International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 03 | Mar-2018 www.irjet.net p-ISSN: 2395-0072

"DESIGN AND CONSTRUCTION OF ELECTRIC DRIVE" -A smart system for disabled person with therapy facilities

Sania Sheikh[1], Alfiya Sheikh[2], Abhishek Waghmare [3], Ankit Yadav[4], Shubham Bhoyar[5] , Chetana dolase[6]

[1,2,3,4,5,6]*B.E Student Department of Electrical Engineering, RTMNU, Nagpur, Maharashtra, India*

Abstract - *Each and every person in this world has a expectations to live a normal human life but road accidents, syndrome, antiquity, make their expectations into disability Physical handicapped people are permanent part of our society. Many of them are using manual wheelchairs. Now-a-days, because of severity and merits , electric wheelchairs are increasingly demanded. The control system depends upon different parameters such as type of disability, cost, habitat in which it is used. There are many of control systems implemented in electric wheelchair such as obstacle detection unit, voice operated, therapy unit etc. Every control system is suitable for different user. The person with relentless disabilities required two or more control system that should be implemented in a wheelchair. This paper focuses mainly on different control system used in electric wheelchair. The aim of project is to compact many facilities in a single wheelchair at low cost.*

Key Words: **Electric Wheelchair, Control Systems, voice recognize, arm exercise**

1. INTRODUCTION

In India, according to census-India 2011, the total population of disabled people is 26814994 and there are 5436826 people disabled in movement. This has caused high demand on some form of transport mechanism and thus wheelchairs continue to play a significant role. And facilitate their incorporation into the running world. Wheel chair enables disabled people perform many activities of daily living thus improving their quality of life. Disabled people are increasingly able to lead an individualistic life and play a more vital role in society. A chair is one of the most important equipments for an independent life especially, elderly people in this coming ageing society. Most of the physical challanged people use manually operated wheel chairs. But More efforts are required to operate this type of chairs. Power assist wheelchairs have become more essential for todays world. The device is either manually operated or automatically operated by motors. There are often handles behind the seat to allow it to be pushed by another person. This paper focuses on various methods of controlling the motion, direction, detecting an obstacle etc. There are various methods of controlling such as joystick-operated and voice-operated and combination of the above two methods. A handicapped person with locomotive disabilities needs a wheelchair to perform functions that require him or her to move around. He can do so manually by pushing the wheelchair with his hands. There are different types of wheelchairs available now days like manual wheelchair, electric wheelchair, automatic wheelchair etc.As an initiative approach, a motor obsessed electronic structure was proposed to renovate the manual one. A few designs for an electric wheelchair based on manual one was first published by an American Inventor, named as George Westinghouse in 1914 . However, a group of engineers leaded by George Klein are considered as the inventor of first electric powered wheelchair. Then in1956, a company named as Everest & Jennings started the commercial production of electric wheelchair .From the invention of power wheelchair, many researchers proposed different methods to control the wheelchair. One of the most popular of them is the use of joystick or toggle switches. Another common alternative is voice control method, where a particular spoken word was recognized by a application called 'AMR VOICE' speech which generates a specific corresponding signal on a microcontroller board. In addition, a compact form of marketable electronic power-driven wheelchair which is organized by a speech recognition method established on grammar and laptop along six Peripheral Interface Controller (PIC) was suggested by Akira Murai.0020 But the system was not user friendly in together the case of easiness and cost. Another, voice activated wheelchair based on PC workstation established on .NET framework was planned .But the recognition system was highly effected by background noises i.e. it was unable to detect which one is ordinary conversion or command if the command is common one. Besides these, Qadri and Ahmed developed a voice controlled system by using a DSP starter kit.

2. PROPOSED METHODOLOGY

The main objective of this project is to design a micro controller-based (ATmega328/P) wheelchair, the speed and direction of wheelchair can be controlled from a controller board that contains controlling of motor driver and controlling of joystick. The wheelchair moves by means of a Geared Dc motor.

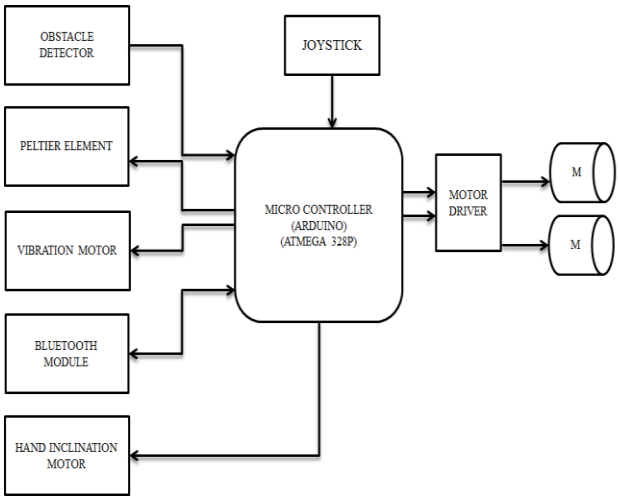

Fig 1 : Block diagram of Proposed Methodology

The enforce work is quite exceptional in the sense that it provides a combination of controlling part and therapy part. Therapy parts give some therapy facilities to the disabled person to overcome their debility.Again, the other part includes two types of controlling method which are joystick and voice control method.The joysticks are Arduino interfaced and can be easily organized by fingers movement. Voice command system is done by the use of Bluetooth module which eliminates the necessity of personal computer.Therefore it is cost effective. Here using of Arduino environment, reduce the circuit complexities. Moreover, obstacle detection provides additional safety in case of any sudden hurdle. Arduino shield and therapy facilities provided a new revolution on wheelchair history and improvised the previous work. Moreover, to help a paralyzed person to move freely was not only our main concern but also help him to recover his strain as well as he can easily go back to his normal life, which we considered as the special feature of this effort.

The whole system is divided into two portions. First one is controlling portion whereas the other is therapy portion

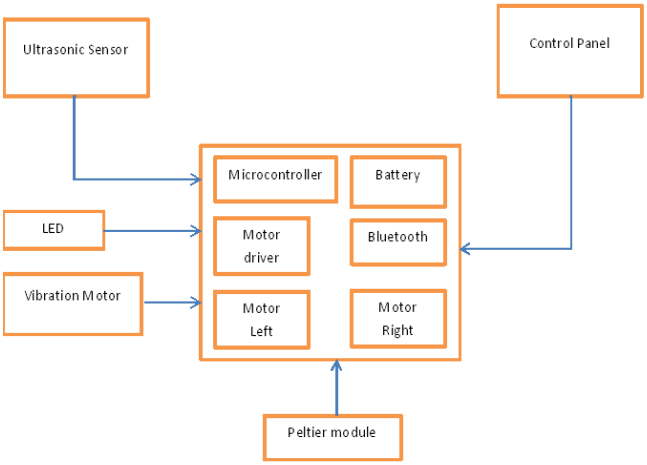

Fig 2: System Overview

A] Controlling Portion

A block diagram representing all the elements used in the wheelchair is shown in Fig. 01. joystick shield which sits on top of Arduino board was use for forward, backward, left and right motion. There are additional 6 toggle buttons. These buttons can be used for switching other components. Bestowing to potentiometer movement of joystick, an analog data is acknowledged through Arduino shield and the motors are driven rendering to the digital outputs provided by it for the four directionl movements of wheelchair (forward, backward, left, right). Person having permanent disabilities in upper limbs also partaking the option to use the chair via using voice command unit. An android app (AMR VOICE) and a Bluetooth module (HC-05) are the fragments of this module. HC-05 module is nothing but a Bluetooth SPP (Serial Port Protocol) component, which is premeditated for transparent wireless serial connection setup. The voice command (sound wave) from the user is collected through the microphone of the android phone and formerly this command is harmonized with some predefined command with the help of an android application. If both commands are the lookalikes then android application generates an equivalent character which indicates the users command. Figure 2 shows HC-05 bluetooth module.

Fig 3: HC-05 bluetooth module

Besides these, the output signal from the obstacle detection unit is always observed by the Arduino shield. In addition, a ultrasonic sensor is used to perceive obstacle. Ultrasonic ranging module used is HC-SR04 which provides 2cm to 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The figure 4 shows the sensor.

Fig 4: Ultrasonic sensor

The driver circuit consists of four 12V relays (Each two of them are used to make H-Bridge to drive any single motor) and four n-p-n transistors (to magnify the driving current to drive the relays). The internal wiring diagram of motor driver is shown in figure 4

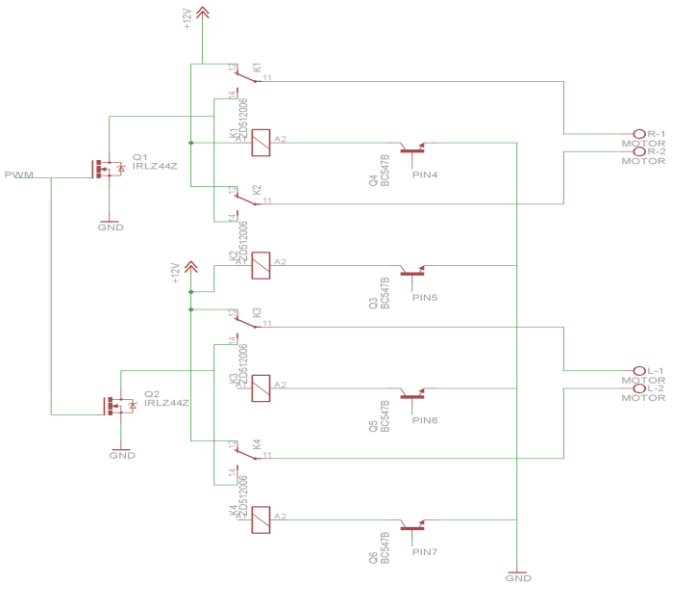

Fig 5: wiring diagram of motor driver

Two PMDC (permanent magnet dc motor) motors are used. PMDC motors are chosen because of offering high starting torque, vigorous, having a simple design and pretty low cost. The voltage and current ratings of both motors are 24V and 13.2 Amp. The RPM (Revolution per Minute) of both motors is 2650 and after a gear mechanism which has the gear ratio is 7:2. For making the connection between the motor's shaft and wheels, freewheel and ruler chain are used. A 24v DC lead acid battery is used as power supply for the motors.

B] Therapy Portion

Therapy unit includes manually controlled weight loading, arm exercise which is automatically controlled pulley system, vibration pad, heating and cooling. The automatic pulley system is used for upper limbs due to left or right cerebral nervous system disorder .It helps the patient to regenerate blood circulation in upper limbs. We have used pmdc motor for this purpose which rotates within a specified angle. . Its stall torque is 10.00 kg-cm and speed is 15 rpm. The rotational range of hand is 90 degree. It can hold up to a 10 Kg weight. The motor makes the revolution of 360 degree. When the rotor rotates anti clockwise, it raises the hand and vice versa. Weight loading exercise increases strength and stability. The benefits of Vibrations are to build strength and burn calories. Here, we have used vibration toy motor to make the vibration pad. For providing heating and cooling therapy, Peltier element is used. This device has two sides, and when a DC electric current flows through the device, it brings heat from one side to the other, so that one side gets cooler while the other side gets cooler while the other gets hotter. The therapy portion is the key of our project having numerous advantages.

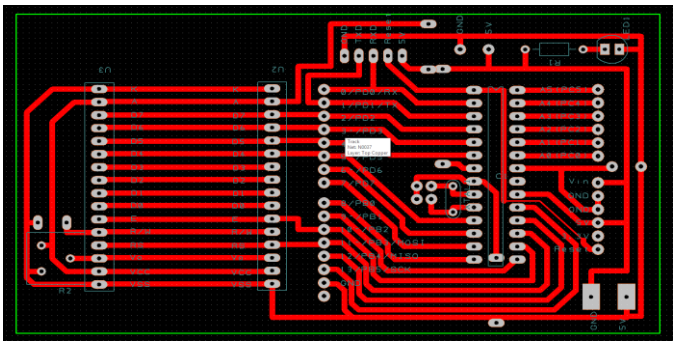

Fig 6: Microcontroller layout

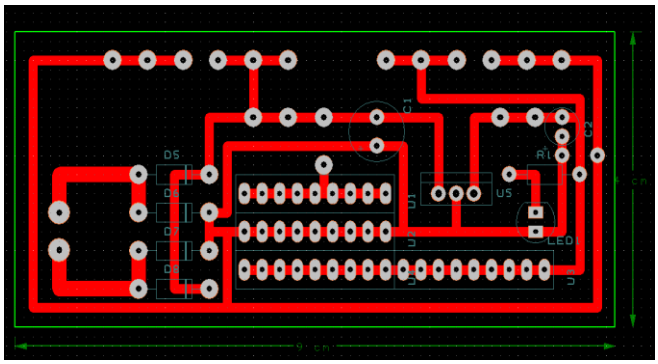

Fig 7: Power supply layout diagram.

3. COMPILATION RESULTS

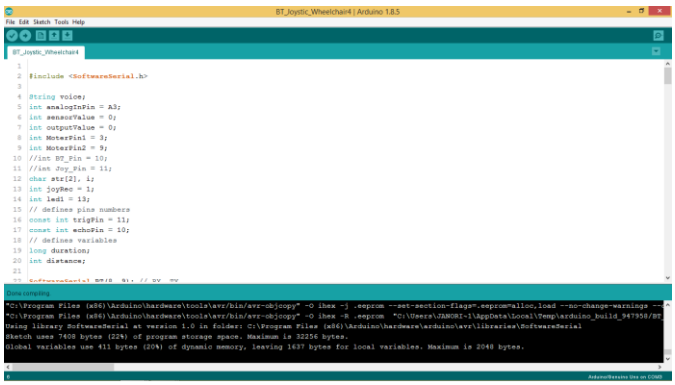

Fig 8: Compilation of code in Arduino

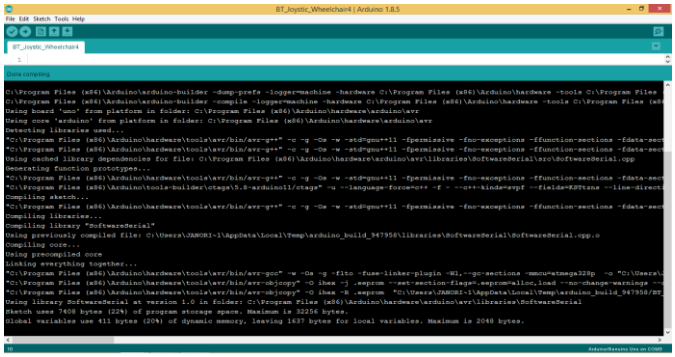

Fig 9: Compilation results/messages in Arduino

4. DRAWBACKS OF PRESENTLY AVAILABLE WHEELCHAIRS

Unavailability of wheelchairs for particular disabilitiy is a considerable issue. Most significant technical issue in the currently available wheelchairs is cost versus accuracy. Also, the present systems are unable to monitor the surrounding conditions and the health condition of the patient. There is also no wheelchair available till date for the bed lying patient. No wheelchair available for mentally challenged people also. Above all the other important aspect to consider is the physical barrier that place additional requirement on strength and durability of wheelchairs.

5. APPLICATIONS

- A disable person can use this system as a wheelchair and also for his recovery of the disability with the therapy facilities.
- With this system the disable person can accomplish some basic therapies without help of another person or only with the help of family members.
- The system is able to detect an obstacle which is not usually present in ordinary wheelchair.
- For more convenience of the disabled person, this device provides chair cum bed system.

6. CONCLUSIONS

In this study we have concluded that there are number of ways of control system used to control the movements of wheelchair. No any one method is suitable for all type of physical disability. The controls are dependent on environment also, voice operated control system cannot used in noisy environment. Multiple control system implemented in a wheelchair is quite suitable to overcome this disadvantage. But as control system increases the cost also increases a lot so there is also limitation on implementation number of control system. There is no any system which makes physical disabled people fully independent. Different control system should be used for different type of physical disability. This paper presents a summary of current state-of-the-art smart wheelchairs. Various techniques are available to operate and control the wheel mechanism of wheelchair. Some of operating techniques of wheelchairs have been explained here. This information is gathered to promote awareness of status of existing types of smart powered wheelchair so that the improvement can be incorporated into it.

Fig 10 : hardware structure of project

7. FUTURE WORK

- Redesigning and rebuilding as per patient's requirements.
- Developments of the wheelchair with brain control system.
- Development of wheelchair with eye control system.
- Implementation of all kinds of therapy facilities related to wheelchair.
- Implementation of more scientific therapy treatments such as transcutaneous electrical nerve stimulation, arm movement using robotic hand.
- Climbing the wheel chair on stairs.

8. REFERENCES

[1] Mohammed Faeik Ruzaij , S.Poonguzhali, "Design and Implementation of Low Cost Intelligent Wheelchair", International Conference On Recent Trends in Information Technology (ICRTIT), IEEE,2012, pp 468-471.

[2] Masato Nishimori, Takeshi Saitoh ,Ryosuke Konishi, "Voice Controlled Intelligent Wheelchair", SICE Annual Conference,pp. 336-340, 2007.

[3] About Bluetooth module (22 November 2014), available at: http://www.rajguruelectronics.com/bluetooth-module.html

[4] About Arduino Mega (15 November, 2014), available at: http://arduino.cc/en/Main/arduinoBoardMega2560

[5] About Ultrasonic distance sensor (15 November, 2014), available at:www.parallax.com.

[6] About Power Wheelchair Battery (20 November 2014), available at: http://www.spinlife.com/spintips/details/k/Power-Wheelchair-Batteries/a/121/c/4

[7] About Dc- motor characteristics (5 November, 2014), available at: http://www.slideshare.net/yazory/wheelchair-is-guided-by-voicecommands- full-documentation.

[8] K. Pretz. Building smarter wheelchairs. making life easier for people who can't walk. *The Institute-IEEE*, June 7, 2013

[9] D.K. Rathore, P. Srivastava, S. Pandey, and S. Jaiswal, "A novel multipurpose smart wheelchair," in Proc. IEEE Students' Conf. Elect., Electron. Comput. Sci., Bhopal, India, Mar. 2014, pp. 1–4.

[10] B. M. Faria, L. P. Reis, and N. Lau, "A survey on intelligent wheelchair prototypes and simulators," New Perspectives Inf. Syst. Technol., vol. 1, pp. 545–557, 2014.

[11] Shaikh, M. H., Kosuri, K., Ansari, N. A., & Khan, M. J. (2013,March). The state-of-the-art intelligent navigational system for monitoring in mobile autonomous robot. In Information and Communication Technology (ICoICT), 2013 International Conference of (pp. 405-409). IEEE.

[12] About wheel chair history (15 October, 2014), available at: http://www.ehow.com/about_6305673_history-electric-wheelchairdisabled-persons.html

[13] Ali A. Abed, "Design of Voice Controlled Smart Wheelchair", International Journal of Computer Applications (0975 – 8887) Volume 131 – No.1, December2015.

[14] Ms. S. D. Suryawanshi, Mr. J. S. Chitode, Ms. S. S. Pethakar, "Voice Operated Intelligent Wheelchair", International Journal of Advanced Research in Computer Science and Software Engg. 3(5), May - 2013, pp. 487-490.

[15] Rakhi A. Kalantri, D.K. Chitre," Automatic Wheelchair using Gesture Recognition", International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 9, March 2013.

[16] Mohammed Asgar, Mirza Badra, Khan Irshad and Shaikh Aftab," AUTOMATED INNOVATIVE WHEELCHAIR", International Journal of Information Technology Convergence and Services (IJITCS) Vol.3, No.6, December 2013.

[17] Monika Jain, Hitesh Joshi, "Tongue Operated Wheelchair for Physically Disabled People", International Journal of Latest Trends in Engineering and Technology (IJLTET).

[18] Nikhil R. Folane, R. M. Autee," EEG Based Brain Controlled Wheelchair for Physically Challenged People", International Journal of Innovative Research in Computer and Communication Engineering, Vol. 4, Issue 1, January 2016.

[19] Srishti, Prateeksha Jain, Shalu, Swati Singh," Design and Development of Smart Wheelchair using Voice Recognition and Head Gesture Control System", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 4, Issue 5, May 2015.

[20] Vijay Khare, Jayashree Santhosh, Sneh Anand, Manvir Bhatia," Brain Computer Interface Based Real Time Control of Wheelchair Using Electroencephalogram", International Journal of Soft Computing and Engineering (IJSCE), Vol. 1, Issue 5, pp. 41-45, November 2011

[21] Tom Carlson, Jose Del R. Millan," Brain–Controlled Wheelchairs: A Robotic Architecture", IEEE Robotics and Automation Magazine, Vol. 20(1), pp. 65 – 73, March 2013

[22] Sathishbalaji L, Bhakkiyalakshmi R," Electric Wheelchair Controlled by EMG Signals with Obstacle Detection", IJEDR, Vol. 2, Issue 2, pp. 1409-1412, 2014

[23] Yathunanthan, S. chandrasena, L.U.R, umakanthan, A., Vasuki, V,"Controlling a wheelchair using EOG Signal", IEEE, PP. 283-288, Dec. 2015

[24] About ITEAD joystick (10 november 2014), available at: http://www.iteadsstudio.com.html

[25]About HC-05 (12 november 2014), available at: http://www.rajguruelectronics.com.com/bluetooth-module.html

[26] A.R. Trivedi, A.K. Singh, S.T. Digumarti, D. Fulwani and S.kumar. Design and implementation of a smart wheelchair. In proceedings on AIR 2013, Pune India, Jul 2013.
[26] A Comprehensive Review of smart wheelchairs: Past, Present, Future Jesse Leaman and Hung manh La, Senior Member,IEEE

[27] Romil Chauhan, Yash Jain, Harsh Agarwal and Abhijit Patil,"Study of Implementation of Voice Controlled Wheelchair,"2016 3rd International Conference on Advanced Computing and Communication Systems (ICACCS-2016), 2016.

BIOGRAPHIES:

B.E Student, Department of Electrical Engineering, ACET, Sadar, Nagpur, India.

B.E Student, Department of Electrical Engineering, ACET, Sadar, Nagpur, India.

B.E Student, Department of Electrical Engineering, ACET, Sadar, Nagpur, India.

B.E Student, Department of Electrical Engineering, ACET, Sadar, Nagpur, India.

B.E Student, Department of Electrical Engineering, ACET, Sadar, Nagpur, India.

B.E Student, Department of Electrical Engineering, ACET, Sadar, Nagpur, India.