

VOICE CONTROLLED WHEELCHAIR

Submitted in partial fulfilment of the requirements for the award of degree

BACHELOR OF ENGINEERING

In

AUTOMOBILE ENGINEERING

by

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**DEPARTMENT OF AUTOMOBILE ENGINEERING
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC I 12B Status by UGC I

Approved by AICTE

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

March - 2021



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **SACHIN.S (37860701)**, **SANJAY (37860029)** who carried out the project entitled "**VOICE CONTROLLED WHEELCHAIR**" under my supervision from **2020** to **2021**

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DECLARATION

We **SACHIN. S (37860701), SANJAY (37860029)** hereby declare that the project report entitled “**VOICE CONTROLLED WHEELCHAIR**” done by under the guidance of **Mr. R. RAJASEKAR, M.E., Department of Automobile Engineering** at SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering in AUTOMOBILE ENGINEERING

DATE:

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We wish to express my thanks to all **Teaching and Non-teaching staff** members of the **Department of Automobile Engineering** who were helpful in many ways for the completion of the project.

Abstract

This project is related to controlling a wheel chair by means of human voice. The objective of this project is to facilitate the movement of people who are disabled or handicapped. Speech recognition technology is used to move the wheel chair. The result of this project is show that this can be used for future research work and public interest.

List of Acronyms

CPU	Central processing unit
GPRS	General Packet Radio Service
DC	Direct current
IC	Integrated Circuit
AC	Alternating current
BT	Bluetooth

List of figures

Fig 4.1.1 refers to Figure 1 of chapter 4

Fig 4.1.2 refers to Figure 2 of chapter 4

Fig 4.1.3 refers to Figure 3 of chapter 4

Fig 4.1.4 refers to Figure 4 of chapter 4

Fig 4.1.5 refers to Figure 5 of chapter 4

Fig 4.1.6 refers to Figure 6 of chapter 4

Fig 4.1.7 refers to Figure 7 of chapter 4

Fig 4.1.8 refers to Figure 8 of chapter 4

Fig 4.1.9 refers to Figure 9 of chapter 4

Fig 4.1.10 refers to Figure 10 of chapter 4

Fig 4.1.11 refers to Figure 11 of chapter 4

Fig 4.1.12 refers to Figure 12 of chapter 4

Fig 4.1.13 refers to Figure 13 of chapter 4

Fig 4.1.14 refers to Figure 14 of chapter 4

Fig 4.1.15 refers to Figure 15 of chapter 4

Fig 4.1.16 refers to Figure 16 of chapter 4

Fig 4.2.1 refers to Figure 17 of chapter 4

Fig 4.2.2 refers to Figure 18 of chapter 4

Fig 4.3.1 refers to Figure 19 of chapter 4

Fig 4.3.2 refers to Figure 20 of chapter 4

Fig 4.3.3 refers to Figure 21 of chapter 4

Fig 4.3.4 refers to Figure 22 of chapter 4

Fig 5.3.1 refers to Figure 1 of chapter 5

List of tables**Page no.**

Table 1: Distinguish Between HC-05 & HC-06

21

CONTENTS

	Page no.
Title Page	I
Bonafide Certificate	II
Declaration	III
Acknowledgement	IV
Abstract	V
List of Acronyms	VI
List of figures	VII
List of tables	IX
Chapter – 1	
1.1 Introduction	1
Chapter – 2	
2.1 Literature survey	5

Chapter – 3

3.1 – Aim	7
3.2 - Scope of the present investigation	7

Chapter – 4

4.1 – Materials	10
4.1.1 - Arduino Uno Board	11
4.1.2 - Arduino Cable	12
4.1.3 - Motor Driver Module (L293D)	13
4.1.4 - Motors – 2	15
4.1.5 - Caster Wheel	17
4.1.6 - Wheels – 2	18
4.1.7 - Bluetooth module (HC-05)	18
4.1.8- Ultrasonic sensors	23

4.1.10 - Android App - BT Voice Control	24
---	----

for Arduino (Google Playstore)

4.2 - algorithms used	25
-----------------------	----

4.3 – Methods	35
---------------	----

Chapter – 5

5.1 – Results	39
---------------	----

5.2 – Discussion	39
------------------	----

5.3 - Performance Analysis	42
----------------------------	----

Chapter – 6

6.1 – Summary	43
---------------	----

6.2 – Conclusions	43
-------------------	----

Reference	45
-----------	----

CHAPTER – 1

INTRODUCTION

This project aims to style integrate program to interface and test a totally motorized, voice-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 Voice 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 voice.

The target of this project is to facilitate the movement of people who are disabled or handicapped. We used Speech 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 speech commands by interfacing the Speech Recognition with a microcontroller and wheelchair.

The voice commands are given to the Bluetooth module HC 05 kit with the help of an android phone and thus the wheelchair moves according to the given directions. 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 speech recognition kit and motors is completed by employing a microcontroller.

The interfacing between speech recognition kit and motors is completed by employing a microcontroller. Here during this project, the microcontroller used is ATMEGA 328. 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. According to the earliest records, the wheeled furniture is an inscription that has been found on a stone slate in China and as a child's bed depicted during a frieze on a Greek vessel, both beginnings in the 6th and 5th century BCE. the original records of wheeled furniture making practiced for carrying disabled characters date to three centuries succeeding in China; the Chinese practiced early roller carts to move people also as large objects. A distinction between the 2 functions wasn't made for an additional several hundred years, until around 525CE,

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 selfly or manually propelled wheelchairs, where the propulsive happend 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 voice-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 prototype wheelchair that's voice actuated.

The project aims in designing a wheelchair that can be operated using Android mobile phone. The controlling of the created prototyped wheelchair is done wirelessly through the Android smartphone using the Bluetooth feature present in it. Here in the project the Android smart phone is used as a remote control for operating the wheelchair.

Android which is a known software stack for mobile devices that includes an operating system, middleware and key applications. Android possesses a healthy host of connectivity choices, including Wi-Fi, Bluetooth, and radio data over a cellular link (for instance, GPRS,

EDGE (Enhanced Data rates for GSM Evolution), and 3G). The Android platform provides availability to a huge range of useful manuscripts and devices that can be used to build rich applications. In addition, Android includes a full set of tools that have been built from the ground up alongside the platform providing developers with high productivity and deep insight into their applications. Bluetooth is a free standard spec for a radio frequency (RF)-based, shortrange connectivity technology that assures to modify the profile of computing and wireless communication. It is outlined to be an economical, wireless networking system concerning all classes of transportable devices, such as laptops, PDAs (personal digital assistants), and mobile phones.

It also will facilitate wireless connections for desktop computers, making links between monitors, printers, keyboards, and the CPU cable-free. The controlling device of the whole system is a Microcontroller. The data obtained by the Bluetooth module of the Android smart phone is fed as input to the controller. The controller acts accordingly on the DC motors of the prototype. The wheelchair in the project can be made to move in all the four directions using the Android phone.

CHAPTER – 2

LITERATURE SURVEY

To understand the effectiveness of our project we had to first understand the types of the existing wheelchair, their advantages, and their shortcomings. Some of the types of wheelchairs are:

- Manual wheel Chair: Had to be manually operated.
- Electric Wheel Chair: Controlled by a lever but not automatic.
- Beach Wheel Chair: Good grip on sand but manual.
- Airplane Wheel Chair: Additional strapping but manual.
- Ergonomic Wheel Chair: Extremely comfortable but manual.
- Pediatric Wheel Chair: Kid-size Wheelchair Semi-Automatic.
- Reclining Wheel Chair: Can be tilted to a limited angle,
- Wheel Chair Stretches: Can be opened to a stretcher.

We even did our research by reading a few of the papers and here are what we understood and used through those.

We went through a paper that specified about the development of wheelchair that can be controlled by voice, eye or using joystick according

to the severity of disability of handicap person. It also features a warning system that analyses the patient real situation such as heart rate, temperature, etc and notifies the doctor regarding the same. It even has integrated robotic hand which helps the patient for taking medicines and food. This study paper concentrates on the queries of the handicapped individual and tries to resolve them in the best feasible way. The condition is that it ought to be formed independently for each single specified to its austerity which raises its price and time.

The other paper which we through focuses on the development of solar based wheelchair which helps in reducing the running cost of the wheelchair. It is specifically created for hemipelagic users to control the wheelchair efficiently. The control of the wheelchair can be assigned to either side to help the user. The wheelchair has significant benefits but still restricts from the circumstance that it has larger battery charging time and less capacity to climb up the slope

The other paper specified about the high costing of the electric wheelchair and modifying the present electric wheelchairs to make it affordable to the common people. It put importance on the utilization of sources open locally to cut the price of wheelchair. It utilizes pair of dc gear motor, PIC microcontroller and h bridge module for commanding the movement of wheelchair. The shortcoming of this research is that expense of the wheelchair is still huge for the ordinary people to afford it.

After looking at all the work we came to the decision that there was no voice-controlled wheel chair which would use an android phone for controlling it through the App where it would send signal through Bluetooth to the HC05 and the rest of the function would take place. Hence our idea would be the first of its kind. But it came with the added disadvantage of 3rd party intervention and failure of the voice control leads to failure of the entire system.

Chapter – 3

Aim and Scope of the present investigation

3.1. Aim:

The main aim of the project is to provide aid to a person who suffering from physically handicapped situation and he or she is not be able to do their ordinary work. Therefore, by this project we thought of providing a solution and people these guys with very efficient designed and using voice.

The intention of this project is to create a wheelchair that has characteristics such as low weight, low cost, long distance travelling range.

- To achieve long distance travel.
- Forming a light-weight wheel-chair prototype structure.
- Coding of a precise program, which would govern the project by using a voice (controlled using Arduino)
- Executing the total prototype as cost-efficient and less costly as possible.

3.2.Scope of the present investigation:

In worldwide context, it is estimated that 100-130 million people with disabilities are present which require wheelchairs for their assistance.

Reasons for the physical disability can be

1. Inherited or genetic disorder such as dystrophy.
2. Health instant at the origin so as spinal bifida.
3. Spinal cord or brain injury during accidents. Experts foretell that the number of people who will require wheelchairs will be raised by 22% over the subsequent ten years.

Wheel-chair is still the most reliable transport means for them. This is the cause why wheelchairs are being produced with added latest improvements which leads its conversion to electric wheelchair.

Shortly available manual wheelchairs need regular assistance of others for people having severe limitation and are at a high risk of damages to the upper part of the body due to mechanical inability of the wheelchair.

Furthermore, standard wheelchairs possess problems while working up the hill or rough surface. The open electric wheelchairs and our wheelchair are voice-operated and also self operational.

The purpose of our research is to provide simpler wheelchair hardware architecture but with powerful computational platforms so that wheelchairs or the robot's designer can focus on their research and tests instead of Bluetooth connection infrastructure. This simplistic architecture is also helpful for educational robotics, because students can construct their own robots at an economical cost and use them as platform for experiments in several courses. The main purpose of this project is to develop a remote user interface to control a system via a wireless technology. There is a need to communicate with the wheelchair remotely in order to control the

wheelchair's movements and pass critical data both ways. The current IR controls are not good enough because the wheelchair does not have an IR transmitter but only a receiver, meaning that the communication is one way.

The IR communication works only in line of direct sight and any objects in the way will obstruct the communication. Bluetooth communication will enable us to control the wheelchair up to 100 meters without the need for direct sight which means that the wheelchair could be located behind a wall or some other purpose and the connection would not be lost.

Chapter – 4

Materials and methods; Algorithms used

4.1. Materials

- Arduino Uno Board
- Arduino Cable
- Motor Driver Module (L293D)
- Motors - 2
- Caster Wheel
- Wheels - 2
- Bluetooth module (HC-05)
- Ultrasonic sensors
- Power adapters or battery
- Android App - BT Voice Control for Arduino (Google Playstore)

4.1.1 Arduino Uno Board

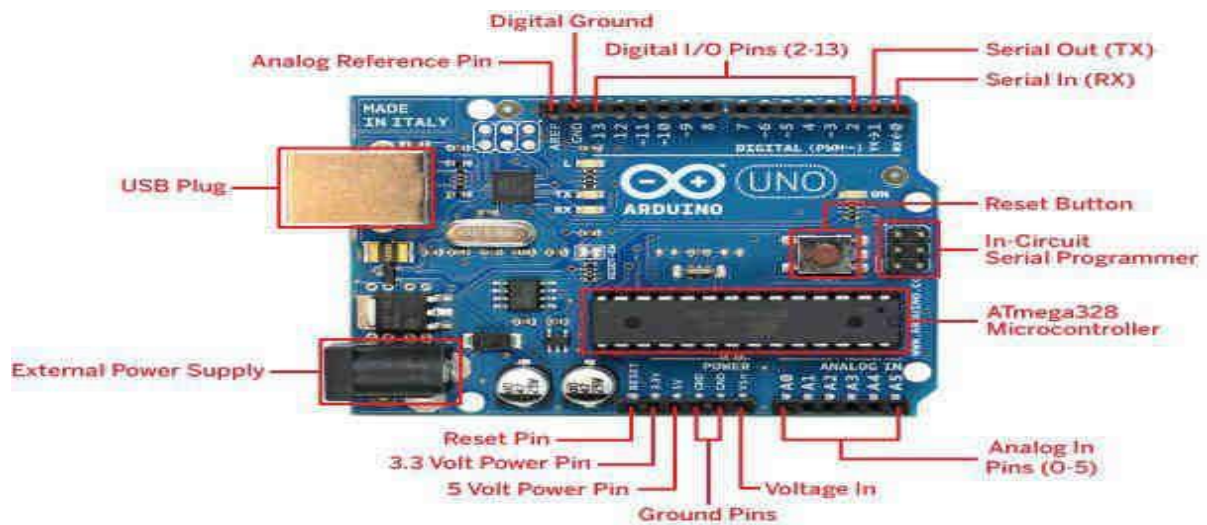


Fig 4.1.1 Arduino board

Arduino is an Open-source-electronic-prototyping-base for simple used hardware and software in the field of micro-controlling.

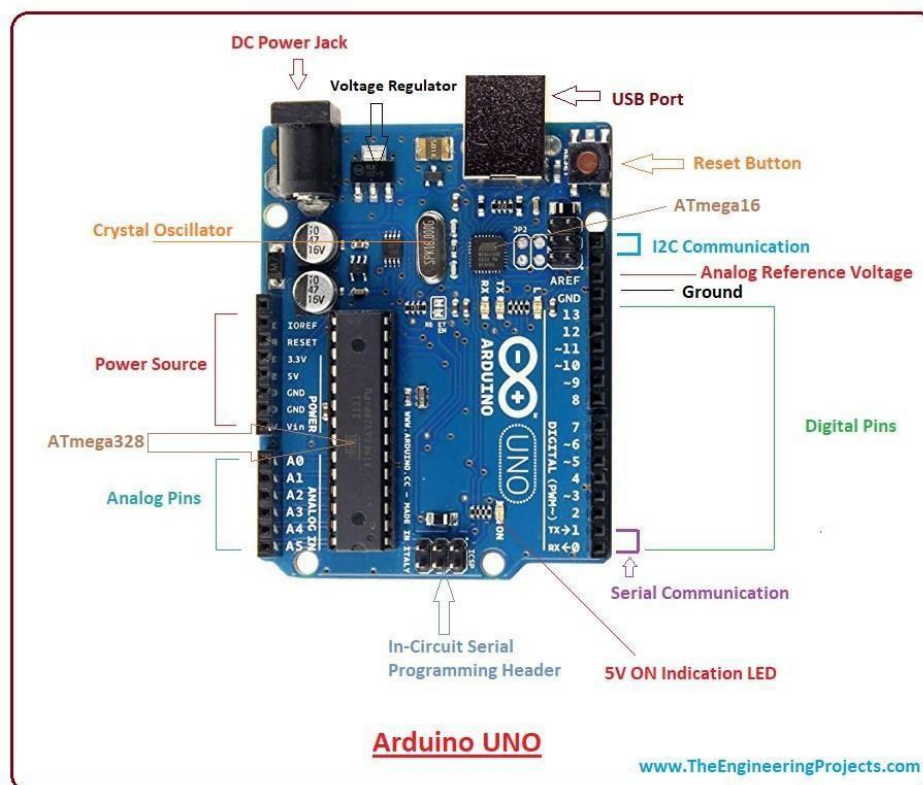


Fig 4.1.2 Arduino board vertical view

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.

4.1.2 Arduino cable



Fig 4.1.3 Arduino cable

It is used to connect our Arduino Uno board, Arduino ATmega328 board which is used both to power the board and upload the program to the board for it to function it out.

4.1.3 Motor driver module L293D

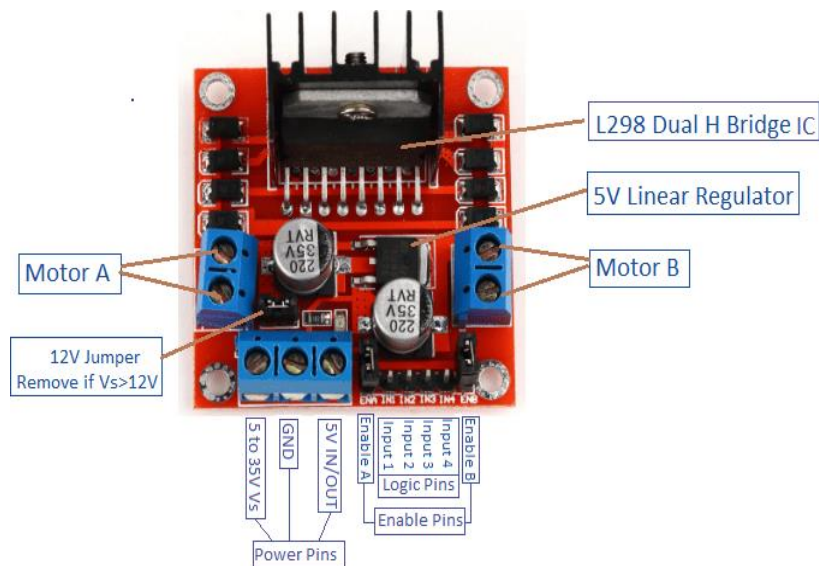


Fig 4.1.4 Motor driver L293D

L293D is a standard Motor driver or Motor Driver IC which enables DC motor to drive on either way. L293D is a 16-pin IC that can command a set of two DC motors concurrently in any way.

It works on the concept of H-bridge. H-bridge is a circuit which enables the voltage to be navigated in either direction.

As you understand, voltage needs to change its direction for rotating the motor in clockwise or anticlockwise direction; hence, H-bridge IC is ideal for driving a DC motor.

In a single L293D chip there are two h-Bridge circuit inside the IC which can turn two dc motor separately. Due its dimension it is very much used-

-in robotic application for regulating DC motors. Given underneath is the pin design of a L293D motor controller.

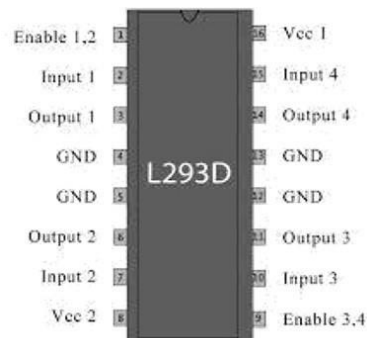


Fig 4.1.5 L293D layout

The L293D is fourfold high-current half-H drivers. It is created to give bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both tools are invented to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as additional high-current/high-voltage loads in positive-supply uses. All inputs are TTL agreeable. Each output is a whole totem-pole drive circuit, with a Darlington transistor sink and a pseudo- Darlington origin. Drivers are enabled in pairs, with drivers

1 and 2 enabled by 1,2EN and drivers 3 and 4 approved by 3,4EN. When an facilitate input is high, the associated drivers are licensed, and their outputs are ready and in phase with their inputs. When the permitted input is low, those drivers are disabled, and their outputs are off and in the high-impedance state.

4.1.4 Motors



Fig 4.1.6 DC motor

Motors are undoubtedly one of the multiple important roles of a mobile robotics program. Overpowered motors generate inability and waste the already restrained supply of energy from the onboard batteries, while small motors could be low on torque at crucial times.

The optimal rotation velocity and the possible speed limit of the motor requirement also be taken into thought. To high of an output rpm from the

motor shaft will cause the robot to operate at a fast, uncontrollable speed. Too weak of output and the robot will not be able to achieve a proper speed to match the user's requirements.

The torque output of the motor also performs a role in the execution because if the torque is not enough, locomotion may not happen in some circumstances. Hence, much thought was put into the choice of the individual motor for the platform.

Motors come in various shapes and sizes. There are electromagnetic direct current (DC) motors and electromagnetic alternating current (AC) motors and plenty of varieties of each. AC motors are typically practiced for large purposes, such as machine tools, washers, dryers, etc., and are power by an AC power line.

As the standard power stock for mobile robotic is a DC battery, and technology for transforming DC to AC is very expensive in both terms of monetary cost and power cost, AC motors are where ruled out as an option for the robot.

4.1.5 Caster wheel



Fig 4.1.7 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.

4.1.6 Wheel



Fig 4.1.8 Wheels

Wheels are that operate around the area` practicing motorized wheels to drive themselves. This study is plainer than using treads or legs and by utilizing wheels they are simpler to create, build, and program for movement in flat, not-so-rugged terrain. They are also more well-controlled than different kinds of robots. Disadvantages of wheeled robots are that they can't navigate well over obstacles, such as rocky terrain, sharp declines, or areas with low friction.

4.1.7 Bluetooth module (HC-05)

Bluetooth is a wireless technology standard for exchanging data over short distances (using short wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs).

This was one interesting topic that we came across. We found out various ways to control our wheelchair with help of voice recognition modules or Bluetooth voice control. Few modules which we came across were:

- i. HM2007: It is used to command and control of appliance and equipment. It is user programmable through keys. It has a MIC interface. It has the ability to detect 40 different words. It would cost around Rs.3500/-

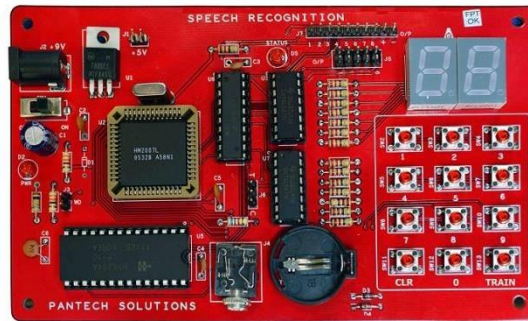


Fig 4.1.9 HM2007

- ii. RKI1199: This Voice Recognition module is compatible and easy control speaking board. It also has microphone pin interface. It supports up to 80 voice commands. Max of 7 voice commands would work at the same time. Its cost would be placed at Rs.2366/-
- iii. HC05: HC05 is a Serial Bluetooth module for Aurdino and other microcontrollers operating at 5V. It has a two-way wireless functionality which is compatible with laptop or phone.

It has a baud rate of 9600. It is readily available in most of the electronic shops. It would cost Rs.400/-.

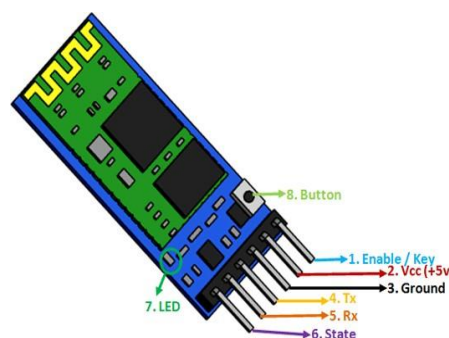


Fig 4.1.10 HC05

HC Serial Bluetooth goods consist of Bluetooth serial interface module and Bluetooth adapter. Bluetooth series module is utilized for changing serial port to Bluetooth.

This module has couple of forms: master and slaver device. The device named after even number is defined to be master or slaver when out of factory and can't be changed to the other mode. But for the project titled after odd quantity, users can set the work mode (master or slaver) of the device by AT commands.

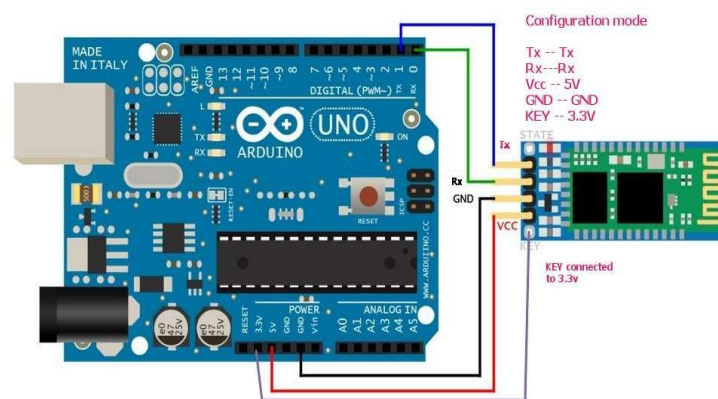


Fig 4.1.11 HC05 plugged in with Aduino board

HC-06 Specifically includes:

Master device: HC-06-M, M=Master Slaver device: HC-06-S, S=Slaver.

The main purpose of the Bluetooth series module is to replace the following port line, such as One connects to the Bluetooth control device while another one equates to a slaver means. Their link can be created once the pair is executed. This Bluetooth link is equally liked to a serial port line agent including RXD, TXD signals. And they can communicate with each other.

1. Meanwhile MCU has Bluetooth cure module, it can interact with Bluetooth adapter of computers and smart phones.
2. The Bluetooth tools in the shop mostly are cure devices, such as Bluetooth printer, Bluetooth GPS. So, we can use the control module to make pairs and interact with them.
3. Bluetooth serial module's work doesn't require drivers and can interact with the other Bluetooth device. But connection between two Bluetooth modules need at two conditions:
 - i) The information must be within master and slave.
 - ii) The password must be correct.

Here is the main factory parameter of HC05 and HC06. Pay attention to the difference:

HC-05	HC-06
Master and Slave mode can be Switched	Master and Slave mode can't be switched

4.1.8 Ultrasonic sensors

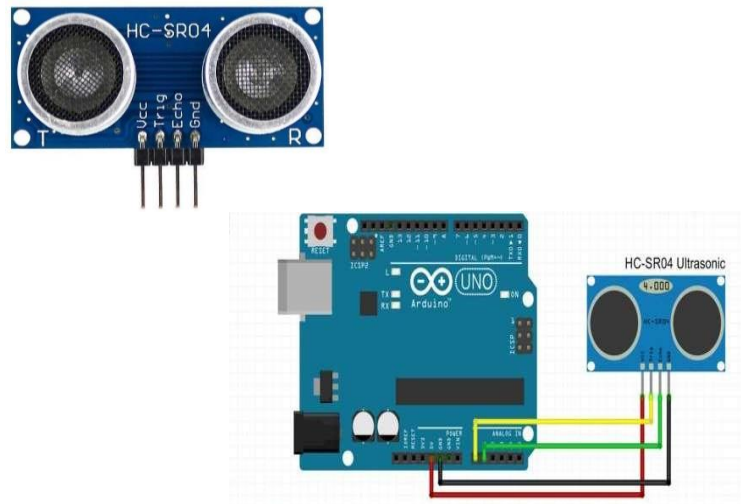


Fig 4.1.13 Sensors layout

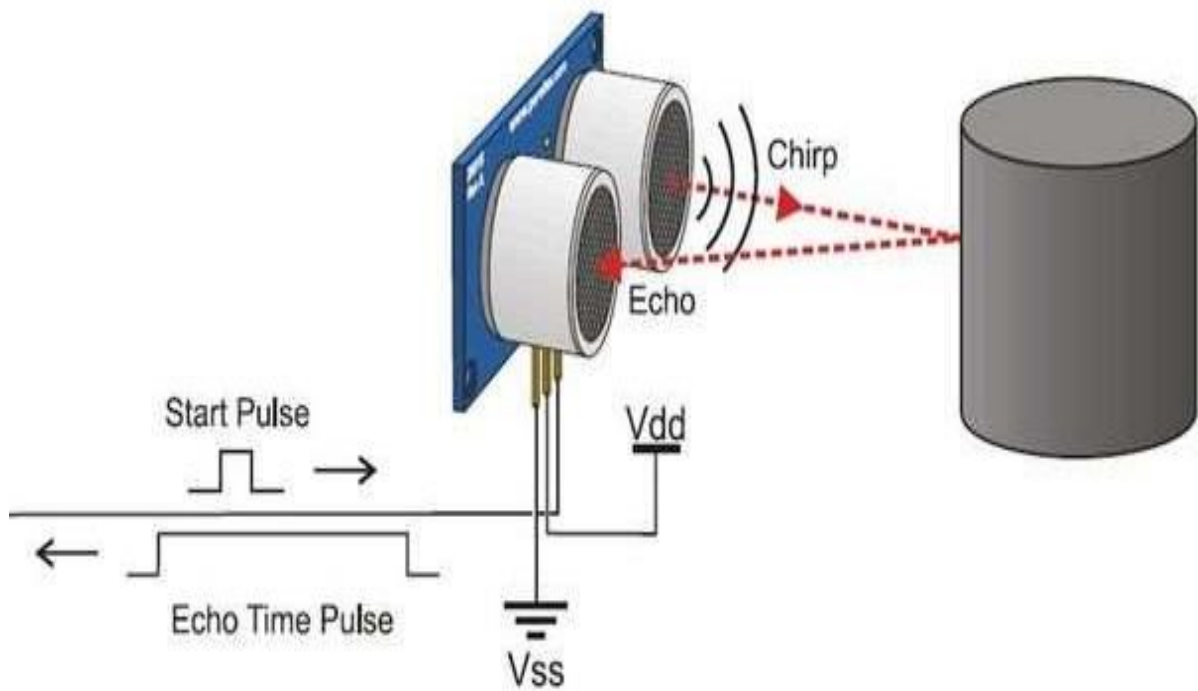


Fig 4.1.14 Ultra sonic sensors

4.1.9 Android App - BT Voice Control for Arduino (Google Playstore)

To control the whole set up through our voice command we would need an android app which we can easily find in the play store named BT voice controlled by Arduino

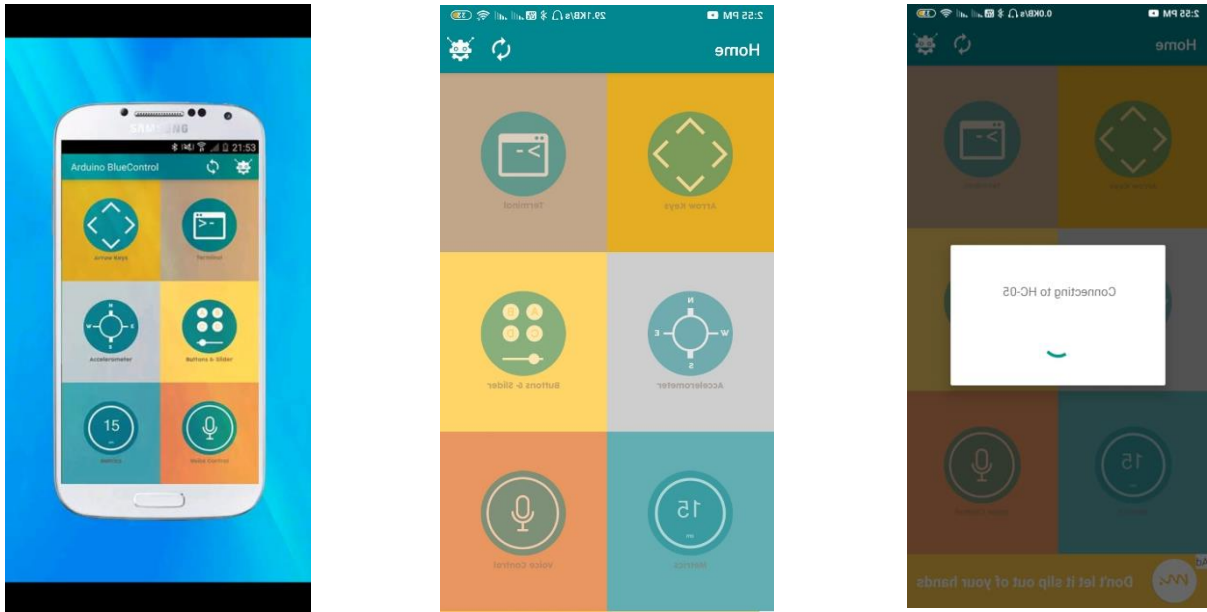


Fig 4.1.15 Bluetooth voice control android app

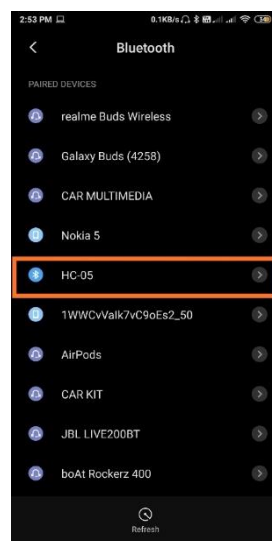


Fig 4.1.16 Connecting Bluetooth

4.2 Algorithms used

```
#define BAUDRATE 9600

const int MotR_A = 5;
const int MotR_B = 3;
const int MotL_A = 6;
const int MotL_B = 9;
const int trigPin = 12;
const int echoPin = 13;

byte GetValue;
long duration, distance;

void setup()
{
    Serial.begin(BAUDRATE);
    pinMode(trigPin, OUTPUT);
    pinMode(echoPin, INPUT);
    pinMode(MotR_A, OUTPUT);
    pinMode(MotR_B, OUTPUT);
    pinMode(MotL_A, OUTPUT);
    pinMode(MotL_B, OUTPUT);
}

byte ReadOneByte()
{
    int ByteRead;
    while(!Serial.available());
    ByteRead = Serial.read();
    return ByteRead;
}

long dist()
{
    digitalWrite(trigPin, LOW);
```

```

    delayMicroseconds(2);
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);
    distance = (duration/2) / 29.1;
    return distance;
}

void loop()
{
    GetValue = ReadOneByte();
    Serial.print(GetValue);
    switch(GetValue)
    {
        case 'L':
            Robot_Left();
            delay(500);
            Robot_Stop();
            break;
        case 'R':
            Robot_Right();
            delay(500);
            Robot_Stop();
            break;
        case 'F':
            Robot_Front();
            break;
        case 'B':
            Robot_Reverse();
            break;
    }
}

```

```

        case 'S':
            Robot_Stop();
            break;
    }
}

void Robot_Front()
{
    long value = dist();
    if (distance < 10)
    {
        Robot_Stop();
    }
    else
    {
        Robot_Forword();
    }
}

void Robot_Forword()
{
    digitalWrite(MotR_A, LOW);
    digitalWrite(MotR_B, HIGH);
    digitalWrite(MotL_B, LOW);
    digitalWrite(MotL_A, HIGH);
}

void Robot_Reverse()
{
    digitalWrite(MotR_A, HIGH);
    digitalWrite(MotR_B, LOW);
    digitalWrite(MotL_B, HIGH);
    digitalWrite(MotL_A, LOW);
}

```

```

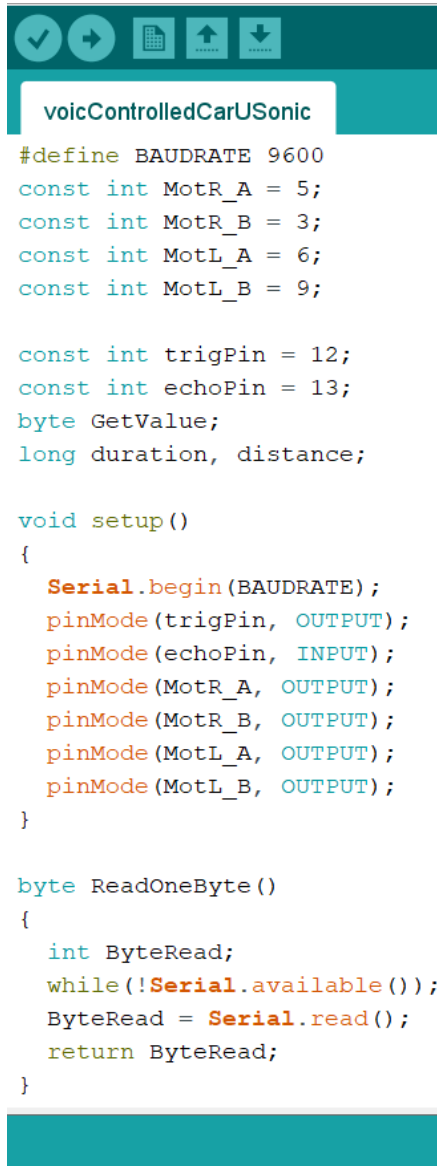
}

void Robot_Left()
{
    digitalWrite(MotR_A, HIGH);
    digitalWrite(MotR_B, LOW);
    digitalWrite(MotL_B, LOW);
    digitalWrite(MotL_A, HIGH);
}

void Robot_Right()
{
    digitalWrite(MotR_A, LOW);
    digitalWrite(MotR_B, HIGH);
    digitalWrite(MotL_B, HIGH);
    digitalWrite(MotL_A, LOW);
}

void Robot_Stop()
{
    digitalWrite(MotR_A, LOW);
    digitalWrite(MotR_B, LOW);
    digitalWrite(MotL_B, LOW);
    digitalWrite(MotL_A, LOW);
}

```

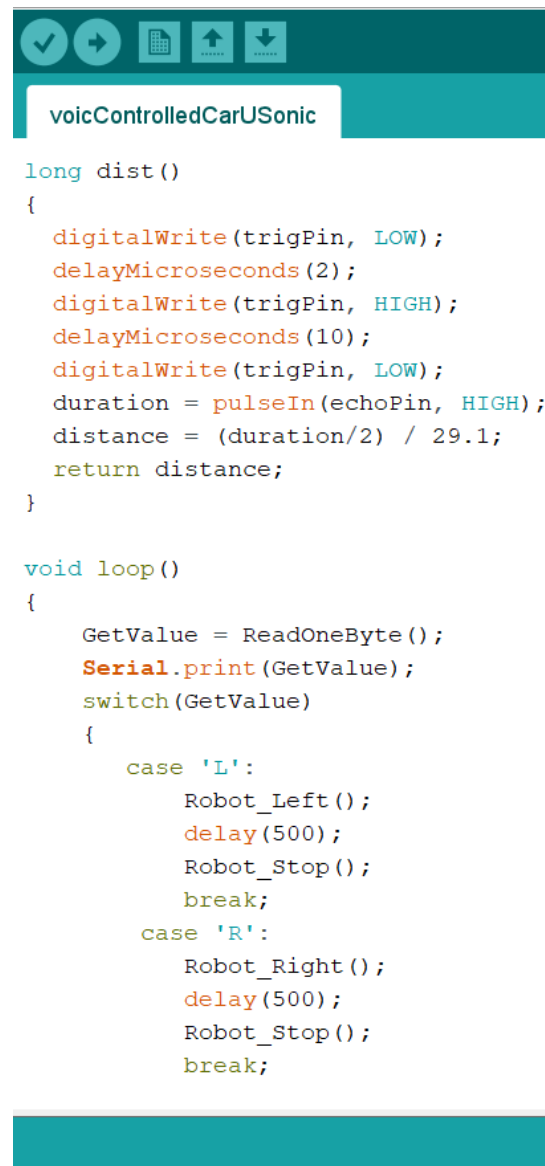


```
#define BAUDRATE 9600
const int MotR_A = 5;
const int MotR_B = 3;
const int MotL_A = 6;
const int MotL_B = 9;

const int trigPin = 12;
const int echoPin = 13;
byte GetValue;
long duration, distance;

void setup()
{
    Serial.begin(BAUDRATE);
    pinMode(trigPin, OUTPUT);
    pinMode(echoPin, INPUT);
    pinMode(MotR_A, OUTPUT);
    pinMode(MotR_B, OUTPUT);
    pinMode(MotL_A, OUTPUT);
    pinMode(MotL_B, OUTPUT);
}

byte ReadOneByte()
{
    int ByteRead;
    while(!Serial.available());
    ByteRead = Serial.read();
    return ByteRead;
}
```



```
long dist()
{
    digitalWrite(trigPin, LOW);
    delayMicroseconds(2);
    digitalWrite(trigPin, HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin, LOW);
    duration = pulseIn(echoPin, HIGH);
    distance = (duration/2) / 29.1;
    return distance;
}

void loop()
{
    GetValue = ReadOneByte();
    Serial.print(GetValue);
    switch(GetValue)
    {
        case 'L':
            Robot_Left();
            delay(500);
            Robot_Stop();
            break;
        case 'R':
            Robot_Right();
            delay(500);
            Robot_Stop();
            break;
    }
}
```

Fig 4.2.1 Code in Aduino open source

```

    case 'F':
        Robot_Front();
        break;

    case 'B':
        Robot_Reverse();
        break;

    case 'S':
        Robot_Stop();
        break;
    }
}

void Robot_Front()
{
    long value = dist();
    if (distance < 10)
    {
        Robot_Stop();
    }
    else
    {
        Robot_Forward();
    }
}

```

```

}

void Robot_Forward()
{
    digitalWrite(MotR_A, LOW);
    digitalWrite(MotR_B, HIGH);
    digitalWrite(MotL_B, LOW);
    digitalWrite(MotL_A, HIGH);
}

void Robot_Reverse()
{
    digitalWrite(MotR_A, HIGH);
    digitalWrite(MotR_B, LOW);
    digitalWrite(MotL_B, HIGH);
    digitalWrite(MotL_A, LOW);
}

void Robot_Left()
{
    digitalWrite(MotR_A, HIGH);
    digitalWrite(MotR_B, LOW);
    digitalWrite(MotL_B, LOW);
    digitalWrite(MotL_A, HIGH);
}

void Robot_Right()
{

```

```

    digitalWrite(MotR_A, LOW);
    digitalWrite(MotR_B, HIGH);
    digitalWrite(MotL_B, HIGH);
    digitalWrite(MotL_A, LOW);
}

```

```

void Robot_Stop()
{
    digitalWrite(MotR_A, LOW);
    digitalWrite(MotR_B, LOW);
    digitalWrite(MotL_B, LOW);
    digitalWrite(MotL_A, LOW);
}

```

Fig 4.2.2 Code in Aduino open source

4.3 Methods

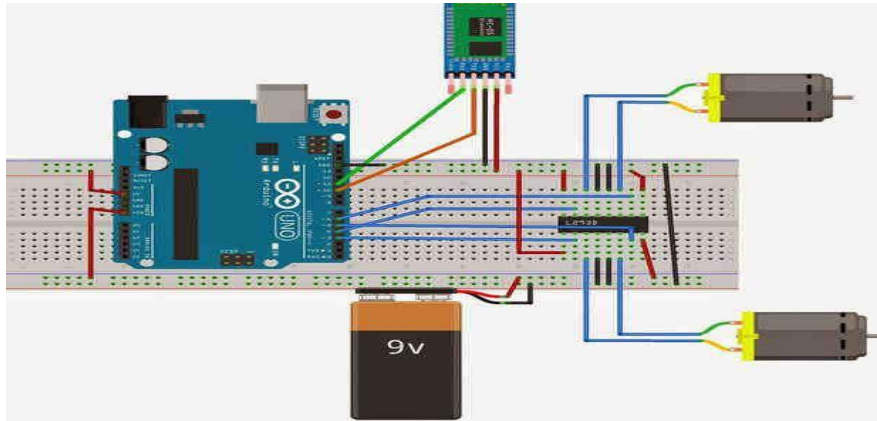


Fig 4.3.1 Circuit connection

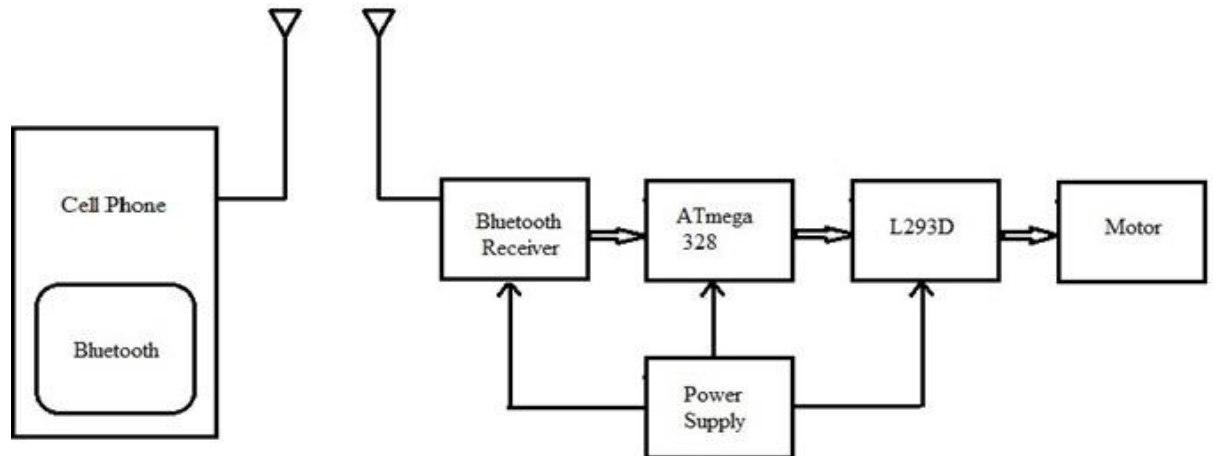


Fig 4.3.2 Block diagram

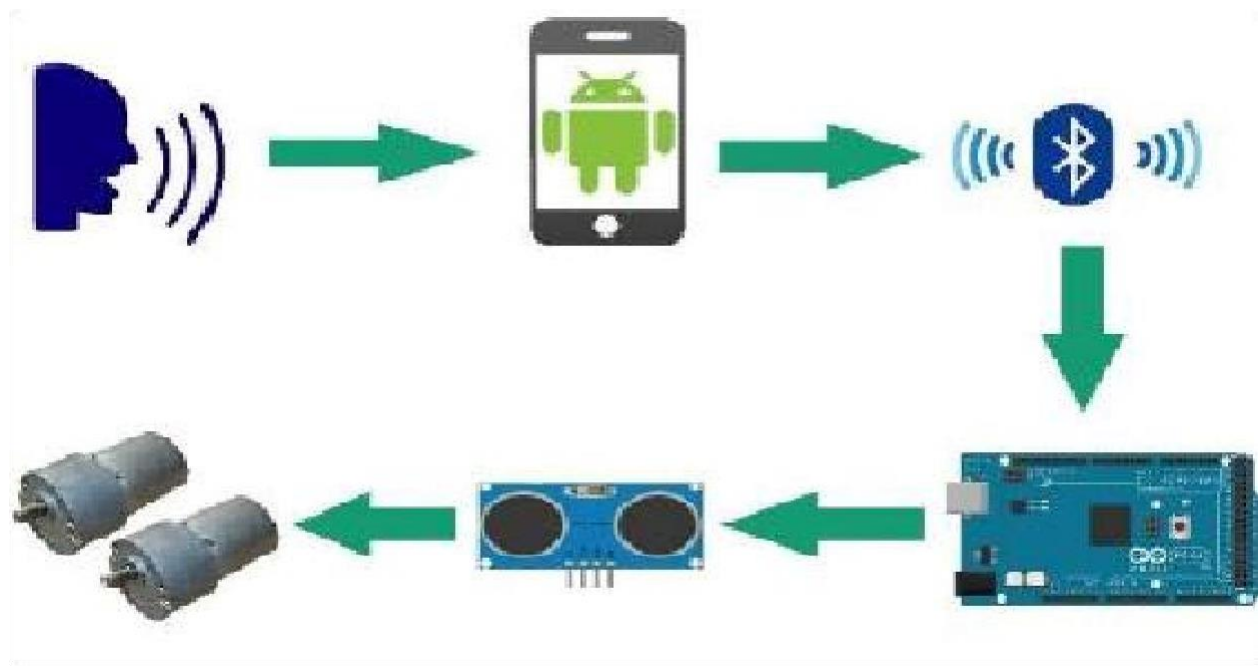


Fig 4.3.3 Flow Chart

- When the app is started at that point a request is created if the Bluetooth is not switched on.
- A combined virtual switch is near which is utilized to combine the Android mobile phone with the device Bluetooth HC-05 for wireless transmission of data.
- When the Bluetooth has turned on the request considers the information when the user affects the virtual button.
- If the requirement is forward and only if the ultrasonic sensor does not sense any object within 30 cm in front of it then all the dc motors are provided with 5V and submitted in forwarding directions for linear progression.
- If the condition is opposite then all the dc motors are provided with 5V and moved in reversed tracks for linear movement.
- If the condition is to switch left then the left dc motors are suspended and the right dc motors are provided with 5V and the wheelchair progress in left direction.
- If the condition is to turn right then the right dc motors are suspended and the left dc motors are provided with 5V and the wheelchair progress in right direction.

- If STOP over the voice command is said then all the dc motors are stopped.

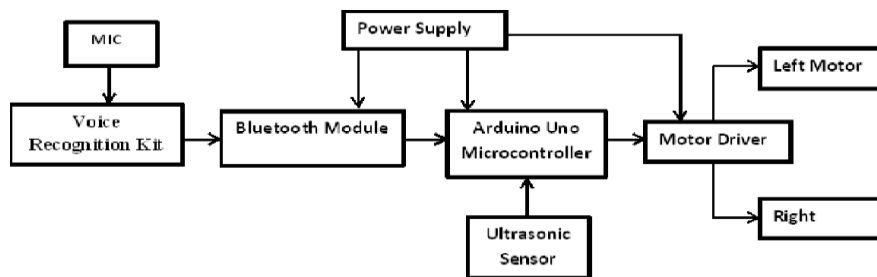


Fig 4.3.4 Voice controlled wheelchair flow chart

The prototype will use an Arduino UNO as a microcontroller and HC05 Bluetooth Module to make it voice actuated. To actuate the wheel chair, we will be using a D.C motor of 10kg-cm Torque rating. To power this motor, we will use a battery of 12V, 1.3Ah. Since the Arduino cannot provide 12V as its output, we will use a L298 motor driver. All the above-mentioned components will be encased in a wooden box which will have wheels attached to it.

- The application in our cell phones sense our voice converts it to written words, encodes it and sends it to the Bluetooth Module.
- Bluetooth Module receives this data and sends it to the microprocessor of Arduino.
- The processor compares this data with the predefined program and generates a digital data according to the program.
- This signal powers the motor and actuates our machine.

- The Ultrasonic sensor senses the obstructions, if there are any, and sends a signal to the Arduino which again compares it with the program and generates a digital signal accordingly.

Chapter – 5

Results, Discussion and Performance Analysis

5.1 Result

Voice controlled wheelchair is the modified version of the manual wheelchair. It is operated based on the voice command of the patient i.e., commands such as forward, left, right, stop, etc. The wheelchair does not require any person to move it as it is automated with motors. Voice of an independent speaker is sent through the android app, which is paired to HC-05 and interfacing of the Arduino and HC-05 converts the voice signals and with the help of L298D Driver motors are driven and hence the wheelchair moves in the direction that's been commanded.

5.2 Discussion

The input is taken from the android mobile; speech signal is converted into the text with the help of an android application. This writing is the command to the Microcontroller which establishes the action and way of wheelchair via a Bluetooth module wirelessly. The microcontroller determines the development of the two DC motors depending on the text sustained. L298D is a dual full bridge driver IC which is used for driving purpose of DC motors.

The wheelchair paths and progress probable are as given below.

1. Forward: Both motors are in forward direction.
2. Reverse: Both motors are in reverse direction.

3. Left: Left motor closed and right motor in front direction.
4. Right: Right motor stopped and left motor in forward direction.
5. Stop: Both motors are stopped.

Movement of the motors is controlled with the help of joystick commands and Arduino UNO and battery using joystick controller board.

When the DC driver is connected to the motors and supply of 12v is given from the external voltage chargeable source. Interfacing of Arduino and HC-05 is done. With the help of android phone connect the Bluetooth HC-05 to the android app it is an independent speaker app.

Backward: Motor1 moves in clockwise direction. Similarly, Motor2 moves in the clockwise direction and the tyres of the wheelchair moves in backward direction.

Forward: Motor1 moves in the anti-clockwise direction. Similarly, Motor2 moves in the anti-clockwise direction and the tyres of the wheelchair moves in forward direction.

Left: Motor1 or the left tyre moves in the anti-clockwise direction and simultaneously Motor2 or the right tyre moves in the clockwise direction.

Right: Motor2 or the right tyre moves in the anti-clockwise direction and simultaneously Motor1 or the left tyre moves in the clockwise direction.

Advantages

1. A handicapped person even with Legs and Hand can use this and become Independent.
2. Very quickly developing input can be effortlessly identified due to Android mobile.
3. Suitable for practical application as compared to HM 2007.
4. Requires less wiring because of Bluetooth section.
5. Less Hardware require i.e., compact.
6. Economical.
7. Reduce manpower.

5.3 Performance Analysis

Calculation

Coefficient of Rolling friction between rubber and ground
 $= 0.04 = \mu$

Load carried by the wheelchair = $15 \text{ kg} = 147 \text{ N}$
 Self weight of the prototype = $5 \text{ kg} = 49 \text{ N}$
 Total Normal force = 196 N

$\therefore$ Friction force = 4 N
 $= 0.04 \times 196$
 $= 13.72 \text{ N}$

Total Torque required at wheels = $F \times r$
 $= \text{Friction force} \times \text{radius of the wheels}$
 $= 13.72 \times 60$
 $= 823.2 \text{ Nmm}$
 $\boxed{T = 0.823 \text{ Nm}}$

$\therefore$ The required torque of the motor is $T > 0.8 \text{ Nm}$

Standard size of motor is
 $T = 10 \text{ kg} \cdot \text{cm}$
 $= 0.98 \text{ Nm}$

$\therefore$ A motor of torque $10 \text{ kg} \cdot \text{cm}$ can be used. $\therefore$
 If the rpm of the motor is 30 rpm , then the max. velocity
 with which wheelchair will travel is

$V = \omega = r \times \omega$
 $= 60 \text{ mm} \times \frac{2\pi \times 30}{60} \text{ rad/sec}$
 $= 188.5 \text{ mm/sec}$
 $= 18.85 \text{ cm/sec}$

$\therefore$ The power of motor is $P = T\omega = 18.5 \text{ W}$

Assuming machine will run for 6 hours/day
 Current capacity $I = P \times t$
 $= \frac{18.5}{12} \times 6 = 92.5 \text{ Ah}$ [Winding battery is 12V]
Battery capacity = 92.5 Ah

Fig 5.3.1 Calculation

Calculation if the weight that has to be carried by wheelchair is 10kg

Total torque = 0.823 Nm

V = 18.85 cm/sec

Battery capacity = 92.5Ah

Chapter – 6

Summary and Conclusions

6.1. Summary

This project can be reviewed as a method that is used for the handicapped personality can able to move around using the voice of that person.

To create and produce an android app within which we can operate a movement of wheelchair Using the android device.

6.2. Conclusions

Wireless controller is one of the most prominent basic needs for all living beings. But sadly, due to a huge amount of data and communication overheads the technology is not fully utilized.

Many of the wireless-controlled robots use RF modules. But this project makes use of Android mobile phone for robotic control which is very cheap and easily available. The control commands open are more than RF modules. For this the android mobile user has to establish an application on her/his mobile. Then the user requires to switch on the Bluetooth in the mobile. The wireless connection method used to command the robot is Bluetooth technology. User can practice many commands like move forward, reverse, move left, move right using these commands which are transmitted from the Android mobile.

Robot has a Bluetooth transceiver unit that accepts the commands and return it to the microcontroller circuit to command the motors.

The microcontroller then transmits the signal to the motor driver ICs to operate the motors the objective of the paper is to realise the smart living, more specifically the home lighting control system using Bluetooth Technology. Robot and smart phones are a perfect match, especially mobile robots.

As phones and mobile devices are each time more powerful, using them as robot for building robot with advanced feature such as voice recognition. Android Bluetooth-enable phones and Bluetooth module via HC-06 and information among Bluetooth tools. It is presumed that smart existence will slowly turn into a reality that user can control their home remotely and wirelessly.

References

Journals

1. "Design and Implementation of an Electric Wheel-Chair to Economies it with Respect to Bangladesh" by Humaira Salmin, Hafiz Rakibul, Pratik Kumar Kundu, B.M. Fahmid Jahur Shuvo, K.B.M. Nasiruzzaman and Rahman MD Moshour, International Journal of Multidisciplinary Sciences and Engineering, Vol. 5, No. 2, pp: (17-22), February 2014 [3]
2. "Solar Powered Wheel Chair: Mobility for Physically Challenged", Arun Manohar Gurram, P.S.V Ramana Rao, Raghuveer Dontikurti, International Journal of Current Engineering and Technology, ISSN 2277 - 4106 Vol.2, No.1, pp: (211-214), March 2012 [2]
3. "Wheelchair for Physically and Mentally Disabled Persons", Nirmal T M, International Journal of Electrical and Electronics Research, ISSN 2348-6988 (online), Vol. 2, Issue 2, pp: (112-118), April - June 2014 [1]

Valid internet articles

1. <https://en.wikipedia.org/wiki/Arduino>
2. [https://www.itead.cc/wiki/Serial Port Bluetooth Module \(Master/Slave\) : HC-05](https://www.itead.cc/wiki/Serial_Port_Bluetooth_Module_(Master/Slave)_:_HC-05)
3. <https://www.instructables.com/Voice-Activated-Arduino-Bluetooth-Android/>

Final outcome:

