SMART GLOVE

GROUP MEMBERS

AKASH JAMIL	ECI-IT-15-037
JAZIB AHMED	ECI-IT-15-051
MUHAMMAD USAMA RIAZ	ECI-IT-15-116
TEHNIYYAT JAMIL ABBASI	ECI-IT-15-081

PROJECT SUPERVISOR

ENGR. KAMRAN KHAN

Hamdard Institute of Engineering and Technology
Department of Electrical Engineering Hamdard University
Karachi, Islamabad Campus

SMART GLOVE

Submitted by

Akash Jamil, Jazib Ahmed, Muhammad Usama Riaz, Tehniyyat Jamil Abbasi

Towards partial fulfillment of requirement for the award of Degree of Bachelor of Electrical Engineering

Hamdard Institute of Engineering and Technology Department of Electrical Engineering Hamdard University Karachi, Islamabad Campus

DEDICATION

Our Beloved
Parents

And Teachers Whose
Proper Guidance and

Prayers
Made This All Possible

CERTIFICATE

This to certify that this project report entitled "**Smart Glove**" by Tehniyyat Jamil Abbasi, Jazib Ahmed, Akash Jamil and Muhammad Usama Riaz submitted in partial fulfillment of the requirements of the Bachelors of Engineering of Electrical Engineering from Hamdard University Karachi, Islamabad campus is the record of candidates own work carried out by them under our supervision and guidance. In our opinion the work submitted has reached a level required for being accepted for exam. The matter embodied in this project has not been submitted to any other university or institute.

Committee:

1. Project Supervisor Signature

Engr. Kamran Khan _____

2. Examiner 1 Signature

_____ _____

3. Examiner 2 Signature

_____ _____

Hamdard Institute of Engineering and Technology
Department of Electrical Engineering Hamdard University Karachi, Islamabad Campus

Table of Contents

LIST OF FIGURES

LIST OFACRONYMS

GSM	Global Configuration Module
RF Sensor	Radio Frequency Sensor
LCD	Liquid Crystal Display
PCB	Printed Circuit Board
LED	Light Emitting Diode
RAM	Random Access Memory
SRAM	Static Random-Access Memory
EEPROM	Electrical Erasable Read Only Memory
Contd.	Continued
DC	Direct Current
Etc.	Et cetera
I/O	Input/ Output
IDE	Integrated Development Environment
K Ohm	Kilo Ohm
PC	Personal Computer
V	Volts

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ABSTRACT

The sole purpose of advancement in science and technology is to make this world a better, peaceful and safer place. This is the idea of making life easier especially for physically disabled person through controlling electronic appliances using hand gesture. But that is not just it this system capable of sending text on relevant number.

For wireless home automation system, a glove circuit has been designed with optical sensors, 3axis accelerometer to capture the gestures or hand's position. The bending of finger is identified using optical sensors present on each finger, while the accelerometer provides the hand's position. Optical sensors consist of LED (Light Emitting Diode) and LDR (Light Dependent Resistor). When any finger of hand is bend optical sensor sense the bending extent with the help of LED and LDR on finger. A voltage signal of specific amount generates at the output of LDR. This signal sends to the microcontroller embedded on the Arduino board. Accelerometer is used to identify the relax or uplifted position of hand. Its output is also given to the Arduino. On Arduino board each voltage signal converts into characters. If hand is in relax position controller sends alphabets through RF transmitter. These alphabets are indication of load switching. Relay is used for switching purpose. In uplifted position of hand numbers are generated and transmitted in the same way. Each of these numbers is responsible of sending one text message of need. These messages send with the help of GSM module. Arduino also gives the instructions to the LCD to display the information that either message has sent or not. When any of the load switched it is also displayed by LCD.

Keywords: Arduino, RF sensors, 3-axis accelerometer, Optical sensors, GSM module.

CHAPTER NO 1

INTRODUCTION

Every human being has ability to see, listen and interact with their environment. Unfortunately some people are unable to use their senses. Speaking and hearing disability causes dumb and deaf population.[1] During last few years due to birth defects, accidents, oral diseases there has been a rapid increase in the speech disabled and hearing-impaired persons. When a speech disabled person speaks to a normal person, the normal person can't understand and asks that person to show gestures of his/her needs. [1]

Sign language is a communication skill that uses gestures instead of sound to convey meaning by combining hand shapes, movement and hands, arms or body's orientation and facial expressions to express thoughts. But most of the time normal people unable to understand this. In the deaf and dump communities this causes problems for people when they try to interact with others, especially in social, educational and professional activities. Stroke is the major cause of disability. Affected person causes great economic burden on his family and the society. Another cause of physical disability is motor impairment which happens after stroke, as it damages the upper and lower limbs. [2]

The sign language translator system is a glove-based system having sensors on each finger that can understand the gestures. The glove uses optical sensors, and accelerometer to gather data of each finger's position and the hand's orientation respectively. Output of glove is analogue signal which is provided to microcontroller which immediately converts this voltage signal into characters (alphabets or numbers) and then transmit these characters through RF transmitter and on receiver side RF receiver get this information. With the help of Arduino required appliance turns on. The hardware components used in the Smart Glove are optical sensors, accelerometer, arduino, RF sensors, GSM module and transformer. [3]

Accelerometer ADXL 335 sensor is used to know that hand is either relax or uplifted position.[4] When hand will change its position from lifted to relax position, these sensors will sense it and microcontroller receives the signal from these sensors, analyses it. In relax position loads switching occurs and in uplifted position text messages of needs deliver through GSM module. GSM module has sim card for this purpose. Also, LCD displays information after switching of each load and after each text message is being sent. The microcontroller is programmed using the Arduino.

1.1 Motivation:

The motivation in making this project is to grow a cost effective, user-friendly, light, nifty glove which can reduce the difficulties for paralyze person so that they can stand with the race. This will make the lives of the disable People meaningful.

1.2 General Description of the Project

This project is classified into following parts: gesture Recognition, Gesture interpretation and Appliance Controlling. Sensor Interfacing with Arduino as Inputs devices and Outputs devices such as appliance AC, Fan, TV etc. and mobile phone (that receives the text). The system starts just after the any of finger is bend where its bending reduces the light and this reduction is detected by on light dependent resistor and according to the intensity of light bending extent detects. This information is given to the Arduino UNO that generates characters. Transmission of these characters takes pace using RF sensors. Receiver side characters interpretation occurs in Arduino and appropriate appliance turns on or text message of needs i.e. “I need food” etc. send according to the instructions of microcontroller. On LCD it displays that which load is turned on or which message sent i.e. load one is on or message one is sent. Accelerometer (ADXL 335) is present on the back of the hand in order to identify the position of hand on space and is the deciding component which decides that from above mention two action which should perform.

1.2.1 Hardware Part

This part consists of electrical and mechanical hardware.

1.2.1.1 Electrical Hardware

It basically comprises development of circuits for assimilating the devices with the Arduino, Sensor such as optical and RF, ADXL 335, HC 11, used as inputs and outputs, devices such as battery (drive the appliances and actuate the Actuators i.e. relays)

1.2.1.2 Mechanical Hardware

- Supporting Frame
- Electrical extension

1.2.2 Software Part

The software used here is Proteus. This is used for simulation of hardware basic circuit. The software used for programming is Arduino Uno version 1.0.2. This code later on burn in microcontroller.

1.3 Problem Statement

Stroke causes high rates of mortality and disability. After stroke usually patients suffer from upper and lower limbs impairment. Disable persons are burden on the society and also on their family. Being dependent on others causes feeling of depression. Usually dumb people try to communicate with other using sign language but every person can't understand these gestures. So, a communication barrier exists between these two communities. For physical disabled persons it's hard to move on and they require permanently an assistant for a person on wheel chair it's tough to move their wheel chair again and again. For a dumb person there is difficulty in conveying his message. It will be time saving that without changing our place we can turn on light, AC or Fan etc. Those who cannot speak cannot call of help. In hospitals nursing staff did a lot of efforts as they constantly monitor their patients and to communicate with dumb person a translator may be needed. The main purposes of this project are

- Saving Man Power, money and time.
- Facilitate the Disabled persons.

1.4 Problem Solution

The solution of above problem is to create a setup that is able to decreases human effort and it should be low-cost and accurate. A system is required that could recognize the gestures based on bending of fingers and could also interpret the gestures, after that Controlling of appliances is also done. The whole system is controlled through microcontroller on Arduino board on both glove and receiver side. This can be achieved using the various sensors i.e. RF sensors optical sensors. In hospitals and homes, it can be used for controlling of appliances and sending messages through gestures with high degree of accuracy and quality. This system is helpful to a person that wants to control home utilizations automatically if he is unable to stride towards switches and can send messages if he needs anything i.e. water, food, medicine etc.

1.5 Aims and Objectives

1.5.1 Aims

- To lower the barrier in communication.
- To develop a system which is easily movable.
- To develop gesture recognition cost-effective system which is based on microcontroller.
- To determine the position of hand.
- To control five different appliances by gestures in lifted position of hand.

- To send five different messages of need in the relax position of hand.
- To display the information on LCD about switching of load and messages being sent.
- The purpose is to develop easy to use system that is not heavy and able to reduce the obstacles for disable persons so that they can stand with the race.
- The glove that could minimize communication gap.

1.5.2 Objectives

- To understand the Principle of Automation System.
- To be able to program the using the most common programming language (c or c ++).
- To be able to build a complete system for gesture recognition, interpretation and controlling system using “microcontroller”.
- To understand the principle of the sensors and their applications.
- To be able to select appropriate or suitable sensors for certain application.
- To be able to design and build the gesture-based appliance control system for home and hospitals applications.
- To study the existing data glove technologies commercially available in the market.
- To arrive at the specific sensors and technical parameters of the hardware used in the project.
- To design the actual Smart Glove hardware and calibrate the sensors. To measure the sensor responses for various gestures.

1.6 Design Components

Following components are used

- Arduino UNO
- Step down transformer
- Bridge rectifier
- Accelerometer ADXL 335
- Relays Module
- Regulator 12V or 5V
- GSM module (SIM 800L)
- LCD 16*2
- Resistor

- Capacitor 100uf
- LED
- 9v battery
- Optical sensors
- RF sensor (HC 11)

1.7 Scope

The project has wide range applications and has a great advancement in human life. Without any physical connection home appliances will turn on and person don't need to move to do this and can act like a normal person. This will reduce the need of any attendant or nurse and reduce the human efforts or man power.

1.7.1 Homes

This glove can be used in home for physically disables persons. While using this there will be no need of any attendant or nursing staff for disabled persons. When text is sent to the appropriate persons it is similar to give a language to the dumb person. This Glove has ability of controlling Home Appliance so that a physically disabled persons are able to live independently.

1.7.2 Hospitals

In hospitals this glove will help the patients and no need for any permanent nursing staff for them.

1.7.3 Old homes

This glove can also be used in old homes for overage persons.

1.8 Limitations:

Drawback of this project is that its glove needed to wear all the time that could be irritating for patient.

It is possible to make it more compact then present condition.

LCD can be embedded on glove so that disable person come to know the status of appliance and text message.

1.9 Report Organization

Chapter 1 Provides a brief introduction and information about the project. Problem statement and Solution also been discussed.

Chapter 2 Gives an overview, introduction and previous knowledge of this project. Basic structure and mechanism to work is also discussed in this chapter. Basically, it is the literature review of the project.

Chapter 3 provides components introduction, their features and working.

Chapter 4 Discusses the methodology of the project in detail, how it was designed?

How it was constructed?

Chapter 5 give knowledge about the Implementation of the project i.e. how the component being implemented.

Chapter 6 Gives results and conclusion and future suggestions for research in this area. It also tells that how this project can enhance to get better results.

CHAPTER NO 2

LITERATURE REVIEW

Gesture recognition has been a significant branch of HCI dating back to the 'Sayre' Glove in 1977. [6] The glove prototypes first time designed in the Massachusetts Institute of Technology (MIT) in 1977.It was Sayre Glove and Later on a LED glove and the Digital Entry Data Glove was also constructed. On each figure there was an LED and one tube. At that time various gesture interpretation devices have been considered, including computer vision techniques and sensor aided glove devices. All these gloves were using only one type of sensors[8]. It was 1983 when Gary Grimes formed a glove named as Digital Entry Data Glove . This was the first glove in which multiple sensors used. This glove had different types of sensors attached on cloth. In this glove proximity /touch sensors were used to know the user's thumb position either it was touching fingers or any other part of the hand. Four "knuckle-bend sensors" used for measurement of bending of the joints in the thumb, index, and little finger. Two tilt sensors also used to determine the tilt position of the hand when it was in the horizontal plane. There were two inertial sensors to know that how much forearm and wrist was twisted. From data of hand position "alphanumeric characters" was created. Using wired hardware hand's motions were perceived. This hardware was using 80 different sensors output to create 96 ASCII characters. This glove was very exact and was attached with PC using bulky wiring. Later on, large number of such glove were produced and used in different applications to conform the idea.

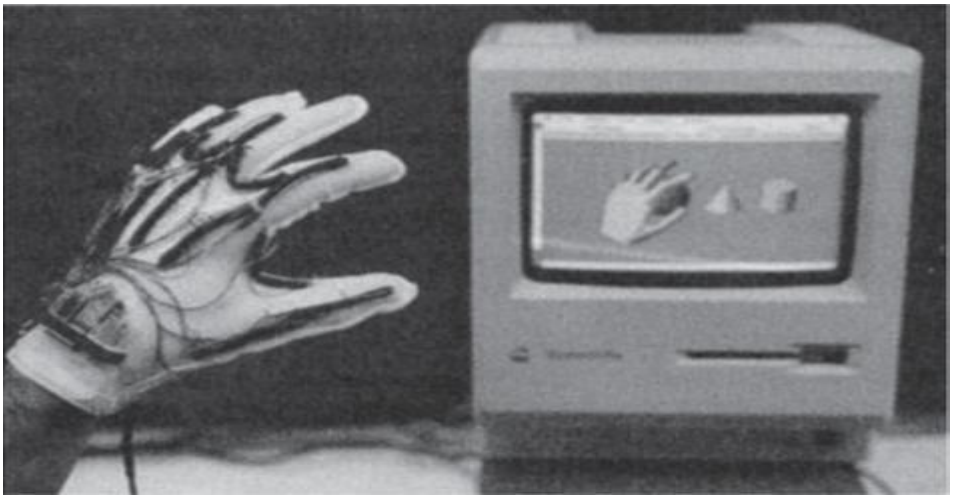

Figure 2.1: The ZTM Glove developed by Zimmerman [8]

They never got any consideration past trial instruments and were rarely popularized. In 1980s, sensor innovation increases very quickly due to cold war fears and the common industry extension

in numerous European nations. The sensor innovations cleared path which leads to quick improvements in PC innovation. At that time many new computer external devices were introduced in market including data glove. During research in peripheral devices the first Data Glove was appeared in 1987 and was available in market. This was modification of the first Data Glove which was created by Zimmerman in 1982.This is shown in Fig. 2.2. [7]

This innovation was like the utilized in Sayre Glove. Be that as it may, in the 1987 fiber optics rather than previous concept of tubes was used and in them up to 15 sensors were used to expanding its capacity to recognize various motions. These sensors were source of a lot of Information and based on this information many devices were created. [9] After that a Power Glove for games was created in 1989.In this glove resistive ink was used to measure bending extent of finger's joints.

In 1995 super glove was developed in Nissho Electronics. This glove was using minimum 10 and maximum 16 sensors and was using a board of ink sewn on the glove cloth. P5 was another version of the Power Glove, was commercialized in 2002. [8] All of these gloves were used for gesture recognition produce by finger and hands movement and they were not using only for appliance controlling but were using for different applications.

Figure 2.2: MIT Accele glove with its multiple sensors.

The Microsoft Kinect is recently popular commercial release of a gesture recognition device, which uses high definition cameras as well as depth sensors to create full models of the user as an input into games. Various other implementations have tried to create sign-language interpretation devices as an accessibility tool for those persons with vocal or aural disabilities. Gesture recognition can be used as another user interface (UI) peripheral (a mouse for example); with varying operational sets depending on its implementation and the software intention. [8]

Smart Glove system is a system which consist of series of equipment that can used for gesture recognition, gesture interpretation and appliance controlling to reduces human efforts and increase easiness in life of physically impaired persons. Application of this project used in different areas includes hospitals homes and many more.

For a long time, gesture recognition techniques were using in assistive technologies for human computer interaction systems and disabled. [9] Hand gestures were always using as a source of input patterns for assistive device implementations [10], such devices which utilize pressure sensors and 3D accelerometers. [11] [12] [13] [14] Similar systems are often expensive, and sometime required advanced machine learning techniques to provide an expanded operational set for sign language interpretation or other goals. To make this system useful high accuracy, low cost, low power consumption system is needed. This system utilizes gesture recognition and provide all features to control whole home appliance.

David j ataman published his work in [1994] which he provides the basic knowledge about how LED which is the source of light can be used at one end and photodiode at the other end to detect the bending extent and voltage at output. [15].

Leo Loui in 2016 provided the knowledge of function, architecture and working of Arduino.[16]. It can interact with surroundings using sensors and actuators. It is simple microcontroller-based boards, used for programming electronic device. It is like a mini computer just like other microcontrollers, it takes inputs and through outputs control different electronics devices. [17]

Switches and different sensors are used to get the information of surroundings and deliver it to Arduino and then Arduino drives output devices to achieve required result. Arduino can read the inputs for example if any light strike on any sensor and it gives output voltage, want to activate a motor, turning on an LED, relay etc. as shown in Fig 2.4. Arduino uses software and a hardware. To develop the code Arduino IDE (Integrated Development Environment) used. This board consist of the 32-bit or 8-bit microcontroller's that are manufactured by Atmel. These controllers can be programmed with the C or C++ language. Simple USB cable can be used to burn the code. This software can easily run on personal computer and program can be used for controlling operations. [18]

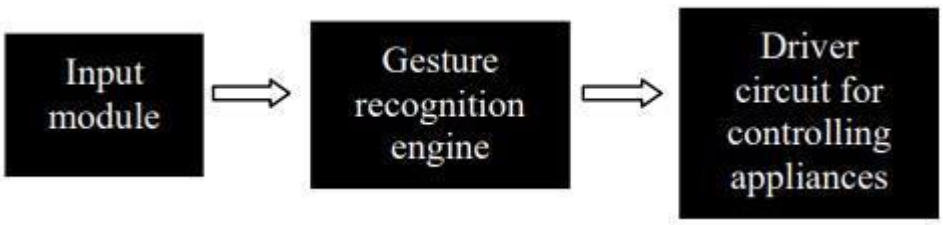

Figure 2.3: Overview of Arduino inputs and outputs

Pomboza-Junez Gonzalo and Holgado-Terriza Juan A [19] published a paper which provided brief information about automated control of home devices using Arduino and it also give the idea that how a SMS can be sent to the mobile number provided. In this paper an idea of capture the orientation and rotation of hand is also given.

The design of an accurate and less expensive microcontroller-based gesture recognition, interpretation and appliance control system which can be used in all appliance control operations. From gestures a voltage levels obtained. This voltage level gives digital data in controller which is then transferred to receiver side and second microcontroller will turn on appliance and also displayed on a 16*2 LCD and also used to control appliance. [32]

The gesture is said to be an idea that is related to a response or a requirement.[20] Without using words or sounds the gestures are the source of a non-verbal communication. But the vocabulary is limited and gestures have to be done to express ideas using their hands and hands positions. [21] The gesture identification by a computer requires firstly capturing the data of gesture, and later to interpret this data and identify the gesture. [22] To interpret and capturing gestures there have been several researches [23], [24], [25] done on hands, eyes, face or even the whole body. Then, new devices were launched to ensure the capture, processing and identification of gestures. [26], [27], [28]Now gesture-based interfaces became the direct way of interaction between humans and machine. [29]

Many smart gloves are proposed in recent years in which preferred technology was wireless mode and they have many distinct features, but those were not light weight, reliable, cheap, Easy to use, plug and play type prototypes. The reason behind this was that components used for fabrication were heavy and they were not easy to use. To open up the lines of communication and conversation between people who are facing hearing-impairment or having speaking disabilities, a designer and student at Goldsmiths University in London has developed a smart-glove named “Sign Language Glove” that is able to translate sign language from hand gestures into on-screen text as well as audible dialogue using speaker. [30] But it not durable as it uses such sensors which damage very soon and it is bulky too. We design a system which uses the same idea and it is not bulky and easy to handle and carry and durable too as we used optical sensors instead of flex sensors. [30]

Some other work which was explored used the gestures for controlling of consumer devices. But mostly they considered gestures performed by motion of the hand with the any movable device [36] or by touch of the smartphone screen with fingers (one or more than). [35][34] The gestures used in this work can be carried out without any physical hindrance. The proposed system could also be considered for projects studying the use of devices such as automatic controls for home, computers and office. [33]

Tushar and Ankit et. el propose in their paper that how a smart glove can be designed using optical sensors. They describe in this paper that optical sensors can designed using a flexible tube of 5 cm LED and LDR. One side of tube is LED and other side has LDR. When LDR has sufficient light its output voltage is negligible. When any finger bends LDR output voltage became very high due to high resistance. This voltage can be given to the Arduino and results can be observed in MATLAB. They also used Hall Effect Sensors. It was a bulky system [31]. They did not give any idea about the appliance control.

In 2017 Darshan and Malad et. el. said in their paper that accelerometer can be used to measure acceleration. It will give the idea to make the circuit simple.[37]

In 2005 P.B Patel et. el. gave concept of microcontroller to record the sensor's value but did not give any idea to control the appliances. Instead he used to monitor the gesture in software and convert it into text.[38]

CHAPTER 3

THEORETICAL ASPECTS

3.1 Introduction

The speedy growing and advancement of recent technology has yield to the developments and inventions of modern equipment's and machineries. These inventions have alleviated human considerably altogether aspects of their daily lives.

There are several disable individuals, a number of them are partly and a few are utterly disabled. The partly impaired individuals which includes those persons who are unable to listen, speak, or walk and they face difficulty to in their daily life. Here communication has important role to feel somebody higher associated pampering them wherever they can call as freelance personality. By considering this need the project for Disable individuals is designed so that such persons will spend his life according to his needs. It provides faciality for such folks to measure with traditional community. This glove is able to convert hand gesture into text. This additionally facilitate traditional creature to grasp what he wants to say.

This system has facility of household appliance management from that a physically impaired person become freelance to measure. the most objective of the enforced project is to develop a reliable, straightforward to use, less weighted good system which might lessen the toughness of impaired wherever they can live like normal individual. Here optical device has the main role. Optical sensors are present on each finger and also on the thumb.

The optical sensors provide output within the sort of voltage variation that varies with degree of bend. This optical device output is given to the ADC channels of microcontroller and it will give data to RF module transmitter. This transmitter information is received by receiver which is also RF module and this give the whole data to Arduino during this section the gesture is recognized and also the corresponding output is displayed on liquid crystal display. Arduino output will turn on the corresponding device i.e. ac, fan etc. or message will be sent to the mobile number provided. The movability of this project may be a major advantage. Therefore, with the assistance of this project, the barrier faced by these individuals in communication with the society will be reduced to a good extent. [38] This report concentrates and focuses on the implementation of Arduino based automatic gesture recognition and controlling of appliances and message to the person. With all the available methods in the ongoing researches, definitely, the system should be improved. This project consists of following main categories:

1. Gesture Recognition

2. Gesture Interpretation

3. Appliance Controlling

3.2 Gesture Recognition

Gesture recognition is the process of identification of movements of the parts of body specially hands. And here in this project it has two distinct meanings:

- Bending of any finger is identified and then recognize that which particular finger has bend either it is thumb, index, middle, ring, pinky fingers and the second meaning is to know the position of hand is either it is lifted position or relax position:

This side uses 5 volts works provided by power supply and regulator. Sensors will sense the position of finger and position of hand. At start when any of finger is bend it is identified by the optical sensors which are placed on each finger. Then this value of output voltage will send in the form of analogue signal to the Arduino microcontroller. This controller will change the value according to programming and will generate specific characters and send the whole data to RF sender. From accelerometer position of hand will be identified and will send the whole data through RF transmitter and this gesture will be used to identify whether to send message to the mobile number or to control an appliance. It also displays a notification on LCD which will be explained later. Now process gets started when Arduino gets values from sensors.

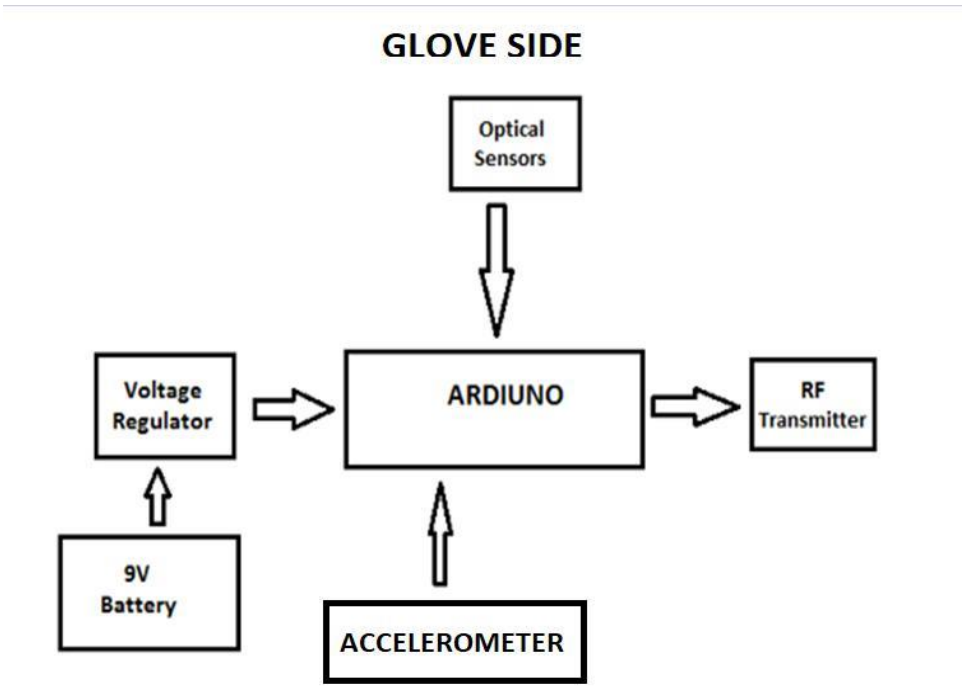

Figure 3.1: Block Diagram of Gesture Recognition

3.3: Gesture Interpretation:

On the receiver side there is RF receiver which will collect the whole data from air and give it to the Arduino Uno through serial transmission. Data from the Arduino is first translated as it got different characters and here in it programming it is mentioned that on receiving which characters which particular appliance should turn on it will be decided here by Arduino.

When the hand's position will change then this gesture will send text message to the number through GSM module and also a notification will display on the LCD. ADXL335 will detect the hands position and signal will give to the Arduino. From Arduino this data will receive by RF which will give the whole data to Arduino on receiver side. A signal from Arduino will send to the GSM module. Each signal will transmit a character. For e.g. if 1 will receive message first will send and similarly system will send five different type of messages on the given number. LCD is also attached here and will display when any message will send to the number i.e. message 1 send, message 2 send etc. The whole system works on 5 volts provided by power supply block.

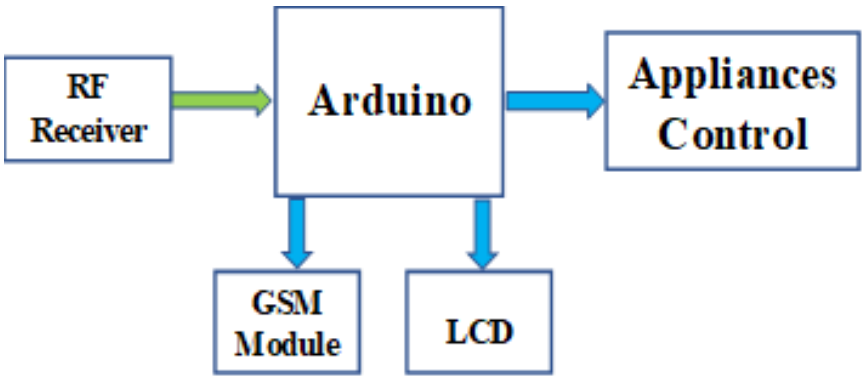

Figure 3.2: Block Diagram of Gesture Interpretation and Appliance Control

3.4 Appliance Controlling

When output of Arduino is given to the relay module it will turn on the required appliance i.e. on receiving the character. Which character will turn on which appliance it is mentioned in programming. For e.g. character A will use to turn on first load and same process will repeat up to character E. When any of load will turn on a message will display on the LCD that load 1 is on or 2 is on. All the appliances will control through hands lifted position. When hand will change its orientation to relax position then 5 messages will send to the mobile number and also LCD will display appropriate notification. This part of project is to design a microcontroller based automatic

controlling system. When specific data is achieved during the process of recognition. At the same time signal from the microcontroller actuates the relays and the appliances turned on.

3.5 Hardware Implementation

Hardware part consists of two main parts

a) Glove

b) Board

Glove consists of Optical Sensors, 9 Volt Battery, Arduino UNO, RF module (receiver), LDR and ADXL 335. Board consists of Arduino UNO, GSM Module, RF receiver, Relay module, Power supply and switches of various appliances.

3.6 Mechanical components/Equipment

- Supporting frame
- Electrical extension

3.7 Electrical Components/Equipment

Here some brief idea about the electrical equipment's/components used to construct the electrical part of the project such as

- Step down transformer
- Bridge rectifier
- Accelerometer (ADXL 335)
- Relays
- Regulator
- Optical sensor
- Microcontroller
- LCD 16*2
- Capacitor
- Resistor
- LED
- RF (HC11)

- GSM module (SIM 800L)
- LDR

The brief idea about the electrical equipment's/components used to construct the project can be taken from the following description.

3.7.1 Step Down Transformer

The step-down converters/transformer are used to convert the high voltage into low voltage. The converter in which output voltage less than the input voltage is called as a step-down, and the converter in which output voltage greater than the input voltage is called step-up converter. The transformers are used to step up or step down the voltage levels. 220V AC is converted into 12V AC using a step-down transformer. 12V output of this transformer is an RMS value and its peak value is given by the multiplying square root of two with RMS value, which is approximately 17V. [39]

Figure 3.3: Transformer

Each transformer has primary and secondary windings. On primary side turns numbers are less and so has voltage and current here is low in comparison with secondary side. Secondary made up of a greater number of turns as it is having low-current high-voltage power, and the secondary has wire with a smaller number of turns and its current is high there as voltage is low. Transformer's working is based on Faraday's law. [39]

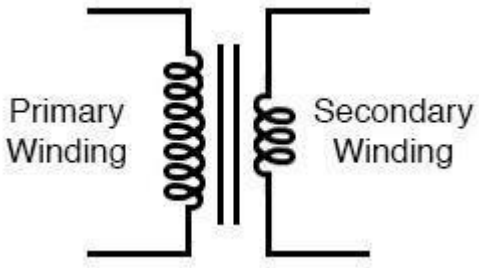

Figure 3.4: Step Down Transformer Symbol

Transformer's working principle is "Faraday's law of electromagnetic induction". In two winding mutual induction is responsible for transmission action in a transformer. This law states that "when the magnetic flux in a circuit changes, an electromotive force (EMF) is induced in the circuit and proportional to the rate of change of the flux linked".

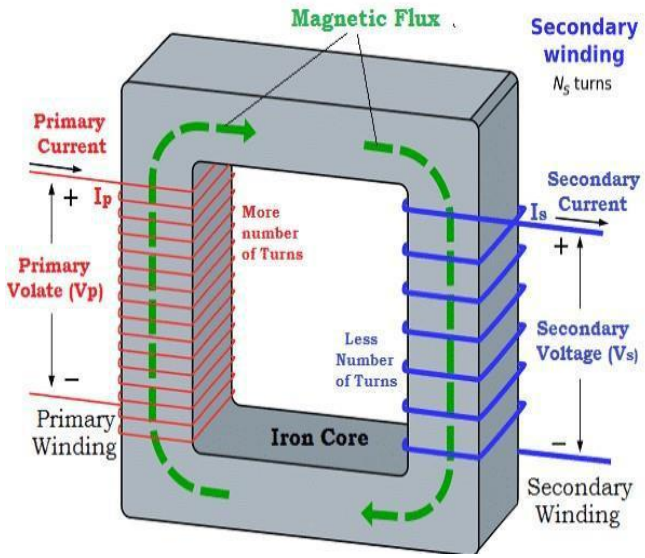

Fig 3.5 Step Down Transformer Internal Structure

The Electro Motive Force induced between two windings is determined by the number of turns in primary and secondary winding. This ratio is known as Turns Ratio. The voltage reduction capability of transformers depends the turn ratio of the primary and secondary. As number of windings in secondary is less then number of windings in primary coil, so the amount of flux linked to the secondary coil of the transformer will less compared to the primary coil and emf induced will be less in the secondary. Due to this voltage reduces at the secondary as compared to primary winding. The first set of coils, which is called as the Primary Winding, is connected to an alternating voltage source called Primary Voltage. The other is called as Secondary Winding, is connected to the load and the load draws the resulting alternating voltage (stepped up or stepped down voltage). The alternating voltage at the input excites the Primary Winding, an alternating current circulates the winding. The alternating current will result in an alternating magnetic flux, which passes through the iron magnetic core and completes its path.

Since the secondary winding is also linked to the alternating magnetic flux, according to Faraday's Law, an E.M.F is induced in the secondary winding. The strength of the voltage at the secondary winding is dependent on the number of windings through which the flux gets passed through. Thus, without making an electrical contact, the alternating voltage in the primary winding is transferred to the secondary winding. [40]

3.7.2 Bridge Rectifier

A bridge rectifier is an alternating current (AC) to direct current (DC) converter that rectifies mains AC input to DC output. Different types of rectifiers are half, full wave rectifier and bridge rectifier. Here bridge rectifier is used. Bridge rectifier has four diodes which are connected to form a bridge shape. Theses diode are not controlled so conduct in forward direction but not in reverse.

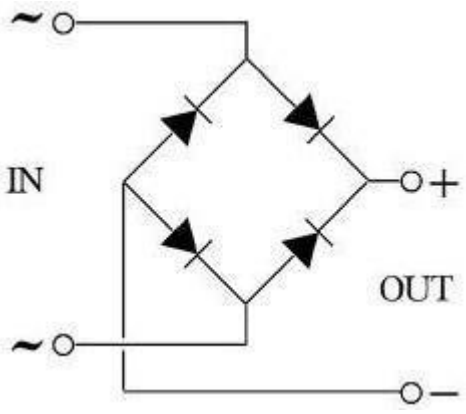

Figure 3.6 Bridge Rectifier [41]

If the anode voltage of diode is greater than the cathode voltage then the diode is said to be in forward bias. In positive half cycle, diodes D2 and D4 will conduct and diodes D1 and D3 will conduct during negative half cycle so now AC is converted into DC and it is not a pure DC as it consists of pulses and called as pulsating DC power the voltage drop across the diodes is (2*0.7V) 1.4V so the peak voltage at the output of this rectifier circuit is 15V (17-1.4) approx.[41] in both the cases, the load current direction is same, i.e., up to down as shown in the figure – so unidirectional, which means DC current. [41]

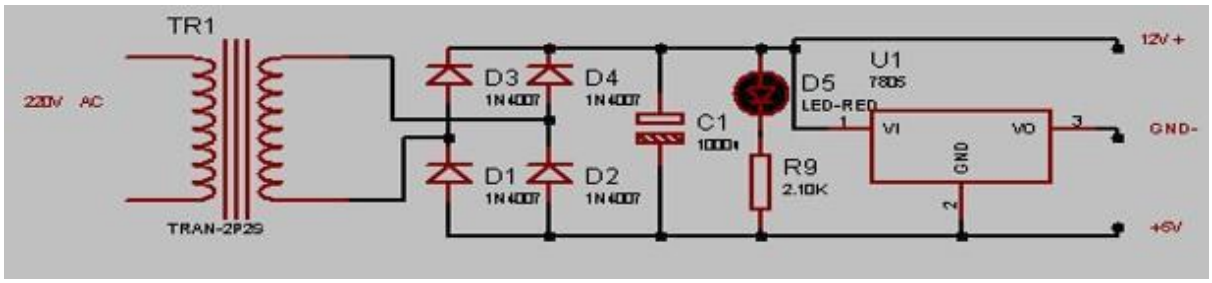

Figure 3.7: Bridge Rectifier Circuit Diagram

Here in above circuit diagram 220V AC power is converted into 12V AC (12V RMS value and the peak value is around 17V), but the required power is 5V DC; for this purpose, 17V AC power must be converted into DC power after that it can be stepped down to the 5V DC with 7805 voltage regulator. AC power can be converted into DC using Rectifier. Capacitor here used for removing ripples [41]

3.7.3 Accelerometer

An accelerometer is an electromechanical device that measures acceleration force and shows acceleration, only due to gravity i.e. g force and It measures acceleration in g unit. On the earth, 1g means acceleration of 9.8 m/s^2 is present. This device can be used for tilt-sensing and dynamic acceleration resulting from shock, motion, shock, or vibration. [42]

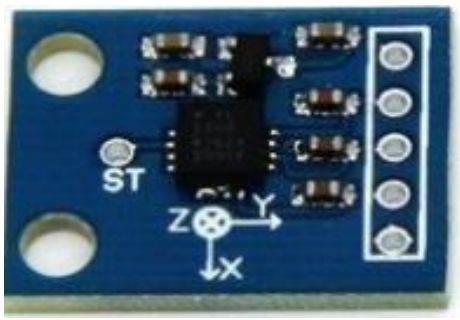

Figure: 3.8 ADLX 335 Accelerometer [42]

Acceleration is change of velocity with time and it is a vector quantity. Likewise, velocity is a quantity having direction. Acceleration of anything can be explained by two ways first one by changing swiftness and by changing track. Now and then both are varying at a time. ADXL 335 is a device for computing acceleration of anything and provides complete 3-axis acceleration measurement. This module measures acceleration in the form of analog input and in the x, y and z axis (three-dimension direction) within range ±3 g. At the output this module produces analog voltages that are proportional to the acceleration. It consists of a polysilicon surface-micro machined sensor and also has a signal conditioning circuitry. This device consumes very less power and it is not noisy.[42]

When acceleration is measured by it is, it can interface to any of controller such that Arduino having controller. This is used in making many types of apparatuses such as drilling piles and destruction and many more like in humanoid tackles such as running etc.

This device has five pins for performing different functions. On first pin 3.3 volts applied that are necessary to activate the device. This pin is named as VCC. Another pin labeled as GND used to provide ground. Third pin name is x pin and it provides acceleration covered along x axis and it gives analogue signal and this value is given to the controller. Fourth pin is labeled as Y. It measures acceleration in y axis. Fifth pin is Z pin and if any distance covered along this direction this pin provide this value which is analogue signal.[43]

3.7.3.1 Specifications of ADXL 335:

Operating Voltage	1.8V – 3.6V
Operating Current	350μA (typical)
Sensing Range	±3g (Full Scale)
Temperature Range	−40 to +85°C
Sensing axis	3 axis
Sensitivity	270 to 330mV/g (Ratio metric)
Shock Resistance	Up to 10,000g
Dimension	4mm x 4mm x 1.45mm [44]

3.7.4 Relay

A relay is a switch which operates electrically. Mostly relays use electromagnet to mechanically operate a switching process, but other operating methods are also there. Relays are used to control a circuit by a low-power signal (between control and controlled circuits it provides complete electrical isolation), or where one signal control several circuits. A relay is operated by a relatively small current to turn on and off a relatively large current. It contains an electromagnet (a coil made up of wire that becomes a magnet (temporary)on flow of electricity). It can switch on by a small current and then it switched on another appliance by passing high currents through it.[45]

Figure 3.9: Relay [45]

The high-voltage side has two connectors, each with three sockets: common (COM),normally closed (NC), and normally open (NO).common is common pin.NC is (Normally Closed) configuration which is used when we want that by default the relay to be closed, and current is flowing unless we send a signal from Arduino to the relay module and open the circuit and current will stop.NO is (Normally Open) normally open configuration the relay is always open, so the circuit is broken and no current will flow unless we send a signal. 5V 8-Channel Relay interface board. In 8 channel relay module that is used here each needs 15-20mA current.

It is high-current relay, AC250V 10A, DC30V 10A.It can be controlled directly by microcontroller (Arduino, 8051, AVR, PIC, DSP, ARM, ARM, MSP430, TTL logic). Indication LED's for Relay output status.[45]

Figure: 3.10 Relay pins

Many sensors are sensitive and produce small currents but often we need high currents to drive bigger apparatus. Relays make it possible to activate the bigger apparatus from small ones.

Figure: 3.11 Eight Channel Relay Module

That means relays work either as switches (turning on and off) or as amplifiers (converts small currents to larger ones). On passing electric current through the coil magnetic field is generated and movable contacts and makes or breaks (depending upon how it was constructed) connection with non-movable contact. At start (when relay was deenergized) If the contacts was closed, then movement opens the contacts and connection will break, and if the contacts were open then movement will close the connections. When coil has no current, the connections will come to its relaxed position. Most relays are operated quickly. They reduce the noise in a low-voltage application. [45]

3.7.5: Regulator

A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. There are two types of voltage

regulators: linear and switching. A linear regulator employs an active (BJT or MOSFET) pass device (series or shunt) controlled by a high gain differential amplifier. It compares the output voltage with a precise reference voltage and adjusts the pass device to maintain a constant output voltage. A switching regulator converts the dc input voltage to a switched voltage applied to a power MOSFET or BJT switch. The filtered power switch output voltage is fed back to a circuit that controls the power switch on and off times so that the output voltage remains constant regardless of input voltage or load current changes. [46]

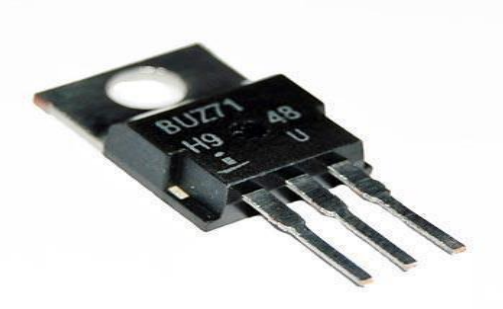

Figure 3.12: Regulator 5v [46]

3.7.5.1 Regulator 7805 IC specifications

Input voltage has range 7V- 35V,

Current rating is 1A,

Output voltage has range $V_{Max} = 5.2V$, $V_{Min} = 4.8V$

3.7.6 Optical Sensor

A sensor should be able to record an event and provide a corresponding output that is measurable and meaningful in it or an output that can be converted to another form that is measurable. An optical sensor used to convert light signal. The purpose of this sensor is to measure a physical quantity of light and, depending on the type of sensor, then translates it into a form that is readable by an integrated measuring device. Optical Sensors are used for contact-less detection, counting or positioning of parts. Optical sensors can be either internal or external. External sensors gather a required quantity of light and transmit while internal sensors are most often used to measure the bends and other small changes in direction. [47]. There are different kinds of optical sensors, the most common types which we have been using in our real-world applications as given below. Photoconductive devices used to measure the resistance by converting a change of incident light into a change of resistance. The photovoltaic cell (solar cell) converts an amount of incident light into an output voltage. The Photodiodes convert an amount of incident.

light into an output current. Phototransistors are kind of bipolar transistor where the base-collector junction is when exposed to light will behave like photodiode with internal gain.

3.7.6.1 Through-Beam Sensors:

The operating principle in optical sensor in the transmitting and receiving of light, the object to be detected reflects or interrupts a light beam sent out by an emitting diode.

The interruption or reflection of the light beam is evaluated depends of light. This makes it possible to detect objects independently of the material they are constructed from (wood, metal, plastic or other).

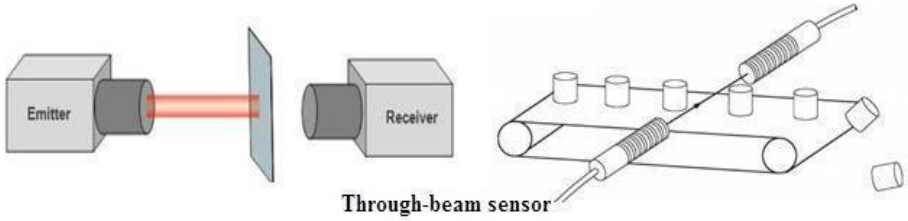

Figure 3.13 Through beam sensors

Huge working separations can be accomplished and the acknowledgment is free of the item's surface structure, shading or reflectivity. During the recombination procedure of electrons with gaps at the intersections of n-doped and p-doped semiconductors, vitality is discharged as light. The excitation happens by applying an outside voltage and the recombination might occur, or it might be invigorated as another photon. This encourages coupling the LED light with an optical gadget.

Figure 3.14: LED

A LED is nothing but a p-n junction semiconductor which on applying voltage emits light rays**.** In this project optical sensor is constructed by using an LED, LDR (Light Dependent Resistors) and a small, thin plastic tube. LDR used here is VT 935G.This model has 100 v and maximum resistance is 1 mega ohm.

3.7.7 Microcontroller:

The microcontroller used on Arduino board is Amega328.It is the product of Atmel. It has 32Kbytes of Flash memory with Read-While-Write capacities, 1Kbytes EEPROM (electrically erasable programmable read only memory), 2Kbytes SRAM (static read only memory), 23 universally useful I/O (input output) ports, 32 broadly registers, Real Time Counter (RTC), three adaptable Timer/Counters for PWM (pulse width modulation), a 6-channel 10-bit ADC, a programmable Timer with inner Oscillator and a SPI (sequential port interface).All the 32 registers are associated with the Arithmetic Logic Unit (ALU).It has RISC (reduced instructions set) type architecture. [48] The Idle mode stops the CPU while permitting the SRAM, Timer/Counters, SPI port and interrupt to keep working. [49] In Standby mode, the resonator oscillator is running while the remaining of the parts is in sleep mode. This permits quick start-up with low control.[49]

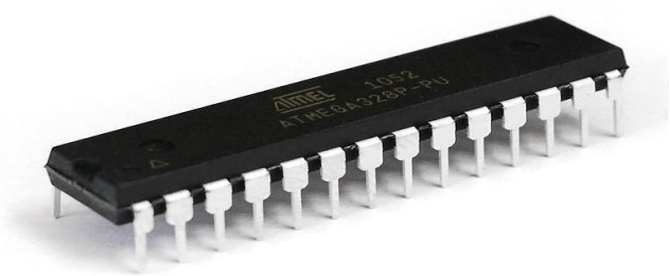

Figure 3.15: Microcontroller ATMEGA328P-PU [49]

3.7.8 LCD

16*2 LCD is a cleanser glassware flavor (LCD) is a soporific room publish, electronic identifiable display or cover disclose that uses the light modulating properties of liquid crystals (LCs). LCs wind up sound emit light directly. LCD displays are reachable to display out-and-out images (as in a general-purpose abacus display) or firm images which in reality be displayed or hidden such as preset words digits seven segment displays etc., as in a digital clock. This LCD is unsurpassed within limits improved than a typical 16x2 module. 16×2 LCD Module can display 32 ASCII characters in 2 lines (16 characters in 1 line). The concord arena of this LCD fits politely on the hasten defend LCD pocket money element and abundantly expands a user's cleverness to display more data using the same code libraries. [50]

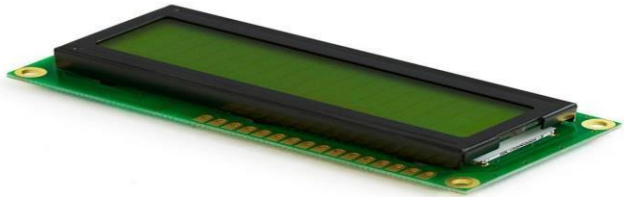

Figure 3.16: 16x2 LCD [50]

3.7.9 Capacitor

A capacitor (also known as a condenser) is a passive, two-terminal electrical component that is used to temporarily store e energy(electrical) in an electric field. Rectifier supplied the raw DC supplied by on its own would consist of a series of sine waves with varying voltage. To make rectifier output smooth a reservoir capacitor is used and placed across the rectifier's output and parallel with the load. This capacitor will charge from the rectifier voltage and will rise above that of the capacitor and then as its voltage falls, the capacitor provides the required current from its store charge. A capacitor with 1000uf and 63V. [51]

Figure 3.17: Capacitor [51]

3.7.10 Resistor

A resistor is a two-terminal passive electrical component that implements electrical resistance as a circuit element. Resistors used to reduce current flow and at the same time can lower voltage levels within circuits. Diagram and symbol of resistor are shown in figure [52]

Figure 3.18: Figure 3.1 Resistor [52]

3.7.11 LED

A light-emitting diode (LED) is made up of semiconductor material having two-leads and produces light. On applying suitable voltage to leads electrons recombine with holes in p-N junction and release energy in the form of photons.

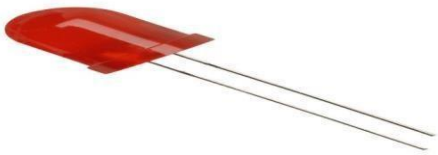

Figure 3.19: LED

Advantages of LED over incandescent light sources are lower energy consumption, improved physical robustness, smaller size, longer lifetime and faster switching.[53] Applications of Light

emitting diodes are as diverse as automotive headlamps, aviation lighting, advertising, traffic signals, general lighting, lighted wallpaper and camera flashes.

3.7.12 RF Transmitter Module:

Module Introduction:

RF transmitter module which is used is HC11.It is used in wireless transmission and has a range of 150 to 300 meters outside and 1 to 40 meter inside.HC-11 has wireless communication frequency band is 434M.It has multiple types of serial port transmission modes having respective features, and the mode is changed by command. (V1.8). User don't need to program the modules, and four modes are only used for receiving and sending serial port data, and are convenient to use. This module has advantage that it has low current consumption; the idle current is 80μA,
3.5mA or 22mA, depending on the selection of mode. The numbers of bytes sent to serial port of module are unlimited. All functions and parameters can be changed by using command, and can be saved in case of power failure.

Figure 3.20: HC11 Module

3.7.12.1 HC 11 Pin Description:

V 3.3V～5V

GND: Ground

RXD: TTL level input port

TXD: TTL level output port

CON: Parameter setting control pin, valid for low level

ANT1: POB antenna pedestal

ANT2: Antenna

Figure 3.21: HC11 Chip

3.7.12.2 HC 11 Features:

The serial RF module is a low cost, high performance transparent FSK transceiver with operating at 434 MHz It features small size, high output power, high sensitivity, long transmission distance and high communication data rate with auto set up for communication change and data receiving and transmission control.

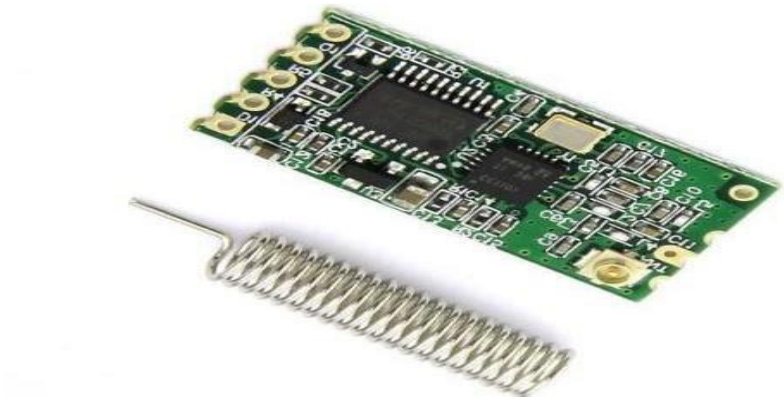

Figure 3.22: HC11 with Detached antenna

With the UART interface, it is easy to realize the wireless data transmission with only providing the UART data. It is flexible for the users to set the UART baud rate, frequency, output power, data rate, frequency deviation, receiving bandwidth etc. parameters. This module cannot work individually, at least 2 pcs would be needed to create the communication.[54]

3.7.12.3 Specifications

- Working frequency: 434Mhz
- Supply voltage: 3.3V to 5VDC
- Communication distance: 1m to 40m indoor
- Serial baud rate: 1.2Kbps to 115.2Kbps （default 9.6Kbps）
- Receiving sensitivity: -112dBm to -95dBm
- Transmit power: -30dBm to 10dBm
- Interface protocol: UART/TTL
- Operating temperature: -40℃ to +85℃
- Dimensions: 27.8 x 14.4 x 4mm

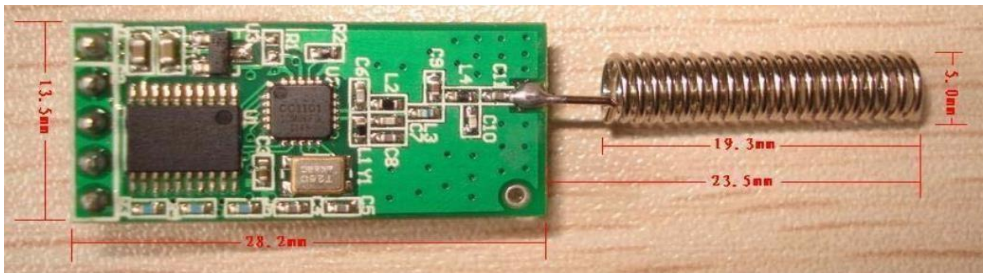

Figure 3.23: HC11 With Antenna Attached

3.7.13 GSM module sim 800L module:

SIM800L GSM/GPRS module is a GSM modem, which can be integrated into a large number of IoT projects

Figure 3.24: SIM 800L Module Without Antenna

. It can be used to accomplish almost anything a normal cell phone can i.e. Make or receive phone calls SMS text messages, connecting to internet through GPRS, TCP/IP, and many more. The module supports baud rate from 1200bps to 115200bps.The module require an external antenna to connect to a network. The module usually forms with a Helical Antenna and solders directly to NET pin on PCB. To keep the antenna away from the board the board also has a U.FL connector.it

Supports Quad-band, EGSM900, GSM850, DCS1800 and PCS1900 and able to Connect to any global GSM network with any 2G SIM.it can Make and receive voice calls using an electret microphone and external 8Ω speaker and can send and receive SMS GPRS data and FM radio broadcasts and also accepts Micro SIM Card. it has transmit Power (2W) for GSM850. **3.7.13.1**

LED Status Indicators:

There is an LED on the top right-side Cellular Module which indicates the status of network. If it blinks every 1s shows module is running but has no cellular network when blink every 2 seconds shows that's GPRS data connection is active and when module is ready to send and receive SMS it will blink every 3 seconds.

3.7.13.2 Antenna Selection:

An antenna is needed to use the module for any reasonably voice or data Communications moreover as some SIM commands. So, choosing associate antenna may be an important factor. There are 2 ways to add associate antenna to SIM800L module. The first one could be a Helical GSM antenna that sometimes comes with the module and solders on to NET pin on PCB.

Fig 3.25: SIM 800L with helical antenna

This antenna is useful for projects that need to save space but doing struggle in getting connectivity especially if project is indoors. The second one is any 3dBi GSM antenna which has a better performance and allows putting module inside even a metal case as long the antenna is outside.[55]

Figure 3.26 SIM 800L with 3 dbi Antenna

The SIM800L module has 12 pins that provide interface it to the outside world. The connections are as follows:

Figure 3.27:Pin description of SIM 800L module.

3.7.14 Light Sensor (LDR)

LDR is an electrical device used to detect the light fall on it. It is basically a passive sensor as it senses visible or infrared light and convert it into the electrical output. There are many types of light sensors but here we are using LDR Light Dependent Resistors which consist of cadmium sulphide CDs' that changes its resistance just few ohms in presence of light but thousands of ohms in darkness. In night resistance increase and voltage drop across it also increases and it give logic 1 to the controlling device. LDR used here is VT 935G.This model has 100 v and maximum resistance is 1 Mega Ohm and power is 80 Mega Watt.[56]

Fig 3.28: LDR (VT935G) [56]

3.8 Mechanical Equipment

Mechanical equipment consists of hardboard on which all the equipment and devices are connected.

CHAPTER NO 4

METHODOLOGY

4.1 Introduction

After the description of components, the implementation phase is now started. In this phase, the system is built to meet designed specification. This phase is concerned with the selection of technology, tools and the components used to develop the system. These decisions for this product are explained in this chapter. These choices for this product are explained during this chapter. Here is the proposed block diagram. As framework predominantly goes for optimization microcontroller can be utilized to accomplish this. Flow charts and circuit diagrams explaining the function, design and development are also presented of each functional block. Complete flow chart of the project is

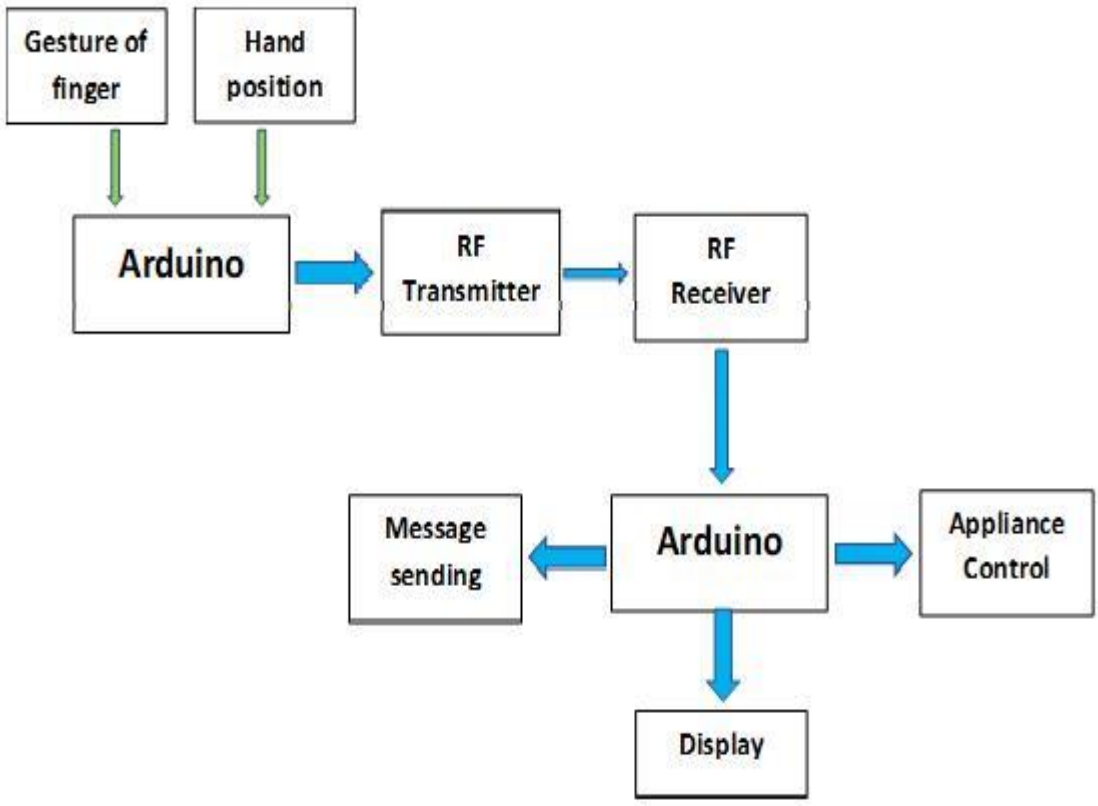

Figure 4.1 Flow chart of complete project

First of all, gesture is identified which is produced by bending of hand. This system is established such that it can recognize the bending of five different fingers with the help of optical sensors and orientation of hand is identified by another sensor. The information is further processed in microcontroller and through RF sensors it is transmitted from hand side in the form of characters. On receiver side this information is received by RF sensors and gesture interpretation is started and again the whole data is translated by microcontroller which will take the decision of controlling that which particular appliance should turn on or which message to send and it's the start of controlling. Here switching is done by relay and this process message will also display on LCD that which appliance is turned on or system can also approach the concerned person through text on his cell phone.

4.2 Description and Design of Functioning Blocks:

The main functioning blocks involved in the project are presented and all technical details of each functioning block and its components are described in detail below.

.4.2.1 Gesture Recognition:

In this project, three different fingers (middle, index, ring, pinky fingers and thumb) bending will be detected on the basis of extent of bending using optical sensors, one side of optical sensor has LED and other side has a device named LDR which is receiver which will detect the light emitted by LED. LDR Light Dependent Resistors which consist of cadmium sulphide CdS that changes its resistance just few ohms in presence of light but thousands of ohms in darkness. In night resistance increase and voltage drop across it also increases and it give logic 1 to the controlling device. It will switch the circuit when there is less amount of light. Depending on this device, the intensity of the light beam is evaluated with the help of microcontroller.

Figure 4.2: Example of Some gestures

On each finger of glove optical sensors are present which will send the whole data to microcontroller. In given below schematics different resistors are connected with LED and 5 volts is supplied to turn on all the LED. In normal finger extended position output of LDR has very low resistance but on bending any finger LDR output will be very high resistance. The input of potentiometer is connected to 5v, its output is given to microcontroller and its ground pin connected with the output of LDR. As we bend the finger LDR offers more resistance than in the relax condition. Now the resistance of the potentiometer increases as its ground(reference) is connected the output of LDR so in that case the output of potentiometer decreases and this analogue signal will be received by Arduino and corresponding to this value any character will defined in the programming.

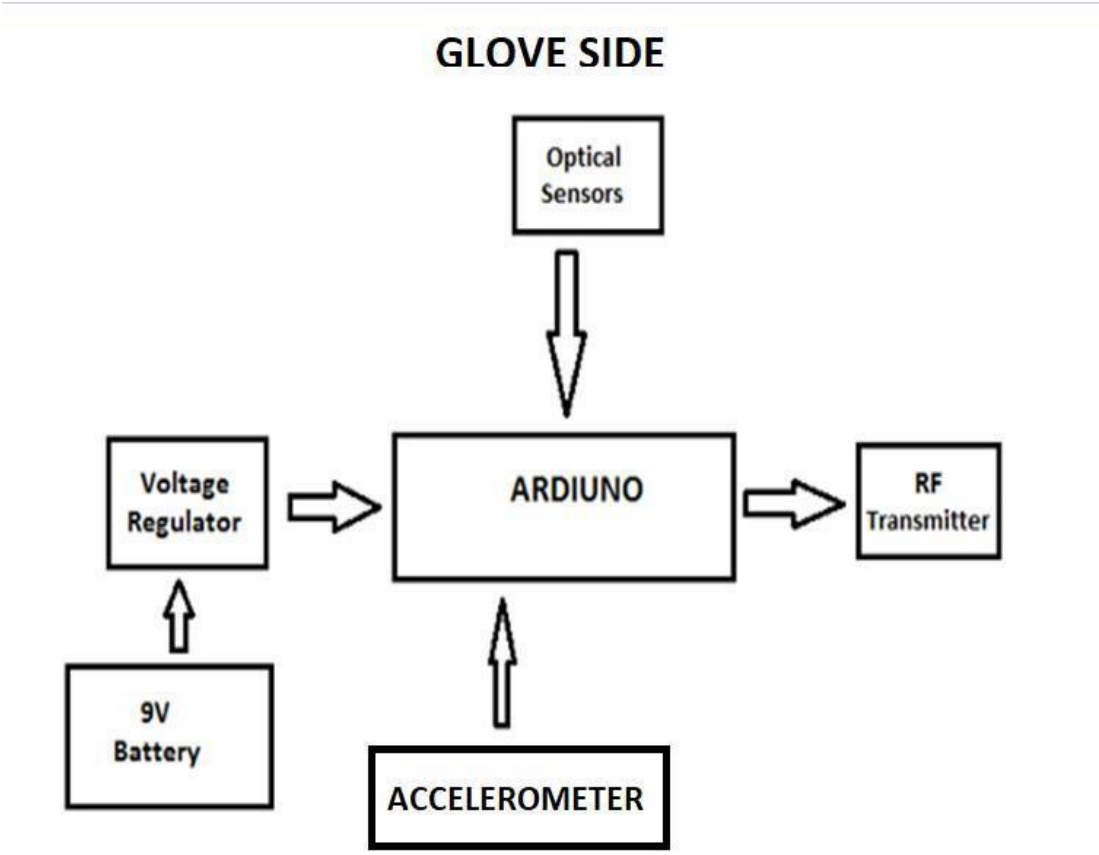

Figure 4.3: Block Diagram of Gesture Recognition

Arduino will generate the five different characters when it will receive the data from A0, A1, A2, A3, A4 pins will transmit these characters through its serial transmission pin TXD and give it to the RXTD pin which is serial data receiver pin on HC11 which is also known as RF transmitter. One pin of HC11 is grounded and the other pin RTS is connected with 5 volts. ADXL 335 will also send the data in analogue form and tells to the microcontroller about orientation of hand when hand will change from lifted to relax position. It's one pin is connected by 5volts and the other is

grounded. In this project gesture is recognize by circuit given below on glove which is also called the transmitter side.

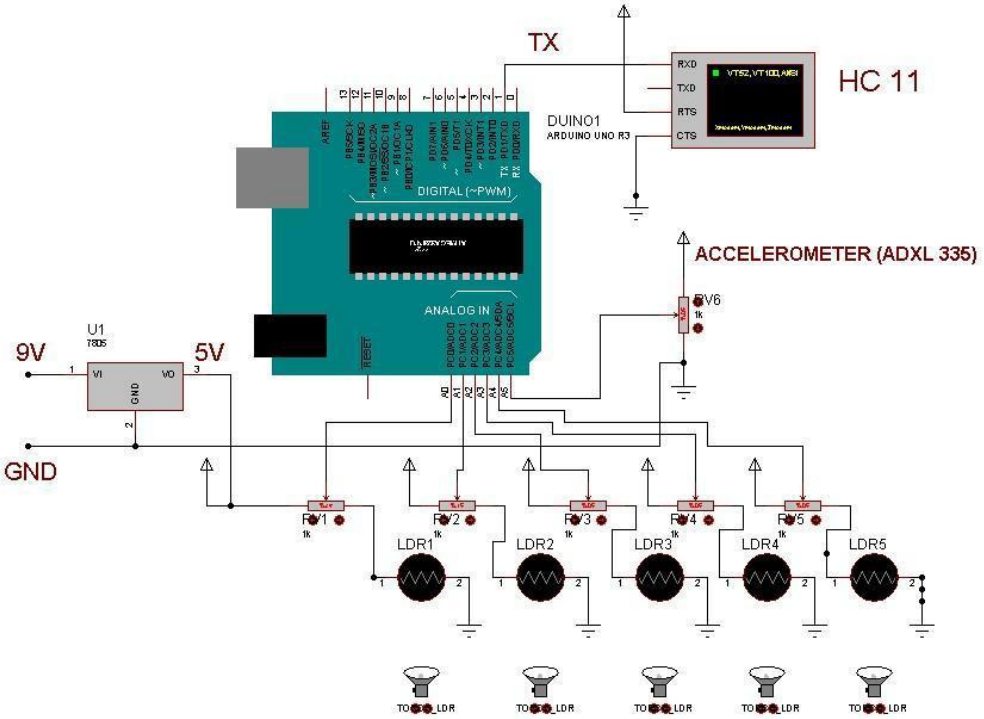

Figure 4.4: Gesture Recognition Schematics

In this circuit 7805 regulator is also used which will convert 9volts into 5 volts and give this voltage at the input pin of potentiometer. Potentiometer has 3 pins .1st is input 2nd is output and 3rd is ground which here got output of optical sensor. Optical sensors are present on each finger. Optical sensor consists of LDR (light dependent resistor) and LED. Each LED get 5volts and ground from regulator. When it turns on it produce light which strike the surface of LDR. LDR in presence of light give minimum voltage at output but when any finger bends light on it become less. In the presence of small amount of light LDR produces very high resistance and voltage drop across this resistance become high. This voltage is now given to the ground pin of potentiometer. Output pin of each potentiometer is connected with the A0, A1, A2, A3, A4 pin of Arduino. These are analogue pins. Output voltage from each of pin is first converted to the digital value with the help of ADC (Analogue to digital convertor) of microcontroller. ADC gives 0-1024 value when it gets 0-5 v. Output of accelerometer decides the position of hand. If hand is in relax position microcontroller sends alphabets and controls the appliances. If hand is in uplifted position it transmits numbers and text messages of needs to the corresponding person. To transmit deta from transmitter side to the receiver side RF (HC 11) transmitter is used.

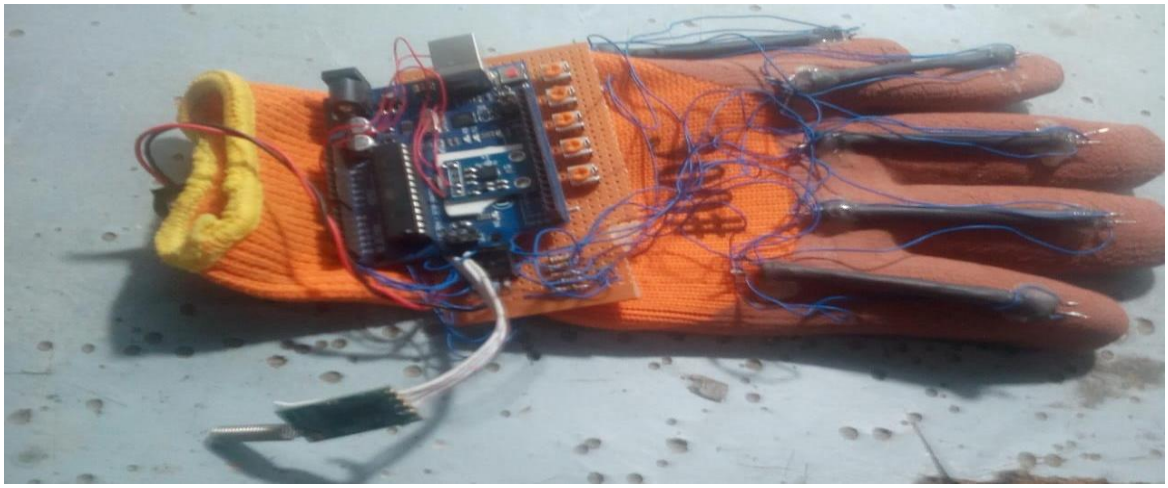

Figure 4.5: Prototype of transmitter side

4.2.2 Sensors Interfacing with Arduino:

In the project, optical sensors are used for gesture recognition and ADXL 335 sensor is used to determine the orientation of hand. The output signals from these sensors are given to Arduino and Arduino provides output according to the programmed in it. RF sensors (HC11) will receive this whole information.

4.2.3 Operating Principle of Optical Sensors

An optical sensor used to change over light beams into electronic signal. It might be a Photoconductive gadget used to gauge the opposition by changing over a difference in occurrence light into a difference in obstruction or it might be a photovoltaic cell (sun-oriented cell) changes over a measure of light into a yield voltage or They may be photodiodes to change measure of occurrence light to a yield current. Phototransistors have bipolar transistor having the base gatherer intersection is presented to incident light. The outcomes is similar conduct of a photodiode, yet with an inside addition. The working rule is the transmitting and accepting of light in an optical sensor, the article to be recognized reflects or interferes with a light bar conveyed by a discharging diode. Contingent upon the sort of gadget, the interference or impression of the light shaft is assessed. This makes it conceivable to identify protests autonomously of the material they are built from (wood, metal, plastic or other). Exceptional gadgets even consider a location of straightforward articles or those with various hues or varieties interestingly.[47]

4.2.4 Working Principal of Accelerometer:

Now a days many types of accelerometers are presented for different purposes. Many of them have MEMS technology. MEMS stands for micro electro mechanical sensor in which a mass is engraved into silicon exterior and then unified into a very small circuit.

Working Mechanism

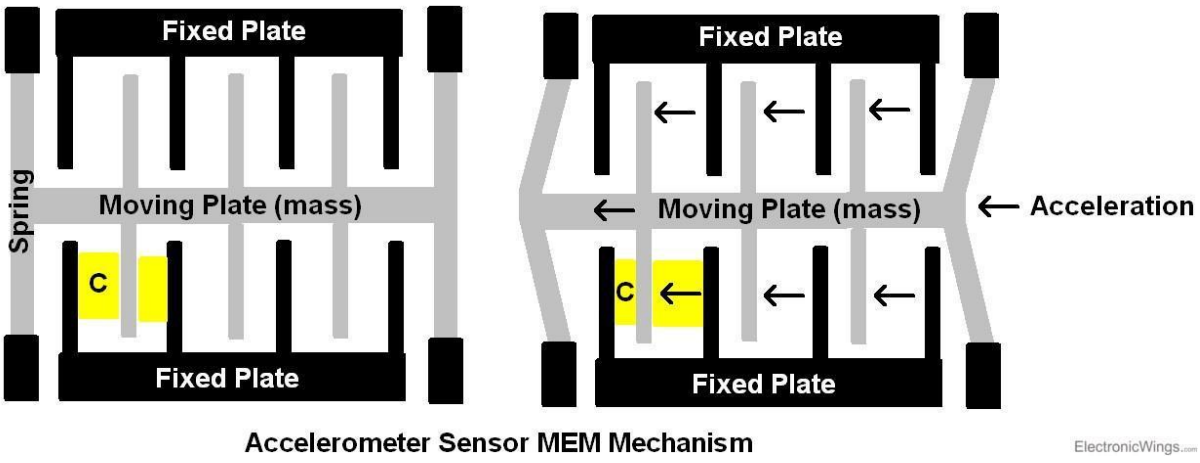

Figure 4.6: Accelerometer sensor MEM mechanism [57]

On applying force, the mass which is attached with movable plates covers distance. According to the Newton's law considerable amount of acceleration is produced. The distance between movable and fixed plates changes and it changes the capacitance. This is analogue device and its working principle is capacitive sensing. In this method change is position causes change in capacitance. Changing capacitance value of output voltage also change which is then sensed by its attached controller . In Figure 4.6 basic structure of accelerometer is shown which consists of fixed plates and moving plates (mass). Acceleration deflects the moving mass and unbalances the differential capacitor which results in a sensor output voltage amplitude which is proportional to the acceleration. Phase-sensitive demodulation techniques are then used to determine the magnitude and direction of the acceleration.[57]

4.2.5 Arduino interface with Accelerometer:

A controller is necessary for interfacing purpose for gaining proper result from ADXL 335 accelerometer. It can join with any controller UNO, MEGA.ADXL 335 accelerometer has five pins. VCC, GND, X, Y, Z pins. X pin gives acceleration covered along x axis. In this project only this pin used and Y and Z pins are not used here. According to schematic A0, GND and 5V pins of Arduino board are connected with x, GND and VCC pins of accelerometer.

"All of above pins are analog pins, no one is digital. All signals obtained from these pins are given to the analogue inputs of controller. A program is written in Arduino and according to this program Arduino can take decisions. X axis value is analyzed with the help of Arduino UNO.[44]

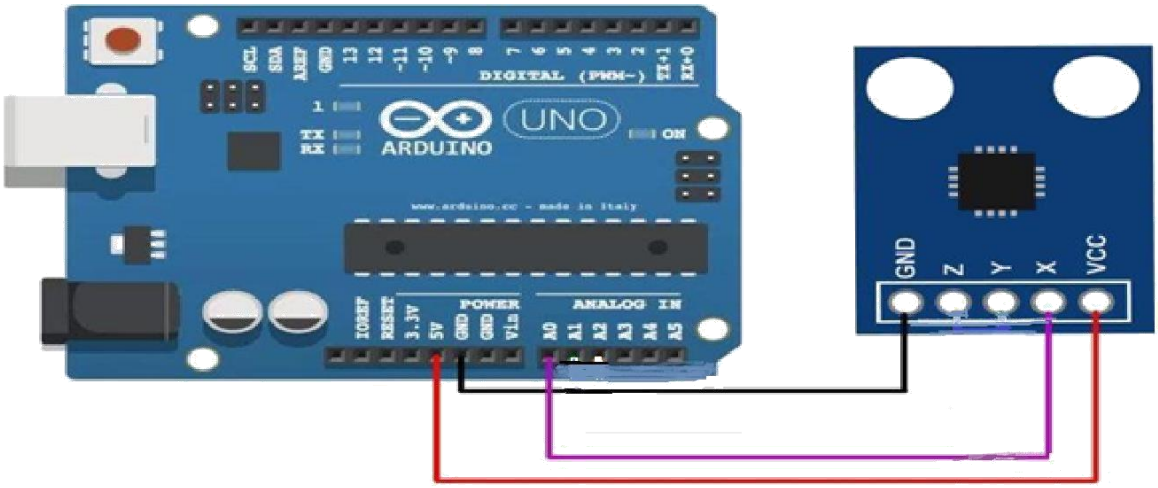

Figure 4.7: Arduino Interface With Accelerometer

4.3 Gesture Interpretation and Appliance control (receiver side):

In this mode a client can control the home machines to manage the significant piece of the task. HC 11 will receive the data from air transmitted by its transmitter side and the output of the sensor is recorded to the Arduino and this value is coordinated with the programming in the Arduino. The Arduino check the value of particular character weather it is A, B, C or D and will turn on the required appliance according to the stored program and the output of it is sent to relay module which will turn on the appropriate appliance.

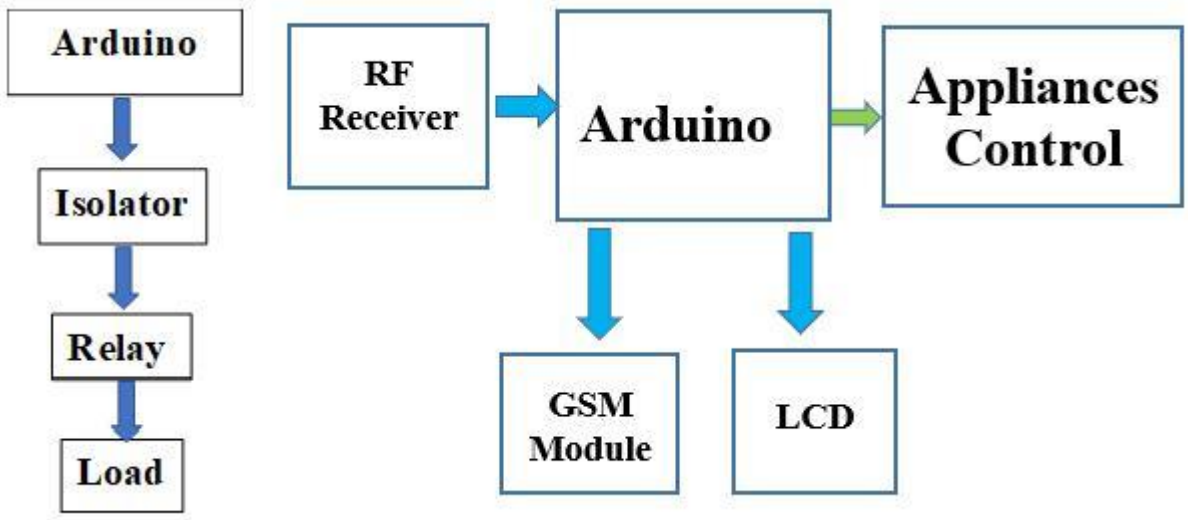

Figure4.8: Gesture Interpretation and Appliance Controlling Block Diagram

On the other hand, data from the Arduino will send to the GSM module and a message from this will send to the appropriate mobile number if the hand is in lifted position. And if the hand is in relax position a text will display on the LCD joined to the Arduino that load 1 is on. If any double character will be received by RF receiver then it will turn off the specific load. On changing the

orientation messages will send to the mobile number through GSM module. When first message will be sent on the mobile number a message of "1 message sent" will display on the LCD and it will repeat till the 5th message will be sent and it will the last message that will sent and display on the LCD.

4.3.1: Gesture Interpretation circuit description:

RF receiver has four pins one is grounded and other has 5v supply. Its transmitter pin is connected with serial data receiving pin 0 on Arduino board and it will send serial data to the Arduino and on sending data one time from it appliance will turn on next time it will turn off the appliance.it will turn on Arduino will interpret the whole data which RF receiver has received. LCD has pin 1 and 3 is grounded at pin 2 there are 5 volts. Pin 3 is also at ground and it is used to improve the contrast of writing on LCD. Pin 4 is reset pin and Arduino will send signal to remove the displayed data and 6th pin is of enable and it will get the signal from Arduino and will be enable before the message display. Pins 11,12,13,14 are data pins and will get data in the form of binary from Arduino. GSM module will get 5 different signals from Arduino and will send 5 different messages to the appropriate number.

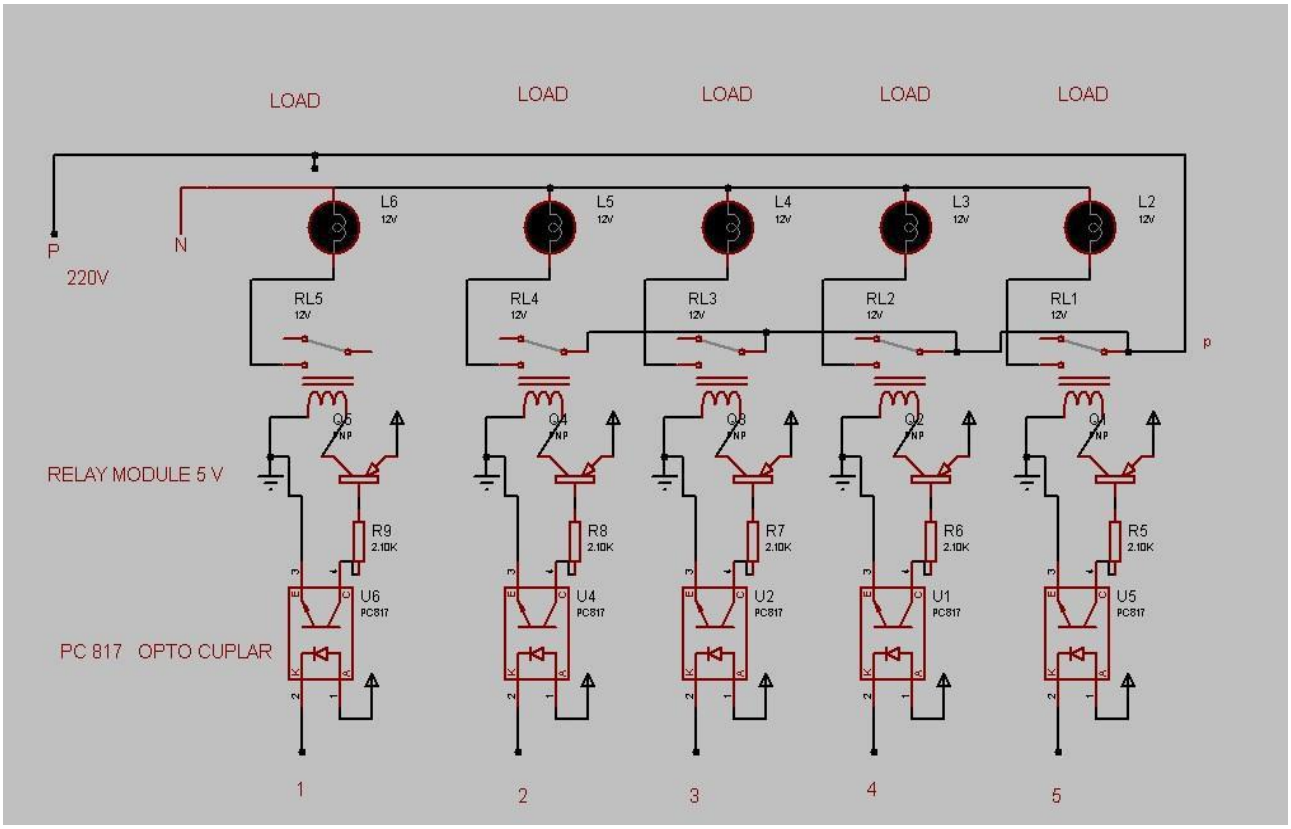

Figure 4.10: Appliance Control circuits schematics

4.3.2: Appliance Control circuits explanation:

Here is the circuit optocoupler PC 817 will provide electrical isolation and used to keep the LED on. And when PNP transistors will get 5 volts it will operate the relay and complete the circuit and ground path will complete and from power supply 220 volts will be provided and on of the all appliances will turn on. From 5 circuits only 1 will be turn on which will get the signal from Arduino.

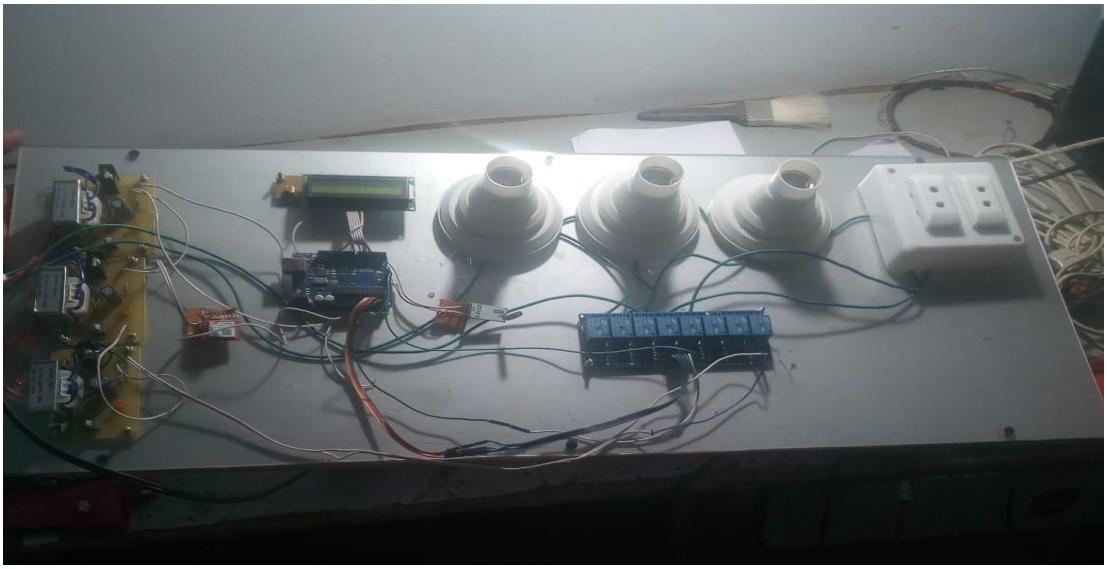

Figure 4.11: Appliance control Hardware. (Receiver side)

4.3.3: Power Supply Circuit working principle:

From main power supply 220 volts is provided and need to be convert into 5v so voltage regulator is used here. At the output of stepdown transformer 12 volts obtained from 220volts and here rectification is done with the help of bridge rectifier. In bridge rectifier 4007 diode is used having 2 Amp. In parallel to this is 1000 uF capacitor is attached to get smooth output. We can use more than 1000 uf capacitor but cannot use less than this value because this will cause ripples in the output and we will get the pulsating dc not the smooth one. Parallel to this is LED is used which is the indication of this that circuit is working properly. After that voltage regulation is done with the help of voltage regulator 7805.Regulator IC 7805 has three pins one is grounded other is at 12 v and also connected with switch and the 3rd and the last one is at 5v. Hence 5v at output is obtained which will then provide to the Arduino. We can use 6 to 12 volts at input of regulator but its output will always be 5 volts.

Here in this complete circuit three separate power supplies are used, one for relay module and the other for Arduino and one for GSM module the reason behind it is that GSM module will operate

on high voltages so separate power supply is used. Relays coil produce back emf as it has magnetic field and can cause distortion and noise and to protect Arduino from relays magnetic field separate supply is used.

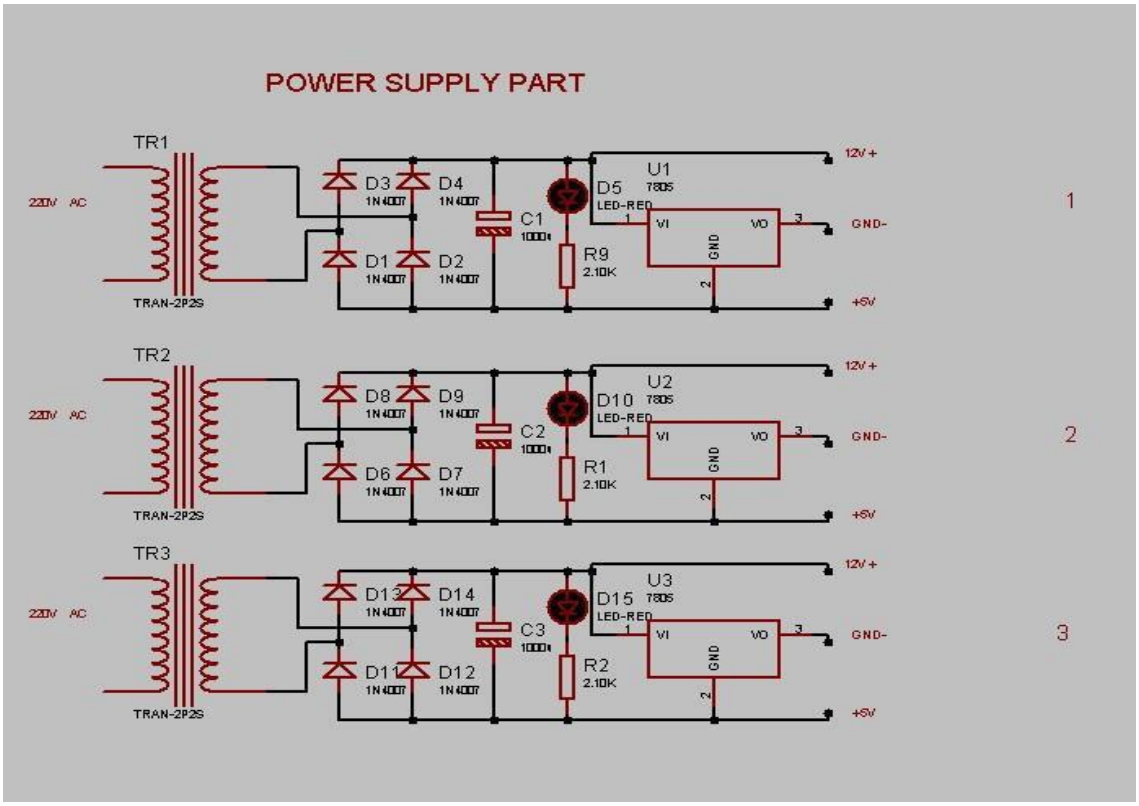

Figure 4.12: Power Supply Schematic

4.3.4 Working Principal of Relay

In first circuit when power flows electromagnets will activate that electromagnets is (that is brown in color)will generate a magnetic field (blue) and attracts a contact (red) that will activates the second circuit (2).On switching off the power, a spring will pulls the contact back to its original position, and again switching the second circuit off.

Description Through Diagram

In first circuit when power flows electromagnets will activate that electromagnets are (that is brown in color) will generate a magnetic field (blue) and attracts a contact (red) that will activate the second circuit (2). On switching off the power, a spring will pull the contact back to its original position, and again switching the second circuit off.

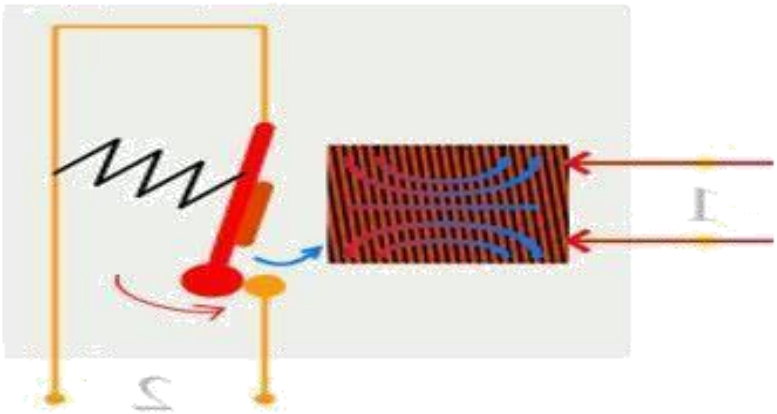

Figure 4.13: Relay Operation Normally Open

On passing electric current through the coil magnetic field is generated and movable contacts and makes or breaks (depending upon how it was constructed) connection with non-movable contact. At start (when relay was deenergized) If the contacts was closed, then movement opens the contacts and connection will break, and if the contacts were open then movement will close the connection. When coil has no current, the connections will come to its relaxed position. Most relays are operated quickly. They reduce the noise in a low-voltage application.

This is a "normally open" (NO) relay in second circuit the contacts are not connected by default, and when current flows through switch will on. In normally close relays current flows through

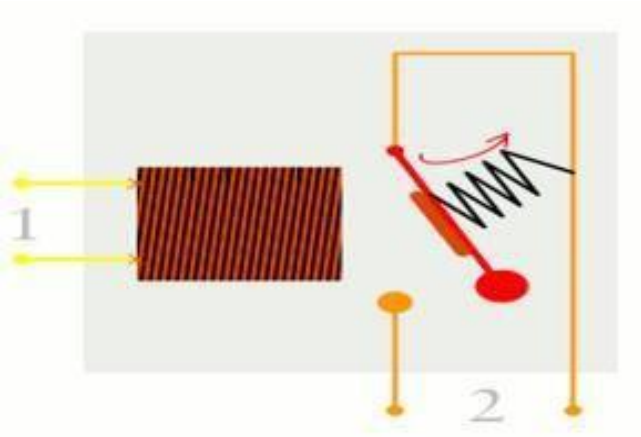

Figure 4.14: Relay Operation Normally Close Circuit

them by default when magnet is activated it will be switched off most common are normally open.

There is an input circuit on left side provide power by a switch.

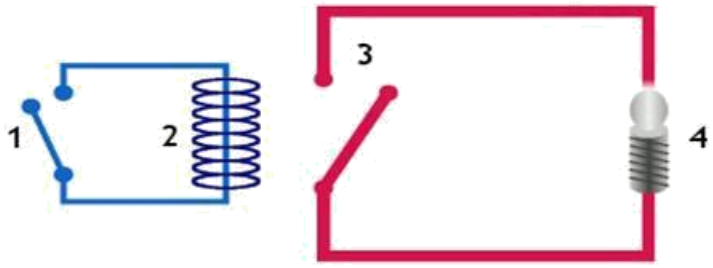

Figure 4.15: Relay Open circuit

When circuit is activated, it feeds current to electromagnet that close the metal switch and activates the output circuit (on right side). The small current in the input circuit activates the larger current in output circuit. The input circuit (blue loop) is not on and no current flows until something turns it on by closing a switch or sensor and output circuit (red loop) is also switched off.

On flowing a small current in input circuit and produces a magnetic field by activating electromagnetic.

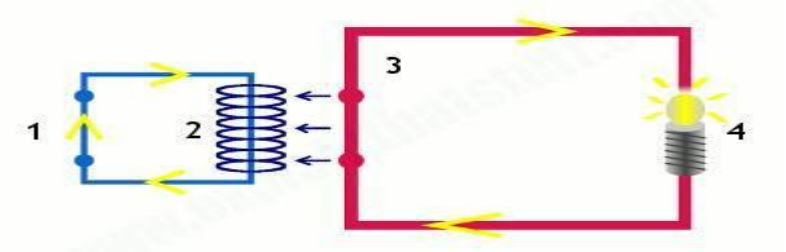

Figure 4.16: Relay Close Circuit

The electromagnet will pull the metal bar by closing the switch and will flow much bigger current in the output circuit. The output circuit will operate a high-current appliance i.e. lamp or electric motor. [25]

4.3.5 Working Principle of Arduino

The Arduino board is connected using USB to a computer where it connects with the (IDE) Arduino development environment. The user then writes the code in the IDE, then uploads it to the microcontroller which later executes the code, interacting with inputs and outputs such as sensors, motors, lights and switches etc. [58]

4.3.6 Arduino Interface with LCD

When Logic HIGH at RS pin data register will select and logic LOW at RS pin will selects command register. If RS pin HIGH and feed an input to the data lines (DB0 to DB7), this input will be treated as data to display on LCD screen. If RS pin LOW and feed an input to the data lines, then this will be treated as a command (a command to be written to LCD controller i.e. positioning cursor or clear screen or scroll). Pin5 (R/W) is used Read/Write modes.

This pin is used for selection of read and writes modes. At this pin Logic HIGH activates read mode and logic LOW at this pin activates write mode. Pin6 (E) is pin meant for enabling the LCD module. A HIGH to LOW signal at this pin will enable the module. Pin7 (DB0) to Pin14 (DB7) are data pins. The commands and data are fed to the LCD module though these pins. Pin15 (LED) is Anode of the back-light LED. When operated on 5V resistor of 560-ohm resistor should be connected in series to this pin. Back light LED can be powered from the 3.3V source on the Arduino board. Pin16 (LED-)is Cathode of the back-light LED. In this project, the LCD module and Arduino are interfaced in the 4-bit mode**.** This means only four of the digital input lines (DB4 to DB7) Â of the LCD are used.[59]. To wire your LCD screen to board, connect the following pins:

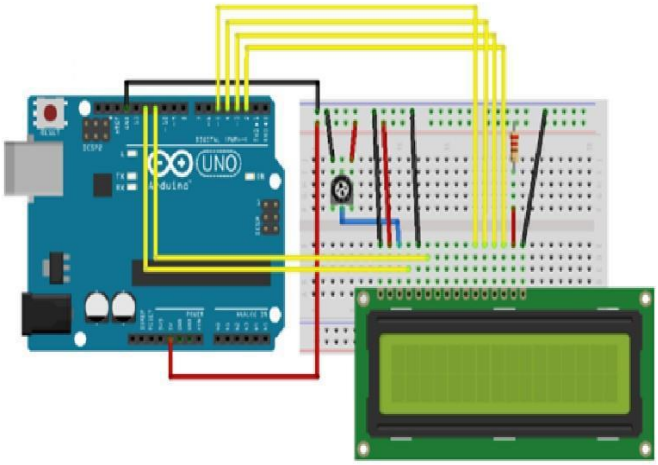

Figure 4.17: Arduino Interface LCD

Also wire a 10k pot to +5V and GND, with its wiper (output) to LCD screens VO pin (pin3). To power the backlight of the display a 220-ohm resistor is used usually on pin 15 and 16 of the LCD connector. [60]

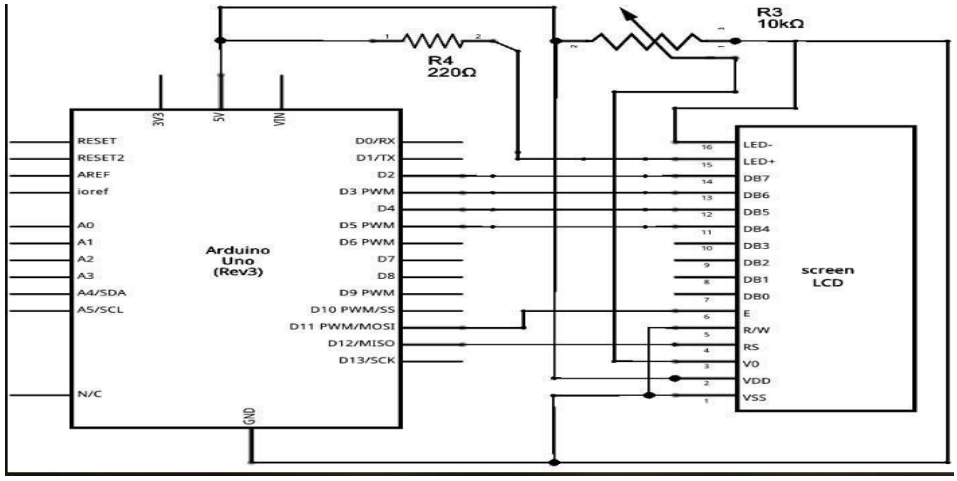

Figure 4.18: Arduino Interface LCD Schematics

4.3.7 Working Principal of HC11:

When the device on the left of the below figure sends serial port data to module, and the RXD port of the left module receives the serial port data, it will automatically send the data in the air by means of radio wave. The right module can automatically receive the data, and restore, from TXD, the serial port data originally sent by the left device. It is the same from right to left.[54].

4.3.8 Arduino interface with GSM Module:

GSM module has 12 pins. First pin is NET which is used to attach antenna. It is used here to attach antenna. Second pin is VCC This can be any value from 3.4 volt to 4.4 volts but more than it is can destroy it. It even cannot work at 3.3 and similarly 5 volts could destroy it. Here separate power supply is attached because GSM module may require surge of 2 A current during its

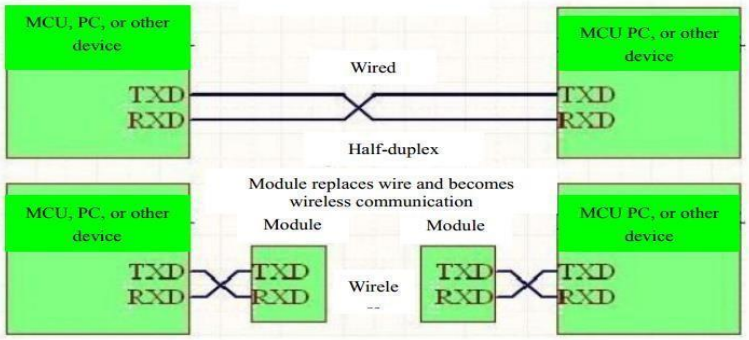

Figure 4.19: Left to Right Serial Data Transfer

function. Third pin is RST which is receiver pin and used to receive data. It is attached with the 10 number (Analogue) pin of Arduino. Pin TXD used for data transmission and it is 5 number pin .6 number pin is ground and it is attached ground of voltage regulator. SPK-and SPK+ used to join Speakers (can be attached with amplifier circuit if essential) through which User can hear sound easily. In this project no speaker is attached so we don't use these pins. MIC+ and MIC used to associate Microphone (abbr. as Mic) through which client can give sound information while calling. DTR pin is used to activate and deactivate sleep mode. When it is high sleep mode activates. RING pin is used as ring indicator. It is by default high. When SMS is received it can also be configured but we don't use this pin in our project. [55]

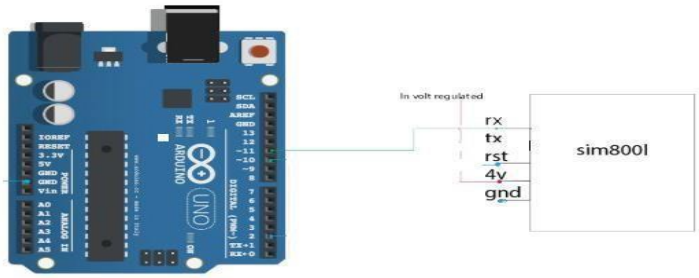

Figure 4.20: Arduino interface with SIM800L

CHAPTER 5

PROJECT IMPLEMENTATION

5.1 Introduction

In this chapter hardware installation of the project is discussed. In first step selection of appropriate tool is done. Component selection is very important and crucial. The project contains two elements.

i) Hardware

ii) Software

In this project two software are used. One is proteus and the other is Arduino IDE.

5.2 Software

5.2.1 Proteus

Proteus is used for PCB designs. It is simulation software. Proteus is useful tool to check weather our embedded design is working properly or not. It also used to check the programs. In proteus software we can simulate our programming. After the simulation is done for electrical circuit in proteus then PCB design is made. After simulation of electrical circuit proteus display both input and output devices. This software also helps to identify which component's value is suitable for particular circuit. It helps to form the electronic designs and it has built in library which contains the wide range of electrical components and it covers almost the whole electrical engineering. Image of workspace window of proteus is given. [59]

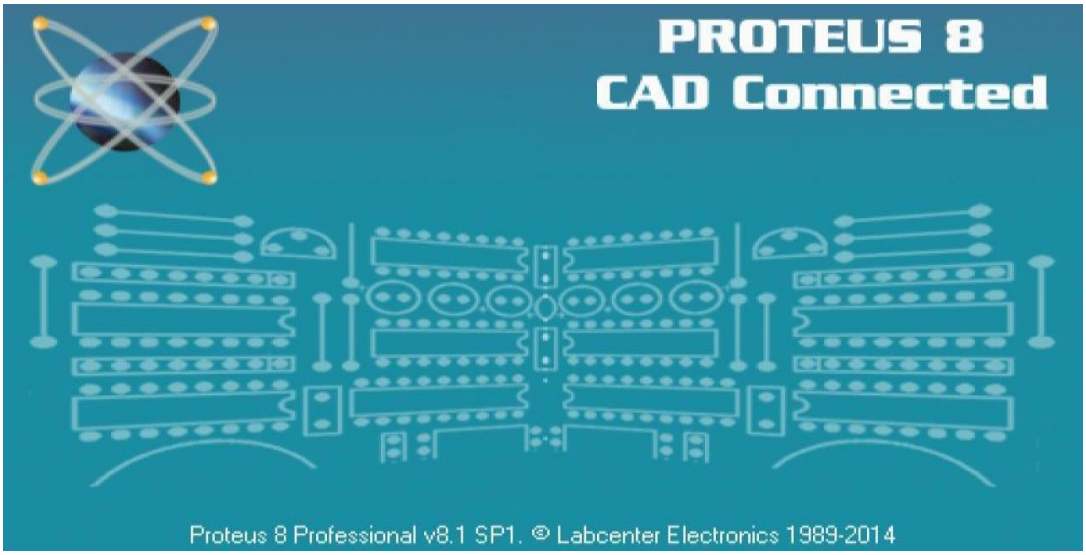

Figure 5.1: Proteus Design Suit[59]

The aspects to the software design of this project. For Arduino programming Arduino programming.

5.2.2 Arduino Software

The coding of this whole project on transmitter and receiver side, has been done in the environment of Arduino UNO.

The program which microcontroller performs write in Arduino software. These programs named as sketch in the end the sketches are transferred to the microcontroller using USB cable. This program can be written any programming. The newer Atmel studio, and AVR Studio are development environment.The Arduino provides the Arduino integrated development environment (IDE) which is nothing but a cross-platform application written in the java which is programming language. It originated from the IDE (integrated development environment) for writing and the languages processing. It also has a code editor with features such as text pasting and cutting, txt searching and replacing, syntax highlighting, automatic indenting, brace matching and to compile and upload programs to an Arduino board provides simple one-click mechanisms. It also contains a text console, message area, a toolbar with buttons for performing common functions and a hierarchy of operation menus. The Arduino IDE also supports C and C++ languages using special rules of code structuring. [62]

Figure 5.2: Arduino 1.6.6 Software[62]

5.3 Hardware

Various hardware tools were required to turn the design into reality. The main components of hardware consist of Arduino UNO, relay module (consist of 8 relays), Accelerometer, RF sensor,

Optical sensors, GSM module and transformer. Complete hardware of the circuit can see in the following figure

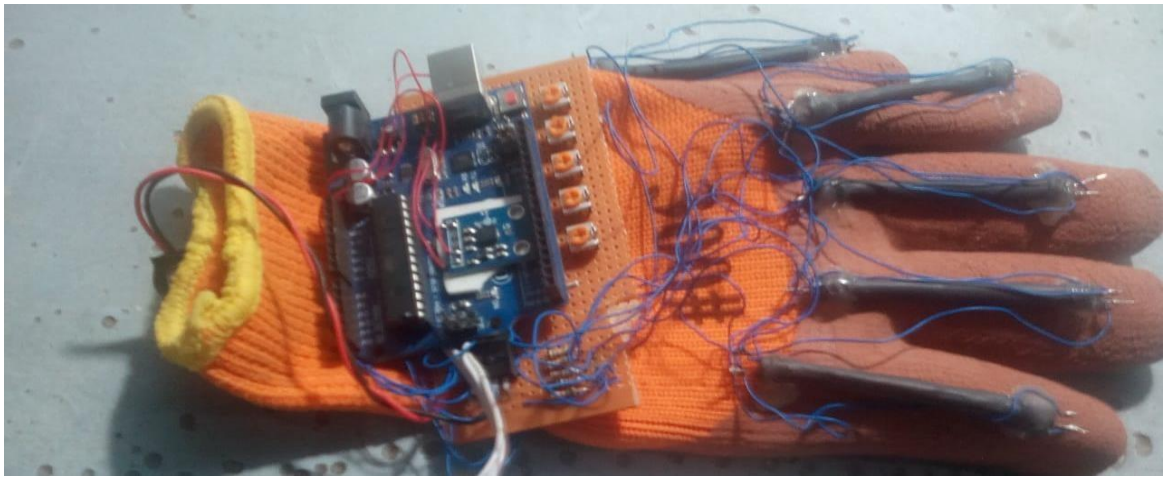

Figure 5.3: Glove Side or transmitter Side

On glove side finger of bending is identified with the help of optical sensors and given to the microcontroller. Microcontroller generates characters according to the position of hand and transmit these characters through RF transmitter. On the receiver side RF receiver receive these characters and give to the Arduino which according to the character either turn on appliance or send text. After each action LCD show a indication message. Characters can be numbers or alphabets. Numbers send in uplifted position of hand and use to send text while alphabets send in down lifted position of hand and use to control the appliance. Alphabet A is used to control the first load and up to E five loads could be controlled. Similarly, numbers from 1 to 5 use to send five different messages of needs. i. e food, water, medicine etc.

Figure 5.4: Receiver Side.

CHAPTER NO 6

RESULTS, CONCLUSION AND FUTURE RECOMENDATIONS

6.1 Results

The result obtained shows that the different types of appliances i.e. AC, bulb, fan with the help of hands gesture. With the help of optical sensors bending is detected by changing light fall on it and this analogue output is provided to Arduino and this whole data is transmitted to the receiver side with the help of transmitter.

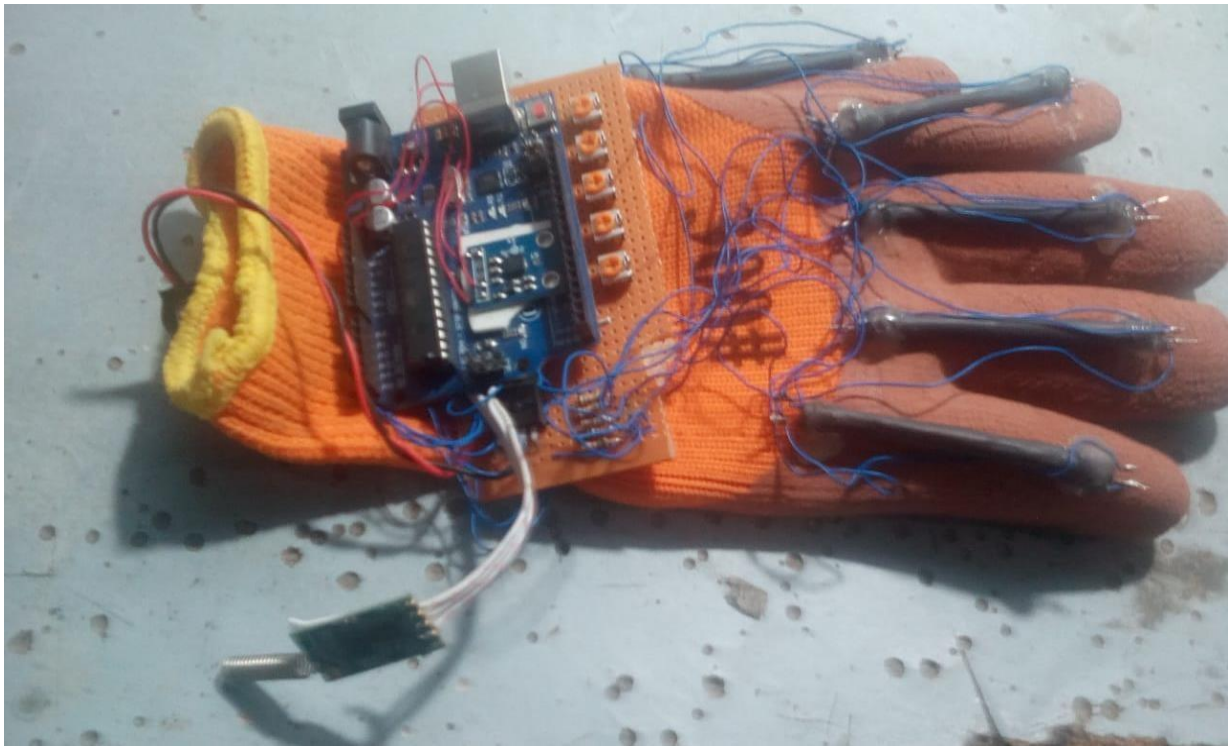

Figure 6.1: Transmitter Side

On the receiver side this data is received by receiver which gives it to the Arduino which reads the message and take a decision to turn on the required appliances i.e. (AC, fan etc.) with the help of relay. It can also send message on mobile and also displays notification on LCD too. The whole process can be done in efficient and automatic way with the help of microcontroller on Arduino board.

Figure 6.2: Receiver side

6.2: Conclusion

An existing object on “Smart Glove” was designed such that the appliances can be operated automatically using Arduino for gesture recognition depending on bending of fingers which was detected using optical sensors in form of resistance change. The data after conversion and transmission went to the receiver for turn on the appliance. Gesture recognition and appliance control mechanism is control by Micro controller on Arduino. The whole system is synchronized automatic and the Microcontroller is controlling device system placed on Arduino board. Accelerometer used to determine the position of hand.

6.3 Future Suggestions

6.3.1 Use of Bluetooth device

This thesis provides a basic framework for a gesture set capable of whole-home automation, however doesn't explore extending this gesture set on the far side a minimalist structure. The system is capable of making a gesture set expanding to at least the American Sign Language (ASL) alphabet, with similar solutions modeling 203 words of sign language. [61]. Bluetooth device such as HC05 and HC06 can be used. It can make the system cost effective but Bluetooth has a short range.

6.3.2 Use of Speaker

Speaker can be used to play the output and can make this system more effective. It will be very helpful for not only the paralyze people but also those who can’t speak.[62]

6.3.3 Use of Arduino Pro mini:

It can be used in glove to replace the Arduino due to its small size so that glove can be handled easily. [63]

6.3.4 Use of Facial expressions:

This project doesn't discuss facial expression concept although facial expressions can convey important part of sign-languages and can use in American sign language.

6.3.5 Use in Hand-Assisted Laparoscopic Surgery

With some modifications i.e. use of a textile-based sensing glove, this glove can be used in hand assisted laparoscopic surgery for movement recognition. To guide a collaborative robot such a glove can be used to recognize the commands given by the surgeon's hand inside the patient abdomen. This glove has piezoresistive sensors to capture flexion degree of surgeon's hand. An algorithm is used to analyze the data. In this way a robot is controlled. [64]

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Appendix A: ATmega328p Datasheet

Feature:

- Program Memory Type: Flash
- Program Memory (KB): 32
- CPU Speed (MIPS): 20
- RAM Bytes: 2,048
- Data EEPROM (bytes): 1024
- Digital Communication Peripherals: 1-UART, 2-SPI, 1-I2C
- Capture/Compare/PWM Peripherals: 1 Input Capture, 1 CCP, 6PWM
- Timers: 2 x 8-bit, 1 x 16-bit
- Comparators: 1
- Temperature Range (C): -40 to 85
- Operating Voltage Range (V): 1.8 to 5.5
- Pin Count: 32
- Low Power: Yes
- Cap Touch Channels: 16

Appendix B: Pin Configuration of Microcontroller

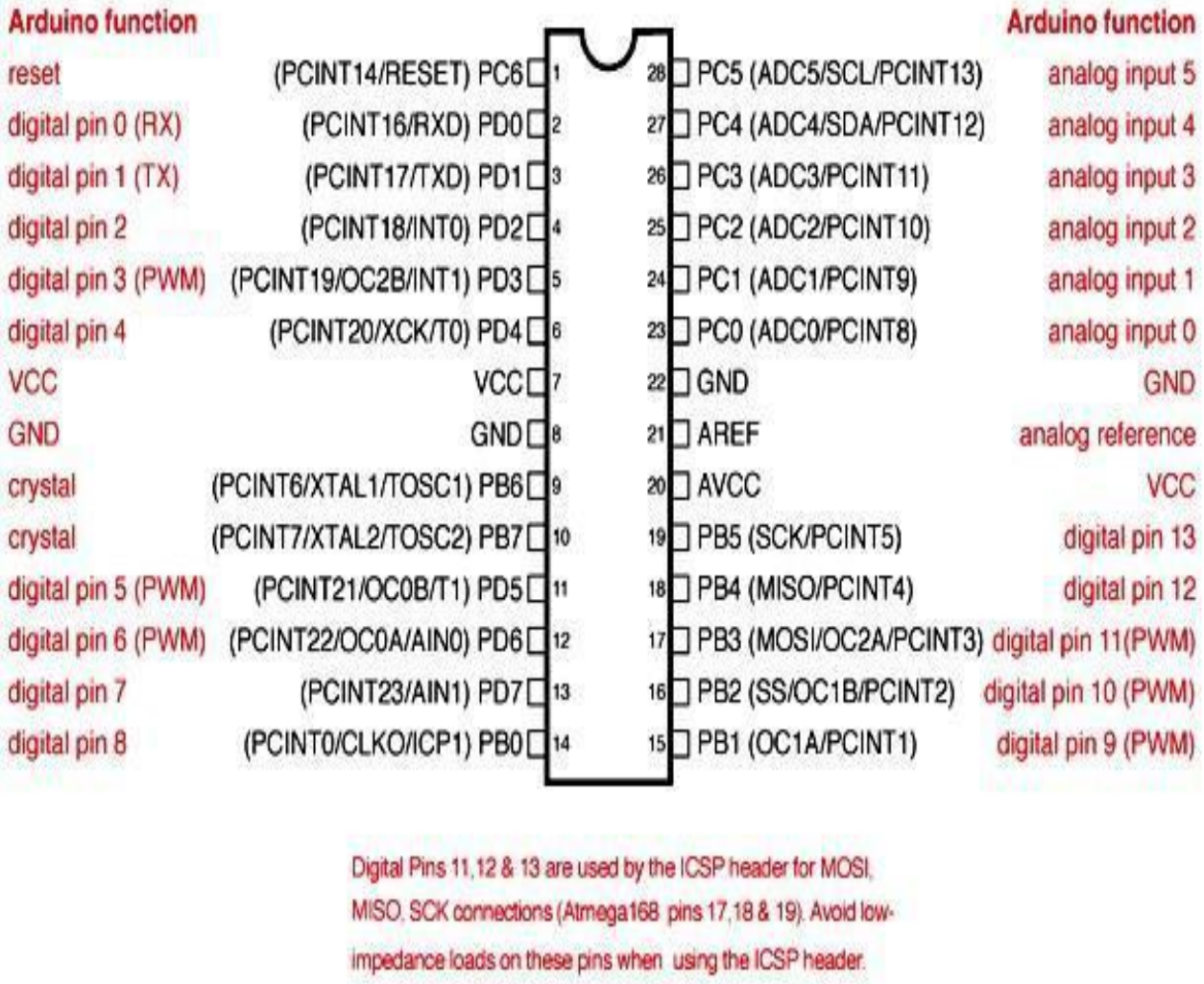


Figure Appendix C: Pin Configuration Microcontroller

Appendix C: 16*2 LCD Datasheet

- Ground (0V): Ground
- Supply voltage; 5V (4.7V – 5.3V): VCC
- Contrast adjustment; through a variable resistor: VEE
- Selects command register when low; and data register when high: Select Register
- Low to write to the register; High to read from the register: Read/Write
- Sends data to data pins when a high to low pulse is given: Enable
- 8-bit data pins: DB0, DB1, DB2, DB3, DB4, DB5, DB6, DB7
- Backlight V_{CC} (5V): LED+
- Backlight Ground (0V): LED-

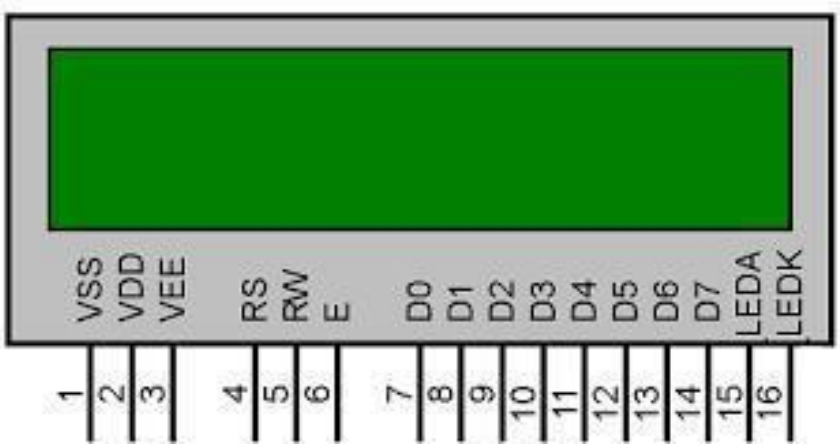
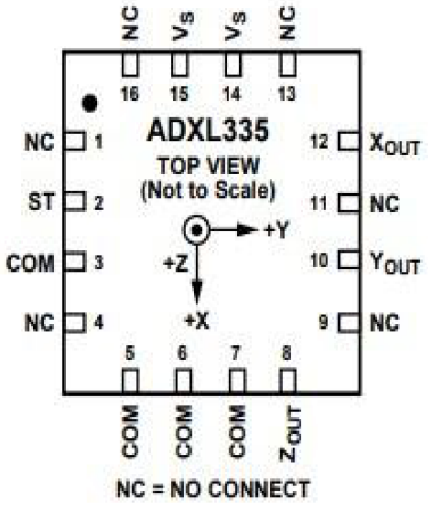


Figure Appendix D: LCD

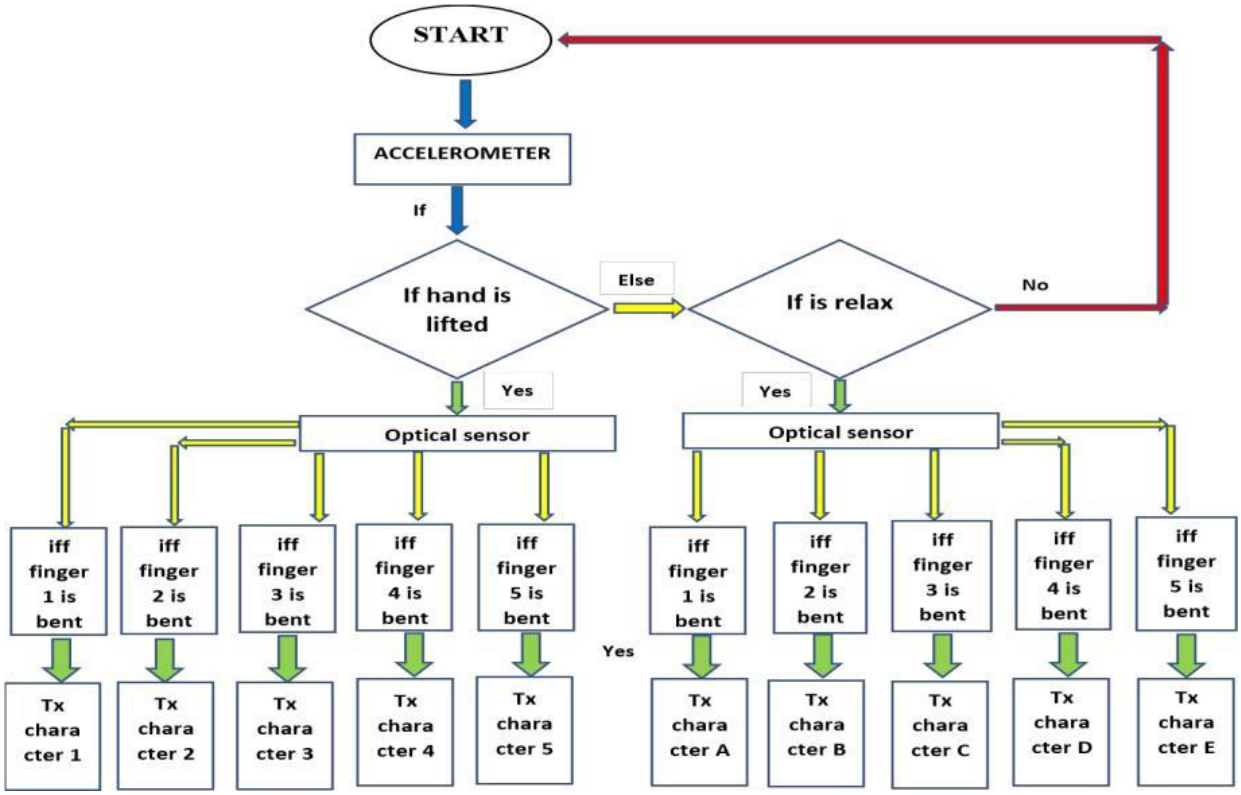
Appendix D: Pin Description of ADXL 335



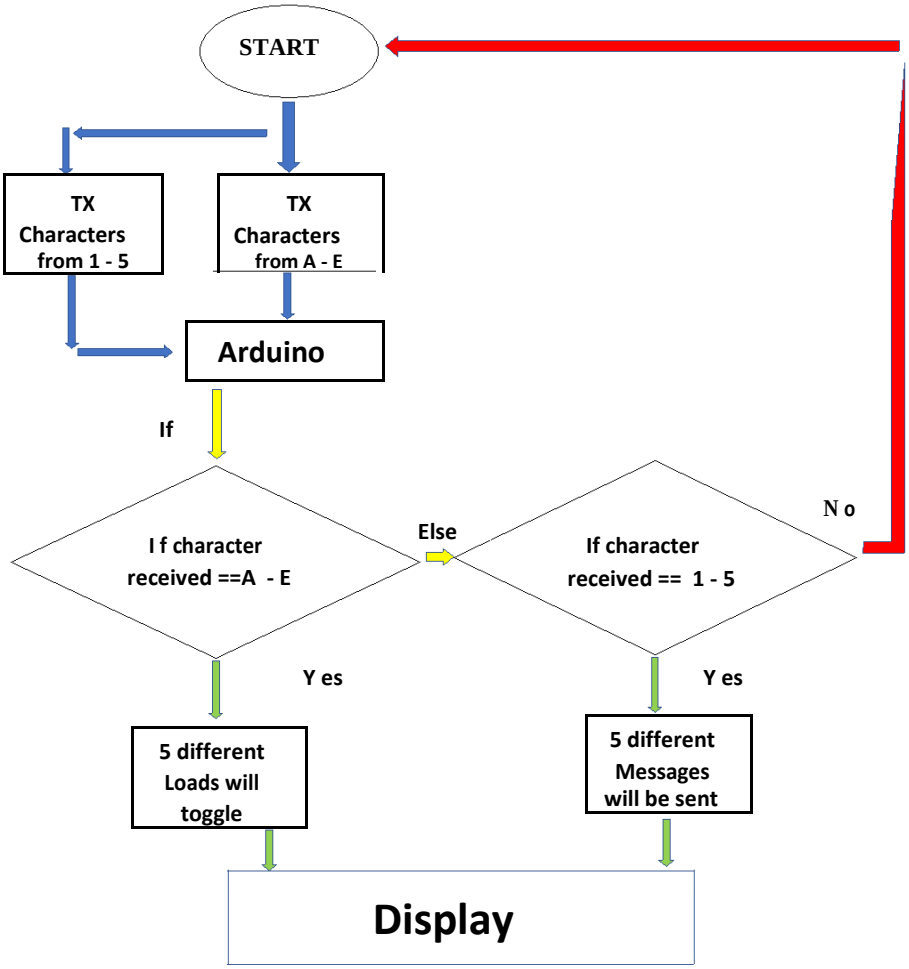
Pin No.	Mnemonic	Description
1	NC	No Connect.[1]
2	ST	Self-Test.
3	COM	Common.
4	NC	No Connect.[1]
5	COM	Common.
6	COM	Common.
7	COM	Common.
8	Z_{OUT}	Z Channel Output.
9	NC	No Connect.[1]
10	Y_{OUT}	Y Channel Output.
11	NC	No Connect. [1]
12	X_{OUT}	X Channel Output.
13	NC	No Connect. [1]
14	V_S	Supply Voltage (1.8 V to 3.6 V).
15	V_S	Supply Voltage (1.8 V to 3.6 V).
16	NC	No Connect. [1]
EP	Exposed Pad	Not internally connected. Solder for mechanical integrity.

Appendix E: Arduino code

GLOVE SIDE:



RECEIVER SIDE :



Appendix F : Arduino code

GLOVE SIDE:

```
#include<SoftwareSerial.h>
SoftwareSerial HC11(2,3);//2rx pir  3tx pin
#define Sensor1 A0
#define Sensor2 A1
#define Sensor3 A2
#define Sensor4 A3
#define Sensor5 A4

#define XPin A5
int Sensor1Value = 0;
int Sensor2Value = 0;
int Sensor3Value = 0;
int Sensor4Value = 0;
int Sensor5Value = 0;
//digitalWrite(4,1);
int XAxis = 0;

void setup() {

  digitalWrite(4,1);
  pinMode(Sensor1, INPUT);
  pinMode(Sensor2, INPUT);
  pinMode(Sensor3, INPUT);
  pinMode(Sensor4, INPUT);
  pinMode(Sensor5, INPUT);
  pinMode(XPin, INPUT);
  pinMode(7,OUTPUT);
  pinMode(8,OUTPUT);
  pinMode(4,OUTPUT);
  Serial.begin(9600);
  HC11.begin(9600);
}

void loop() {

  Sensor1Value = analogRead(Sensor1);
  Sensor2Value = analogRead(Sensor2);
  Sensor3Value = analogRead(Sensor3);
  Sensor4Value = analogRead(Sensor4);
  Sensor5Value = analogRead(Sensor5);
  XAxis = analogRead(XPin);


  Serial.print(" S1 = ");
  Serial.print(Sensor1Value);
  Serial.print(" S2 = ");
```

```
  Serial.print(Sensor2Value);
  Serial.print(" S3 = ");
  Serial.print(Sensor3Value);
  Serial.print(" S4 = ");
  Serial.print(Sensor4Value);
  Serial.print(" S5 = ");
  Serial.println(Sensor5Value);
  Serial.print(" XAxis = ");
  Serial.println(XAxis);
  delay(1);

  Check();
}
void Check() {
  if (XAxis >= 400) {
  digitalWrite(7,1);digitalWrite(8,0);
   Message();
  }

  if (XAxis < 280) {
  digitalWrite(7,0);digitalWrite(8,1);
   Control();
  }
  else{

  }
}

void Control () {
   if (Sensor1Value <= 100 && Sensor2Value >= 100 && Sensor3Value >= 100 && Sensor4Value >= 100
&& Sensor5Value >= 100) {
    HC11.println("A");
    digitalWrite(4,0);
    delay(2000);
    digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value <= 100 && Sensor3Value >= 100 && Sensor4Value >= 100
&& Sensor5Value >= 100 ) {
    HC11.println("B");
    digitalWrite(4,0);
    delay(2000);
    digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value >= 100 && Sensor3Value <= 100 && Sensor4Value >= 100
&& Sensor5Value >= 100 ) {
    HC11.println("C");
    digitalWrite(4,0);
    delay(2000);
    digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value >= 100 && Sensor3Value >= 100 && Sensor4Value <= 100
&& Sensor5Value >= 100 ) {
    HC11.println("D");
```

```
   digitalWrite(4,0);
   delay(2000);
   digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value >= 100 && Sensor3Value >= 100 && Sensor4Value >= 100
&& Sensor5Value <= 100 ) {
   HC11.println("E");
   digitalWrite(4,0);
   delay(2000);
   digitalWrite(4,1);
  }
  else{


}
}
void Message () {
 if (Sensor1Value <= 100 && Sensor2Value >= 100 && Sensor3Value >= 100 && Sensor4Value >= 100
&& Sensor5Value >= 100) {
   HC11.println("1");
   digitalWrite(4,0);
   delay(2000);
   digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value <= 100 && Sensor3Value >= 100 && Sensor4Value >= 100
&& Sensor5Value >= 100 ) {
   HC11.println("2");
   digitalWrite(4,0);
   delay(2000);
   digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value >= 100 && Sensor3Value <= 100 && Sensor4Value >= 100
&& Sensor5Value >= 100 ) {
   HC11.println("3");
   digitalWrite(4,0);
   delay(2000);
   digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value >= 100 && Sensor3Value >= 100 && Sensor4Value <= 100
&& Sensor5Value >= 100 ) {
   HC11.println("4");
   digitalWrite(4,0);
   delay(2000);
   digitalWrite(4,1);
  }
  if (Sensor1Value >= 100 && Sensor2Value >= 100 && Sensor3Value >= 100 && Sensor4Value >= 100
&& Sensor5Value <= 100 ) {
   HC11.println("5");
   digitalWrite(4,0);
   delay(2000);
   digitalWrite(4,1);
  }
  else{
```

```
}
}
```

RECEIVER SIDE:

```
#include <SoftwareSerial.h>
#include <LiquidCrystal.h>
SoftwareSerial Gsm(11, 10);

LiquidCrystal lcd(8, 7, 6, 5, 4, 3);
#define Load1 14
#define Load2 15
#define Load3 16
#define Load4 17
#define Load5 18

bool Active1 = false;
bool Active2 = false;
bool Active3 = false;
bool Active4 = false;
bool Active5 = false;

bool Start = false;

char data;

void setup() {

  pinMode(Load1, OUTPUT);
  pinMode(Load2, OUTPUT);
  pinMode(Load3, OUTPUT);
  pinMode(Load4, OUTPUT);
  pinMode(Load5, OUTPUT);

  digitalWrite(Load1, HIGH);
  digitalWrite(Load2, HIGH);
  digitalWrite(Load3, HIGH);
  digitalWrite(Load4, HIGH);
  digitalWrite(Load5, HIGH);

  Serial.begin(9600);
  Gsm.begin(9600);
  lcd.begin(16, 2);
  lcd.setCursor(0, 0);
  lcd.print("    Welcome    ");
  lcd.setCursor(0, 1);
  lcd.print("  Smart Glove  ");
  delay(200);
  Gsm.println("AT");    //To send SMS in Text Mode
```

```
 delay(200);
 Gsm.println("AT");    //To send SMS in Text Mode
 delay(200);
 Gsm.println("AT+IPR=9600");    //To send SMS in Text Mode
 delay(200);
 Gsm.println("AT"); //Once the handshake test is successful, it will back to OK
 delay(200);
 Gsm.println("AT+CSQ"); //Signal quality test, value range is 0-31 , 31 is the best
 delay(200);
 Gsm.println("AT+CCID"); //Read SIM information to confirm whether the SIM is plugged
 delay(200);
 Gsm.println("AT+CREG?"); //Check whether it has registered in the network
 delay(200);
 Gsm.println("AT+CMGF=1"); // Configuring TEXT mode
 delay(200);
 Gsm.println("AT+CNMI=2,2,0,0,0"); // Decides how newly arrived SMS messages should be handled
 delay(200);
 Gsm.println("AT+CMGF=1");    //To send SMS in Text Mode
 delay(1000);
 Gsm.println("AT+CMGS=\"+923135302984\""); // change to the phone number you using
 delay(1000);
 Gsm.println("Device Activated");//the content of the message
 delay(2000);
 Gsm.println((char)26);//the stopping character
 delay(2000);
 lcd.clear();
}
void loop() {
 if (Serial.available()) {
   data = Serial.read();
   Serial.println(data);



   switch (data) {
     case ('1'):
       Gsm.println("AT+CMGF=1");    //To send SMS in Text Mode
       delay(1000);
       Gsm.println("AT+CMGS=\"+923135302984\""); // change to the phone number you using
       delay(1000);
       Gsm.println("I Want To Eat Food");//the content of the message
       delay(2000);
       Gsm.println((char)26);//the stopping character
       delay(1000);
       lcd.setCursor(0, 1);
       lcd.print("Message 1 Send  ");
       delay(10);
       break;

     case ('2'):
       Gsm.println("AT+CMGF=1");    //To send SMS in Text Mode
       delay(1000);
```

```
  Gsm.println("AT+CMGS=\"+923135302984\""); // change to the phone number you using
  delay(1000);
  Gsm.println("I Want To Drink Water");//the content of the message
  delay(2000);
  Gsm.println((char)26);//the stopping character
  delay(1000);
  lcd.setCursor(0, 1);
  lcd.print("Message 2 Send");
  delay(10);
  break;

case ('3'):
  Gsm.println("AT+CMGF=1");    //To send SMS in Text Mode
  delay(1000);
  Gsm.println("AT+CMGS=\"+923135302984\""); // change to the phone number you using
  delay(1000);
  Gsm.println("I Need Help");//the content of the message
  delay(2000);
  Gsm.println((char)26);//the stopping character
  delay(1000);
  lcd.setCursor(0, 1);
  lcd.print("Message 3 Send");
  delay(10);
  break;

case ('4'):
  Gsm.println("AT+CMGF=1");    //To send SMS in Text Mode
  delay(1000);
  Gsm.println("AT+CMGS=\"+923135302984\""); // change to the phone number you using
  delay(1000);
  Gsm.println("I Want To Goto Washroom");//the content of the message
  delay(2000);
  Gsm.println((char)26);//the stopping character
  delay(1000);
  lcd.setCursor(0, 1);
  lcd.print("Message 4 Send");
  delay(10);
  break;

case ('5'):
  Gsm.println("AT+CMGF=1");    //To send SMS in Text Mode
  delay(1000);
  Gsm.println("AT+CMGS=\"+923135302984\""); // change to the phone number you using
  delay(1000);
  Gsm.println("I Want To Take My Medicine");//the content of the message
  delay(2000);
  Gsm.println((char)26);//the stopping character
  delay(1000);
  lcd.setCursor(0, 1);
  lcd.print("Message 5 Send");
  delay(10);
  break;
```

```
case ('A'):
  Start = true;

  if (Active1 == false && Start == true) {

    lcd.setCursor(0, 0);
    lcd.print("Load1 OFF      ");
    digitalWrite(Load1, HIGH);
    delay(1000);
    Active1 = true;
    Start = false;
  }
  if (Active1 == true && Start == true) {

    lcd.setCursor(0, 0);
    lcd.print("Load1 ON       ");
    digitalWrite(Load1, LOW);
    delay(1000);
    Active1 = false;
    Start = false;
  }
  else {

  }


  break;

case ('B'):
  Start = true;

  if (Active2 == false && Start == true) {

    lcd.setCursor(0, 0);
    lcd.print("Load2 OFF      ");
    digitalWrite(Load2, HIGH);
    delay(1000);
    Active2 = true;
    Start = false;
  }
  if (Active2 == true && Start == true) {

    lcd.setCursor(0, 0);
    lcd.print("Load2 ON       ");
    digitalWrite(Load2, LOW);
    delay(1000);
    Active2 = false;
    Start = false;
  }
  else {

  }
```

```
  break;

 case ('C'):
  Start = true;

  if (Active3 == false && Start == true) {

   lcd.setCursor(0, 0);
   lcd.print("Load3 OFF      ");
   digitalWrite(Load3, HIGH);
   delay(1000);
   Active3 = true;
   Start = false;
  }
  if (Active3 == true && Start == true) {

   lcd.setCursor(0, 0);
   lcd.print("Load3 ON       ");
   digitalWrite(Load3, LOW);
   delay(1000);
   Active3 = false;
   Start = false;
  }
  else {

  }


  break;

 case ('D'):
  Start = true;

  if (Active4 == false && Start == true) {

   lcd.setCursor(0, 0);
   lcd.print("Load4 OFF      ");
   digitalWrite(Load4, HIGH);
   delay(1000);
   Active4 = true;
   Start = false;
  }
  if (Active4 == true && Start == true) {

   lcd.setCursor(0, 0);
   lcd.print("Load4 ON       ");
   digitalWrite(Load4, LOW);
   delay(1000);
   Active4 = false;
   Start = false;
  }
  else {
```

```
      }


      break;


    case ('E'):
      Start = true;

      if (Active5 == false && Start == true) {

        lcd.setCursor(0, 0);
        lcd.print("Load5 OFF      ");
        digitalWrite(Load5, HIGH);
        delay(1000);
        Active5 = true;
        Start = false;
      }
      if (Active5 == true && Start == true) {

        lcd.setCursor(0, 0);
        lcd.print("Load5 ON       ");
        digitalWrite(Load5, LOW);
        delay(1000);
        Active5 = false;
        Start = false;
      }
      else {

      }


      break;
  }


 }
 else {

 }




}
```