International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Design and Development of GPS Enabled Voice Controlled Wheel Chair

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A B S T R A C T :

Differently disabled people face many hardships in life, having to be dependent on another person to move from place to place. Therefore, a wheel chair is needed to use when handicapped people would like to travel by themselves. The wheel chair is divided into two different types based on the power used for mobility:

Manually powered wheelchairs.

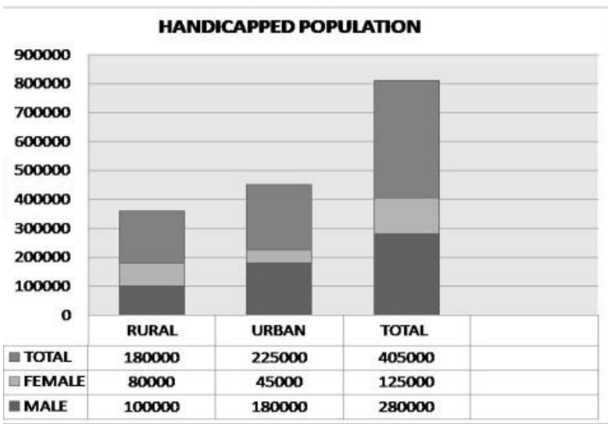
Electric powered wheelchairs.

Manually operated wheelchairs are powered by hand. Even though electrically powered wheelchairs run on electricity, the joystick needs to be manually operated, which means that the chair must be propelled with the hands and arms. As a result, people with hand and arm disabilities find it difficult to use a regular wheelchair. These people need help from others to operate the wheelchair, thus it will be a big problem if they want to go alone. Thus, the objective of this project is to design and construct a voice-activated wheelchair that is location-assignable. The wheelchair can be operated with voice commands using the input that is available. In this study, we are using both manual and voice recognition module input to construct the real-time hardware component of the AUTONOMOUS WHEELCHAIR. .

Keywords: Disabled people, Wheel chair, Manual switches control, Voice Controlled, GSM Module, Real time, Motorized Wheelchair

1. Introduction

India carries out the Census every ten years. The last Census was conducted in the year 2011. Thereis 2.21% of total population in India has disability, approximately 2crore 68 lakh persons with disability.About 69% of the overall disabled Indian population lives rural areas. This tells us that 1.86 crore (18.6 million) disabled people live in rural areas. Only about 0.81 crore (8.1 million) disabled people live in urban areas.
UnderRPWDAct2016atotalof21typesofdisabilitiesarerecognized.Inthat13%peoplehave In-movement related disabilities. The percentage of disabled is highest in the age group 10-19 years followed by age group 20-29 years for both the male and female disabled persons. Therefore, it will not be easy for the handicapped people to do their daily works. They have to depend on others to do their works. So, a “Wheelchair” is an 2 essential vehicle for people with physical disability in order to transport to any places.



Methodology

1. **Voice Recognition Module (VRM):** This module processes voice commands and converts them into digital signals that the MCU can understand.
2. **Microcontroller (MCU):** The brain of the system, responsible for processing voice commands, controlling motor movements, and managing other functions.
3. **Motor Driver:** Translates signals from the MCU to control the motors, enabling the wheelchair to move in different directions and speeds.
4. **GPS Module:** Tracks the wheelchair's location and sends the data to a smartphone app or other devices for navigation and tracking purposes.
5. **Sensors:**

A. **Ultrasonic Sensors:** Detect obstacles and help the wheelchair avoid collisions.

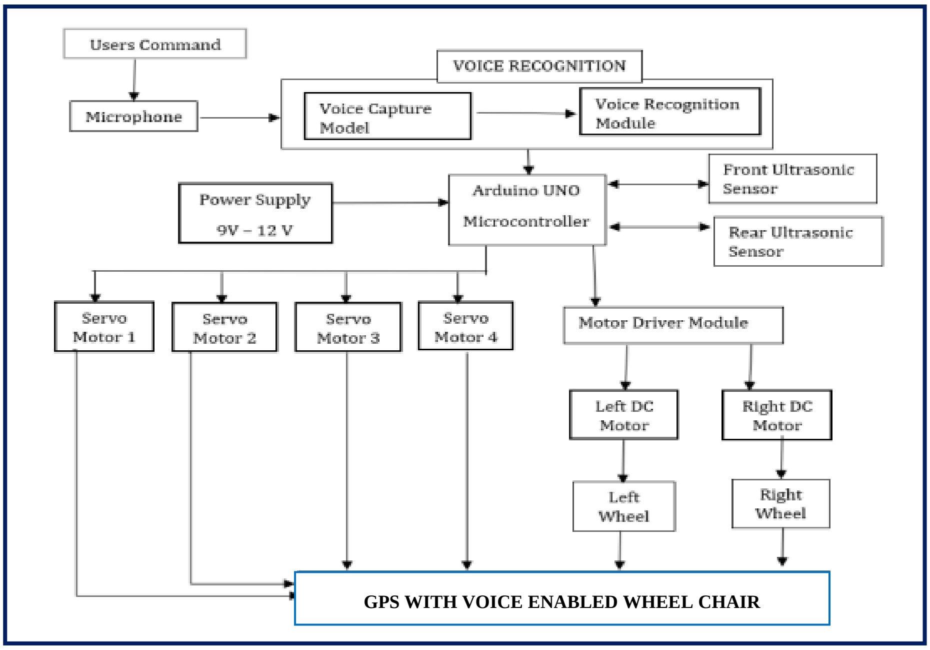
B. **IR Sensors:** Can be used for line following or other applications.

6. **Motors:** Provide the power for the wheelchair's movement.
7. **Battery:** Powers the wheelchair and its electronic components.
8. **Control Interface:** Allows the user to interact with the wheelchair using voice commands, such as a microphone or a headset.
9. **Frame and Chassis:** Provide the structure and support for the wheelchair and its components.

1.1. Structure

The project has Speech is the most important means of interpersonal communication and the main channel of human communication. One possible method of human–computer interaction (HCI) is speech, which involves using a microphone sensor to communicate with a computer. These sensors are being used for quantitative voice recognition research in human–computer interactions (HCI). Wheelchair control, HCI, and health-related applications are just a few of the areas where this work has promise. As a result, the creation of smart or intelligent wheelchairs that use voice recognition technology has significantly increased. For instance, Aktar et al. developed an

intelligent wheelchair system using voice recognition and a GPS tracking model. In order to manage the wheelchair in three different speed phases, the verbal commands were converted into hexadecimal numerical data using a Wi-Fi module. The system also used an infrared radiation (IR) sensor to detect obstructions and a mobile app to locate the patient. Similarly, Raiyan et al. developed an automated wheelchair system with the Arduino and Easy VR3 speech recognition module. The authors claim that the approach developed in this study is less expensive and does not call for wearable sensors or complex signal processing. In a cutting-edge study, an adaptive neuro-fuzzy has been created to control a powered wheelchair. The implementation of the system was based on real-time control signals generated by the categorisation unit of the voice commands. The proposed method used a wireless sensor network to track the wheelchair. Even with the highly sophisticated techniques that researchers in this field have presented, the most significant challenges remain the high cost and accuracy in detecting, classifying, and distinguishing the patient's voice.



Many studies have used the convolutional neural network (CNN) technique to address the inaccuracy of patient speech classification and distinction. This approach first converts speech commands into spectrogram images, which are then fed into CNN. The accuracy of speech recognition using this method has shown promise. In this context, Huang et al. proposed a method to analyse CNN for voice recognition. By visualising the localised filters that were learned in the convolutional layer, this method identified autonomous learning. The authors claim that this method's ability to identify four CNN domains gives it an advantage over the fully connected method. These domains include distant voice recognition, noise robustness, low-footprint models, and channel-mismatched training-test scenarios. Furthermore, Korvel et al. used CNN to analyse 2D feature spaces for voice recognition. To feature maps, the analysis employed the Lithuanian word recognition task. The findings demonstrated that spectral analysis produced the best word recognition rate. Furthermore, cepstral feature spaces exceed the Mel scale and spectral linear cepstra and chroma.

Many academics are interested in the use of CNN's voice recognition technology to operate smart wheelchairs. Sutikno et al., for example, suggested a voice control system for wheelchairs that makes use of CNN and long short-term memory (LSTM). Sound Recorder Pro and Sox Sound Exchange were utilised in this approach to accomplish the goal. This method's accuracy level was higher than 97.80%. In a different study, Ali et al. created a CNN-based algorithm for smart wheelchairs that would assist individuals with disabilities in identifying buses and bus doors. The technique was put into practice using precise localisation data and CPU for quick detection. CNN's application in smartphones is still in its infancy, though, because it requires intricate computations to produce predictions with great accuracy.

1.2. Relays and their operation.

The relay module and geared motors were successfully integrated also with the help of Arduino.The relay module is connected to the manual switches so the relay works by the operation of the switches, the wheel chair can move in forward, backward, right and left directions.The Arduino integrated the multifunctional operation of the wheel chair

Table 1 – Table representing the movement of wheel.

RELAYS	STATE OF RELAY	LEFT MOTOR DIRECTION	DIRECTON RIGHT MOTOR	MOVEMENT OF WHEELCHAIR
3,4,7,8	ON	FORWARD	FORWARD	FORWARD
1,2,5,6	ON	BACKWARD	BACKWARD	BACKWARD
5,6	ON	START	BACKWARD	RIGHT
1,2	ON	BACKWARD	START	LEFT

Directions of motors based on the command of manual switches and voice control

- Forward: The two DC motors are powered to rotate both wheels in the forward direction.
- Backward: The two DC motors are powered to rotate both wheels in the backward direction
- Left: The left DC motors are powered to rotate the Left wheel of the chair in the back ward direction and the right wheel is to be stop.
- Right: The right DC motors are powered to rotate the right wheel of the chair in the back ward direction and the left wheel is to be stop.

1.3. Manual switching output

In the manual control mode, a board was designed using six ON/OFF switches to control the movement of the wheelchair to left, right, forward, or backward. The designed switches send directly to the DC motors that control the wheel chair ovements. It could be attached to any of the chair armrest (i.e., right or left armrests) as the user prefer. The hes.In the forward & backward directions we have 2 switches, with that two switches we can get right and left operations also. So by controlling the manual switches we can operate the wheelchair movement in forward, backward, right & left directions. The wheelchair will move until we release of switch buttons. We have tested in plain and rough surface also the result we got is 100% working so; we can operate the wheelchair in rough surface also.

1.4. Voice controlled output

The relay module and geared motors were successfully integrated also with the help of Arduino. The relay module is connected to the manual switches so the relay works by the operation of the switches, the wheel chair can move in forward, backward, right and left directions. The Arduino integrated the multifunctional operation of the wheelchair.

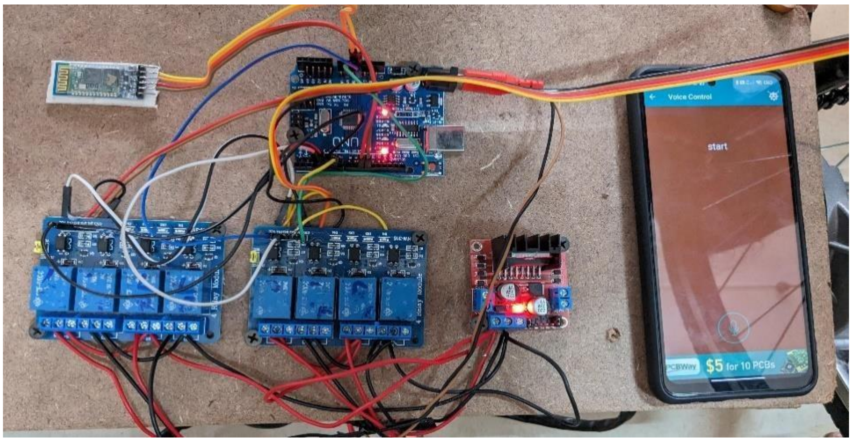
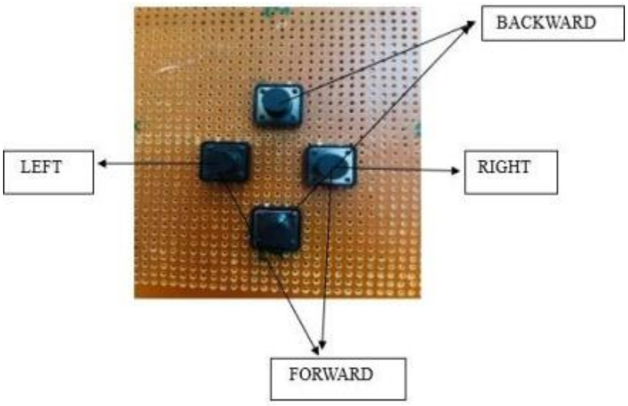


Image representing the relay module for voice control mechanism

1.5. Manual Switching Output

In the manual control mode, a board was designed using six ON/OFF switches to control the movement of the wheelchair to left, right, forward, or backward. The designed switches send commands or signals directly to the DC motors that control the wheelchair movements. It could be attached to any of the chair armrest (i.e., right or left armrests) as the user prefer. The user can easily control the switches. In the forward & backward directions we have 2 switches, with that two switches we can get right and left operations also.

So by controlling the manual switches we can operate the wheelchair movement in forward, backward, right & left directions. The wheelchair will move until we release of switch buttons. We have tested in plain and rough surface also the result we got is 100% working so, we can operate the wheelchair in rough surface also.



1.6. GPS Tracking Output:

In this project we have worked on advanced tracking technology not only streamlines the management of wheelchair assets but also significantly enhances patient care quality. By selecting Digital Matter's solutions, healthcare facilities can secure a robust system that protects against theft, reduces operational costs, and improves service delivery.

Few of the important features of GPS tracking is

- **Accurate Indoor/Outdoor Location Updates:** Precise and reliable location updates ensure that wheelchairs are easily traceable
- **Theft Prevention and Recovery Options:** Features such as theft recovery mode and geo fencing prevent unauthorized use and assist in the recovery of wheelchairs.

Results and Discussions:

The team has designed and developed a better multipurpose wheelchair for disable people to move from one place to another place. Wheel chair analysis was carried out both theoretically and practically. During the practical examination the weight of 110 kg was loaded and using a multifunctional wheelchair and also the GPS tracking facilitated of locating the wheel chair inside and outside premises.

Conclusion:

Wheelchair users' mobility and user experience have improved thanks to a smart wheelchair project that incorporates obstacle detection and navigation via a mobile app. Accurate obstacle identification, effective navigation, and real-time alerts have been made possible by the combination of IoT technology, sensors, Geo fencing and mobile app control, guaranteeing user convenience and safety. The study has demonstrated how IoT- based solutions can help people with mobility disabilities overcome their obstacles for those with mobility disabilities, the GPS and IoT - based smart wheelchair project can develop further, providing even more sophisticated and user-focused features to improve their mobility, independence, and general quality of life.

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