Voice Controlled Robotic Vehicle

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I. *Abstract-*

This project was constructed in a way that allows the robot to be controlled by voice instructions. An android application with a microcontroller is used for critical tasks. The android app and the car can connect thanks to Bluetooth technology. The user can ut ilise the program's buttons or speak commands to the robot to control it. The microcontroller at the receiver side is coupled to two DC servo motors that allow the robot to move. The Bluetooth RF transmitter transforms the application's commands into digital signals for the robot at a reasonable range (about 100 meters). At the receiver end, the data is decoded and delivered to the microcontroller, which uses it to drive the necessary DC motors. The goal of a voice-controlled robotic vehicle is to carry out the necessary work by paying attention to the user'sorders. For the user to operate the robot smoothly, a prior preparation session is required. A code is employed for the same purpose to instruct the controller.

Keywords: Robot, Design, Fabrication, Sensor, Automation

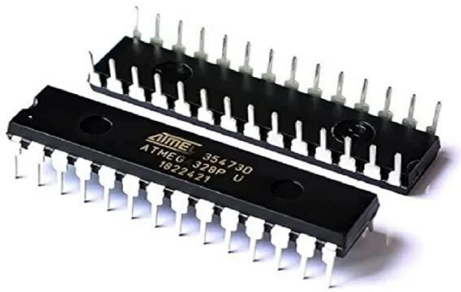
I. Introduction (Problem Definition)

The main objective of the project is to direct the robotic vehicle in the intended path. The main objective of the project is to provide push-button or spoken control of the robot. It is possible to interact with robots and humans. The voice-controlled robot's job is to hear what the user says and do it. The suggested system comprises of two blocks: a transmitter and a receiving block, and is powered by a battery. We may control the robotic car by utilising a cell phone and this app. The project is designed to remotely manage a robotic vehicle utilising voice commands and manual input.

II. Methodology

Employing an Android phone to design robot controls. This project aims to provide solid computational android platforms for robots with simpler hardware design. The characteristics of Bluetooth technology, how to control a robot with a mobile device using Bluetooth connection, and the components of the mobile and robot are all covered in this essay. It gives an overview of robots that can move forward, backward, left, and right with the help of an Android app like Arduino or Bluetooth.

- Robot Operated by Smartphone Using ATMEGA328 Microcontroller. In this study, a robot that can be controlledby an android phone application has been created. It communicates control commands via Bluetooth, which includes several functions like regulating the motor's speed and sensing and sharing information with the phone regarding the robot's direction and distance from the closest barrier.



FIG[1]

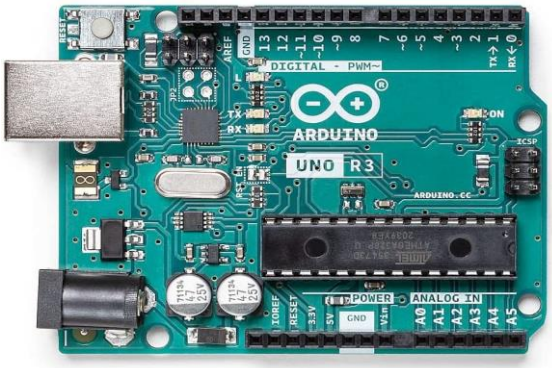
- Bluetooth robot controlled by an Android mobile phone using an 8051 microcontroller. A robot is often an electromechanical device that is controlled by electronic and computer programming. For manufacturing, many robots have been developed by factories all over the world and serve a purpose. This paper creates remote buttons for an Android app that may be used to control a robot's motion.

FIG[2]

III. Experimental setup

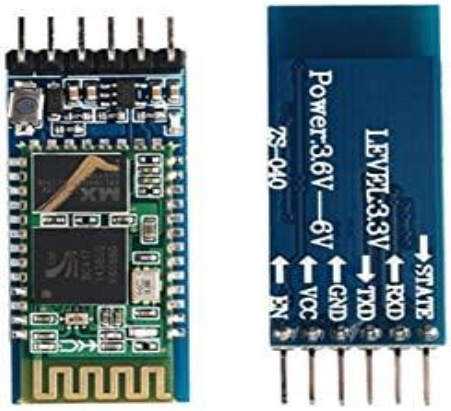
The experimental setup for a voice controlled robotic vehicle using Internet of Things (IoT) would typically involve the following components:

1. Microcontroller: A microcontroller controls the robot's different functions, such as movement, sensor reading, and communication with the Android application. Arduino, Raspberry Pi, and STM32 are examples of popular microcontrollers used in automation. We'll be using Arduino



FIG[3]

2. Bluetooth Module: A Bluetooth module is used to relay the voice commands back to the Arduino which in turn move the robot move forward backward or make it turn left and right . As the vehicle is voice controlled we use Bluetooth module to control the robots movement the basic commands include forward, backward, left and right



FIG[4]

3. Motor Driver: The robot's mobility is controlled by a motor driver. It gets microcontroller signals and converts them into commands that the motors can comprehend. L293D and TB6612FNG are two common motor drivers used in automation. We'll be using L293D in our product.

FIG[5]

4. Motors: Motors are used to propel the automaton in different directions. In robotics, DC motors and servo motors are widely used. We used 4 gear motors for our robots movements and a servo motor for direction detection.

FIG[6]

FIG[7]

5. Sensors: Sensors sense the environment of the robot and provide input to the microcontroller. Ultrasonic sensors, infrared sensors, and light sensors are examples of common sensors used in automation. In our product we used HC-SR04 for distance detection and obstacle avoidance.

FIG[8]

6. Android Application: A user-friendly interface for communicating with the robot is provided by an Android programe. The application communicates with the microcontroller via voice commands, gets status updates from the robot, and shows information to the user.

7. Power Source: A power source is needed to supply electricity to the robot's various components. Batteries and power packs are common power sources.

FIG[9]

IV. Feature and character identification

A voice-controlled robotic vehicle can have several features and character identification options. Here are someideas:

1. **Voice Recognition**: The vehicle should be equipped with advanced voice recognition technology to accurately understand and interpret voice commands given by the user.
2. **Intelligent Navigation**: The robotic vehicle should havethe ability to navigate autonomously or based on user instructions. It should be able to map its environment, avoid obstacles, and plan optimal routes to reach its destination.
3. **Multi-Sensor Integration**: The vehicle can be equipped with various sensors such as cameras, lidar, radar, and ultrasonic sensors to gather information about its surroundings. This data can be used to enhance the vehicle's perception and decision-making capabilities.
4. **Communication Capabilities**: The robotic vehicle can have built-in communication capabilities to interact with the user or other devices. It can send status updates, receive commands or queries, and provide real-time feedback.
5. **Safety Features**: Safety should be a priority for a robotic vehicle. It can include collision detection and avoidance systems, emergency stop functionality, and fail-safe mechanisms to ensure the vehicle operates safely in various scenarios.
6. **Personalization**: The vehicle can be designed with options for personalization to create a unique character. This can include changing the voice of the vehicle, selecting different personalities or avatars, and customizing the vehicle's appearance.

V. Constraint Identification

When it comes to voice-controlled robotic vehicles, there can be several constraints that need to be considered. Here are some constraint identification points for a voice-controlled robotic vehicle:

1. Speech Recognition Accuracy: One of the primary constraints is the accuracy of speech recognition. The robotic vehicle must be able to accurately understand and interpret the spoken commands to execute the intended actions. Inaccurate speech recognition can lead to incorrect or unintended vehicle movements.

2. Vocabulary Limitations: The vehicle's speech recognition system may have limitations in terms of recognizing and understanding specific words or phrases. This constraint can affect the range of commands that can be given to the vehicle and may require users to learn specific keywords or phrases for effective control.

3. Noise and Environmental Factors: Voice control can be impacted by background noise or environmental factors such as wind, traffic, or other sounds. These external factors may interfere with the voice commands, affecting the vehicle's ability to accurately recognize and respond to user instructions.

4. Response Time: The response time of the robotic vehicle to voice commands is another constraint to consider. There may be a delay between issuing a command and the vehicle's execution of the corresponding action. Reducing this response time is crucial for a smooth and intuitive user experience.

5. Security and Privacy: Voice-controlled robotic vehicles may raise concerns about security and privacy. It's importantto ensure that the vehicle's voice recognition system is secureand cannot be easily manipulated or hacked. Additionally, user privacy should be protected, with personal voice data handled and stored securely.

6. Limited Voice Command Complexity: The complexity of voice commands that can be effectively recognized and executed by the robotic vehicle may be limited. Complex instructions or multi-step tasks might be challenging for the system to understand and perform accurately. This constraint may require simplification of commands or the incorporationof additional technologies for more complex tasks.

7. Training and Customization: Some voice-controlled robotic vehicles may require initial training or calibration to

adapt to specific user voices or accents. The constraints here involve the need for user training and customization to achieve optimal speech recognition accuracy.

8. Language Support: The language support of the voice recognition system is a constraint that needs to be considered. Different robotic vehicles may have different language capabilities, limiting the ability to control the vehicle in certain languages.

These are just a few examples of constraints that may arise in the context of voice-controlled robotic vehicles. Identifying and addressing these constraints during the design and development process is essential to ensure reliable and user-friendly operation.

To overcome the constraints associated with voice-controlled robotic vehicles, you can consider the following strategies:

I. Improve speech recognition

- Use advanced speech recognition algorithms and technologies, such as natural language processing (NLP) and machine learning, to enhance the accuracy of recognizing and interpreting voice commands.
- Continuously update and train the speech recognition system with a diverse range of voice samples and data to improve its performance over time.
- Implement error handling mechanisms that allow the vehicle to ask for clarification or confirmation when it is unsure about a command.

II. Expand Vocabulary:

- Regularly update the vocabulary database of the speech recognition system to include commonly used words andphrases, as well as domain-specific commands.
- Provide a user interface or documentation that lists the supported commands to help users learn and remember theavailable vocabulary.

III. Noise and Environmental Factors:

- Employ noise cancellation techniques to minimize the impact of background noise and environmental factors onspeech recognition accuracy.
- Design the vehicle's microphone and audio processing system to focus on capturing the user's voice while reducing surrounding noise.

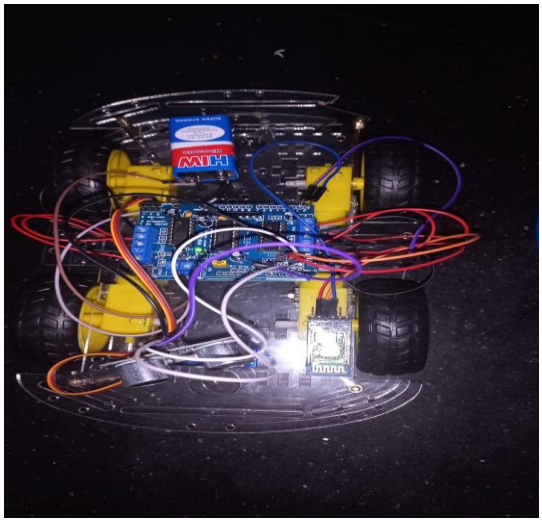
IV. Optimize Response Time:

- Use efficient algorithms and hardware components to reduce the processing time required for speech recognition and actionexecution.
- Employ parallel processing and optimization techniques to minimize latency between command input and vehicle response.

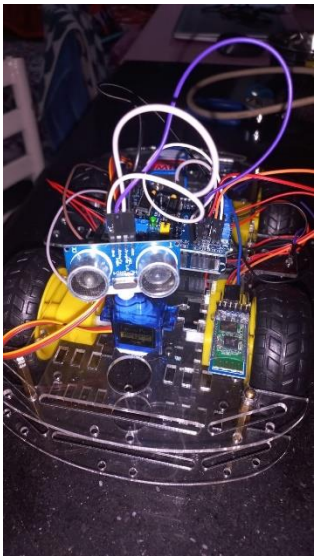
VI. RESULT

Human voice is identified using a microphone in the android smart phone. This voice is analyzed and converted into English words using the android operating system codes and Artificial Intelligence software.

The FIG 9 and FIG 10 Shows the assembly image for voice control robot using Arduino software. The project was completed according to the specification and needs. Simple movements can be controlled with the voice. The proposed system is basically based on Voice Controlled Robotic Vehicle helps to control robot through voice commands received via android application. The Voice Controlled Vehicle is controlled through voice commands given by the user who is operating the project. These voice command needs to be given through an android app which is installed on the users android mobile.Speech recognition is done within the android app and then a respective command is sent to the voice controlled robot vehicle. Microcontroller fitted on the Vehicle decodes these commands and gives an appropriate command to the motors connected to the vehicle.



FIG[9]



FIG[10]

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VII. CONCLUSION

Speech recognition and a navigation system are integrated into a robotic car to assist individuals with disabilities. Even though it is quite basic, this speech control system demonstrates how speech recognition methods can be used in a control application. Our robot can respond to control commands that are spoken in a natural way and understand them. Simply put, this technology uses an Android software to identify human speech, convert it to text, and then process the text to direct robotic motion. It can also move on its own for which we use an ultrasonic sensor for obstacle avoidance. Real-time operation of the approaches has been demonstrated.

VII. REFERENCES

Images:

FIG[1]

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FIG[4]

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FIG[7]

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FIG[8]

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