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Voice Controlled Wheelchair Using ESP

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Abstract: *This paper is a design of Voice Controlled Wheel Chair for people who has any physical illness. Here Arduino, microcontroller and geetech voice recognition module are used to support the motion of the wheelchair. In order to provide the battery level, a battery level indicator is also provided. Based upon the direction specified in the commands, the Arduino will drive the 2 motors. People those who has disabilities with their hands, foot and lower body are unable to perform tasks on regular basis. So, there are many applications which help handicapped person to perform their tasks. The aim of this system to help people who cannot move properly without help others due to any physical illness or disabilities. Speech recognition technology will provide a new way of human interaction with machine.*

Keywords: Voice Controlled Wheel Chair

I. INTRODUCTION

Physical disabilities occurs due to variety of causes, including accidents, health issues, and ageing. Wheelchairs are design to offer transportation for physically disabled people who have problems with their hands and legs. People having disabilities, such as paralysis or accidents find it difficult to control the wheelchair manually. Approximately 650 million people worldwide, accounting for around 10% of the global population, are living with disabilities. In India alone, there are around 1.5 million individuals with spinal cord injuries, and this number continues to grow with the addition of 10,000 new cases each year. They need for artificial mobility solutions is increasing as more individuals require assistance due to illnesses or accidents. Tragic accidents also contribute to the rising number of disabled people, with some victims suffering from severe spinal injuries, leading to a life that deviates from the norm. The dream of mobility and freedom becomes paramount for individuals with physical disabilities. As human existence has evolved, the value and significance of life have become increasingly complex. However, there is limited time available to care for older individuals or those with specific physical challenges. The number of elderly individuals living alone in their homes is on the rise worldwide. Due to diminished sensory and interaction capabilities such as weak memory, memory loss, impaired sight, hearing, and mobility, the aging population often experiences a significant decline in their quality of life. According to a study conducted by the World Health Organization, it is estimated that one out of every fifty people suffers from paralysis caused by damage to the nervous system. Paralysis resulting from spinal cord injuries, strokes, and cerebral palsy is a common occurrence. Paralyzed individuals become confined to wheelchairs and dependent on others for their daily movement and needs. Although attempts have been made to customize wheelchairs by adding accessories, existing models like joystick control and head control wheelchairs have limitations such as wired remote systems, mechanical issues, or high costs. To overcome these drawbacks, a smart wireless wheelchair control system is required.

Wheel-chair is still the most reliable transport means for them. This is the cause why wheelchairs are being produced with added latest improvements which leads its conversion to electric wheelchair. Shortly available manual wheelchairs need regular assistance of others for people having severe limitation and are at a high risk of damages to the upper part of the body due to mechanical inability of the wheelchair. Furthermore, standard wheelchairs possess problems while working up the hill or rough surface.

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1.1 OVERVIEW OF MODERN WHEELCHAIR

Over the intervening centuries, advances in medicine, ergonomics, and materials sciences have led to an explosion of different types and variants; all modern wheelchairs still bear echoes of the original design. Chiefly, the presence of two large wheels at the back, and hand grips to allow someone walking behind to push the chair forward.

The current, **cutting edge technology is the mind-controlled wheelchair**. This technology isn't built into the chair itself but is rather contained in a headset worn by the person sitting in it.

The headset like this one measures brain activity when the wearer thinks about moving the chair, charting the differences in electrical signals when the user thinks "forward," "backward," "left," "right," and so on.By identifying changes in brainwave patterns, an electric wheelchair interfaced with this device can be controlled by the power of thought alone, making it one of the most exciting types of wheelchairs for paraplegics, and others with extreme limitations in mobility.

II. LITERATURE SURVEY

[1] "Development of a Voice-Controlled Wheelchair for Physically Impaired Individuals" by Jenina R. Amoguis, Mabel A. Lingon, Edwin R. Arboleda, Airah Cahigan.

Background and Objective: Traditional manual wheelchairs provide mobility to individuals with physical impairments but are poorly suited for individuals with a combination of physical and cognitive or perceptual impairments. Manual wheelchairs are more physically demanding than powered wheelchairs; however, powered wheelchairs require cognitive and physical skills that not all individuals possess. The general objective of this study is to develop a voice-controlled wheelchair that allows a disabled person to move around independently using a voice-recognition application that is interfaced with motors. The study will be beneficial for quadriplegic individuals who are paralyzed in both arms and both legs. Material and Methods: This study aims to modify a standard wheelchair controlled by voice commands where the EasyVR 3 Voice Recognition Module, ultrasonic sensors, microcontroller, and 12V wiper motor were integrated. Based on the signal given by the motor driving circuit, the controller switches the motor accordingly. The added safety feature is the ultrasonic sensor that senses obstacles with a fall detection system and sends a signal to the microcontroller to stop the chair. Results: Through testing and evaluation, the device's functionality was proven to meet the desired objectives, and the limitations of the device were concluded.

[2] "AStar-Algorithm based Voice-Controlled Wheelchair for Quadriplegic Patients "by Mohamed R. Abdelkader, Eslam T. Abdullah, Rana A. Mohamed, Rehab K. Salam, mar Y. Mohamed, Azza M. Anis.

Physical disabilities caused by ageing, accidents, and diseases, pose significant challenges for individuals, hence affecting their mobility and communication abilities. Besides, the conventional control mechanisms proved ineffective for individuals with hand injuries or paralysis. Therefore, assistive devices such as wheelchairs have received much interest in recent years. In this paper, a voice-controlled wheelchair based on AStar-algorithm is proposed to overcome these limitations. The proposed design consists of a microcontroller interfaced with an ultrasonic sensor, a rotary encoder, a gyroscope, and motors for rotating the wheels in a specific direction. Moreover, an android application is created to send voice commands via a Bluetooth module to interact with the microcontroller unit. The proposed system allows users to communicate easily to their desired destination using voice commands, then the wheelchair will autonomously find the shortest path and guide a user accordingly. The validity of the design is confirmed by Proteus simulations. After that, the capability of mobile application for fast communication between a user and the design is verified. Finally, a prototype for the proposed voice-controlled wheelchair is implemented and tested for different destinations.

[3] "Arduino based voice controlled wheelchair" by Tan Kian Hou, Yagasena and Chelladurai.

A voice controlled wheelchair prototype was developed using a commercially available manual wheelchair to assist people with both upper and lower limb disabilities. An Arduino microcontroller processes the voice command from the speech recognition module and controls the motor movement of the wheelchair. Bluetooth module was also used to do away with messy wiring and an optional joystick command was also incorporated into the prototype design. The

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success rate of the wheelchair to recognize the voice commands in English, Chinese and Malay was high. The overall cost of the prototype was kept low to make it affordable.

[4]"Voice controlled wheelchair" by Sasireka Murugaiyan, Jeevanandham Varatharaj, Kanyaa Anandraj, Manobala Duraisamy

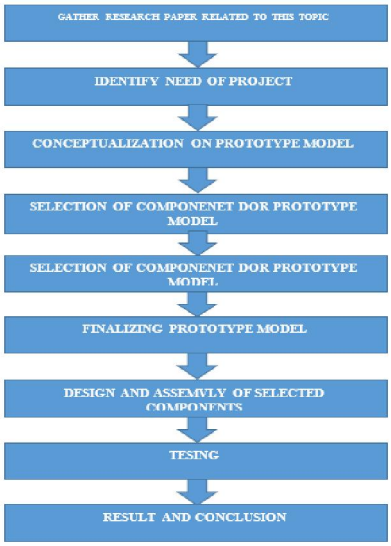
Most of the physically challenged people depend on others for their movement from one location to the other location. People using wheel chair also need others support to move the wheel chair if they don't have hands. The voice-controlled wheelchair helps the physically challenged people to make their movements easier one without getting damaged. The wheelchair uses motors for the wheel rotation and it is accessed by voice recognition. The circuit contains Arduino, HC05 Bluetooth module and dc motors. The module is used for recognizing and processing the command given by the user and it provides the data coded to micro controller. Micro controllers control the movement of the wheelchair. The additional features are manual control and automatic turning ON/OFF lights at darker places automatically.

[5]"Smart Wheelchair with Voice Control for Physically Challenged People" BY Md Abdullah Al Rakib, Salah Uddin, Md. Moklesur Rahman, Shantanu Chakraborty, Md. Ashiqur Rahman, and Fysol Ibna Abbas.

A wheel chair is a mechanically operated device that allows the user to move about independently. This minimizes the user's personal effort and force required to move the wheelchair wheels. Furthermore, it allows visually or physically handicapped people to go from one location to another. Voice commands and button controls can be used to operate wheelchairs. In recent years, there has been a lot of interest in smart wheelchairs. These gadgets are very handy while traveling from one location to another. The devices can also be utilized in nursing homes where the elderly have difficulties moving about. For individuals who have lost their mobility, the gadgets are a godsend. Different types of smart wheelchairs have been created in the past, but new generations of wheelchairs are being developed and utilized that incorporate the use of artificial intelligence and therefore leave the user with a little to tamper with. The project also intends to develop a comparable wheel chair that has some intelligence and so assists the user in his or her mobility.

III. METHODOLOGY

3.1 Methodology



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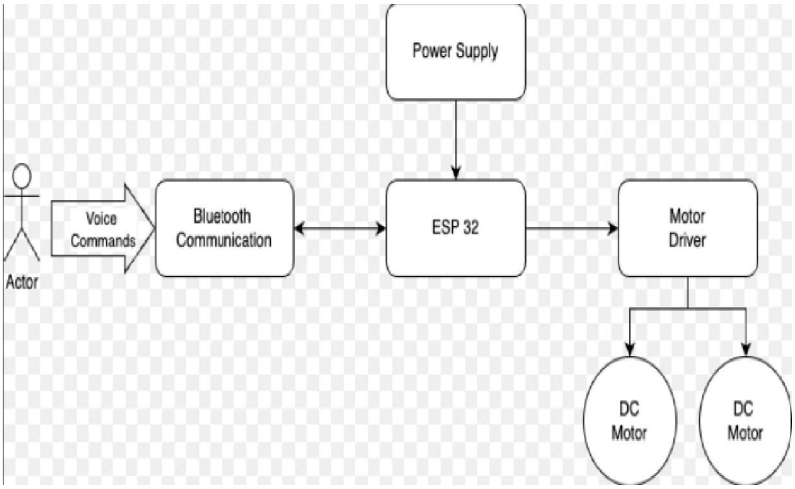
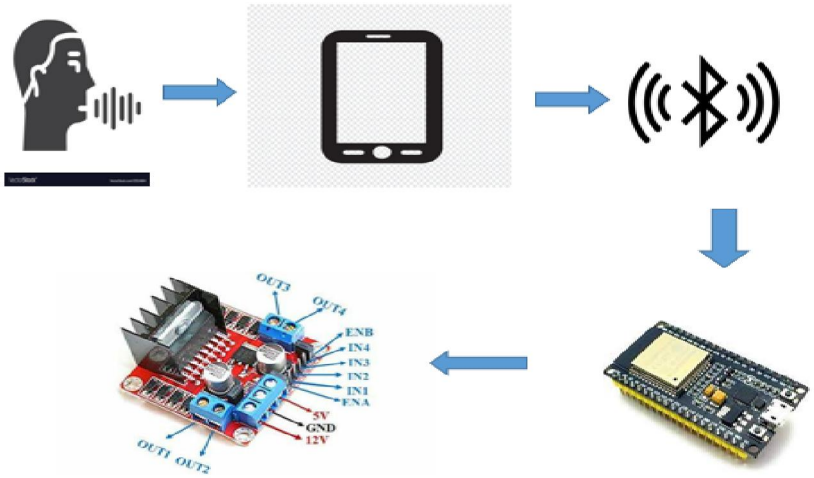
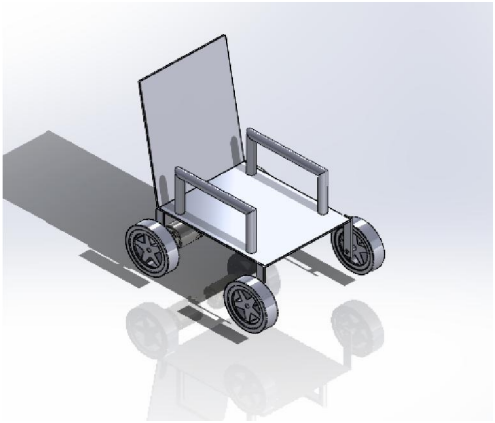
3.2 Block diagram



3.3 Flowchart



3.4 3D model:



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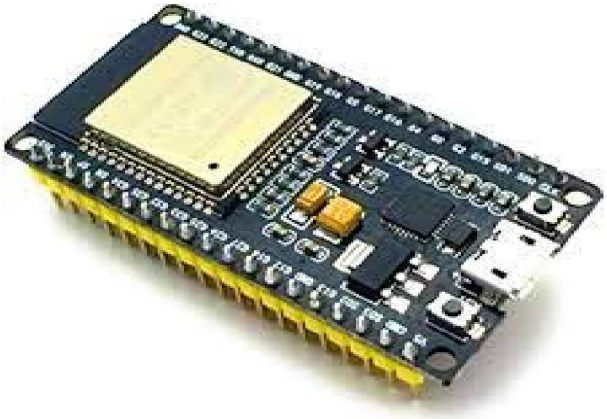
3.5 Components

3.5.1 ESP32



The ESP32 is a versatile microcontroller developed by Espressif Systems, which is known for its support for Wi-Fi and Bluetooth connectivity. It is widely used in various IoT (Internet of Things) applications. When working with the ESP32, you can define and use functions to perform specific tasks or operations within your program. Here's a general outline of how functions are used with the ESP32:

Function Definition: To create a function, you typically start with a function definition. This defines the function's name, return type, and parameters. For example:

In this example, my Function is the name of the function. It takes two parameters: an integer (param1) and a float (param2). It has a return type of void, which means it doesn't return any value.

Function Call: To execute the code inside a function, you need to call the function. You can do this by simply using the function's name followed by parentheses and passing the required arguments:

This will call my function with the arguments 42 and 3.14.

Function Implementation: Inside the function, you can write the code that performs a specific task or operation. For example, you might use the ESP32's functions to control pins, interact with sensors, or communicate over Wi-Fi and Bluetooth.

In this code snippet, digital Write and delay are functions that interact with the GPIO pins on the ESP32 to control an LED.

Return Statement (if needed): If the function is supposed to return a value, you use the return statement to do so. For example, if your function needs to perform a calculation and return the result, you can use the return statement:

In this case, the add function takes two integer parameters, calculates their sum, and returns the result.

3.5.2 30 RPM DC motor

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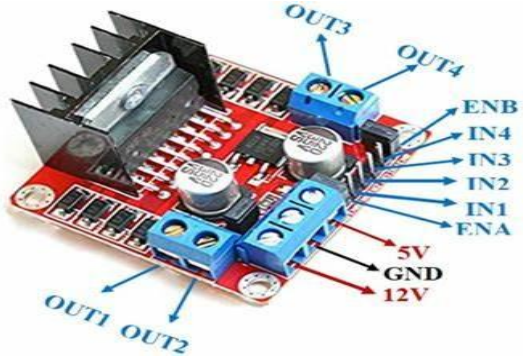
After many other more or less successful attempts with relatively weak rotating and reciprocating apparatus Prussian Moritz von Jacobi created the first real rotating electric motor in May 1834. It developed remarkable mechanical output power. His motor set a world record, which Jacobi improved four years later in September 1838. His second motor was powerful enough to drive a boat with 14 people across a wide river. It was also in 1839/40 that other developers managed to build motors with similar and then higher performance.

The first commutator DC electric motor capable of turning machinery was invented by British scientist William Sturgeon in 1832. Following Sturgeon's work, a commutator-type direct-current electric motor was built by American inventor Thomas Davenport, which he patented in 1837. The motors ran at up to 1000 revolutions per minute, and powered machine tools and a printing press. Due to the high cost of primary battery power, the motors were commercially unsuccessful and bankrupted Davenport. Several inventors followed Sturgeon in the development of DC motors, but all encountered the same battery cost issues. No electricity distribution system was available at the time. No practical commercial market emerged for these motors.

3.5.3 L298 motor driver



It is a high voltage, high current dual full-bridge driver de-signed to accept standard TTL logic level sand drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the in-put signals .The emitters of the lower transistors of each bridge are connected together rand the corresponding external terminal can be used for the connection of an external sensing resistor. An additional Supply input is provided so that the logic works at a lower voltage.

IV. CONCLUSION

The ESP 32 based voice controlled wheelchair prototype was successfully built and tested to respond to voice commands. It will greatly improve the quality of life for those with severe disabilities. The cost has also been kept low by adding the design to any manual wheelchair.The implementation of a voice-controlled wheelchair using an ESP microcontroller has demonstrated a practical, low-cost solution to assist individuals with mobility impairments. Through the integration of voice recognition modules, motor drivers, and wireless communication, the system successfully interprets spoken commands to control wheelchair movement, offering users a higher degree of independence and ease of use.

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