iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 Issue: XII Month of publication: December 2025

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

Voice Controlled Wheel Chair

Pradeep Bharade[1], Rahul Kumar[2], Sachin mulge[3], Dr. Rakesh Huded[4]
[1, 2, 3]UG Student, [4]Assistant Professor, Department of Electronics and Communication, PDA College of Engineering, Kalaburagi, Karnataka

***Abstract:** This study focuses on the development of a voice-controlled wheelchair integrated with an obstacle detection system, designed to improve mobility, safety, and independence for people with physical disabilities. The system allows users to operate the wheelchair using voice commands, eliminating the need for manual control and providing a practical solution for individuals with limited hand or arm movement. Voice commands are processed and converted into appropriate directional actions, offering a simple and intuitive interface. For enhanced safety, ultrasonic sensors continuously monitor the surrounding area for obstacles. Upon detecting an obstruction, the wheelchair either stops or changes direction to prevent collisions, depending on the obstacle's distance. This real-time detection system significantly lowers the risk of accidents. By combining voice control with automated obstacle avoidance, the wheelchair offers a reliable and efficient assistive mobility solution, supporting safer and more independent navigation in different environments.*
***Keywords:** Voice-controlled wheelchair, Assistive technology, Obstacle detection, Ultrasonic sensor, Voice recognition, Autonomous navigation*

I. INTRODUCTION

Mobility is crucial for maintaining independence and participating in daily activities for individuals with physical disabilities. Conventional wheelchairs usually rely on manual controls, which can be difficult or impractical for those with limited hand or arm function. Consequently, assistive mobility technologies are increasingly focusing on intelligent, user-friendly solutions that minimize physical effort while promoting autonomy. Voice-controlled wheelchairs offer an effective solution by enabling hands-free operation through natural voice commands.

This research presents the design and development of a fully motorized wheelchair controlled by voice commands, aimed at improving mobility and independence for individuals with physical disabilities. A custom prototype is created using a mechatronic design approach, which integrates mechanical components, electronic hardware, embedded software, and user interface elements into a cohesive system. Speech recognition functions as the primary control method, enabling verbal commands to be interpreted and translated into corresponding wheelchair movements. This eliminates the need for traditional input devices like joysticks, making the system suitable for users with severe motor impairments while providing a simple and intuitive mode of operation..

The control system is centered on an ATmega328 microcontroller, which communicates with an HC-05 Bluetooth module to receive wireless commands from an Android smartphone application. The mobile application processes voice inputs and transmits corresponding control signals to the wheelchair. Based on the received commands, the microcontroller drives the motor control circuitry to operate DC motors, allowing movement in forward, backward, left, and right directions. Functional testing demonstrates that the system reliably responds to voice commands while maintaining stable movement control, highlighting its effectiveness in real-world use. These results underscore the importance of interdisciplinary engineering in developing assistive technologies that promote independent mobility and enhance the quality of life for individuals with physical disabilities.

II. LITERATURE SURVEY

Awachar et al. [1] presented a voice-controlled wheelchair based on the Arduino Uno platform, demonstrating the feasibility of using low-cost embedded systems for assistive mobility applications. Their system integrates voice recognition, Bluetooth communication, and ultrasonic sensors to enable hands-free navigation and obstacle detection. The results confirm reliable performance, modular design, and effective real-world operation while maintaining affordability through open-source hardware and software.

Lodhi et al. [2] developed an intelligent electronic wheelchair using Arduino and Bluetooth technology, allowing individuals with severe physical disabilities to control it through voice commands.. The system supports hands-free navigation, thereby enhancing user independence.

Experimental results demonstrated reliable voice recognition and responsive movement under different operating conditions. The straightforward system design and use of commonly available components contribute to its suitability for cost-effective and practical implementation.

Karande et al. [3] presented a voice-controlled wheelchair that integrates MATLAB-based speech processing with embedded control. The system employs Linear Predictive Coding for feature extraction and a neural network trained using the backpropagation algorithm for command classification. The recognized commands are transmitted to an Arduino Uno via Bluetooth to control motor operation. This method offers an intuitive alternative to joystick-based interfaces and demonstrates effective integration of speech processing techniques with embedded systems for assistive mobility applications.

III. METHODOLOGY

A. Block Diagram and Explanation:

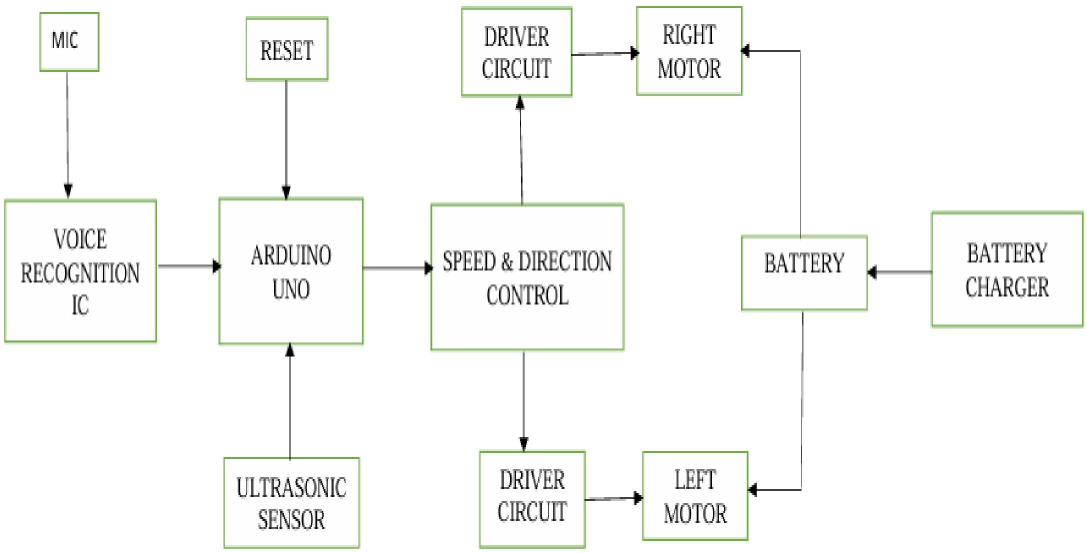


Fig 1: Block Diagram

Figure 1 presents the block diagram of the voice-controlled wheelchair equipped with obstacle detection. A microphone captures the user's voice commands, which are processed by the voice recognition circuit and transformed into digital control signals. These signals are sent to the Arduino Uno microcontroller, functioning as the main control unit. A reset module is included to reinitialize the controller when necessary. Additionally, the Arduino Uno receives input from an ultrasonic sensor that continuously scans the environment to detect any obstacles.

Using the received voice commands and obstacle detection information, the controller generates suitable speed and direction control signals. These signals are applied to the motor driver circuits, which provide the required power to operate the left and right DC motors. Coordinated motor operation enables movement in forward, backward, left, and right directions. The wheelchair is powered by a rechargeable battery, with a charging unit provided to ensure consistent and uninterrupted operation.

IV. HARDWARE IMPLAMENTATION

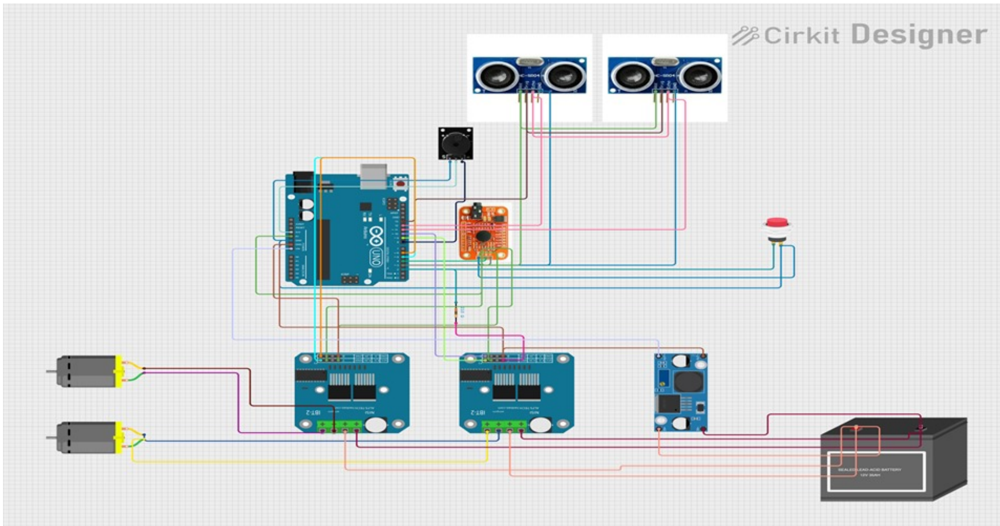


Fig 2: Circuit Diagram

The hardware components used in the system shown in Fig. 2 are described as follows:

1) Arduino Uno:

The Arduino Uno, based on the ATmega328 microcontroller, serves as the main control unit of the system. It processes voice commands received via the Bluetooth module and also handles input from the ultrasonic sensor. With 14 digital I/O pins, 6 analog inputs, and PWM capability, the Arduino Uno efficiently manages motor control and peripheral devices. Its easy-to-use programming environment and dependable performance make it highly suitable for embedded control applications.

2) Motor DriverModule (L293D):

The L293D motor driver is used to control the speed and direction of two DC motors. Utilizing the H-bridge configuration, it allows for bidirectional motor operation. Additionally, the module provides electrical isolation between the microcontroller and the motors, ensuring safe and reliable performance during wheelchair movement.

3) HC-05 Bluetooth Module:

The HC-05 Bluetooth module enables wireless communication between the wheelchair and an Android smartphone. It receives voice command data from the mobile application and sends it to the Arduino Uno through serial communication. Its dependable short-range connectivity ensures smooth and responsive system control.

4) Ultrasonic Sensor:

The ultrasonic sensor is used to detect obstacles by measuring the distance between the wheelchair and surrounding objects. It improves user safety by supplying real-time feedback to the controller, allowing the wheelchair to take preventive actions during navigation.

5) Power Supply:

A rechargeable battery supplies power to all hardware components. It ensures continuous operation of the system and supports portability, making the wheelchair suitable for everyday use.

V. SOFTWARE REQUIREMENTS

1) Arduino IDE:

The Arduino Integrated Development Environment (IDE) is an open-source software tool used to develop, compile, and upload programs to Arduino-based hardware. It offers a straightforward and user-friendly interface for embedded system development. The IDE supports multiple microcontroller platforms and provides a collection of built-in libraryes that simplify hardware interfacing. Program code developed using the Arduino IDE is transferred to the controller via a USB connection, allowing efficient program testing, modification, and debugging.

2) Android Application – BT Voice Control for Arduino:

The "BT Voice Control for Arduino" app is an Android-based tool that allows wireless voice control of Arduino projects via Bluetooth. It converts spoken commands into text and sends the corresponding serial data to the Arduino using a Bluetooth module, such as the HC-05. The microcontroller interprets these commands to manage system functions. With minimal setup required and support for hands-free operation, the app is well suited for voice-controlled embedded systems and assistive mobility applications.

Below Fig 3 shows the Flow Chart:

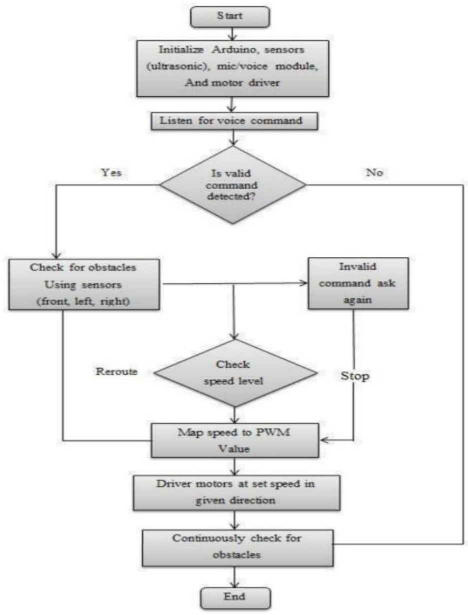


Fig 3: Flow Chart

VI. RESULT

The anticipated result of the voice-controlled wheelchair with obstacle detection is a smart mobility system that allows users to control the wheelchair through voice commands while ensuring safe navigation. The system constantly monitors its surroundings and reacts to obstacles to prevent collisions, providing reliable and secure operation. Figure 4 below illustrates the wiring connections and the overall project model.

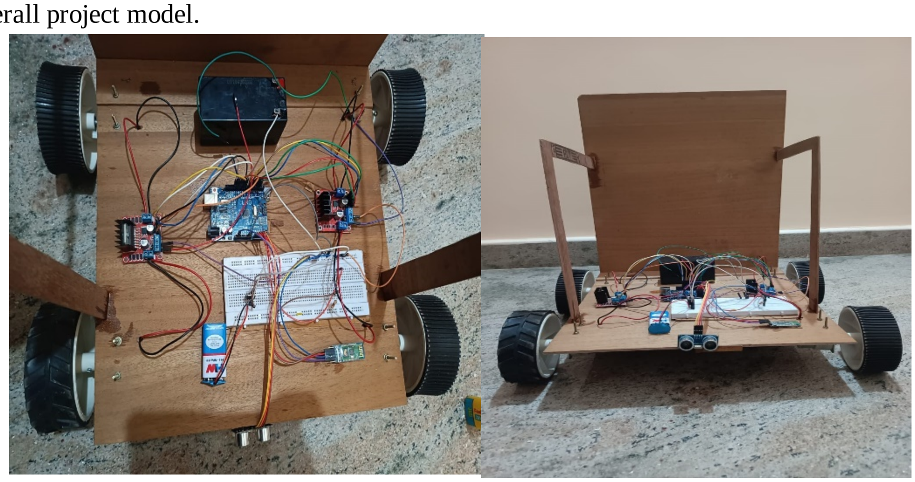


Fig 4: Wiring connection and Project model

Expected Outcomes:

1) Accurate Voice Command Response:

The wheelchair accurately recognizes and executes predefined voice commands such as forward, backward, left, right, stop, fast, and slow through an Android-based voice control application.

2) Stable and Smooth Movement:
When a valid command is received, the DC motors propel the wheelchair in the chosen direction with controlled speed and smooth movement, ensuring stable and reliable operation.

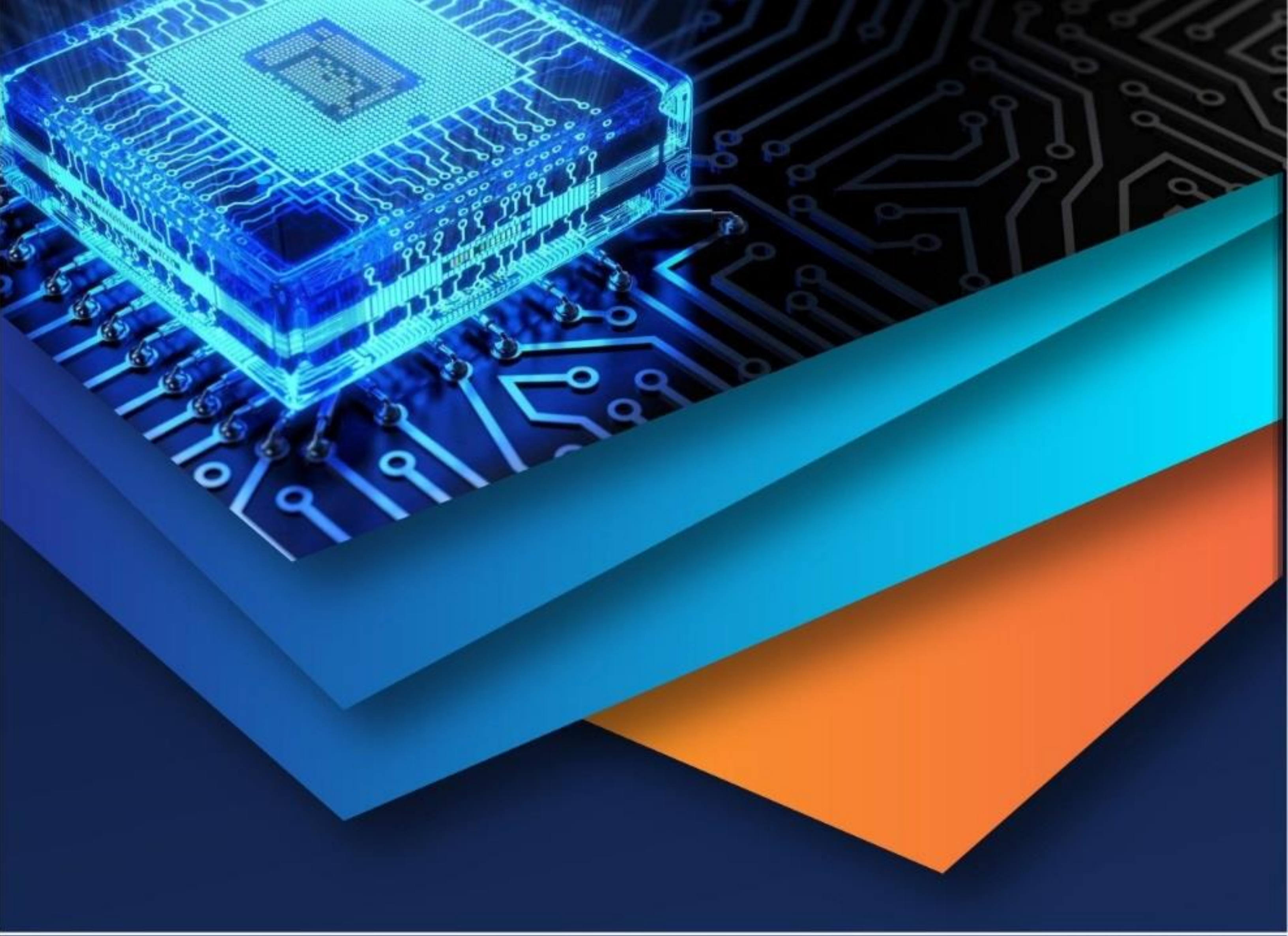
3) Effective Obstacle Detection:
The ultrasonic sensor constantly scans the environment, and if an obstacle is detected within a predefined distance, the system automatically stops or adjusts the wheelchair's movement to avoid a collision.

4) Enhanced Safety and User Independence:
The control system enhances user safety by preventing unsafe actions, such as moving forward when obstacles are detected, thereby promoting secure and independent mobility.

5) Wireless Operation:
The HC-05 Bluetooth module enables reliable wireless communication between the Android device and the Arduino controller, removing the requirement for manual input devices.

REFERENCES

[1] VOICE CONTROLLED WHEELCHAIR USING AURDINO UNO Dr. Sandeep Awachar, Sanika Kale, Shruti Nagdeote, Nital Badratiye, Amisha Jaiswal
[2] Smart Electronic Wheelchair Using Arduino and Bluetooth Module Deepak Kumar Lodhi1,Prakshi Vats , Addala Varun , Prashant Solanki , Ritakshi Gupta , Manoj Kumar Pandey , Rajat Butola
[3] Design and Implementation of Voice Controlled Wheelchair using MATLAB Kaushal Balu Karande, Jagruti Dilip Zope, Sakshi Somani, Balu Bhusari
[4] Development of Voice Controlled Wheelchair for Persons with Physical Disabilities Sumet Umchid,Veeraaphab sutthipibul,Arisara Vorapantrakool,Ponpalat vipattipumiprates,Thidarat Wangkham
[5] Voice and Hand Controlled Wheelchair System Fida Hussain,Sayed Mazhar Ali Shah, Asif Ali , Imran Ali , Haresh Kuma
[6] Arduino based voice controlled wheelchair Tan Kian Hou et al 2020
[7] Voice Controlled Wheelchair M. S. Arsha, A. Remya Raj , S. R. Pooja , Rugma Manoj, S. A. Sabitha , Shimi Mohan



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY