JAET

Journal homepage: http://jae-tech,com

Journal of Applied Engineering & Technology

ISSN : 2523-6032 ISSN-L : 2523-2924

Voice and Hand Controlled Wheelchair System

Fida Hussain[1], Sayed Mazhar Ali Shah[1], Asif Ali[1], Imran Ali[1], Haresh Kumar[1]

[1]Department of Electronic Engineering,
Quaid-e-Awam University of Engineering, Science & Technology Nawabshah, Sindh, Pakistan

*Corresponding Author

Abstract: No matter what the problem, the modern human being does not want to remain reliant. Because of their impairments, differently-abled people are unable to meet their own modest requirements. As a result, they don't get along well with others and want to avoid interacting with them as much as possible; however, this may be avoided if we provide them with the newest technology, such as a wheelchair. In the market, there are two types of wheelchairs: manual and electric-powered wheelchairs. The first kind is for those with disabilities in their lower limbs. Furthermore, the manual wheelchair's efficiency is just 10-20%. The goal of this project is to use a human voice and a joystick to drive a wheelchair. It enables a differently-abled person to move his body enough utilizing contemporary technology speech recognition application that is attached to motors to make movement as simple as possible, by employing voice control and identification technology that is coupled to motors. It allows a handicapped person who is deaf to travel from one location to another using his hand and a joystick. The wheelchair is based on computer software, as well as its ability to execute mathematical calculations and communicate with other electrical components. This wheelchair project is aimed at the low and middle classes, therefore if it becomes marketed, it will assist this group of people. We utilized an Arduino circuit that is connected to a speech recognition system. When a command is issued, the circuit sends out impulses to activate a motor and control the chair's movement.

Keywords: Controlled Wheelchair, disabled people, Arduino Nano, DC gear motors, Relays, voice recognition

1. Introduction

It is estimated that the population of persons with disabilities in Pakistan to be 2.38% of the entire population of Pakistan. These wheelchairs are good solution for them. The following thesis report contents a 6 months research and design effort to develop a wheelchair which based on Arduino Nano. The results are given from some experimentation that is done on a project to evaluate the performance of the wheelchair. Three evaluations are expert interviews, a wheelchair performance evaluation, and a usability evaluation which utilized wheelchair operator.

This project Arduino nano based wheelchair is aimed to develop because it is observed that there is no such wheelchairs frequently available in local markets and specially, for those peoples who are

Corresponding author: Fidakhoso17es68@gmail.com

unable to walk e.g. paralyzed. However imported wheelchairs are available in markets are very costly.

Many, people who are disabled and cannot move independently. Also, many people who are paralyzed they are unable to move their hands and the Wheelchairs that available in market voice controlled or joystick controlled are way out of the budget of a common man and only have one function of voice or joystick.

2. Literature Review

[1] Tan Kian Hou et al,. 9roposed a voice guided wheelchair is created locally available wheelchair to assist handicapped people. An Arduino microcontroller processes the voice command from the speech recognition module and controls the motor movement of the wheelchair [2]. Bluetooth is used too, to remain far away from messy wiring and a joystick is additionally included to direct within the design [3]. The wheel chair can understand English chines as good as. The overall cost of the prototype was kept low to form it affordable. [2] Khyati Meena et al,. presented a voice activated wheelchair makes it simple to move for differently-abled people. The, pivot of Voice activated wheelchair for motion is motor and voice recognition for command [4]. The circuit comprises of an Arduino, HM2007 the module can identify the command by the operator which is a codded data within the memory of microcontroller of the Arduino [5]. Arduino Microcontroller controls the locomotion accordingly. The wheelchair also has provision for joystick for physically disabled people those who can move their hands. [3] Prof. Manoj V et al,. describes a voice controlled wheelchair. It's hard for the paraplegic person to steer or move around on his/her will and always depend on others to maneuver their wheelchair. This makes their movement much easier and independent with the of voice control [6-8]. It's bit hard to use the standard powered joystick wheelchair. But, a voice activated and controlled wheelchair is much easier to use specially, for those whose hands, does not work properly [9]. The, patients of quadriplegic, encephalopathy brain disease and disseminated sclerosis whose sustenance is on 5 others for movements because of which they don't have the discretion of mobility. This wheelchair will assist the handicapped to steer around without the help of anyone [10-11]. Once the operator initiate a command the Arduino will drive the motors. Process of identification of voice is finished by voice identifier module, affixed to Arduino [12]. The wheelchair would care for real analogous voice signal of patient while user using the wheelchair. [4] Mohammad Ilyas Malik purposed of voice controlled wheelchair is to regulate a wheel chair by using speech recognition module. The system is meant to control a wheel chair using the voice of person. The foremost reason of this project is to assist the elderly differently-abled folks that cannot move freely. This project will help people to measure less dependent life. And voice recognition technology will open new vistas of human machine interactions [13]. Therefore the issues that they face can be solved by using speech recognition technology for the movement of wheel chair smart-phones may be used as an arbitrator [14]. During the designed it was made sure to develop a program to recognize speech to controls the movement of chair and a software is developed that can handle the graphical commands. The Arduino microcontroller circuit and dc motor makes the movement of the wheelchair and Ultrasonic Sensors are affixed to seek out the obstacles in front of the wheelchair [15-17]. [5] psana.S1 et al,. Wheelchairs can easily be bought from the market. But a particular unfortunate differently – abled persons find it difficult to work wheelchair. Several, thorough researches are

done on a subject matter to cut back human involvement the maximum amount as possible. This, project could be a smart voice-controlled wheelchair using embedded system [18-19]. Arduino microcontrollers and speaker dependent voice recognition processor have been used to support this model works on voice recognition for handicapped peopleto regulate the navigation of the wheel chair. The system only responds to the owner and nobody else so it is secure further. Betting on the 6 direction selected on the joystick, microcontroller controls the wheelchair directions. Also can be directed by voice commands. By using ultrasonic sensors we are able to avoid obstacles.

3. Methodology

The drive wheel unit is powered by motor through batteries and controlled with Arduino Nano. Fig. 1 shows the box attached to the front section of the wheel chair having mic, joystick and two channel switch which is used to either on joystick and mic so that it can be easily manipulated by operator. At the base of wheelchair 4 channel relays are used to move motors. Two relays for motor one and two relays for other motor, then wheelchair, start its movement like (FORWARD, BACKWARD, RIGHT, LEFT) directions.

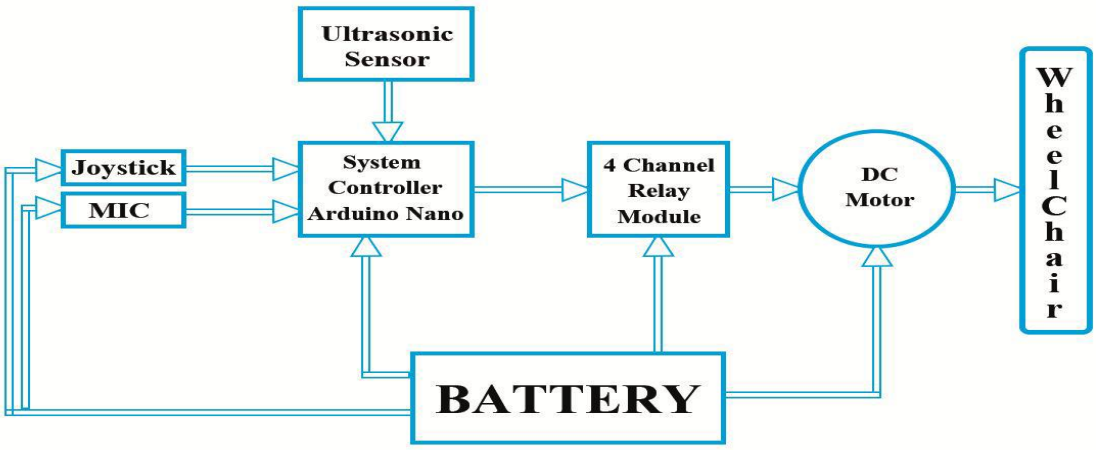

Fig 1 – Block Diagram

3.1 Interfacing of Components

Voice module is connected with D2 of Arduino nano and joystick is connected with A1 and A2 of Arduino nano when we push joystick in any direction or give specific instruction through Mic then Arduino nano decoded that instruction and send the signal to the 4 channel relays to the ground and power pins are the first 2 couples that connects the chip +5v to the 4 relay Vcc pin and the Arduino ground to the 4 relay board GND pin. We used 4 relays in the circuit in which 2 relays works for motor1 and 2 relays for motor 2, when we push forward the joystick/MIC IN1 and IN3 turn on. When we push backward the joystick/MIC IN2 and IN4 will turn on. When we push left the joystick/MIC, IN1 and IN4 will turn on. When we push the right joystick MIC, IN1 and IN3 will turn on. Relays drive the motor on applied direction and motor turns ON either forward or

backward direction or one turns ON forward direction and second motor turns ON backward direction and vice versa.

12 volt DC, 5Ampere battery is used from which 12 volt DC supply is used for relays and also given to arduino nano by converting 12 volt DC to 5Volt DC by DC jack and +5volt DC also given to the joystick and MIC as shown in Fig. 2.

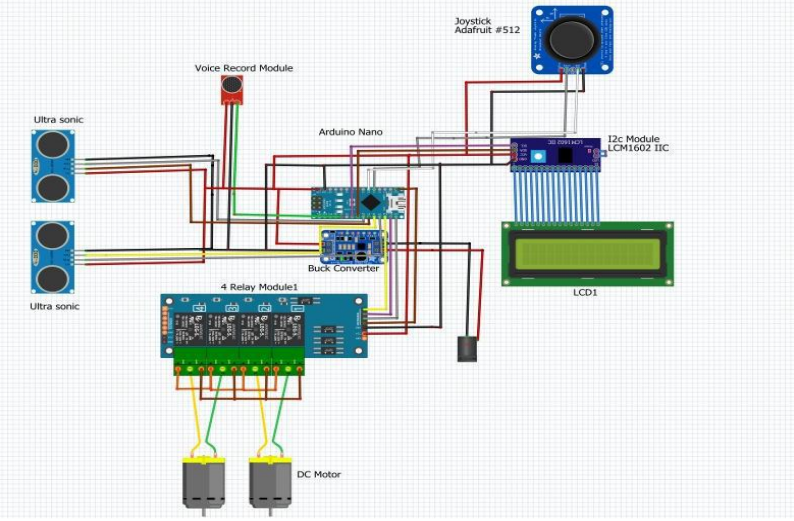

Fig 2 – Interfacing of components

4. Project Hardware and Software

The voice and hand controlled wheelchair system consists of two parts hardware and software. The hardware part has metallic base, Arduino Nano, DC Motors, Ultrasonic sensors, Relays, LCD, Joystick, Voice Recognition module. Software section consists of Arduino IDE using C language programming.

4.1 Major Hardware Components

Arduino Nano: The Arduino Nano is a small compact chip based on the ATmega328 Arduino Nano 3.x. it is same as the Arduino Duemilanove but is still bit different as it does not have power jack instead usb-b mini is added. This is microcontroller board architecture by arduino cc. the controller same controller is used in Arduino nano and arduino which is Atmega328.this controller is pretty famous because of its small size here are some features: It has 22 IOs pins, 14 digital pins, 8 analogue pins and 6 PWM pins, it has 16MHz crystal oscillator and attached reset button as shown in Fig. 3.

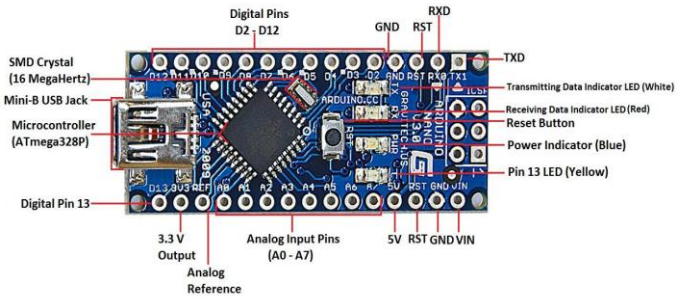

Fig 3 – Arduino Nano

Ultrasonic sensor: Ultra sonic module is used that emits ultrasonic sound and converts them into electrical signals. It helps to avoid hurdles, in the way of wheelchair. As ultrasonic waves travels a lot faster as compared to the sound that we listen if any object places in front of ultrasonic sensor about the distance of 20cm and less ultrasonic will detect it and motor will not move forward or backward. Ultrasonic has a 4 PINS(VCC,TRIGGER, ECHO, GND) .VCC and GND operates in +5 volt, TRIGGER and ECHO are connected with Arduino nano at PIN D6 and D7 respectively work as a sensor and detect the obstacle in front of ultrasonic sensor as shown in Fig. 4.

Fig 4 – Ultra Sonic sensor

DC Gear Motor: A DC motor is a machine that converts the electrical (DC) current into mechanical energy. The universal is a light weight brushed motor used for moveable appliances. DC gear motor in this project is operates at 12Volt and 5Ampere, this motor is universal motor which has forward polarity and reverse polarity, if a person push joystick in forward direction, forward polarity will occur. And if a person push joystick in backward direction, backward polarity will occur. We connected 12 Volt 5 Ampere batteries which will generate current for overall operating process. These DC motors are connected with relays, when relays will on through MIC/joystick then signal in the form of current will start to motors as shown in Fig. 5.

Fig 5 – DC Gear motor

Four Channel Relay: The 4 relay module is used for heavy loads to control high voltage, high current load, such as the load of AC, motor and other heavy appliances and devises .the rely is architecture to work with small controllers such as Arduino, PIC and other such chips.

To connect the 4Relayboard to an Arduino to operate motors of wheelchair is very easy and allows you to turn on and off a wide range of device, both AC and DC. The first to connections are the ground and power pins, you need to connect the Arduino +5v to the four Relay board VCC pin and the Arduino ground to the four Relay board GND pin. It has 6 pins (VCC, 2IN4, GND). 2IN4 are 4 inputs, 2 connected with motor1 and motor 2 as shown in Fig. 6.

Fig 6 – Four Channel Relay

LCD 16x2: A LCD is an electronic devise with screen that has so many appliances. A 16x2 is the most common LCD used in lots of devises. the (16x2) 16 here represents the characters that it can display and 2 represents the lines means each line displays 16 character in LCD consist on 16 pins which are divided by 4 to convert into I2C module that will provide 4 pins (GND, VCC, SDA, and SCL). The SCL, SDA pins on chip are A4 and A5 pins which are on wheelchairs Arduino black jumper cable is affixed all the way to GND pin on the LCD and BND pin on the chip

Affix the VCC pin which is on the nano with red jumper cable. Link the SDA pin on the LCD to the A4 with the green jumper cable. Attach the SCl pin on LCD to A5 with yellow jumper cable as shown in Fig. 7.

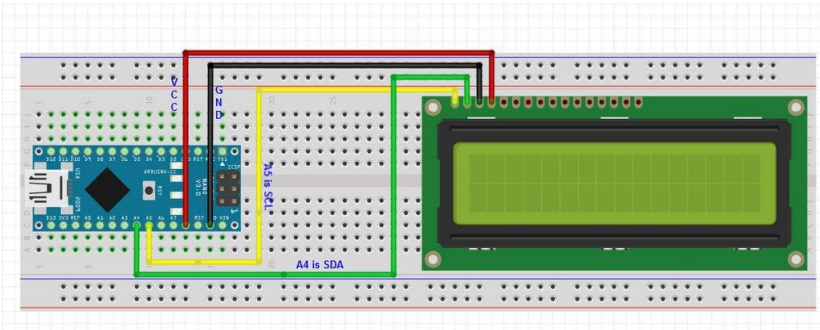

Fig 7– LCD 16x2

Joystick: Joystick is a devise that is used in computer to control the arrow on display. The controls of arrow are managed by joystick's motion. Joystick in wheelchair project is an analog sensor, In an industrial joystick, a potentiometer is connected to each of joystick shafts so that pivoting the shaft rotates the contact arm. When the nob of joystick is moved the potentiometer orders the arm for required turn by varying the resistance in the potentiometer as shown in Fig. 8

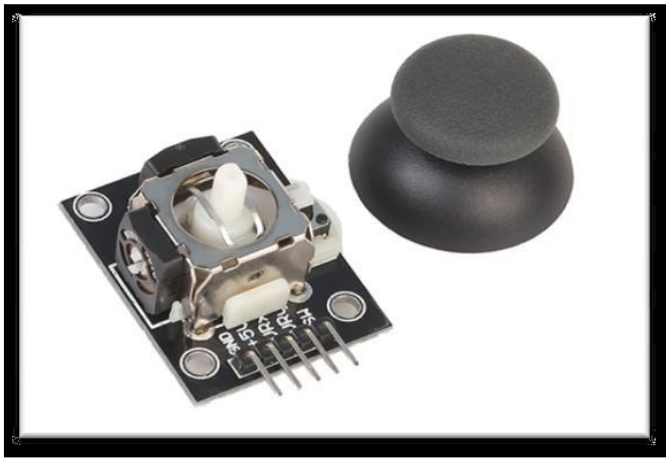

Fig 8 – Joystick

Voice Recognition Module: Voice recognition module is a compact easy-control speaking recognition board based on speakers and can uphold 80 commands. Any sound could be trained as command. Voice order is kept in a large cluster. Only 7 commands can be brought into identifier as shown in Fig. 9.

Fig 9– Mic Module

4.2 Software Requirements

The Arduino integrated environment IDE is used to program the Arduino Nano and C language is used as programming language. Arduino IDE is simple and easy to program and interface with microcontrollers

5. Working

The voice and hand controlled wheelchair system consists of DC Motors connected with Arduino Nano by relays. For the instructions Joystick and Mic is interfaced with Arduino Nano. Ultrasonic sensor is also connected with Arduino Nano Board. Whole circuit is power by battery. The instruction for the forward, backward, left and right is given by Joystick or Mic. The Arduino Nano gives the command to the relay, the relay on or off motors as per given instructions and wheelchair moves forward, backward, right or left. Ultrasonic sensors are used to detect the

obstacle on the way of wheelchair. When hurdles are detected and signal is given to Arduino Nano the wheelchair stops the doing current task to avoid the striking with hurdles or obstacles.

6. Results and Discussions

This project is about a wheelchair that can maneuver by the voice .this is for those who cannot control the movement of their hand the wheelchair can be controlled either by voice or physically. The powered wheelchair depends upon motors for locomotion and voice recognition for command. The circuit comprises of Arduino, HM2007 voice recognition module and motors. The client gives command which the module recognizes and transfers a particular code that is stored in the board of Arduino. Arduino microcontroller controls the locomotion accordingly. Joystick is also included for people whose hands do not move.

7. Conclusion

The conclusion of this project based on the voice and hand controlled wheelchair is obvious that how this project could is helpful for the concerned area. The main purpose of our project is to provide help to the handicapped people or disable person in hospital or elsewhere. Since, the project has mainly bonded for this issues occurring in our societies that most of the accidents took places on highways and the people are fractured , lots of causes of damaging the arms and legs over the accident so it will be helpful for the society or the concerned area where these types of accident occurs.

Since, most of the people are disabled from their birth and are unable to walk freely so this project will help them by continuing their life happily and efficiently.

8. Future Scope

The additional advancement is possible, extra circuitry and sensor can be used to make it better and efficient. Battery charging system with the motion of the chair can be used and reduction of power usage.

Acknowledgement

The authors would like to thanks Department of Electronic Engineering, Quaid-e-Awam University of Engineering, Science and Technology, Nawabshah, Sindh, Pakistan for their support in carrying this work without their support work accomplishment of the work wouldn’t possible.

References

1. Hou, Tan Kian. "Arduino based voice controlled wheelchair." In Journal of Physics: Conference Series, vol. 1432, no. 1, p. 012064. IOP Publishing, 2020.
2. Meena, Khyati, Shubham Gupta, and Vijay Khare. "Voice controlled wheelchair." International Journal of Electronics, Electrical and Computational System 6, no. 4 (2017): 23-27
3. Bramhe, Manoj V., Nvya Vijay, K. Bhagyashree Rao, Payal Bisen, Riddhi Navsalkar, and Tanushri Bajganiya. "Voice controlled wheelchair for physically disabled person." International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering 6, no. 2 (2017): 940-948.

4. Malik, Mohammad Ilyas, Tanveer Bashir, and Omar Farooq Khan. "Voice controlled wheel chair system." International Journal of Computer Science and Mobile Computing 6, no. 6 (2017): 411-419.
5. Rai, Kharka Bahadur, Jeetendra Thakur, and Nirmal Rai. "Voice Controlled Wheel Chair Using Arduino." International Journal of Science, Technology & Management 4, no. 06 (2015): 6-13.
6. Muneera, T. N., and C. N. Dinakardas. "A voice controlled wheel chair for physically challenged people with therapy unit." International Journal of Engineering Research & Technology (IJERT) 8, no. 7 (2019).
7. Pramila Kupkar, Prajakta Pandit, Nikita Dhadhere and PP Jadhav, "Android controlled wheelchair", Imperial Journal of Interdisciplinary Research (IJIR) Volume-2 Issue-6 2016
8. Apsana S, Renjitha G Nair, "Voice Controlled Wheelchair using Arduino", International Advanced `Research Journal in Science, Engineering and Technology(IARJSET), Vol 3, Issue 3, August 2016
9. Mr. Tarun Agrawal, "Review on Voice Recognition Module Working", International Journal of Advanced Research in Computer Science and Software Engineering, May 2014
10. Ms S. D. Suryawanshi Mr. J. S. Chitode Ms. S. S. Pethakar, "Voice Operated Intelligent Wheelchair", 2013.
11. Kharka Bahadur Rai, Jeetendra Thakur, Nirmal Rai. Voice Controlled Wheel Chair Using Arduino, International Journal of Science, Technology & Management, June 2015
12. R. Puviarasi, Mritha Ramalingam, Elanchezhian Chinnavan "Low Cost Self-assistive Voice Controlled Technology for Disabled People". International Journal of Modern Engineering Research (IJMER) 4, Jul.-Aug. 2013
13. G Azam and M T Islam " Design and Fabrication of a Voice Controlled Wheelchair for Physically disabled people", International Journal of Modern Engineering Research (IJMER) 2015
14. Atul Kumar, Prashant Singh, Amit Kumar, S. K Pawar, Speech Recognition Based Wheelchair Using Device Switching, International Journal of Emerging Technology and Advanced Engineering (IJETAE), Volume 4, Issue 2, February 2014.
15. Voice Operated Intelligent Wheelchair by Ms. S. D.Suryawanshi , Mr. J. S. Chitode , Ms. S. S. Pethakar,International Journal of Advanced Research in Computer Science and Software Engineering Volume 3, Issue 5, May 2013.
16. Voice and Touch Screen Based Direction and Speed Control of Wheel Chair for Physically Challenged Using Arduino by M.Prathyusha, K. S. Roy, Mahaboob Ali Shaik, International Journal of Engineering Trends and Technology (IJETT) ,Volume4Issue4, April 2013.
17. A Wheelchair Steered through Voice Commands and Assisted by a Reactive Fuzzy- Logic Controller by Gabriel Pires and Urbano Nunes Journal of Intelligent and Robotic Systems 34: 301314, 2002
18. Vasundhara G. Posugade, Komal K. Shedge, Chaitali S. Tikhe, TouchScreen Based Wheelchair System, International Journal of Engineering Research and Applications (IJERA).
19. D. A. Bell, S. P Levine, Y. Koren,, L. A Jaros, J. Borenstein,, ”Design Criteria f o r Obstacle Avoidance in a Shared-Control System”, RESNA94, Nashville,1994.