International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Mobile-App Operated Smart Robot Car Using Arduino

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Abstract - This paper presents the design and implementation of a smart robot car that can be remotely controlled using a mobile application via Bluetooth connectivity. The system utilizes an Arduino microcontroller as the core processing unit, interfaced with a motor driver module and Bluetooth module (HC- 05) to enable wireless communication with an Android- based smartphone. The mobile application provides an intuitive user interface to control the movement and direction of the robot car in real time. This project demonstrates a cost-effective and flexible solution for wireless robotic control, making it suitable for educational purposes, home automation, and beginner- level robotics projects. The integration of Arduino and Android technologies showcases the potential for creating smart, responsive systems with minimal hardware and open-source platforms.

***Key Words*:** Arduino, Android, Robot Car, Bluetooth Communication, Mobile Application, Wireless Control, HC-05 Module, Motor Driver, Embedded Systems, Smart Robotics.

1. INTRODUCTION

The rapid development of embedded systems and wireless communication technologies has significantly influenced the evolution of automation and robotics. Among these, Arduino-based systems have gained popularity due to their affordability, flexibility, and ease of integration with various modules and sensors. Simultaneously, the widespread use of smartphones has opened new opportunities for wireless control systems through mobile applications.This paper focuses on the development of a smart robot car that is operated via a mobile application using Bluetooth communication. The system is designed around an Arduino Uno microcontroller, which acts as the brain of the robot, receiving commands from an Android smartphone through an HC-05 Bluetooth module. A motor driver module is used to control the movement of the car's wheels, based on the instructions sent from the mobile app.The primary objective of this project is to create a cost-effective, user- friendly, and flexible robotic platform that can be easily controlled without requiring specialized equipment. The proposed system demonstrates the integration of hardware and software components to achieve real-time wireless control, making it suitable for educational demonstrations, beginner robotics projects, and further research in mobile- based automation.This paper is organized as follows: Section 2 discusses related works, Section 3 describes the system design and components, Section 4 presents the implementation and results, and Section 5 concludes with possible future improvements.

2. Body of Paper

In recent years, the integration of smartphones with microcontrollers has opened up new possibilities in the field of robotics and automation. Several researchers have explored wireless control of robots using Bluetooth modules and mobile applications. Many of these studies employed Arduino boards due to their open-source nature and user-friendly environment. Android smartphones have been widely used as control units, leveraging their processing power and built-in wireless communication features. While previous projects have focused on advanced navigation, obstacle avoidance, or GPS-based tracking, there remains a need for simple, cost-effective designs that can be used in educational and prototype applications. This project builds upon these ideas by combining ease of use with basic functionality to create a straightforward, Android- controlled robotic car.The system is designed around an Arduino Uno microcontroller, which acts as the brain of the robot. It is connected to an HC-05 Bluetooth module, which facilitates communication between the Arduino and an Android smartphone. The robot uses an L298N motor driver module to control two DC motors, allowing for forward, backward, left, and right movement. A rechargeable battery powers the entire system. The Bluetooth module receives commands sent from the mobile application, which are then interpreted by the Arduino. Based on these commands, the Arduino sends appropriate signals to the motor driver to control the direction and speed of the motors. The mobile application provides a graphical user interface with directional

buttons, allowing the user to send commands wirelessly via Bluetooth.The project began with the physical assembly of the robot car, which includes mounting the motors onto a chassis and connecting them to the motor driver. The Arduino was connected to both the motor driver and the HC-05 Bluetooth module. After assembling the hardware, the Arduino was programmed using the Arduino IDE. The code listens for incoming Bluetooth data and translates specific characters (such as 'F' for forward, 'B' for backward, etc.) into corresponding motor movements. Simultaneously, a mobile application was developed using MIT App Inventor, allowing for a simple interface with buttons representing each direction. When a button is pressed, the app sends a character command via Bluetooth to the Arduino. Communication between the devices follows the standard serial protocol, with the HC-05 module operating at a baud rate of 9600. Once the entire setup was completed, the system was tested to ensure that commands were correctly received and executed in real-time. he proposed system is designed to control a robot car using an Android mobile application via Bluetooth communication. At the core of the system is an Arduino Uno microcontroller, which serves as the main processing unit. The robot car receives commands wirelessly from a smartphone application developed using MIT App Inventor. This application features a simple graphical interface with directional buttons— forward, backward, left, and right—that, when pressed, send specific character signals over Bluetooth. These signals are received by the HC-05 Bluetooth module connected to the Arduino board through serial communication at a baud rate of 9600.

Once the Arduino receives a command, it interprets the signal and triggers the appropriate control logic. Based on the received input, the Arduino sends signals to the L298N motor driver module, which is connected to two DC motors fixed to the robot chassis. The motor driver adjusts the direction and speed of the motors, allowing the robot car to move in the direction selected by the user. A rechargeable battery powers the entire setup, making the system portable and independent of external power sources.

The hardware assembly was carefully done to ensure reliable communication and efficient motor control. The software program uploaded to the Arduino is written in the Arduino IDE and contains condition-based instructions to map specific characters to motor actions. For example, the character ‘F’ makes the car move forward, while ‘B’, ‘L’, and ‘R’ correspond to backward, left, and right movements, respectively. The design emphasizes simplicity, modularity, and low cost, making it ideal for beginners in robotics, hobbyists, and educational projects. Additionally, the modular nature of the system allows for future enhancements such as the integration of sensors for obstacle avoidance, autonomous navigation, or camera modules for real-time

Fig -1: Cost Estimation

Components	Quantity	Estimated Unit Cost (INR)	Total Cost (INR)
Arduino Uno	1	₹700	₹700
HC-05 Bluetooth model	1	₹500	₹500
Motor Driver Module L293D	1	₹300	₹300
H-Bridge – to control the spinning direction	4	₹100	₹400
Voltage Drop of L293D	2	₹400	₹400
Micromors and Grippy Wheels	3	₹1	₹360
Switch	1	₹150	₹150
Male to Male Jumper Wires	2	₹150	₹300
Male to Female Jumper Wires	2	₹150	₹300
Lithium-Ion Battery (18650)	3	₹100	₹300
Chassis (Car Body)	1	₹100	₹100
Battery Holder (18650)	1	₹100	₹100
Total			

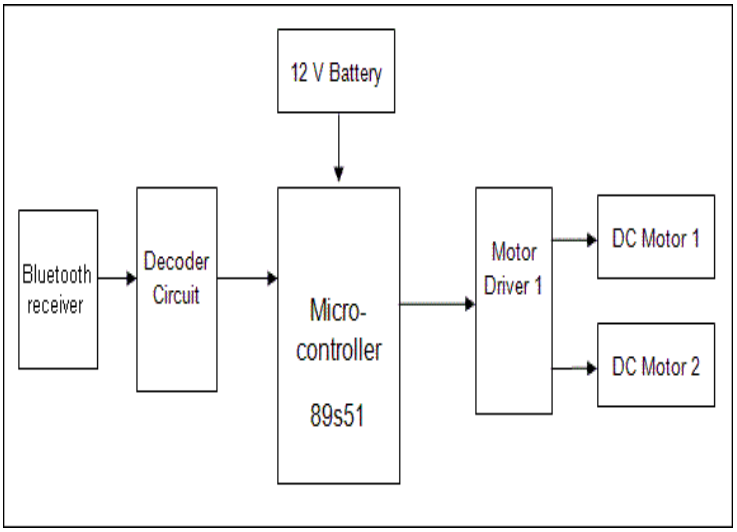

Fig -2: Block Diagram

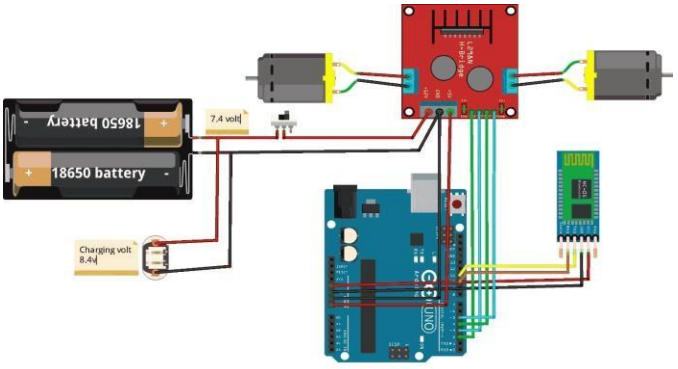

Fig -3 : Circuit Diagram

1. CONCLUSIONS

To us the need of internet and the things which are internet based are very much important nowadays. IOT or internet of things is the very important part in both computer and our daily lives. The above model describes how the arduino programs thecar motor module and by this we actually rotate the wheels and give direction to the car. It gives us the opportunity to work with different platforms and it helps us to createvarious interesting modules to work on. We also tested the applications used to drive the car. Due to the new concept of Wireless Controlled Car using Bluetooth, Wifi we were able to come up with various possibilities that can take place.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to all those who contributed to the successful completion of the "Android Controlled Arduino Robot Car" project. First and foremost, we extend our heartfelt thanks to Prof. Pradnya Korde mam, whose guidance, expertise, and encouragement were invaluable throughout the project's development. Their insightful feedback and continuous support played a crucial role in shaping the project's direction and ensuring its success. We also acknowledge the contributions of our team members, whose dedication, hard work, and collaboration were essential in executing various aspects of the project.

Each team member brought unique skills and perspectives to the table, contributing to a synergistic and productive working environment. Furthermore, we would like to thank Head of the department Prof.

Ashvini Patil for providing the necessary resources, facilities, and funding that facilitated the execution of this project. Their support enabled us to access essential equipment, software tools, and technical assistance, enhancing the quality and scope of our work. Finally, we are grateful to our friends and family for their understanding, patience, and encouragement throughout the project duration. Their unwavering support and motivation provided us with the strength and inspiration to overcome challenges and achieve our goals. Together, the collective efforts of everyone involved have culminated in the successful realization of the "Mobile-App Operated Smart Robot Car Using Arduino

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