A Project Report On

Speaking Gloves

Assistive aid for the Speech Impaired

Submitted in partial fulfillment of the requirements
of the degree of
Bachelor's of Engineering
Electronics and Telecommunication

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Project Report Approval for B. E.

This project report entitled **Speaking Gloves**-Assistive aid for the Speech Impaired by **Hariharr C Punjabi,Manali Mukkannavar, Satish Talreja, Nikhil Raghani** is approved for the degree of Bachelor in **Electronics and Telecommunication**.

Examiners

1...

2...

Date:

Place:

CERTIFICATE

This is to certify that **Hariharr C Punjabi, Manali Mukkannavar, Nikhil Raghani,Satish Talreja** have completed the project report on the topic " **Speaking Gloves**-Assistive aid for the Speech Impaired satisfactorily in partial fulfillment for the Bachelor's Degree in Electronics and Telecommunication under the guidance of **Prof.(Mrs.) Shoba Krishnan** during the year 2016-17 as prescribed by University of Mumbai.

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Examiner 1	Examiner 2

DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included,we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Acknowledgement

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Abstract

Assistive technology, is a term which includes rehabilitative and adaptive devices for people with disabilities and also includes the process used in locating and using them. It promotes independence by enabling differently abled people to perform tasks that they were formerly unable to accomplish, or had great difficulty in accomplishing, by providing various methods for interacting with the innovative technology needed to accomplish such tasks. It points to any piece of equipment, or product system, and is used to maintain, or improve functional capabilities of differently abled individuals.

It is very rare to see a speech impaired person communicating with the ones who speak. For communication to take place between them, it is essential that the other person should know sign language. If not it becomes difficult for the two to interact which creates a barrier and hampers the growth of a speech impaired person in a corporate world.In recent years, researchers have been focusing on hand gesture detections and been popular for developing applications in the field of robotics and extended in the area of artificial or prosthetic hands that can mimic the behaviour of a natural human hand. Thus, a system that transcribes symbols in sign languages into plain text can help with real-time communication .This project utilizes a similar approach for the detection of the movement of fingers, with a small yet significant application.This project will be useful for the speech impaired, it can also be used for those with half of their bodies paralysed and who are not able to speak but are able to move their fingers.

The aims and objectives of this research work include:

- To design a portable embedded system.
- Developing a simple solution for the detection of finger gestures.
- Reliable data acquiring method and signal conditioning
- Facilitate an easy communication through synthesized speech for the benefit of speech impaired individuals.

Contents

List of Tables

List of Figures

Nomenclature

TTL	transistor-transistor logic
LCD	Liquid Crystal Display
DTMF	Dual Tone - Multi Frequency
EEPROM	Electrically erasable programmable read-only memory
USB	Universal Serial Bus
IDE	Integrated Development Environment

Chapter 1

Introduction

The Speech impaired people communicate with each other using sign language. But common man fails to interpret what they want to convey thus creating a communication barrier and also thwarting their progress.This project focuses on designing a Glove for speech impaired people that will sense their hand movements and enable them to communicate with everyone thus bridging the barrier. [**?**]

1.1 Problem Statement

Communication is the exchange of information; it can be in any form verbal or non-verbal. A person with partial or complete speech imparity communicates through SIGN LANGUAGE (gesture and specific movements of hand). The problem arises when they try to communicate with a person who does not know this sign language and hence the communication often fails or is miss interpreted, hence creating a COMMUNICATION BARRIER

1.2 Approach Towards The Problem Statement

Main aim of this project is the judicial use of knowledge and TECHNOLOGY to bridge the communication barrier by building a portable and efficient device which will convert the GESTURE to more easily understood modes of Communication: AUDIO and VISUAL. This will be done by recording and processing the hand gestures to drive a SPEAKER and LCD display. Thereby assisting the impaired patient with a smooth and better way of communication.

1.3 Block Diagram

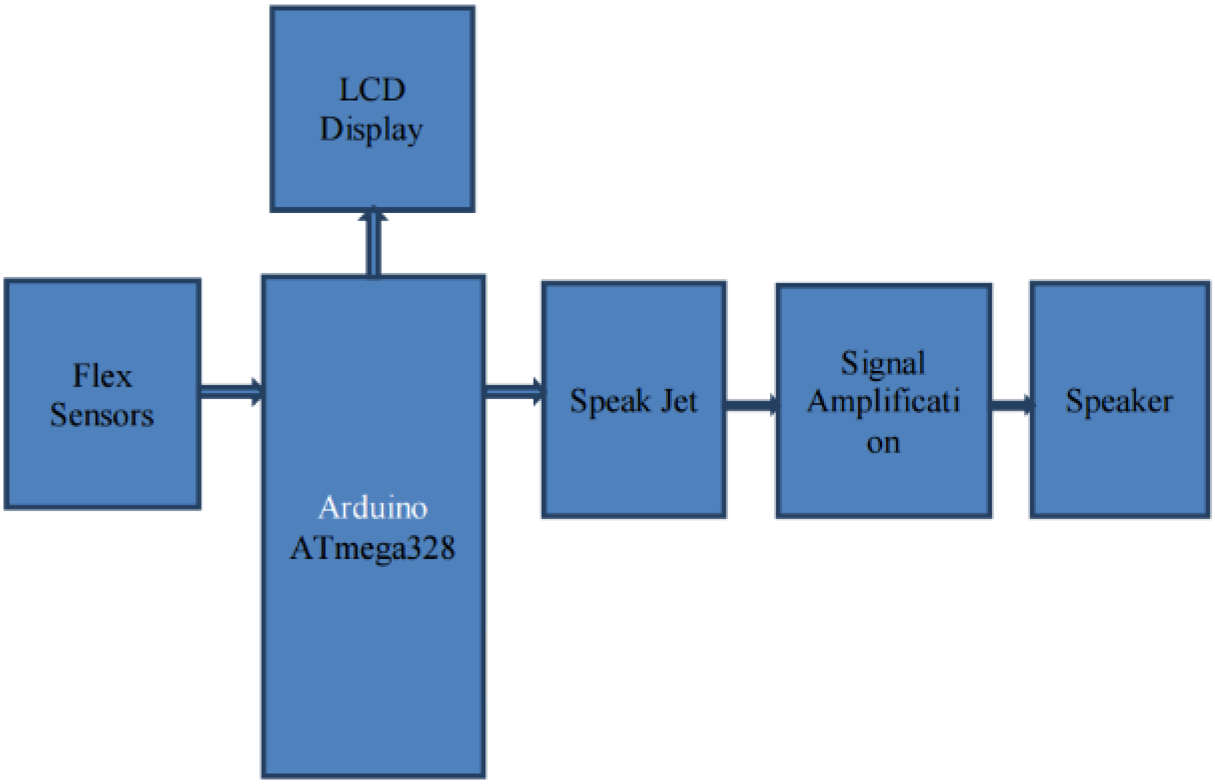

Figure 1.1: Block diagram

Chapter 2

Literature Survey

The first Hand Talk glove was designed by Ryan Patterson in the year 2001 [?].His Sign Language Translator consists of two separate components, a leather golf glove that has five flexible sensors sewn into it which monitors the position of the fingers by measuring the electrical resistance created by the fingers as they bend. A small microcontroller on the back of the hand converts the change in the electrical current into digital signals and transmits them wirelessly to a computer. The computer then reads the numerical values and converts them into the letters which appear on the screen. The main disadvantage with this model was that a computer or a laptop was always required for its functioning which made it less portable.

Anbarasi Rajamohan et. al [?] , proposed a work to communicate between a speech impaired person and a normal person using a glove and flex sensors and accelerometer will measure the orientation of hand and based on hand movement the angle of the axis varies, if it matches with program done in microcontroller a speech output is automatically generated corresponding to the hand movement.

Ruize Xu and his co authors [?],explained how to provide communication between speech impaired person and normal person based on recognition of hand gestures. The output signals from mems accelerometer are fed to microcontroller. An automatic hand gesture algorithm is developed to identify the individual gestures in sequence. The directions are also transmitted to PC via Bluetooth protocol and finally the gesture is recognized by comparing the gesture code with the stored templates and corresponding hand gestures are obtained.

Chapter 3

Hardware

- Flex Sensor
- Accelerometer
- Speakjet
- Arduino
- LCD
- LM386
- Speaker
- Connectors

3.1 Flex Sensor

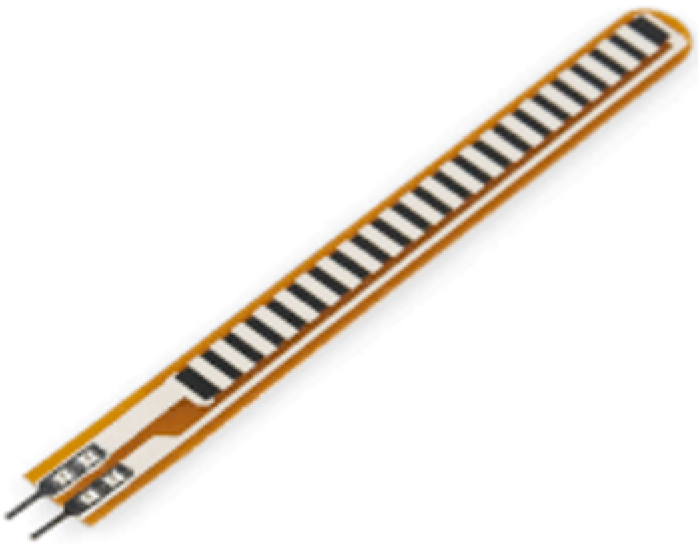

Figure 3.1: Flex Sensor

A flex sensor or bend sensor is a sensor that measures the amount of uni-directional deflection or bending. Usually the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface. The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radiusthe smaller the radius, the higher the resistance value. The straight resistance (0 degrees) is 35k-40k ohms and bent (90 degrees) resistance is 75k-80k ohms. Thus, using a flex sensor for each finger we can get the angle of bend of each finger by mapping a table of resistance vs. bend angle.

3.1.1 Electrical Specifications:

- Flat Resistance: 25K Ohms
- Resistance Tolerance: 30
- Bend Resistance Range: 45K to 125K Ohms (depending on bend radius)
- Power Rating : 0.50 Watts continuous. 1 Watt Peak

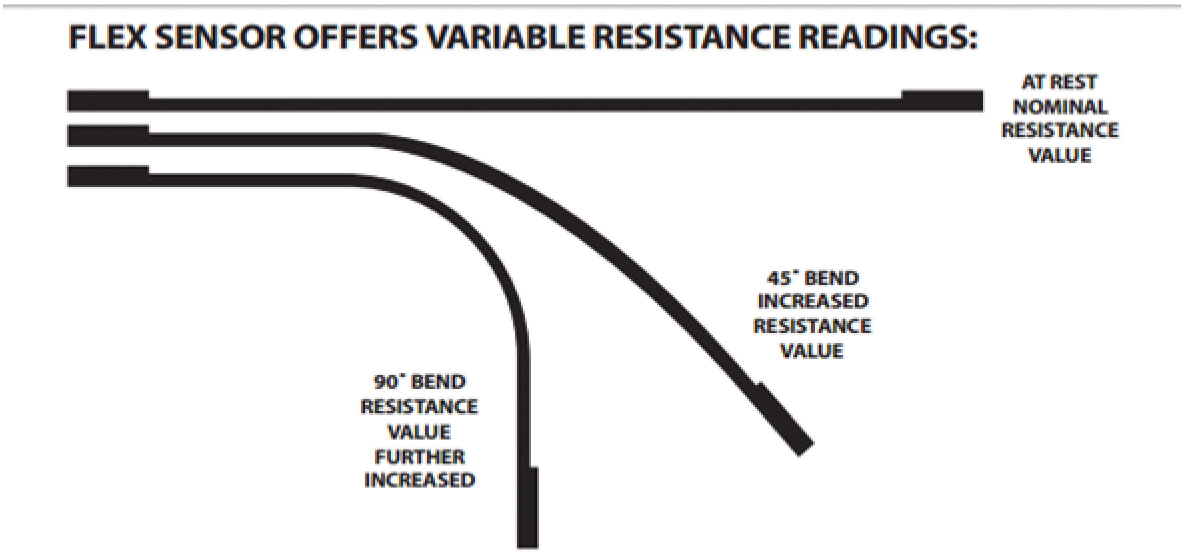

Figure 3.2: Variation of Flex resistance with bend

3.1.2 Mechanical Specifications:

- Life Cycle: Greater than 1 million
- Height: 0.43mm (0.017")
- Temperature Range: -35C to +80C

3.1.3 Features:

- Angle Displacement Measurement
- Bends and Flexes physically with motion device
- Simple Construction
- Low Profile

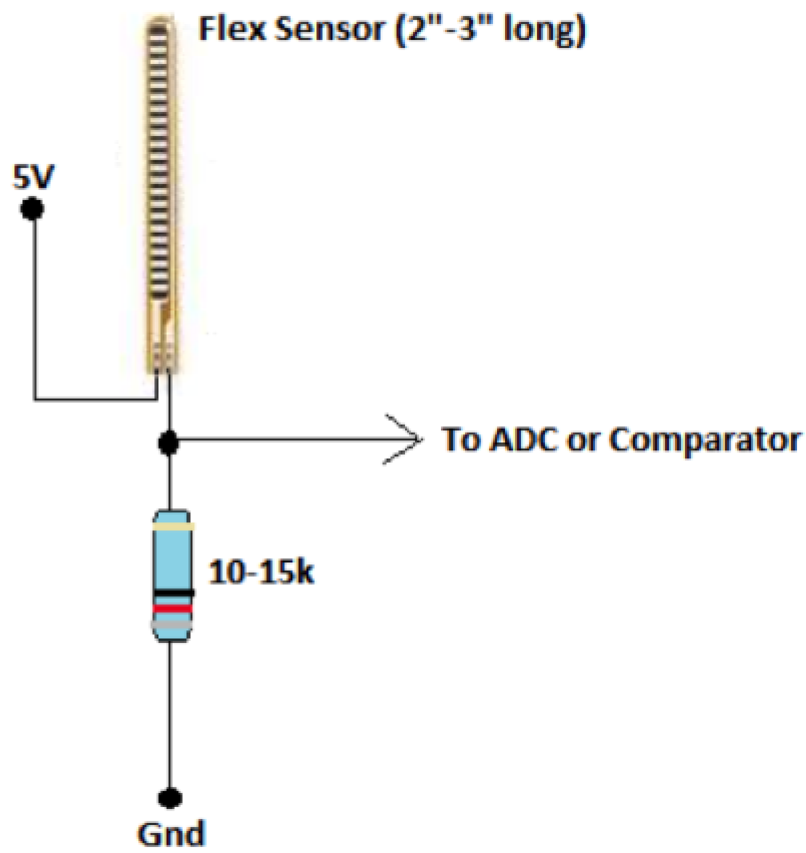

Figure 3.3: Voltage divider circuit for Flex sensor

3.2 Accelerometer:

3.2.1 Introduction:

Accelerometers are available that can measure acceleration in one, two, or three orthogonal axes. The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. The product measures acceleration with a minimum full-scale range of 3 g. It can measure the static acceleration of gravity in tiltsensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

The user selects the bandwidth of the accelerometer using the CX, CY, and CZ capacitors at the XOUT, YOUT, and ZOUT pins. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis.

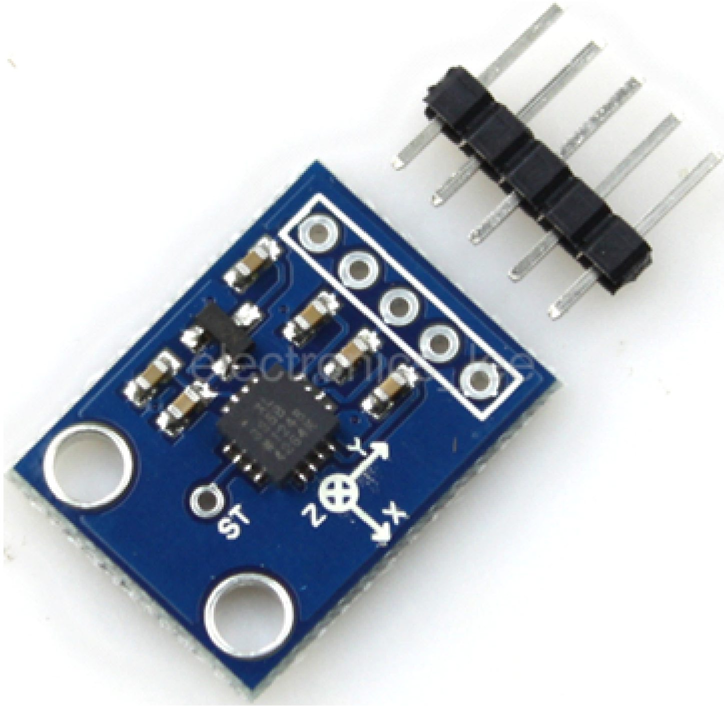

Figure 3.4: Accelerometer

The ADXL335 is available in a small, low profile, 4 mm 4 mm 1.45 mm, 16-lead, plastic lead frame chip scale package They are typically used in one of three modes:

- As an inertial measurement of velocity and position;
- As a sensor of inclination, tilt, or orientation in 2 or dimensions, as referenced from the acceleration of gravity (1 g = 9.8m/s2);
- As a vibration or impact (shock) sensor.Our 3-axis acclerometers detect orientation, shake, tap, double tap, fall, tilt, motion, positioning, shock or vibration. The use of accelerometer allows us to identify the plane in which the hand lies and thereby allowing us a better sensing capability of exact the hand position. We can have a wider array of symbols by having the same finger position but the hand being in a different plane at each instance of input.

3.2.2 Features:

- 3-axis sensing

- Small, low profile package
- Low power : 350 A (typical)
- Single-supply operation: 1.8 V to 3.6 V
- Excellent temperature stability
- BW adjustment with a single capacitor per axis

3.2.3 Applications:

- Cost sensitive, low power, motion- and tilt-sensing applications
- Mobile devices
- Gaming systems
- Disk drive protection
- Image stabilization
- Sports and health devices

3.3 Speakjet:

The SpeakJet is a completely self contained, single chip voice and complex sound synthesizer. It uses Mathematical Sound Architecture tm (MSA) technology which controls an internal five channel sound synthesizer to generate on-the-fly, unlimited vocabulary speech synthesis and complex sounds. The SpeakJet is preconfigured with 72 speech elements (allophones), 43 sound effects, and 12 DTMF Touch Tones. The SpeakJet can be controlled simultaneously by logic changes on any one of its eight Event Input lines, and/or by a Serial Data line from a CPU (such as the OOPic, Basic Stamp or PC) allowing for both CPUControlled and Stand-Alone operations. Other features include an internal 64 byte input buffer, Internal Programmable EEPROM, three programmable outputs, and direct user access to the internal five channel sound synthesizer.

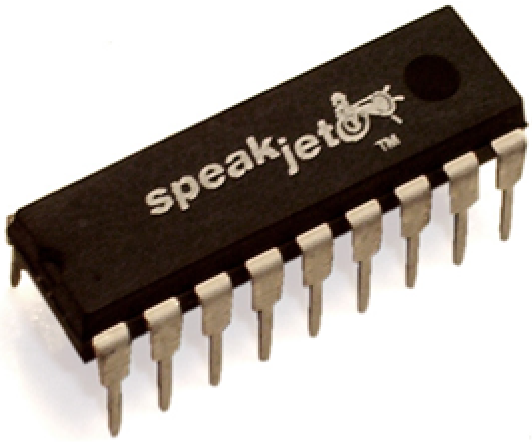

Figure 3.5: Speakjet

3.3.1 Features of Speakjet:

- Programmable, 5 channel synthesizer.
- Natural phonetic speech synthesis.
- DTMF and other sound effects.
- Programmable control of pitch, rate, bend and volume.
- Programmable power up or reset announcements.
- Internal 64 Byte input buffer.
- Internal programmable EEPROM.
- Extremely low power consumption.
- An internal clock oscillator provides for a truly Self Contained sound system. Simply connect the SpeakJet to a power supply and a speaker to hear it speak. *
- An internal user programmable EEPROM allows for programming of up to 16 complex phrases or sound sequences. These may be played back once or looped many times in response to events.
- No special equipment is required to program the internal EEPROM, only a serial connection is required.

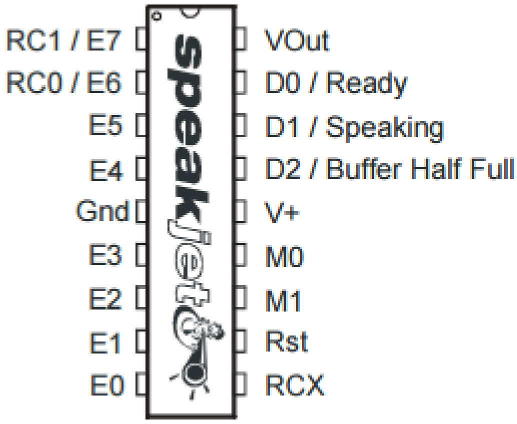

Figure 3.6: Pin configuration for Speakjet

3.3.2 Interface Options:

- CPU Control: Single Wire Serial Input from microprocessors such as the OOPic, Basic Stamp, or any other computer system equipped with a serial port.
- Stand Alone: Eight Event Inputs for execution of up to sixteen phrases, sound effects or control functions with or without a microcontroller.
- RC Input: Two Servo Pulse Inputs for execution of up to four phrases, sound effects or control functions via wireless model Airplane or Car Radio Control receivers.

3.3.3 Electrical Specifications:

- Supply Voltage: 2 to 5.5V DC
- Supply current:

$$Idle :< 5ma.Plusloads \qquad Speaking :< 5ma.Plusloads \tag{3.1}$$

- Sink/Source Current: Output 25ma.
- EEPROM: Max. Write cycles Typical 1,000,000times

3.3.4 Mechanical Specifications:

- Thermal Storage: -60 to +140 Degrees C
- Thermal Operating: -18 to +60 Degrees C

3.4 Arduino Board:

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one.

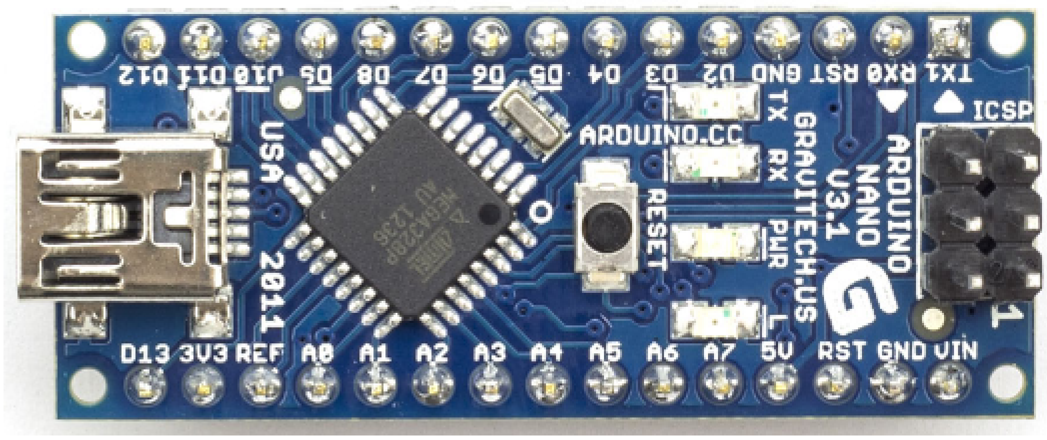

Figure 3.7: Arduino nano

3.4.1 Technical Specifications:

- Microcontroller Atmel ATmega168 or ATmega328
- Operating Voltage (logic level) 5 V
- Input Voltage (recommended) 7-12 V
- Input Voltage (limits) 6-20 V
- Digital I/O Pins 14 (of which 6 provide PWM output)

- Analog Input Pins 8
- DC Current per I/O Pin 40 mA
- Flash Memory 16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by bootloader
- SRAM 1 KB (ATmega168) or 2 KB (ATmega328)
- EEPROM 512 bytes (ATmega168) or 1 KB (ATmega328)
- Clock Speed 16 MHz

3.4.2 Power:

The Arduino Nano can be powered via the Mini-B USB connection, 6-20V unregulated external power supply (pin 30), or 5V regulated external power supply (pin 27). The power source is automatically selected to the highest voltage source.

3.4.3 Memory:

The ATmega328 has 32 KB, (also with 2 KB used for the bootloader. The ATmega328 has 2 KB of SRAM and 1 KB of EEPROM.

3.4.4 Input and Output:

Each of the 14 digital pins on the Nano can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the FTDI USB-to-TTL Serial chip.
- External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

- PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.
- LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off. The Nano has 8 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the analogReference() function. Analog pins 6 and 7 cannot be used as digital pins. Additionally, some pins have specialized functionality:
- I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library (documentation on the Wiring website). There are a couple of other pins on the board:
- AREF: Reference voltage for the analog inputs. Used with analogReference().
- Reset: Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one on the board.

3.4.5 Automatic Software Reset:

Rather then requiring a physical press of the reset button before an upload, the Arduino Nano is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the FT232RL is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload. This setup has other implications. When the Nano is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Nano. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data. [?]

3.5 LM386

3.5.1 Introduction:

The LM386M-1 and LM386MX-1 are power amplifiers designed for use in low voltage consumer applications. The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value from 20 to 200. The inputs are ground referenced while the output automatically biases to one-half the supply voltage. The quiescent power drain is only 24 mW when operating from a 6-V supply, making the LM386M-1 and LM386MX-1 ideal for battery operation.

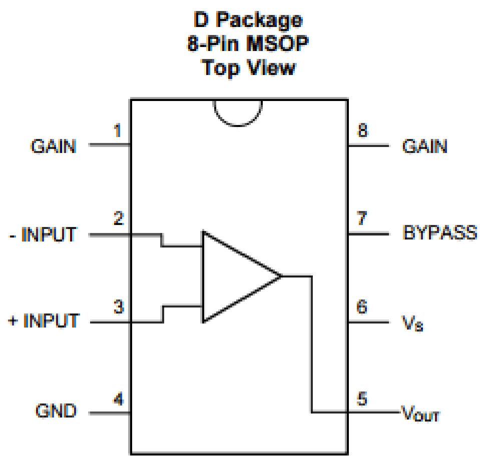

Figure 3.8: Pin configuration of LM386

3.5.2 Features:

- Minimum External Parts

- Wide Supply Voltage Range: 4 V12 V or 5 V18 V
- Low Quiescent Current Drain: 4 mA
- Voltage Gains from 20 to 200
- Ground-Referenced Input
- Self-Centering Output Quiescent Voltage

3.5.3 Pin Description:

- Pins 1 and 8 control gain. When not connected (NC), the amplifier gain is 20. Adding a 10uF capacitor between them gives a gain of 200. Intermediate values are also possible, by varying the capacitance value.
- Pin 2 is the negative input GND in this case.
- Pin 3 is the positive input i.e. the actual signal to be amplified. There is a 10K potentiometer before it, which adjusts the input signal level, acting as a volume control.
- Pins 4 (GND) and 6 (Vs) provide the supply voltage for the amplification.
- Pin 5 is the output. It is biased to 1/2 of the supply voltage Vs. In simple terms, this means that the signal there has two components: An AC component, which is the amplified input signal, plus a DC component of 1/2 Vs = 2.5V. This biased voltage cannot be fed directly to a speaker, but is exactly what we need for a C sound sensor. The 250uF electrolytic capacitor filters out the DC component and the remaining AC goes to the speaker.
- The 0.05uF capacitor and 10 ohm resistor pair from pin 5 to ground turns out to be called a Boucherot cell or Zobel Network and is used to prevent high frequency oscillations.
- Pin 7 is just named bypass,the datasheet does not provide any further detail on it or its usage. [**?**]

3.5.4 Why is it used in this project:

The reason to use this particular IC is its low cost device. Can be particularly used in normal temperature conditions. The designing is pretty simple and works great as a low voltage audio amplifier. In the project the IC is placed at the output of the Speakjet IC . This amplifies the sound it received from the speakjet IC and feeds it to the Audio Spaker. The Audio speaker then plays the pre-defined voice (audio).

- Low Voltage Audio Amplifiers
- Intercoms
- TV Sound Systems
- Power Converters

3.6 Liquid Crystal Display:

3.6.1 Introduction:

Liquid crystal display various display devices such as seven segment display, LCD display etc. Can be interfaced with microcontroller to read the output directly. In our project we used a two line LCD display with 16 characters each.
LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

- The declining prices of LCDs.
- The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.
- Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
- Ease of programming for characters and graphics.

These components are specialized for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.
A model described here is for its low price and great possibilities most frequently used in practice. It is based on the HD44780 microcontroller (Hitachi) and can display messages in two lines with 16 characters each. It displays all the alphabets, Greek letters, punctuation marks, mathematical symbols etc. In addition, it is possible to display symbols that user makes up on its own. Automatic shifting message on display (shift left and right), appearance of the pointer, backlight etc. are considered as useful characteristics.
LCDs are most commonly used because of their advantages over other display technologies. They are thin and flat and consume very small amount of power compared to LED displays and cathode ray tubes (CRTs).

3.6.2 Pin Functions:

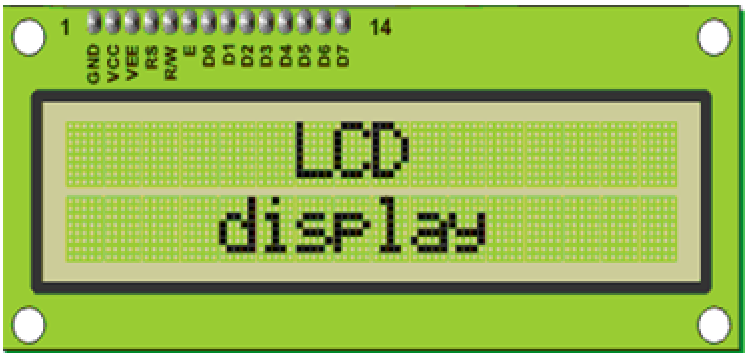

Figure 3.9: LCD Pins

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as VEE. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

Function	Pin No	Name	Logic State	Description
Ground	1	VSS	-	0V
Power supply	2	VDD	-	+5V
Contrast	3	VEE	-	0 to VDD
Control of operation	4 5 6	RS R/W E	0 1 0 1 0 1 from 1 to 0	D0 D7 are interpreted as commands D0 D7 are interpreted as data Write data (from controller to LCD) Read data (from LCD to controller) Access to LCD disabled normal operation Data/commands are transferred to LCD
Data/commands	7-14	D0-D7	0/1	Bit0(LSB)-Bit7(MSB)

Table 3.1: Pin description of LCD

3.6.3 Advantages:

- Consumes less power and generates less heat.
- Saves lot of space compared picture tubes due to LCD's flatness.
- Due to less weight and flatness LCDs are highly portable.
- No flicker and fewer screens glare in LCDs to reduce eyestrain.

3.6.4 Limitations:

- LCDs cannot form multiple resolution images.
- The contrast ratio for LCD images is lesser than CRT and plasma displays.
- Due to their longer response time, LCDs show ghost images and mixing when images change rapidly.
- The narrow viewing angle of an LCD weakens the image quality in wider viewing angles. [**?**]

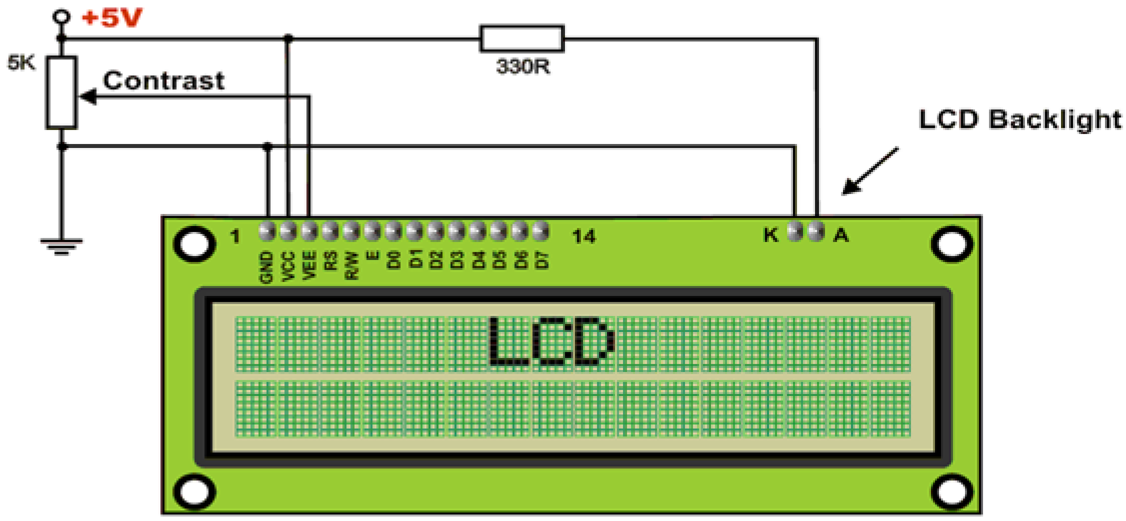

Figure 3.10: LCD Screen

3.7 Speaker:

Speakers are one of the most common output devices used with computer systems. Some speakers are designed to work specifically with computers, while others can be hooked up to any type of sound system. Regardless of their design, the purpose of speakers is to produce audio output that can be heard by the listener.

Speakers are transducers that convert electromagnetic waves into sound waves. The speakers receive audio input from a device such as a computer or an audio receiver. This input may be either in analog or digital form. Analog speakers simply amplify the analog electromagnetic waves into sound waves. Since sound waves are produced in analog form, digital speakers must first convert the digital input to an analog signal, then generate the sound waves.

The sound produced by speakers is defined by frequency and amplitude. The frequency determines how high or low the pitch of the sound is. speaker system's ability to accurately reproduce sound frequencies is a good indicator of how clear the audio will be. Many speakers include multiple speaker cones for different frequency ranges, which helps produce more accurate sounds for each range. Amplitude, or loudness, is determined by the change in air pressure created by the speakers' sound waves.

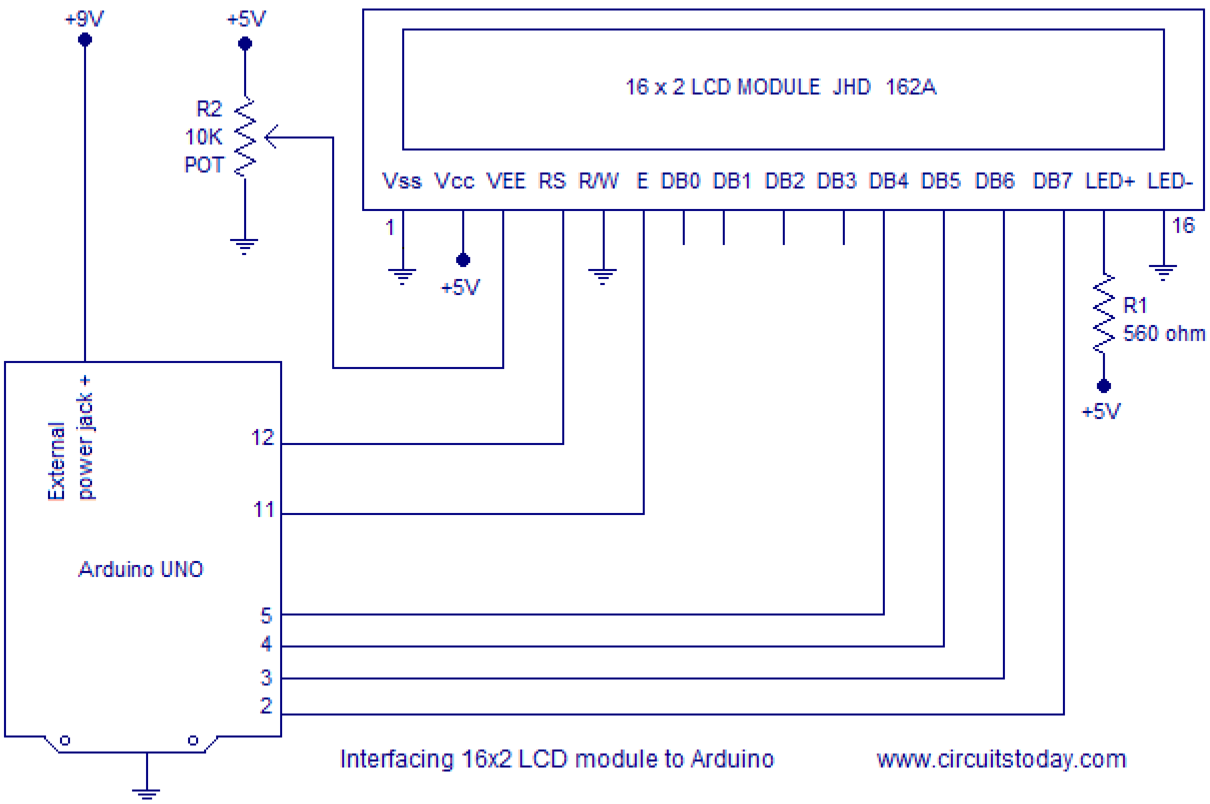

Figure 3.11: LCD interfacing with Arduino

3.8 Connectors:

Connectors are basically a device used for connecting / attaching two distinct objects/devices. Connectors are basically of 3 types:

- Male
- Female
- Male-Female

A female connector is a connector attached to a wire, cable, or piece of hardware, having one or more recessed holes with electrical terminals inside, and constructed in such a way that a plug with exposed conductors (male connector) can be inserted snugly into it to ensure a reliable physical and electrical connection . A female connector is also known as a jack, outlet, or receptacle. This type of connector can be recognized by the fact that, when it is disconnected or removed, the electrical conductors are not directly exposed, and therefore are not likely to make accidental contact with external objects or conductors. A male connector is a connector attached to a wire, cable, or piece of hardware, having one or more exposed, unshielded electrical terminal s, and constructed in such a way that it can be inserted snugly into a receptacle (female connector) to ensure a reliable physical and electrical connection . This type of connector is also known as a plug. A male connector can be recognized by the fact that, when it is disconnected or removed, the unshielded electrical prongs are plainly visible.

The wires are great and the wires are available in many colors so as to differentiate when a circuit is made.There are different sizes of wire hence it gives more flexibility to use. These jumper wires are good for probing on circuit boards. Similarly these wires help to maintain electrical insulation, connecting various points to the main device (ICs). [**?**]

Chapter 4

Software Packages

4.1 Arduino IDE

4.1.1 Introduction

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them. A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. It is a cross-platform application written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino.

Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde.

The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor. A minimal Arduino C/C++ sketch, as seen by the Arduino IDE programmer, consist of only two functions: setup: This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes, and other libraries needed in the sketch. loop: After setup has been called, function loop is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

4.1.2 Writing Sketches

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension .ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom righthand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

- Verify
  Checks your code for errors compiling it.

- Upload
  Compiles your code and uploads it to the configured board. See uploading below for details. Note: If you are using an external programmer with your board, you can hold down the "shift" key on your computer when using this icon. The text will change to "Upload using Programmer"

- New
  Creates a new sketch.

- Open
  Presents a menu of all the sketches in your sketchbook. Clicking one will open it within the current window overwriting its content. Note: due to a bug in Java, this menu doesn't scroll; if you need to open a sketch late in the list, use the File — Sketchbook menu instead.

- Save
  Saves your sketch.

- Serial Monitor
  Opens the serial monitor.

4.1.3 Libraries

Libraries provide extra functionality for use in sketches, e.g. working with hardware or manipulating data. To use a library in a sketch, select it from the Sketch then Import Library menu. This will insert one or more include statements at the top of the sketch and compile the library with your sketch. Because libraries are uploaded to the board with your sketch, they increase the amount of space it takes up. If a sketch no longer needs a library, simply delete its #include statements from the top of your code. There is a list of libraries in the reference. Some libraries are included with the Arduino software. Others can be downloaded from a variety of sources or through the Library Manager. Starting with version 1.0.5 of the IDE, you do can import a library from a zip file and use it in an open sketch. Serial monitor displays serial data being sent from the Arduino or Genuino board (USB or serial board).

4.1.4 Uploading a sketch to Arduino board

A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, you look for USB serial device in the ports section of the Windows Device Manager. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the Sketch menu. Current Arduino boards will reset automatically and begin the upload. Once you've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the Sketch menu. Current Arduino boards will reset automatically and begin the upload. When you upload a sketch, you're using the Arduino bootloader, a small program that has been loaded on to the microcontroller on your board. It allows you to upload code without using any additional hardware. The bootloader is active for a few seconds when the board resets; then it starts whichever sketch was most recently uploaded to the microcontroller. The bootloader will blink the on-board (pin 13) LED when it starts (i.e. when the board resets).

4.2 Phrase-A-Lator

The Phrase-A-Lator is a demonstration program that allows all of the SpeakJets features to be utilized and experimented with. By demonstrating all the features, the way it can be used for a particular project can be understood.

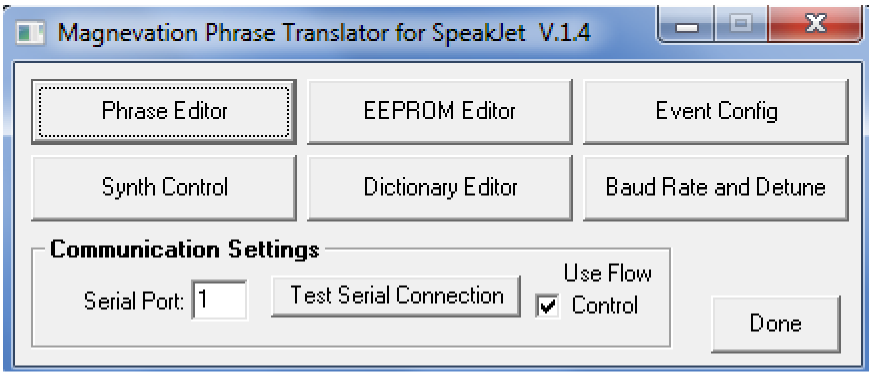

Figure 4.1: Phrase A Lator window

Phrase editor: Pressing this button opens the Phrase Editor screen . The Phrase Editor is the main work area for the development of words, phrases and sound effects using the built-in phonemes and sound effects. The Phrase Editor also lets you experiment with Pitch, Volume, Bend, and Speed of each phoneme and sound. The Phrase Editor has 3 areas of interest, Phonemes and Sound Effects, Modifiers and Controls and the Phrase Construction and Dictionary area. The Phoneme and Sound Effect area is further

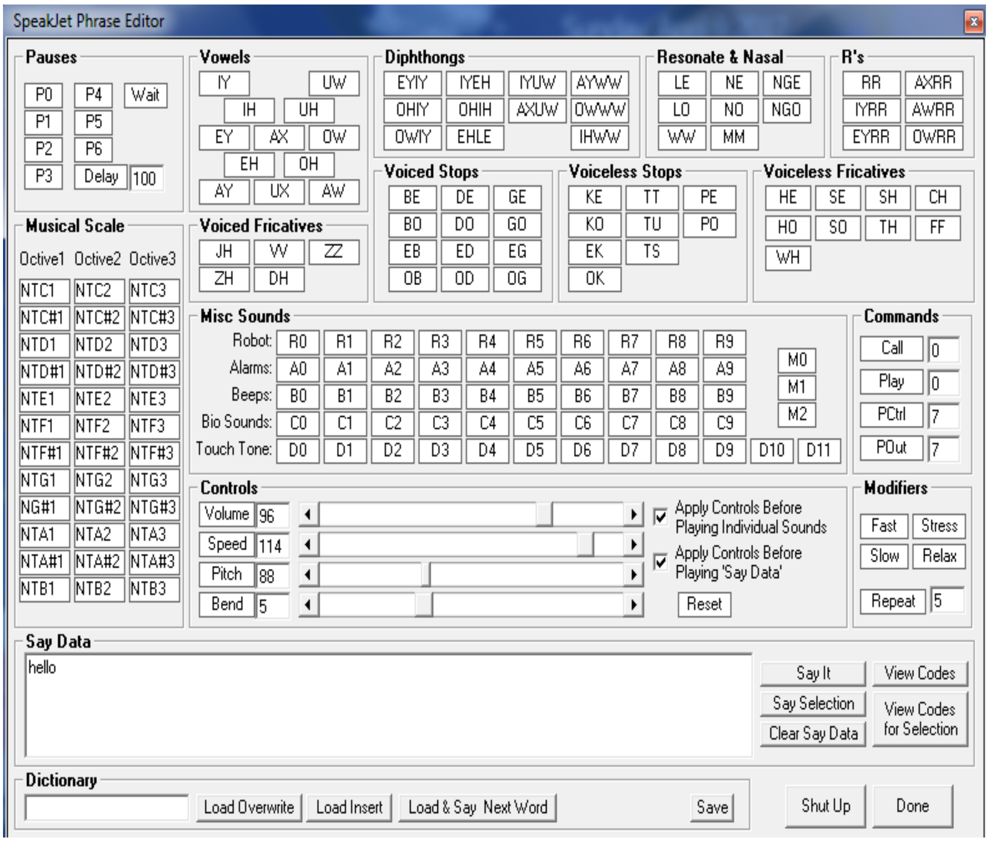

Figure 4.2: Phrase Editor window

broken down into the Vowels, Diphthongs, Resonance and Nasal, Rs, Voiced Fricatives, Voiced Stops, Voiceless Fricatives and Miscellaneous Sounds. Modifier and Controls area is further broken down into the Musical Scales, Commands, Controls and Modifiers. Phrase Construction area is further broken down into the Say Data area and the Dictionary lookup area. The Say Data area also has the view codes option to see the actual codes sent directly to the SpeakJet. The final section in the bottom right hand corner has the Shut Up and the Done button to silence the SpeakJet and to exit from this screen back to the Main Menu screen. By Single Clicking on any of the white buttons on the Phrase Editor screen, you will hear the sound immediately. By Double Clicking on any of the white buttons on the Phrase Editor screen the sound or control is copied to the Say Data window. Once the window has the desired word, phrase, sentence, or sound, press the Say It button to hear the compilation or the Say Selection to say only words or sounds sections highlighted by the mouse. Any word may be typed directly into the Say Data

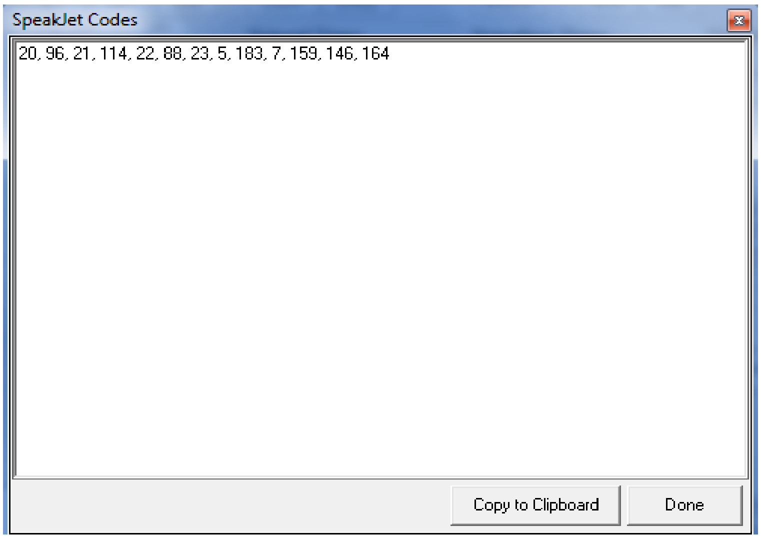

Figure 4.3: Code of 'hello' for Speakjet

and if the word is in the dictionary, the word will be uttered once the Say It button is pressed. If the word is not listed in the dictionary no sound will be uttered for that word. The Save button will allow you to save an entry into the dictionary that may not be already included or editing of an existing entry in the dictionary. The Clear Say Data button will clear the Say Data window of all contents. To view the actual data that is sent to the SpeakJet, press the View Code or the View Codes for Selection button. If the Apply Controls Before Playing Say Data box is checked, the two byte codes for Volume, Speed, Pitch and Bend and the values from the four sliders will be added to the front end of the codes going to the SpeakJet. This feature is very handy for Copying and Pasting into compilers and programming stations for microprocessors that may be used with the SpeakJet.

Chapter 5

Working

5.1 Description

The speech impaired people use hand gestures to communicate.To detect these gestures data of hand movement is collected and processed. There are five Flex Sensors, one for each finger. They are basically used to detect the bend angle for the fingers. An accelerometer is used to distinguish between the various planes. The Flex Sensors are connected in a voltage divider form with a 47k ohm resistor. The voltage applied to the voltage divider block is 5V, this is given from the arduino board. The voltage across the 47k ohm resistor is given as an input to the analog pin of the arduino board. Using this analog voltage the resistance of the flex is calculated. Resistance of the flex is around 25-40k ohm when it is not bent. Its resistance increases to 60-90k ohm. The resistance value of each flex is measured using DMM(Digital multimeter) for 0 degree bend and 90 degree bend. This defined in the code. The flex voltage is compared with these pre-determined values and correspondingly mapped to a bend angle. Output voltage of Accelerometer for the x,y and z pins is different in different planes hence it is used to distinguish between different planes. This analog voltage is given to the analog pin of arduino. This bend angle and analog voltage of accelerometer is then converted to binary values, and then binary value for all fingers is used to calculate a decimal value. This value is then compared with the pre-determined meaning of gesture corresponding to each decimal value. Speakjet IC is used for the voice part. Phrase a lator software is used to find the decimal values corresponding to phrases these values are sent by arduino to serial input of Speakjet IC.

Output of Speakjet IC is an audio signal. To amplify this audio it is fed to input of LM386. Gain of this IC is 200. The audio output of LM386 is given to speaker using an AUX cable.

5.2 Flowchart

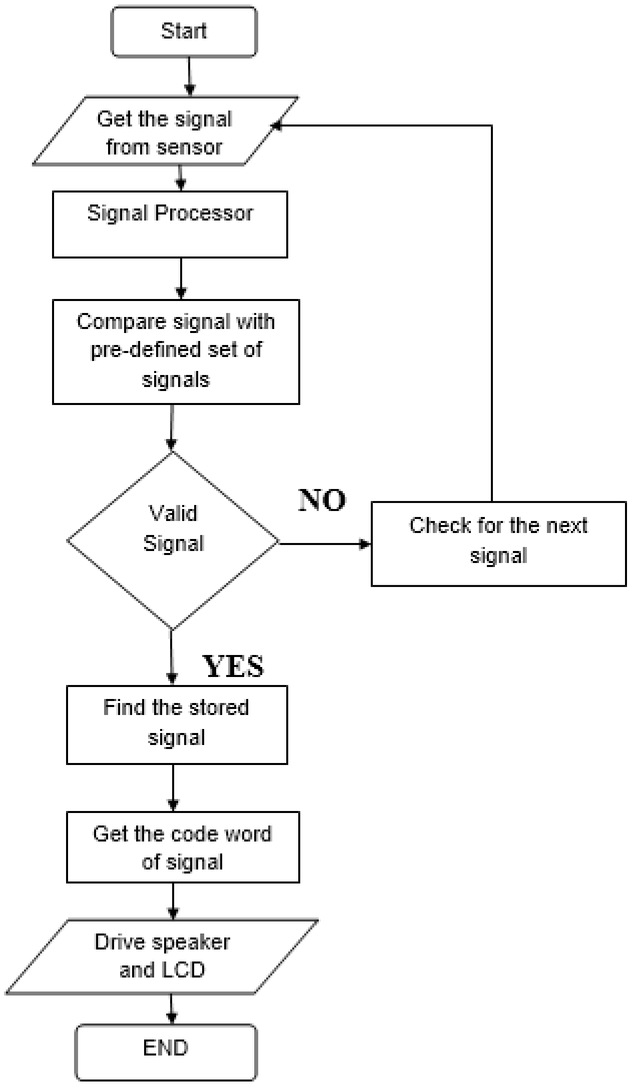

Figure 5.1: Flowchart

5.3 Output

Figure 5.2: Gesture for Hello

Figure 5.3: Gesture for Goodbye

Figure 5.4: Gesture for Really?

Figure 5.5: Gesture for Rock On

Figure 5.6: Gesture for That's it

Chapter 6

PCB Design

Printed circuit board artwork generation was initially a fully manual process done on clear Mylar sheets at a scale of usually 2 or 4 times the desired size. The schematic diagram was first converted into a layout of components pin pads, then traces were routed to provide the required interconnections. Traces between devices were made with self-adhesive tape. The finished layout "artwork" was then photographically reproduced on the resist layers of the blank coated copper-clad boards. Modern practice is less labor-intensive since computers can automatically perform many of the layout steps. The general progression for a commercial printed circuit board design would include: Schematic capture through an electronic design automation tool. Card dimensions and template are decided based on required circuitry and case of the PCB. Determine the fixed components and heat sinks if required. Deciding stack layers of the PCB. 1 to 12 layers or more depending on design complexity. Ground plane and power plane are decided. Signal planes where signals are routed are in top layer as well as internal layers. In the design of the PCB artwork, a power plane is the counterpart to the ground plane and behaves as an AC signal ground, while providing DC voltage for powering circuits mounted on the PCB. In electronic design automation (EDA) design tools, power planes (and ground planes) are usually drawn automatically as a negative layer, with clearances or connections to the plane created automatically.

6.1 Process of PCB layout making

STEP-1:-After cutting the copper clad sheet to size, the PCB is cleaned with thinner, so that the dust on the PCB is removed and we get a shiny surface. Then we insert the PCB in Dip coat, that is, negative photo resistive material.

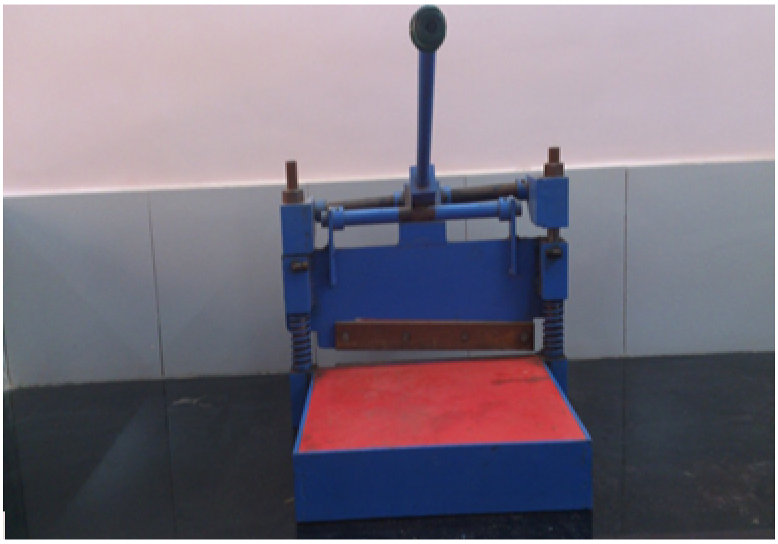

Figure 6.1: PCB Cutter

STEP-2:-The photo resistive material should be made hard on the PCB for which the PCB is kept in the oven for four minutes.

Figure 6.2: PCB Oven

STEP-3:-After the liquid is made hard, it is kept in the UV exposure for two minutes. In the UV exposure, the circuit is kept with its layout. The ultraviolet rays are passed through the PCB. STEP-4:-Then we have to expose out PCB to nail polish remover

Figure 6.3: UV Exposure

solution which is also called as developer liquid. As a result of this an impression of tracks is formed on the PCB. Repeat the STEP-2, in which the PCB is kept in the oven for four minutes. STEP-5:-In this step, the board is placed in an etcher, which is a machine that washes warm ferric chloride (or another etchant) over the board, eating away any exposed copper. For this step you will need to make sure the etchant is warm enough to use. This step takes 2minutes.

Move the holder into the etching tank, again facing to the right. Check that the temperature monitor reports 42-45 degrees C, and that the fluid well feels warm. also make sure the top is secured so that there is very little chance FECL will spray out the top. By default the timer is set for 1:30 minutes, which I've found satisfactory. You can also change the time if necessary (for different weights of copper). Turn on the spray pump by pressing start. The entire tank will turn reddish brown as the etchant removes the copper from your board. After the time is up, remove the holder and quickly put it

Figure 6.4: Agitating PCB

in the wash tank again. Be careful as there will be a lot of FECL dripping off the holder and you dont want it going anywhere but in the machine or the sink.

STEP-6:- Then the PCB is washed in water by hand and cleaned by the cloth.

6.2 PCB Drilling:

Drill all holes of one size at a time. Try to position the drill bit right in the center of the hole, or at least, try not to drill through any copper traces. Holding the board steady while drilling through it helps.

6.3 Component Assembly:

In this we mount the entire component on the board with the help of schematic and layout. While doing this we take care that component terminals are place at the correct position.

Figure 6.5: Easy Etcher

6.4 Soldering:

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal. Soldering differs from welding, soldering does not involve melting the work pieces. In brazing, the filler metal melts at a higher temperature, but the work piece metal does not melt. In the past, nearly all solders contained lead, but environmental concerns have increasingly dictated use of lead-free alloys for electronic and plumbing purposes.

6.5 Troubleshooting

Printed circuit boards, or PCBs, are a mass of insulators and copper traces that connect densely packed components together to create a modern circuit. Troubleshooting a multi-layer PCB is often quite a challenge, with factors such as size, number of layers, signal analysis, and types of components playing a large role in the ease of troubleshooting. Some more complicated boards will require specialized equipment to properly troubleshoot, but most troubleshooting can be done with basic electronic equipment to follow traces, currents and signals through the circuit.

6.6 Schematics and Layout

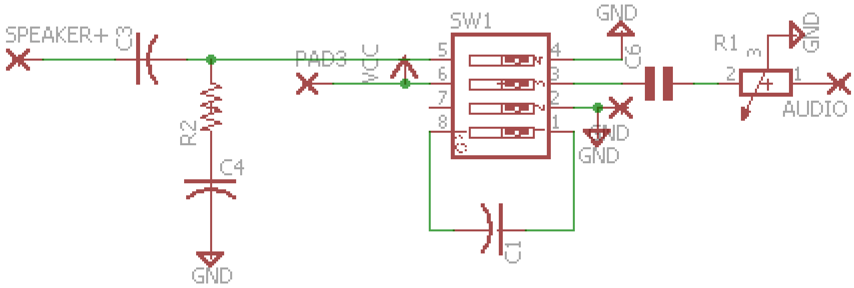

Figure 6.6: Schematic of Amplifier

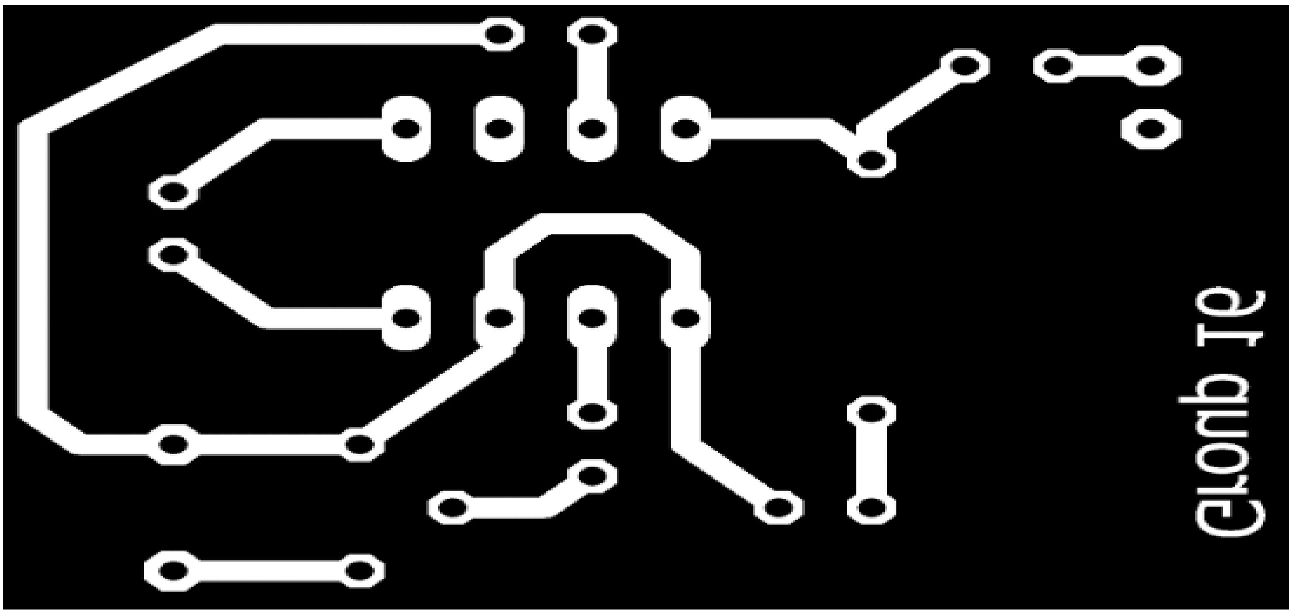

Figure 6.7: Board for Amplifier

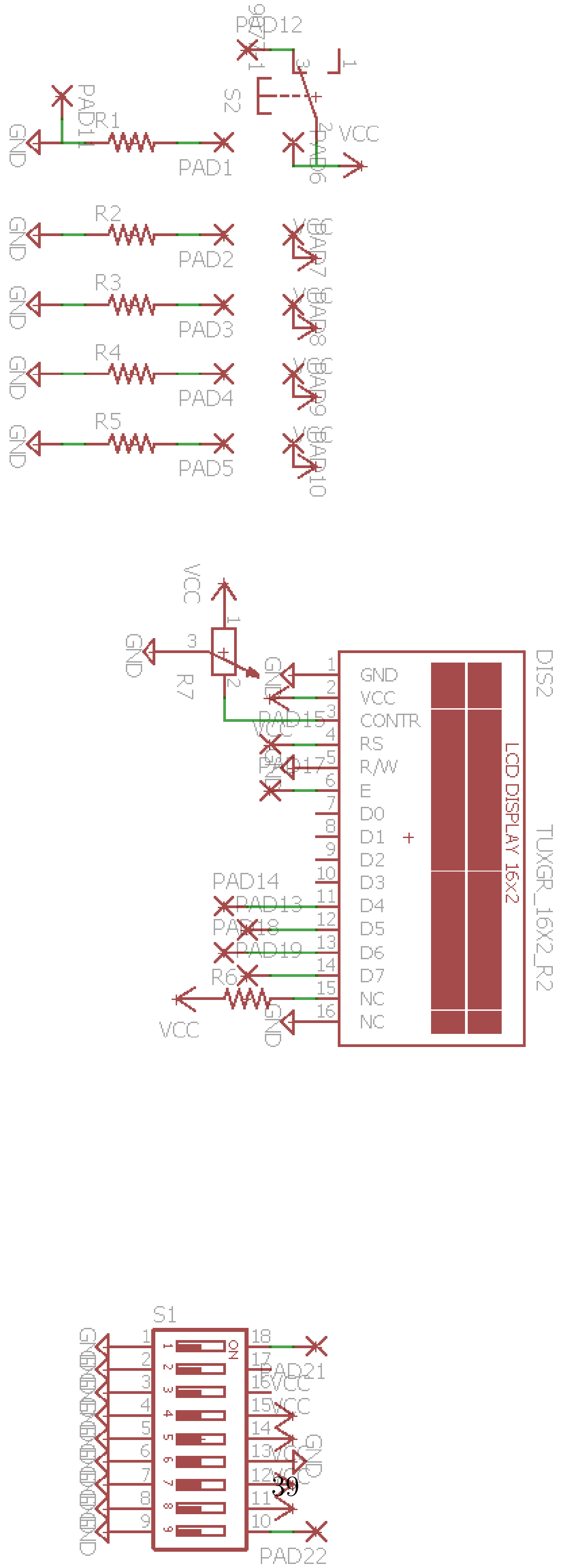

Figure 6.8: Schematic for flex, LCD and Speakjet

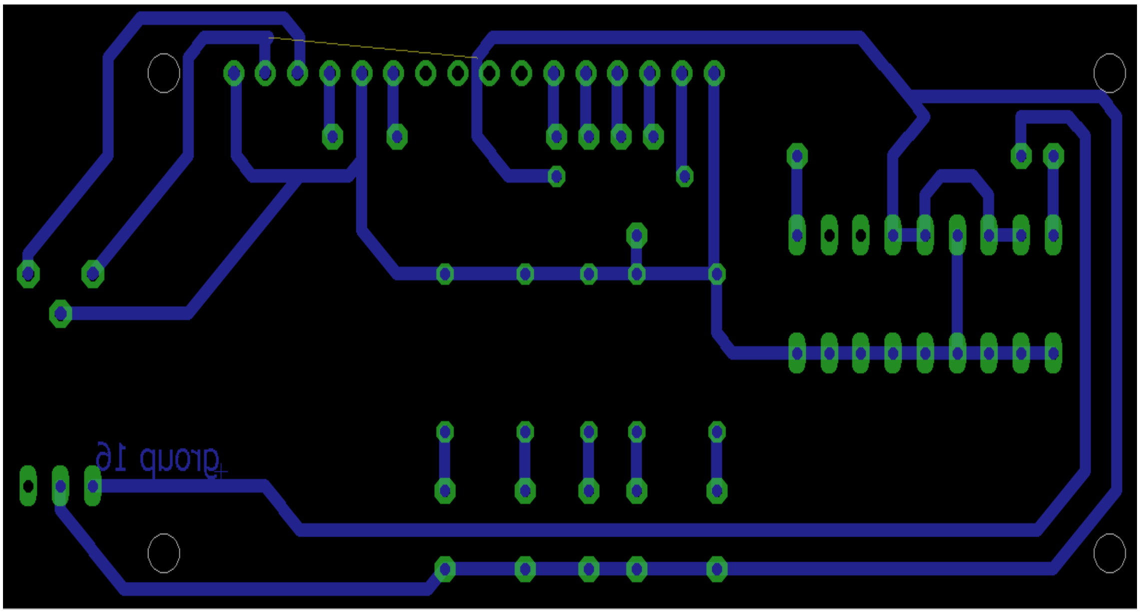

Figure 6.9: Board for flex, LCD and Speakjet

Chapter 7

Conclusion and Future Scope

Conculsion

Sign language is a useful tool to ease the communication between the deaf or mute community and the normal people. Yet there is a communication barrier between these communities with normal people. This project aims to lower the communication gap between the deaf or mute community and the normal world. This project was meant to be a prototype to check the feasibility of recognizing sign language using sensor gloves. With this project the deaf or mute people can use the gloves to perform sign language and it will be converted in to speech so that normal people can easily understand.

Future Scope

The completion of this prototype suggests that sensor gloves can be used for partial sign language recognition. More sensors can be employed to recognize full sign language. A handy and portable hardware device with built-in translating system, speakers and group of body sensors along with the pair of data gloves can be manufactured so that a deaf and dumb person can communicate to any normal person anywhere. Keeping in mind this basic idea of communication the prototype can be further improved in the following ways: With the help of this proposed hand gloves gives a speech impaired person/paralytic patient can communicate with us normally which helps to bridge the current gap which exists. Currently our proposed hand gloves can successfully voice out $32\hat{(3)}$ signals with the helpof acclerometer which can be further increased to $32\hat{(}6)$ with the help of 2 hands. Also the 2 hand communication will help the speech impaired patient to totally voice over using just the hands.

- Designing of a whole jacket, which would be capable of vocalizing the gestures and movements ofanimals.
- Virtual reality application e.g., replacing the conventional input devices like joy sticks in videogames with the data glove.
- The Robot control system to regulate machine activity at remote sensitive sites.

References

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