ACCELEROMETER CONTROLLED CAR

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING,AUST

SUBMITTED BY:

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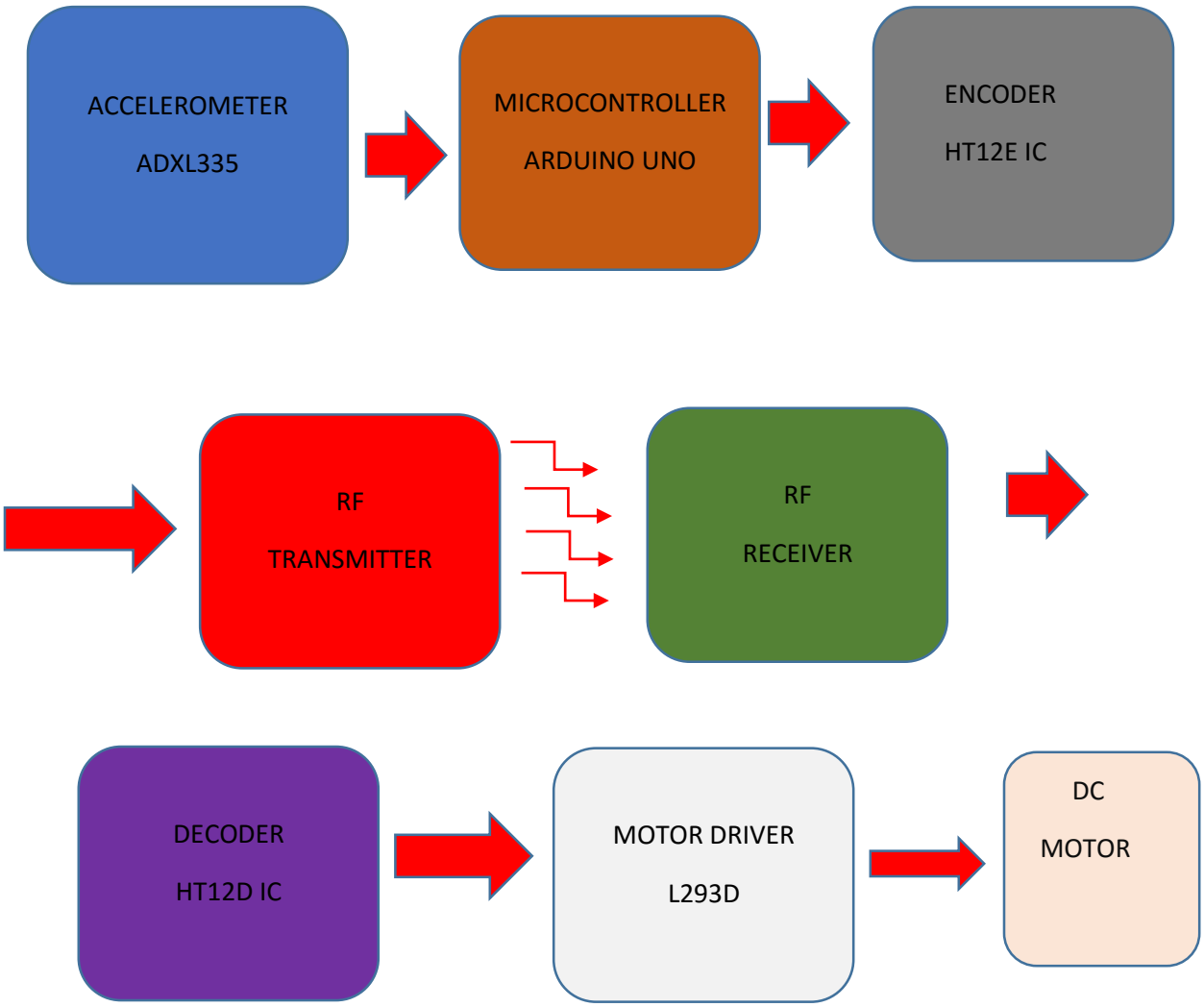
ytINTRODUCTION:



The accelerometer is a device which gives us the coordinates of any axis, that is coordinates of x ,y , z when any object is placed on a surface. We can use this accelerometer and its coordinate system to design a car which moves forward, backward, left or right according to tilting of this device and the coordinates that it gives. These coordinates can be sent as commands to the microcontroller arduino uno which then sends the signal input to HT12E encoder IC .This IC then uses a 433MHZ frequency to send filtered radio wave through a RF transmitter module which is then received by a RF receiver module. The RF receiver sends the received signal to a HT12D decoder IC. The decoder then sends the 4 bits signal to the input terminals of the motor IC L293D.

COMPONENTS REQUIRED:

1.ACCELOMETER ADXL 335

2.RF TRANSMITTER RECEIVER MODULE

3.HT12E ENCODER IC

4.HT12D DECODER IC

5.MOTOR DRIVER L293 D

6.ARDUINO UNO/MEGA

7.RESISTANCE 43K,1MEG

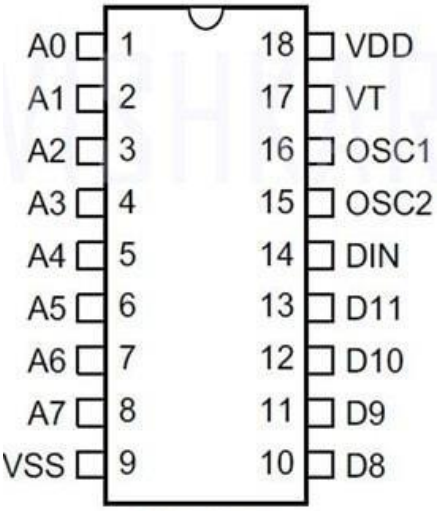
8.JUMPER WIRES

9.TIRES

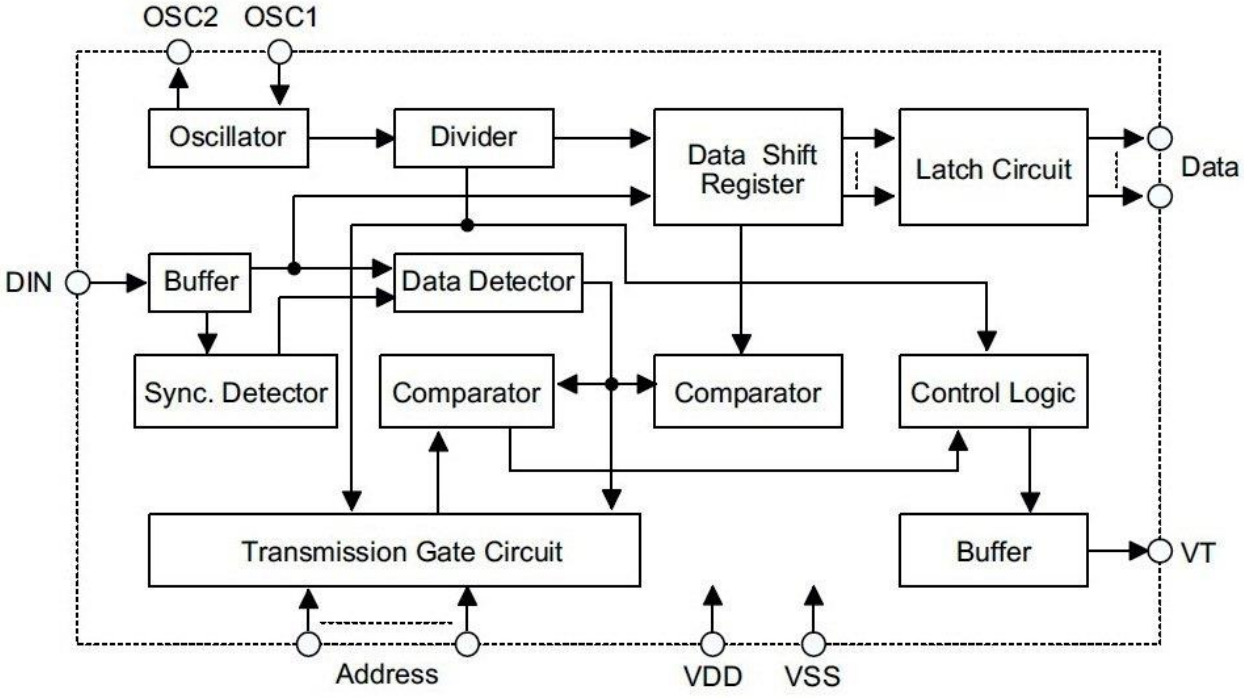
10.BATTERIES

11. DC MOTOR

HT12D PIN DESCRIPTION:



HT12D



VDD and **VSS:** These pins are used to provide power to the IC, Positive and Negative of the power supply respectively

DIN: This pin is the serial data input and can be connected to a

RF receiver output.

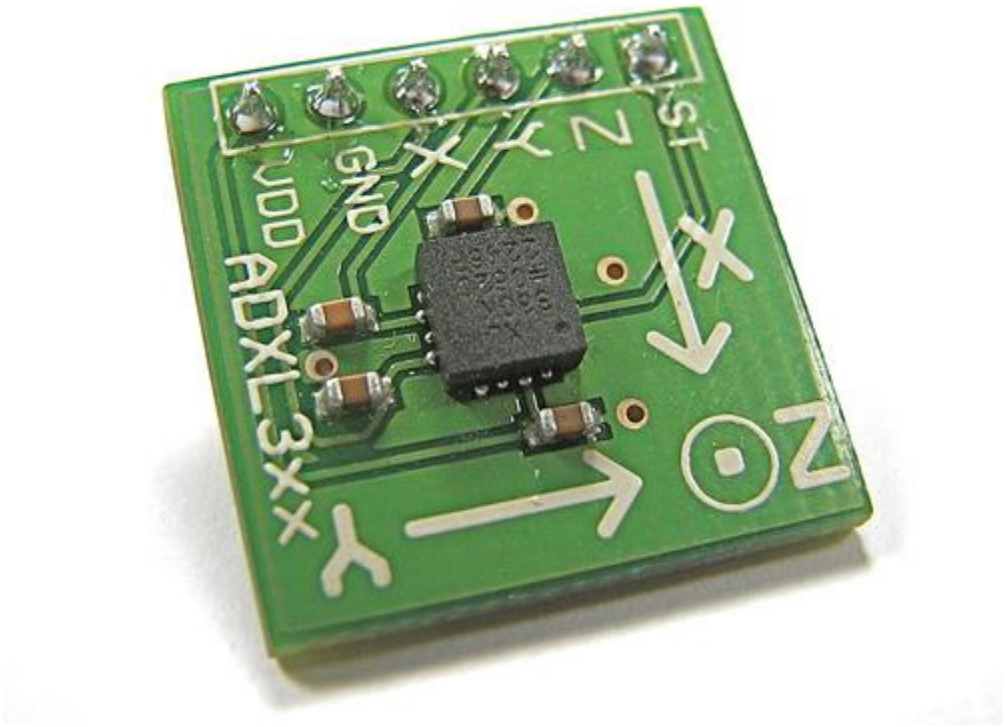
A0 – A7: This is the address input. Status of these pins should match with status of address pin in HT12E(in transmitter) for receiving data. These pins can be connected to VSS or left open.

D8 – D11: This is the data output pins. Status of these pins can be VSS or VDD depending upon the received serial data through pin DIN.

VT: stand for Valid Transmission. This output pin will be HIGH when valid data is available at D8 – D11 data output pins.

OSC1 and **OSC2:** These pins are used to connect external resistor for internal oscillator of HT12D. OSC1 is the oscillator input pin and OSC2 is the oscillator output pin.

Accelerometer:



VDD: This pin is for supplying 5v signal source to the accelerometer.

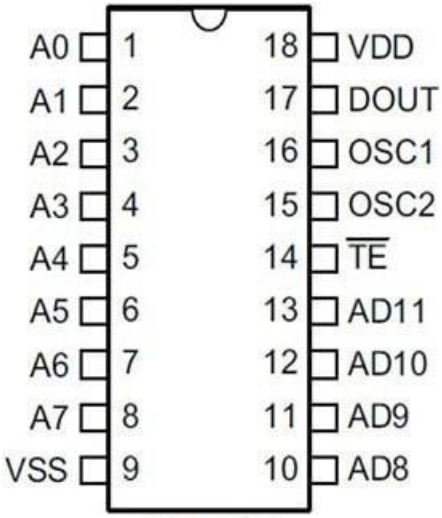
GND: This pin is to provide ground to the device.

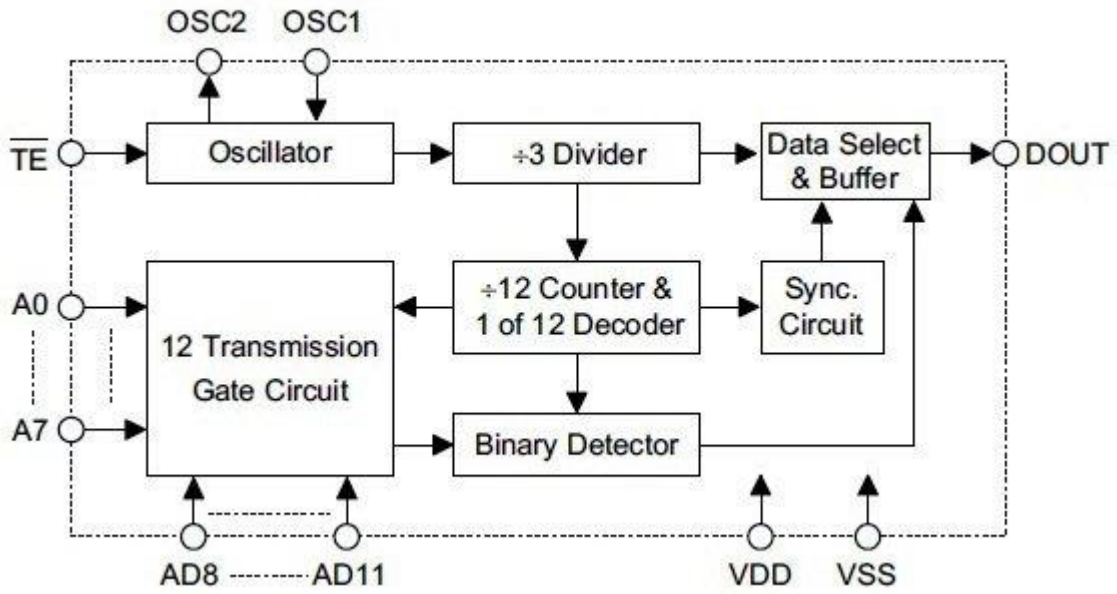
X,Y & Z PIN: These pins are used to determine the coordinates of the relative axes.

ST : The ST pin helps in doing a self test of the accelerometer.

The x ,y and z pins are connected to analog pins in the arduino board as they act as analog input for determining the direction in which the car will rotate.

HT 12 E – Encoder IC





Pin (1- 8) – 8 bit address pin for output [A0, A1,A2,A3,A4,A5,A6,A7]
Pin 9 – Ground [Gnd]

Pin (10,11,12,13) – 4 bit address pin for input [AD0,AD1,AD2,AD3]
Pin 14 – Transmission enable, Active low [TE]
Pin 15 – Oscillator input [Osc2]
Pin 16 – Oscillator output [Osc1]
Pin 17 – Serial data output [Output]
Pin 18 – Supply voltage 5V (2.4V-12V) [Vcc]
A0-A7 – these are 8 bit address pin for the output.
GND — this pin should also be connected to the negative of the power supply.
TE – this are the transmission enable pin.
Osc 1,2 – these pins are the oscillator input and output pins. This pin is connected to each other with a external resistor.
Output – this is an output pin. The data signals are given out from this pin.
Vcc – the Vcc pin connected to positive power supply. It is used to power the IC.
AD0 – AD3 – these are the 4 bit address pins.

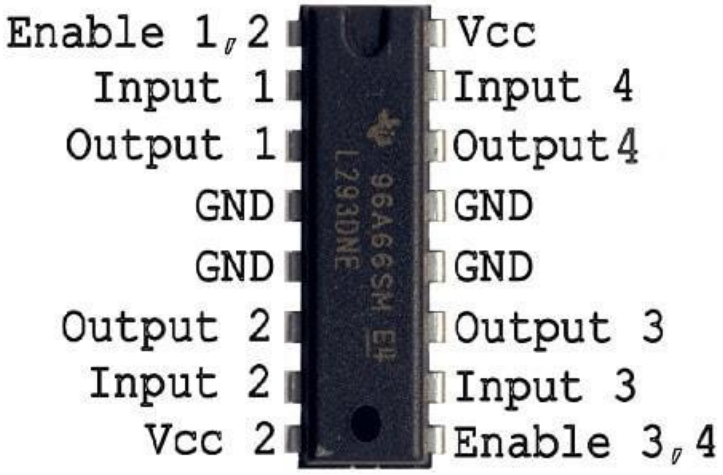
PIN DESCRIPTION: RF TRANSMITTER

Pin 1 — Ground [GND]
Pin 2 — Serial Data Input Pin [DATA]
Pin 3 — Power supply; 5V [Vcc]
Pin 4 — Antenna output pin [ANT]

PIN DESCRIPTION: RF RECEIVER

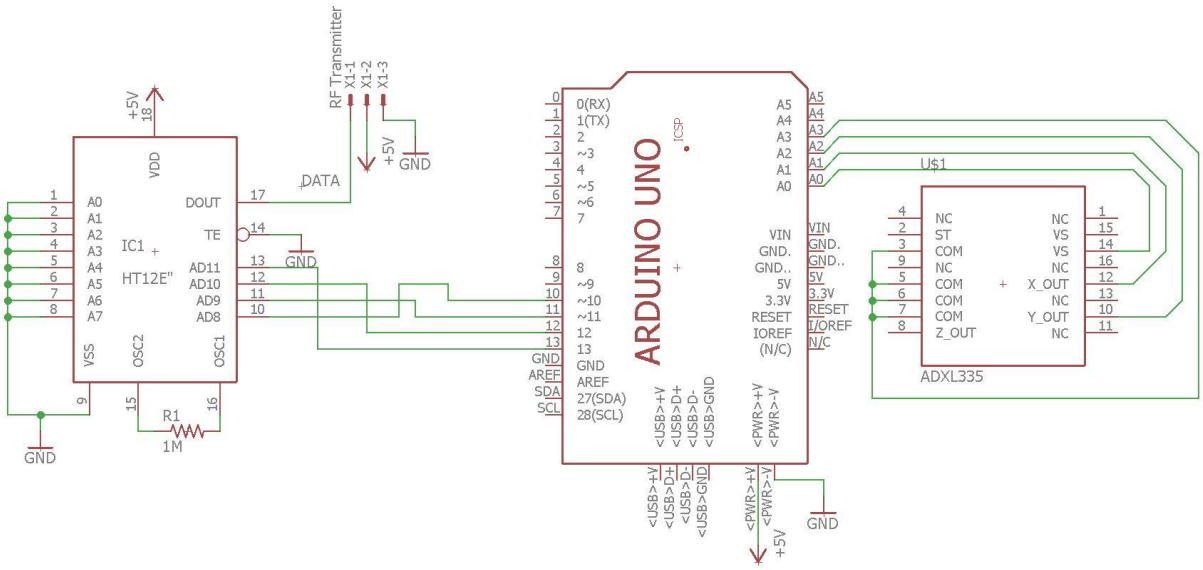
Pin 1 — Ground [GND]
Pin 2 — Serial data output pin [DATA]
Pin 3 — Linear output pin (Not connected) [NC]
Pin 4 — Power supply; 5v [Vcc]
Pin 5 — Power supply; 5v [Vcc]
Pin 6 — Ground [GND]
Pin 7 — Ground [GND]
Pin 8 — Antenna Input pin [ANT]

L293D Motor Driver IC



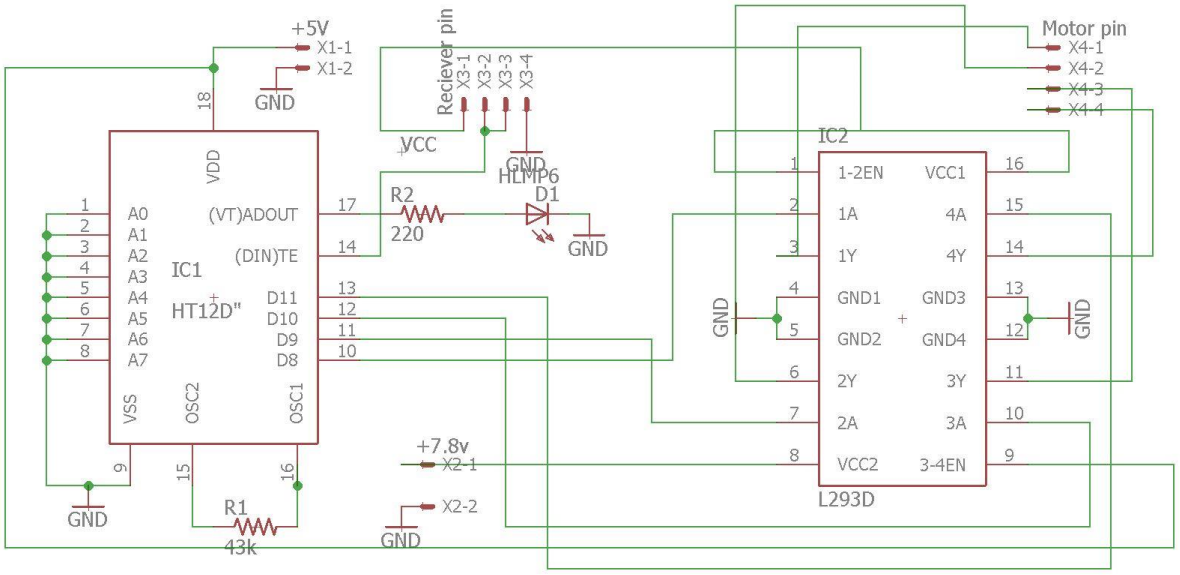
Pin 1 — Enable pin for motor 1 [Enable 1]
Pin 2 — Input pin 1 for Motor 1 [Input 1]
Pin 3 — Output pin 1 for Motor 1 [Output 1]
Pin 4,5,12,13 — Ground [GND]
Pin 6 — Output Pin 2 for Motor 1 [Output 2]
Pin 7 — Input pin 2 for motor 1 [Input 2]
Pin 8 — Power supply for motors (9-12v) [Vcc]
Pin 9 — Enable pin for motor 2 [Enable 2]
Pin 10 — Input pin 1 for motor 1 [Input 3]
Pin 11 — Output pin 2 for motor 1 [Output 3]
Pin 14 — Output 2 for motor 1 [Output4]
Pin 15 — Input 2 for motor 1 [Input 4]
Pin 16 — supply voltage ; 5V [Vcc1]

TRANSMITTER SCHEMATIC:



The schematic above represents the necessary circuit connections of the transmitter circuit. The accelerometer consists of pins x, y and z pins which gives us analog reading of each axes coordinates. Since we are making a car only and not a plane so we do not require the z axis readings. Also the self test pin or the ST pin is also not required as we do not need to test the accelerometer. The VCC GND X Y pins are connected to the arduino uno which is the microcontroller which we are using in this project. They are connected to the analog pins because we are taking analog readings from accelerometer and converting it to digital signals which can be sent through arduino to encoder. Here the VCC is 5V which is received directly from the arduino. Next comes the encoder circuit HT12E IC . The HT12E takes 12 bit digital input signal respectively with the help of pins A0-A7 and A8-A11 .Here pins A0-A7 ensure secure data transmission and always work with low input signal and VSS pin is the GND pin so all these 9 pins are grounded as low input means grounding the terminals. The pins 10-13 receive 4 bit input signal from arduino uno based on which the motor runs. This 4 bit input signal to encoder are the only commands we need to send to the motor. Here we powered the encoder using 5V from arduino by connecting pin 18 to 5V pin on the arduino and ground to gnd pin on the arduino. We connected 1 megaohm resistance between the oscillator pins. The TE pin also receives low signal so it is grounded. The 4 bit signal contains noise. This is noise is filtered using rc filters in oscillator and a certain wave signal of 433 MHZ is provided as output to the data pins of RF transmitter through DOUT pin which transmits this radio frequency wave which is received by the RF receiver in the receiver circuit.

RECEIVER SCHEMATIC:



The radio frequency signal of 433 MHZ is received by the RF receiver. This RF receiver is powered using 4 AA sized 1.5V batteries. It uses 5v to turn on. We can use rechargeable batteries as long as we get 5V any source can be used which provides 5 V . Here the data received through the data pins of the receiver is sent through pin 17 to the decoder. The decoder decodes the signal and sends the command to the motor driver IC through 4 pins that is the 4 bits signals sent through receiver is decoded and then sent to the motor driver through pins 10 11 12 and 13. Here we connected resistance of 43 k between the oscillators. We also connected a led to the decoder to check whether signal is received. For each transmission the led will blink once. The other pins work similar to the encoder IC . The 4 pins of decoder are now connected to pins 2,7,10, 9 respectively of l293D. These are signal input pins of the motor. The input signals are then sent directly to motors via the 4 output pins of the l293D. As a result the motors now run according to the coordinates of the accelerometer. Here some pins of l293D are grounded as these are GND pins. The motor driver IC receives two input voltages, one is 5v for turning the IC on and the other is 9 volt given via rechargeable mobile batteries for running the motors at a constant speed.

THE CODE:

```
    int VCCPin=A0;
    int GNDPin=A3;
    int XPin=A1;
    int YPin=A2;
    int Q1=10,Q2=11,Q3=12,Q4=13;
    long x;
    long y;
void setup() {
  Serial.begin(9600);
  pinMode(Q1,OUTPUT);
  pinMode(Q2,OUTPUT);
  pinMode(Q3,OUTPUT);
  pinMode(Q4,OUTPUT);
  pinMode(GNDPin,OUTPUT);
  pinMode(VCCPin,OUTPUT);
  digitalWrite(GNDPin,LOW);
  digitalWrite(VCCPin,HIGH);

}

void loop() {
  x=analogRead(XPin);
  y=analogRead(YPin);



Serial.println(x);
Serial.println("\t");
Serial.println(y);
Serial.println("\t");
delay(5);


/*Serial.println(digitalRead(Q1));
  Serial.println("\t");
  Serial.println(digitalRead(Q2));
  Serial.println("\t");
  Serial.println(digitalRead(Q3));
  Serial.println("\t");
  Serial.println(digitalRead(Q4));
  Serial.println("\t");
  delay(500);*/
```

```
if(y>360)
forward();
else if(y<300)
backward();
else if(x>380&&y>330)
left();
else if(x<285&&y>330)
right();
else if(x>335 && y<345)
stop_();

  delay(5);
}

void stop_()
{
  Serial.println("");
  Serial.println("STOP");
  digitalWrite(Q1,LOW);
  digitalWrite(Q2,LOW);
  digitalWrite(Q3,LOW);
  digitalWrite(Q4,LOW);

}
void forward()
{
  Serial.println("");
  Serial.println("FORWARD");
  digitalWrite(Q1,HIGH);
  digitalWrite(Q2,LOW);
  digitalWrite(Q3,HIGH);
  digitalWrite(Q4,LOW);

}
void backward()
{
  Serial.println("");
  Serial.println("Backward");
  digitalWrite(Q1,LOW);
  digitalWrite(Q2,HIGH);
  digitalWrite(Q3,LOW);
  digitalWrite(Q4,HIGH);

}

void left()
{
  Serial.println("");
  Serial.println("Left");
  digitalWrite(Q1,LOW);
  digitalWrite(Q2,LOW);
```

```
  digitalWrite(Q3,HIGH);
  digitalWrite(Q4,LOW);

}


void right()
{
  Serial.println("");
  Serial.println("RIGHT");
  digitalWrite(Q1,HIGH);
  digitalWrite(Q2,LOW);
  digitalWrite(Q3,LOW);
  digitalWrite(Q4,LOW);

}
```

DRAWBACKS:

1. The range of RF is only 100 m .For commercial uses we need to use RF of longer range for transmission purposes.
2. Due to using non rechargeable battery the battery seems to wear down quickly. To avoid complexities it is better to use a rechargeable battery.
3. We must be very careful in the circuit connections making.
4. It is better to solder the components in a vero board.

USES:

1. Can be used in wheel chair construction, where the user can move the chair according to his own will.
2. Can be used in various rescue operations where it is impossible for man to conduct a rescue mission
3. Synching it with prosthetic arm can be very useful to lift heavy loads.
4. GYRO can also be used for vibrational analysis and gravity measurement.