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Voice Controlled Wheel Chair for Physically Disabled People with Obstacle Sensor and Therapy Unit

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***Abstract*—The voice-activated autonomous wheelchair design presented in this study is based on anArduino platform. The primary goal of this effort is to suggest using a person's voice to operate a wheelchair for someone who uses one for personal reasons. For the system's safe movement and to lower the likelihood of a collision while traveling, the design also includes a few extra functions like obstacle detection. A treatment unit is also part of this system, which helps users with their limbs so they will not become numb from prolonged rest.**

***Index Terms*— wheelchair, voice, obstacle, therapy, disability, and user interface.**

I. INTRODUCTION

The inspiring and admirable effort has been done by many researchers to make patients' lives as simple and independent as possible. The fact that physically challenged patients can hardly move and must use a wheelchair is one of their major limitations. A controller is now built into certain wheelchairs, making them more modern. This type of wheelchair can be useful for patients who have functional upper limbs but little control over their bottom limbs. In today's world, speech recognition is a hot topic. Speech recognition has a wide range of uses that improve the quality of our lives. However, for people who had issues with both of their limbs, using this type of wheelchair remained a notable barrier. As a result, an intelligent wheelchair system based on voice recognition is suggested. The voice-activated wheelchair is built with safety features to prevent collisions with obstacles and can be operated via voice commands. The primary goal of this system is to be able to recognize speech as accurately as possible. Speech recognition is the process of turning spoken words into forms that computers can understand. This intelligent wheelchair incorporates speech recognition, so when a command is given verbally, the system will carry it out as instructed. It has a therapy machine to help the crippled person's limbs and prevent numbness from being brought on by prolonged rest. Through this approach, disabled people can receive some therapies alone. Using their voice commands, those who are physically disabled or socially isolated will be able to move around freely and independently like other members of the community. This paper discusses the creation of a system that uses an infrared sensor, Google Assistant, a servo motor, and an Android handset as a microphone.

II. DESIGN AND IMPLEMENTATION

A schematic of the experimental setup, which includes both hardware and software, is shown in the picture. Messages are received via a microphone. With the aid of visual basic software, the voice signal is processed before being sent to the microcontroller. These instructions are transformed by the microcontroller into specific

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directives that the motors can understand. The motor driver regulates how the wheelchair moves and is pointed. Depending on the provided instructions, the microcontroller determines how the two DC motors will operate. First, six instructions are used to teach the Voice module. After that, the user issues the voice command. The work linked to this command is carried out by the microcontroller, which also checks the signal associated with it and compares it to the recorded commands. The wheelchair's probable movements and directions are shown below.

1. Forward: FW is selected for both motors.
2. Reverse: RW is engaged on both motors.
3. To the left are Motors 1 FW and 2 RW.
4. Right: Motors 2 FW and 1 RW.
5. Stop: Both engines have been turned off.
6. Massage: vibrating vibrator motor

Giving orders to the wheelchair will cause it to travel in that direction when the voice is recognized. Electrical signals utilized to power the wheelchair's left or right motor is employed to provide these instructions to the wheelchair. Essentially, the wheelchair's left and right wheels are connected to two motors. These motors receive the electrical impulses via hardware ports referred to as communication ports. There are a few standard parallel port present pins that can take commands sent to the wheelchair as electrical impulses. The wheelchair has three wheels to provide optimal balance. DC motors that are attached to the wheelchair oversee the steering of the wheels. One motor operates the wheel on the wheelchair's left side, while a second motor operates the wheel on the right side in a similar manner. Like this, a relay attached to the microcontroller causes the vibrator motor to vibrate when a command is sent. When an obstacle is identified and the stop instruction is linked with it, the obstacle sensor, which is directly connected to the microcontroller, activates.

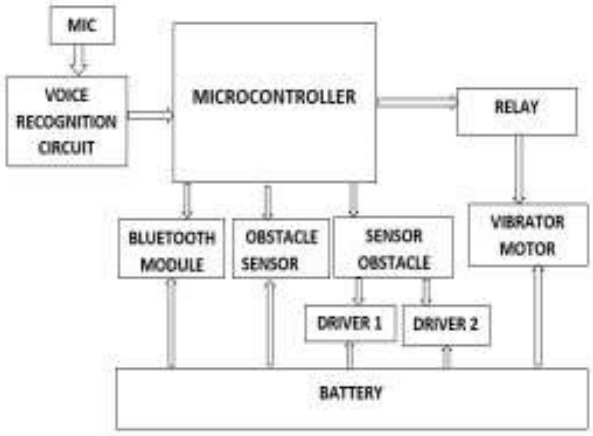

Fig 1. Block diagram

III. Implementation Details

The voice-controlled wheelchair prototype with an obstacle sensor and therapy unit is depicted in the figure below.

Fig 2. The prototype model of the Wheelchair

Fig 3. User Interface of the Application to Control Wheelchair

The snapshot of the software used to identify voices and operate wheelchairs using voice commands is shown in the image above. The user must first pair their smartphone with the wheelchair's Bluetooth module. Then, using vocal instructions like Forward, Backward, Left, Right, Massage, and Stop, the user may steer the wheelchair.

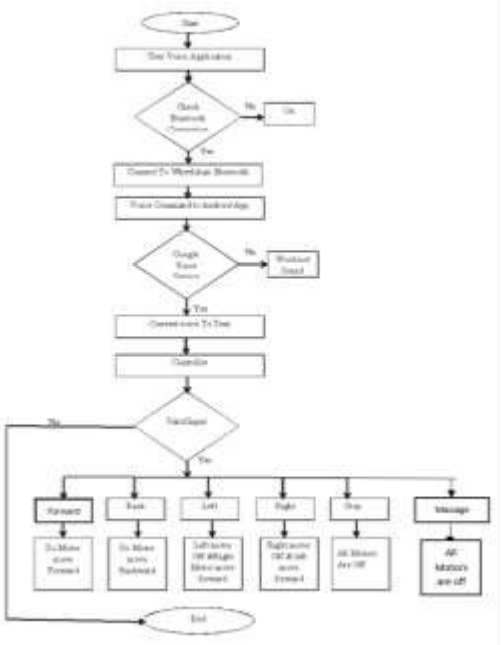

Fig 4. Flowchart for user voice command

The Bluetooth device for the wheelchair is connected to the user voice application. The user is then expected to utilize the application to utter certain commands. The word is then verified and converted to text using the Google Voice service. The text format is then analysed by the controller, who then verifies that the input is correct before giving the motor drivers specific instructions for their movement in the left, right, straight, backward, massage, or stop directions.

IV. RESULTS

A key element is determining the wheelchair system's velocity. While the voice-controlled wheelchair travels ahead, the distance travelled and the passing of time is recorded for velocity. The wheelchair's velocity must be tested in two separate circumstances. First, the velocity's unloaded condition is used to measure it. The wheelchair's speed was measured at 1.53 feet per second and it was made to move straight ahead. Second, the wheelchair was authorized to move 15 kg of weight at a pace of 1.24 feet per second. A 30-kg person then climbed into the wheelchair.

The voice-activated wheelchair was given the go-ahead to proceed straight. The wheelchair is moving at a 1.21 ft/s speed with this load. According to the conclusion, the load affects how quickly a voice-controlled wheelchair moves. The wheelchair system's speed has been observed to diminish in direct proportion to the weight it is hauling.

V.CONCLUSION

In this study, a voice-activated wheelchair for disabled people is designed and implemented. The suggested method aids in the movement of people who are disabled or handicapped and offers vibration treatment to hasten the patient's rehabilitation. Using this method, disabled people can receive therapy without a third party's assistance. Additionally, the technology can detect impediments that are not present in a typical wheelchair. The created wheelchair has ultrasonic sensors built into it for an autonomous obstacle detection system that would halt the wheelchair as soon as an obstruction suddenly blocks its path. When an obstruction is recognized, the wheelchair user is stopped and alerted if they fall out of it. Therefore, the developed voice-controlled wheelchair can provide easy access for people with physical disabilities and offer more safety due to automatic protection

from obstacle collisions. The implemented device helps to improve the lifestyle of physically disabled persons and leads them to keep pace with others in society.

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