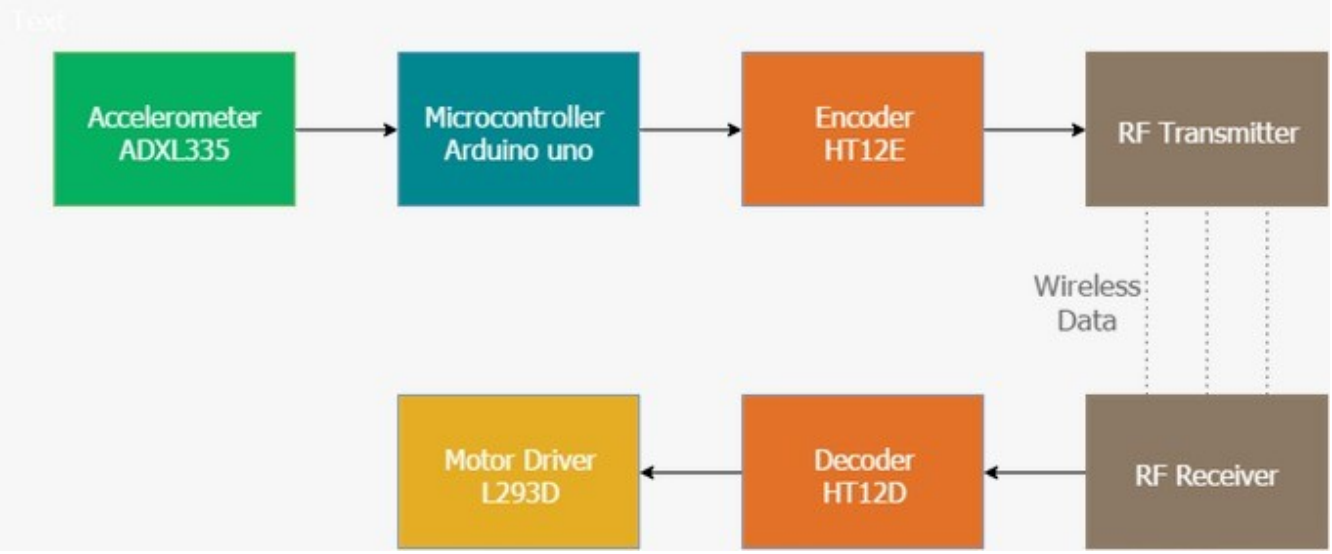
GESTURE CONTROL ROBOT

COMPONENTS

1. Aurdino UNO(ATMEGA 328P)
2. HT12E IC
3. HT12D IC
4. RF433 Transmitter
5. RF 433 Reciver
6. L293DNE Motor driver
7. Batteries and Duwheels
8. 3 -Axis accelerometer

BLOCK DIAGRAM



ACCELEROMETER:

An accelerometer is an electromechanical device used to measure acceleration forces.such forces may be static,like

continous force of gravity or,as is the case with many mobile devices,dynamic to sense movement or vibrations

Acceleration is the measurement of the change in velocity, or speed divided by time.

WORKING PRINCIPLE:

An Aceelerometer looks like a simple circuit for some larger devices and the accelerometer consists of many different parts and works in many ways, two of which are the piezoelectric effect and the capacitance sensor

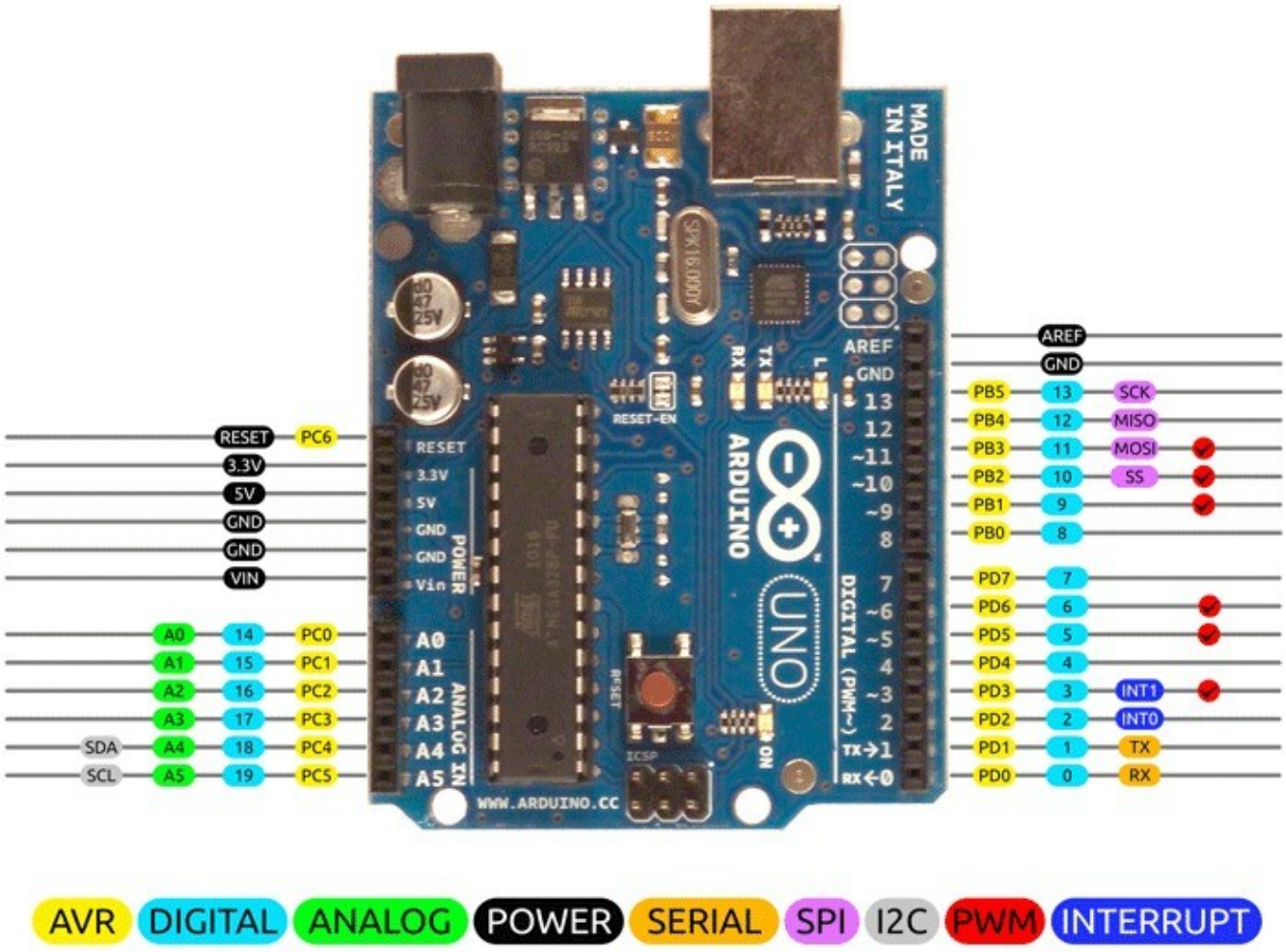
Piezoelectric effect:

The piezoelectric effect is the most common form of accelerometer and uses microscopic crystal structures that become stressed due to accelerative forces. These crystals create a voltage from the stress, and the accelerometer interprets the voltage to determine velocity and orientation.

Capacitance sensor:

The capacitance accelerometer senses changes in capacitance between microstructures located next to the device. If an accelerative force moves one of these structures, the capacitance will change and the accelerometer will translate that capacitance to voltage for interpretation.

Aurdino UNO:



The Arduino Uno is an open-sourced microcontroller based on the Microchip ATmega328p microcontroller .The board is equipped with sets of digital and analog input/outpt(I/O) pins that may be interfaced to various expansion boards(shields) and other circuits.The board has 14 Digital pins, 6 Analog pins, and programmable with the AURDINO IDE(Integrated Development Environment) via a type B USB-Cable It can be

powered by the USB cable or by an external 9-volt battery though it accepts voltages between 7 and 20 volts. It is also similar to the AURDINO NANO

The word "uno" means "one" in Italian and was chosen to mark the initial release of the Aurdino software.The Uno board is the first in a series of USB-based Arduino boards,and it and version 1.0 of the Arduino IDE were the reference versions of Arduino, now evolved to newer releases.The ATmega328 on the board comes pre programmed with a bootlaoder that allows uploading new code to it without the use of an external hardware programmer.

While the Uno communicates using the original STK500 protocol,it differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-Serial conveter

HT12E:

HT12E is a 2^{12} series encoder IC (Integrated Circuit) for remote control applications. It is commonly used for radio frequency

(RF) applications. By using the paired HT12E encoder and HT12D decoder we can easily transmit and receive 12 bits of parallel data serially. HT12E simply converts 12 bit parallel data in to serial output which can be transmitted through a RF transmitter. These 12 bit parallel data is divided in to 8 address bits and 4 data bits. By using these address pins we can provide 8 bit security code for data transmission and multiple receivers may be addressed using the same transmitter

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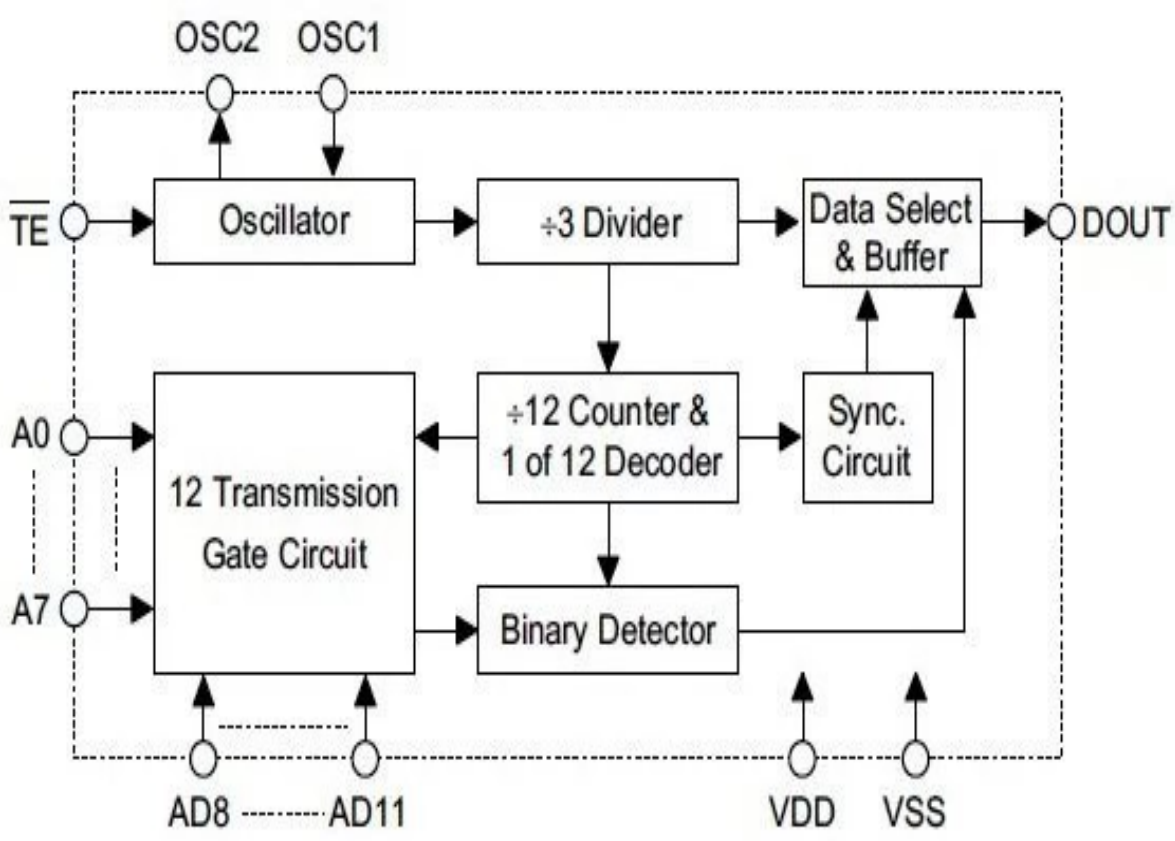
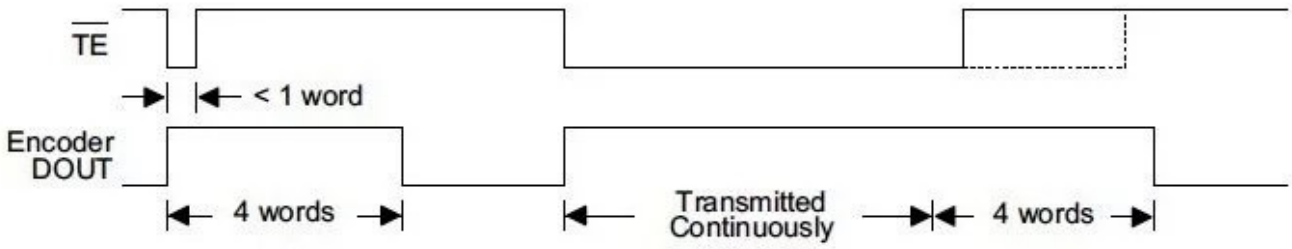
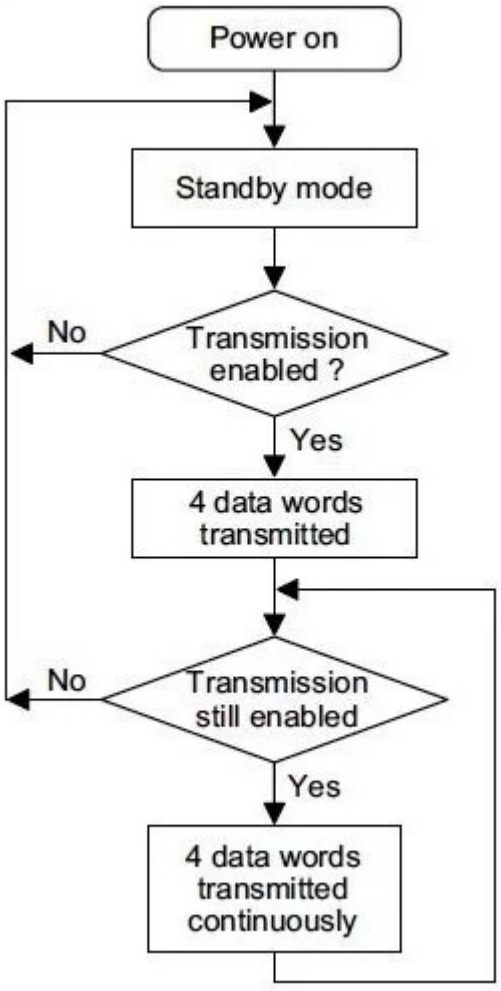


Working:

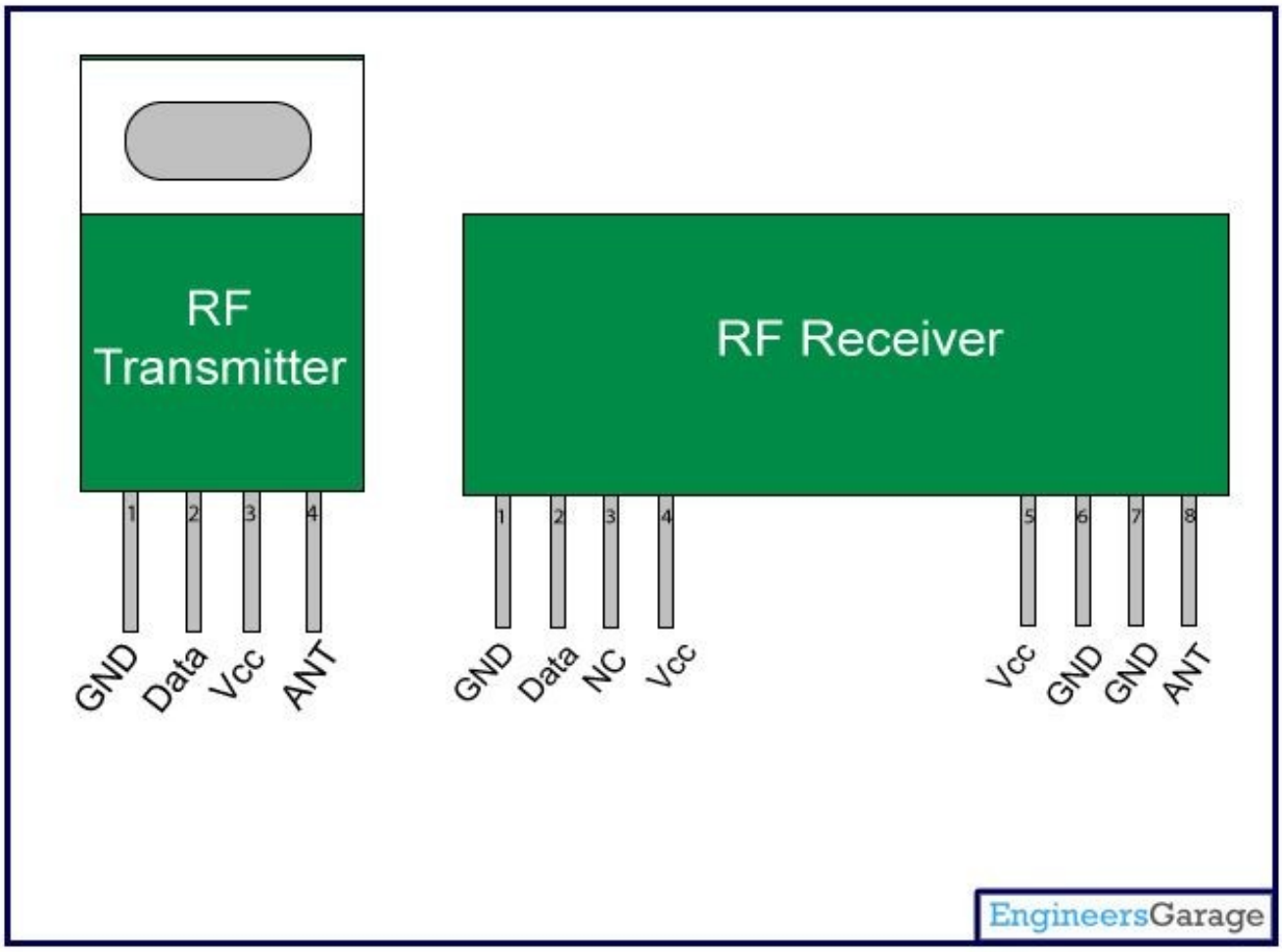


Transmission timing for the HT12E

The HT12E 2^{12} series encoder starts a 4 word transmission cycle upon receiving transmission enable signal on TE input. This output cycle will repeats as long as the transmission is enabled. When the transmission enable (TE) signal switches to HIGH, the encoder output completes the current cycle and stops as shown above. The encoder will be in the Standby mode when the transmission is disabled.



RF MODULES:



Basically the RF modules are 433 MHz RF transmitter and receiver modules. The transmitter draws no power when transmitting logic zero while fully suppressing the carrier frequency thus consume significantly low power in battery operation. When logic one is sent carrier is fully on to about 4.5mA with a 3volts power supply. The data is sent serially from the transmitter which is received by the tuned receiver.

Transmitter and the receiver are duly interfaced to two micro controllers for data transfer.

Main Factors Affecting RF Module's Performance:

As compared to the other radio-frequency devices, the performance of an RF module will depend on several factors like by increasing the transmitter's power a large communication distance will be gathered. However, which will result in high electrical power drain on the transmitter device, which causes shorter operating life of the battery powered devices. Also by using this devices at higher transmitted power will create interference with other RF devices.

Applications:

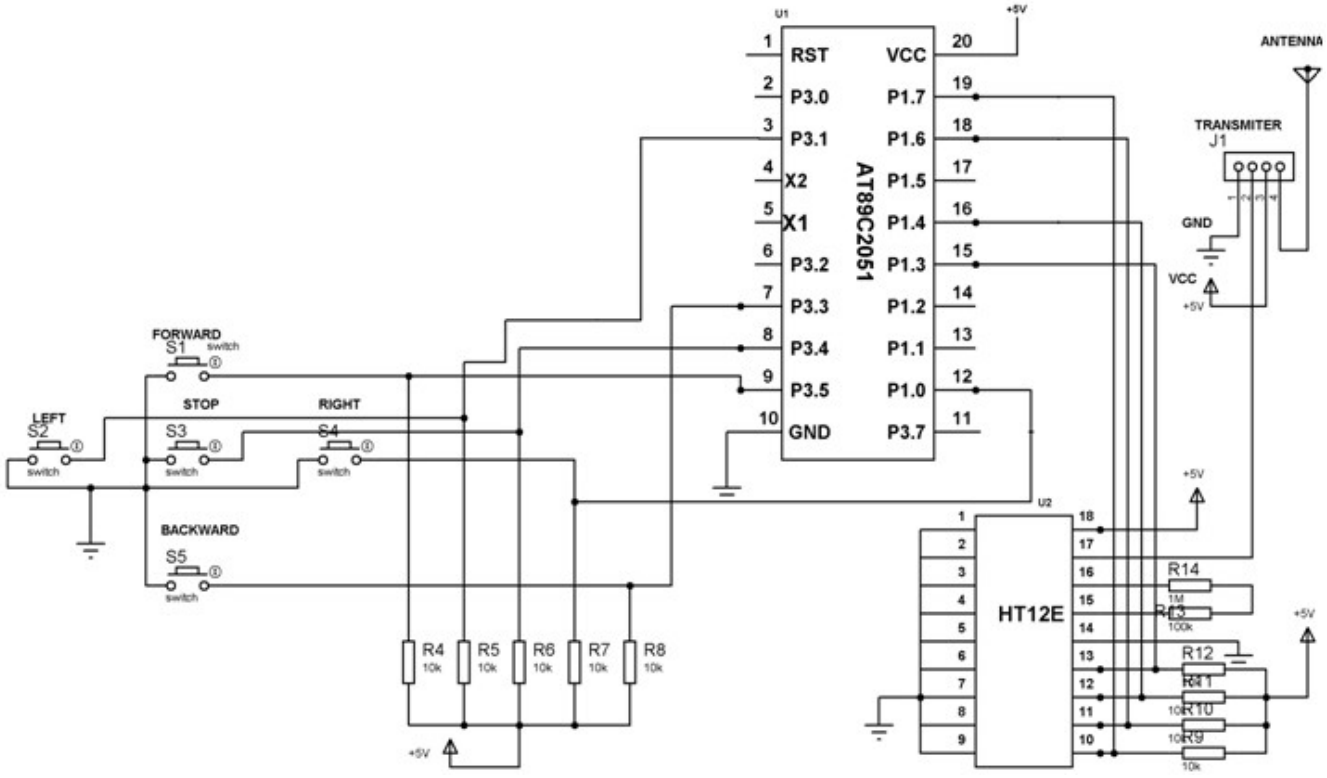
1. Wireless security systems
2. Car alarm systems
3. Remote controls
4. Sensor reporting
5. Automation Systems

433 MHz RF Transmitter and Receiver:

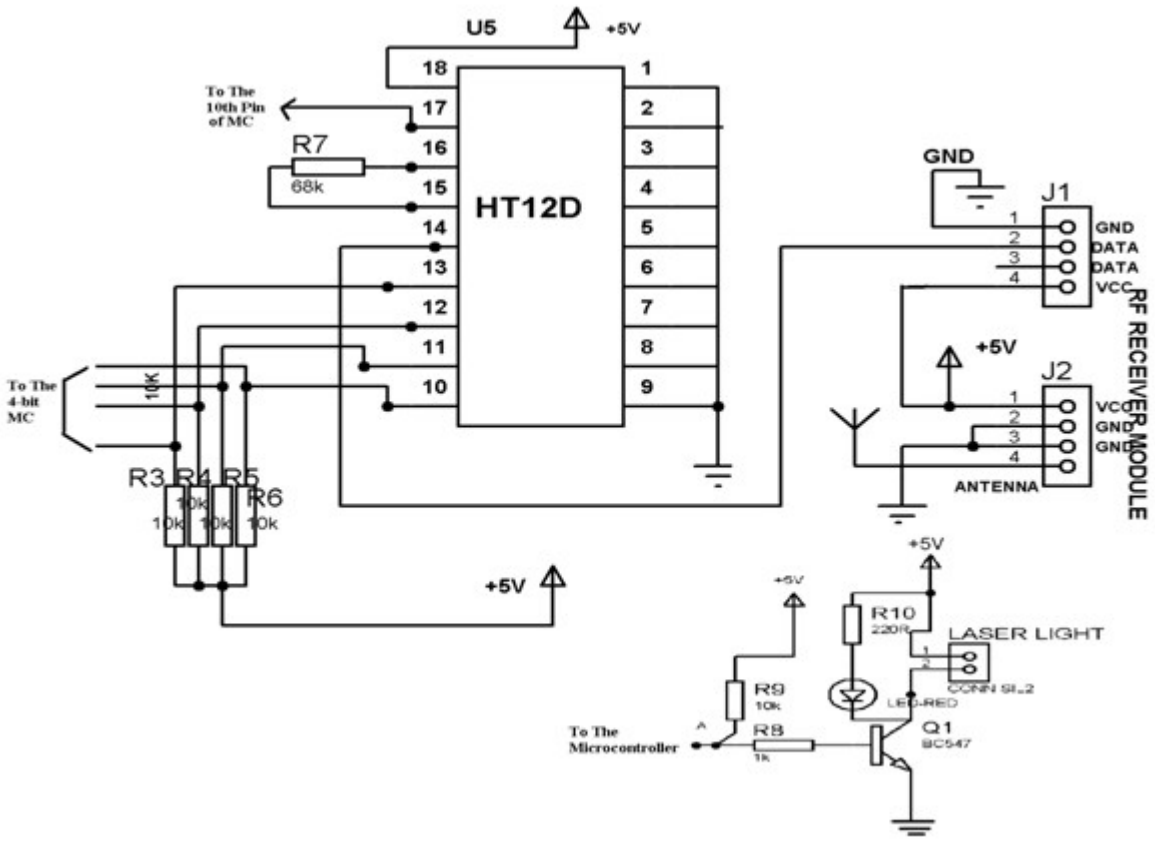
In many projects we use RF modules for transmit and receive the data because it has high volume of applications than IR. RF signals travel in the transmitter and receiver even when there is an obstruction. It operates at a specific frequency of 433MHz.

RF transmitter receives serial data and transmits to the receiver through an antenna which is connected to the 4th pin of the transmitter. When logic 0 applied to transmitter then there is no power supply in transmitter. When logic 1 is applied to transmitter then transmitter is ON and there is a high power supply in the range of 4.5mA with 3V voltage supply.

RF Transmitter Circuit:



RF Receiver Circuit:



Features of RF Transmitter and Receiver:

1. Receiver frequency: 433MHz
2. Receiver typical sensitivity: 105Dbm
3. Receiver current supply: 3.5mA
4. Receiver operating voltage: 5V
5. Low power consumption
6. Transmitter frequency range: 433.92MHz
7. Transmitter supply voltage: 3V~6V
8. Transmitter output power: 4~12Dbm

HT12D:

The IC HT12D can be used only with its pair HT12E. These two ICs together form an Encoder and Decoder pair. They are 12-bit Encoders/Decoders, meaning they can transmit 12-bit a data among them. But your encoder IC should not communicate with someone else's decoder IC, so an Encoder and Decoder IC pair will share a common Address which is an 8-bit data. So out of the 12-bits 8-bits will be used to set address and the remaining 4-bit will be used to transmit data. With 4-bit data we can create

16 types (2^4 =16) of combinations. These IC's are commonly used with RF pairs or IR pairs. So if you are working on a project which has to transmit a 4-bit data from one end to other either by wire or wireless then this IC pair will be best suited for you.

Applications:

- Used to convert Parallel 4-bit data to series data
- Highly useful in wireless communication projects involving RF or IR
- Remote controlled systems like garage doors, Car alarm system, Car door controls etc.
- Can be used in Home automation for short range remote switching
- Safety systems like Burglar alarm system, Smoke or Fire alarm system etc..

Features:

- 12-bit Decoder IC to be used with HT12E
- Decoded data has 4 Data bits and 8 Address bits (8+4=12-bits)
- Commonly used for RF and IR wireless transmission
- Operating Voltage 5V
- Low stand by current of 0.1uA at Vcc=5V
- Available in 16-pin DIP, 20-pin SOP

L293DNE MOTOR DRIVER IC:

A motor driver is an integrated circuit chip which is usually used to control motors in autonomous robots. Motor driver act as an interface between Arduino and the motors . The most commonly used motor driver IC's are from the L293 series such as L293D, L293NE, etc. These ICs are designed to control 2 DC motors simultaneously. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor. We will be referring the motor driver IC as L293D only. L293D has 16 pins. The L293D is a 16 pin IC, with eight pins, on each side, dedicated to the controlling of a motor. There are 2 INPUT pins, 2 OUTPUT pins and 1 ENABLE pin for each motor. L293D consist of two H-bridge. H-bridge is the simplest circuit for controlling a low current rated motor.

Pin No. - Pin Characteristics:

- 1 - Enable 1-2, when this is HIGH the left part of the IC will work and when it is low the left part won't work.
- 2 - INPUT 1, when this pin is HIGH the current will flow though output 1
- 3 - OUTPUT 1, this pin should be connected to one of the terminal of motor
- 4,5 - GND, ground pins
- 6 - OUTPUT 2, this pin should be connected to one of the terminal of motor
- 7 - INPUT 2, when this pin is HIGH the current will flow though output 2
- 8 - VCC2, this is the voltage which will be supplied to the motor.
- 16 - VCC1, this is the power source to the IC. So, this pin should be supplied with 5 V
- 15 - INPUT 4, when this pin is HIGH the current will flow though output 4
- 14 - OUTPUT 4, this pin should be connected to one of the terminal of motor
- 13,12 - GND, ground pins
- 11 - OUTPUT 3, this pin should be connected to one of the terminal of motor
- 10 - INPUT 3, when this pin is HIGH the current will flow though output 3

- 9 - Enable 3-4, when this is HIGH the right part of the IC will work and when it is low the right part won't work.

Why 4 grounds in the IC?

The motor driver IC deals with heavy currents. Due to so much current flow the IC gets heated. So, we need a heat sink to reduce the heating. Therefore, there are 4 ground pins. When we solder the pins on PCB, we get a huge metallic area between the grounds where the heat can be released.

Why Capacitors?

The DC motor is an inductive load. So, it develops a back EMF when supplied by a voltage. There can be fluctuations of voltage while using the motor say when suddenly we take a reverse while the motor was moving in some direction. At this point the fluctuation in voltage is quite high and this can damage the IC. Thus, we use four capacitors that help to dampen the extreme variation in current.

AURDINO CODE

```
#include<Easy2transfer.h>
#include<Multiplexer.h>
#include<Lineflow.h>


int VccPin=A5;   // Set Analog pin 5 as VCC

int xPin=A3;     //X axis input

int yPin=A2;    //Y axis input

int zPin=A1;  // Z axis input

int Q1=10,Q2=11,Q3=12,Q4=13; //Output pins to be connected to 10, 11, 12, 13 of Decoder IC

long x;  //Variabe for storing X coordinates

long y;  //Variabe for storing Y coordinates

long z;  //Variabe for storing Z coordinates

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);  //Set A4 pin LOW
 digitalWrite(VccPin, HIGH);  //Set A5 pin HIGH
}
void loop()
{
 x = analogRead(xPin);  //Reads X coordinates
 y = analogRead(yPin);  //Reads Y coordinates
 z = analogRead(zPin);  //Reads Z coordinates
  if(x<340)    // Change the value for adjusting sensitivity
   forward();
  else if(x>400)  // Change the value for adjusting sensitivity
   backward();
  else if(y>400)  // Change the value for adjusting sensitivity
   right();
  else if(y<340)  // Change the value for adjusting sensitivity
```

```
    left();
   else
    stop_();
}
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,HIGH);
 digitalWrite(Q3,HIGH);
```

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

APPLICATIONS:

* The applications of the accelerometer based gesture controlled robot include
* These robots are used in military applications to operate robots
* These robots are used in medical applications for the purpose of surgery
* These robotics are used in the construction field

LIMITATIONS AND FUTURE WORK :

- The on board batteries occupy a lot of space and the battery gets drained within a less time so we have to choose an another alternative source
- secondly we are using RF module for wireless transmission nearly a range of upto 50-80m. This problem can be solved by using GSM module for wireless transmission. The GSM modules are installed all over the world and also provides large range
- Thirdly camera can be fixed on board for monitoring long operations.

Conclusion:

At the end we are able to complete our mini-project and we are getting proper output as expected

THE END