Design Lab

Laboratory report submitted for the partial fulfillment
of the requirements for the degree of

Bachelor of Technology - Masters Of Technology Integrated
in
Electronics and Communication Engineering

by

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1.1 Abstract

The aim of this experiment is to design a hand gesture based robot. Its basic function is to move as per the movement of the hand of the driver.

It is composed of two parts :- Receiver and a Transmitter. Receiver part will be present on the bot to receiver the input data from the transmitter part and the transmitter part will be attached to the hand of the driver.

In the experiment we will look at the design specification. We will also look at the features of the component used. Further, we will also discuss the Arduino code and how the various component are working,

1.2 Introduction

Aim - To design a hand gesture based robot

Its basic function is to move according to the movement of the hand. Here we will Arduino Uno along with RF module and a Accelerometer.

1.3 Principle

This bot works due to working of 3 components :-
1. Accelerometer
2. RF Module (434MHz)
3. Arduino Uno

Accelerometer
The basic underlying working principle of an accelerometer is such as a dumped mass on a spring. When acceleration is experienced by this device, the mass gets displaced till the spring can easily move the mass, with the same rate equal to the acceleration it sensed. Then this displacement value is used to measure the give the acceleration.
Accelerometers are available as digital devices and analog devices.

RF Module
The RF module operates at Radio Frequency. The corresponding frequency range varies between 30 kHz 300 GHz.
The RF module used comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz.

Microcontroller
A microcontroller is embedded inside of a system to control a singular function in a device. It does this by interpreting data it receives from its I/O peripherals using its central processor. The temporary information that the microcontroller receives is stored in its data memory, where the processor accesses it and uses instructions stored in its program memory to decipher and apply the incoming data. It then uses its I/O peripherals to communicate and enact the appropriate action.

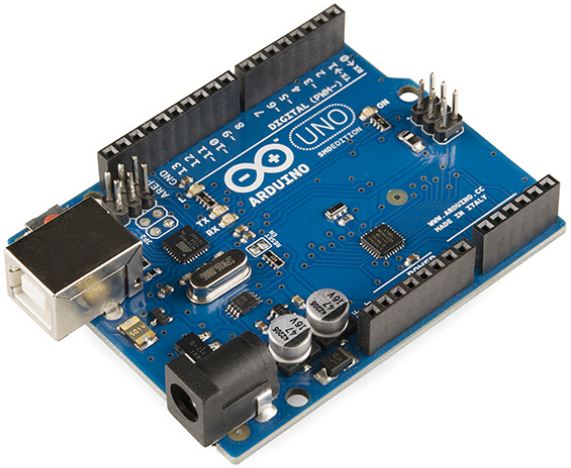
1.4 Component Detail

1.4.1 Component Used

1. **Microcontroller -**
Arduino Uno x2
2. **Transmitter - Reciever Module -**
RF Module 434MHz x1
3. **Accelerometer**
MMA7361
4. **Motor Driver**
L298N x1
5. **Motor**
150 RPM x2
6. **IC7805 - Voltage Regulator**
7. Batteries
8. Wheels
9. Chassis
10. Breadboard
11. Jumper Wire

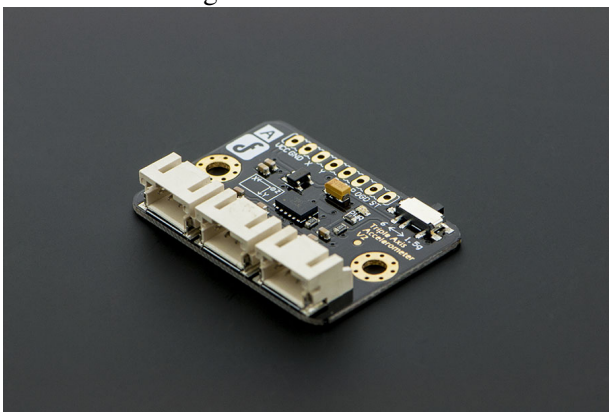
1.4.2 Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc and initially released in 2010.The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable.



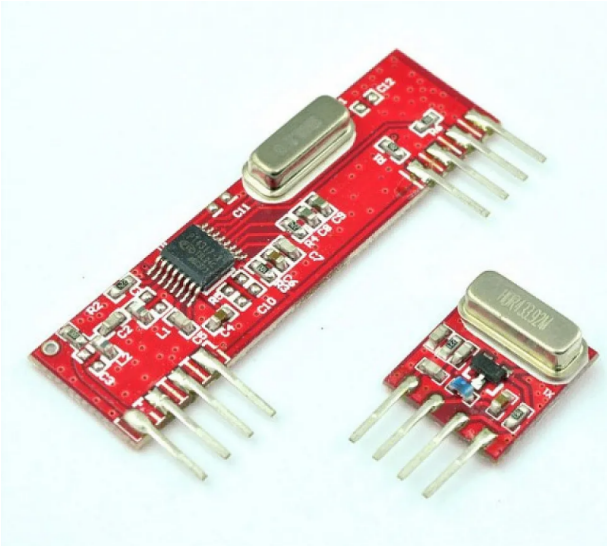
1.4.3 MMA7361 - Accelerometer

MMA7361L three-axis analog accelerometer. The sensor requires a very low amount of power and has a g-select input which switches the accelerometer between ±1.5g and ±6g measurement ranges.



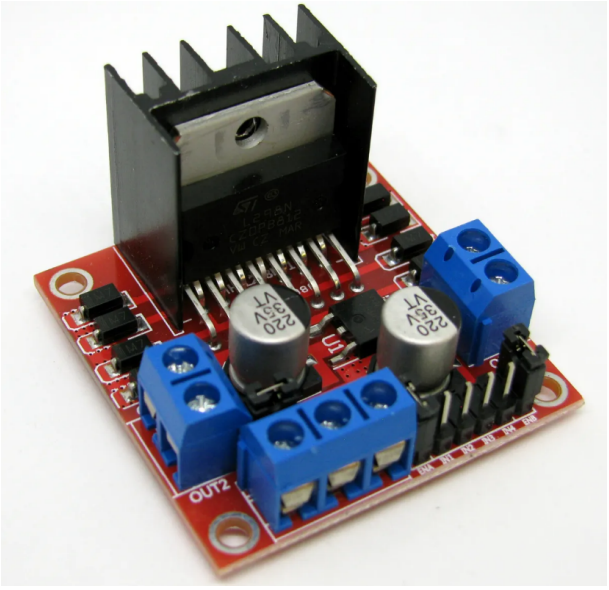
1.4.4 RF Module

RF module is a pair of transmitter and receiver which are hence used to transmit or receive data. In this project we have used the RF module to transmit the axis motion to the bot so that it can move accordingly.



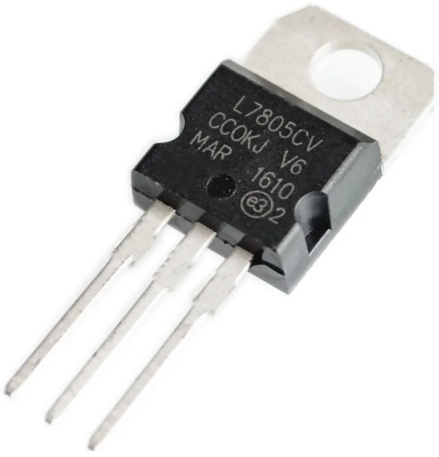
1.4.5 L298N - Motor Driver

Motor driver is used to provide enough power to the motor to spin. The power recieved from the arduino is not sufficient to rotate the motors thus a motor driver is used to amplify the signal recieved from the arduino.



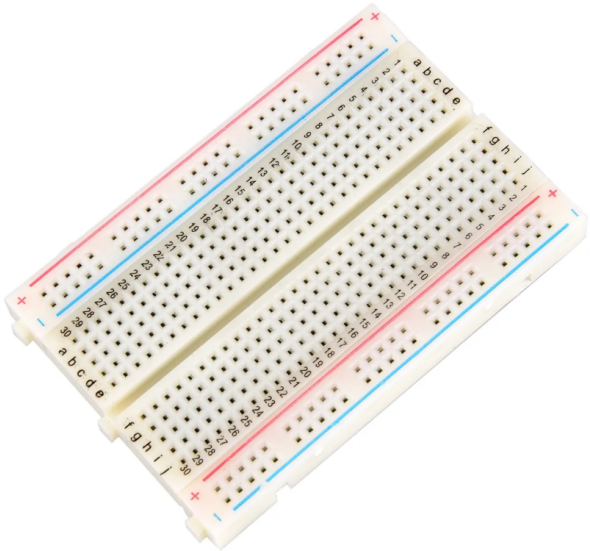
1.4.6 IC7805 - Voltage Regulator

This IC is used to regulate voltage. It converts any type of incoming signal to 5V DC supply thus giving constant voltage to the circuit.



1.4.7 Breadboard

A breadboard, solderless breadboard, or protoboard is a construction base used to build semi-permanent prototypes of electronic circuits.



1.5 Working Of Circuit

1.5.1 Basic working

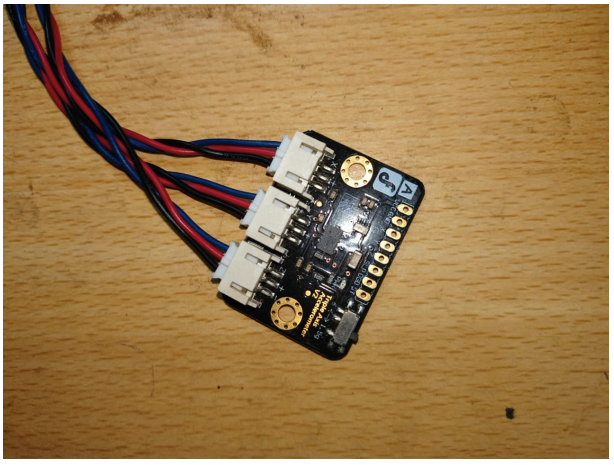
In the transmitter the Arduino is used to transfer letters to the receiver present on the bot. Pin number 12 of Arduino is used to transfer to the Data pin of the transmitter. As per the values

received from the Accelerometer the Arduino provides different value to the transmitter such as f for forward, b for backward, s for stop, l for left, r for right and so on.
On the bot the receiver of the RF module is present which receives the value send from the transmitter part of the module. The received data is sent to the Arduino through the data pin connected to pin number 12 of the Arduino.
Later on the basis of the value received the Arduino provides output of the six pins of L298 motor driver, 4 being the driver pins and 2 being the control pins.
Further the motor driver is used to provide power to the motors which further provides power to the motor and make the motor spin in the required direction.

1.5.2 Use of each component

1.5.2.1 MMA7361

This is a triple axis accelerometer. It send the value of its x and y axis to the Arduino uno on the transmitter end. Arduino uno consistently takes value from the accelerometer and whenever change in axis value exceeds a certain value the ardunio sends the respective data to the transmitter.



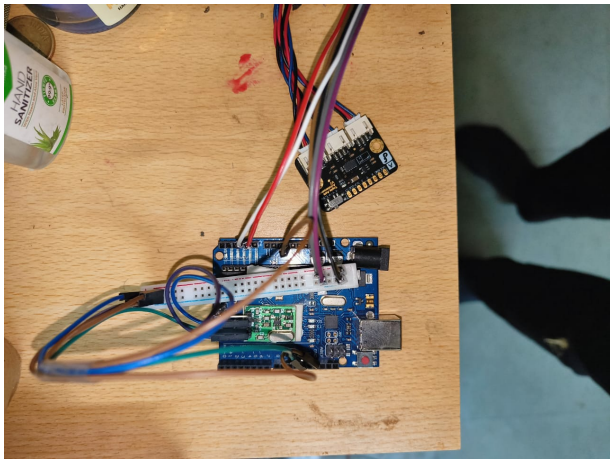
1.5.2.2 Arduino Uno Transmitter

PseudoCode :-

xval = Initial x value of accelerometer
yval = Initial y value of accelerometer
x = Read data of pin A1;
y = Read data of pin A2;
if(x - xval is greater than 70) transmit f
else if (xval - x is greater than 70) transmit b

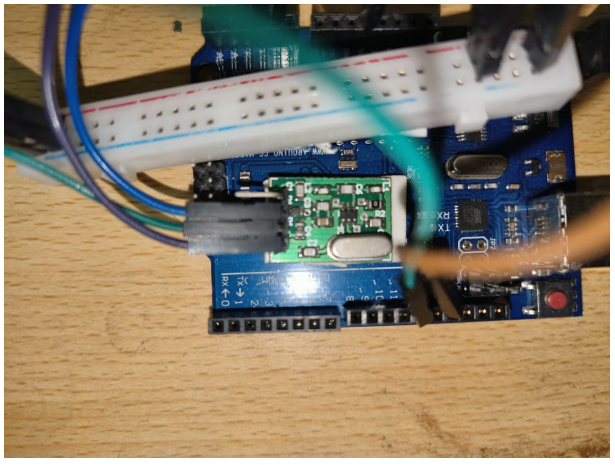
else if (y - yval is greater than 70) transmit r
else if (yval - y is greater than 70) transmit l
else transmit s

Here xval and yval variable are used to store the initial value of the x and y axis of the accelerometer. They are placed in the setup ortion of sketch
Then x and y variable taked the value again and again as that are in the void loop of the sketch. Whenever the change in value of x and y occur more then 70 they transit the data f, b, l, r, s as stated in the pseudocode.



1.5.2.3 Transmitter RF Module

It has 4 pin namely :- Vcc, Ground, Data and Antenna. The Vcc is connected to direct power supply while the ground is connected to the ground of the arduino. The data pin is connected to the digital pin 12 of the arduino and with the antenna pin it transmits the data recieved from the arduino to the reciever present on the bot.
It connect to the reciever as both the reciever and the transmitter have same frequency of working i.e. 434 MHz.



1.5.2.4 Reciever RF Module

This is the first part of the Bot. Its main work is to recieve the data from the transmitter and further send the data to the Ardunio present on the bot.
It has 2 data pin so any one pin is connected to the digital pin 12 of the arduino. Rest of its pins are connected to Vcc or Ground based on their configuration.

1.5.2.5 Arduino UNO Reciever

Pseudocode : -
if (data recieved) if(f) Both motor in forward else if(b) Both motor in backward else if(r) Left motor forward and right motor backward else if(l) Left motor backwar dand right motor forward else Both motor stop

When the data is recieved from the RF module then according to the data recieved the arduino give power to the L298 module which is used to rotate the motor. 4 wire from the arduino are given for the direction of the spon of motors while 2 are connected to the enable pin of the l298 module just to change/modify the speed of rotation of motor.
In this bot we have reduced to rotation speed to 50 percent.

1.5.2.6 Motor driver - L298

This device is used to rotate the motor. Its basic function is to amplify the signal recieved from the arduino. It has 4 ports for the motor connection and with 6 pins, 4 to control the direction of rotation of motor while 2 to control the speed of rotation.

1.6 Result

With the help of the component discussed we are able to design a bot that works on the basis of our hand. If we tilt our hand in forward direction the bot moves forward while if we tilt the hand in backward direction the bot moves backward similarly if we tilt our hand in left or right direction the bot similarly turn left or right.

1.7 Conclusion

We got to know the functioning of Arduino, accelerometer, RF module, Motor driver and various other components. With use of these we have designed a Gesture controlled bot.

Name of the Entity	**Cost**
Arduino	800 x2
L298N	350
RF module	90
MMA7361	280
Chassis	600
Breadboard	50

TABLE 1.1: Price of the components

Total Price = Around 2040rs

1.8 References

1. https://en.wikipedia.org/wiki/Breadboard

2. https://www.arduino.cc/

3. https://www.dfrobot.com/product-507.html

4. https://www.google.co.in/

Bibliography