A

PROJECT REPORT

ON

"SMART AND AUTOMATIC WHEEL CHAIR FOR DISABLED PERSON WITH HAND GESTURE"

In the practical fulfillment this project report submitted to the
Savitribai Phule Pune University,Pune
For the Degree of

Bachelor of Engineering
in
Electrical Engineering

Under the Faculty of Engineering
By

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Year 2024-2025.

CERTIFICATE

This is to certify that the Project Report entitled,

"Smart And Automatic Wheel Chair For Disabled Person With Hand Gesture"

Submitted by

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Abstract

A method for directing wheelchair movement through hand gestures. The wheelchair is made in such a way that any individual may control it with ease if they just move their wrist. The hand movements are recognized by using hand gesture recognition algorithm. It recognizes five different hand movements like forward, reverse, left, right and stop. It does not involve complex computing system which is quite challenging for the elderly people. This design also has GPS features to track location of the wheelchair from anywhere in the world. It is also connected by using Bluetooth technology which helps the people to control through assisting people.

Hand movement electronic wheelchair is a basic wheelchair which is modified into two modes i.e. either manually or by following the motion of the head. This type of wheelchair is designed for those patients who are unable to move their limbs and are dependent on care takers for their movement. So our projects solves the problem to some extent. The head set is made up of inertial measurement unit (IMU), which sends the position of the head to the microcontroller Arduino mega 2560. The controller then follows a control algorithm and sends the commands to the motor driver relay module circuit to drive the motors accordingly. Old homes, hospitals and bed ridden soldiers are the application of this type of wheelchair

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Abbreviations

1	MEMS	Micro-Electro-Mechanical Systems
2	ADC	Analog To Digital Converter
3	RF	Radio Frequency

Chapter 1
INTRODUCTION

1.1 Introduction:

This project aims to style integrate program to interface and test a totally motorized, gesture-operated wheelchair. A regular standard wheelchair wasn't used instead a prototype was made to meet this project's goals. In this project, the procedure of the Mechatronic systems design was followed to assure the quality of the final product i.e; the Gesture controlled wheelchair. The project took the following of the subsequent parts: Hardware, software, interface, and testing. This project is said to controlling a wheelchair by means of the human gesture.

The target of this project is to facilitate the movement of people who are disabled or handicapped. We used Arduino recognition technology which has been employed to maneuver the wheelchair. The results of this project show that this will be used for future research work and public interest. The main objective is to style a system that gives the answer for the physically handicapped (challenged) people those who that can't move by themselves, they can use Arduino commands by interfacing the Arduino Recognition with a microcontroller and wheelchair.

The gesture sensor commands are given to the Arduino kit with the help of an Arduino and thus the wheelchair moves according to the given directions. forward backward left right there are direction to move wheelchair. The wheelchair's movement is being controlled by the motors and the motor drivers are being connected to the wheels of the chair. The interfacing between Arduino recognition kit and motors is completed by employing a microcontroller. Here during this project, the microcontroller used is Arduino UNO The idea was taken during this paper to reduce the human efforts in driving a wheelchair.

It's an incontrovertible fact that humans are born imperfections. But disabilities have never stopped a person from achieving greatness. Furthermore, many devices/instruments are invented to assist those that are mentally or physically challenged. "Wheelchair" is supposedly the simplest example to support the above mentioned inventions. when images of wheeled chairs made specifically to take the human from one place to another and is being seen to begin and occur in Chinese art.

Many people are using these instruments and it's been proven to be a really useful gizmo for the disabled. Wheelchairs are available in a good sort of format to satisfy the precise needs of their users. These are popularly known to include and have particularly well-specialized seating adaption, build for individualized controls, and also adapted for certain particular activities, as seen with the ones used in the sports wheelchairs and also which are used in beach wheelchairs. the foremost widely known the distinction is between powered wheelchairs, where propulsion is seen to be provided by batteries and electric motors, and selfie or manually propelled wheelchairs, where the propulsive happened force is provided either by the wheelchair user/occupant pushing the wheelchair by their own force using their hand ("self-propelled") or by an attendant who might be behind the wheelchair using their hands pushing from the rear ("attendant propelled").

Earlier the wheelchair was to be moved by a mechanical force applied by the user. In recent trend Joystick with a motor are getting used to cause movement. But it comes with its own

limitation of force to be applied on these levers. There could also be an opportunity that it's going to grind to a halt or it's going to break. To overcome this problem, we thought of employing a gesture-controlled actuation which not only removes the matter of lever adjustment but also would be more convenient for the user hence we've come up with a actual work model wheelchair that's gesture actuated. This wheelchair is specially designed for those patients who are unable to move their limbs except their head. This wheelchair is operated by detecting the motion of the head and providing such paralyzed patient, a certain degree of independence and freedom in their movement. We used accelerometer; one of the components of the inertial measurement unit (IMU). Accelerometer sensor is the detects the orientation of the hand and send signals to the micro-controller which is Arduino UNO.

The design we proposed is cost effective and simple. No specific calibration is required before use. Additional characteristic of wheelchair in the hardware design is that it can be operated in 2 modes i.e. either manually or by using patient hand. Standard wheelchair has been purchased from the market and modified mechanically by applying helical gears which are coupled with the motors. These gears can be attached and detached according to the patient's requirement and that can be done by simply unscrewing a bolt at the back of the wheelchair.

1.2 Need of Project:

The percentage of disabled people has increased in both rural and urban part of India. The disability could be by birth or due to some medical or accidental reason. The aim of this paper is to make a hand gesture-controlled wheel chair using accelerometer as sensor to help the physically disabled people in moving from one place to another just by giving direction from the hand. Today in India many people are suffering from disability, there are people whose lower half of the body is paralyzed. This Wheelchair will add on to the comfort and make the life of people bit easier. Around 5436604 people are affected from movement disability. Percentage of population which suffers from different disabilities is shown in graph below. Out of total disability maximum people suffers from disability in movement. Benefits to people who are: a. Paralytic person. b. Those who crawl. c. Those who walk with the help of aid. d. Those have acute and permanent problems of joints/muscles. e. Those who have stiffness or tightness in movement or have loose, involuntary movements or tremors of the body or have fragile bones. f. Those who have difficulty in motor cell and neurons coordination. g. Those who have lost sense of sensation in lower part of the body due to paralysis or other problems. h. Those who have twisted body parts and suffer from any kind of deformity in the body.

1.3 Problem Statement:

1. To select correct dimension and parameter wheelchair fabrication.
2. Motor selection: Choose motors that can provide sufficient torque and speed for the wheelchair's weight and desired performance.
3. To control motor speed: Implement a control system, like PWM (Pulse Width Modulation), to regulate motor speed accurately.
4. Wheelchair rotate: Design the wheelchair with the ability to rotate in place, which may involve differential steering or additional hardware.

5. To develop program control direction: Write a program to interpret hand gestures and translate them into directional commands for the wheelchair.

The problem for a hand-gesture controlled wheelchair is to provide a more natural and intuitive way for people with disabilities to control their wheelchairs. Traditional wheelchairs are controlled by joysticks or other manual input devices, which can be difficult and tiring to use for people with limited mobility. Hand gesture control offers a more efficient and user-friendly alternative, allowing users to control their wheelchairs simply by moving their hands. There are several challenges that need to be addressed in order to develop a successful hand- gesture controlled wheelchair. One challenge is to develop a sensor system that can accurately and reliably detect hand gestures. Another challenge is to develop a control algorithm that can translate hand gestures into wheelchair movements. Finally, the wheelchair must be designed in a way that is safe and easy to use for people with disabilities. Despite these challenges, hand-gesture controlled wheelchairs have the potential to revolutionize the way that people with disabilities move around. By providing a more natural and intuitive way to control their wheelchairs, hand gesture control can help people with disabilities to live more independent and active lives.

1.4 Objective:

1. Enhancing mobility and independence for wheelchair users.
2.Introducing innovative assistive technology solutions
3.The aim of the project is to design a wheelchair tilt communicator system that could operate the wheelchair handicapped person with the help of tilt of hand

Chapter 2
LITERATURE REVIEW

1.V.Purushothaman, R.Androse, M.J.Lokesh, S.Nawin Chander, R.Rajkamal described in "Head Motion Controlled Wheelchair" This work elaborates the design and construction of Smart Electronic Wheelchair with the help of MEMS Module. The circuit works properly to maneuver because the command given by the user. After coming up with the circuit that allows physically disabled to regulate their wheel victimisation associate MEMS device application in their sensible phones and it's conjointly been tested and valid. The detection of any obstacle is with success controlled by the microcontroller. As the person switches on the circuit and starts moving, any obstacle that is anticipated to lie among a spread of four meters are detected by the unbearable device. This planned system contributes to the self-dependency of otherwise abled and older folks

2. Ankit Kunti ,Vikas Chouhan , Kuldeep Singh , Avinash Raj Yadav , Ishwar Yadav, D. Pankaj , Sandeep Somkuwar described in "Head-Motion Controlled Wheel Chair Direction Using ATMega328p Microcontroller" This survey is the accomplishment of the task where gesture controlled user interface for elderly and disable people has been. From this survey it has been identified that elderly and disable needs more technology support using their nature behavior, considering their limitations. We can use affordable technology for daily activities. The wheelchair is fully capable of carrying the load up to 110Kg, and moving in accordance to the head gesture given by the person who is using the wheel chair. Certain improvisation and improvement can be done to make the wheelchair more reachable to those whose whole body is paralyzed. Certain eyes gesture or brain signals reader can be imparted on the wheelchair system so as to make it better. For now, it works for all kind of disabled or elderly person, and even for those patients whose whole body is paralyses but still head movement is possible.

3. Dr. Sachin M. Bhosle, Mr. Mandar A. More, Mr. Ashish B. Nalawade, Mr. Ashutosh V. Hajare, Mr. Akshay B. Garad described in "Hand Gesture Controlled Wheelchair" The hand gesture-controlled wheelchair is a great improvement in assistive technology; however, it may have drawbacks and difficulties when it is put into use. There remains constant room for innovation and optimization in areas like cost, battery consumption, and the precision and reliability of gesture detection. However, the hand gesture-controlled wheelchair offers more mobility, independence, and social integration for people with physical limitations, which has the potential to significantly enhance their quality of life. Authors foresee even more advanced and effective versions of this technology in the future as research and development in this area continue to advance.

4. Harshwardhan Patil described in "Design and Making of Head Motion Controlled Wheelchair" With the completion of our wheelchair, we have concluded that it works well for head tilt motions and it proves to be an effective solution for quadriplegic patients with more than 45 % disability or for the patients with spinal cord injury who could not move their hands and legs for driving a manual or automatic wheelchair. This system proves better than automatic joystick powered wheelchairs in terms of ease of operation and head tilt control. Also, the project comes out to be economical as compared to other available wheelchairs in the market.

Chapter 3
3. PROJECT DESIGN

3.1 Standard Wheelchair:

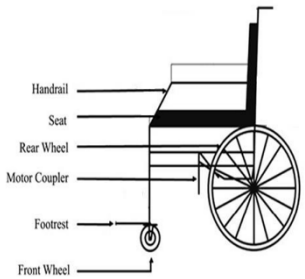


Figure 3.1. Manual Wheelchair

The quality of our project design is that any standard wheelchair available in the market can be converted into an electronic wheelchair. In our project we purchased a standard light weight wheelchair from the market. We welded a steel plate at the back of the wheelchair so that motors can be attached on this steel plate. Also a steel plate in the front bottom is welded to place the electronic components and batteries. After welding these plates the folding features of the wheelchair has been eliminated. After this welding process, the frame of the wheelchair became misaligned and it required enough time and effort to realign the frame and maintain the stability. We repainted the wheelchair to cover the welded parts and steel plates.

3.2 Materials

- Fabrication wheelchair
- Arduino Uno Board
- Caster Wheel
- Motion Sencer
- Specifications of motor
- Relay module

3.2.1 Fabrication wheelchair:

A wheelchair is a manually operated or power-driven device designed primarily for use by an individual with a mobility disability for the main purpose of indoor, or of both indoor and outdoor, locomotion. Wheelchair is a transportation device used by people who have difficulties in walking due to illness or disability. It is moved either by the handles or by turning the wheels. Today there are many options and many different types of wheelchairs such as manual wheelchairs, powered wheelchairs, and transport wheelchair. Wheelchair consists of mechanical components basically such as the hand rims, armrests, footrests, castors, seat and back upholstery.

3.2.2 Arduino Uno Board:

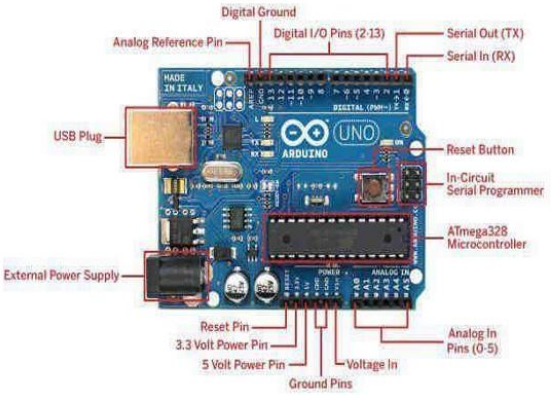


Figure 3.2.2 Arduino uno board

Arduino is an Open-source-electronic-prototyping-base for simple used hardware and software in the field of micro-controlling. A microcontroller (MCU for microcontroller unit or UC for µ-controller) is a little processor on a separate integrated circuit. In modern language, it is comparable to but less complicated than, a system on a chip (SoC). A microcontroller comprises one or higher CPUs (processors core) accompanying with memory and programmable input/output peripherals. Program memory in the form of ferroelectric. Arduino is a board which has ATmega328 microcontroller built on it. It has 16 MHz crystal, 6 analogue input and output pins, 14 digital input output pins and out of which 14 digital pins 6 pins can be used as PWM pins that are pretty accommodating in motor control applications. RAM, NOR flash or OTP ROM is also usually involved on chip, as well as a little amount of RAM Microcontrollers are created for embedded applications, in contrast to the microprocessor used in personal computers or other general-purpose applications consisting of various discrete chips. It contains a USB connector that can be practiced to attach Arduino to the pc for uploading the code. While Arduino is united to PC it can bring constant power from the PC needed for its operation. It has an adaptor jack which can be utilized to control the Arduino in offline mode. It has also Vin pin to allow the 9V supply required for its working. It has two to three 5V and ground pins which can be utilized to power up the diminutive power-consuming accessories directly from the Arduino.

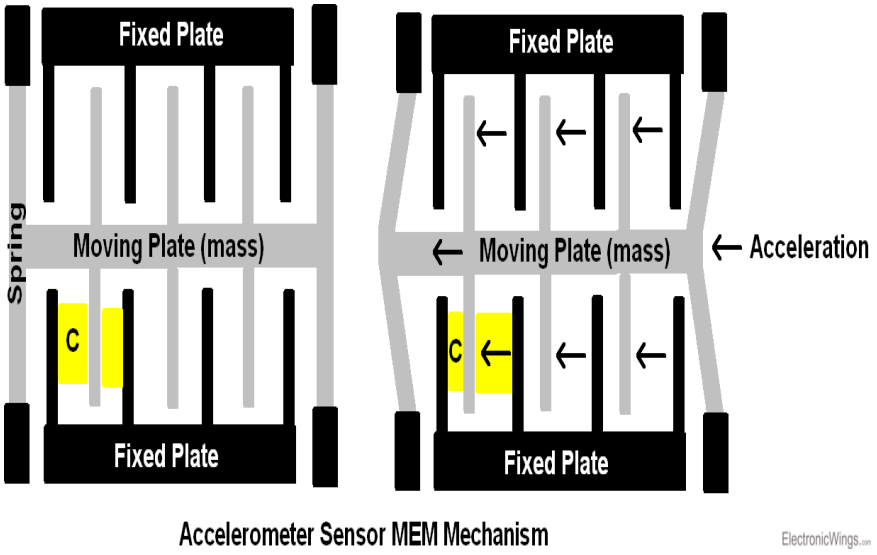
3.2.3 Caster wheel:

Figure 3.2.3 Caster wheel

A caster (or castor) is an undriven wheel that's designed to be attached to rock bottom of a bigger object (the "vehicle") to enable that object to be moved. Casters are utilized in numerous applications, including shopping carts, office chairs, hospital beds, and material handling equipment. High capacity, heavy duty casters are utilized in many industrial applications, like platform trucks, carts, assemblies, and tow-lines in plants.

3.2.4 Motion sensor:

• How Accelerometer Works:



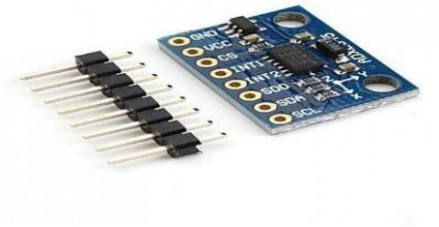


Figure 3.2.4 ADX335 accelerometer sensor

That acceleration hen gets converted into an amount of electric signal which is used for the measurements of variation in the position of the device. AThe accelerometer can be found with both the forms analog as well as digital form devices. The ADXL335 gives complete 3-axis acceleration measurement. This module measures acceleration within range ±3 g in the x, y and z axis. The output signals of this module are analog voltages that are proportional to the acceleration. . The sensor which tilt any direction for ex. Sensor tilt forward direction so the wheelchair is moves forward direction the same as backward direction tilt the sensor wheelchair is moves to backward direction same condition is left & right direction.

3.2.5 Specifications of Motors:

Figure 3.2.5 Gear Motor

We did research and perform calculations regarding the motor specification to be used in our project. We come up with decision that two permanent DC motors having 12V 17W and 5 ampere rating and RPM 50 should be used. The reason behind selecting high power rating is because we want our wheelchair to move smoothly on rough surface or terrains. Gear ratio 1:6 is used providing us enough torque to move the wheelchair smoothly from stationary position without jerks. Further more in order to have smooth motion and lesser noise we use helical gears instead of spur gears.

3.2.6 Relay module:

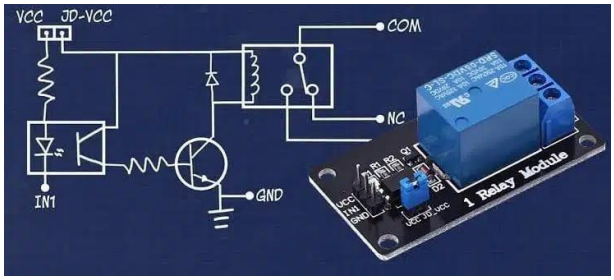


Figure 3.2.6 Relay Module

The switching device we used is Dual channel – dual motor control module. This device works with single channel max A 5 Amp Relay is Rated at 250 Volts AC. 5 x 250 = 1,250 AC Watts load capacity. So the advantage of using this relay module is that it will not burn out easily because of its higher specifications, our work is being done by only one module, as both the motors are being controlled by a single relay module circuit.

A two outputs for the two motors. The power vcc pins are attached to battery where 24 V are provided to the relay module , which are being transferred to the motors. The control vcc is connected to Arduino, from where the signal or command is transferred to the relay module to control the motors accordingly. To move the motors in forward direction.

Chapter 4

DESIGN AND IMPLEMENTATION

The relay module is connected to Arduino UNO the Arduino supply is 12v input supply the relay module is the switching device its work motor direction, such as forward, backward, left Right The accelerometer sensor is the connected the Arduino pin no. A4,A5 and the relay is connected is digital pins . 4 relay module is use in this project this function four direction the motor is connected relay module

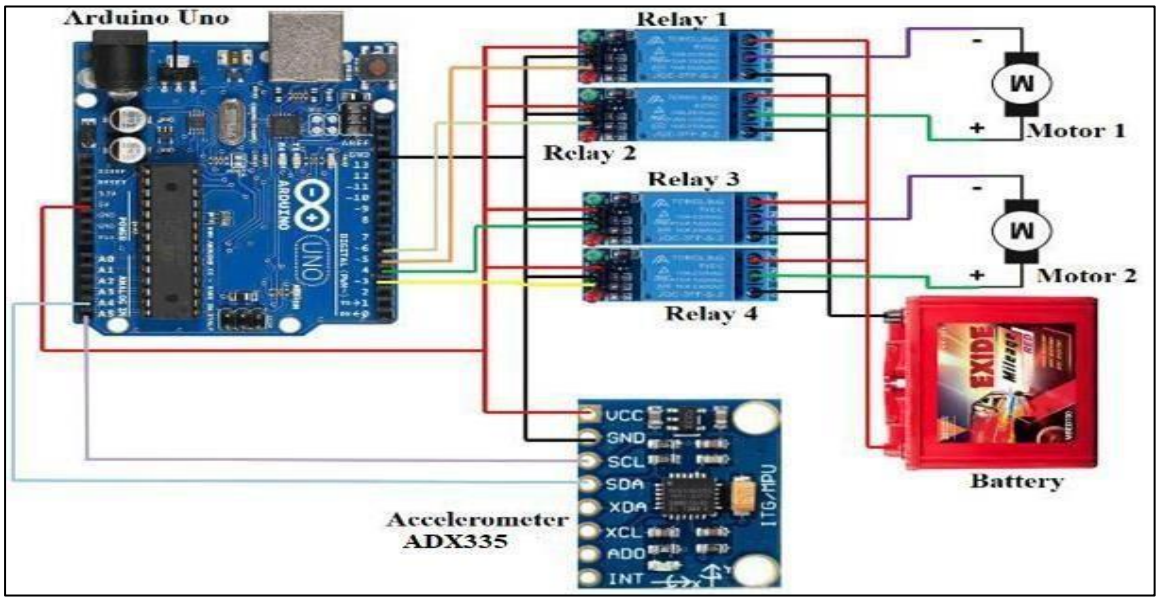


Figure 4. connection of circuit diagram

4.1 Wheelchair part name:

1	Weight Capacity	100kg
2	Maximum Speed	1 m/s
3	Diameter of Wheelchair Wheel	0.6 m
4	Battery Charger	2.4 A 12 V
5	Battery for motors	12 V 4.5 Ah
6	Battery for electronic components	12 V 4.5 Ah
7	Motor	17W 12 V
8	Batteries run time on full load	3 hours
9	Current drawn on full load	4 A

Tabel 4.1 Wheelchair Specification

4.2 Mechanical Assembly:

Two types of gears most widely available and used in India it is the chain. Gears having straight teeth are known as spur gears and they can be fabricated easily. Teeth of the chain gears are at an angle and are difficult to make in comparison to spur gears. Chain gear have advantage over spur gears because of the fact that they make less noise.

Chain gears teeth engage smoothly and gradually but they are less efficient than spur gears. Chain gears are more durable and run smoothly on high loads. Friction is greater in spur gears and because of this they wear out quickly as compared to chain gears. Considering these facts chain gears are chosen in our mechanical design. Gear ratio was set 1:6 means driving gear has one third the teeth as the driven gear. So basically, gears are being used to reduce the revolutions of the motor which was 180 revolutions per minute, which was too much for the wheelchair to move directly with the motors without using gears. This gear ratio was chosen keeping in mind the safety feature along with the required speed. Considering the weight of the wheelchair accompanied with electrical and mechanical components and weight of the person gear ratio was set to obtain torque according to our requirement. Mechanical design of wheelchair has been modified in such a way that gears between motors and shaft can be attached and detached according to user requirement.

Mechanical design of wheelchair has been modified in such a way that gears between motors and shaft can be attached and detached according to user requirement.

Chapter 5

PROPOSED SYSTEM

5.1 Methodology:

The accelerometer is used to detect the user's hand gestures, and the Arduino Uno is used to process the data from the accelerometer and send signals to the motor driver. The motor driver then controls the movement of the DC motor, which in turn moves the wheelchair. The wheelchair is made in such a way that any individual may control it with ease if they just move their wrist. The hand movements are recognized by using hand gesture recognition algorithm. It recognizes five different hand movements like forward, reverse, left, right and stop. Here an accelerometer sensor is used, which gives the analog signal according to the tilt of the accelerometer in x (x positive axis, x negative axis) and y (y positive axis, y negative axis) direction and RF module is used to transmit the signal from the transmitter section to receiver section then the movement of the hand.

5.2 Block Diagram:

Block diagram represents the main components and basic functioning of our project. The inertial measurement unit is mounted on the headset. Headset consist of four main parts including pressure sensor, three-axis gyroscope, tilt axis accelerometer and 3-axis magnetic field. We are only using accelerometer in our project. Accelerometer detects the orientation of the head and sends raw value signals to the micro- controller which is Arduino mega 2560. It provides ten degree of freedom to the user for the measurement of a body. Arduino process the information according to control algorithm we proposed.

The processed information is send to the H-bridge to drive the motors accordingly. If the person moves head towards right the wheelchair right wheel stop and left wheel began to move hence wheelchair moves in the right direction. If the person moves head towards left the wheelchair left wheel stop and right wheel began to move hence wheelchair moves in the left direction. If the person keep his head straight wheelchair both wheel halts and hence it stops. If the person bend his head forward both wheels began to move and hence wheelchair began to move in forward direction.

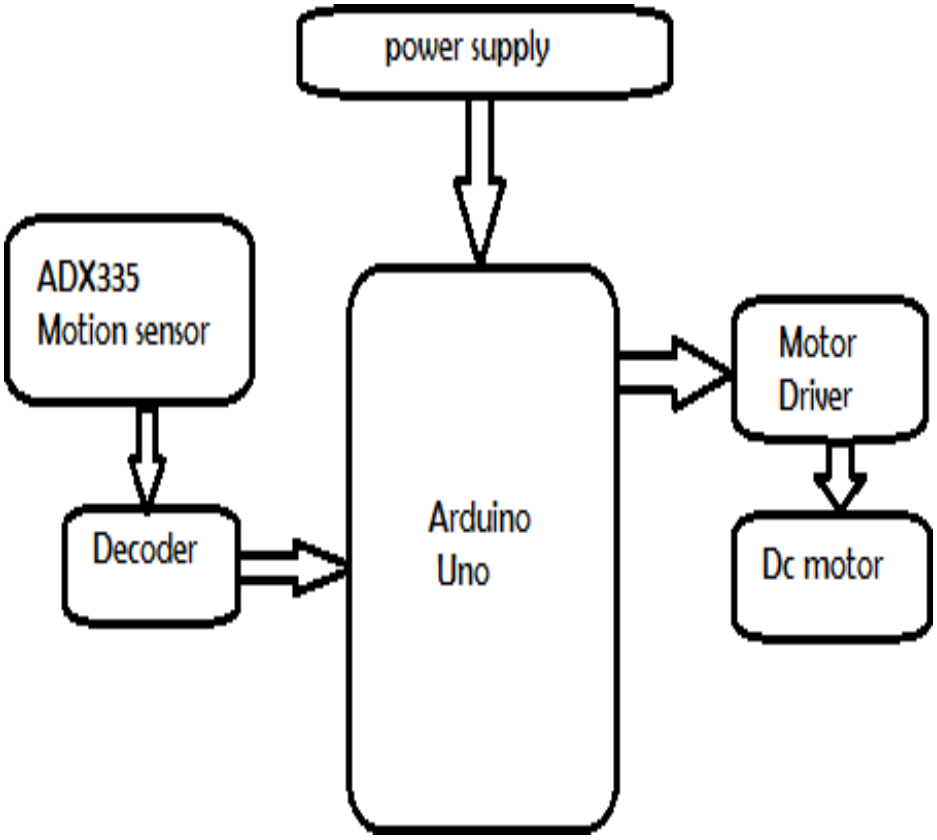


Figure. 5.2 Block diagram

5.3 Working Principle:

Now we look the working principle of our project by using step by step method. The IMU sensor attached on the headset gives the movement commands by detecting the orientation of the head.

Following are the commanding options available for patient.

• Forward command

By tilting his head in forward direction at the angle of 20 degrees

• Stop Command

By keeping the head in straight position

• Right Command

By tilting his head towards right at the angle of 20 degrees

• Left Command

By tilting his head towards left at the angle of 20 degrees

When the user is sitting on the wheelchair with a straight hand position, the stop condition is being met and wheelchair shows no response. Now if the user want to move in forward direction he has to tilt the head 20 degrees downward. As long as the users head orientation is greater than 20 degrees downward, the wheelchair will continue to move forward unless user return the head to less than 20 degrees, where stop condition sets true. Similarly, is the case for left and right conditions. The micro-controller, Arduino UNO, receives new values from the accelerometer after every 100ms. So if the forward command is true, the relay module allows both the motors to power up at the same instant and hence wheelchair moves forward. When forward loop is executed the relay module of both the left and right motors is set to HIGH hence both wheels start to move in forward direction. When the Stop loop is executed the ENABLE pins for both motors are set to LOW hence both wheels stop. When the Right loop is executed the relay pin for left motor is set to HIGH and RPWM pin for Right motor is set to HIGH, Hence wheelchair turns towards right. When the Left loop is executed the relay pin for Right motor is set to HIGH and RPM for left motor is set to HIGH.

Hence wheelchair turns towards Left. Arduino is also powered by the 12V batteries source. As the microcontroller Arduino UNO operates on low voltage and current, so a circuit was needed to lower the voltage coming from the battery to power the controller. This was done by LM7809 regulator IC which steps down the voltage from 12V to 9 V Another feature of moving the wheelchair backward is not added in the project keeping in account the safety features of the patient as he is unable to look back.

5.4 Control Algorithm:

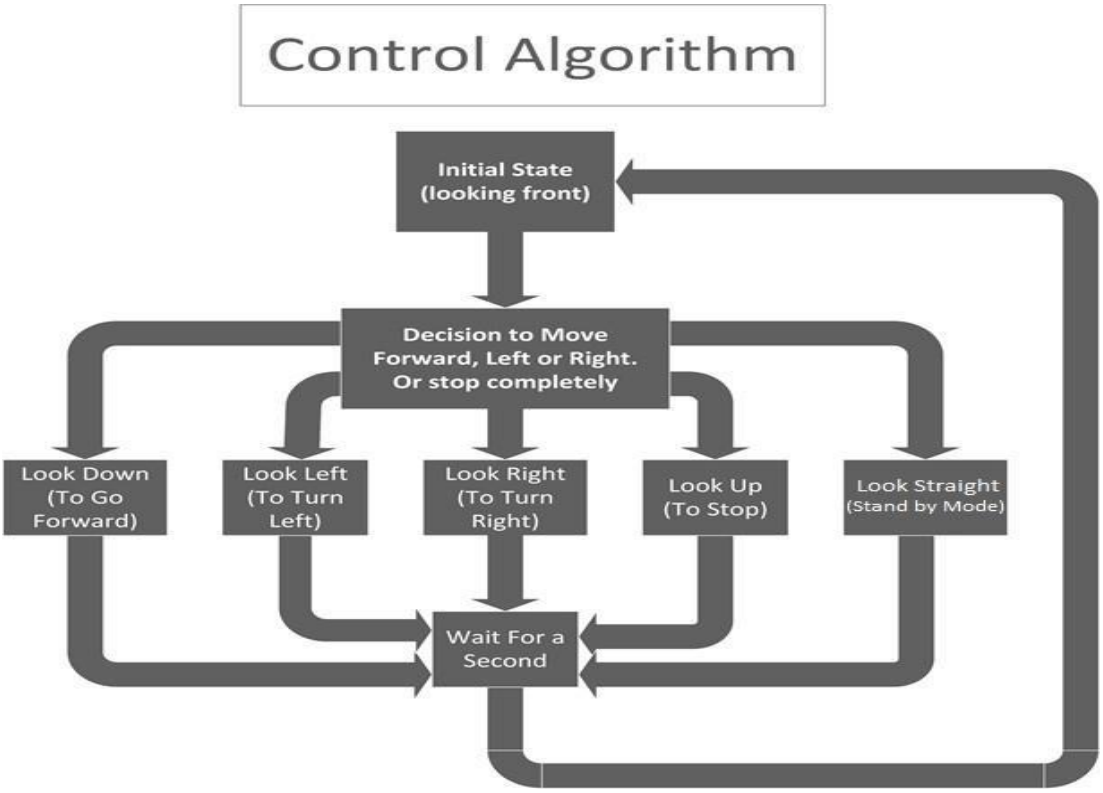


Figure 5.4 Movement Commands

Head tilted forward > 20°	Wheelchair moves forward
Head tilted backward < 20°	Wheelchair stops
Head tilted right > 20°	Wheelchair turns right
Head tilted left <-20°	Wheelchair turns left

Table 5.4 Command Direction

Chapter 6

RATING OF EQUIPMENT'S

6.1 Rating Of Equipment:

Component	Quantity	Ratting
Arduino	01	5v input
wheelchair	01	--
Dc motor	02	12 v
Dc motor driver	04	input :12v output:12v
ADXL335, sensor module	01	9v
Battery	02	12v, 8ah, 2.40A
Charger	01	12v , 2.0A
Jumper wire	--	--

Table 6.1 Rating Of Equipment

Chapter 7

SYSTEM PERFORMANCE

7.1 System Development:

1. Requirement Analysis:
2. Research and Technology Review:
3. Prototyping and Experimentation:
4. System Design and Architecture:
5. Deployment and Evaluation:
6. Implementation and Integration:
7. Testing and Validation:

Chapter 8

Advantages

1. Enhanced mobility
2. Intuitive operation
3. Convenience and comfort
4. Increased social interaction

Chapter 9

RESULT

1.Battery takes 2 hr. to 2.30 hr. full charge

2.Ones the fully charge battery discharge time is 2.30 HR’s

3.Battery current are 8amp and 12 volt supply.

4.The wiring resistance are 0.2 gauge

5.The all electrical equipment are 12volt supply

Chapter 10

CONCLUSION AND FUTURE WORK

10.1 Conclusion:

The wheelchair is fully capable of carrying the person load up to 100kg. The improvement in assistive technology, the hand gesture operated wheelchair increases freedom and mobility for those with physical limitations. Users may operate the wheelchair, carry out necessary tasks, and interact with their surroundings by using hand gestures.

In conclusion, the hand gesture-controlled wheelchair provides a number of noteworthy The hand gesture-controlled wheelchair is a great improvement in assistive technology; however, it may have drawbacks and difficulties when it is put into use. There remains constant room for innovation and optimization in areas like cost, battery consumption, and the precision and reliability of gesture detection. However, the hand gesture controlled wheelchair offers more mobility, independence, and social integration for people with physical limitations, which has the potential to significantly enhance their quality of life. Authors foresee even more advanced and effective versions of this technology in the future as research and development in this area continue to advance.

Main components used in our project is IMU sensor, Arduino Mega 2560, H bridge and motors. Values from the movement of head is given by the accelerometer mounted on the IMU sensor, micro-controller receives that values and processed it. Theses processed commands are then send to the relay module to operate the motors accordingly. Processing of the commands in the micro-controller are performed according to our designed control algorithm. Four commanding actions can be performed by patient; forward, right, left, stop. By tilting his head towards forward wheelchair moves in forward direction and same goes for right and left command. We all are extremely thankful to our advisor Prof .Gophane M.S. and co-advisor prof. Deokar .T.V for their guidance and support through the final year project from the very beginning to the completion.

10.2 Future Works:

- Controlling of speed:

Presently our wheelchair is moving with a constant speed. The speed cannot be varied by users or patients desire. So two types of modifications can be done i.e. either by PWM pins in the Arduino code or by providing variable voltage to the motors of the wheelchair.

- Obstacle detection system:

Currently there is no such mechanism for obstacle detection, however a system can be introduced in such a way that if some obstacle is detected the wheelchair should stop to avoid any collision or incident..

- Health monitor:

A health monitoring system should be introduced in the wheelchair such that it can measure basic information about health, such as temperature, blood pressure and pulse etc. Upper and lower ranges should be defined and immediate emergency indication should be provided to the care taker on crossing these ranges. Speed controller can be added to get.

- Different modes of speed:

Camera can be added for full autonomous navigation and laser scanner can be added to avoid collision. Robotic arm can be installed on the wheelchair for wheelchair to the specified location.

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