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Visvesvaraya Technological University, Belgaum



Project Work -3 Report on

“OBSTACLE AVOIDING ROBOTIC CAR USING ARDUINO WITH BLUETOOTH AND VOICE CONTROL”

Submitted in partial fulfilment of the requirement for completion of
PROJECT WORK –3 [22EC7PWPJ3]

Submitted by

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CERTIFICATE

This is to certified that the Project work -3 entitled “**Obstacle Avoiding Robotic Car Using Arduino With Bluetooth And Voice Control**” is a bonafide work carried out by **Lepakshi (1BM21EC224)**, **Mithu Yadav M (1BM21EC230)**, **Sushma D (1BM22EC422)** and **Hamsa V N (1BM22EC407)** submitted in partial fulfilment of the requirement for completion of PROJECT WORK - 3 [22EC7PWPJ3] of Bachelor of Engineering in Electronics and Communication during the academic year 2024-25. The Project Work - 3 report has been approved as it satisfies the academic requirements.

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DECLARATION

We, **Lepakshi (1BM21EC224)**, **Mithu Yadav M (1BM21EC230)**, **Sushma D (1BM22EC422)** and **Hamsa V N (1BM22EC407)**, hereby declare that the Project Work - 3 entitled “**Obstacle Avoiding Robotic Car Using Arduino With Bluetooth And Voice Control**” is a bonafide work and has been carried out by us under the guidance of **Mrs. Vijaya.K**, Assistant Professor, Department of Electronics and Communication Engineering, BMS College of Engineering, Bengaluru submitted in partial fulfilment of the requirement for completion of PROJECT WORK - 3 [22EC7PWPJ3] of Bachelor of Engineering in Electronics and Communication during the academic year 2024-25. The Project Work -3 report has been approved as it satisfies the academic requirements in Electronics and Communication engineering, Visvesvaraya Technological University, Belagavi, during the academic year 2024-25. We further declare that, to the best of our knowledge and belief, this Project Work -3 has not been submitted either in part or in full to any other university.

Place: Bengaluru

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ABSTRACT

The “Obstacle Avoiding Robotic Car Using Arduino with Bluetooth and Voice Control” is a versatile project that integrates automation, robotics, and advanced control mechanisms. The robotic car is designed to autonomously navigate its environment by detecting and avoiding obstacles using ultrasonic sensors. Powered by an Arduino microcontroller, the system leverages Bluetooth technology for wireless control via a smartphone and voice commands for hands-free operation.

The ultrasonic sensors continuously monitor the surroundings, ensuring real-time obstacle detection and safe navigation. Additionally, the Bluetooth module enables seamless communication between the robotic car and a mobile application, allowing users to control the car remotely. Voice commands are processed through a paired device or voice recognition module, enhancing user convenience and control flexibility.

This project demonstrates the fusion of sensor technology, microcontroller programming, and wireless communication to develop a smart robotic system. Potential applications include home automation, surveillance, and educational robotics. It also lays a foundation for further advancements such as GPS-based navigation, LiDAR integration, and AI-powered decision-making systems.

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List of abbreviations

Abbreviation	Full form
IoT	Internet of Things
MCU	Microcontroller Unit
PCB	Printed Circuit Board
VCC	Voltage Common Collector (Power Supply)
GND	Ground
HC-SR04	Ultrasonic Distance Sensor
IR Sensor	Infrared Sensor
GSM	Global System for Mobile Communication
MPU	Motion Processing Unit
ESC	Electronic Speed Controller
Wi-Fi	Wireless Fidelity
RPM	Rotations Per Minute

Chapter 1: Introduction

In recent years, automation and robotics have gained significant importance in various fields, from industrial automation to personal assistance. One such innovation is the **Obstacle Avoiding Robotic Car Using Arduino with Bluetooth and Voice Control**. This intelligent robotic vehicle is designed to navigate its environment efficiently while avoiding obstacles, making it ideal for applications such as surveillance, smart transportation, and assistance for differently-abled individuals.

This robotic car integrates **Arduino**, a widely used microcontroller, with multiple sensors such as **ultrasonic sensors, infrared (IR) sensors, and Bluetooth modules** to achieve seamless navigation. The primary objective is to detect obstacles in its path and autonomously change direction to prevent collisions. The ultrasonic sensor continuously scans the surroundings and sends signals to the Arduino, which then processes the data and controls the movement of the car accordingly.

Additionally, the **Bluetooth module** allows remote control of the robotic car through a smartphone or computer. Users can manually control the car via a mobile application or **voice commands**, making it a smart and user-friendly system. Voice recognition technology further enhances the efficiency of the robot by enabling hands-free operation. This feature is particularly beneficial for individuals with mobility challenges, providing them with an easy-to-use and intelligent transportation system.

The obstacle-avoiding robotic car is not only an excellent project for robotics enthusiasts but also serves as a foundation for more advanced autonomous vehicle systems. By integrating **IoT (Internet of Things) and AI-based decision-making algorithms**, the system can be further enhanced for real-world applications such as automated delivery robots, rescue operations, and smart city solutions.

In conclusion, this project demonstrates the **fusion of embedded systems, wireless communication, and artificial intelligence**, making it a versatile and practical innovation. With further advancements, obstacle-avoiding robots can significantly contribute to smart mobility solutions in the future.

Chapter 2: Literature survey

1. Obstacle Avoiding Robotic Car Using Arduino with Bluetooth and Voice Control - Tuijin Jishu/Journal of Propulsion Technology

This paper provides a comprehensive overview of the project, including the hardware components, software implementation, and experimental results.

It focuses on the integration of ultrasonic sensors for obstacle detection, Bluetooth module for wireless communication, and voice recognition for user interaction.

The paper highlights the advantages of using Arduino for controlling the robotic car and discusses the challenges involved in real-time obstacle avoidance and voice command recognition.

2. Arduino Obstacle Avoiding + Voice Control + Bluetooth Control Robot - International Journal of Advanced Research in Science, Communication and Technology

This paper presents a detailed design and implementation of an obstacle avoiding robotic car with Bluetooth and voice control capabilities.

It explores the use of multiple ultrasonic sensors for enhanced obstacle detection and the integration of a voice recognition module for user commands.

The paper emphasizes the importance of efficient software algorithms for real-time obstacle avoidance and voice command processing.

3. Obstacle Avoiding Robotic Car Using Arduino with Bluetooth and Voice Control - Tuijin Jishu/Journal of Propulsion Technology

This paper provides a concise overview of the project, focusing on the key components and their interactions.

It highlights the use of Bluetooth technology for wireless communication between the user's smartphone and the robotic car.

The paper discusses the challenges of integrating voice recognition and obstacle avoidance algorithms within the limited processing power of the Arduino microcontroller.

4. Obstacle Avoiding Voice Controlled Bluetooth Car Using Arduino - IJIRSET

This paper presents a detailed design and implementation of an obstacle avoiding robotic car with Bluetooth and voice control capabilities.

It explores the use of multiple ultrasonic sensors for enhanced obstacle detection and the integration of a voice recognition module for user commands.

The paper emphasizes the importance of efficient software algorithms for real-time obstacle avoidance and voice command processing.

Chapter 3: Problem Analysis & Solution

3.1 Problem Definition

The objective of this project is to design and implement an obstacle-avoiding robotic car with Bluetooth and voice control using Arduino. The system will autonomously navigate its environment by detecting and avoiding obstacles with an ultrasonic sensor while providing an option for manual control through a Bluetooth-connected smartphone. Users can send commands via a mobile app or use voice commands for hands-free operation, enabling the car to move forward, backward, turn, or stop. The project aims to create a cost-effective and user-friendly solution that integrates autonomous navigation with remote control, addressing challenges such as real-time obstacle detection, seamless mode switching, and stable motor control.

3.2 Proposed Solution

The solution involves building a multi-functional robotic car controlled by an Arduino microcontroller. The system combines autonomous navigation using an ultrasonic sensor and manual operation via Bluetooth and voice commands. Here's how each component works:

Obstacle Avoidance: An ultrasonic sensor detects obstacles in the car's path by measuring the distance to nearby objects. If the distance falls below a threshold (e.g., 20 cm), the car stops and changes direction to avoid a collision. This ensures smooth and safe autonomous navigation.

Bluetooth Control: A Bluetooth module (e.g., HC-05) is used to connect the robotic car to a smartphone. Users can send predefined commands (F for forward, B for backward, L for left, R for right, S for stop) via a Bluetooth terminal app to manually control the car.

Voice Control: Using a voice control app on a smartphone, users can issue commands such as "forward," "backward," "left," "right," and "stop." The app translates these voice commands into text and sends them to the Arduino through the Bluetooth module for execution.

Motor Control: A motor driver module (e.g., L298N) interfaces with the Arduino to control the speed and direction of the DC motors, ensuring smooth and responsive movement.

Power Management: The system is powered by a battery pack, with separate power for motors and sensors to ensure stability.

Chapter 4: Methodology & Implementation

4.1 Block Diagram

4.1.1 Pictorial Representation

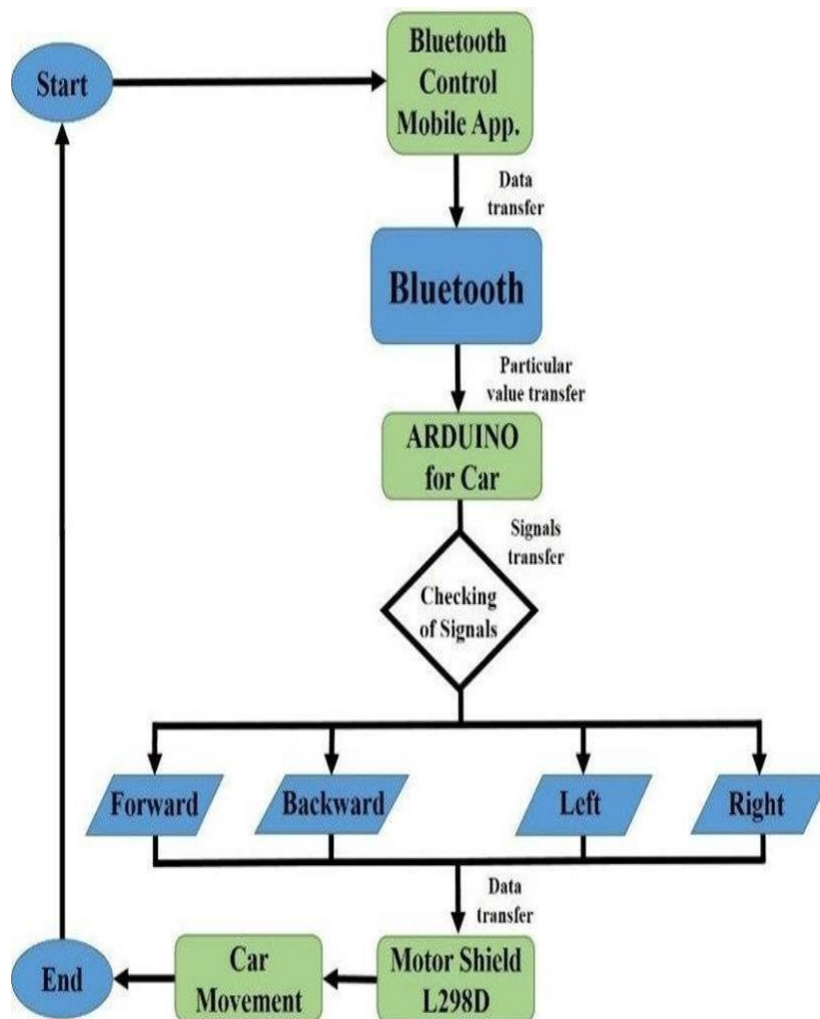


Fig 1. Block diagram

4.1.2 Structure of the Work

Block 1 - gives the information about the starting of the car

Block 2 - gives the information about connection to the Bluetooth app in mobile

Block 3 - gives the information about connecting car Bluetooth to mobile

Block 4 - gives the information about connects it to the Arduino using the data and code

Block 5 - gives the information about the movement of the car using instructions

Block 6 - gives the information about connects to the motor driver and servo motor

Block 7 - gives the information about obstacle avoidance using ultrasonic sensors

WORKING PRINCIPLE:

In this project, the vehicle uses the ultrasonic sensor to detect objects. Initially the system starts with one sensor i.e ultrasonic, but as cars have some blind spots in it's left and right direction that is why two additional sensors were added to overcome the blind spot and limiting its chances of collision.

Robot is designed in such a way that it detects the obstacle inside a particular range. Suppose there is something inside the range, then that is referenced as an obstacle the smart vehicle avoids it and changes it's direction.

4.1.3 Flow Chart

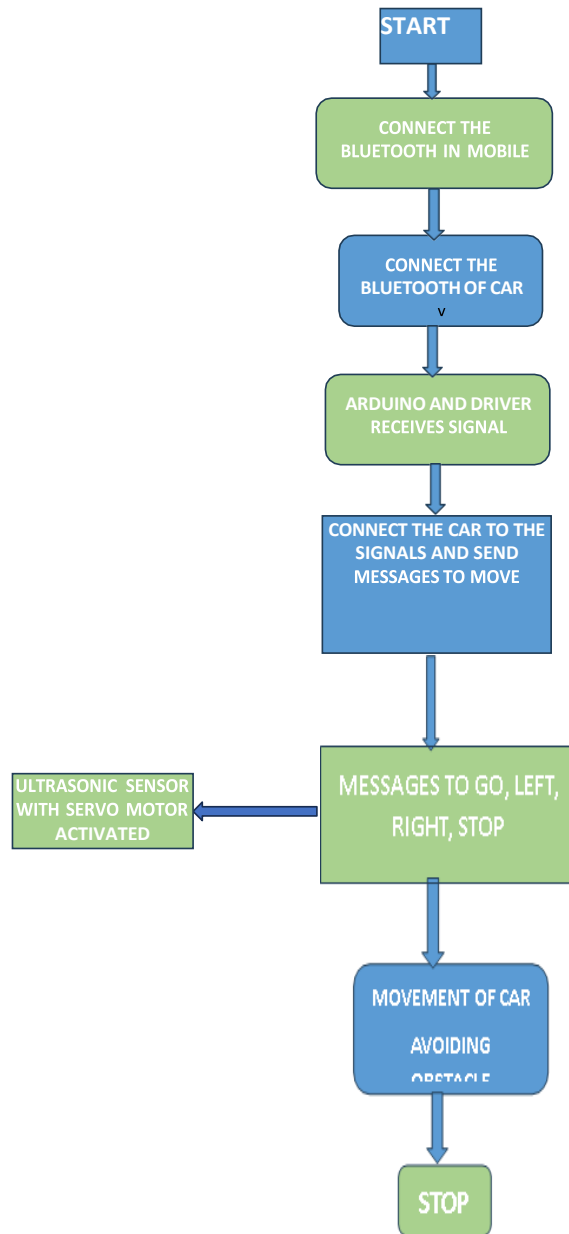


Fig 2. Flow Chart of the Algorithm

4.2 Implementation

This project involves creating a robot car that can move autonomously around its surroundings without running into obstacles. The system combines Bluetooth voice control and an ultrasonic sensor to offer manual and autonomous movement. A microcontroller (Arduino Uno) interprets the input command and sensor information, facilitating smooth and intelligent movement. The robot car uses an HC-SR04 ultrasonic sensor, placed on a servo motor, to scan for obstacles in real time. When an obstacle is identified, the system measures the distance and re-routes the car to avoid a collision. The HC-05 Bluetooth module enables users to control the car through voice commands from a smartphone. The L298N motor driver module supplies power and regulates the movement of the DC motors, facilitating efficient movement. The system is designed with low power consumption and portability in mind, making it suitable for various applications, such as smart automation and education. The voice commands are also customizable, adding flexibility in use. This technology improves robotic automation and remote control functionality, making it a viable solution for intelligent mobility devices.

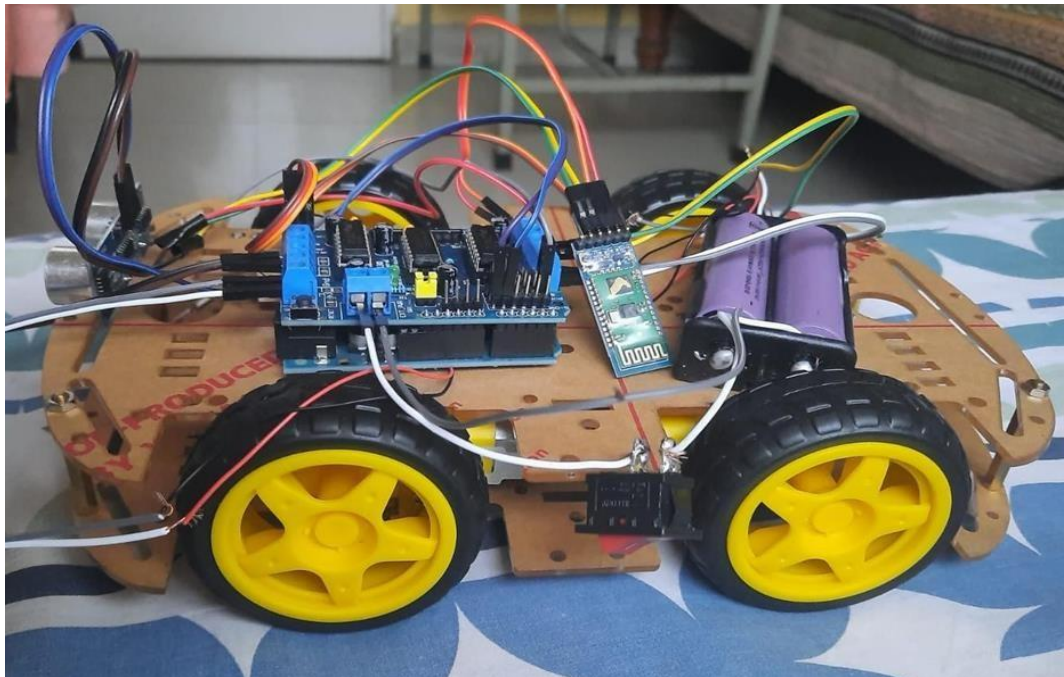


Fig 3. Model of the robotic vehicle developed

Chapter 5: Results & Discussion

Frictional Prototype: A fully operational robotic car capable of autonomously avoiding obstacles and receiving manual commands via Bluetooth and voice control.

Autonomous Navigation: The car successfully detects and avoids obstacles using an ultrasonic sensor, demonstrating real-time decision-making for navigation in various environments.

Remote Control Capabilities: Bluetooth integration allows users to manually control the car through a smartphone app, enhancing flexibility in operation.

Voice Command Integration: Voice control provides hands-free operation, improving user convenience and accessibility.

Technical Learning: Practical experience in microcontroller programming, interfacing sensors (ultrasonic), communication modules (Bluetooth), and motor drivers (L298N), enhancing skills in robotics and embedded systems.

Scalability: A modular design that can be further enhanced with features like GPS navigation, camera integration, or additional sensors for advanced functionality.

Cost-Effective Solution: A low-cost robotic system combining autonomous and manual control modes for use in education, research, or real-world applications like automation and navigation.

Chapter 6: Future Trends and Conclusion

6.1 Conclusion

The **Obstacle Avoiding Robotic Car Using Arduino with Bluetooth and Voice Control** successfully demonstrates autonomous navigation and remote control functionality. By integrating an **ultrasonic sensor**, the robot effectively detects and avoids obstacles, ensuring smooth movement in unknown environments. The **Bluetooth module** enables wireless control via a smartphone, allowing users to operate the car using voice commands or manual inputs. This project enhances **understanding of embedded systems, sensor integration, and wireless communication**. It is a practical application in robotics, with potential real-world uses in **automated vehicles, smart mobility solutions, and assistive robotics**. Future improvements could include **AI-based navigation, camera integration, and IoT connectivity** for enhanced functionality.

6.2 Future Trends

Integration of Artificial Intelligence (AI) and Machine Learning (ML):

Implementing AI algorithms for smarter obstacle detection and path planning.

ML models could enable the car to learn from its environment and improve navigation over time.

Incorporation of Advanced Sensors:

Utilizing LiDAR or infrared sensors for more accurate obstacle detection and mapping.

Adding cameras for vision-based navigation and object recognition.

GPS and Location-Based Navigation:

Equipping the car with GPS modules for predefined route planning and autonomous delivery tasks.

Integration with real-time location systems for enhanced precision.

IoT Connectivity:

Connecting the robotic car to the Internet of Things (IoT) ecosystem for remote monitoring and control via cloud platforms.

Real-time data logging and analysis for performance optimization.

Energy Efficiency and Renewable Energy:

Utilizing solar panels for power to improve sustainability.

Employing low-power components to extend operational time. **Voice**

Recognition Enhancements:

Advanced natural language processing (NLP) for better interpretation of complex voice commands.

Multi-language support for broader accessibility.

Autonomous Swarm Robotics:

Enabling multiple robotic cars to communicate and work together as a coordinated swarm.

Applications in logistics, agriculture, and disaster recovery.

Augmented Reality (AR) and Virtual Reality (VR) Control:

Using AR or VR interfaces for immersive and intuitive control of the robotic car.

Real-time visualization of sensor data through AR displays.

Enhanced Mobility and Terrain Adaptability:

Designing adaptive wheels and suspension systems for challenging terrains.

Improving speed and precision in various environments such as indoors, outdoors, and uneven terrains.

5G and Edge Computing:

Leveraging 5G networks for ultra-fast and low-latency communication.

Edge computing for processing complex algorithms locally on the car without relying on external servers.

Application in Autonomous Delivery Systems:

Adapting the robotic car for last-mile delivery services in urban areas. Integration with e-commerce platforms for automated order fulfillment. **Educational and**

Research Enhancements:

Expanding the system as a modular and customizable platform for learning robotics, programming, and automation.

Using the project as a baseline for experimenting with cutting-edge technologies.

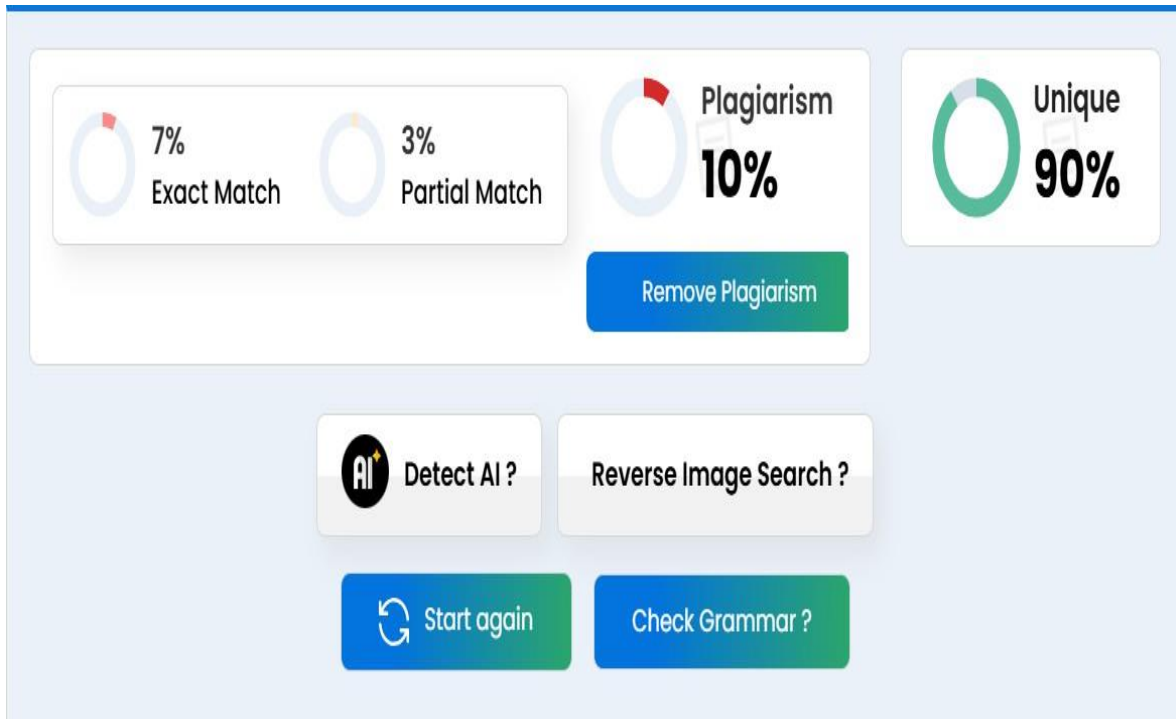
These trends reflect the potential of this project to evolve into a more sophisticated and widely applicable robotic system, keeping pace with advancements in robotics and automation.

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APPENDIX A:

Plagiarism Report



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