

VOICE OPERATED WHEELCHAIR USING ANDROID (the smart wheelchair)

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Introduction

- ▶ This project is conceived as an idea to ease the lives of those among us who are unfortunate enough to have lost the ability to move their legs due to a significant amount of paralysis, accident or due to old age.
- ▶ For the wheelchair users, they need continuously someone to help them in getting the wheelchair moving.
- ▶ Their lives are made difficult by the fact that there is lack of an intuitive control system for their wheelchairs that allows moving independently.
- ▶ Using a voice operated wheelchair leads to a large amount of independence for persons with a physical disability who can neither walk nor operate a mechanical wheelchair alone as it requires great effort and help of other people

Objective

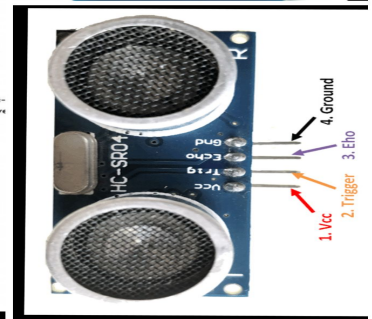
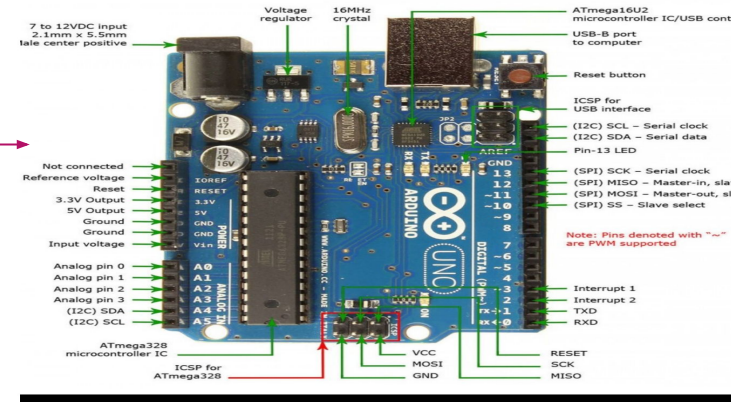
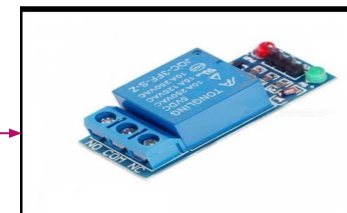
- ▶ The way of controlling a power wheelchair can be done using speech commands for hands-free patients leading to an interesting and promising outcome
- ▶ Providing independent , enjoyable , and joyful living for the physically challenged people by the use of voice to operate the wheelchair
- ▶ The goal of this smart wheelchair project is to enhance an ordinary powered wheelchair using sensors to perceive the user's surroundings , a speech interface to interpret commands

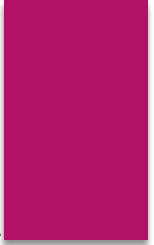
Voice operated wheelchair



Components Used

- ▶ ARDUINO UNO MICRO CONTROLLER
- ▶ BLUETOOTH MODULE HC-05
- ▶ ULTRASONIC SENSOR SR-04
- ▶ MOTORS(2)
- ▶ RELAY MODULE(2)
- ▶ SMARTPHONE

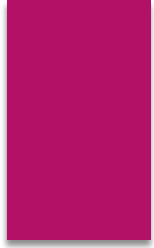




Relay Board: 8 channel relay board used in this project. The relay board is connected with the motors. The relay board just switches the motor on/off controlling the motion. The working range of this board is 12V, it is working in both AC and DC supply. The motor is connected to the common ports of the Relay board and the Normally open and Normally closed are connected one another with the same ports of other relays.

Bluetooth Module HC-05: It is the one of the type of Bluetooth SPP (Serial Port Protocol) module. It is used to passing the communication data between Bluetooth Device (e.g. Smartphone) to Arduino in the form of serial code(ASCII). Transmitter(TX) and Receiver(RX) Pin are also available in this device. It can send the data up to 2MB per second and the working frequency of the module is 2.4GHz.

Arduino Uno ATmega328: It is a microcontroller board. It has 6PWM input , 6 Analog inputs and Transmitter(TX) and Receiver (RX) Ports. The RX Port is connected with the TX pin of Bluetooth Module and the TX port is connected with the RX pin of HC-05 module for transmitting and receiving the communication data. We can store the programme in arduino which helps to send analog signals to relay board based on the serial code communication between Arduino and Bluetooth module. The recommended power supply for this Microcontroller is 5V.

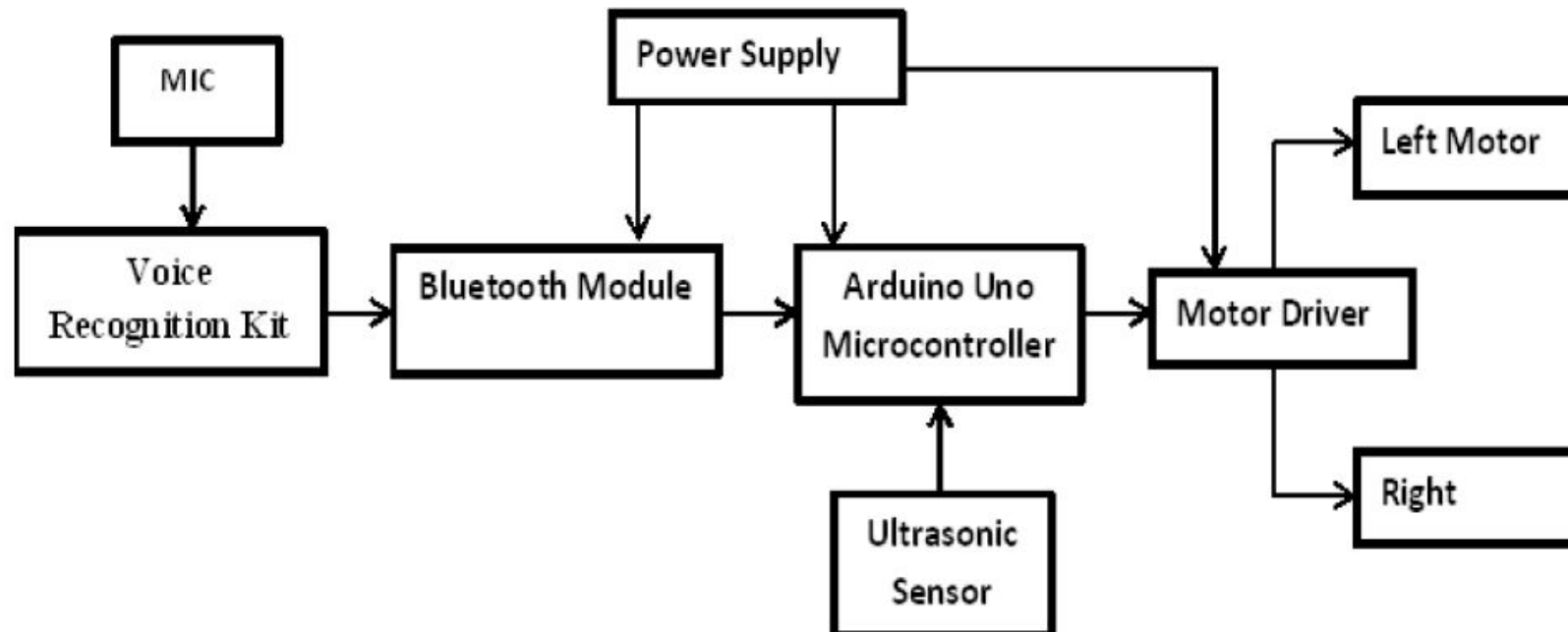


HC-SR04 Ultrasonic Sensor: It uses SONAR to determine the distance of an object just like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package from 2 cm to 400 cm or 1” to 13 feet.

Power Supply: The Power Source used for this project is Sealed Lead Acid Battery and the range of this battery is 12V, 7.2Ahr. The Power supply is given to the Arduino and Relay Board.

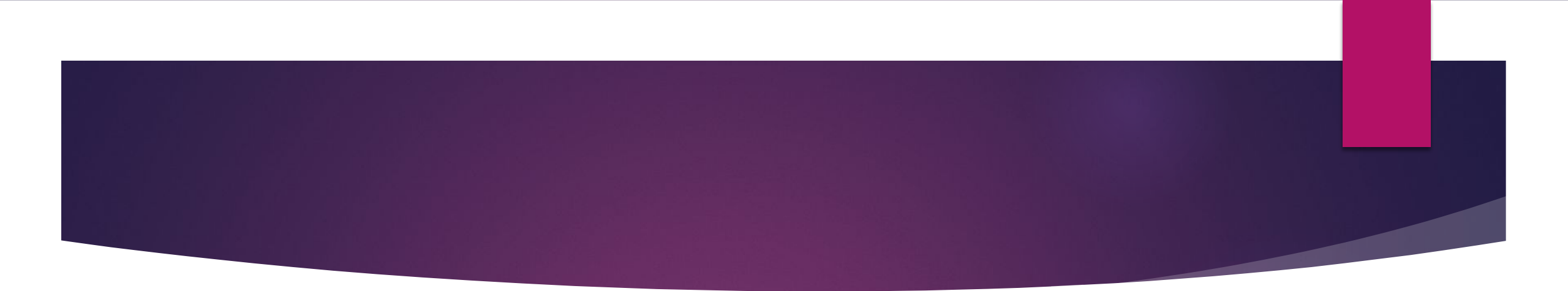
DC Motor: The motor used in this project is DC Geared Motor. There are four motors used in this project in the range of 12V, 500mA each.

BLOCK DIAGRAM

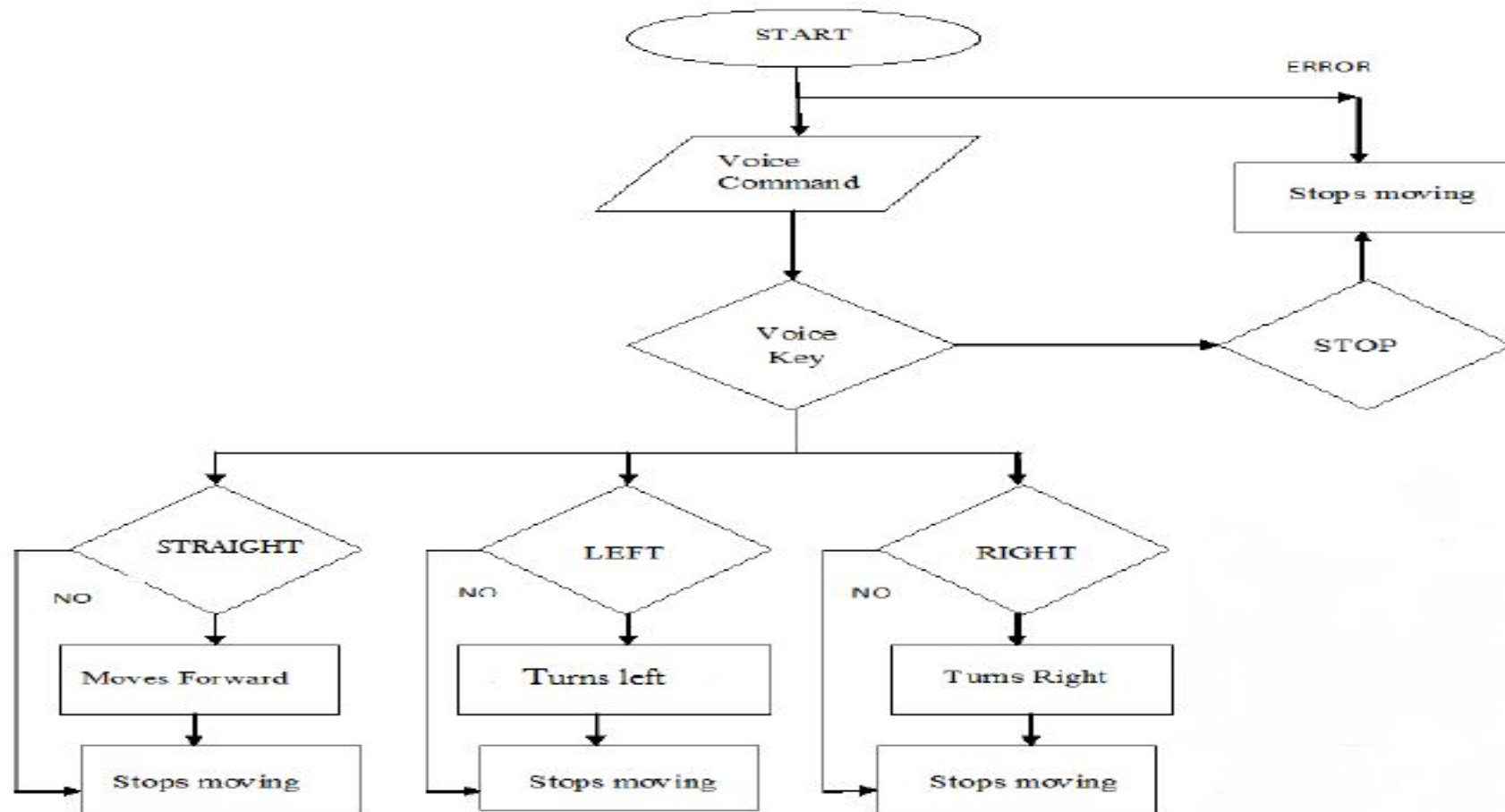


WORKING

- ▶ The system has two parts, namely; hardware and software.
- ▶ The hardware architecture consists of an embedded system that is based on Arduino Uno board, a Bluetooth Module, Motor Driver and an Android phone.
- ▶ The Bluetooth Module provides the communication media between the user through the android phone and the system by means of voice command given to the android phone.
- ▶ The user speaks the desired command to the “BT Voice Control for Arduino voice (AMR Voice Application)” software application installed in the android phone that is connected through Bluetooth with Bluetooth Module hc-05.

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- ▶ The voice command is converted to an array of string and the string is passed to Arduino Uno connected to it.
 - ▶ Once the Bluetooth Module receives the message, the command sent will be extracted and executed by the microcontroller attached to it and depending on the commands fed to the Motor Driver, the motors will function accordingly.
 - ▶ The system will interpret the commands and control the Wheelchair accordingly via android application.
 - ▶ Meanwhile, the ultrasonic sensor works while the circuit is on and makes sure the path has no obstacle and if any obstacle occurs it notifies the Arduino and stops wheelchair till further command is obtained from the user.

FLOWCHART



Application Instructions

- ▶ First make sure Bluetooth module is paired with the android mobile. The default password for pairing is “1234” or “0000”.
- ▶ When the user says “straight”, AMR Voice application sends the data in form of string “* straight #” to Bluetooth module connected to the circuit. When microcontroller detects “straight”, the motor attached to the wheelchair moves FORWARD.
- ▶ When the user says “LEFT” AMR Voice application sends the data in form of string in form of string “*LEFT#” to Bluetooth module connected to the circuit. When microcontroller detects “LEFT” the moves the motor attached to the wheelchair LEFT side.
- ▶ When the user says “RIGHT” AMR Voice application sends the data in form of string “*RIGHT#” to Bluetooth module connected to the circuit. When microcontroller detects “RIGHT” the moves the motor attached to the wheelchair RIGHT side.
- ▶ When the user says “STOP” button which is in the Centre of remote the AMR Voice application sends the data in form of string “*STOP#” to the Bluetooth module connected to the circuit. When microcontroller detects “STOP” the wheelchair gets stopped.
- ▶ Click on “DISCONNECT” icon to disconnect the paired Bluetooth module .

Code/Algorithm

```
String inputString = "";
String finalstring = "";
boolean stringComplete = false;
int Relay1 = 12;
int Relay2 = 7;
const int trigPin = 9;
const int echoPin = 10;
long duration;
int distance;

void setup() {
  Serial.begin(9600);
  inputString.reserve(200);
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input
  pinMode(Relay1, OUTPUT);
  pinMode(Relay2, OUTPUT);
  pinMode(3, OUTPUT);
  pinMode(4, OUTPUT);
  pinMode(5, OUTPUT);
  digitalWrite(Relay1, HIGH);
  digitalWrite(Relay2, HIGH);
  inputString = ""; //to set up all components
}
```

```
void loop() {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration = pulseIn(echoPin, HIGH); //to

  if ( stringComplete == true)
  {
    distance = duration * 0.034 / 2;

    if ((finalstring == "straight" ) && (distance > 10) )
    {
      digitalWrite(Relay1, LOW); //turn on motor
      digitalWrite(Relay2, LOW);
      digitalWrite(4, HIGH);
      digitalWrite(5, HIGH);
      digitalWrite(3, LOW);
    }
  }
```

Continue....

```
if ((finalstring == "left" ) && (distance > 10) )
{
    digitalWrite(Relay1, LOW);          //turn on motor
    digitalWrite(Relay2, HIGH);
    digitalWrite(5, HIGH);
    digitalWrite(3, LOW);
    digitalWrite(4, LOW);
    //    finalstring = "";
    // Serial.print("str===="); Serial.print(finalstring);
    //  Serial.print("dist====");
    //  Serial.print(distance);
}

else if ((finalstring == "right") && (distance > 10))
{
    //    finalstring = "";
    //                                //turn off motor
    digitalWrite(Relay1, HIGH);
    digitalWrite(Relay2, LOW);
    digitalWrite(5, LOW);
    digitalWrite(3, LOW);
    digitalWrite(4, HIGH);
    //stringComplete = false;
    //    Serial.print("str===="); Serial.print(finalstring);
    //  Serial.print("dist====");
    //  Serial.print(distance);
}
```

```
else if ((finalstring == "stop"))
{
    finalstring = "";
    //turn off motor
    digitalWrite(Relay1, HIGH);
    digitalWrite(Relay2, HIGH);
    digitalWrite(5, LOW);
    digitalWrite(3, HIGH);
    digitalWrite(4, LOW);
}

else if (distance < 10)
{
    digitalWrite(Relay1, HIGH);
    digitalWrite(Relay2, HIGH);
    digitalWrite(5, LOW);
    digitalWrite(3, HIGH);
    digitalWrite(4, LOW);
}

//  Serial.print(finalstring);
}
```

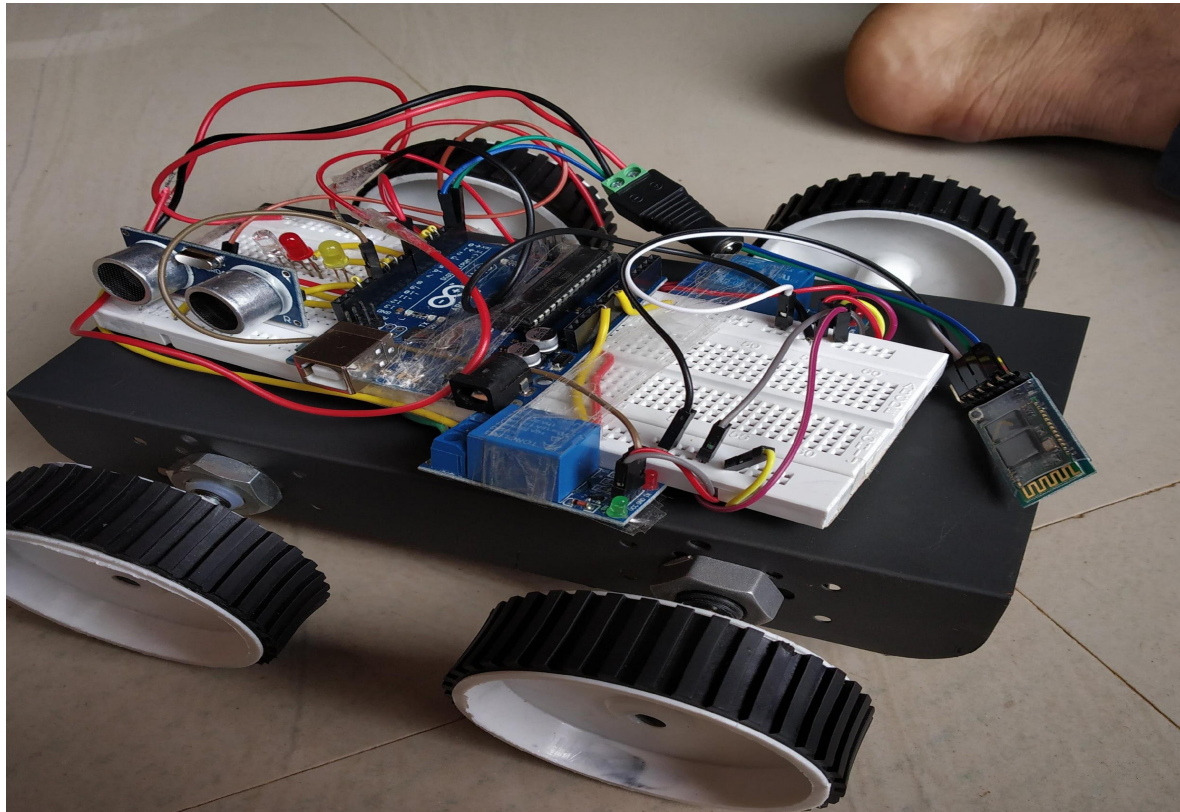
Software required

- ▶ Arduino compiler
- ▶ This compiler is used to write , compile and execute the code and when the code is successfully compiled with no errors , then the code is finally dumped into the arduino microcontroller
- ▶ The programming language used to write the code is embedded c

Why embedded c ?

- ▶ it is easier to understand.
- ▶ It performs the same task all the time so there is no need of any hardware changing such as extra memory or space for storage.
- ▶ It performs only one task at one time mean it purposed the dedicated task
- ▶ Hardware cost of embedded c systems are usually so much low.
- ▶ Embedded applications are very suitable for industrial purposes.

Prototype



Advantages

- ▶ Input can be changed rapidly
- ▶ Automated operation
- ▶ More reliable
- ▶ User friendly
- ▶ Reduce man power
- ▶ Less wiring because of Bluetooth
- ▶ Very easy to use

Disadvantages

- ▶ Sometimes the voice input can be interpreted wrongly.. For example when we give input as “straight” the google text to speech could recognize it wrongly as street , treat etc
- ▶ There is no particular voice installed in the module, so anybody other than the physically disabled person can operate the vehicle through his voice
- ▶ The cost of the device is quite high

Applications

- ▶ Hospital
- ▶ Home
- ▶ Can be operated by handicap itself
- ▶ Ability to provide sufficient risk management

Conclusion

- ▶ This project 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 10 centimeters will be detected by the Ultrasonic sensor.
- ▶ This proposed system contributes to the self-dependency of differently abled and older people.

Future scope

- ▶ This prototype can be used to make the working model of the wheelchair.
- ▶ Additional features like horn, Light system can be added for using the wheelchair during insufficient sunlight or night times.
- ▶ This prototype only works with the android based Bluetooth. In future to make the system works with the Windows, iOS operating systems.



THANK YOU



Any queries?