Fabrication of Voice Operated Wheelchair Using Android Phone

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Abstract: The paper focuses on wheelchair controlled using voice commands. A voice controlled wheelchair makes it easy for physically disabled person who cannot control their movements of hands. The system is designed to control a wheel chair using the voice of person. The powered wheel chair depends on motors for locomotion and voice recognition for command. The circuit comprises of Arduino, HC-05 voice recognition module and motors. The wheel chair can be controlled using voice commands. User just needs to say the commands and the wheel chair moves in the desired direction. In hardware development, HC-05 Bluetooth module is used and speech to text voice recognition android application which correlates speech to signals and give the result to Arduino which is connected to Bluetooth further programmed with respective locomotion commands.

Index Terms: **Wheel chair, Android**

I.INTRODUCTION

A wheelchair is an important vehicle for the persons physically handicapped. However, for the injuries who suffer from spasms and paralysis of extremities, the joystick is a useless device as a manipulating tool. They neither can operate the joystick smoothly at all. So, the voice command system may be the good information transmission means of high efficiency and low load for such users.

Robotic wheelchairs have enhanced the manual wheelchairs by introducing locomotion controls. These devices can ease the lives of many disabled people, particularly those with severe impairments by increasing their range of mobility. This robotic enhancement will provide benefit people who cannot use hands and legs. In this project we have developed a voice controlled wheelchair which aim to counter the above problems. The wheel chair can be controlled using voice commands. User just needs to say the commands and the wheelchair moves in the desired direction. In hardware development, we are using HC-05 Bluetooth module and speech to text voice recognition android application which correlates speech to signals and give the result to Arduino which is connected to Bluetooth further programmed with respective locomotion commands.

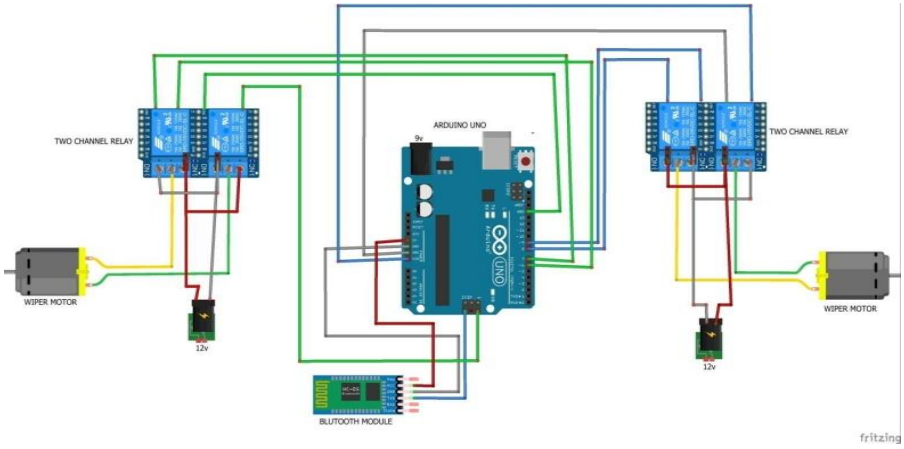
Thus the requirement of the handicapped person is solved through this project. That is, why we have chosen the voice operated wheelchair for handicapped as our project. The project which we have selected is to reduce the human needs for the physical disabled person. For the person sitting on the chair should have to move position by giving voice commands.

II.OBJECTIVES

- To equip the present motorized wheelchair control system with a voice command system. By having this features, disabled people especially with a severe disabilities that is unable to move their hand or other parts of a body are able to move their wheelchair around independently.
- To simplify the operations of the motorized wheelchair as to make it easier and simpler for the disabled person to operate. With this simplified operation, many disabled people have a chance to use the system with little training on how to use it.
- Provide the freedom to travel independently.

III.EXPERIMENTAL EQUIPMENT AND INSTRUMENTATION

Fig 1.Circuit diagram



HARDWARE USED:

Wheelchair	: Foldable type
Power Supply	: 12VDC
Microcontroller	: Atmega328p
DC motors	: 12VDC
Channel relay	: 5V
Bluetooth module	:HC-05

SOFTWAREUSED:

Arduino IDE
Android
Application
Coding language: Arduino programming (java & C++)

IV.EXPERIMENTAL METHODS

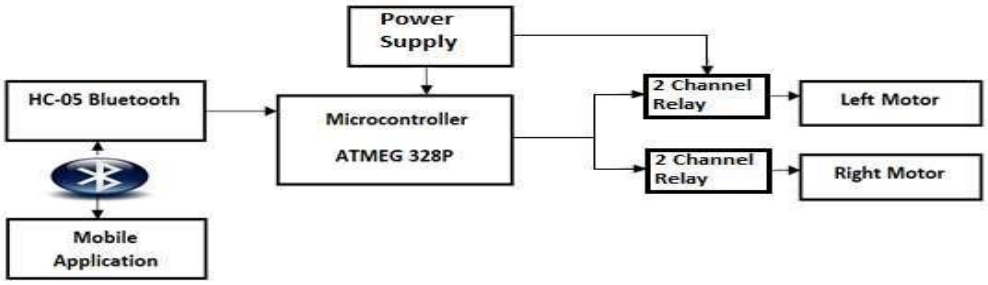


Figure 2. Block Diagram

This system works on voice commands given by the wheelchair user. The system is fully independent as the users do not need any other person to help him to move the wheelchair. There are basically five commands, which command is given by the user, accordingly the wheelchair will move. The voice commands of the user are recognized in the first step. Once it is recognized, the commands are converted into its equivalent instructions which drive the system. This system consists of two major modules namely Voice recognition module and motor driving module. The voice recognition is done through voice recognition module. The output of this module is directed to Arduino which uses a motor driver IC to drive the motors.

The system would recognize the commands given to it and hence would work or rather respond according to the given command. Below is the flowchart of the acceptance of the commands given to the system. Once the command is given through the microphone it hardly takes time for the system to respond accordingly.

Figure 3. Model of voice operated wheelchair

PROPOSED SYSTEM 2DVIEW

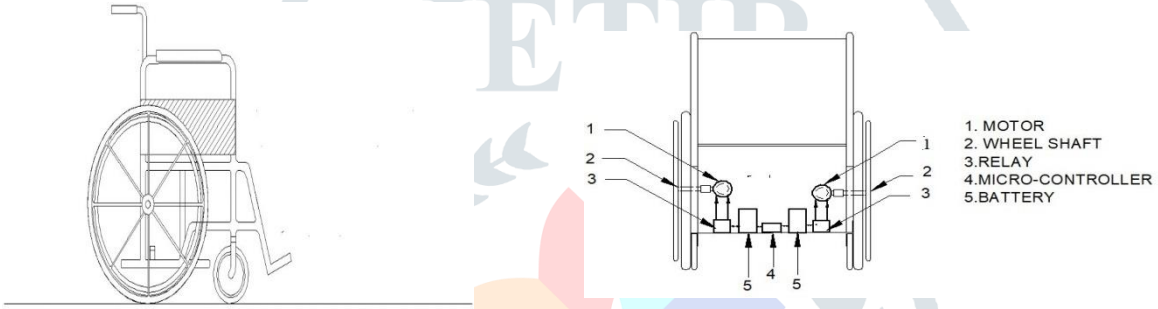


Figure 4. Side View & Back View

V. CODING

This program is for arduino to control the relays.

```
#include<SoftwareSerial.h
> intrelay1=9;
Int
relay2=8;   int
relay3=7;           int
relay4=6;
void setup()
{
Serial.begin(9600); pinMode(relay1,OUTPUT); pinMode(relay2,OUTPUT); pinMode(relay3,OUTPUT); pinMode(relay4,OUTPUT);
}
void loop()

while(Serial.available()>0)
{
charinbyte=Serial.read();
Serial.print(inbyte); if(inbyte=="f")
digitalWrite(relay1,HIGH);

digitalWrite(relay4,HIGH);

delay(5000);

}

else if(inbyte=="b")

{
digitalWrite(relay2,HIGH); digitalWrite(relay3,HIGH); delay(5000);
}
else if(inbyte=="l")
```

```
{
digitalWrite(relay1,HIGH); digitalWrite(relay3,HIGH); delay(5000);
}
else if(inbyte=="r")

{
digitalWrite(relay4,HIGH); digitalWrite(relay2,HIGH); delay(5000);

}

else if(inbyte=="s")

{
digitalWrite(relay1,LOW);

digitalWrite(relay2,LOW);
digitalWrite(relay3,LOW);

digitalWrite(relay4,LOW);

delay(5000);
}
//delay(5000);
}

}
```

VI.EXPRERIMENTAL RESULTS

To find the velocity of wheelchair:
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.

1) Velocity of the unload condition.

The wheelchair will let it go in a straight line and the result was taken: Weight of the wheelchair in unload condition=25kg
Distance was taken = 2m

Trial	Time(s)
1	5
2	4.8
3	4.5
Average	4.76

Table 1. unloaded test results

$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}} = \frac{2}{4.76} = 0.420 m/s$$

The wheelchair was made to move in a straight line and the velocity is found 1.53m/s.

2) Velocity of the load condition.

The wheelchair will let it go in a straight line and the result was taken: Weight of the wheelchair in unloaded condition = 25kg
Distance was taken = 2m

Weight of the person who sat on the wheelchair

Weight In Kg	Time(s)
60	9.2

65	9.7

Table 2. loaded test result

The wheelchair was made to move in a straight line and the velocity is found 0.2m/s with load of 60kg.
Based on the result above, the velocity of voice controlled wheelchair is affected by the load. That's mean the velocity of wheelchair system will decrease proportional to the load that is carry by the system.

RECOGNITIONACCURACY

Subject was male, aged 22.The pattern of its orders was used for training the neural nets in the first environment described later. The training was made on the basis of the next number of patterns:

- forward– 65samples,
- back – 59samples,
- left – 62samples,
- right – 68 samples in
- Stop – 69samples.

Test was executed in two different environments:

- The first one was with a little background sound. We could hear the cars on the road but really suppressed.
- These cond was with a louder sound mainly caused by a speaker, which was at full blast so that a normal conversation was not possible. The sound mainly consisted out of music with some interference of the speaker.

- Neural networks were trained to the samples gathered from speaker in first environment. The test was done in 6 different ways:

- repeating the word `f'
- repeating the word `b'
- repeating the word `r'
- repeating the word `l' and
- repeating the word`s'

The results of the words pronunciation spoken by subject in the first environment can be seen in the table

Word	Number of samples	Error count	Recognition Quality
`f'	31	2	94%
`b'	28	1	96%
`r'	33	2	91%
`l'	29	1	97%
`s'	35	1	97%

Table 3. Command check trial-1

The results of the words pronunciation spoken by subject in the second environment can be seen in the table

Word	Number of samples	Error count	Recognition Quality
`f'	34	5	93%
`b'	31	4	92%

`r'	35	6	94%
`l'	33	5	93%
`s'	34	4	91%

Table 4 command check trial-2

We can say that the recognition of isolated words in the speech with neural nets is successful. Besides that, the neural nets were learnt with the words of subject in the first environment and there was average of 95% recognition. Certainly, it is possible to improve the system to the extent where the recognition of the primary user in an unpredictable situation would be 100% for every case. There also is a possibility to improve the system, so that the recognition of spoken command enables with a special one or the in sequence. The suggested improvement is based on repeating the word "stop" three times to enable or disable the system depending in which state it would be.

RUNNING EXPERIMENT INFLOORS

To evaluate the total performance of proposed system, we set new course as shown in figure. In this course begins from the START, and the go alis END at room 2.Thus, the user needs to give commands. The total length of the room is about20m.

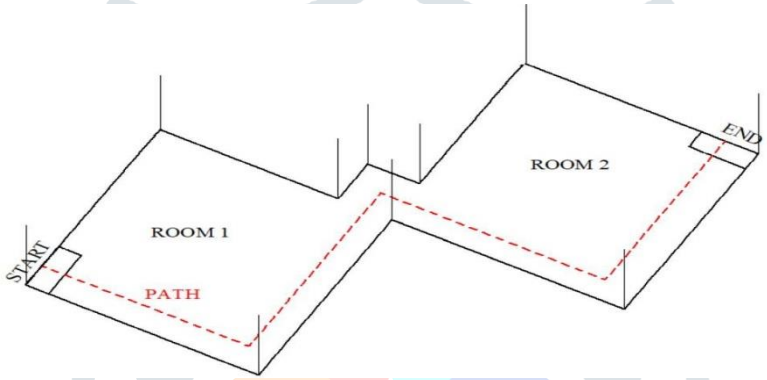


Figure 5.1 Room model

The user runs at condition where the background sound is low. Through the path wheelchair is controlled to move as shown in figure. Experimental results are shown in Table. This table explains the number of instruction, the voice recognition rate and the running time each user. The user can run this course safety.

User	Instruction (times)	Recognition rate (%)	Running time(s)
A	16	86%	1.9m
B	14	100%	1.5 m
C	17	79%	2m
Average	16	88%	1.8m

Table 5.5 Test results

VII.CONCLUSION

This proposed system contributes to the self-dependency of physically challenged and older people. It reduces the manual effort for acquiring and distinguishing the command for controlling the motion of a wheelchair. The speed and direction of the wheelchair now can be selected using the specified commands. Thus the only thing needed to ride the wheelchair is to have a trained voice. Besides that, the development of this project is done with less cost and affordable. However this system requires some improvements to make it more reliable. This design could be improved by implementing wireless communication, using sensors to detect obstacle in the wheelchair. The wheelchair was made to move in a straight line and the velocity is found 0.2m/s with load of 60kg.The velocity of voice controlled wheelchair is affected by the load. We hope that this kind of system could contribute to the evolution of the wheelchair technology.

REFERENCES

[1] "Design and Fabrication of a Voice Controlled Wheelchair for Physically Disabled People" by Azam, G., and M. T. Islam, International Conference on Physics Sustainable Development &Technology(ICPSDT-2015),pp80-90

[2] "Head gesture recognition for hands free control of an intelligent wheelchair." Pei JiaHuosheng H. Hu2013

[3] "Eye Controlled Wheelchair" Pragati Pal, Asgar Ali, Deepika Bane, Pratik Jadhav International Journal of Current Trends in Engineering & Research (IJCTER) e-ISSN 2455– 1392 Volume 2 Issue 4, April 2016 pp. 12 - 19 Scientific Journal Impact Factor :3.468

[4] "Assisted Control Mode for a Smart Wheelchair" G. Bourhis, M.Sahnoun

5] "Wheelchair Control Using an EOG-and EMG-Based Gesture Interface" Masafumi Hashimoto, Kazuhiko Takahashi and Masanari Shimada IEEE/ASME International Conference on Advanced Intelligent Mechatronics Suntec Convention and Exhibition Center Singapore, July 14-17, 2009

[6] "Elevator Available Voice Activated Wheelchair" Akira Murai, Masaharu Mizuguchi, Takeshi Saitoh, Member, IEEE, Tomoyuki Osaki. The 18th IEEE International Symposium onRobotandHumanInteractiveCommunicationToyama,Japan,Sept.27-Oct.2,2009

[7] "IntelligentWheelchairControlSystemBasedOnHandGestureRecognition"YiZhang, Jiao Zhang, yuan luo,2011 IEEEIICME International Conference on Complex Medical Engineering May 22 -25, Harbin,China

[8] "Voice Operated Intelligent Wheelchair – VOIC", IEEE ISIE 2005, June 20-23, 2005