INTERNATIONAL JOURNAL OF ADVANCE RESEARCH AND DEVELOPMENT

***(Volume3, Issue3)***

Available online at: www.ijarnd.com

# Effortless Haptic Wheelchair with Double Compliance

**Amrendra Kumar[1], Deepak Singh[1], Dushyant Sharma[1], Sharad Mishra[1]**

*[1]Student, IMS Engineering College, Ghaziabad, Uttar Pradesh*

## ABSTRACT

***This paper presents a smart wheel chair with the double compliance for the convenience of the differently abled persons. The movement of the proposed smart wheelchair is controlled by voice commands as well as a joystick. Joystick specifies the direction and accordingly, Arduino will navigate the motors. The voice command is recognized using Bluetooth module, connected to Arduino. The wheelchair would operate on a real analogous voice signal of patient or user who adopts the wheelchair.***

**Keywords:** *Disable1, Wheelchair2, Microcontroller (Arduino)3, Microchip4 and Bluetooth module5.*

## 1. INTRODUCTION

About 15% of the total population in the world is differently abled [1], so in order to make their life easy a lot of work have been done in this field. The disability prevalence is high and growing, due to aging populations and the increase in chronic conditions. Other factors like road traffic crashes, violence and disasters contribute to the growing numbers in certain contexts [2]. The wheelchair is one of the sources for the movement of especially abled persons. Earlier wheelchair was controlled manually by the person itself but for those who were fully disabled by legs and hands, they need an assistant i.e. they were dependent on some other person. Nowadays technology has advanced to a new level, the wheelchair can be controlled by the user itself in both of these cases of disability. . Smartphones, which act as a brain of the microcontroller, is already an active research field with several open opportunities and outcome promises [3]. But a recent clinical survey indicated that 9%-10% of patients who received power wheel-chair training, found it extremely difficult or futile to use it for their activities of daily living, and 40% of patients found the steering and maneuvering tasks difficult or impossible [4].

A brief review of a literature survey on wheel chair is presented here as several prototypes of a smart wheelchair has been already developed. In ref. [5], a system was proposed that uses a small camera, mounted on the wheelchair, which captures the hand gesture of the user. The hand gestures are processed using image processing algorithm and navigate the wheelchair to the desired directions. Ref. [6] describes a wheelchair which is controlled by the movement of eyes. The movement of the eye is captured by an infrared camera, mounted on the user glass and with this movement user controls the movement of the wheelchair. In 2014, a system was proposed which was controlled by hand and finger gestures with the help of Micro-Electro-Mechanical System (MEMS) accelerometer [7]. This sensor finds the tilt and makes use of the accelerometer to change the direction of the wheel chair depending on tilt. A wheelchair having both active castor wheels as well as passive wheels is driven by smart driving assistance, by which wheelchair detour the obstacles and also controls the speed and steering, so that the wheelchair can move freely without any collision with an obstacle is explained in [8]. Wheelchair system implemented with the voice recognition module is presented in [3, 9-11]. The user gives the command through a microphone and this command is recognized by voice recognition module and sends in digital form to Arduino Uno that controls the motors. Some of the wheelchair were controlled through voice but by bluetooth module as preferred in [11-13].

All of the proposed wheelchairs have some disadvantage i.e. some of the wheelchair were only used by joystick module, so for the users who are disabled by hand finds no use of these wheelchairs and some are only controlled with the help of only voice, these wheelchair does not fulfill the needs of those who cannot speak. Similarly, wheelchair with other mechanism was costly. The objective of this research paper is to facilitate the present smart wheelchair with voice commands and through joystick at a very low price with friendly operations.

## 2. PROPOSED WHEELCHAIR

In order to diminish the problem of specially-abled users, a haptic wheelchair using double compliances is presented in the paper. The proposed Wheelchair is controlled either by joystick or by voice through Bluetooth module which uses the command given by the users or specially abled persons and accordingly directs the motors with the help of a microcontroller. The system consists of

two parts i.e. hardware and software. Hardware consist of an Arduino Uno board, joystick, phone, motor driver and two brushed dc motors. The basic algorithm of the movement of the wheelchair is represented through the flowchart shown in Fig1. In the first block, input & output pins are initialized, input pins are connected to the voice module (HC 05) and joystick, Further output pins are connected to the Motors. The motors will rotate according to the instructions provided in the directions shown in flow chart. Significant loops are used for the continuous movement of the wheelchair.

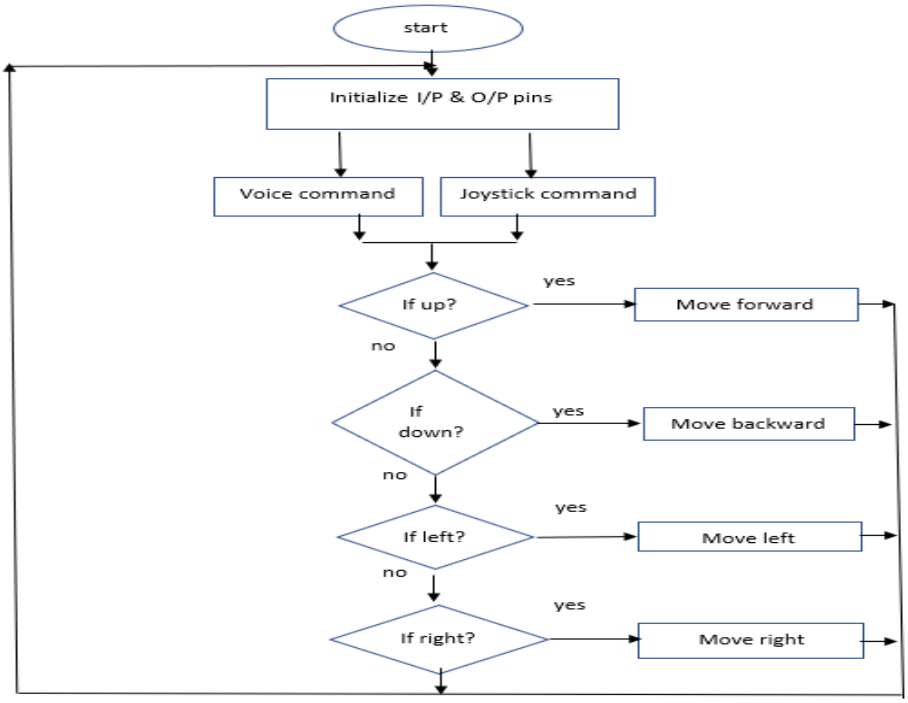



**Fig-1: Flowchart of Wheelchair Operations**

The block diagram of proposed wheel chair is presented in Fig.2. From the block diagram, it can be seen that commands are initiated using phone or joystick. Phone transmits data in digital form and the joystick transmit data in analog form. These data are received by Arduino Uno microcontroller and the microcontroller passes commands to motor driver circuit as per program burnt in the microcontroller. The motor driver circuit, shown in Fig.3, is an H-bridge MOSFET circuitry which is used to balance the signal and current transfer to both the motors equally. Another important function of the motor driver is that it resists the back electromotive forces (emf) which can damage the microcontroller IC. Therefore, when microcontroller transfer data to the motor driver, it passes the signal to the motor without any resistance but in a balanced mode.

The operation of the wheel chair is explained through an example of forward command. When the forward command is initialized using Bluetooth module (HC-05), it transfers signal in digital form to the Arduino where Arduino perform some calculation as per program and transfer another equivalent signal to the motor drivers of both the motors and accordingly motors rotate in clock wise direction so that wheel chair will move in a forward direction. The movement of wheel chair in backword, left and right direction can be performed in a similar manner.The detailed explanation of joystick and voice module is presented in the following section.

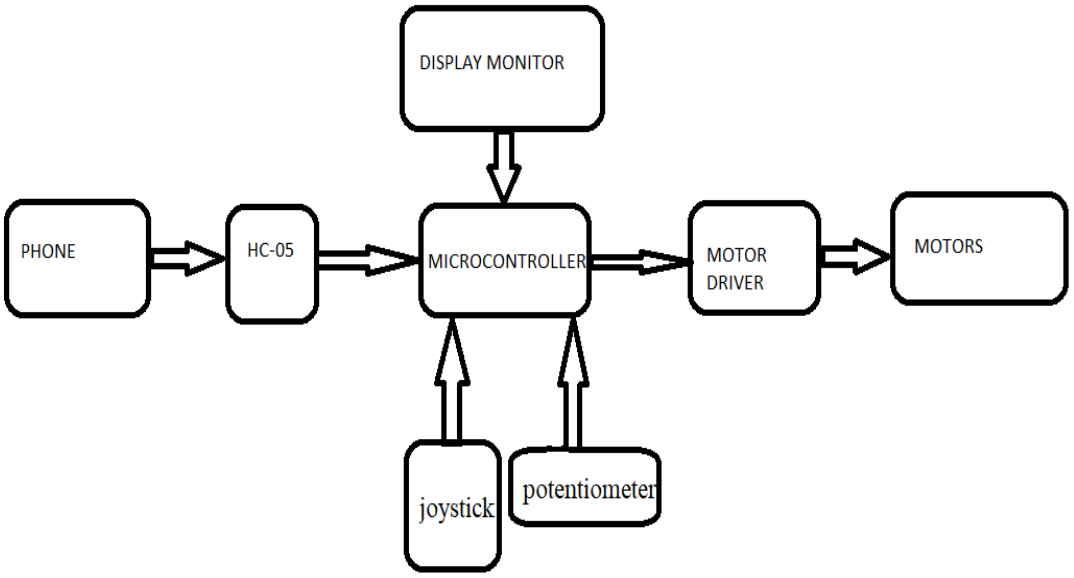



**Fig-2: Block Diagram Representation of Smart Wheel Chair**

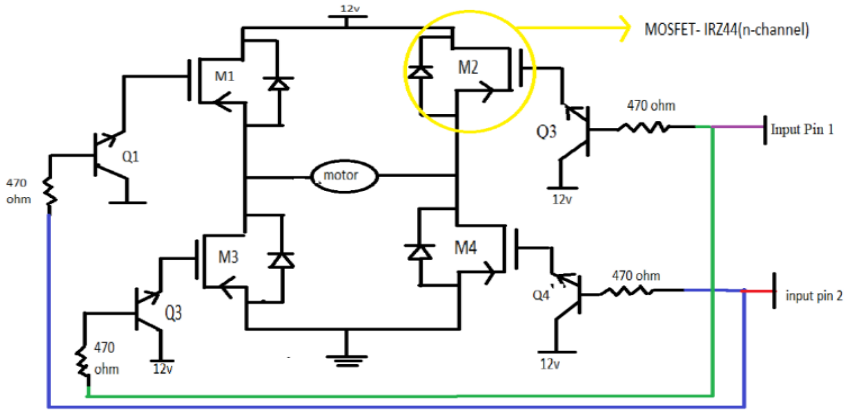



**Fig-3: Motor Driver Circuitry based on H-Bridge Circuit**

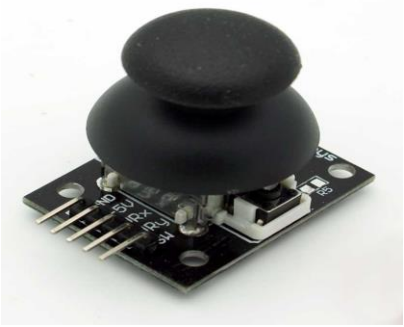
### 2.1 Joystick Module

The joystick shown in Fig. 4 basically consists of two potentiometers that allow us to measure the movement of the stick in 2-D. Potentiometers are variable resistors and act as sensors Potentiometers provide a variable voltage whose value depends on the rotation of the device around its shaft.

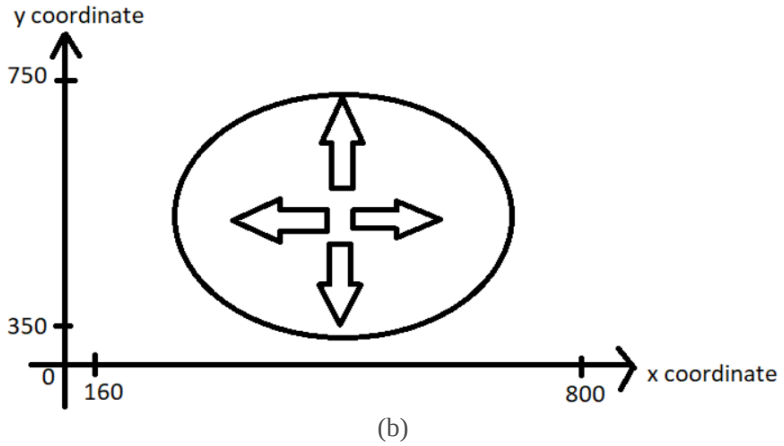
The joystick provides analog values to Arduino when the joystick is rotated as per user's requirement. The microcontroller calculates the commands using pixels values of the joystick and passed the command to the motor which accordingly rotates the wheelchair. The motor rotation according to the command input through joystick is demonstrated in Table 1.

**Table-1: Demonstration of motor rotation through the joystick**

| X (Pixel) | Y (Pixel) | The motion of the motors |
|---|---|---|
| >800 | 550<y<490 | Forward |
| <250 | 380<y<435 | Backward |
| 490<x<520 | <350 | Left |
| 160<x<530 | >750 | Right |



**(a)**




(b)

**Fig-4: (a) Commercial Joystick Module and its (b) Coordinates Graph**

### 2.2 Voice Module (HC-05)

The controlling of the wheelchair through voice is done using Bluetooth module (HC-05). Voice command through HC05 is carried out by connecting smartphone with HC-05 using Bluetooth connectivity technique. In voice command technique, the mobile phone is working as a transmitting device which transmits digital signal and Bluetooth module works as a receiving device. An android application to communicate with Bluetooth module is installed in the mobile phone. When the user provides a voice command using android application, Bluetooth module passes digital values to Arduino to computes some action as per programming. The computed action in ardunio passes to motor driver circuitry to rotate the motor according to command. The motor rotation through voice command is shown in table 2.

**Table-2: Motor Rotation using Voice Command**

| Voice Command | Motor Rotations | |
|---|---|---|
| | Motor M1 | Motor M2 |
| FORWARD | ON (*CW) | ON(*CW) |
| BACKWARD | ON(*ACW) | ON(*ACW) |
| LEFT | OFF | ON |
| RIGHT | ON | OFF |

*CW = Clockwise, **ACW = Anticlockwise

## 3. CONCLUSION

In this paper, a smart wheelchair using double compliances is presented. The movement of the wheelchair can be controlled either by joystick or by voice. Thus the proposed wheelchair is useful for both type of disabled person who cannot speak or who are disabled by hands. The presented smart wheelchair is economic and user-friendly.

## 4. REFERENCES

[1] https://www.cbsnews.com/news/15-worldwide-have-physical-or-mental-disability/.
[2] https://en.wikipedia.org/wiki/World_report_on_disability.
[3] Ajinath Daund, Gopal Merkar, Manoj Deshmukh , Parchi Janbandhu,Mr.R.S.Badodekar, SMART HOME AUTOMATION USING ANDROID APPLICATION AND ARDUINO MICROCONTROLLER, IJARIIE-ISSN(O)-2395-4396.
[4] S. D. Suryawanshi, J. S. Chitode, S. S. Pethakar, Voice Operated Intelligent Wheelchair, International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 5, May 2013, ISSN: 2277 128X, Page 1.
[5] ChaitrashreeV, Vivechana M. S, Anindita Das, Shewtha N. S, Shilpashree P. S, INTERNATIONAL JOURNAL OF CURRENT ENGINEERING AND SCIENTIFIC RESEARCH (IJCESR), VOLUME-4, ISSUE-7,2017.
[6] Kohei Arai, Ronny Mardiyanto, Eyes Based Eletric Wheel Chair Control System, (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 2, No. 12, 2011
[7] Prof. Vishal V. Pande, Nikita S.Ubale, Darshana P. Masurkar, Nikita R. Ingole, Pragati P. Mane, Hand Gesture Based Wheelchair Movement Control for Disabled Person Using MEMS, Int. Journal of Engineering Research and Applications www.ijera.comISSN : 2248-9622, Vol. 4, Issue 4( Version 4), April 2014, pp.152-158.
[8] Thomas R¨ofer , Christian Mandel, and Tim Laue, Controlling an Automated Wheelchair via Joystick/Head-JoystickSupported by Smart Driving Assistance, 2009 IEEE 11th International Conference on Rehabilitation Robotics Kyoto International Conference Center, Japan, June 23-26, 2009.
[9] Drasti Kanakia, Aditi Shah, Rushabh Shah, Ami Jariwala, Electronic Voice Controlled Wheelchair, International Journal of Scientific & Engineering Research, Volume 5, Issue 10, October-2014 171 ISSN 2229-5518
[10] Prof. Manoj V. Bramhe , Navya Vijay , K. Bhagyashree Rao , Payal Bisen , Riddhi Navsalkar ,Tanushri Bajganiya , VoicControlled Wheelchair for PhysicallyDisabled Person,International Journal of Advanced Research in Electrical,Electronics and Instrumentation Engineering(An ISO 3297: 2007 Certified Organization)Vol. 6, Issue 2, February 2017.
[11] R. Puviarasi, Mritha Ramalingam, Elanchezhian Chinnavan, Low Cost Self-assistive Voice Controlled Technology for Disabled People, International Journal of Modern Engineering Research (IJMER) Vol. 3, Issue. 4, Jul.-Aug. 2013 pp-2133-2138.
[12] Deepak Kumar Lodhi, Prakshi Vats, Addala Varun, Prashant Solanki1,Ritakshi Gupta, Manoj Kumar Pandey, Rajat Butola, Smart Electronic Wheelchair UsingArduino and Bluetooth Module, IJCSMC, Vol. 5, Issue. 5, May 2016, pg.433 – 438.
[13] Ekshinge Aarti, Ghadage Pooja, Pawar Supriya,Prof. S.B.Deokar, Android Phone Controlled VoiceSmart Wheelchair, International Engineering Research Journal (IERJ), Volume 2 Issue 8 Page 3049-3051.