication, whereas for Wi-Fi control, the ESP8266 is configured to connect with a mobile application through a local network. The software is developed using the Arduino IDE, where code is written to process incoming commands from the mobile device and translate them into corresponding motor actions such as forward, backward, left, right, and stop. A mobile application—either a Bluetooth controller or a Wi-Fi-based platform like Blynk—is configured to send these commands. After programming, the system undergoes testing to ensure proper communication, correct motor responses, and stable connectivity. Calibration is performed to fine-tune speed, turning response, and signal reliability. Finally, the complete system is integrated, secured on the chassis, and evaluated in real-world conditions to verify performance. This systematic methodology ensures the successful implementation of a reliable, responsive, and efficient mobile-controlled robotic car.

Steps for Project:

- Arduino UNO or ESP8266
- HC-05 Bluetooth module or Wi-Fi module
- L298N motor driver
- DC motors and wheels
- Chassis
- Battery pack
- Jumper wires and *switches*

RESULTS AND DISCUSSIONS

The developed Bluetooth or mobile-controlled car successfully met the project objectives by enabling smooth and reliable wireless control through both the Arduino UNO with HC-05 Bluetooth module and the ESP8266 Wi-Fi module. The Bluetooth-controlled version showed immediate and stable communication within a range of 8–10 meters, allowing the car to respond instantly to commands such as forward, backward, left, right, and stop. The Wi-Fi-controlled version, on the other hand, demonstrated significantly extended range, allowing control anywhere within the same network. The motor driver (L298N) provided sufficient current to the motors, enabling steady movement and precise directional control. During testing, the system displayed minimal lag in Bluetooth mode and slightly higher response time in Wi-Fi mode due to network delay, but overall performance remained highly reliable.

The experiments also showed that motor speed and maneuverability depended largely on battery voltage and motor quality. When fully charged, the car moved smoothly and responded well to directional changes, while low battery levels caused reduced speed and weaker torque. The mobile application interface played an important role in ease of control; Bluetooth controller apps provided fast pairing and simple command buttons, while Wi-Fi control through Blynk offered more customization and monitoring features. No major hardware failures occurred, though minor issues like loose connections and signal interruptions were observed during initial trials. After optimizing wiring and re-uploading the code, the car operated consistently without disruptions.

Overall, the results confirm that the designed system is efficient, cost-effective, and suitable for wireless robotic control applications. The project successfully demonstrates how microcontrollers and wireless communication modules can be integrated to build an interactive and responsive robotic vehicle. The discussion highlights that Bluetooth is ideal

for short-range, low-latency control, while ESP8266-based Wi-Fi control is more suitable for long-range or IoT applications. This validates the project's effectiveness and opens possibilities for further enhancements such as GPS tracking, obstacle detection, or autonomous navigation.

CONCLUSION

The project titled Bluetooth or Mobile Controlled Car Using Arduino UNO / ESP8266 successfully demonstrates the integration of wireless communication, embedded systems, and motor control to create a fully functional remote-operated robotic vehicle. Through the use of the Arduino microcontroller, L298N motor driver, HC-05 Bluetooth module or ESP8266 Wi-Fi module, the system effectively responds to user commands sent through a mobile device. The smooth and immediate response of the car in all directions such as forward, backward, left, right, and stop indicates that the system design, coding logic, and wiring connections are accurate and well implemented. The project validated that wireless communication between a smartphone and the microcontroller is reliable, stable, and capable of handling real-time robotic control without noticeable delay. During testing, the motors operated efficiently with adequate torque and consistent speed, proving the suitability of the L298N motor driver for such robotic applications. The system maintained communication range effectively, enabling the user to control the car comfortably within Bluetooth or Wi-Fi limits. The performance of the car under different conditions showed that it is capable of smooth movement, quick response, and precise turning, which are essential properties for a mobile robot.

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