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Voice Controlled Wheelchair

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Abstract- This project focuses on the development of a voice-controlled wheelchair designed to assist individuals with physical disabilities or limited mobility. The wheelchair move automatically based on voice commands, improving accessibility, independence, and safety for users. It incorporates speech recognition technology interfaced with a microcontroller (Arduino UNO) to interpret commands and control movement. Key components include a motor driver, two DC motors, a Bluetooth HC-05 module, and lead-acid batteries. The system also integrates an obstacle detection mechanism for enhanced safety. The project is currently in progress,with manufacturing completed, component connections underway, and software implementation yet

to be finalized.

Keywords-Voice Control, Wheelchair, DC Motor Accessibility, Speech Recognition, Arduino UNO, Bluetooth HC-05, Motor Driver, Obstacle Detection, Assistive Technology

I. INTRODUCTION

A Voice Control Wheelchair is a revolutionary assistive technology designed to provide individuals with mobility impairments or disabilities with greater independence and autonomy. This innovative wheelchair is controlled using voice commands, eliminating the need for manual operation or external assistance.

❖Key Features:

1. Voice Command Interface: Users can control the wheelchair using simple voice commands, such as "forward," "backward," "left," "right," and "stop."

2. Hands-Free Operation: The voice control feature allows users to navigate without needing to use their hands or limbs.

3. Increased Independence: The Voice Control Wheelchair provides users with greater autonomy, enabling them to move around freely without relying on others.
4. Improved Safety: The voice control feature reduces the risk of accidents caused by manual operation or external assistance.
5. Enhanced Quality of Life: The Voice Control Wheelchair can significantly improve the quality of life for individuals with mobility impairments or disabilities.

❖ Target Users:

1. Individuals with spinal cord injuries or paralysis
2. People with muscular dystrophy or other neuromuscular disorders
3.Those with cerebral palsy or other developmental disabilities
4. Seniors or elderly individuals with mobility impairments

❖ Benefits:

1. Increased independence and autonomy
2. Improved mobility and navigation
3. Enhanced safety and reduced risk of accidents
4. Improved quality of life and overall well-being
5.The Voice Control Wheelchair is a groundbreaking technology that has the potential to revolutionize the lives of individuals with mobility impairments or disabilities.
6.The voice controlled wheel chair is designed to help the handicapped person who moves on a wheel chair.
7.The chair will automatically move in a particular direction as dictated by the person.
The main objective is to style a system that gives the answer for the physically handicapped (challenged) people those who that can't move by themselves, they can use speech commands by interfacing the Speech Recognition with a Arduino and wheelchair.

II. METHODOLOGY

The Voice Control Wheelchair uses a combination of hardware and software components to enable voice-controlled navigation. Here's a step-by-step overview of the methodology:

❖ Hardware Components:

1. Microcontroller: Arduino
2. Bluetooth Module: HC-05
3. Relay Module: 24V Dual Channel Relay Module
4. Motor Driver: L298N
5. DC Brushless Motor: 24V DC Brushless Motor

6. Power Supply: 24V, 7Ah Lead-Acid Battery or Li-ion Battery
7. Microphone: USB Microphone or Electret Microphone

❖Software Components:

1. Voice Recognition Software: Google Cloud Speech-to-Text, Microsoft Azure Speech Services, or similar
2. Microcontroller Programming: Arduino IDE or Raspberry Pi OS
3. Bluetooth Communication Protocol: Serial Communication Protocol (SCP)

❖Methodology:

1. Voice Command Input: The user speaks a voice command into the microphone.
2. Audio Signal Processing: The microphone sends the audio signal to the microcontroller.
3. Voice Recognition: The microcontroller uses voice recognition software to interpret the voice command.
4. Bluetooth Communication: The microcontroller sends the interpreted voice command to the Bluetooth module.
5. Relay Module Activation: The Bluetooth module sends the signal to the relay module, which activates the corresponding motor.
6. Motor Control: The motor driver controls the speed and direction of the motor based on the voice command.
7. Wheelchair Movement: The wheelchair moves according to the voice command.

III. ALGORITHM

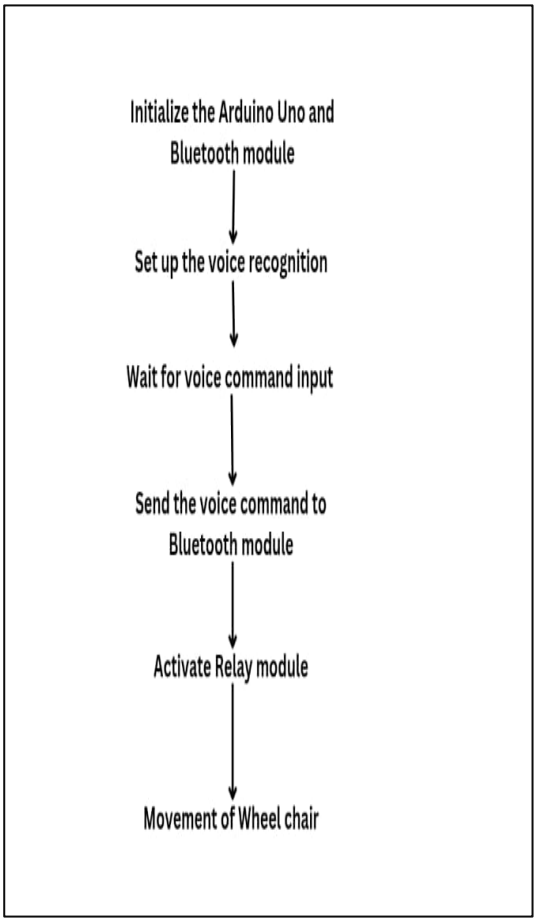

Fig.1: Algorithm of Voice Controlled Wheelchair

1. Initialize the Arduino UNO and Bluetooth module.

2. Set up the voice recognition software.

3. Wait for voice command input.

4. Process the audio signal and interpret the voice command.

5. Send the interpreted voice command to the Bluetooth module.

6. Activate the relay module and control the motor.

7. Move the wheelchair according to the voice command.

8. Repeat steps 3-7 until the user stops the wheelchair

IV. BLOCK DIAGRAM

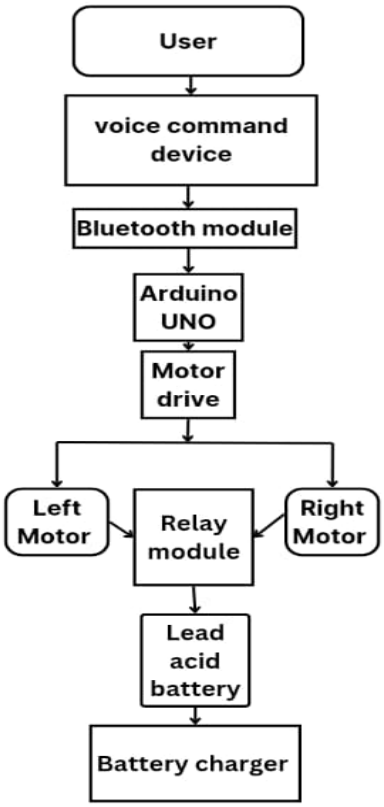

Fig.2: Block Diagram of Voice Controlled Wheelchair

❖ Hardware Components

1. Arduino Uno
2. Bluetooth Module (HC-05/HC-06)
3. Motor Driver IC (L298N/L293D)
4. DC Motors (2)
5. Wheels and Axles
6. Chassis and Frame
7. Power Supply (Batteries)
8. Relay Module (optional)
9. Microphone (optional)

Connection Steps

Step 1: Connect Arduino Uno to Bluetooth Module

1. Connect the Bluetooth module's TX pin to Arduino's RX pin (Digital Pin 0).
2. Connect the Bluetooth module's RX pin to Arduino's TX pin (Digital Pin 1).
3. Connect the Bluetooth module's VCC pin to Arduino's 5V pin.
4. Connect the Bluetooth module's GND pin to Arduino's GND pin.

Step 2: Connect Arduino Uno to Motor Driver IC

1. Connect the Motor Driver IC's IN1 pin to Arduino's Digital Pin 2.
2. Connect the Motor Driver IC's IN2 pin to Arduino's Digital Pin 3.
3. Connect the Motor Driver IC's IN3 pin to Arduino's Digital Pin 4.
4. Connect the Motor Driver IC's IN4 pin to Arduino's Digital Pin 5.
5. Connect the Motor Driver IC's VCC pin to Arduino's 5V pin.
6. Connect the Motor Driver IC's GND pin to Arduino's GND pin.

Step 3: Connect Motor Driver IC to DC Motors

1. Connect the Motor Driver IC's OUT1 pin to Motor 1's positive terminal.
2. Connect the Motor Driver IC's OUT2 pin to Motor 1's negative terminal.
3. Connect the Motor Driver IC's OUT3 pin to Motor 2's positive terminal.
4. Connect the Motor Driver IC's OUT4 pin to Motor 2's negative terminal.

Step 4: Connect Power Supply to Arduino Uno and Motor Driver IC

1. Connect the Power Supply's positive terminal to Arduino's VIN pin.
2. Connect the Power Supply's negative terminal to Arduino's GND pin.
3. Connect the Power Supply's positive terminal to Motor Driver IC's VCC pin.
4. Connect the Power Supply's negative terminal to Motor Driver IC's GND pin.

Step 5: Connect Relay Module (optional)

1. Connect the Relay Module's IN pin to Arduino's Digital Pin 6.
2. Connect the Relay Module's VCC pin to Arduino's 5V pin.
3. Connect the Relay Module's GND pin to Arduino's GND pin.

Step 6: Connect Microphone (optional)

1. Connect the Microphone's VCC pin to Arduino's 5V pin.
2. Connect the Microphone's GND pin to Arduino's GND pin.
3. Connect the Microphone's OUT pin to Arduino's Analog Pin 0.

TABLE 1. COMPONENTS AND ITS RATING

Component Name	Rating	Quantity
DC Motor	24V,250W	2
Lead acid battery	12V,7Ah	4
Bluetooth module	HC-05	1
Relay Module	24v dual channel relay module	1
Arduino UNO	5V	1
Motor drive IC	L298N	1
Battery charger	24V,2A	1

V. OUTCOME & IMPACT

The Voice Control Wheelchair has the potential to significantly improve the lives of individuals with mobility impairments or disabilities. The outcomes and impacts of this technology can be far-reaching and multifaceted:

Short-Term Outcomes

1. Increased Independence: Users can navigate their surroundings without relying on others, promoting autonomy and self-reliance.
2. Improved Mobility: Voice control enables users to move around with greater ease, reducing fatigue and strain.
3. Enhanced Safety: The voice control system can help prevent accidents by allowing users to quickly respond to changing environments.
4. Increased Confidence: Users can regain confidence in their ability to navigate and participate in daily activities.

Long-Term Outcomes

1. Improved Quality of Life: The Voice Control Wheelchair can significantly enhance the overall quality of life for individuals with mobility impairments.
2. Increased Social Participation: Users can participate more fully in social activities, promoting social inclusion and reducing feelings of isolation.
3. Reduced Caregiver Burden: Caregivers may experience reduced physical and emotional strain, as users become more independent.
4. Economic Benefits: Increased independence and mobility can lead to greater employment opportunities and economic self-sufficiency.
5. Improved Mental Health: The Voice Control Wheelchair can help reduce stress, anxiety, and depression by promoting independence and autonomy.

Societal Impact

1. Increased Accessibility: The Voice Control Wheelchair can promote accessibility and inclusivity in public spaces, workplaces, and communities.
2. Reduced Healthcare Costs: By promoting independence and reducing the risk of accidents, the Voice Control Wheelchair can help reduce healthcare costs.
3. Advancements in Assistive Technology: The development of Voice Control Wheelchairs can drive innovation in assistive technology, leading to new solutions and improved outcomes for individuals with disabilities.

4. Increased Employment Opportunities: The Voice Control Wheelchair can enable individuals with mobility impairments to participate more fully in the workforce.
5. Improved Social Inclusion: The Voice Control Wheelchair can promote social inclusion and reduce stigma around disability, promoting a more inclusive and equitable society.

VII. RESULT

1. Improved Mobility for Disabled Users

Allows individuals with motor impairments to navigate independently.

Enhances quality of life for people with conditions like quadriplegia, cerebral palsy, or muscular dystrophy.

2. Hands-Free Operation

Users can control the wheelchair through voice commands instead of using joysticks or buttons.

Beneficial for those with limited hand function.

3. Increased Accessibility & Ease of Use

Simple voice commands like "move forward," "turn left," or "stop" make navigation intuitive.

Some systems support multiple languages and custom commands.

4. Integration with AI & Smart Features

AI-based speech recognition improves accuracy.

Some wheelchairs integrate with IoT devices, GPS, and obstacle-detection sensors.

5. Challenges & Limitations

Speech Recognition Issues: Background noise and speech impairments can reduce accuracy.

Battery & Power Consumption: Voice-controlled systems may drain battery faster than manual ones.

Cost: Advanced models can be expensive due to AI and sensor integration.

Environmental Factors: Difficulties in noisy or outdoor environments.

6. Real-World Implementations

Research projects and commercial prototypes have successfully demonstrated voice-controlled wheelchairs.

Companies and universities continue improving designs with better AI and sensor-based navigation.

VIII. CONCLUSION

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Allows individuals with motor impairments to navigate independently.

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REFERENCES

[1] "Voice Operated Intelligent Wheelchair" by Ms. S. D. Suryawanshi, Mr. J. S. Chitode, Ms. S. S. Pethakar, "International Journal of Advanced Research in Computer Science and Software Engineering

[2] "Voice Based Direction and Speed Control of Wheel Chair for Physically Challenged by M.Prathyusha, K. S. Roy, Mahaboob Ali Shaik, International Journal of Engineering Trends and Technology (IJETT)" ,

[3] "A Wheelchair Steered through Voice Commands by Gabriel Pires and Urbano Nunes "Journal of Intelligent and Robotic

[4] "Smart Wheelchairs: A literature Survey" , by Richard Simpson "Journal of Rehabilitation Research & Development

[5]http://www.who.int/mediacentre/news/notes/2013/disability_and_development_20130920/en

[6]http://www.indiability.org/resources/disability-in-india

[7] www.techtriks.wordpress.com

[8]http://www.electroschematics.com/wp-content/uploads/2013/01/PIC16F877A-Datasheet.pdf

[9] IEEE Transactions on Neural Systems and Rehabilitation Engineering: "Voice-Controlled Wheelchair for People with Severe Disabilities" (2018)

[10]Journal of Assistive Technologies: "Design and Development of a Voice-Controlled Wheelchair" (2019)

[11]International Journal of Advanced Research in Computer Science and Software Engineering: "Voice Controlled Wheelchair Using Android Application" (2017)

[12] ResearchGate: "Voice Controlled Wheelchair for Disabled People" (2020)

[13] Hindawi: "Voice-Controlled Wheelchair for People with Disabilities" (2020)

[14] International Journal of Robotics and Automation: "Voice-Controlled Wheelchair Navigation System" (2018)