## Voice Controlled Wheelchair for Improving Performance of Disabled Players

# Amaljith B Nair<sup>a</sup>, G. Nallavan<sup>b</sup>

<sup>ab</sup>Tamilnadu Physical Education and Sports University ,Chennai, 600127, India

# Abstract

This paper describes the significant design to build a voice controlled wheelchair for using in sports field. It can also be used for ordinary disabled people. This paper is intended to increase the easiness of playing and reduce the risk of injury in the play field. This design will allow disabled people to play games more freely, since they can use both hands for playing, it's because the wheelchair is controlled by voice signal. Presently Paralympics athletes are using traditional wheelchair which are movable by pushing the wheel using hands for playing. We can able to resolve the disabled problems and injuries that occur in sports field by implementing voice control interfacing, over a microphone, for the wheelchair. In this paper, the manual wheelchairs have been modified so that it can be actuated by DC motors. The motions of the wheelchairs are then controlled by the verbal instructions of the user. The speech processing can be done in real-time and is therefore deemed a viable alternative to present methods of motorized wheelchair control.

KEYWORDS: Wheelchair, Speech Recognition, Disabled.

## INTRODUCTION

The paper aim is to develop a voice controlled wheelchair for the disabled athletes who are participating in sports events. The athletes with disabilities, who are participating in the events like Paralympics, can improve their performance in the games like basketball, tennis, rugby etc. Also with the implementation of this type of wheelchairs in the sports we can add the ball games such as hockey, handball etc to Paralympics which were not included because of the difficult in the play.

While the needs of many individuals with disabilities can be satisfied with power wheelchairs, some members of the disabled community find it is difficult or impossible to operate a standard power wheelchair. This paper could be part of an assistive technology. It is for more independent, productive and enjoyable living.

## METHODOLOGY

In Voice controlled wheelchair, the manual wheelchair is modified into an electrical wheelchair which is controlled using voice command. The important part is to upgrade the manual wheelchair into an electrical wheelchair. Thus the parts like motors, pulleys, belts and a battery are needed. With the combination of these mechanical and electrical parts, the manual wheelchair now is turned to be an electrical wheelchair. There are a number of possible driving wheel configurations (front wheel drive, rear wheel drive and mid wheel drive) which affect the characteristics of the chair in different situations, with turning while driving being the most complex. Further features can be added to assist the user such as lights, actuators and wireless links. The heart and brains of the powered wheelchair is in the controller as it provides both a conduit for the power to the motors and controls the overall



system. The wheel which is connected with the motor is considered as the main wheel.

#### SYSTEM DESIGN

The main part of the design is to control the motion of the wheelchair. Four types of motions are considered, like moving forward, moving in reverse direction, moving to the left and moving to the right. For the speed, the user may use slow or fast speed. Slow speed is important as the user want to move in short distance or approaching an object. The system is designed as in figure 2.



Figure 2: Flowchart for the motion controlled wheelchair using voice

The system starts by applying the supply voltage to the speech recognition circuit. The system will be in stand by condition which the LED on circuit recognition board will be turned on. The system can be controlled in two speed conditions which are fast and slow. For fast condition the system will supply higher current to the motors. If the user does not want the wheelchair move in high speed, the slow speed can be set by applying low current supply to the motors.

The direction and speed of wheelchair depend on the user. Forward command the wheelchair move in forward direction. For the reverse direction the opposite movement of wheel rotation will occur. The left command will make right wheel moves forward and left wheel moves backward. The right command makes left wheel moves forward and right wheel rotate backward.

In this system, by assigning the word command stop the rotation of both motors will stop. The wheelchair system will go back to the stand by condition or end the whole system by turning off the power supply of the speech recognition board.

#### **RESULT AND ANALYSIS**

After the design and development parts are completed, some testing and analysis are done. This includes testing on the accuracy of the system and wheelchair velocity.



Figure a: Front and Side view of Voice Controlled Wheelchair

# a) Accuracy for Speech Recognition Circuit

Condition 1: Silent area

This experiment was conducted in a room which is in quiet condition to obtain proper result of the experiment. Experiment purpose is to find out the accuracy of the HM 2007 speech recognition circuit in different conditions. The things needed to ready are microphone, SR-07 speech recognition circuit etc.

Five trials were done to the circuit based on the commands listed at the table a.

Trail	1	2	3	4	5	Total
Command						
Forward	1	1	1	1	1	5
Reverse	1	1	1	1	1	5
Right	1	0	1	1	1	4
Left	1	1	1	0	1	4
HLT	1	1	1	1	1	5

## **Table a:** The result in silent area

From table 5.1, there are 23 over 25 commands recognized by the SR-07 speech recognition circuit. The percentage of the accuracy of SR-07 speech recognition circuit in silent condition is 86.67%. Calculation for percentage is shown as below.

Condition 2: Noisy area

The testing is done outside of the quiet room where it is considered as natural environment. From this testing, the results are as table b.

Trail	1	2	3	4	5	Total
Command						
Forward	1	1	0	1	1	4
Reverse	0	1	1	0	1	3
Right	0	1	1	0	1	3

Left	1	0	0	1	0	2
HLT	1	0	1	0	1	3

**Table b**: The result in noisy area

From table 5.2, there are 15 over 25 commands recognized by the SR-07 speech recognition circuit. The percentage of the accuracy of SR-07 speech recognition circuit in noise condition is 60.00%.

Calculation for percentage is shown as below.

Accuracy =  $15/25 \times 100\%$ = 60.00%

## b)Velocity

There is important to find out the velocity of the wheelchair system. The experiment conducted by using the ruler and time watch. Voice controlled wheelchair moved in a straight line then the distance and time was taken. There are two conditions of velocity need to take in the experiment, In load condition and in unload condition. Since I am doing only the prototype, unload condition is only taken. The velocity of the unload condition. The wheelchair will let it go in a straight line and the result was taken. The distance has been measure was six meter and time is 6.34s. So, distance over the time is 0.95m/s.

## c) Angle of Movement

The voice controlled wheelchair prototype is moving in straight line in forward direction, when forward command is giving. For backward movement it is moving in opposite straight line when we are giving reverse command. For moving in right direction, when we are giving its command it will rotates in clockwise direction towards right at an angle of nearly  $30^0$  in one second of time. Likewise when we are giving left direction towards in anticlockwise direction towards left at an angle nearly  $30^0$  in one second of time.

## CONCLUSION

As a conclusion, the objective for this paper was covered and is in the path of finishing. This is going done by implementing voice recognition processor HM2007 chip for acquiring and distinguishing the command for controlling the motion of a wheelchair. The direction of the wheelchair now can be selected using the specified commands. Thus the only thing needed to ride the wheelchair is to have voice. Besides that, the development of this paper is done with less cost and affordable. However we are making only a prototype, some improvements should be done to make it more reliable. This is outlined in the recommendation part. By improving this system, we can make wheelchair games more easy and injury free. And also we can include more wheelchair games in Paralympics. This can also enhance the life style of the disable people in the community. Lastly, we hope that this kind of system could contribute to the evolution of the wheelchair technology.

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