

Arduino Based, Bluetooth Controlled E-Vehicle

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Abstract- An Arduino-based Bluetooth-controller electric vehicle (E-Vehicle) intended for wireless operation and efficient transportation of moderate loads. The proposed system uses an Arduino UNO microcontroller as the central control unit, an HC-05 Bluetooth module for wireless communication, motor drivers for controlling the drive motors, and rechargeable batteries as the power source. The vehicle can be operated through a Bluetooth-enabled mobile device, allowing the user to control its basic movements such as forward, backward, left, right. The Arduino receives control commands from the mobile device through the Bluetooth module and generates appropriate signals for the motor drivers to control the vehicle. The system is designed with multiple DC motors to provide sufficient traction and stability while carrying a specified load. The developed prototype demonstrates the integration of embedded systems, wireless communication, motor control, and electric mobility technologies, providing a foundation for further development of smart and autonomous electric vehicles.

Keywords: Arduino UNO, Bluetooth-controlled Electric vehicle, HC-05 Bluetooth Module, Wireless Communication, Embedded System, Motor Control, DC Motors, Mobile-Based Control, Electric Mobility, Remote Vehicle Control.

I. INTRODUCTION

The primary contribution of this research is the design implementation of a low-cost Arduino-based Bluetooth-controlled electric vehicle that integrates wireless mobile control with a multi-motor drive system. The study develops a complete control architecture consisting of an Arduino UNO microcontroller, HC-05 Bluetooth communication module, motor driver, DC motors, and rechargeable power supply.

The developed prototype enables wireless directional control and demonstrate the practical coordination of Bluetooth communication, embedded processing, and motor actuation. In addition, the study evaluates the basic mobility and load-carrying performance of the developed vehicle under specified operating conditions. The work provides a practical prototype and implementation framework that can be further extended with advanced features such as speed regulation, obstacle detection, autonomous navigation, and battery monitoring[1], [2], [5]

II. LITERATURE SURVEY

Design of Bluetooth Wireless Transporter Mecanum Wheeled Robot with Android Smartphone Controller for Moving Items (2023) Gumilang et al. (2023) developed a Bluetooth-controlled transporter robot using an Arduino Uno, an HC-06 Bluetooth module, an L293D motor driver, four DC motors, and four Mecanum wheels. The robot included a gripper mechanism for handling objects.

Experimental results indicated a Bluetooth operating distance of up to 20 metres, a gripper shifting capacity of up to 350 g, a lifting capacity of up to 200 g, and an operating time of up to 128 minutes on fully charged batteries. The study demonstrated the feasibility of smartphone-controlled material handling. Nevertheless, the prototype was designed for relatively light objects, highlighting the need for further development of the drive system, power supply, and mechanical structure for heavier payloads. permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited.

1. Bluetooth Remote Controlled Car Using Arduino (2017)

Raizada et al. (2017) presented a Bluetooth remote-controlled car using an Arduino microcontroller, a motor driver, DC motors, and a Bluetooth communication module. The system uses an Android or iOS smartphone to send wireless commands to the vehicle, enabling forward, backward, left, right, and stop operations. The study highlighted the advantages of Arduino-based control, including low development cost, ease of programming, and flexibility in hardware implementation. However, the study primarily focused on basic vehicle movement and did not establish the performance of a vehicle designed to carry a substantial load. This provides a foundation for developing an improved electric vehicle with enhanced load-bearing capability.

2. Three-Way Controlled Android Smartphone-Based Robotic Vehicle Via Bluetooth (2015)

Dey et al. proposed a robotic vehicle controlled through an Android smartphone using Bluetooth communication and smartphone-based sensor inputs. The system processes commands from the mobile application through an onboard microcontroller to control vehicle movement. The study explored alternative methods of human-machine interaction and identified potential applications in surveillance and security. Although it demonstrated flexible smartphone-based control, the study did not specifically focus on an electric vehicle designed for transporting heavy loads or on the electrical requirements associated with higher-power motors.

3. Arduino-Based, Bluetooth-Controlled Rc Car (2019)

Paul et al. (2019) developed an Arduino-based remote-controlled car operated through an Android smartphone application. Their system used an Arduino Uno, an HC-05 Bluetooth module, an L298N motor driver, and DC motors. Commands transmitted from the smartphone were received by the Bluetooth module and processed by the microcontroller to control the vehicle's direction. The researchers emphasized simple

operation, affordable components, and systematic software testing to reduce programming errors. However, the work concentrated on a small robotic car and did not specifically investigate the motor torque, battery capacity, or chassis strength required for carrying heavier loads.

Voice-Controlled Car Using Android, Arduino and Bluetooth (2021)

Santhakumar et al. (2021) developed a voice-controlled car using an Arduino controller, an HC-05 Bluetooth module, DC motors, and a motor driver. The system receives commands from an Android smartphone and processes them through the microcontroller to control motor direction. The study demonstrated the practical use of Bluetooth communication for wireless vehicle operation and discussed its suitability for educational robotics and future vehicle applications. However, the study did not specifically address the mechanical design, energy consumption, or motor performance required for a load-carrying electric vehicle. The proposed project builds upon this control approach by considering the electrical and mechanical requirements of a more practical vehicle.

4. Controlling And Monitoring A Robot-Car Based On Smartphone Applications (2021)

Meteab et al. (2021) developed a robot-car controlled through Android smartphone applications using Bluetooth communication and an Arduino microcontroller. Their design also incorporated a camera that transmitted video to a smartphone through Wi-Fi, enabling remote observation of the vehicle's surroundings. The study demonstrated the potential of combining wireless movement control with visual monitoring for applications such as surveillance and exploration of hazardous environments. However, its primary focus was remote operation and monitoring rather than heavy-load transportation.

Further investigation is required to evaluate the performance of motor drivers, battery systems, and chassis structures under higher payload conditions.

III. METHODOLOGY

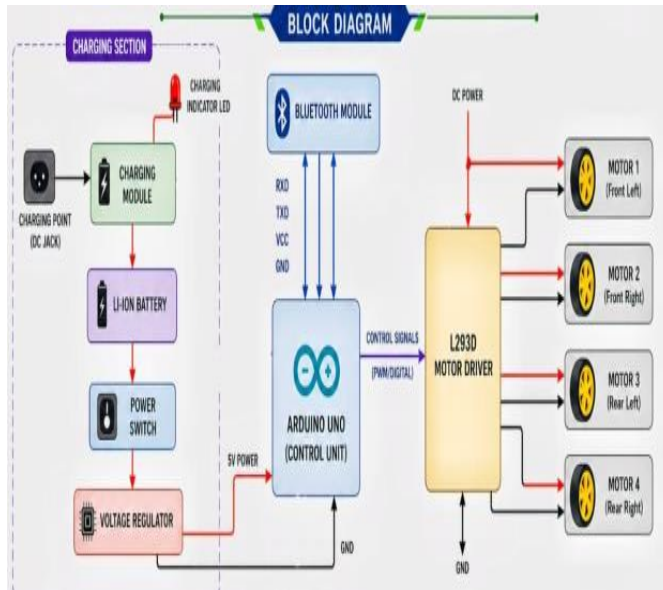


Figure 1: Block Diagram

1. Arduino Uno

The Arduino uno is the main control unit of the system. It receives commands from the Bluetooth module, processes them, and generates control signals for the motor drivers. Paragraph comes content here



Figure 2: Arduino uno HC-05 Bluetooth Module

The HC-05 provides wireless serial communication between the vehicle and a mobile application. It receives movement commands and transmits them to the Arduino Uno through serial communication.



Figure 3: HC-05 Bluetooth module

2. Bts7960 Motor Driver Modules

Four BTS7960-based motor driver modules are used to control the four DC motors independently. The drivers provide bidirectional motor control by switching the motor polarity according to the Arduino's control signals.

3. Power Supply And Battery

The battery supplies the electrical energy required to operate the motors. A regulated 5 V supply is used for the Arduino and compatible logic circuits, as required by the selected modules.



Figure 4: Motor Driver DC Gear Motors

Four DC gear motors provide the mechanical movement of the vehicle. Two motors are installed on the left side and two on the right side. Coordinated control of these motors enables forward and reverse movement, while differential direction control enables turning.



Figure 5: DC Gear Motors Vehicle Chassis and Wheels

The chassis supports the motors, wheels, electronic modules, and battery. Four wheels provide traction and stability during movement.



Figure 6: Wheels

4. Flow Chart



Figure 7: Battery

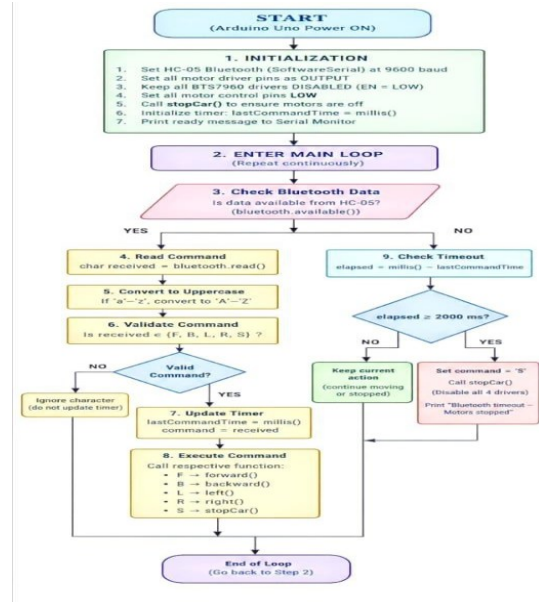


Figure 8: Flow chart

5. Results



Figure 9: Top view

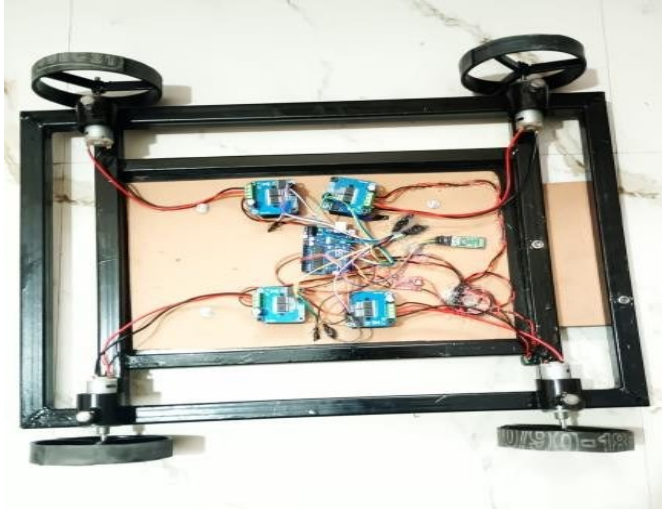


Figure 10: Bottom view

Command	Vehicle Direction	Motor Control	
M1	Forward	Front left=1	Front Right=1
		Rare left=1	Rare Right=1
M2	Backward	Front left=-1	Front Right=-1
		Rare left=-1	Rare Right=-1

M3	Right	Front left=1	Front Right=-1
		Rare left=1	Rare Right=-1
M4	Left	Front left=-1	Front Right=1
		Rare left=-1	Rare Right=1
M5	Stop	Front left=0	Front Right=0
		Rare left=0	Rare Right=0

IV. CONCLUSION

The project "Design and Development of EV with Bluetooth Controller" demonstrates the wireless control of an electric vehicle using an Arduino and Bluetooth technology. It provides a simple and convenient method to control vehicle movement through a mobile phone. This project helps us understand electric vehicle technology, embedded systems, and wireless communication. In the future, additional safety features can be implemented to improve its performance.

1. Acknowledgements

The project "Design and Development of EV with Bluetooth Controller" demonstrates the wireless control of an electric vehicle using an Arduino and Bluetooth technology. It provides a simple and convenient method to control vehicle movement through a mobile phone. This project helps us understand electric vehicle technology, embedded systems, and wireless communication. In the future, additional safety features can be implemented to improve its performance.

REFERENCES

1. Anmol Raizada, Gaurav Ojha, Mithlesh Kumar, Abhishek Rana, Harpreet Kaur Channi, Bluetooth Remote Controlled Car using Arduino, International Journal of Scientific Research in Science and Technology (IJSRST), Volume 3, Issue 8, 2017.
2. Souvik Paul, Saumedhik Biswas, Atreyo Sengupta, Banhishikha Basu, Sreya Basu, Arduino Based Bluetooth Controlled RC Car. International Journal of Computer Science & Communication, Vol. 11, Issue 1, 2019–2020.
3. M. Santhakumar, S. Saran, S. Sathishkumar, M. Gunaseelan and Dr. K. Elango, Voice controlled car using android, Arduino & Bluetooth, Volume 12, Issue 3, March 2021, pp. 244-251, Article ID: IJEET_12_03_032
4. Wisam Kareem Meteab, Haider Th Salim ALRikabi, Salwan Ali Habeeb Al Sultani and Ibtisam A Aljazeera. Controlling and Monitoring a Robot-Car Based on Smart. To cite this article: Wisam Kareem Meteab et al 2021 IOP Conf. Ser.: Mater. Sci. Eng. 1094 012096

5. Akash Pal, Sayantan Nandi, Lusika Roy, Three-Way Controlled Android Smartphone based Robotic, Aritra Dey, International Journal of Applied Science Engineering and Management VOL 1, ISSUE 1 ISSN 2454-9940
6. Yandhika Surya Akbar Gumilang, Krisdianto, Haitam, Moch. Aditya Rizky Fahreza, and Aziz Alfayid5, Design of Bluetooth Wireless Transporter Mecanum Wheeled Robot with Android Smartphone Controller for Moving Item, Journal Teknik Elektro, Vol. 15 No.1, April 2023, pp. 61 - 66 ISSN: 1858-1463 (print), 2580-6807 (online)
7. Ahmet Top, Muammer Gok Bulut, Design of an Android application for autonomous control of mobile robot, NOHU Muh. Bilim. Derg. / NOHU J. Eng. Sci., 2024; 13(2), 448-459
8. Abubakar Umar, Mohammed Abdulkadir Giwa, Abduljalal Yusha'u Kassim, Muhammad Usman Ilyasu, Ibrahim Abdulwahab, Ezekiel Ehime Agbon and Matthew T. Ogedengbe, Development of an Android-Based, Voice-Controlled Autonomous Robotic Vehicle, Citation: Umar, A.; Giwa, M.A.; Kassim, A.Y.; Ilyasu, M.U.; Abdulwahab, I.; Agbon, E.E.; Ogedengbe, M.T. Development of an Android-Based, Voice-Controlled Autonomous Robotic Vehicle. Eng. Proc. 2023, 58, 48. <https://doi.org/10.3390/ecsa-10-16026> Academic Editor: Stefano Mariani Published: 15 November.