CHAPTER 1

INTRODUCTION

1.1 OVERVIEW OF THE PROJECT

It is an Android application and a voice recognition system which mainly focuses for paralysis patients. However, many disabled people who require wheelchairs are happy with it. But, few people with disabilities find it hard or impossible to operate a regular motorized wheelchair. Assistive technology includes this initiative. It is more independent, fruitful, and joyful for dependent and disabled people to live this way. A wheelchair is necessary for a disabled person with locomotors impairments to do tasks that involve movement. physically propelling the wheelchair, can be done by Most of the physically challenged people but some of them are physically unable to use manual controls or find them to be too taxing. Because of this, it would be ideal to give them a motorized wheelchair that they can operate by speaking directions. what any language conveys. This technology (wheelchair) can therefore be used by people who do not speak English. It can move at a reasonable speed because it's crucial for a motorized wheelchair to be able to automatically avoid obstacles in real time. For as many disabled people as possible, the price of this motorized wheelchair is affordable.

This concept outlines a wheelchair that can only be operated via an Android application and the user's voice. This project's primary goal is to aid with the movement of elderly persons and those with disabilities who have trouble moving around. Enabling individuals to live better lives without difficulty A vital tool that can help is speech recognition. Wheelchair control through human-machine interaction. It has been realized that our Android phone acts as a middleman for human voice input. Within this project, based on the input of a human voice, a wheelchair's movement is controlled by an Ardiuno kit.

Several studies have shown that each youngsters and adults profit well from access to a method of freelance quality. Whereas the wants of the many people with disabilities are often glad with ancient manual or supercharged wheelchairs, a phase of the disabled community finds it's tough to use wheelchairs severally. "Smart wheelchairs are the focus of analysis ever since the first eighties and are

developed on four continents. Smart wheelchairs additionally offer a chance to review human-robot interaction, reconciling or shared management, and novel input ways, like voice management, EOG, and eye- pursuit.

Though the recent developments of science and technology has drastically changed the way a normal person lives his life , there are certain groups of people who have not been able to be benefit from this development. On particular handicapped people with have limited mobility are still living a miserable life. A smart wheel chair aims to provide aid to those handicapped and physically challenged persons by providing them with some sort of mobility which would greatly help them. Smart wheel chair consists of a major controller unit which allows the user to provide the input in the form of joystick or accelerometer or a voice command. The controller unit then synthesizes the command and takes required action so as to move the wheelchair to the particular position.

It is designed to build an avoidance robotic vehicle using ultrasonic sensors for its movement. An Arduino is used to achieve the desired operation. A robot is a machine that can perform task automatically. Robotics is generally a combination of computational intelligence and physical machines (motors). Computational intelligence involves the programmed instructions from one system to other system.The project proposes robotic vehicle that has an intelligence built in it such that it guides itself whenever an obstacle comes ahead of it. This robotic vehicle is built, using an Arduino uno. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the Arduino.

In today’s world robotics is a fast growing and interesting field. robot has sufficient intelligence to cover the maximum area of provided space. Autonomous Intelligent Robots are robots that can perform desired tasks in unstructured environments without continuous human guidance. The obstacle detection is primary requirement of this autonomous robot. The robot gets the information from surrounding area through mounted sensors on the robot.

1.2 OBJECTIVE

Fall detection is major challenge in health care domains. For elder individuals, it's terribly troublesome to manage once they area unit fall from chair. It terribly serious and results in particularly health care problems. Thus we've developed an IoT primarily based fall detection system that involves, if someone falls from the chair, it'll activate the buzzer and alert the individuals around that

place, and also the fall detection can updated. Here we have a tendency to area unit victimization IoT primarily based local area network that shows the autumn detection. For police work the autumn detection we have a tendency to area unit victimization measuring instrument and gyro sensors. If the device worth's exceeds the actual threshold value, it'll detect as fall, the buzzer can on.

The objective of this equip the present motorized wheelchair control system with a voice command system at low-price and friendly operation. By having these features, differently able people especially with a severe disability who are unable to move like normal people will be able to move independently. Prototypes of several smart wheelchairs have been developed, based on advanced technology to help the differently abed. In 2012, Megalingam, Rajesh Kannan, et al, proposed a system that uses a small camera mounted very close to the user's hand, which tracks the small movements of their fingers to understand the direction of movement of the wheelchair. A gesture recognition system which identifies the gesture is then interfaced to the wheelchair control system inorder move it to the desired location. In 2012, Andrej Škraba et al, presented a prototype speech controlled cloud based wheelchair platform. The control of the platform is implemented using low-cost available speech Web Kit in the cloud. Besides the voice control, the GUI is implemented which works in the web browser as well as on the mobile devices providing live video stream. In 2014, Sobia, M. Carmel et al, proposed a wheelchair command interface that does not require the other's hands. It includes 3 major modules. They are face detection, facial expression recognition and command generation. The software contains digital image processing for face detection, principal component analysis for facial expression recognition and generating a command signals for interfacing the wheelchair.

In 2016, Klabi I. et al, presented controlled the movement of wheelchair in different directions by monitoring voice commands and also the simple movement of the patient's face. Automatic obstacle detection and avoidance had been done using ultrasonic and infrared sensors which helps the patient to apply a temporary brake in case any obstacle suddenly comes in the way of the wheelchair. Also wall tracking and target tracking algorithms had been developed in the wheelchair. Each one of the works above has its drawbacks and weakness. In this project, simple package with very cheap electronics that would not intricate the wheelchair and

with high efficiency voice recognizer that could achieve sometimes to 100% of recognition rate, is used to build an effective voice-controlled smart wheelchair.

In 2024, we have Proposed a project which can sense ultrasonic based active smart wheelchair to detect an obstacle and a wheelchair that can only be operated via an Android application and the user's voice. we have made possible by using arduino uno to sense any obstacle using ultrasonic sensors,and the ultrasonic based voice active smart wheelchair that can benefit from future enhancements such as improved navigation, enhanced voice recognition, integration with smart home devices, improved ergonomics, communication with medical devices, and advanced security and safety measures.

CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

This population needs a support that is provided by wheelchair. The normal pushing wheelchair is the primitive one in which the user has to push the chair with the hands. It has a stress on the user when travelling for a long distance. So with the help of technology and human intelligence the idea of automated wheelchair was evolved. An automated wheelchair is based on some input interfacing machine which provides input to the motor. The motor processes the input provided and takes the corresponding action(in terms of movement move left, front, back, right). With the introduction of android Smartphone in the system, the working becomes less complex. The system becomes quite user-friendly to the user.

2.2 LITERATURE REVIEW

The majority of wheelchairs in use today are physically propelled models, making them difficult for most physically challenged people to operate without assistance from (or intervention from) others. There are wheelchairs with joystick controls for physically disabled people who are unable to operate a standard wheelchair on their own and always require assistance. But other persons with physical disabilities who couldn't use their arms to steer the wheelchair are still in pain. Even wheelchairs with joystick controls are not offered at reasonable prices. A very small number of wheelchairs are available with audio controls, although they are very expensive. Even they are not responsive to spoken commands in any other language other than English. Additionally, the current smart wheelchair is significantly heavier than the standard wheelchair. It cannot be folded, so a special truck is required to transport it wherever the user goes.

Sharifuddin et al. proposed the Comparison of CNNs and SVM for voice control wheelchair. The automation with the advance of technology in term of speed and modularity and robotic system comes into reality. In this paper an obstacle detection robot system explained for different purposes and applications. The ultrasonic and infrared sensors are actualized to distinguish obstacles another robot's way by imparting signs to and interfaced microcontroller. The miniature

regulator diverts the robot to mover substitute way by inciting the motors in request to keep away from the distinguished obstacle. The exhibition assessment of the framework shows an exactness of 85 percentage and 0.15 likelihood of disappointment individually. Taking everything into account, an obstacle discovery circuit was effectively actualized utilizing the infrared and ultrasonic sensors that were mounted on the panel.

Abdul ghani et al. proposed wheelchair neuro fuzzy control and tracking based on voice recognition. An obstacle avoidance robot vehicle which is controlled by ultrasonic sensor and with bluetooth device is discussed here. The robot is made using ultrasonic sensor and it is controlled by Arduino microcontroller. Ultrasonic sensor fixed in front portion of the robot vehicle. The sensor gets the data from surrounding area through mounted sensors on the robot. The sensor is sense the obstacle and deviate its path to choose an obstacle free path. The sensor will be send the data to the controller is compared with controller to decide the movement of the robot Wheel. The robot wheel movement and direction will be based on the sensing of the ultrasonic sensor and also using a wheel encoder. This vehicle is used for detecting obstacle and avoiding the collision. We have programmed the controller to be used with Android app.

Arun Francis et al. proposed An Object Detection Using Ultrasonic Sensor International Journal of Innovative Technology.The use of robot and its enormous technological applications in today's era of industrial and intelligent systems has been seen to be highly impactful. The ability of these robots to move freely with minimal control is posing a real challenge. In this paper, the development of an autonomous obstacle avoidance robot using ultrasonic sensors is presented. In the design, the ultrasonic sensor serves as the eye of the robot to aid its autonomous movement. The robot is a wheeled type which can either be control using ad edicated control application (Android App) or autonomously. The control application was an added feature in case there is need to manually control the robot. The accuracy of the robot obstacle avoidance is highly encouraging scoring 87.5%, although, there are other challenges which are noted for further study.

M. Callejas-Cuervo et al. proposed the Design and implementation of a position, speed and orientation fuzzy controller using a motion capture system to operate a wheelchair prototype.The existing ultrasonic obstacle avoidance robot only uses an

ultrasonic sensor in the process of obstacle avoidance, which can only be avoided according to the fixed obstacle avoidance route. Obstacle avoidance cannot follow additional information. At the same time, existing robots rarely involve the obstacle avoidance strategy of avoiding pits. In this study, on the basis of ultrasonic sensor obstacle avoidance, visual information is added so the robot in the process of obstacle avoidance can refer to the direction indicated by road signs to avoid obstacles, at the same time, the study added an infrared ranging sensor, so the robot can avoid potholes. Aiming at this situation, this paper proposes an intelligent obstacle avoidance design of an autonomous mobile robot based on a multi-sensor in a multi-obstruction environment. Cascade Classifier is used to train positive and negative samples for road signs with similar colour and shape. A multi-sensor information fusion is used for path planning and the obstacle avoidance logic of the intelligent robot is designed to realize autonomous obstacle avoidance.

P. Ranjith Kumar et al. proposed An iot based User- Friendly Wheelchair.People with severe disabilities often rely on power wheelchairs for moving around. Although the needs of many people with disabilities can be met by wheelchair or portable wheelchairs, the disabled community finds it difficult or impossible to use wheelchairs independently. To meet this need, researchers have used advanced technology to enable mobile robots to build "smart wheelchairs" and have been the subject of research since the early 1980s and are built on four continents. This article presents a summary of the current state of the art and the directions for future research.

Sateesh Reddy Avutu et al .proposed a Modelling of Brushless DC Hub Motor to Control the Speed of Indigenous Powered Wheelchair Disabled Person.Physically challenged persons those who are suffering through different physical disabilities face many challenging problems in their day to day life for commutating from one place to another and even sometimes they need to have to be dependent on other person to move from one place to another. There have been many significant efforts over the past few years to develop smart wheel chair platforms that could enable the person for its ease of operation without any ambiguity. The main aim of our paper is to develop the smart wheel chair to make the life easier of physically challenged persons This voice-activated smart wheelchair has improved functions like voice control, electric power, queue following, obstacle avoidance, etc. The integrated AVR microprocessor

ATmega328 smart wheel chair control unit also includes Bluetooth, GSM, ultrasonic, and infrared sensors, a temperature sensor LM35, and a motor driving circuit for managing the motor's speed.

M. A. Kader et al .proposed a Design and implementation of a head motion-controlled semi-autonomous wheelchair for quadriplegic patients based on 3-axis accelerometer. The voice-controlled wheel chair system's primary goal is to suggest ways to control a wheelchair using a speech recognition module. The system can be used to operate a wheelchair by voice command. The goal of this concept is to facilitate the movement of older individuals who are unable to move with ease as well as disabled or handicapped people. This system's objective is to lessen certain people's reliance on other people for daily needs like movement. The use of speech recognition technology will open up new possibilities for how people interact with tools and machines. Therefore, by utilizing speech recognition technology for the movement, the issues that they confront can be resolved.

A. Jayakody et al.proposed a Smart Wheelchair to Facilitate Disabled Individuals.In this study, an electric wheelchair that combines two controls: joystick analog and voice control is designed. IC MCP3008 is used to navigate wheelchairs by using Joystick, where joystick analog data will be converted into digital data. The movements resulted from the joystick analog on the xAxis axis (horizontally) are the right turn and left turn, and on the yAxis axis (vertically) are forward and backward, The results of the wheelchair control testing with sound indicate that the accuracy and speed of the wheelchair response rely heavily on Internet connection and room conditions. The average response when the condition of the room is quiet is 0.16 s and when the condition of the room is noisy is 5.18 s. Wheelchairs with joystick control and the voice made can be used for the disabled, whether for those who can move their fingers or not, at a low cost so that they can be an alternative in developing countries.

Zhao et al.proposed a voice control method for intelligent wheelchair based on convolutional neural network.Physically propelling the wheelchair, can be done by Most of the physically challenged people But some of them are physically unable to use manual controls or find them to be too taxing. Because of this, it would be ideal to give them a motorized wheelchair that they can operate by speaking directions. what any language conveys. This technology (wheelchair) can therefore

be used by people who do not speak English. It can move at a reasonable speed because it's crucial for a motorized wheelchair to be able to automatically avoid obstacles in real time. For as many disabled people as possible, the price of this motorized wheelchair is affordable.

Monali Mundane et al. proposed a voice-controlled intelligent wheelchair for people with disabilities or impairments. Automation is the technique of making an apparatus, a process, or a system operate automatically. With respect to automation a smart idea is developed towards the handicapped people, and physically challenged people. This paper proposed an idea and model to ease those persons, who cannot perform hand movements in a way that can move a wheelchair. Several studies have shown that both children and adults benefit substantially from access to a means of independent mobility. This paper describes the design of a smart, motorized, voice-controlled wheelchair using embedded system. Proposed design supports voice activation system for physically disabled persons incorporating manual operation. This system consists of hand gesture-controlled wheelchair using image processing through web camera which not only recognizes hand gesture but also control the wheelchair according to the hand movement. It includes HSV shading space method to discover hand motion thought picture preparing. This paper utilized the raspberry pi board and sensors to detect obstacles lying ahead in the way of the wheelchair that can hinder the passage of the wheelchair. This designed wheelchair in prototype form is tested and get accurate output and efficient framework for the users with low power consumption.

2.3 CONCLUSION

In conclusion, the ultrasonic based voice active smart wheelchair can benefit from future enhancements such as improved navigation, enhanced voice recognition, integration with smart home devices, improved ergonomics, communication with medical devices, and advanced security and safety measures. Future enhancements will not only improve the user's life by providing a more efficient, comfortable, and natural interaction and more control over their immediate environment. This system will be additional developed into Associate in Nursing intelligent system that works on machine intelligence to assist report with alternative varied medical conditions with the assistance of alternative sensors. It elaborates the design and construction of Smart Electronic Wheelchair

with the help of Bluetooth Module. The circuit works properly to move as the command given by the user. After designing the circuit that enables physically disabled to control their wheel using an android application in their smartphones and it has also been tested and validated. The detection of any obstacle is successfully controlled by the microcontroller. As the person switches on the circuit and starts moving, any obstacle which is expected to lie within a range of 4 metres will be detected by the Ultrasonic sensor. This proposed system contributes to the self-dependency of differently abled and older people.

CHAPTER 3

SYSTEM ANALYSIS

3.1 EXISTING SYSTEM

In existing system, “Active Smart Robotic Wheelchair Vehicle Using Ultrasonic Sensor, Android and Bluetooth for Obstacle Detection” has been designed and developed by Vaghela et.al has mentioned that enormous amount of work has been done on wireless gesture controlling of robots. Although, recent researches in this field have made wireless gesture controlling a ubiquitous phenomenon, it needs to acquire more focus in relevant areas of applications like home appliances, wheelchairs, artificial nurses, table top screens etc. in a collaborative manner.

3.1.1 OBJECTIVES / AIM OF THE PROJECT WORK

Obstacle detection is considered as the primary requirement for an autonomous robot. A robotic car will avoid collisions and accidents. The obstacle avoidance is an autonomous robot which is used for detecting the presence of an object or an obstacle and avoiding the collision that makes both the robot and the environment safe. Effective obstacle detection can thus only be achieved via handling previously unseen objects. To this end, existing methods generate synthetic training frames by injecting objects into the road scenes. However, they use random object sizes and locations

3.1.2 PROBLEM STATEMENT / SCOPE OF THE PROJECT WORK

Robotics cars are a threat to life as sudden approach can’t be detected so we are creating this obstacle avoiding sensor to detect that Privacy and security might get affected so it can be hacked. It requires prior knowledge of the road and as well as how to operate that is the reason, we are building it with minimal hardware objects so that it is easily accessible

3.2 PROPOSED SYSTEM

This voice-controlled system makes them more independent. Powered wheelchairs with the standard joystick interface are unable to be controlled by many people. A voice-controlled wheelchair can provide easy access for physical disabled

persons who cannot control their movements, especially hands. Particularly in this project, we increase the smart wheelchair's intelligence so that it may be accessed using our own native languages.

Any language's comments are possible. In order for someone who does not speak English can also utilize this smart device. This technology was added to a foldable wheelchair, making it more portable and practical because it can be folded up like a regular wheelchair. For someone who is physically challenged, this endeavor can be quite beneficial.

We can also alter a few things in the coding to make it even smarter for blind folks. It can move automatically and use an ultrasonic sensor to automatically detect impediments. This wheelchair's battery lasts for a very long time. Only a smaller amount of electricity is needed. By pulling the cable to the switch box, it can be recharged. We don't want to often replenish the battery because the wheelchair's sensors, motors, and other components utilize very little electricity.

3.2.1 FEATURES

The future of the ultrasonic based voice active smart wheelchair is bright, with continued enhancements and advancements in technology. The proposed system is an innovation that will benefit millions of individuals with mobility difficulties. Future improvements include more sophisticated natural language processing, better ergonomics, and enhanced safety features such as obstacle detection, collision avoidance, fall prevention, and medical device integration. With these improvements, the smart wheelchair will become more versatile, adaptable, and accessible.

In addition, the proposed system of integrating ultrasonic sensors with voice activated controls can be extended to other assistive devices, such as hospital beds, rehabilitation equipment, and home automation systems, to provide people with disabilities more precise and automated assistance. The smart wheelchair will continue to be more intuitive and customizable, enabling ease of movement and independence for individuals with disabilities. The future of the ultrasonic based voice active smart wheelchair is focused on enhancing the user experience, safety, mobility, and accessibility.

3.3 SYSTEM DESIGN

Once the requirements are finalized, the design phase can begin. The design phase involves developing a detailed plan of the system's architecture, functionality, and interface. A team of experts develops the hardware and software specification for each module, as well as their integration with other components. The design is based on user requirements, technological standards, and best practices. After successful testing and evaluation, the system is deployed to the end-users. The final preparation is made and the system is installed at the desired location. Training on the system is conducted to facilitate better user understanding and use.

3.3.1 SYSTEM SPECIFICATIONS

The file design of an ultrasonic based voice active smart wheelchair includes both software and hardware elements. The following are some of the critical design files required for the wheelchair system.

3.4 HARDWARE FILES

3.4.1 CAD FILES

The CAD (Computer-Aided Design) files include 3D models of the wheelchair, its components and all parts of the system that need to be produced by 3D printing or machining.

3.4.2 PCB DESIGN

The PCB (Printed Circuit Board) design files contain layouts for the board that will house various electronic components. It will guide the manufacturers of PCBs to produce the board with exact specifications.

3.4.3 WIRING DIAGRAM

Wiring diagrams schematically represent the various connections between the different components of the system. They will guide the technicians in the installation process.

3.5 SOFTWARE FILES

3.5.1 SOURCE CODE

The source code files are written in a language such as C++ that describes the behaviour of each software module that constitutes the Voice Active Smart Wheelchair system.

3.5.2 ARDUINO SKETCH FILES

The sketch files contain a set of standardized commands that are required to operate the Arduino microcontroller.

3.5.3 MOBILE APPLICATION FILES

The mobile application developed for the system, for instance in Android, will manage communication between the system and the user's mobile device.

3.6 DOCUMENTATION FILES

3.6.1 USER MANUAL

The user manual is intended to educate the user about the features of the system, guiding software installation and configuration.

3.6.2 TECHNICAL MANUAL

A Technical Manual outlines the system's hardware and software modules and provides instructions on how to assemble and install the system.

CHAPTER 4

ULTRASONIC BASED SMART ROBOT WHEELCHAIR USING ARDUINO

4.1 PROJECT DESCRIPTION

The list specifies the necessary components and parts required for the operation of the system. The required file design for an ultrasonic-based voice-activated smart wheelchair includes hardware files like CAD files, PCB designs, and Wiring Diagrams. The software files may include source code, Arduino Sketch files, and Mobile Application files while technical and user manual and bill of materials documents are essential documentation resources.

4.2 MODULES DESCRIPTION

4.2.1 VOICE RECOGNITION MODULE

The Voice Recognition Module is responsible for receiving voice commands from the user. It consists of a microphone, pre-amplifier, and voice recognition algorithm as described below:

- **Microphone:** The microphone captures the user's voice and converts it into an electrical signal.

- **Pre-amplifier:** The signal obtained from the microphone is weak and requires amplification. The pre-amplifier amplifies the electrical signal from the microphone.

- **Voice Recognition Algorithm:** The voice recognition algorithm analyzes the amplified signal and determines whether the input corresponds to a valid command, such as "move forward" or "stop". Once a valid command is detected, it sends the command to the microcontroller.

4.2.2 ULTRASONIC SENSOR MODULE

The Ultrasonic Sensor Module is responsible for sensing any obstacles in the wheelchair's path. It contains ultrasonic sensors, which are used to detect the

distance between the wheelchair and any obstacles. Ultrasonic sensors are used to measure the distance between the ultrasonic sensor and an obstacle. They emit high-frequency sound waves, which bounce off the obstacle and are received by the same sensor. The time it takes for the sound waves to travel between the sensor and the obstacle is calculated and converted into a distance. This information is then used by the microcontroller to navigate the wheelchair to avoid the obstacle.

The Voice Recognition Module and the Ultrasonic Sensor Module are integrated with a microcontroller to provide an efficient and effective input system for the ultrasonic based voice active smart wheelchair. These components work together seamlessly to provide the user with a safe and user-friendly interface for controlling the wheelchair.

4.3 OUTPUT DESIGN

The output design for the ultrasonic based voice active smart wheelchair primarily consists of two main components:

4.3.1 MOTOR DRIVER MODULE

The motor driver module is responsible for driving the motors that control the movement of the wheelchair. It comprises of an Arduino board, a Motor Shield, and servo motors as described below:

- **Arduino Board:** The Arduino board is the main component responsible for driving the motor driver module. It receives the commands from the microcontroller based on the input from the voice recognition and ultrasonic sensor modules.

- **Motor Shield:** The Motor Shield provides an interface between the Arduino board and the servo motors. It has multiple input and output pins that connect to the Arduino board and the servo motors.

- **Servo Motors:** The servo motors are used to control the movement of the wheelchair. They contain a small DC motor and a gear train that converts the rotation of the motor into linear motion, which is used to control the movement of the wheelchair

4.3.2 VOICE RECOGNITION MODULE

The output of the Voice Recognition Module in the ultrasonic based voice active smart wheelchair mainly consists of audio feedback, movement control, and an emergency stop feature in case of any emergency situation.

- **Audio Feedback:** The audio feedback feature of the Voice Recognition Module provides acknowledgement to the user that the wheelchair has recognized the voice command. Whenever a command is recognized, the audio feedback module produces an audible tone or message to confirm that the wheelchair is performing the specific task.

- **Movement Control:** The movement control feature of the Voice Recognition Module provides the output to the DC motors, which are responsible for the movement of the wheelchair. The voice commands given by the user are translated into motor movements to control the speed and direction of the wheelchair. When the user commands the wheelchair, the voice recognition module translates their commands into instructions for the motor driver IC to drive the wheels of the wheelchair in the desired direction and speed. The movement control feature ensures that the wheelchair provides efficient and reliable movement based on the user's commands.

- **Emergency Stop:** The Voice Recognition Module has an emergency stop feature that is activated when the user commands the wheelchair to "stop." This feature ensures that the wheelchair stops immediately in any emergency situation. When the emergency stop command is recognized, the voice recognition module generates an instruction to the motor driver IC to immediately stop the motors of the wheelchair, overriding any other movements or commands. The emergency stop feature provides an essential safety feature that ensures the user's safety in case of an unexpected situation. Overall, the Voice Recognition Module's output features provide a safe and reliable wheelchair control system based on the user's voice commands.

4.4 BLOCK DIAGRAM

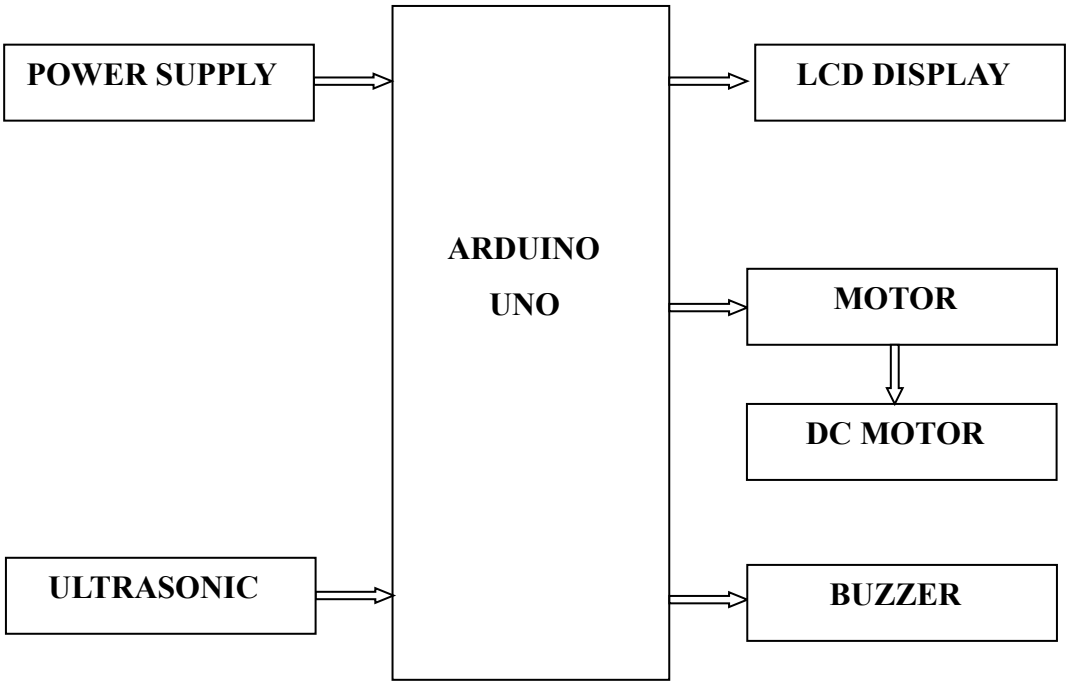

Fig. 4.4 : Block diagram of robot wheelchair

- **Power supply**: The motors draw power from the batteries and move the drive wheels.
- **Ultrasonic sensor:** actually consists of two parts: the emitter which produces a 40 kHz sound wave and detector which detects 40 kHz sound waveand sends electrical signal back to the microcontroller it include the equipment is kept on his head/ in his hand which detects the movement of the person. If the device finds the swing of head front then the chair moves forward automatically.
- **LCD Display:** A resistive touch screen comes preinstalled with the module as a bonus and hence you can easily detect your finger presses anywhere on the screen.
- **Motor Driver**: This joystick movement is converted to electrical signals, which are translated down to the motors by the control unit (which will act like the brain of the chair).
- **DC motor**: Here we are using 12V DC 60 RPM motor. 60RPM Centre Shaft Economy Series DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties.

4.5 CIRCUIT DIAGRAM

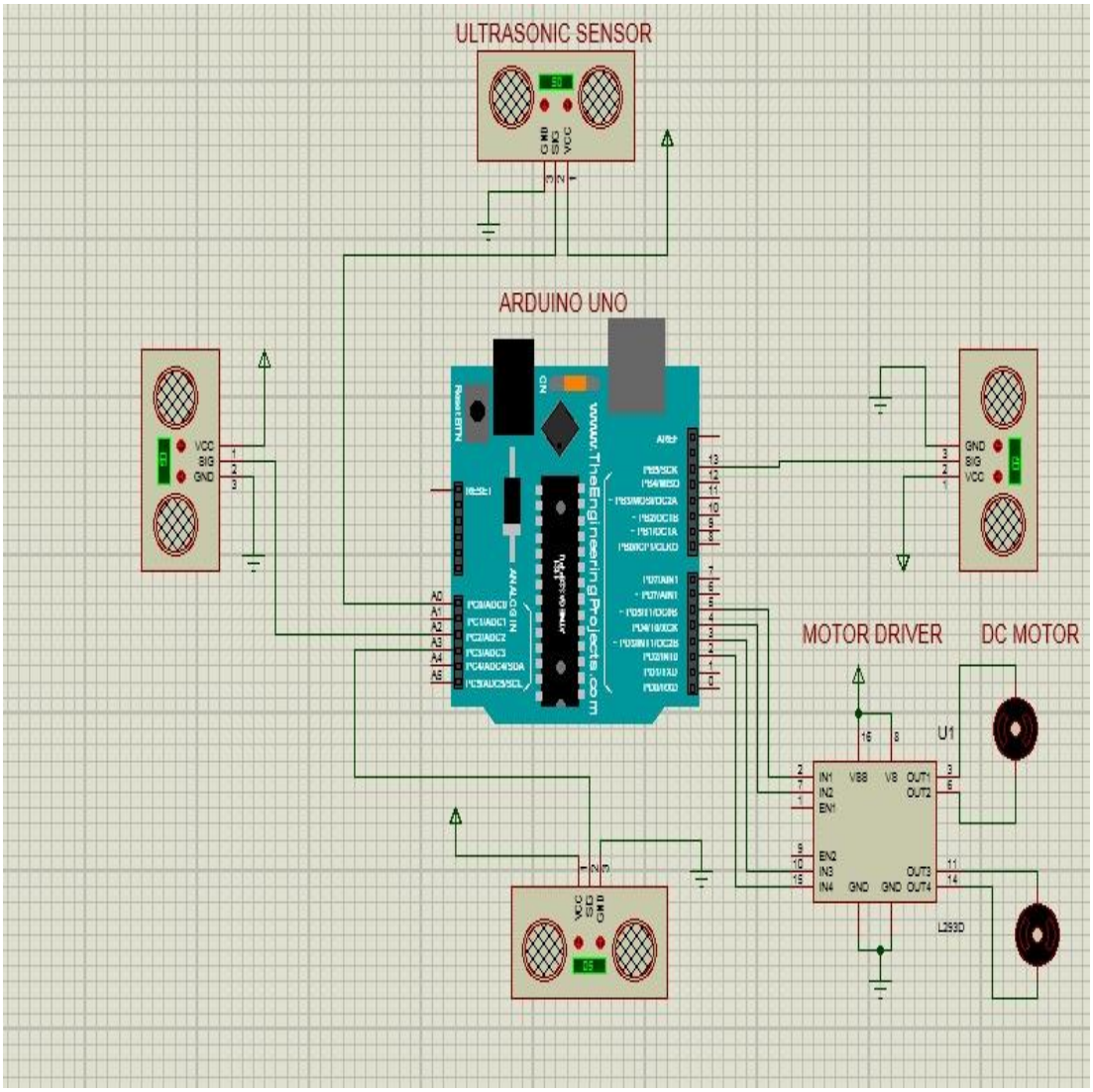

Fig. 4.5 : Circuit diagram of smart robot wheelchair

4.6 WORKING PRINCIPLE

In fig 4.5, It is important to understand how the ultrasonic sensor works. The basic principle behind the working of ultrasonic sensor is as follows: Using an external trigger signal, the Trig pin on ultrasonic sensor is made logic high for at least 10µs. A sonic burst from the transmitter module is sent. This consists of 8 pulses of 40KHz.The signals return back after hitting a surface and the receiver detects this signal. The Echo pin is high from the time of sending the signal and receiving it. This time can be converted to distance using appropriate calculations. The aim of this concept is to implement an obstacle avoiding robot using ultrasonic sensor and Arduino. All the connections are made as per the circuit diagram. The working of the project is explained below.When the robot is powered on, both the motors of the robot will run normally and the robot moves forward. During this

time, the ultrasonic sensor continuously calculate the distance between the robot and the reflective surface. This information is processed by the Arduino. If the distance between the robot and the obstacle is less than 15cm, the Robot stops and scans in left and right directions for new distance using Ultrasonic Sensor.

4.6.6 OPERATION TABLE FOR A WHEELCHAIR

COMMON WORDS	OPERATION
GO	Moves forward
BACK	Moves backward
LEFT	Moves left
RIGHT	Moves right
STOP	Stops moving

Table 4.6.6 : Common words and its operations

4.7 MODULES

The entire set up is divided into 4 parts the power supply unit, sensing unit, monitoring unit and data storage unit.

- Power supply unit
- Sensor unit
- motor

(i) POWER SUPPLY MODULE

Power supply module used to supply the power to microcontroller and all the sensors. Here we are using 12v and 5v power supply. This is a simple approach to obtain a 12V and 5V DC power supply using a single circuit. The circuit uses two ICs 7812 and 7805 for obtaining the required voltages. The AC mains voltage will be stepped down by the transformer, rectified by bridge and filtered by capacitor to obtain a steady DC level .The 7812 regulates this voltage to obtain a steady 12V

DC. The output of the IC1 will be regulated by the 7805 to obtain a steady 5V DC at its output. In this way both 12V and 5V DC are obtained.

(ii) SENSOR MODULE

Sensors For Obstacle Avoidance Varieties of sensors are available which can be used for the detection of obstacles some of the very popular sensors are: Infrared sensors (IR), Ultrasonic sensors, Cameras, which can be used as a part of Computer Vision, Sonar. It can measure the distance in its field of view of about thousands to hundreds points In the design of robot, we are using ultrasonic sensors for obstacle detection and avoidance The ultrasonic sensors continuously emits the frequency signals, when obstacle is detected this signals are reflected back which then considered as input to the sensor.

(iii) ULTRASONIC SENSOR

The ultrasonic sensor consists of a multi vibrator, which fixed at its base. The multi vibrator is combination of a resonator and vibrator the ultrasonic waves generated by the vibration are delivers to the resonator. Ultrasonic sensor actually consists of two parts: the emitter which produces a 40 kHz sound wave and detector which detects 40 kHz sound wave and sends electrical signal back to the microcontroller. HC-SR04 ultrasonic sensors are used which consist of 4 pins VCC, Trigger, Echo and GND.

(iv) MOTOR

A DC motor in simple words is a device. An Electric DC motor is a machine which converts electric energy into mechanical energy. This DC or direct current motor works on the principal, when a current carrying conductor Is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action. If the direction of current in the wire is reversed, the direction of rotation also reverses. A brushless DC motor, also known as synchronous DC motor, unlike brushed DC motors, do not have a commutator. The commutator in a brushless DC motor is replaced by an electronic servomechanism that can detect and adjust the angle of the rotor.

4.8 COMPONENTS DETAILS

4.8.1 HARDWARE CONFIGURATIONS

- Arduino Uno
- Power Supply
- Ultrasonic Sensor
- Motor driver
- Dc motor

4.8.2 SOFTWARE CONFIGURATIONS

- Software = Arduino IDE
- Language = embedded C.

4.8.3 EMBEDDED C DESCRIPTION

As mentioned earlier, Embedded Systems consists of both Hardware and Software. If we consider a simple Embedded System, the main Hardware Module is the Processor. The Processor is the heart of the Embedded System and it can be anything like a Microprocessor, Microcontroller, DSP, CPLD (Complex Programmable Logic Device) or an FPGA (Field Programmable Gated Array).

Embedded C Programming Language, which is widely used in the development of Embedded Systems, is an extension of C Program Language. The Embedded C Programming Language uses the same syntax and semantics of the C Programming Language like main function, declaration of datatypes, defining variables, loops, functions, statements, etc.

4.8.4 SPECIFICATIONS OF COMPONENTS

(i) ARDUINO UNO

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. Message can be sent to the board what to do by sending a set of instructions to the microcontroller on the

board. To do so the Arduino programming language and the Arduino Software (IDE) are used.

Arduino UNO is easy to program and a person with little or no technical knowledge can get hands-on experience with this board. The Arduino UNO board is programmed using Arduino IDE software which is an official software introduced by Arduino.cc to program the board. The Arduino program is called a sketch which you need to unload into the board. The sketch is nothing but a set of instructions that allow the board to perform certain functions as per your requirements.

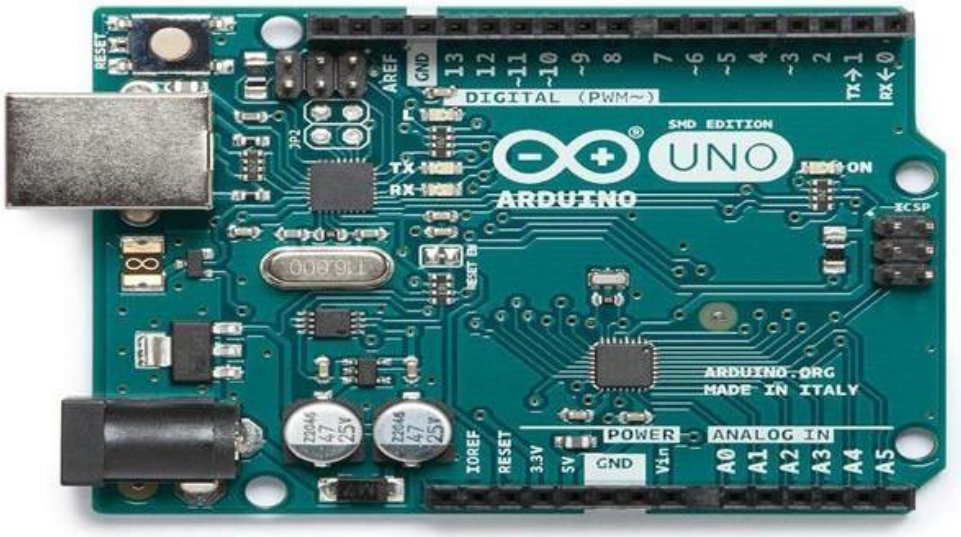

Fig. 4.8 :Arduino uno

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. Arduino was born at the Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IOT applications, wearable, 3D printing, and embedded environments.

(ii) CONFIGURATION

- Microcontroller ATmega328 Ø Operating Voltage 5V.
- Input Voltage(recommended) 7-12V Ø Input Voltage(limits) 6-20V.

- Digital I/O Pins 14(of which 6 provide PWM Output).
- Analog Input Pins 6.
- DC Current per I/O Pin 40 mA Ø DC Current for 3.3V pin 50 mA.
- Flash Memory 32 KB(ATmega328) of which 0.5 KB used by boot loader Ø SRAM 2 KB (ATmega328).
- EEPROM 1 KB (ATmega328).
- Clock Speed 16 MHZ.

(iii) ATMEGA 328P –MICROCONTROLLER

ATMEGA328P is high performance, low power controller from Microchip. ATMEGA328P is an 8-bit microcontroller based on AVR RISC architecture. It is the most popular of all AVR controllers as it is used in ARDUINO boards.

As said, first we need to program the controller and that is done by writing the appropriate program file in the ATMEGA328P FLASH memory. After dumping this program code, the controller executes this code and provides appropriate response.

With program memory of 32 Kbytes ATMEGA328P applications are many. With various POWER SAVING modes it can work on MOBILE EMBEDDED SYSTEMS.

(iv) PINDIAGRAM

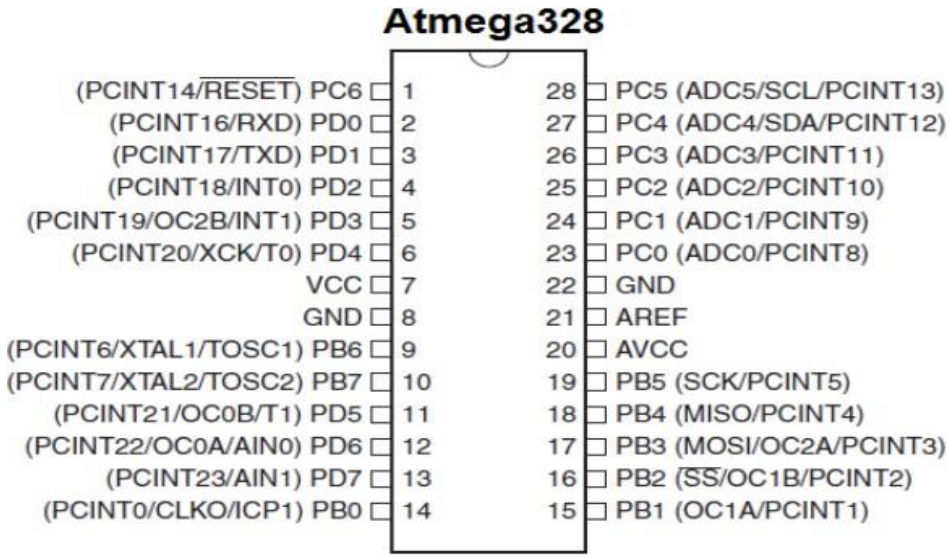

Fig. 4.8.1 : Pin diagram of atmega328

- VCC
- Digital supply voltage for MCU.
- GND
- Ground forMCU.
- Port B(PB7:0)

XTAL1/XTAL2/TOSC1/TOSC2 Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, port B pins that are externally pulled low will source current if the pull- up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

(a) PORT C (PC5:0)

Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC5..0 output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated.

(b) PC6/RESET

If the RSTDISBL fuse is programmed, PC6 is used as an input pin. If the RSTDISBL fuse is un programmed, PC6 is used as a reset input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

(c) PORT D (PD7:0)

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, port D pins that are externally pulled low will source current if the pull-up resistors are activated. The port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

(d) AVCC

AVCC is the supply voltage pin for the A/D converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

(e) AREF

AREF is an analog pin for the A/D converter. By combining an 8-bit RISC CPU with in system self programmable flash on a monolithic chip.

4.9 ARCHITECTURE DESIGN

The ATmega 328P is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega48P/88P/168P/328P achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while

achieving throughputs up to ten times faster than conventional CISC microcontrollers. AVR MCUs are extremely popular MCUs used in various application specially in project prototyping and embedded devices. AVR is a 8-bit RISC architecture (Reduced Instruction Set Computing) microcontroller in market since 1996 which is having on-chip programmable flash memory, SRAM, IO data space & EEPROM. AVR is the first MCU in market which has on-chip flash storage.

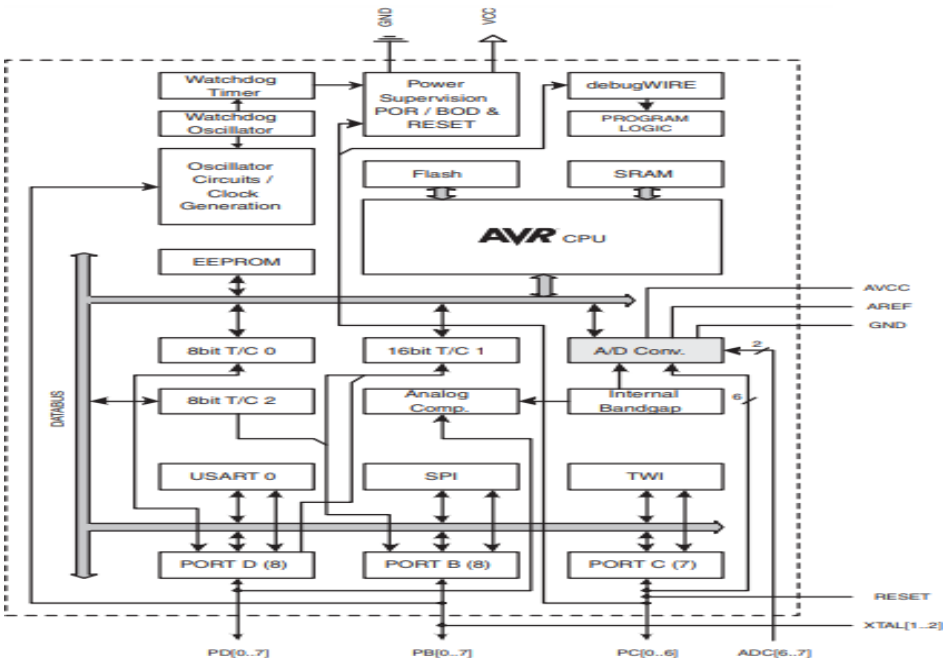

Fig. 4.9.1 : Architecture design of avr mcu - at328p

The fast-access register file contains 8-bit general purpose working registers with a single clock cycle access time. This allows single-cycle arithmetic logic unit (ALU) operation. In a typical ALU operation, two operands are output from the register file, the operation is executed, and the result is stored back in the register file – in one clock cycle.

Since ATmega328P is used in Arduino Uno and Arduino nano boards, you can directly replace the arduino board with ATmega328 chip. For that first you need to install the Arduino boot loader into the chip (Or you can also buy a chip with boot loader – ATMega328P-PU). This IC with boot loader can be placed on Arduino Uno board and burn the program into it. Once Arduino program is burnt into the IC, it can be removed and used in place of Arduino board, along with a Crystal oscillator and other components as required. Below is the pin mapping between Arduino Uno and ATmega328Pchip**.**

Six of the 32 registers can be used as three 16-bit indirect address register pointers for data space addressing – enabling efficient address calculations. One of the these address pointers can also be used as an address pointer for look up tables in flash program memory. These added function registers are the 16-bit X-, Y-, and Z-register, described later in this section. The ALU supports arithmetic and logic operations between registers or between a constant and a register. Single register operations can also/ be executed in the ALU. After an arithmetic operation, the status register is updated to reflect information about the result of the operation.

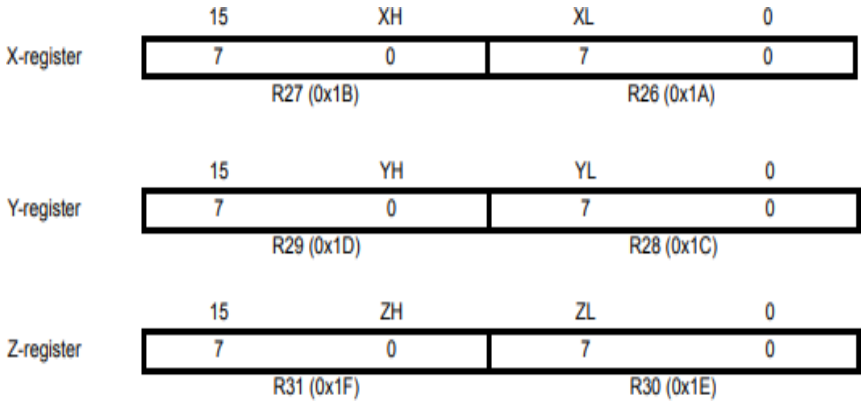

Fig. 4.9.2 : Arithmetic operation

Program flow is provided by conditional and unconditional jump and call instructions, able to directly address the whole address space. Most AVR instructions have a single 16-bit word format. Every program memory address contains a 16- or 32-bit instruction. Program flash memory space is divided in two sections, the boot program section and the application program section. Both sections have dedicated lock bits for write and read/write protection. The SPM instruction that writes into the application flash memory section must reside in the boot program section. During interrupts and subroutine calls, the return address program counter (PC) is stored on the stack.

The stack is mainly used for storing temporary data, for storing local variables and for storing return addresses after interrupts and subroutine calls. Note that the stack is implemented as growing from higher to lower memory locations. The stack pointer register always points to the top of the stack. The stack pointer points to the data SRAM stack area where the subroutine and interrupt stacks are located.

The I/O memory space contains 64 addresses for CPU peripheral functions as control registers, SPI, and other I/O functions. The I/O memory can be accessed directly, or as the data space locations following those of the register file, 0x20 - 0x5F. In addition, the ATmega328P has extended I/O space from 0x60 - 0xFF in SRAM where only the ST/STS/STD and LD/LDS/LDD instructions can be used.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20volts.

The Microcontroller operates in 5 sleep modes as given below:

Power save Mode: It is used when Counter/Timer is clocked asynchronously. In general this mode used for saving the operational power requirement of microcontroller.

Idle Mode: It stops the functioning of CPU, but allows operation of ADC, TWI, SPI, and interrupts system and Watchdog. It is achieved by setting SM0 to SM2 bits of Microcontroller Unit register flag at zero.

Power down Mode: It enables external interrupts, the 2-wire serial interface, and watchdog while disabling the external oscillator. It stops all generated clocks.

ADC Noise Reduction Mode: It stops the central processing unit but allows the functioning of ADC, timer/counter and external interrupts.

Stand By mode: In this mode, only oscillator is allowed to operate by slowing all other operation of microcontroller pins are as follows VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack,access it through this pin.

AVR microcontrollers support a variety of arithmetic operations, including addition, subtraction, multiplication, and division. These operations can be performed on data stored in registers, and can also involve immediate values or data stored in memory.

AVR microcontrollers support both 8-bit and 16-bit data types, allowing for arithmetic operations to be performed on both bytes and words of data.

AVR microcontrollers provide flags to detect arithmetic overflow, which occurs when the result of an arithmetic operation exceeds the maximum or minimum value that can be stored in a register.

Modes of Arithmetic operation:

- 5V Regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50mA.
- GND Ground pins.
- Sleep modes application to shut down unused modules in the MCU, thereby saving power.
- The AVR provides various sleep modes allowing the user to tailor the power consumption to the application's requirements. When enabled, the Brown-out Detector (BOD) actively monitors the power supply voltage during the sleep periods.

4.9.1 MEMORY

The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the boot loader); It has also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library). It is organized as 21 separate data space, in which single bytes can be read and written. The EEPROM has an endurance of at least 100,000 write/erase cycles.

All ATmega48P/88P/168P/328P I/Os and peripherals are placed in the I/O space. All I/O locations may be accessed by the LD/LDS/LDD and ST/STS/STD instructions, transferring data between the 32 general purpose working registers and the I/O space. I/O Registers within the address range 0x00 - 0x1F are directly bit-accessible using the SBI and CBI instructions. In

these registers, the value of single bits can be checked by using the SBIS and SBIC instructions. Refer to the instruction set section for more details. When using the I/O specific commands IN and OUT, the I/O addresses 0x00 - 0x3F must be used.

4.10GENERAL PURPOSE INPUT AND OUTPUT

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 KO hms. In addition, some pins have specialized functions

- Serial 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB- to-TTL Serial chip.

- External Interrupts 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt () function for details.

- PWM 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write () function.

- SPI 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

- LED 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. The Uno has 6 analog inputs, each of which provides 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference() function. Additionally, some pins have specialized functionality I 2C 4 (SDA) and 5 (SCL).

4.10.1 LAYOUT CONNECTION OF ARDUINO

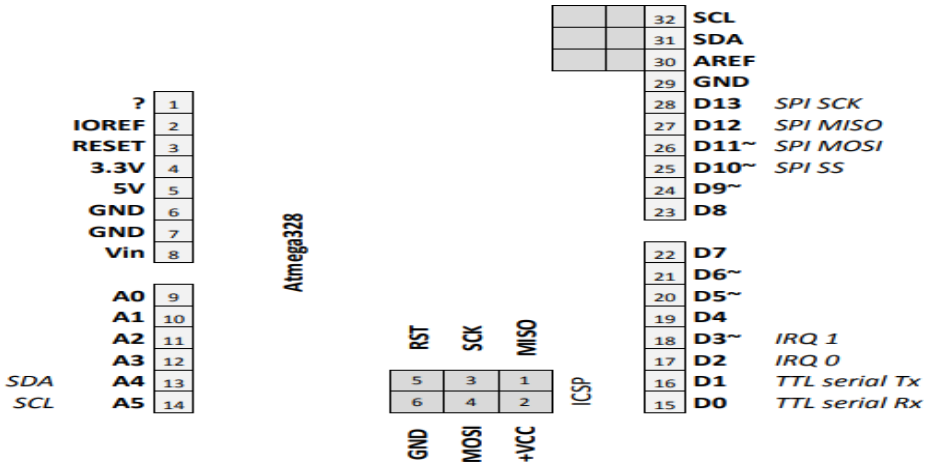

Fig. 4.10.1 : Layout diagram of arduino

4.10.2 FEATURES OF ARDUINO

- Microcontroller ATmega328.
- Operating Voltage 5V.
- Input Voltage (recommended) 7-12V.
- Input Voltage (limits) 6-20V.
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6.
- DC Current for 3.3V Pin 50 mA.

(i) Quick start

The board has a reset pin that helps you reset the whole circuit board. Also, the reset pin comes in handy when the board stops working when running the program. All you need to do is push this pin and everything in the program will be cleared. After this, it will help you start the program from scratch.

(ii) Low voltage requirement

This board needs 5V to get turned on. Users can achieve this by integrating the USB port directly. However, the Arduino UNO board can offer support to external power source of about 12V. This volt can be limited to 3.3V or 5V according to the project's requirement.

(iii) Usb interface

This board features a USB interface. With this feature, you can develop a serial communication with other devices.

4.10.3 BENEFITS OF ARDUINO

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms
- Cross-platform - The Arduino software runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
- Simple, clear programming environment - The Arduino programming environment is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well.
- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers.
- Open source and extensible hardware - The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 microcontroller.

4.10.4 ARDUINO IDE

The Integrated Development Environment (IDE)is a combination of editor, linker and a compiler which helps the developer to make their Firmware for their Innovative Projects. Arduino IDE play a major role in open source platform for fast prototyping and easy to access of library. It is user friendly tool for beginners and it supports programming language like embedded C, Luna etc. Over the years Arduino has been the brain of thousands of projects, from everyday objects to

complex scientific instruments. Its supports all the variant of Arduino boards like Arduino Uno, Nano and Mega etc. As soon as it reaches a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments

. **4.10.5 ARDUINO IDE SOFTWARE**

With this Arduino Integrated Development Environment you can edit, compile and upload Arduino sketches to the Arduino boards.

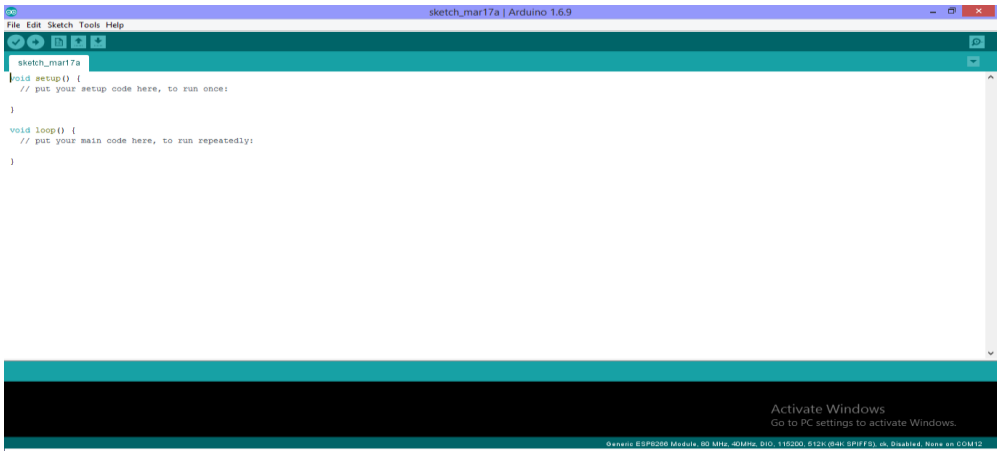

Fig. 4.10.5 : Arduino ide software

4.10.6 POWER SUPPLY

This is a simple approach to obtain a 12V and 5V DC power supply using a single circuit. The circuit uses two ICs 7812 and 7805 for obtaining the required voltages. The AC mains voltage will be stepped down by the transformer, rectified by bridge and filtered by capacitor to obtain a steady DC level.The 7812 regulates this voltage to obtain a steady 12V DC. The output of the IC1 will be regulated by the 7805 to obtain a steady 5V DC at its output. In this way both 12V and 5V DC are obtained.

4.10.7 BLOCK DIAGRAM

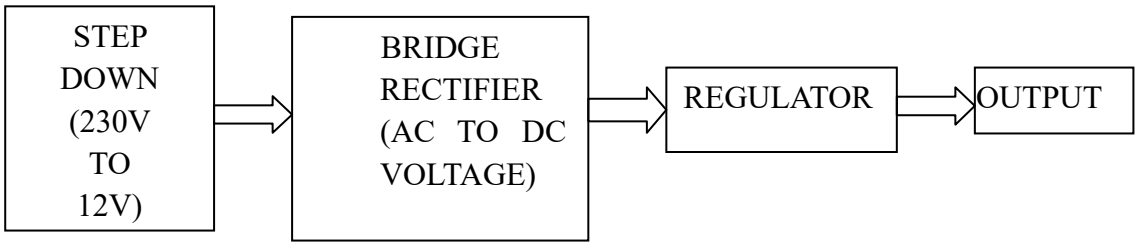

Fig. 4.10.7 : Block diagram of power supply

4.10.8 CIRCUIT DIAGRAM

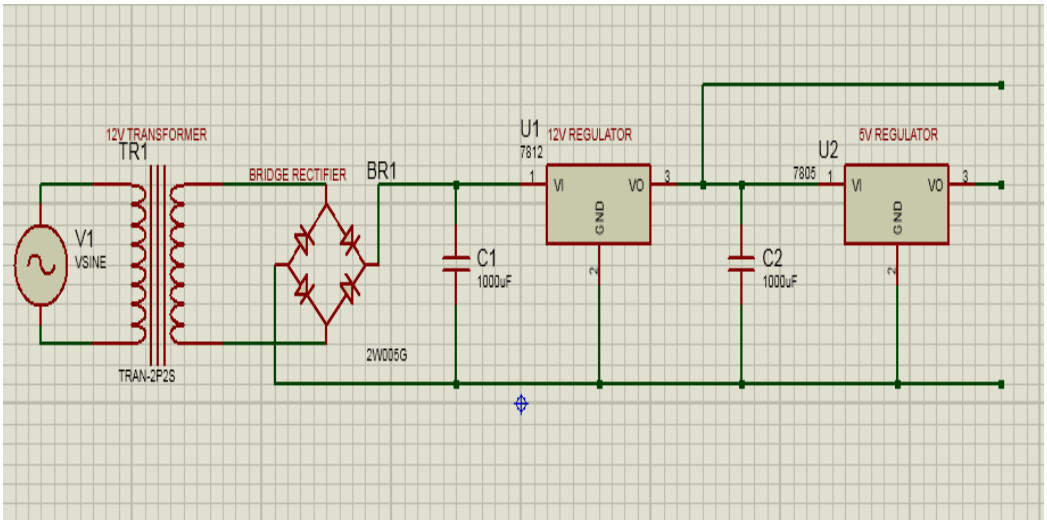

Fig. 4.10.8 : Circuit diagram of power supply

Initially small step down transformer is used to reduce the voltage level 230V AC into 12V AC. The output of the transformer is a pulsating sinusoidal AC voltage, which is converted to pulsating DC with the help of a rectifier. This output is given to a filter circuit which reduces the AC ripples, and passes the DC components. 7812 regulator is used to converts 12V DC study voltage. And 7805 regulator is converts constant 5V DC voltage.

4.11 ULTRASONIC SENSOR

Ultrasonic ranging module HC - SR04 provides 2cm - 40cm the ranging accuracy can reach to 3mm.The modules includes ultrasonic transmitter, receiver and control circuit.To using IO trigger for at least 10us high level signal,and not lowsignals.

The Module automatically sends eight 40 kHz and detect whether there is a pulse back.IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time ×velocity of sound (340M/S) / 2.

With ultrasonic sensors, all physical properties of the system can be measured, that modify ultrasonic wave propagation across the material (namely, longitudinal and shear wave velocities and reflection coefficients). Therefore, especially two critical stages during the cross-linking process can be detected by ultrasound. Smart electric wheelchairs are equipped with ultrasonic sensors for obstacle detection,

which prevent the chair from being damaged by a collision or harming the user. To condition the S.R.M. with these sensors, it is necessary to design a casing that allows storage inside. An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. Ultrasonic sensors are a well-known technology that continues to be extremely relevant in many industrial and consumer applications. Their simplicity, low cost, and robust build make them an excellent choice for many new products requiring presence detection or distance measurement.

4.11.1 INTERFACING PINS

- 5V Supply
- Trigger Pulse Input
- Echo Pulse Output
- 0V Ground

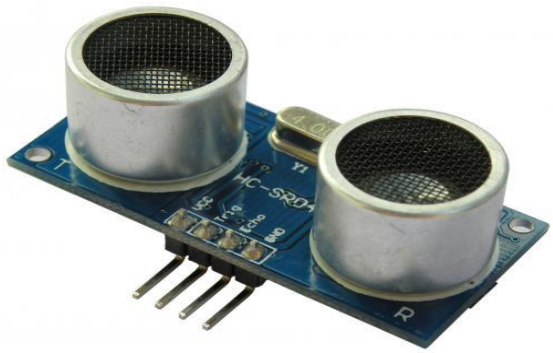

Fig. 4.11.1 : Ultrasonic sensor

Ultrasonic transmitter emitted an ultrasonic wave in one direction, and started timing when it launched. Ultrasonic spread in the air, and would return immediately when it encountered obstacles on the way. At last, the ultrasonic receiver would stop timing when it received the reflected wave. As Ultrasonic spread velocity is 340m / s in the air, based on the timer record t, we can calculate the distance (s) between the obstacle and transmitter, namely: s = 340t / 2, which is so- called time difference distance measurement principle The principle of ultrasonic distance measurement used the already-known air spreading velocity, measuring the time from launch to

reflection when it encountered obstacle, and then calculate the distance between the transmitter and the obstacle according to the time and the velocity. Thus, the principle of ultrasonic distance measurement is the same with radar. Distance Measurement formula is expressed as: L = C X T In the formula, L is the measured distance, and C is the ultrasonic spreading velocity in air, also, T represents time (T is half the time value from transmitting to receiving).

Ultrasonic Application Technology is the thing which developed in recent decades. With the ultrasonic advance, and the electronic technology development, especially as high-power semiconductor device technology matures, the application of ultrasonic has become increasingly widespread: Ultrasonic measurement of distance, depth and thickness; Ultrasonic testing; Ultrasound imaging; Ultrasonic machining, such as polishing, drilling; Ultrasonic cleaning; Ultrasonic welding;

4.11.2 MODULE OPERATING PRINCIPLE

Set low the Trig and Echo port when the module initializes , firstly, transmit at least 10us high level pulse to the Trig pin (module automatically sends eight 40K square wave), and then wait to capture the rising edge output by echo port, at the same time, open the timer to start timing. Next, once again capture the falling edge output by echo port, at the same time, read the time of the counter, which is the ultrasonic running time in the air. According to the formular: test distance = (high level time * ultrasonic spreading velocity in air) / 2, you can calculate the distance to the obstacle.

4.11.3 ELECTRIC PARAMETERS:

- Working Voltage DC 5 V
- Working Current 15mA
- Working Frequency 40Hz
- Max Range 400cm
- Min Range 2cm
- Measuring Angle 15 degree
- Trigger Input Signal 10uS TTL pulse

- Echo Output Signal Input TTL lever signal and the range in proportion
- Dimension 45*20*15mm

4.11.4 DC MOTOR

A DC motor is any motor within a class of electrical machines whereby direct current electrical power is converted into mechanical power. Most often, this type of motor relies on forces that magnetic fields produce. Regardless of the type, DC motors have some kind of internal mechanism, which is electronic or electromechanical. In both cases, the direction of current flow in part of the motor is changed periodically.

The speed of a DC motor is controlled using a variable supply voltage or by changing the strength of the current within its field wind rings. While smaller DC motors are commonly used in the making of appliances, tools, toys, and automobile mechanisms, such as electric car seats, larger DC motors are used in hoists, elevators, and electric vehicles.

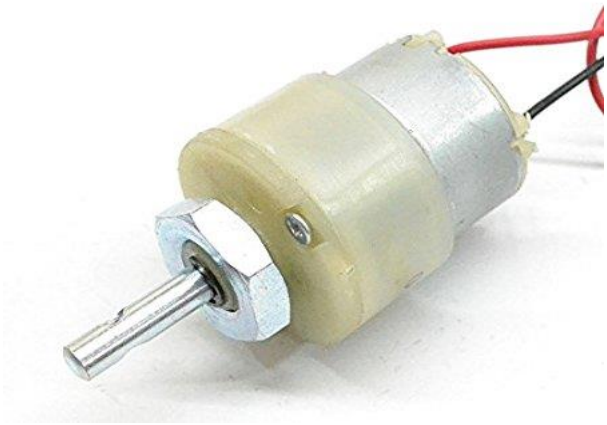

Fig. 4.11.4 : Dc motor

Here we are using 12V DC 60 RPM motor. 60RPM Centre Shaft Economy Series DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. Although

motor gives 60 RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque. Tables below gives fairly good idea of the motor's performance in terms of RPM and no load current as a function of voltage and stall torque, stall current as a function of voltage.

4.11.5 SPECIFICATIONS AND FEATURES

- Operating Voltage: 12V DC
- Gearbox: Attached Plastic (spur)Gearbox
- Shaft diameter: 6mm with internal hole
- No-load current = 60 mA(Max)
- Load current = 300 mA(Max)

4.11.6 MOTOR DRIVER

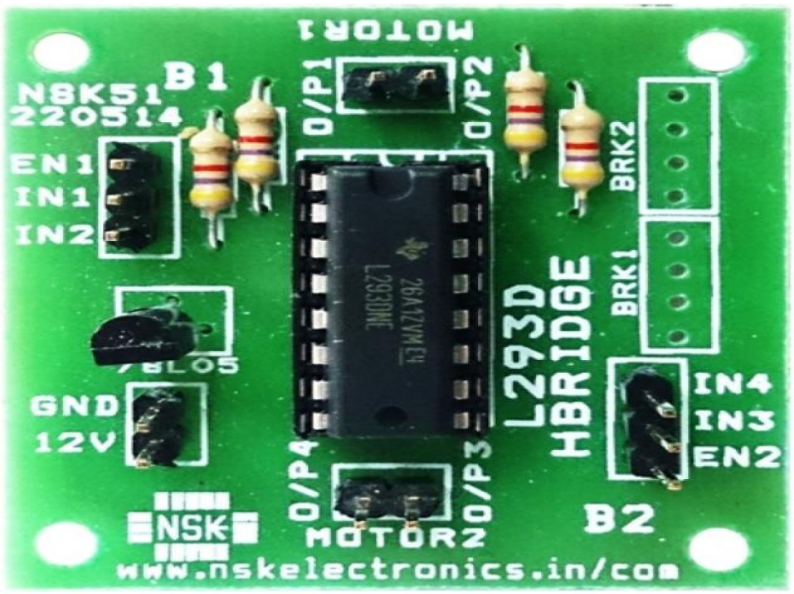

Fig. 4.11.6 : Motor driver

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D IC.It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction.

As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for

driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller.

There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

4.11.7 L293D PIN DIAGRAM

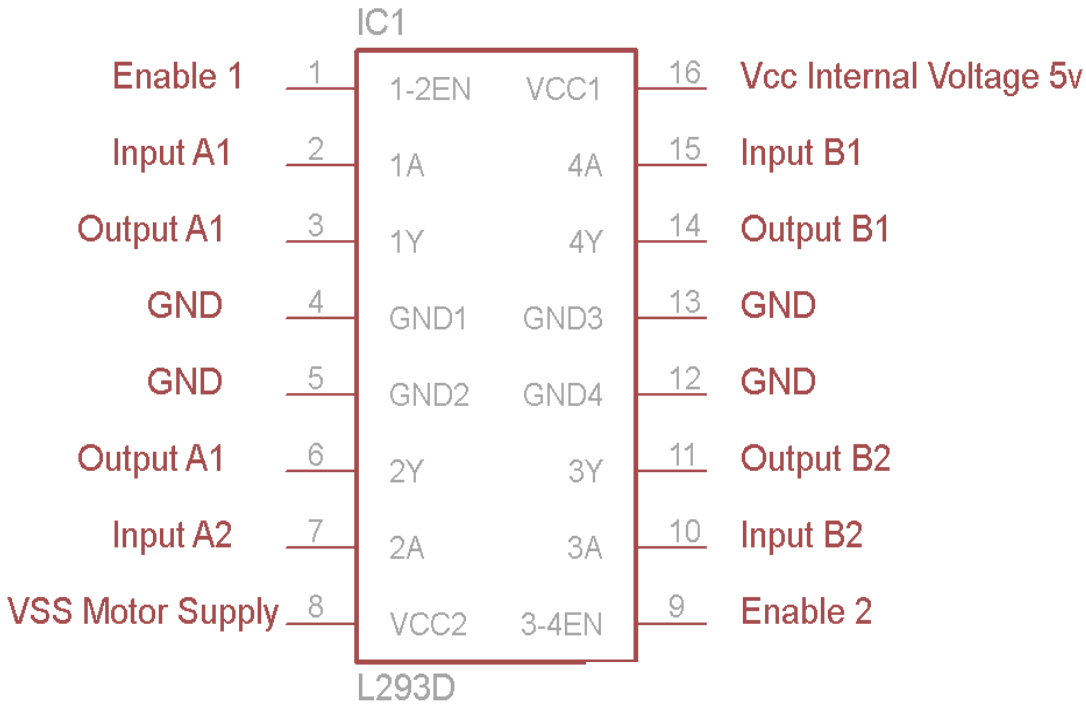

Fig. 4.11.7 : Pin diagram for l293d

4.11.8 WORKING OF L293D

There are 4 input pins for l293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or

LOGIC 1.In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

4.11.9 L293D LOGIC TABLE.

Lets consider a Motor connected on left side output pins (pin 3,6). For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0.

•**Pin 2** = **Logic 1** and **Pin 7** = **Logic 0** | Clockwise Direction
•**Pin 2** = **Logic 0** and **Pin 7** = **Logic 1** | Anticlockwise Direction
•**Pin 2** = **Logic 0** and **Pin 7** = **Logic 0** | Idle [No rotation] [Hi-Impedance state]
•**Pin 2** = **Logic 1** and **Pin 7** = **Logic 1** | Idle [No rotation]

In a very similar way the motor can also operate across input pin 15,10 for motor on the right hand side.

4.11.10 VOLTAGE SPECIFICATION

VCC is the voltage that it needs for its own internal operation 5v; L293D will not use this voltage for driving the motor. For driving the motors it has a separate provision to provide motor supply VSS (V supply). L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS Motor supply.

The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors Up to 36v hence you can drive pretty big motors with this l293d VCC pin 16 is the voltage for its own internal Operation. The maximum voltage ranges from 5v and up to 36v.

CHAPTER 5

RESULTS AND DISCUSSION

5.1 RESULTS

In order to evaluate the performance of the presented speech recognition system to drive the wheelchair following test done to test the effectiveness of the Voice-recognition to drive the wheelchair. The recognition rate of each Keyword word programmed to operate when spoken by the user is calculated by the following equation: RR% = Number of Recognized Words divided by Number of Tested Words. In order to test the accuracy and effectiveness of the project, four volunteers were asked to become a part of testing of the project. Each volunteer was asked to give 10 commands and based on how many the commands are followed will give the result. The test was carried in silent and noisy environment by both male and female users. This test will determine the accuracy and effectiveness of the project.

There is a maximum of 1 word wrong every 10 times repeating words leading to an error of 10% i.e. recognition rate not less than 90%. This percentage might reach 100% if the test is done in clear environment with good pronunciation of words with moderate time. This test proved that there is no big difference in RR if the speaker is male or female. The voice commands are interpreted and translated to string and provided to the Arduino that in turn produces and actuates the wheelchair accordingly as shown in Table 5.

Designing a simple and efficient automatic speech recognition system for isolated command words to satisfy the motion control of an electric motorized wheelchair for differently abled persons is the interest of this project. The processing units (the speech kit and the microcontroller) are directly attached to the wheelchair in one package that made the design representing a complete autonomous and smart wheelchair. The speech recognizer is tested to prove its performance to generate exact movement of the chair. It proved a recognition rate of above 90%.

5.2 SAMPLE INPUT

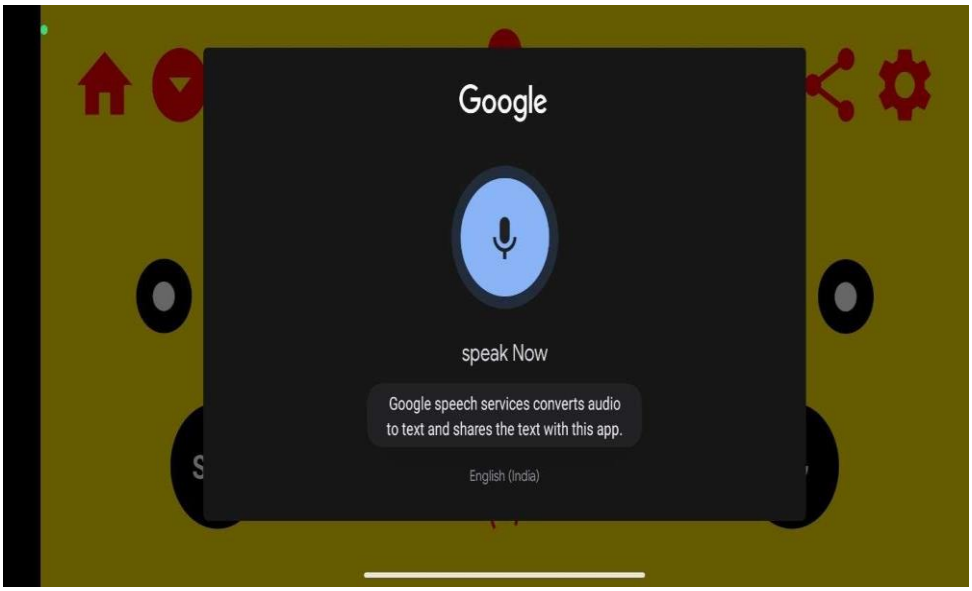

Fig. 5.2.1 : Sample photo of active smart bluetooth services

It elaborates the design and construction of Smart Electronic Wheelchair with the help of Bluetooth Module. The circuit works properly to move as the command given by the user. After designing the circuit that enables physically disabled to control their wheel using an android application in their smart phones and it has also been tested and validated. The detection of any obstacle is successfully controlled by the microcontroller. As the person switches on the circuit and starts moving, any obstacle which is expected to lie within a range of 2 metres will be detected by the Ultrasonic sensor. This proposed system contributes to the self-dependency of differently abled and older people. It focuses on two main properties: The human - machine interface and the navigation methods and devices. Also it reviews other smart systems like monitoring and safety systems. From the review of many published papers, it is concluded that researchers are continuously trying to build a powerful and helpful wheelchairs to ease the daily life activities and to give more independent mobility for people with different types of disabilities.

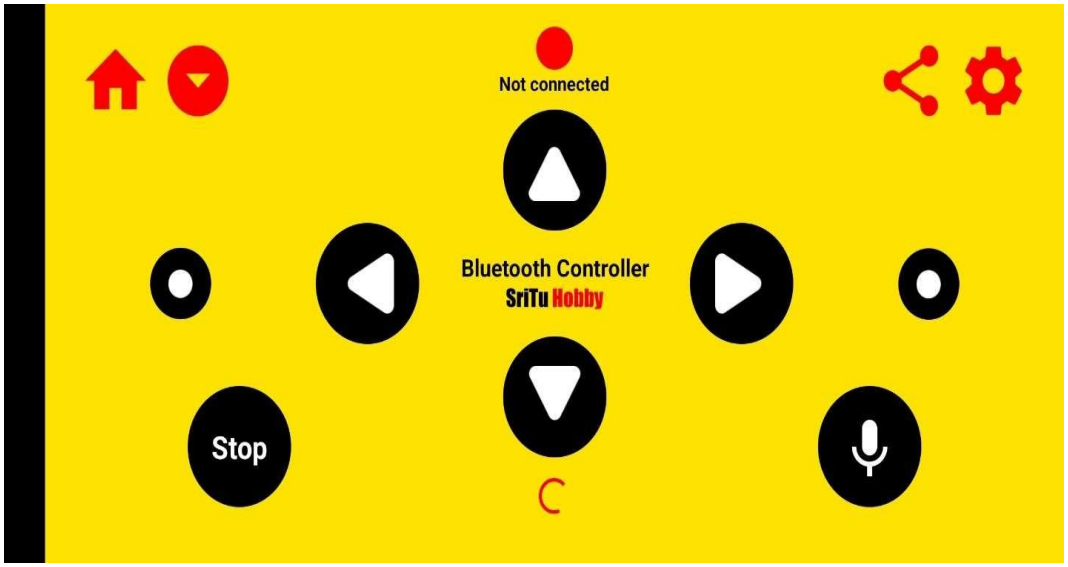

Fig. 5.2.2 : Sample photo of navigation based services

The GPS system provides security needed of a particular vehicle in certain circumstances. For instance, it can save the vehicle as well as the drivers and passengers from serious risks as the technology can monitor speed violations. Plus, it help in conserving fuel as it can help driver look for shorter and alternate routes, giving less time to arrive in a particular destination. Also, the GPS technology can point out directions to the driver, allowing a worry-free drive For motor profile 1 subjects (who are able to manipulate objects with relative dexterity), a manual interface (joystick) is used for the above tasks. The subjects have to navigate through the items.

In order to select a given item, the navigation program does not require the user to take the distance between items into account and tolerates a (programmable) wide range of variation in angular direction. In the subsequent evaluation, we used a minimum tolerance value of 10 degrees. Validating an item corresponds to the fact that the subject does not activate the joystick for a programmable duration. Motor profile 2 subjects cannot manipulate objects. A scrolling navigation system has been implemented. It consists in presenting the subject with a succession of items which are selectable during a given programmable duration.

5.3 SAMPLE OUTPUT

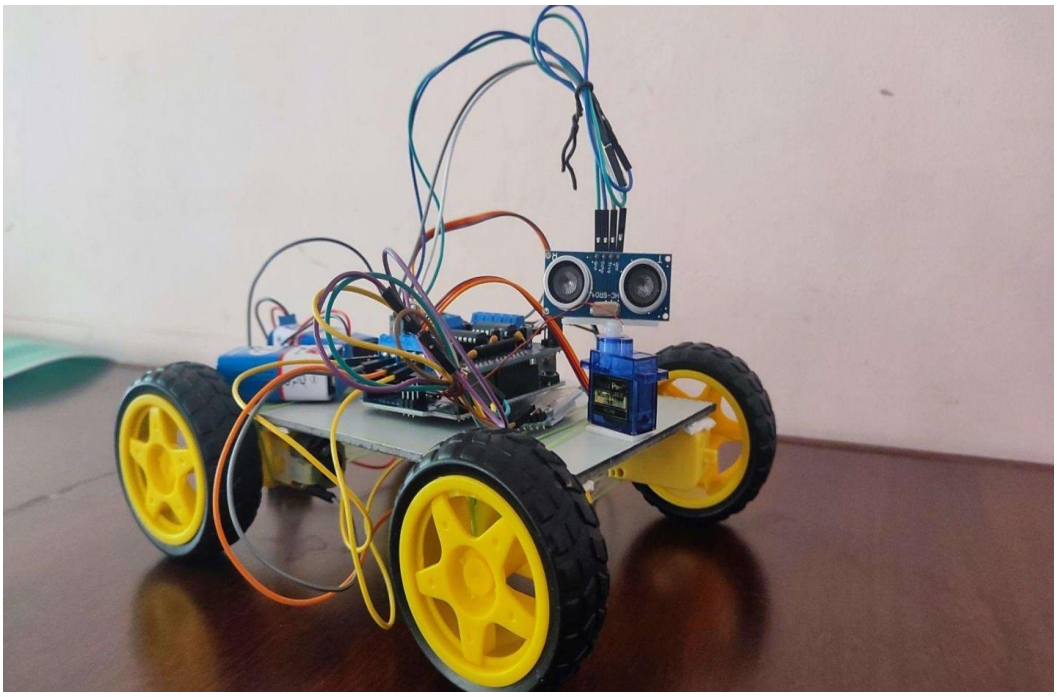

Fig. 5.3.1 : Sample photo of ultrasonic based robot wheelchair using arduino

The system Arduino is used as a controller for controlling the modules and the sensors. Arduino UNO because it have more no. of pins than Arduino Nano. A battery of 12v is used for power supply and to drive motors. When the module is on another operating mode then it receives signal by the android mobile app with the help of Bluetooth. In this the commands are given on android mobile app which are transmitted wirelessly to the Bluetooth Module (HC05) at the receiver side. The commands are in the string format which are compared by predefined commands with the help of microcontroller. Then according to those commands the motor driver IC rotates the wheel in the desired direction. We also implemented the voice and gesture controlled wheelchair in real world. Those who are old and handicapped for is very helpful. The results is very much satisfied and if this concept is industrialized then it will surely change the perspective of handicapped person.

5.4 DISCUSSION

The proper interfacing of all components according to the circuit diagram gives us hardware circuitry for prototype wheelchair with voice and gesture control. The prototype wheelchair runs perfectly for head gesture and voice command as a Smart Wheelchair. The hardware and software implementation is done properly. Now,in this section all the steps of this work is discussed and their results are also specified. The implemented software is uploaded on the Arduino board then the prototype is checked using gesture and voice module.The head gesture should be in stable condition at the time of voice module working. The prototype worked successfully by using gesture and voice module.

The above Arduino controller and ultrasonic sensor were studied and the HcSR-04 ultrasonic sensor was selected, as the controlling result are satisfying for its use in the automobile prototype system bring developed. It was used to sense the obstacle and avoidance them. On successful implementation of obstacle avoidance algorithm was successfully carried out too with minimal errors, by coding the algorithm in python. Obstacle avoidance is a very good application to be used in vehicle preventing many accidents and loss of life.

The design and implementation of a sensible chair for disabled individual's victimization Arduino and Bluetooth module for dominant the motion of a chair designed the look not solely cut back the manufacture value compared with gift market however conjointly can provide nice competitive with alternative sorts of electric chair.It has several blessings like safety, comfort, energy saving, full automation etc. The technology is increased safely for users World Health Organization use chair, by preventing collision with walls, fastened objects, furnishings and people with the assistance of object device, so all the drawbacks of the assorted sorts of chair area unit overcome by this "smart wheelchair".

CHAPTER 6

CONCLUSION AND FUTURE ENHANCEMENTS

6.1 CONCLUSION

Our society will greatly benefit from the effort, especially those who need this kind of technology. It also has the potential to revolutionize industries such as healthcare and transportation. The lives of those with physical disabilities would unquestionably change as a result of this. This benefits them greatly. individuals can move their wheelchair simply by talking (commanding), making them feel liberated, autonomous, and happier. It is not necessary for everyone to remark in English; they are free to do so in their own tongue. The wheelchair for blind people can move on its own with a few coding adjustments, and by employing an ultrasonic sensor to detect obstructions, it can lead people in the right direction.

In conclusion, the ultrasonic based voice active smart wheelchair can benefit from future enhancements such as improved navigation, enhanced voice recognition, integration with smart home devices, improved ergonomics, communication with medical devices, and advanced security and safety measures. Future enhancements will not only improve the user's life by providing a more efficient, comfortable, and natural interaction and more control over their immediate environment. This system will be additional developed into Associate in Nursing intelligent system that works on machine intelligence to assist report with alternative varied medical conditions with the assistance of alternative sensors.

It elaborates the design and construction of Smart Electronic Wheelchair with the help of Bluetooth Module. The circuit works properly to move as the command given by the user. The detection of any obstacle is successfully controlled by the microcontroller. As the person switches on the circuit and starts moving, any obstacle which is expected to lie within a range of 4 metres will be detected by the Ultrasonic sensor. This proposed system contributes to the self-dependency of differently abled and older people.

6.2 FUTURE ENHANCEMENT

The wheelchair could be upgraded to include mapping technologies, obstacle detection, and correction based on the user's input. Users can easily navigate around areas they need to go using voice commands and pre-set maps. Incorporating natural language processing (NLP) can provide more human-like interactions with the user. The system can understand the user's spoken commands more accurately and provide more detailed responses. Integrating the smart wheelchair with other smart home devices could offer users more control over the wheelchair in the house. For example, the user may be able to turn on appliances remotely using the wheelchair's voice-activated system. Wheelchair component designers can improve the design and ergonomics, make the wheelchair more flexible and durable by maximizing the features such as weight management, suspension, and battery life. Smart Wheelchair developers can incorporate integration with medical devices to monitor and manage the user's medical conditions. For example, the wheelchair can help manage a patient's breathing machine or monitor their blood sugar levels, providing convenience and safety to the user. Advanced safety features can be implemented, such as obstacle sensing, automatic deceleration modes, automatic movement, and fall detection technologies, and an emergency alert system that notifies emergency services when a fall is detected or the user is in danger.

6.2.1 ALTERNATE POWER SOURCE

Solar panel roof can be used as alternative power source and also it can be a protective layer from rain and sun.

6.2.2 ARTIFICIAL INTELLIGENCE AND IMAGE PROCESSING

Artificial intelligence (AI) is technology and a branch of computer science that studies and develops intelligent machines and software. Major AI researchers and textbooks define the field as “the study and design of intelligent agents”, where an intelligent agent is a system that perceives its environment and takes actions that maximize its chances of success.

6.2.3 GPS NAVIGATION

Navigating the actual position of the wheel chair.

6.2.4 MIND CONTROL

Controlling wheelchair by electric signal coming from brain. As our brain contains thousands of neuron, there is certain potential difference between each neuron. When we think something neuron emits 0 to 50 HZ electric signal. By interpreting the signal by modulation/demodulation, we can control the chair.

This system can be extended by including GSM which sends an SMS during emergency by assigning particular gesture command. By including GPS, position of the wheelchair can also be known. Work is at present being carried out on the incorporation of a new interface so that the user can give orders on guiding based on eye movement. Wheel chair can be fitted with direct mind reader.

For example, if a person is paralyzed and cannot move his body parts, in that case it can be used. Improvements can be made by using various body gestures such as eye gaze, leg movement or head movement accordingly. Generally the pulse rate of an ordinary person is 72 bits/min. If the pulse rate increases or decreases nearby 72 bits/min then the signal will make the wheelchair to halt immediately at current position and it will activate the alarm system. This will tend others to know about the situation and position of the patient.

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APPENDIX

```
#include <Ultrasonic.h>
int state = 0;
const int motor1 = D0;
const int motor2 = D1;
const int motor3 = D2;
const int motor4 = D3;
Ultrasonic ultrasonic(D5, D6);
int distance;
void setup() {
Serial.begin(9600); // Default communication rate of the Bluetooth module
pinMode(motor1,OUTPUT);
pinMode(motor2,OUTPUT);
pinMode(motor3,OUTPUT);
pinMode(motor4,OUTPUT);
}
void loop() {
if(Serial.available() > 0){ // Checks whether data is comming from the serial port
   state = Serial.read(); // Reads the data from the serial port
delay(50);
 }
  distance = ultrasonic.read();
Serial.print("Distance in CM: ");
Serial.println(distance);
delay(100);
  if(distance<20){
```

```
do{
Serial.println("UST");
digitalWrite(motor1,LOW);
digitalWrite(motor2,LOW);
digitalWrite(motor3,LOW);
digitalWrite(motor4,LOW);
   distance = ultrasonic.read();
Serial.print("loop Distance in CM: ");
Serial.println(distance);
delay(100);
}while(distance<20);
  }
 if (state == '1') {
Serial.println("F");
digitalWrite(motor1,HIGH);
digitalWrite(motor2,LOW);
digitalWrite(motor3,HIGH);
digitalWrite(motor4,LOW);
 }
  if (state == '2') {
Serial.println("R");
digitalWrite(motor1,LOW);
digitalWrite(motor2,HIGH);
digitalWrite(motor3,LOW);
digitalWrite(motor4,HIGH);
 }
  if (state == '3') {
```

```
Serial.println("RT");
digitalWrite(motor1,HIGH);
digitalWrite(motor2,LOW);
digitalWrite(motor3,LOW);
digitalWrite(motor4,LOW);
 }
if (state == '4') {
Serial.println("LT");
digitalWrite(motor1,LOW);
digitalWrite(motor2,LOW);
digitalWrite(motor3,HIGH);
digitalWrite(motor4,LOW);
 }
 if (state == '5') {
Serial.println("ST");
digitalWrite(motor1,LOW);
digitalWrite(motor2,LOW);
digitalWrite(motor3,LOW);
digitalWrite(motor4,LOW);
 }
}
```

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