**Voice Controlled Robot**

**19ELC212 Microcontroller and Applications**

**Term Project Report**

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# Declaration

We, Adhavan, Aravindhan, Sudarshini, Harikrishnan and Sree Varshan, hereby declare that project work entitled **“Voice Controlled Robot”**, is the record of the original work done by us and this written submission represents our work in our own words. To the best of our knowledge, this work has not formed the basis for the award of any degree/diploma/associate ship/ fellowship or a similar award to any candidate in any University.Wherever we have borrowed material from other sources, we have adequately cited and referenced the original sources. We also declare that we have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will result in a grade of zero.

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ABSTRACT

The development of voice-controlled robots has gained prominent attention due to their potential to improve human-robot interaction. Robotic technology is the future. Specific tasks are performed by robots which humans cannot do or where humans take more time to complete. Robots follow human instructions and perform the tasks such as security operations, act as spy robots etc. In this project, we propose the design and development of a voice-controlled robot car that can perform tasks based on voice commands given by the user. The robot is designed to respond to voice commands and execute various actions such as moving forward and backward and turning left and right. Apart from this, it can also stop when given the command. The movement of robot car is by controlling via IoT technology. The robot car is developed on a NodeMCU ESP8266 micro-controller based platform. The voice commands are carried out using Google’s API and this signal is converted into text format and then communicated to the robot through Wi-Fi network. This robot is able to move in different directions like left, right, backward, forward and can stop when given proper voice commands. It also contains an ultrasonic sensor to detect obstacles on its way. When it senses an obstacle, it stops and then continues to move forward after the obstacle is removed.

INTRODUCTION

Robotic evolution begins with certain fundamental notions. It reduces human labor and can be used in a variety of domains, including military and surveillance applications, industrial pick and place robots, and the most recent humanoid robots made in the modern world. Nowadays, robotic cars are built employing wireless technologies. Wireless technology in robotics begins with Bluetooth, Wifi, and Zigbee communication. They are used in projects depending on the requirements and applications. A smartphone is used to simplify and optimize the processing of voice commands. With its own operating system and internet connectivity, they are increasingly being employed in a wide range of applications. One of the most important elements that we will employ is the Internet. An internet connection enables the phone to communicate with the robot. There are other operating systems for smartphones, but the most popular and efficient is the Android OS, which was developed by Google Inc. The Internet facilitates data sharing and is a highly effective means of communication between two devices, such as a microcontroller and a smart phone. The robot can either retain its preset direction or change direction in response to a specific order. A microcontroller known as NodeMCU is used for voice recognition. An Ultrasonic sensor module is used to identify and avoid obstacles. It is configured to stop the robot if there is an obstruction in its path and notify the user to use another spoken command. The suggested system includes a NodeMCU ESP8266, a motor driver, four DC motors, and a mobile phone to control it. The robot is controlled by voice commands via the Arduino IDE software, which runs on NodeMCU. Wi-Fi is managed with an Android-based application named MJRobot, which uses an MIT App inventor. This is an alternative to the standard joystick approach. The Android application is used to steer the car in forward, reverse, left, and right directions. So, in this case, the MIT App Inventor Android application serves as a transmitter, while a Wi-Fi module (NodeMCU ESP8266) installed in the automobile serves as a receiver. The Android application will communicate commands to the car via Wi-Fi, allowing it to move forward, reverse, turning left, turning right and stopping. MIT App Inventor is a tool that allows you to easily create Android apps using drag-and-drop block programming. This allows people with little to no knowledge in Java programming to create basic applications that meet their needs. Once the app runs, the user must connect to the robot over the Internet. When you click the microphone button, the speech will be recorded. The captured audio is analyzed, and the transcribed text is displayed and delivered to the internet as a string or character array. The application uses Google's Speech Recognition API to transform speech to text, which is then processed to decide the robot's next action. The robot can go forward and backward, turn left and right, and stop. The device also contains a safety mechanism that prevents the robot from moving if it encounters an obstruction. The robot's performance is evaluated using a variety of studies to determine its accuracy and efficiency in responding to voice commands. The results reveal that the system recognizes voice commands with high accuracy and that the robot can complete jobs efficiently. Voice-controlled robots have tremendous potential in a variety of applications, including home automation, healthcare, and industrial automation. The system's design is scalable, and extra functionalities can be added based on the application's individual requirements.

METHODOLOGY

*A. NODE MCU*

The NodeMCU-ESP8266 is a popular development board for IoT applications. It is based on the ESP8266 Wi-Fi module, a low-cost, low-power system on a chip (SoC) that includes Wi-Fi connectivity. The NodeMCU is based on the ESP8266 microcontroller, a 32-bit RISC CPU operating at 80 MHz. It features a 16-bit instruction set, 64 KB of instruction RAM, and 96 KB of data RAM. The ESP8266 Wi-Fi module is built into the NodeMCU board, allowing for Wi-Fi connectivity. The module supports the IEEE 802.11 b/g/n wireless protocols and may function as both a client and an access point. The NodeMCU ESP8266 includes 4MB of flash memory to store firmware and user data.The board has a USB-to-UART bridge that enables for simple programming and debugging. It employs the CP2102 USB-to-UART chip and may be programmed with the Arduino IDE or other programming tools.

*B. MOTOR DRIVER [L298N]*

The L298N motor driver is a popular dual H-bridge driver that can handle both DC and stepper motors. The L298N motor driver is a widely used integrated circuit that drives DC and stepper motors. It is intended to function from a variety of voltage inputs and can manage motor currents of up to 2A per channel. The L298N has two H-bridge circuits that may be operated independently, making it excellent for driving motors in forward, reverse, stop, and coast modes. The L298N motor driver includes four input pins: IN1, IN2, IN3, and IN4. These input pins control the motors' direction and speed. The driver also has two enable pins, ENA and ENB, which can be used to toggle the motor outputs on and off. When the enable pin is high, the motor is enabled, and when it is low, the motor is turned off. The L298N also includes a built-in protective circuit to keep the driver from overheating, overloading, or short-circuiting. This makes it a dependable and safe option for driving motors. So, the L298N is a versatile and dependable motor driver that can operate both DC and stepper motors. Its twin H-bridge design, high voltage input range, and built-in protective circuit make it an attractive option for a variety of motor control applications.

*C. SPEECH RECOGNITION*

Voice controlled robots typically use a combination of hardware and software to convert voice commands into coding.

1. *Speech Recognition:* Use a speech recognition technology to transform voice commands to text. This is usually accomplished using machine learning algorithms.
2. *Natural Language Processing (NLP):* Once voice commands are transformed to text, the robot must parse and understand them. Natural language processing algorithms evaluate sentence structure and extract meaning.
3. *Code Generation:* fter identifying the command's intent, the robot generates the necessary code to execute it. This is often done using pre-defined templates and code libraries that are adjusted depending on the unique hardware and software.
4. *Execution:* Once generated, the robot can run the code to do the specified activity.

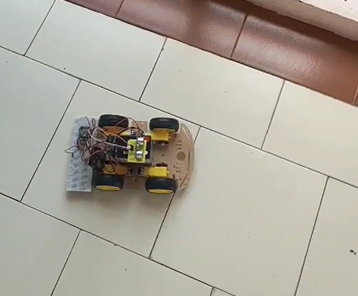
DESIGN/LOGIC

When the user gives a command to a voice-controlled robot to move forward, several processes are initiated to ensure that the robot responds correctly. Here's a full explanation of how to respond to the "move forward" instruction:

1. *App Sends Command:* The app sends the "move forward" command to the robot. This can be accomplished through the use of a voice recognition system or the app's joystick control.
2. *Voice Recognition:* If a command is delivered using voice recognition, the MIT App creator captures the audio input and processes it using speech recognition software. The software transforms the audio data to text and then matches the text to the right instruction, which in this case is "move forward."
3. *Signal Processing:* The robot's microcontroller recognizes the command and processes it. The microcontroller is responsible for controlling the motors and processing the signals from the sensors.
4. *Motor Control:* The microcontroller provides signals to the driver to regulate the motors' speed and direction. In this case, the robot is commanded to move forward, so the motors will rotate in a direction that causes the robot to move forward.
5. *Sensor Feedback:*The robot's sensors continuously examine the environment for impediments and changes in topography. The microprocessor processes the sensor data and adjusts the robot's movement to avoid obstacles and maintain its course.

RESULTS

*Robot Car:*



*MIT App Inventor:*



CONCLUSION

Finally, the voice-controlled robot built in this study shows the possibilities for voice-based human-robot interaction. It represents a successful application of voice recognition technology in robots. The research demonstrated that it is possible to build a robot that can be controlled via voice commands, resulting in a more intuitive and natural user experience. The robot can recognize a wide range of orders, including those for movement and interaction with the environment. The system's concept and execution provide a foundation for future study and development of voice-controlled robots with more advanced capabilities. The future potential of voice-controlled robots is enormous and promising. As voice recognition technology advances, the potential uses for voice-controlled robots will only grow. Healthcare is one of the most promising sectors for future voice-controlled robot development. Voice-controlled robots can aid people with disabilities or mobility challenges, increasing their freedom and quality of life. They can also be utilized in medical settings to help with patient care and monitoring. Education is another area that has the potential for growth. Voice-controlled robots can be utilized as teaching tools, allowing students to acquire new concepts and interact with instructional content in a more interactive and engaging manner. Voice-controlled robots could also be employed in the industrial industry for duties including inventory management, assembly line operations, and quality control. It can also be used to create a real-world voice-automated car in the future, similar to how Tesla has an automated parking system in their cars, but we must use our smartphones to do so. Imagine if you simply said "Hey Google, Park my car" and your car was parked in its designated spot. As a result, the speech automation concept is feasible.

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