DESIGN OF MICROCONTROLLER BASED VOICE CONTROLLED ROBOT

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***ABSTRACT*- Robotics has become an interesting area of research in the field of electronics engineering. The recently introduced android operating system used in many devices such as mobile phone tablet is user friendly and can be extended to control smart and intelligent systems such as robot. Our design develops a voice controlled robotic vehicle using an android application to control the robot through voice commands. The robotic vehicle operates as per the command received via android application. Therefore, this paper gives an analysis and implementation to help those who are handicapped and cannot drive their own vehicle. The Bluetooth module is used for receiving the voice command. After receiving the voice command data, the robot responses to the command by performing movement to the specified direction.**

Keywords: **ESP32, Node MCU, WIFI, Arduino App**.

1. INTRODUCTION:

We are using a voice recognition system with trending ESP 32 Microcontroller in this project. However, while many people with disabilities who require wheelchairs are satisfied with it, few members of the disabled community find it difficult or impossible to operate a standard power wheelchair. This project falls under the category of assistive technology. It is more independent, productive, and enjoyable to live for handicapped and dependent disabled people. A handicapped person with locomotive disabilities requires a wheelchair to perform functions that require him or her to move around. He or she can do so by pushing the wheelchair with his or her hands. Many of us, however, have weak upper limbs or find the manual mode of operation too tiring. As a result, it is preferable to provide them with a motorized wheelchair that is controlled by voice commands. Because it is critical for a motorized wheelchair to be able to avoid obstacles automatically in real time, it can move at a reasonable speed.

The price of this motorized wheelchair is reasonable for as many disabled people as possible, as well as organizations that support it. In light of these requirements, we propose an automated wheelchair with real-time Herald avoidance capability. Power wheelchair control interfaces are currently insufficient to provide mobility for a significant number of people with disabilities. Through research and design, the wheelchair can be used to control development while providing independence and self-use mobility. This project will provide innovative solutions for handling wheel chairs using voice interfaces for people with disabilities.

This project describes a wheelchair that can only be controlled by a Voice Recognition module and the user's voice. The primary goal of this project is to facilitate the movement of disabled and elderly people who are unable to move properly, allowing them to live better lives without difficulty. Speech recognition is an important technology that can allow humans to interact with machines in order to control a wheelchair.

2. LITRETURE REVIEW

2.1 Joshi, K., Ranjan, R., Sravya, E., & Baig, M. N. A. (2019): Physically challenged people face a significant challenge in their lives because they are unable to perform their daily tasks and must rely on others for care. According to [1], a wheelchair is important in the life of a physically disabled person because it allows the person to work and makes life easier. The voice controlled smart wheelchair, which consists of some parts such as voice control, electric power mode, line follower, and so on, as well as its control units consisting of AVR microcontroller with Bluetooth, some sensors, and a motor driving circuit for controlling speed, makes life easier for the disabled person. Wheelchairs are an excellent asset for physically disabled people because they are simple to use.

2.2 Noman, A. T., Khan, M. S., Islam, M. E., & Rashid, H. (2018, October) and Sharmila, A., Saini, A., Choudhary, S., Yuvaraja, T., & Rahul, S. G. (2019): According to [2], a low-cost wheel chair, a smartphone and a touch sensor, a mega processor, a motor driver, gear motors, an IP camera, and Bluetooth is a new design to consider for a smart wheel chair. According to [3], the World Health Organization estimates that 15% of the world's population is physically disabled, owing to limited access to health care services for each individual. The use of batteries in power wheelchairs can provide exceptional conditions for disabled people. As the smart wheelchair's eye blink sensor, the results show the safety measure.

2.3 Zhen gang Li, Yong Xiong, Lei Zhou: Another author [6] emphasized an efficient solution known as ROS-Based Indoor Autonomous Exploration and Route Wheelchair, which solves many problems such as high cost, complex mechanism, as well as making and deficient reusability of the required system. The programmed runs on the Robot Operating System, and the camera detects its surroundings. The collected data is used to create maps, and the Adaptive Monte Carlo Localization algorithm is used to determine the wheelchair's position and orientation.

2.4 Tatiana Alexenko, Megan Biondo, Deya Banisakher, Marjorie Skubic, “Android-based Speech Processing for Eldercare Robotics”, IUI '13 Companion Proceedings of the companion publication of the 2013 international conference on Intelligent user interfaces companion, pp.87-88, March2013.

The paper titled "Android-based Speech Processing for Eldercare Robotics" by Tatiana Alexenko, Megan Biondo, Deya Banisakher, and Marjorie Skubic was presented at the 2013 International Conference on Intelligent User Interfaces. The paper describes an Android-based speech processing system for eldercare robotics. the paper provides a valuable insight into the application of speech processing technology in eldercare robotics. The authors present a detailed description of the system and its components and provide a comprehensive analysis of its performance. The paper is a useful resource for researchers and practitioners working in the field of eldercare robotics and speech recognition technology.

2.5 Prof. V.A. Badadhe, Priyanka Deshmukh, Sayali Bhujbal, Priti Bhandare, "sBOT: A Face Authenticated and Speech Controlled Robot," International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), vol.2, Issue 2, pp. 160-167, 2013.
The paper titled "sBOT: A Face Authenticated and Speech Controlled Robot" by Prof. V.A. Badadhe, Priyanka Deshmukh, Sayali Bhujbal, and Priti Bhandare was published in the International Journal of Advanced Research in Electronics and Communication Engineering in 2013. The paper presents a study on a robot that uses facial recognition and speech control technology for user authentication and control. the authors conclude the paper by summarizing their findings and highlighting the potential applications of facial recognition and speech control technology in robotics. They suggest that future research should focus on improving the performance and usability of the system and developing more sophisticated algorithms for facial and speech recognition.
2.6 Vladimir Cvetkovic & Milan Matijevic, "Overview of architectures with Arduino boards as building blocks for data acquisition and control systems",13th International Conference on Remote Engineering and Virtual Instrumentation (REV), pp. 56 – 63, February 2016.
The paper titled "Overview of Architectures with Arduino Boards as Building Blocks for Data Acquisition and Control Systems" by Vladimir Cvjetkovic and Milan Matijevic was presented at the 13th International Conference on Remote Engineering and Virtual Instrumentation in 2016. The paper provides an overview of various architectures that use Arduino boards as building blocks for data acquisition and control systems. The authors conclude the paper by summarizing their findings and highlighting the benefits of using Arduino boards as building blocks for data acquisition and control systems. They suggest that future research should focus on developing more sophisticated architectures that can handle larger amounts of data and provide more advanced features such as machine learning and artificial intelligence.

3. RELATED WORK

The robot will be based on microcontroller Because of it versatile features and numerous advantages the robot will be based on Node MCU ESP32 an open-source platform with the benefit of physical computing. Wifi technology and a standard communication interface known as the SPI interface will be used in the system. Bluetooth uses radio waves and a low-power device to connect and exchange data between devices without the use of any physical contact such as wires and cables. SPI interface is a synchronous serial information process used by Node MCU to interact with one or more peripheral devices quickly over short distances. The robot will be able to perform two main tasks, which are discussed below.
The proposed robot's movement will be controlled by the user's voice command. The user will use a MIC to issue a voice command and an Android application to issue a command. An app can be used to retrieve the command. The phone will be linked to the MCU via the Node MCU module's WIFI function. After the voice command conversation, the phone's wifi will send the necessary data to the Node MCU, and the Node MCU will receive the data via the Node
MCU module. The robot will move forward, backward, left, right, or fully autonomously based on the command. Two geared DC motors with gripped tyres will drive the robot, which will be controlled by a DC motor driver. During autonomous mode, an ultrasonic sensor will be used to detect obstacles. Node MCU will send signals based on ultrasonic sensor readings to provide data about any obstacle in front of the robot within a specific range. There will be a command to stop the robot immediately.
The robot will be able to communicate with the user while carrying out a specific command. When the robot is turned on, it will greet the user and ask for a command to perform its action. When the user commands a specific direction, the robot will respond by generating a voice record indicating that the robot is moving in that direction and asking for the next command. The robot will continue to follow the previous command until it receives the next direction. Each command the robot receives causes it to generate the sound of each sentence defined for its actions. For example, the user will say "backward" for the backward command.
Similarly, the robot will receive each instruction given by the user. The sound will be pre-recorded human voices, which will be saved in the Voice Recognition Module V3.
When the voice Module receives the command, the request sent will be isolated and executed by the microcontroller attached to it, and depending on the orders dealt with to the Motor, the motors will function as required. The system will interpret the orders and control the Wheelchair similarly via the microphone.
The user interface in our model is a voice recognition system. Figure 1 depicts the smart wheelchair system's block diagram. We are developing a speech recognition-based wheel chair for disabled patients. Patients who are unable to walk and must rely on a wheel chair can steer it with their voices. In our project, we have one input device, a microphone, which takes input from the user in the form of speech. A speech recognition system recognizes the input word spoken from the microphone. When the signal is received, the microcontroller directs the motors via the control circuit. Two DC high torque stepper motors are used to independently control the chair's two wheels. These stepper motors are extremely useful for rotating at specific angles. If a user wants to rotate its motor in 30 degrees, he simply needs to issue a command to the motor via a simple programmed, and the motor shaft will move to that specific angle. This mechanism will be very useful in rotating the wheelchair left or right at the angle desired by the user.
When a user voice input is detected, the robot can be controlled to move in that direction by issuing commands to the robot. These commands are sent to the robot via electrical signals, which power the robot left or right motor. There are two motors connected to the robot left and right wheels. Electrical signals are routed to these motors via hardware ports. In most cases, the communication

port is a parallel port. This parallel port has some basic predefined pins that accept commands given to the robot in the form of electrical signal.

4.PROPOSED ROBOT MODEL

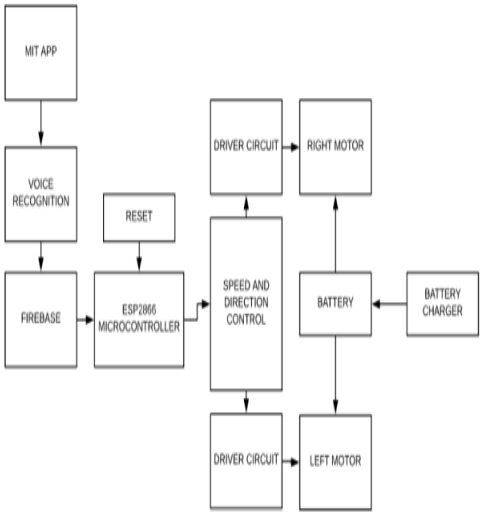

figure 1: block diagram of proposed system

Functional Diagram

Figure 1 depicts the functional diagram of the proposed robot. A Node MCU connected to a Voice Recognition Module V3 will serve as the central processing unit. It will be used to give voice commands, which will be converted and sent to the Node MCU. The motor driver will be required for controlling the robot's movement, and it will be operated by the Node MCU to control two different motors, one on each side, by controlling the direction of rotation of the motors. An ultrasonic sensor will be integrated to detect obstacles and assist the robot in fully autonomous operation. To store the pre-recorded human voices, a V3 module will be connected to the Node MCU.

A. **Circuit Diagram**

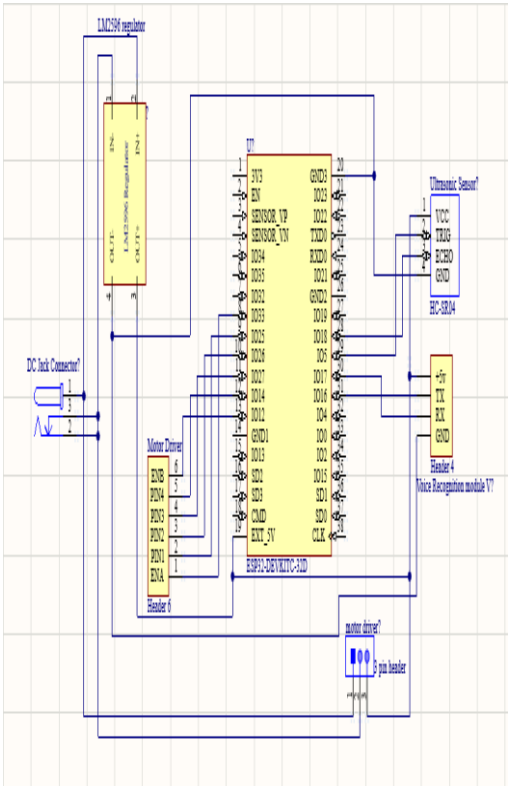

figure 2: schematic for robot

Figure 2 depicts the proposed robot circuit diagram. The main central processing unit will be an ESP32-Wroom Node MCU with 22 GPIO. The power supply will be developed using the LM2596 Regulator Module, which has three input, ground, and output terminals and is capable of providing fixed voltage with accuracy to maintain voltage regulation.

The L293D motor driver has 16 pins, four of which are used to connect two DC motors and four of which are connected to the Node MCU for motor control.

5. SOFTWARE DEVELOPMENT

The microcontroller is programmed using the Arduino IDE, which is the vendor's official software based on C programming and is used to programmed the ESP32.

An android software is created that receives voice command data and converts it into textual content using Google speech recognition technology. Speech recognition, movement, and user communication are all part of the process. The MIC uses Google Speech to Text technology to convert voice commands into text, which is then sent to the ESP32. The ESP32 is programmed to receive a textual command via Bluetooth and to move forward, left, right, backward, and stop depending on the command. A programming for autonomous operation is also developed, which allows the robot to operate completely autonomously by using ultrasonic sensors to detect obstacles and drive defensively.

CONLUSION

Robotics is becoming more reliable, with many new methods and developments being implemented. Although the development of a prototype is presented in this paper, much more future development and research is required to turn the developed robot into a complete product for consumers. Commercial production of this robot may be possible in the future if further research and updates are conducted to improve the robot.

The developed robot can move in any direction based on voice commands received from the user via android phone and Bluetooth. Voice commands can direct the robot to move forward, backward, left, or right. There is a voice command "Autonomous" that causes the robot to move completely autonomously without hitting any obstacles using an ultrasonic sensor. The voice command "Stop" can be used at any time to stop the robot from performing any type of movement.

The developed robot can interact with its user by using a prerecorded human voice file. Individual response audio files are recorded and saved as wav files on the V3 module for each command. When the user issues a command, the robot will generate the corresponding human voice as a response on the amplifier from Module. Future development can be carried out by creating a system that can receive voice commands and recognize them using direct voice recognition hardware, eliminating the need for an Android app to control the robot. The developed device communicated with the user using prerecorded human voice sounds, but artificial intelligence can be implemented for interaction purposes so that the robot can interact more appropriately by analyzing the testing environment and the user's behaviors.

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