VOICE CONTROLLER BASED WHEELCHAIR

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Keywords:

Voice Recognition, Arduino Nano, Bluetooth Communication, Assistive Technology, Motorized Wheelchair Control.

Introduction:

According to a joint report by the World Health Organization (WHO) and the World Bank, around 1.3 billion people globally are affected by disabilities, many of whom face mobility challenges that traditional manual wheelchairs cannot address. For individuals with severe motor impairments, manual wheelchairs can be difficult or impossible to operate. This project introduces a voice-controlled wheelchair using speech recognition technology to interpret and execute user commands, enabling hands-free control and promoting user independence. The system tackles issues such as limited mobility, high costs, and lack of customization, aiming to improve autonomy and quality of life while reducing reliance on caregivers. The prototype is built using an Arduino Nano, Bluetooth HC-05, and motor driver modules for precise and responsive control. It supports both online and offline modes for flexibility across various environments. With the rising demand for smart and affordable mobility solutions, this project offers a cost-effective, accessible alternative. By integrating real-time voice recognition, it enhances mobility and independence, especially for users in resource-limited settings.

Objectives:

1. Implement speech recognition technology for accurate voice command interpretation.
2. Real-Time Responsiveness are executed promptly to provide a seamless user experience.
3. Implementing both online and offline features to control wheelchair through command.

Methodology:

The voice-controlled wheelchair system operates through an integrated set of components designed for responsive and intelligent mobility. The process begins with the user giving voice commands such as "forward," "back," "left," "right," or "stop" through a microphone. These commands are captured and sent to a speech recognition module, which processes the audio input, converts it into digital signals, and identifies the specific instruction. The recognized command is then transmitted to the Arduino Nano microcontroller, which serves as the system's central processing unit. The Arduino decodes the instruction and sends appropriate control signals to the L298N motor driver. The motor driver regulates motor speed and direction, enabling smooth and accurate movements such as moving forward, reversing, turning, or stopping. To support wireless functionality, the system uses an HC-05 Bluetooth module, allowing voice commands to be sent remotely via devices like smartphones. This adds flexibility for users and caregivers alike. DC motors receive signals from the motor driver and convert electrical energy into mechanical motion, moving the wheelchair at a predefined speed. A stable power supply ensures all components—microcontroller, Bluetooth module, motor driver, and motors—receive consistent voltage and current for uninterrupted operation. Overall, the system ensures seamless movement of the wheelchair based on voice input, offering a smart and accessible mobility solution for individuals with disabilities.

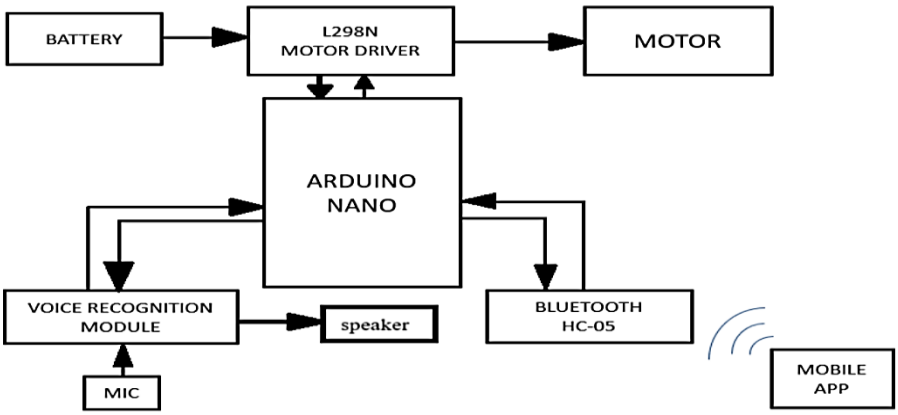

Figure 1: Block diagram of the proposed methodology

Result and Conclusion:

Table 1: Table of commands

Sl. No	VOICE COMMANDS	MOVEMENT OF CHAIR
1.	Forward	Chair moves forwards
2.	Backward	Chair moves back
3.	Left	Chair moves left side
4.	Right	Chair moves right side

Fig. 4.1. Front view of wheelchair

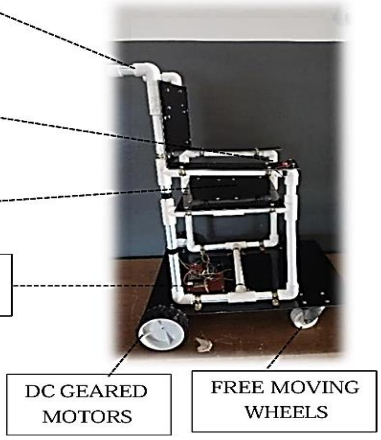

Fig. 4.2. side view of wheelchair

Speech recognition technology was successfully implemented to enable accurate voice command interpretation, allowing for hands-free control and improving user experience. The system processes commands in real-time with minimal delay, ensuring a seamless and natural interaction. Additionally, both online and offline control features were integrated, using Bluetooth and voice recognition modules to provide reliable and independent wheelchair operation.

Future Scope:

The voice controller-based wheel chair can be converted into smart wheelchair by adding features like:

1. Push buttons.
2. Joystick.
3. Voice Biometrics for Security.
4. Battery Optimization and Solar Charging.
5. Mobile App and Cloud Connectivity.