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Voice, Manual, Gesture Controllable Robotic Car-Automata

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Abstract:

A noteworthy achievement in automotive technology is the creation of an automatic hand gesture, manual and voice -controlled robot that can operate and control a variety of car operations. Its main goal is to drastically improve driver comfort and safety by lowering the likelihood of accidents, boosting road focus, and minimising distractions. This technology makes some functions quickly accessible, which is especially helpful in emergency situations where a prompt response is needed. It also advocates for accessibility for people with physical disabilities, enabling them to drive on their own.

Keywords: Autonomous Vehicle, Self-Driving Technology , AI Navigation, Computer Vision

1.0 Introduction

This study investigates a revolutionary robotics system that does away with standard buttons and remote controls by having autonomous robots understand hand gestures and vocal commands. Actuators and accelerometers work together to make it simple for humans to control robots. The goal of the project is to simplify difficult activities so that different modules operate flawlessly and without errors, especially in applications related to home, medical, and vehicle safety. Because wired methods have historically proved to be ineffective for controlling robots, accelerometer-based control systems have become the norm for effective, hand gesture-directed robotic vehicles. This system's wireless architecture allows for fine control over the robot's movement, which may be controlled by hand gestures for left, right, forward, and backward motions. Additionally, the system's ability to provide live video surveillance increases its usefulness by enabling remote monitoring in dangerous situations. The goal of the article is to use on-board cameras for remote surveillance in order to develop affordable, easily obtainable smart devices. Users can monitor and control activities remotely with its wireless live streaming feature, which is very useful in dangerous or inaccessible scenarios. The suggested system has a number of benefits over human involvement, including the ability to function continuously in difficult circumstances.

2.0 Literature Review:

The development of robotic cars has garnered substantial academic attention, addressing various technological, ethical, and societal aspects. Various approaches have been explored in the field of gesture and voice-controlled robotic vehicles. Thivagar et al. (2020) introduced a system for controlling a smart vehicle through both hand gestures and voice commands. Their research highlights the integration of affordable hardware like Arduino to improve user interaction with robotic systems [1]. Harsha et al. (2022) further enhanced this concept by developing a hybrid control system that uses both gesture and voice recognition to control a robot, focusing on industrial applications where such systems could increase the efficiency of robotic operations in dynamic environments [2]. Kantekar et al. (2022) proposed a voice-controlled robot vehicle, utilizing Arduino and Bluetooth technology to enable the vehicle to follow commands issued via a smartphone application. Their work emphasizes the ease of use and affordability for small-scale applications [3]. In a similar vein, Chandrashekhar et al. (2020) designed a voice and gesture-controlled Mecanum wheel robot, providing users with intuitive control via both voice commands and hand gestures, demonstrating the versatility of such systems for mobile robots [4]. Vadlamudi et al. (2020) focused on gesture-controlled robots using an MPU6050 accelerometer and Arduino, offering a straightforward implementation for beginners in robotics, with a focus on learning and experimentation [5]. Additionally, Reddy et al. (2022) designed an autonomous robotic car that integrates both gesture and voice controls, pushing the boundaries towards creating fully autonomous vehicles that can interact with human users through natural modes of communication. This development could be essential for advancing human-robot interaction in both domestic and industrial settings [6].

3.0 Methodology

The Gesture, Manual, and Voice-Controlled Car Using Arduino project demonstrates the integration of two control modalities, namely manual control and voice recognition, into a single system. The Arduino Uno microcontroller acts as the central processing unit, coordinating inputs from both control modules and generating the necessary motor control signals to drive the car's motors. Manual control utilizes a switch connected to digital pin 12 of the Arduino Uno. Pressing the switch triggers the car to move forward, while releasing it brings the car to a halt. Additionally, holding the switch for a longer duration can toggle the car's direction. Voice recognition incorporates speech-to-text technology to convert spoken commands into control

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signals. The voice recognition software can be integrated with a smartphone app or a dedicated voice recognition module. Recognized voice commands, such as "forward," "backward," "left," or "right," are transmitted to the Arduino via Bluetooth. The Arduino processes these commands and generates the necessary signals to control the car's movement accordingly

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4.0 Results and discussion

The result of a voice gesture manual control robotic car project can vary depending on various factors such as the sophistication of the design, the accuracy of voice recognition and gesture detection, the responsiveness of the robotic car, and the overall functionality achieved. Here's a general outline of what a successful result might entail: Voice Recognition Accuracy: The robotic car accurately recognizes voice commands given by the user. This involves implementing a robust speech recognition system that can understand a variety of commands. Gesture Detection Accuracy: The system accurately detects gestures made by the user to control the robotic car. This could involve gestures such as hand movements or body gestures recognized through sensors or cameras. Smooth Control: The robotic car responds smoothly and promptly to voice commands and gestures, moving in the desired direction without delay or confusion. Functionality: The robotic car should be able to perform a range of functions based on the voice commands and gestures given by the user. This could include moving forward, backward, turning left or right, stopping, and possibly performing additional tasks like picking up objects or navigating obstacles. Discussion: Voice gesture control robotic car projects are fascinating endeavors that combine various technologies such as robotics, natural language processing (NLP), and machine learning. Here's a discussion covering different aspects of such a project: Technology Stack: In a voice gesture control robotic car project, you would typically use hardware components like microcontrollers (Arduino, Raspberry Pi) to control the car's movement and sensors (ultrasonic, infrared) for obstacle detection. On the software side, you'd implement algorithms for speech recognition to interpret voice commands, gesture recognition for recognizing hand movements, and possibly machine learning models for improving accuracy over time. Speech Recognition: Speech recognition is crucial for interpreting voice commands accurately. This involves converting spoken words into text that the car's controller can understand and act upon. There are various speech recognition APIs available like Google Speech-to-Text or Mozilla's Deep Speech, which can be integrated into the project. Gesture Recognition: Gesture recognition allows users to control the car through hand movements. This could involve using cameras or sensors to detect gestures such as waving, pointing, or specific hand shapes. Open CV (Open Source Computer Vision Library) is a popular choice for implementing gesture recognition algorithms. Integration Challenges: Integrating speech and gesture recognition systems with the robotic car's control system can be challenging. It requires careful synchronization and handling of different inputs to ensure smooth and responsive control.

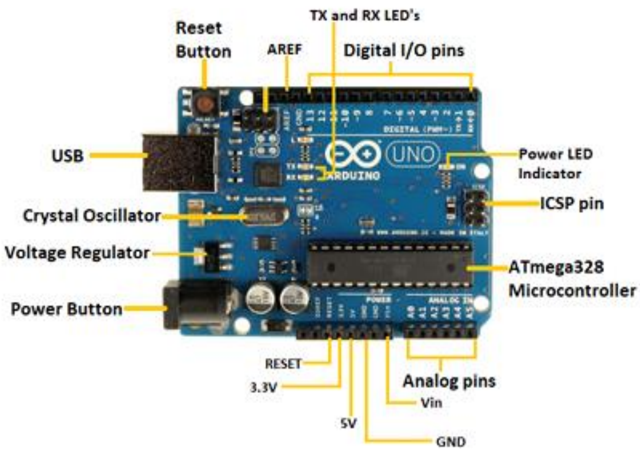
5.1 **Presentation of Findings Using Text, Tables, and Figures**

5.1.1 Component Information:

Materials/Components

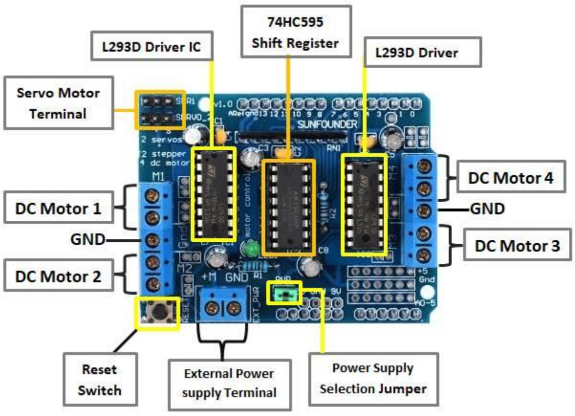
Component Information:

Arduino uno: We have Arduino UNO Microcontroller Board based on ATmega328P microcontroller. This particular board provides 14 input/output pins, of which 6 are PWM capable. In addition to these 14 digital pins, the microcontroller board includes 6 analog inputs, as well as important components such as a 16 MHz ceramic resonator, USB connection, power input, reset button and ICSP header. These devices play an important role in the smooth operation of the microcontroller. It is worth noting that the microcontroller can be powered by a USB cable, AC-DC adapter or battery. Overall, the Arduino UNO microcontroller board provides all the elements needed to get started with a microcontroller, making it easy to connect to a computer via USB cable or to an AC-DC adapter or battery.



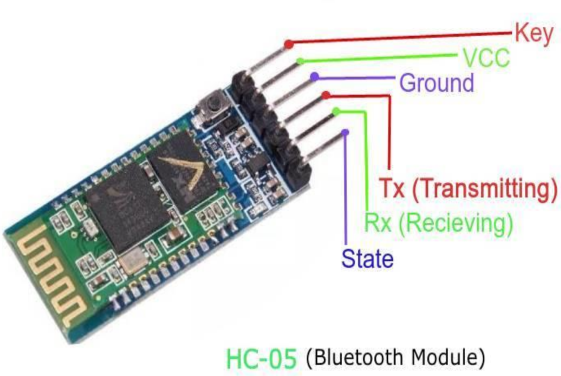
Arduino uno

Motor driver shield: A motor driver shield is a circuit board that is designed to control the speed and direction of motors. It typically contains an H bridge circuit, which is a type of electronic circuit that can control the voltage and current applied to a motor. Motor driver shields are commonly used with Arduino boards to control motors in robots and other electronic projects.



Motor driver shield

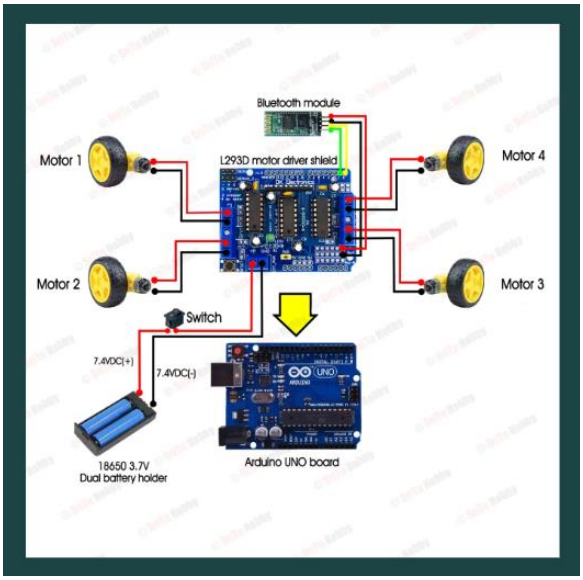
Bluetooth module: A Bluetooth module is a wireless communication device that allows two or more devices to exchange data over short distances. Bluetooth modules are commonly used in smartphones, tablets, laptops, and other electronic devices. In the context of a gesture, manual, and voice-controlled car, the Bluetooth module would be used to transmit control signals from a smartphone or other device to the Arduino Uno.



Gear motor: A gear motor is an electric motor that has been integrated with a gearbox. The gearbox reduces the speed of the motor and increases its torque, making it more powerful. Gear motors are commonly used in robots, toys, and other applications that require high-torque, low-speed motors.

Robot wheel: A robot wheel is a specialized wheel that is designed for use in robots. Robot wheels typically have a smooth tread and a rubber or plastic coating to provide traction. They may also have encoders or other sensors that can be used to measure the wheel's speed and position.

Lithium-ion battery: A lithium ion battery is a type of rechargeable battery that is commonly used in electronic devices. Lithium ion batteries have a high energy density and a long lifespan, making them a popular choice for portable devices. In the context of a gesture, manual, and voice-controlled car, the lithium-ion battery would be used to provide power to the Arduino Uno, motor driver shield, motors, and other components.



Circuit Diagram

6.0 Conclusions:

The development of a voice and gesture-controlled robotic car project holds significant promise across various fields and industries. By integrating cutting-edge technologies such as voice recognition, gesture sensing, and robotics, these projects offer intuitive and efficient methods of human-robot interaction. These robotic cars can enhance mobility, improve efficiency, increase safety, and enable new forms of human-robot collaboration in both professional and everyday settings.

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Conflicts of Interest: Conflict in research on voice gesture manual control for robotic cars could arise from various perspectives:

1**.Accuracy vs. User Experience**: Some researchers might prioritize accuracy in interpreting voice commands and gestures to ensure the robotic car responds correctly and safely. Others might prioritize a smoother, more intuitive user experience, even if it means sacrificing some accuracy.

2.**Technological Limitations vs. Ambitious Goals**: There could be a conflict between researchers advocating for incremental improvements based on current technological capabilities and those pushing for ambitious goals that might require significant advancements in AI, machine learning, and sensor technologies.

3. **Safety vs. Convenience**: There could be a trade-off between designing systems that prioritize safety by limiting the complexity of voice commands and gestures, versus systems that provide more convenience but might increase the risk of user error or distraction.

References:

1.T. Thivagar, A. Sriram, Hand Gesture and Voice Controlled Smart Vehicle, International Journal of Modern Science and Technology, 2020;5(6):164-167.

2.Mr. Harsha C J, Mohammad Hafeel, Mahammed Ibrahim , Mahammad Kasim , Kalandar K, Gesture and Voice Controlled Robot, 2 nd International Conference on Frontiers in Engineering Science & Technology, 9(13), 2022.

3.Kantekar Sampath Kumar, Pinkesh Santhosh Reddy, Manchala Rajiv Vikram Revanth, Dr. Krishna Samalla., Voice Controlled Robot Vehicle Using Arduino, International Journal for Research in Applied Science and Engineering Technology (IJRASET), 10(VI), 2786-2791, 2022.

4. Mr. G. Chandrasekar, Gokul J, Kaviyarasan K, Rajasekar S, Mecanum Grounded Vehicle with Robotic Arm, International Journal of Advanced Research in Science, Communication and Technology, 2581-9429, 2(8),2022.

5. Syambabu Vadlamudi, D. Naresh Kumar, G. Shravan kumar, Hand Gesture Controlled Robot using Arduino and MPU6050, International Journal of Recent Technology and Engineering, 9(1),2020.

6. Dola Sainath Reddy, Rayanki Vignesh Chowdary, Bellam Naveen Kumar, M Sai Charan, G Vighnesh, Voice Control Based Robotic Car Using Arduino Uno, International Journal of Novel Research and Development,7(12), 2022.