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Review Paper on a Voice Controlled Wheel Chair System

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Abstract: ***The main objective of VOICE CONTROLLED WHEEL CHAIR SYSTEM project is recommended to control a wheel chair by using speech recognition module. The system is designed to control a wheel chair using the voice of person. The objective of this project is to fascilate the movement of people who are disable or handicapped and elderly people who are not able to move well. The goal of this system will allow certain people to live a life with less dependence on others for their movement as a daily need. Speech recognition technology is a key technology which will provide a new way of human interaction with machine or tools. Therefore the problems that they face can be solved by using speech recognition technology for the movement of wheel chair. This can be realized and optimized with use the smart phone device as an intermediary or interface. In this project interfaces has been designed therefore to develop a program for recognize speech also controls the movement of chair and an application which can handle or manage the graphical commands. This project uses arduino kit Microcontroller circuit and DC motors to create the movement of wheel chair and Ultrasonic Sensors to detect the hurdles in between wheelchair and the way of direction.***

KEYWORDS: ***Android Application, Wheel chair, physically Challenged, Ultra sonic Sensor, Voice Command, HC-05 Bluetooth Module, DC Motors, Arduino UNO Micro-controller.***

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1. Introduction

In this project we are using Android Application and Voice Recognisation System. But many of individuals with disabilities who need wheelchairs are satisfied with it, few members of the disabled community find it is difficult or impossible for operating a standard power wheelchair. This project is included in assistive technology. For handicapped and depended disable it is more independent, productive and enjoyable living.

[1]To perform functions a handicapped person with locomotive disabilities needs a wheelchair that require him or her to move around. He/She can do so manually by pushing the wheelchair with his/her hands. However many of us have weak upper limbs or find the manual mode of operating too tiring. Therefore it is desirable to provide them with a motorized wheelchair which is controlled by moving a voice commands. Since motorized wheelchair is important that it be able to avoid obstacles automatically in real time, it can move at a fair speed. Cost of this motorized wheelchair is affordable for many handicapped people as possible, as well as for organizations that support it. With these requirements in mind we propose an automated wheelchair with real-time Herald avoidance capability. The power wheelchair control interfaces currently still not enough to provide mobility for substantial number of person with disabilities. Through research and design wise, the wheelchair to control development along safe and effective use of the provision independence and selfuse mobility. This project will provide disability weight innovative solutions to handle the wheel chairs to use voice interface. [2]This project describes a wheelchair which can be controlled only by using the android application and user's voice also. The main aim of this project is to facilitate the movement of the disabled people and elderly people who cannot move properly so with this we can enable them to lead better lives without any problem. Speech recognition is a key technology which can provide human interaction with machines for controlling a wheelchair. This project includes two parts which is software and hardware. It is realized that for input of human voice we are using Android phone as an intermediary. In this project, Ardiuno kit (Atmega 328) is used as controller to control the movement of wheelchair based on the human voice as an input.[3] There are five basic movements of a wheelchair to be applied by the user.

The Five operations perform by the wheelchair are described as following:

1) Moving forward
2) Moving backward
3) Turning to the right
4) Turning to the left
5) Stop condition

2. Related work

Several studies have concluded that the independent mobility or movement which is included powered wheel chair, manual wheelchair and walker access the benefit to all the disabled human beings .Independent mobility increases vocational and educational opportunities, reduces dependence on other members, and promotes feelings of self-reliance and independability. [1]Independent mobility plays a vital role in building the foundation for much early learning for young people. The lack of exploration and control often results into a cycle of deprivation and lack of motivation that leads to learned helplessness. For aged people, independent movement is an important aspect of selfesteem and plays a vital role in "aging in place." Mobility difficulties led to the problem of activities of daily living (ADL) and instrumental ADL disabilities because of the need to move to accomplish many of these activities. [2]The impaired mobility often results in reduced opportunities to have socialized policies, which leads to social isolation, and many mental problems. While the needs of many individuals with disabilities can be satisfied with traditional manual or self-automated wheelchairs, a segment of the disabled community finds it difficult or impossible to use wheelchairs independently.[5] The disabled population includes people with low vision, visual field reduction, spasticity, tremors, or cognitive deficits. These individuals dependent on other people for mobility to push them in a manually handled wheelchair. To accommodate this population, several researchers have used technologies originally developed for Power wheelchairs have been designed of different ways, such as assuring collision free travel, aiding the performance of specific tasks (e.g., passing through doorways), and autonomously transporting the user between locations. [7]The Idea of using voice based technology for controlling the motion of the wheels of wheelchair is to prove that this project stands one step ahead of other average projects. [8]The use of this new technology in conjunction with a mechanical system in order to simplify everyday life would spark interest in the developing modern society. Many people with disabilities do not have the dexterity necessary to control a joystick on an electrical wheelchair.[9]

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3. Proposed system

Architecture:

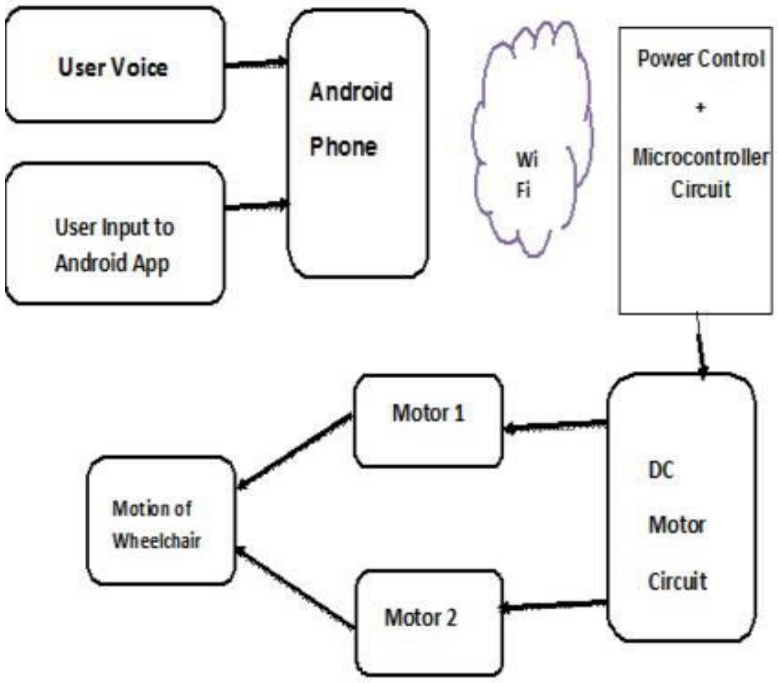

Fig 1: Block Diagram of System

Components of Wheelchair:

i) Wheelchair battery:

The battery is used in this work is wet type. To create electrical energy the chemical reaction between lead and sulphuric acid which is use wet batteries. There is need filling with distilled water to the batteries, wheelchair battery do have a higher maintenance rate, but are lighter than AGM (Absorbed Glass Mat) or Gel batteries.

ii) Wheels:

Wheelchair has two rear wheels. Universal wheel is fixated in wheelchair base in front both wheels have the same diameter. The two rear wheels are drive using two DC motor connected to each wheel. The instructions are passed through micro-controller to the motor, the wheels rotated in the specific direction.

iii) Motors:

Motors are arguably one of the most important parts of a mobile robotics platform. Overpowered motors cause waste the already limited supply of power and inefficiency from the on-board batteries. At critical times undersized motors could be short on torque. The available speed range as well as the optimal rotation speed of the motor must also be taken into consideration. Too high of an output rpm from the motor shaft will cause the robot to operate at a fast, uncontrollable speed. Too low of an output and the robot will not be able to attain a speed and the available speed range of the motor must also be considered. Too high of an output rpm from the motor shaft will cause the robot to operate at a fast, uncontrollable speed. To meet the user's needs it is low of an output and the robot will not be able to attain a suitable speed. The torque is the output of the motor plays a role in the performance because locomotion may not occur in certain situations .Therefore, the selection of the proper motor for the platform is very important. There is many shapes and sizes of motors. Figure shows the 12V DC motor use in wheelchair.

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The 12VDC motor is connected to the wheels and driver of the microcontroller Atmega328. One Driver is sufficient to control two motors simultaneously.

iv) Bluetooth Device: Bluetooth Device is main component when connection of the wheelchair and android phone is to be made. The Bluetooth device provides the security to the wheelchair as only one device is connected at a time. Frequency is of 2.4GHz.It is highly cost effective. Used for serial communication between android device and the wheelchair.

v) Motor Driver: It is an interface between the DC motor and the microcontroller Atmega328. The commands are processed further to Atmega 328 towards driver and executed by DC motor to rotate the wheels in specific direction or to stop.

vi) Ultrasonic Sensors: Sensors are used to detect the hurdle from specific distances and alert the user about it. They are highly effective and efficient.

4. Implementation

4.1 Implementation Platform:

- *Hardware Requirement*
  - Arduino UNO.
  - L293D Motor Shield.
  - Bluetooth Module HC-05.
  - Ultrasonic Sensor HC-SR-04.
  - Wheel chair chassis.
  - Battery 12 volts.
  - 2 DC Motors (12 V 200 rpm).
  - Android phone.
  - Power supply.

- *Software Requirement*
  - Arduino IDE.
  - Android Application.
  - Coding language: Arduino programming (java & C++).

4.2 Implementation Details

Currently the prototype of the project has been developed. The figure below depicts the same.

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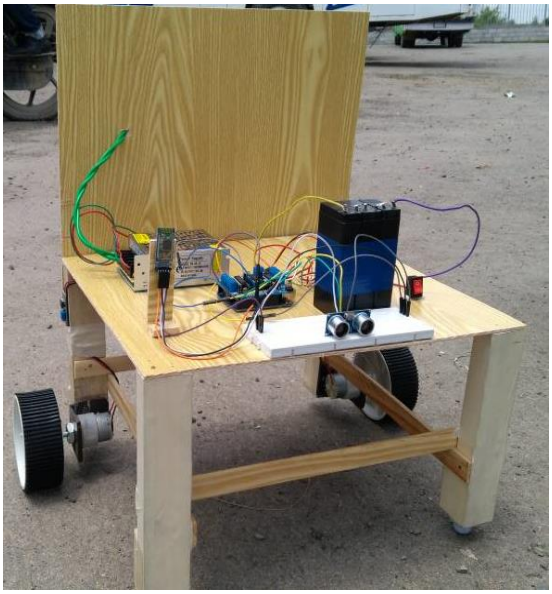

Fig 2 The prototype model of the wheelchair.

The above figure shows the prototype model of the Voice Controlled Wheel Chair.

Fig. 3 User Interface of the application to control Wheelchair.

The above figure is the screenshot of the application to recognize the voice and control the wheel chair using voice commands. User first connects the mobile with the Bluetooth module of the wheel chair. Then, the user can control the wheelchair with the help of various voice commands like Go-ahead, Go-back, Turn-right, Turn-left and Stop.

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5. Flowcharts

We have two parts in our project.

i) Wheel chair using user's voice and ii) Wheel chair using android app.

The first flowchart shows the functioning of the wheel chair using voice commands. Firstly the user voice application is connected with the wheelchair Bluetooth device. Then user is supposed to speak specific commands through the application .Then using the Google voice service the word is checked and converted to text. The text format it processed further to controller, it checks for the valid input and then gives specific instruction to the motor drivers for Its movement towards left, right, straight, backward otherwise stop.

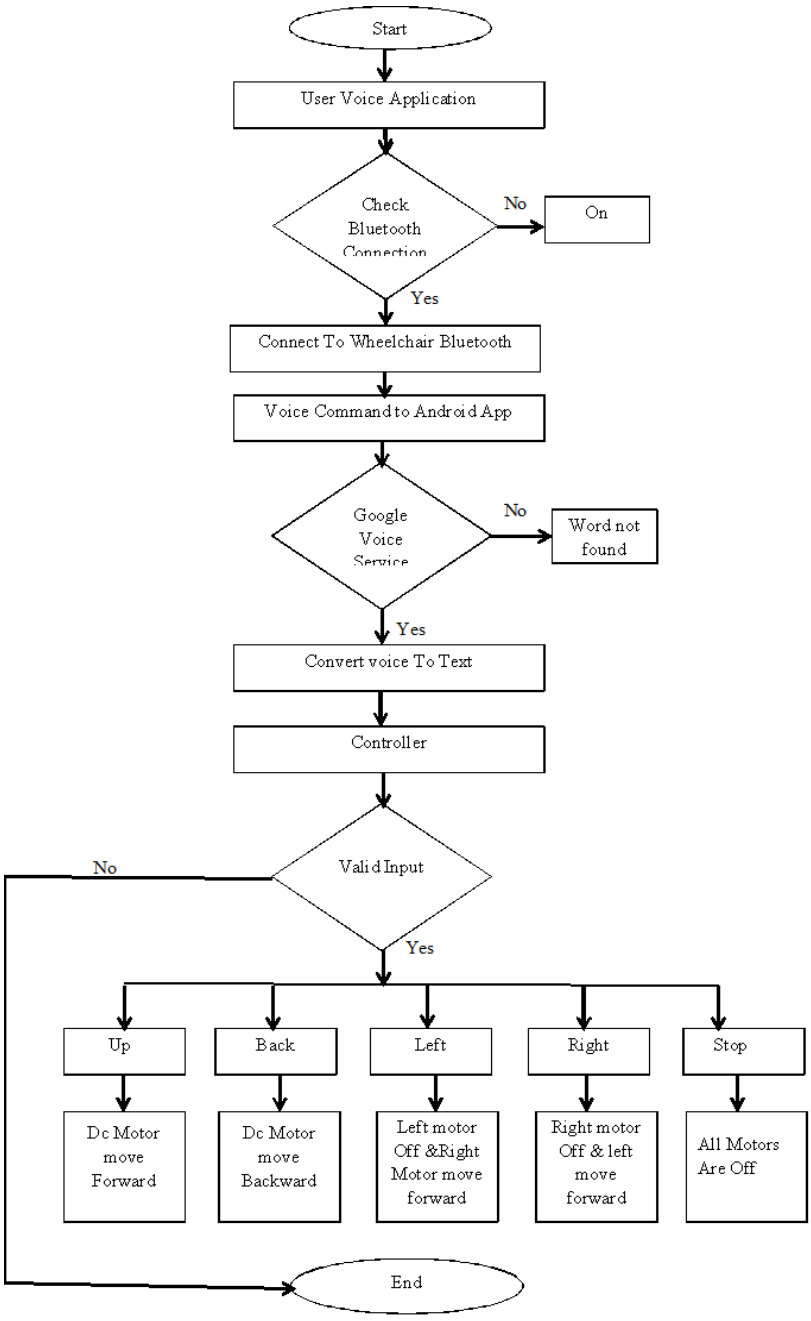

Fig 4: Flowchart for User Voice Command

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The second part of our project where the user will use android device with the GUI app for sending command by clicking on the specific button and the wheelchair will behave accordingly as per the command. The commands will produce the movement of wheelchair .The Wi-Fi or internet connection is must part in this module. Micro-controller checks for the valid input and then gives specific instruction to the motor drivers for its movement towards left, right, straight, backward otherwise stop.

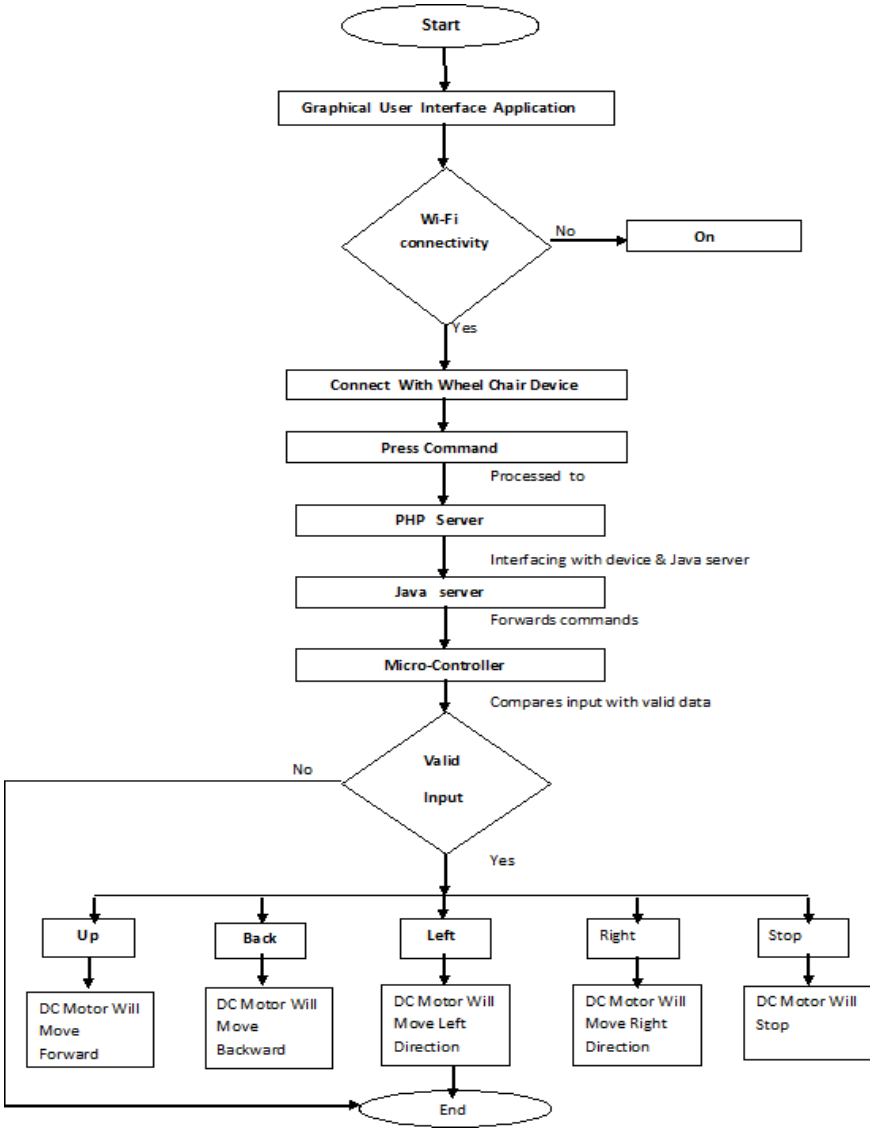

Fig 5: Flowchart for GUI Command

6. Advantages

This project describes the design and development of the motion control using voice recognition and graphical Android App for a wheelchair application.

Objectives of Project:

• To develop a voice controlled wheelchair system by using C++ and java for wheelchair control.
• To design and develop an android app through which we can operate a movement of wheel chair Using android device.

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• To implement and use the voice based system so that users voice as an input to control the mobility of wheelchair.
• Helps to implement movement for disabled people and aged people who can't move properly.
• Easy to drive with negligible efforts.
• Less Complexity and Hardware to mount.
• Can be mounted on the existing wheelchair.
• Wireless control helps to monitor the wheelchair.
• Reduces manpower and dependency on other human drive.
• Wheelchair is compact and economical.
• Provides easy movement for physically challenged people.
• Low power consuming and easy to operate the wheelchair.

7. Future Scope of project

• Voice recognition module is used to develop the voice recognition system. Voice recognition issues a Command to control the movement of wheelchair. For movement of wheelchair Microcontroller Atmega328 and DC motor circuit were built. For not to occur disorder during recognize the user voice, this system works in a quiet environment. Furthermore, the pronunciations accuracy must be ensured and the word-related (voice) the users voice must clear in short distance on microphone was essential in this innovation.
• Using gear box we can produce high speed moving wheelchair.
• PWM modulation can also increase speed.
• Solar Panel can also be used to charge the battery for power supply to the components required to drive the wheelchair.
• The wheelchair can also include the gesture feature to operate the wheelchair.
• Wheelchair only can function properly when the weight of the load for this system must be below 50 kilogram.
Obstacle avoidance sensors are used.

8. Results and discussions

The project was tested for the movement of the wheel chair using trained voice after the design and development of the self-automated wheel chair with its various interfacing units.
• On the basis of two important aspects, firstly, on the accuracy of the voice system and secondly, wheelchair velocity by means of control commands this design is experimented. This would be implemented for disabled people. Firstly the voice recognition system will be tested in a quiet room with only one single user. Every word was correctly recognized.
• For a next time we will test it with a different user on whom the system was not trained .For example words like "right" were recognized as "write" in this way about 5% errors occurred in this case.
• This was because the recognizer heard a different pronunciation. However, after the user had to speak the word a number of times the system had enough examples and properly determined what pronunciation the user speak of the word.
• After this system was tested in a noisy room by turning on some music in that room. There was no problem in correctly recognizing the words when the music was light but the recognizer found it difficult to recognize the user's voice when we turned the volume high and often took commands from what it heard in the song.

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