IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Voice Controlled Wheelchair Using ESP

Prof.Rukyabano M Sayyad[1], Shabnam Liyakat Mulani[2], Nigar Liyakat Mulani[3], Rutuja Nitin Sutar[4]

[1]Professor, Department of Electronics and Telecommunication, Al-ameen Educational and Medical Foundations College of Engineering and Management Studies, Koregaon Bhima, Pune

[2,3,4]Student, of Department of Electronics and Telecommunication, Al-ameen Educational and Medical Foundations College of Engineering and Management Studies, Koregaon Bhima, Pune

Abstract: The integration of voice control technology in assistive devices is a significant advancement for enhancing the independence and quality of life for individuals with mobility impairments. This paper presents the design and implementation of a voice-controlled wheelchair utilizing the ESP (Espressif Systems) microcontroller platform. The system leverages voice recognition capabilities to allow users to operate the wheelchair with spoken commands, thereby reducing the need for physical interaction with traditional controls. The proposed solution employs the ESP32 microcontroller, known for its versatility and connectivity options, as the central processing unit for the voice control system. A voice recognition module is interfaced with the ESP32 to process and interpret voice commands, which are then translated into control signals for the wheelchair's movement and functionality. The design incorporates safety features such as obstacle detection and emergency stop functions to ensure reliable and secure operation. This voice-controlled wheelchair system aims to provide a more intuitive and accessible means of navigation for users, particularly those with severe physical disabilities. The paper discusses the technical implementation, including the hardware integration, software algorithms for voice recognition, and the communication protocols between the ESP32 and the wheelchair's motor control units. Additionally, user testing and performance evaluation are presented to assess the effectiveness and user experience of the system. The results demonstrate that the voice-controlled wheelchair offers a viable alternative to conventional joystick-based controls, with improved ease of use and greater autonomy for the user.

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.

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 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

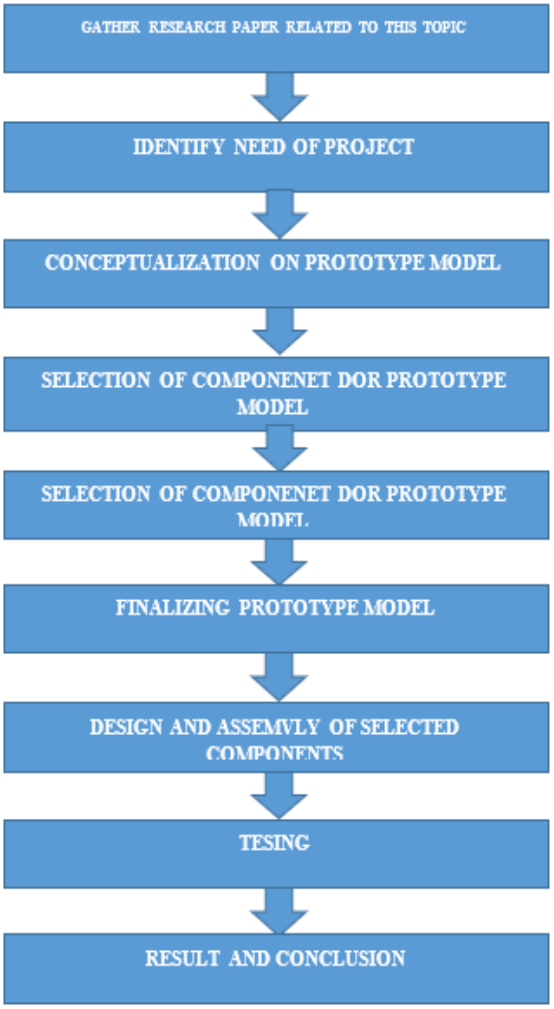
Most of the physically challenged people depend on others for their movement from one location to the other location. People using wheel chair also need others support to move the wheel chair if they don't have hands. The voice-controlled wheelchair helps the physically challenged people to make their 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.

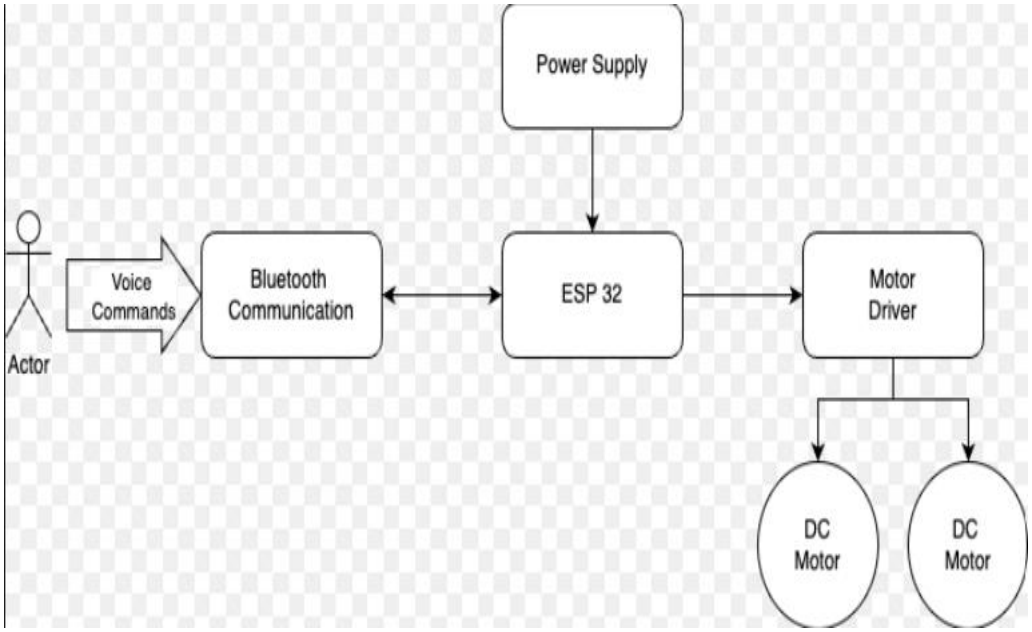
A wheel chair is a mechanically operated device that allows the user to move about independently. This minimizes the user's personal effort and force required to move the wheelchair wheels. Furthermore, it allows visually or physically handicapped people to go from one location to another. Voice commands 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

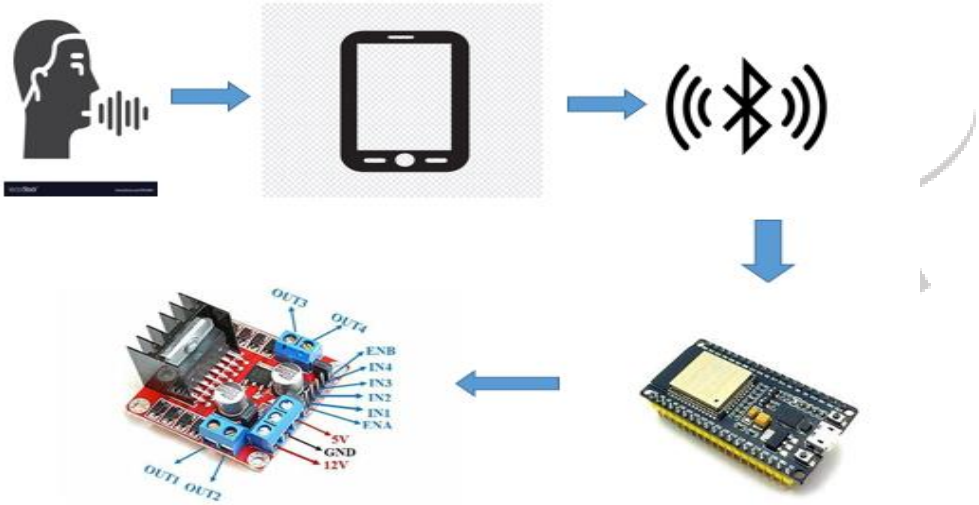
3.1 Methodology



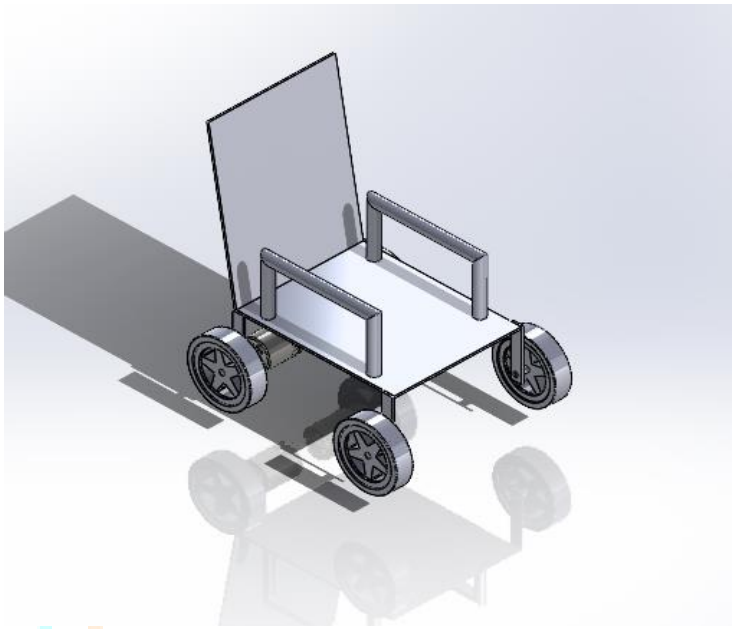
3.2 Block diagram



3.3 Flowchart



3.4 3D model:



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.

REFERENCES

1. **By Jenina R. Amoguis, Mabel A. Lingon, Edwin R. Arboleda, Airah Cahigan "Development of a Voice-Controlled Wheelchair for Physically Impaired Individuals" J Global Clinical Engineering Vol.6 Issue 3: 2024**
2. **Mohamed R. Abdelkader, Eslam T. Abdullah, Rana A. Mohamed, Rehab K. Salam, mar Y. Mohamed, Azza M. Anis "AStar-Algorithm based Voice-Controlled Wheelchair for Quadriplegic Patients "Volume 185 – No. 34, September 2023**
3. **Tan Kian Hou, Yagasena and Chelladurai "Arduino based voice controlled wheelchair "doi:10.1088/1742-6596/1432/1/012064**
4. **Sasireka Murugaiyan,Jeevanandham Varatharaj,Kanyaa Anandraj,Manobala Duraisamy "Voice controlled wheelchair" https://doi.org/10.1063/5.0126311**
5. **Ahmed I. Iskanderani, Foyzur Razzaque Tamim, Md. Masud Rana, Wasif Ahmed, Ibrahim, Mehedi, Abdulah Jeza Aljohani, Abdul Latif, Shaikh Abdul Latif Shaikh, Mohammad Shorfuzzaman, Farzana Akther, Thangam Palaniswamy, Mahendiran T. Vellingiri "Voice Controlled Artificial Intelligent Smart Wheelchair"**
6. **Sushil Kumar Sahooa* and Bibhuti Bhusan Choudhurya "Voice-activated wheelchair: An affordable solution for individuals with physical disabilities" doi: 10.5267/j.msl.2023.4.004**
7. **Md Abdullah Al Rakib, Salah Uddin, Md. Moklesur Rahman, Shantanu Chakraborty, Md. Ashiqur Rahman, and Fysol Ibna Abbas "Smart Wheelchair with Voice Control for Physically Challenged People" Vol 6 | Issue 7 | December 2021**
8. **A. Jayakody, A. Nawarathna, I. Wijesinghe, S. Liyanage and J. Dissanayake, "Smart Wheelchair to Facilitate Disabled Individuals", *2019 International Conference on Advancements in Computing (ICAC)*, pp. 249-254, 2019**

9. **R. Alkhatib, A. Swaidan, J. Marzouk, M. Sabbah, S. Berjaoui and M. O. Diab, "Smart Autonomous Wheelchair", *2019 3rd International Conference on Bio-engineering for Smart Technologies (BioSMART)*, pp. 1-5, 2019.**
10. **P. V. Baiju, K. Varghese, J. M. Alapatt, S. J. Joju and K. M. Sagayam, "Smart Wheelchair for Physically Challenged People", *2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS)*, pp. 828-831, 2020.**