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DIGITAL TUNING BASED WHEELCHAIR MOVEMENTS CONTROL FOR PHYSICALLY CHALLENGED PERSON

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ABSTRACT
This paper describes the design of a smart, motorized, voice controlled wheelchair using embedded system. Proposed design supports voice activation system for physically differently abled persons incorporating manual operation. This paper represents the "Voice-controlled Wheel chair" for the physically differently abled person where the voice command controls the movements of the wheelchair. The voice command is given through a cellular device having Bluetooth and the command is transferred and converted to string by the BT Voice Control for Arduino and is transferred to the Bluetooth Module SR-04connected to the Arduino board for the control of the Wheelchair. For example, when the user says "Go" then chair will move in forward direction and when he says "Back", then the chair will move in backward direction and similarly "Left", "Right" for rotating it in left and right directions respectively and "Stop" for making it stop. This system was designed and developed to save cost, time andenergy of the patient. Ultrasonic sensor is also made a part of the design and it helps to detect obstacles lying ahead in the way of the wheelchair that can hinder the passage of the wheelchair.
Keywords—Bluetooth, Arduino, D.C. Motor, design

1. Introduction

This paper is conceived as an idea to ease the lives of those among us who are unfortunate enough to have lost the ability to move their legs due to a significant amount of paralysis, accident or due to old age. Many differently abled people usually depend on others in their daily life especially in moving from one place to another. For the wheelchair users, they need continuously someone to help them in getting the wheelchair moving. Their lives are made difficult by the fact that there is lack of an intuitive control system for their wheelchairs that allows moving independently. Using an electrical wheelchair leads to a large amount of independence for persons with a physical disability who can neither walk nor operate a mechanical wheelchair alone as it requires great effort and help of other people.

The problem is that in some cases the disability causes someone to lose the ability to use his hands, therefore in this case, the way of controlling a power wheelchair can be done using speech commands for hands-freepatients leading to an interesting and promising outcome. But, still the availability of the smart wheelchair solutions is often limited due to the high costs and not-so-friendly operation. By the proposed approach, described in this paper, the low-cost, simple and friendly solution for the voice controlled platform will be presented that is user friendly, fully-customizable according to the language spoken by the user and will help in enhancement of users independent mobility. Using a Smartphone as the "brain" of a robot is already an active research field with several open opportunities and promising possibilities. Another recent and very successful technology, Bluetooth has changed how people use digital device at home or office, and has transferred traditional wired digital devices into wireless devices. This research is based on Voice-controlled Wheelchair design based on mobile platforms, by means of Bluetooth technology, design and implementation of wireless remote control

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solutions.

The project also incorporates use of ultrasonic sensors to detect obstacles within range of 4 metres and notifies the system and stop the wheelchair till further command. In this work, Smart Wheelchair control using Arduino Uno microcontroller and Bluetooth Module via android application is presented. The rest of this paper is organized as follows: Section 2 specializes to display the related most recent works. Section 3 concerns with the Flowchart of the project and application instruction. Section 4 discusses the result. The last section is dedicated to the main conclusions.

2. Experimental Methods or Methodology

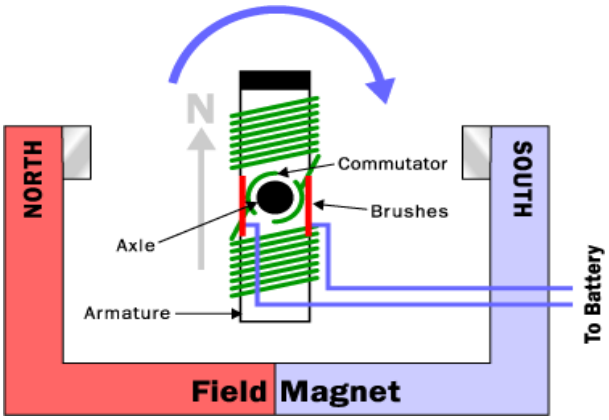

Fig 1. D.C MOTOR USED TO DRIVEN THE WHEEL CHAIR

The Android Mobile is used as an input. The Application is developed on the Android platform. The graphical user interfaces provide the user with direction options and an SOS help part. When the application (app) is opened at that time an announcement comes to turn on the mobile Bluetooth. When the user touches the virtual button at that time a sequence is passed that and then transmitted from the transmission unit to the receiving section through the mobile phones Bluetooth. Single Battery of 12V is used to drive the wheelchair. Battery is used for the purpose of mobility. DC motors are driven by driver IC.

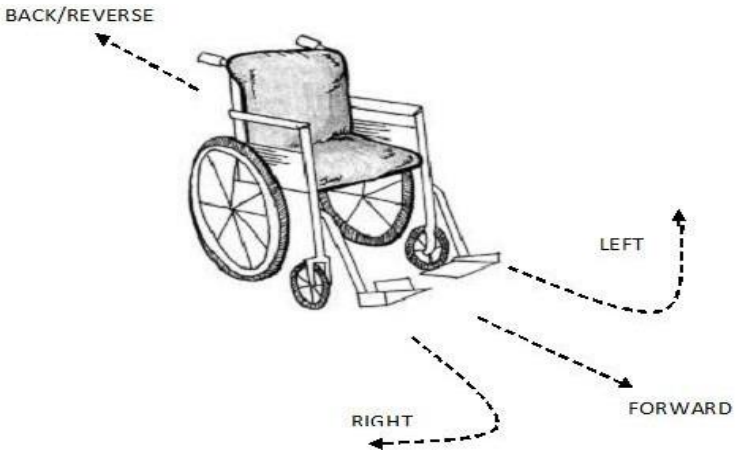

Fig 2. WHEELCHAIR MOVEMENT PATHS

3. Results and Discussion

In order to evaluate the performance of the presented speech recognition system to drive the wheelchair following test done to test the effectiveness of the Voice-recognition to drive the wheelchair. The recognition rate of each Keyword word programmed to operate when spoken by the user is calculated by the following equation:

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RR% = Number of Recognized Words *divided by* Number of Tested Words

In order to test the accuracy and effectiveness of the project, four volunteers were asked to become a part of testing of the project. Each volunteer was asked to give 10 commands and based on how many the commands are followed will give the result. The test was carried in silent and noisy environment by both male and female users. This test will determine the accuracy and effectiveness of the project.

Volunteer	Number of commands spoken	Number of times the command is followed	Accuracy
A(Male) Silent Environment	10	10	100%
B(Female) Silent Environment	10	10	100%
C(Male) Noisy Environment	10	9	90%
D(Female) Noisy Environment	10	9	90%

Table 1. TEST RESULTS BASED ON VOIC COMMAND GIVEN AND FOLLOWED

There is a maximum of 1 word wrong every 10 times repeating words leading to an error of 10% i.e. recognition rate not less than 90%. This percentage might reach 100% if the test is done in clear environment with good pronunciation of words with moderate time. This test proved that there is no big difference in RR if the speaker is male or female. The voice commands are interpreted and translated to string and provided to the Arduino that in turn produces and actuates the wheelchair accordingly as shown in Table.

Voice Command	**Condition**	**String command**	**Left/Right Motor**
GO	Moves Forward	*Go#	On/On Forward
BACK	Moves Backward	*BACK#	On/On Backward
LEFT	Moves Left	*LEFT#	Off/On Forward
RIGHT	Moves Right	*RIGHT#	On/Off Forward
STOP	Stops	*STOP#	Off/Off

Table 2. VOICE AND STRING COMMAND ACTION

Designing a simple and efficient automatic speech recognition system for isolated command words to satisfy the motion control of an electric motorized wheelchair for differently abled persons is the interest of this project. The processing units (the speech kit and the microcontroller) are directly attached to the wheelchair in one package that made the design representing a complete autonomous and smart wheelchair. The speech recognizer is tested to prove its performance to generate exact movement of the chair. It proved a recognition rate of above 90%.

CONCLUSION

This project elaborates the design and construction of Smart Electronic Wheelchair with the help of Bluetooth Module. The circuit works properly to move as the command given by the user. After designing the circuit that enables physically disabled to control their wheel using an android application in their smartphones and it has also been tested and validated. The detection of any

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obstacle is successfully controlled by the microcontroller. As the person switches on the circuit and starts moving, any obstacle which is expected to lie within a range of 4 meters will be detected by the Ultrasonic sensor. This proposed system contributes to the self-dependency of differently abled and older people.

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