Project II

"SignTalk and Animator for Speech and Hearing Impaired"

Submitted in partial fulfillment of the requirements for the degree of

Bachelor of Computer Engineering

by

(Shaikh Ruba Iqbal Nazeema)	Roll No.13CO12
(Biya Haseeb Habib Nasrin)	Roll No.13CO21
(Siddiqui Sayma Atik Sabeeha)	Roll No.13CO14
(Khot Sufiyan Iqbal Arifa)	Roll No.12CO41

Supervisor

(Asst.Prof. Mubashir Khan)

Co-Supervisor

(Asst.Prof. Abdul Salam Shaikh)

Department of Computer Engineering,
School of Engineering and Technology
Anjuman-I-Islam's Kalsekar Technical Campus
Plot No. 2 3, Sector -16, Near Thana Naka, Khanda Gaon,
New Panvel, Navi Mumbai. 410206

Academic Year : 2016-2017

CERTIFICATE

Department of Computer Engineering,

School of Engineering and Technology,
Anjuman-I-Islam's Kalsekar Technical Campus
Khanda Gaon,New Panvel, Navi Mumbai. 410206

This is to certify that the project entitled ***SignTalk and Animator for Speech and Hearing Impaired*** is a bonafide work of **Ruba Shaikh,Haseeb Biya,Siddiqui Sayma,Sufiyan Khot**(Roll No.:13CO12,13CO21,13CO14,12CO41) submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** in **Department of Computer Engineering**.

Asst.Prof. Mubashir Khan — Supervisor

Prof. Javed Sheikh — Project Co- Coordinator

Prof. Tabrez Khan — Head of Department

Dr. Abdul Razak Honnutagi — Director

Project I Approval for Bachelor of Engineering

This project entitled ***SignTalk and Animator for Speech and Hearing Impaired*** by ***Ruba Shaikh,Haseeb Biya,Siddiqui Sayma,Sufiyan Khot*** is approved for the degree of ***Bachelor of Engineering in Department of Computer Engineering.***

Examiners

1. .....
2. .....

Supervisors

1. .....
2. .....

Chairman

.....

Declaration

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Student Name: Shaikh Ruba Iqbal
Roll Number:13CO12

Student Name: Biya Haseeb Habib
Roll Number:13CO21

Student Name: Siddiqui Sayma Atik
Roll Number:13CO14

Student Name: Khot Sufiyan Iqbal
Roll Number:12CO41

Abstract

Tittle : SignTalk and Animator for Speech and Hearing Impaired

Communication is basic fundamental human right, however who are deaf and mute communicate differently than everyone else using Sign Language (SL), while we communicate verbally. This puts them at disadvantage. Our system will help them better communicate with rest of the world without changing how they already interact with each other. The system, **SignTalk** i.e. Hand gloves will translate sign language to voice. Flex sensors, accelerometer, gyroscope, are placed on hand gloves to capture hand movements. Arduino Nano recognizes these signals and sends it to smart phone via Bluetooth for voice generation. **Animator** is an android application that takes text sentences as input and converts it to 2D animations for facilitating two way communication.

Shaikh Ruba Iqbal Nazeema
Roll No: 13CO12

Biya Haseeb Habib Nasrin
Roll No: 13CO21

Siddiqui Sayma Atik Sabeeha
Roll No: 13CO14

Khot Sufiyan Iqbal Arifa
Roll No: 12CO41
B.E. (Computer Engineering)
University of Mumbai.

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Keywords And Glossary

Keywords :
Arduino Nano, Bluetooth Module, Accelerometer, Smart Phone, Flex Sensors, MPU6050, 6-Axis Gyro Sensor Module, Android Studio

Glossary :
A
Accelerometer
ADXL335 complete, low-power 3-axis accelerometer measures dynamic acceleration (motion, shock, or vibration) and static acceleration (tilt or gravity) over a 3 g range with 0.3 percent non linearity and 0.01/C temperature stability.
Arduino IDE
The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.
Arduino Nano
The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328; offers the same connectivity and specs of the UNO board in a smaller form factor.
Animator
Animator is an android application that converts text sentences to animations of Sign Language.

B
Bluetooth
HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.

F
Flex Sensors
A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending.

G
Gyroscope
It measures angular motion of movements.

S
Smart Phone
We have used smart phone to render our application i.e. Animator.
SignTalk
SignTalk is name given to our system i.e. hand gloves that translates sign language to audio message.

Chapter 1

Project Overview

1.1 Introduction

The Deaf and mute community use Sign Language for conveying their thoughts. Sign Language involves simultaneously combining hand shapes, orientation and movement of hands, arms to express thoughts. While it's easy for them to communicate amongst themselves using sign language, the general public often finds it difficult to follow these gestures. Interpreters are needed in such cases. It can be quite frustrating for them to constantly depend on interpreter whilst communicating with their peers. These People are treated Differently.Thus Creating a Gap Between Normal Person and Them.Sign Language is not universal. When India ratified the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD), India made a promise to the world that she would ensure that dumb and deaf people will be treated equally and will enjoy the same rights as other Indian citizens. But the absence of such a common sign language proves to be a hurdle in the efforts to treat the hearing and speech impaired people equally.Due to Rapid Growth of Technology Mobile Plays a Important Role in Day-to-Day Life.As Most of the People prefer Mobile phone For completing their chores the usage of Smart phone has increased tremendously, this can be used as a Teaching and translator tool.

1.1.1 Motivation

The Deaf and Dumb People Conveys Their Emotions and Thoughts with Sign Language. As Sign Language provides a Medium for these people to Communicate with Outside World, but these Sign Language are not understood by Normal People. Hence it become Difficult to communicate with them. It requires a Third Person as a Translator to map those Sign Language into human Understandable Language. So it Becomes Difficult every time to Search For Translator. Due to Advancement in Technology Majority of World's Population uses Mobile Phone in order to Complete their Daily Chores. But Some People Cannot use Such Technology to Convey their Thoughts in Real Time. So We decided lets just Bring their emotions and Thoughts in to Reality with the Help of Technology and this Idea lead to Development of This Project.

1.2 Problem Definition

In Democratic Country Like India,Hearing Handicapped numbered about 13 lakh and constituted 0.13 per cent of the population of the country.The needs of the Deaf community in India and their problems have been documented by various organizations working for the deaf. The Institute will lead the way in academic development, training and propagation of the Indian Sign Language.So we are Developing a Hand Glove that will track hand motion and produce Speech.

1.3 Current Systems

As we had Seen Many System which has been made by Students from all over the world such as Gesture Recognition,Indian Sign Language using Flex Sensors etc.Flex Sensors Measure Bending of Finger and produce voice. Accelerometer measures the Hand Orientation.

1.4 The Problems with Current System

• The system specified above has some limitations in terms of circuitary, language, portability, responsiveness, freedom of movement and motion.
• Some systems does not have gyroscope to capture angular motions.
• Huge ciruitary, no portability in case of vision based system.

1.4.1 Advantages Over Current System

• The system has accelerometer for hand orientation detection, MPU-6050 for capturing angular motion which adds up the motion's gesture.
• Portable
• Small Cirtuitary
• Sign Language Learning with Animation.

1.5 Goals and Objectives

1.To lower the communication gap between Deaf and Dumb people and speech enabled people.

2.It will help the people to learn, understand the Sign Language so that they can communicate with Deaf/Dumb People.

1.6 Scope and Applications

Our project aims to reduce the work of third person which acts as a translator between Deaf and Dumb and normal person.To overcome the communication barrier we also aim to provide two way communication i.e Deaf and Dumb can talk normal Person and normal person can learn sign language with the help of animator and can communicate with them.It is portable(i.e Battery Driven) so that we can reduce the limitation of connecting with main power supply.

Chapter 2

Review Of Literature

2.1 Gesture Recognition System for Indian Sign Language on Smart Phone by Ankit P.Parmar, Dr. Nehal G.Chitaliya, International Journal of Advanced Research in Computer and Communication Engineering

2.1.1 Description

In this paper, the authors have make use of an android based smart phone application to deliver sign language interpreter.Smart phone has camera module which is used to capture hand movement it is converted to image and is compared with database image, if any match found an appropriate text is displayed hence establishing a communication.If not found the iteration is repeated until a match is found.

2.1.2 Overcoming Drawbacks

Our system does not have any environmental issues.The effort of image processing can be reduced by using sensors to capture real time data and put it on to some useful purpose.As image processing is not that much efficient because hand movement cannot be accurate.The user should have that much flexibility to freely convey his gesture, need not be perfect all the time. ‘

2.2 Gesture Based Vocalizer for Deaf and Dumb by Supriya Shevate, Nikita Chorage, Siddhee Walunj,Moresh M.Mukhedkar in International Journal of Advanced Research in Computer and Communication Engineering

2.2.1 Description

In this paper, the authors have make use of accelerometer for tilt detection, flex sensor for bend detection, micro controller,ADC and speech synthesis.A wireless data gloves attached with flex sensor on each finger and micro controller mounted over it.It also has a accelerometer mounted.flex sensor and accelerometer data is given to micro controller.The micro controller process the data and display on LCD and a sound is heard.As this project is still in progress the author are trying to dynamically get values.Designing a jacket to get gesture from animals.

Figure 2.1: Huge circuitry

2.2.2 Overcoming Drawbacks

your system has predefined words and sentences for the hand movements so that it takes less time comparatively.

2.3 Indian Sign Language using Flex Sensors Glove by Solanki Krunal in June 2013

2.3.1 Description

In this paper, author has make use of flex sensor,micro controller,ADC and LCD.Movements in hand's finger causes voltage drop which is given to the micro controller via ADC.The micro controller identifies the signal and process word to word to be displayed on LCD screen.For example. BOY, each letter is process at a time and it is saved by pressing a button the complete sentence is shown on LCD.

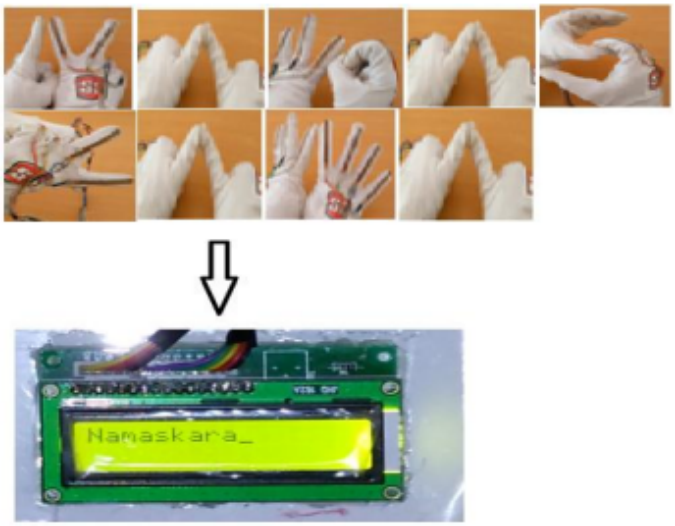

Figure 2.2: single word processing

2.3.2 Overcoming Drawbacks

Our output is played as audio which can be directly comprehended thus enabling faster communication. We are using smart phone that takes text as input and gives the hand movement on the screen so that abled person can communicate easily.

2.4 Inertial Motion Sensing Glove for Sign Language Gesture Acquisition and Recognition by Mariusz Ma.sior, Mateusz Zaborski, and Katarzyna Barczewska, Jakub galka

2.4.1 Description

In this paper, authors have make use of accelerometer glove(which is mounted on each finger) and RBG camera to identify sign language.The entire limb movement is track with the help of additional accelerometer on the limb.The author's model isolates sign language gestures by using parallel hidden Markov models.Efficiency is much more than video sensors.

2.4.2 Overcoming Drawbacks

Our device, i.e. gloves covers palm and wrist only for communication and its more concentration on palm so that the user's freedom will not be restricted.

2.5 Translating Indian Sign Language to text and voice messages using flex sensors by Sachin Bhat, Amruthesh M, Ashik, Chidanand Das, Sujith in IJARCCE Vol. 4, Issue 5, May 2015

2.5.1 Description

In this paper, the authors make use of flex sensors, ADC,AT89S52 micro controller and bluetooth module.The flex sensor measure bend and send to micro controller and gesture is identified and displayed on LCD and same identified gestured is send to smart phone via bluetooth and text to speech conversion takes place.The system uses smart phone internal speaker as speech medium.

2.5.2 Overcoming Drawbacks

In our system motion gesture can be captured by accelerometer and gyroscope.Our system does not require additional LCD module as smart has one. Arduino Nano mircocontroller is used which only process and identify gesture and send signal via bluetooth hence less communication is comparatively faster.

2.6 Technological review

2.6.1 Arduino

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.

2.6.2 Accelerometer

The triple axis accelerometer - ADXL335 from Sparkfun the 3-axis ADXL335 accelerometer sensor from analog devices.The ADXL335 is a triple axis mems accelerometer with extremely low noise and power consumption - only 320uA! The sensor has a full sensing range of +/-3g. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration.

2.6.3 MPU 6050

The InvenSense MPU-6050 sensor contains a MEMS accelerometer and a MEMS gyro in a single chip. It is very accurate, as it contains 16-bits analog to digital conversion hardware for each channel. Therefor it captures the x, y, and z channel at the same time. The sensor uses the I2C-bus to interface with the Arduino.

2.6.4 Android

Android Studio provides the fastest tools for building apps on every type of android device.Android Studio is the official IDE for android application development.It works based on IntelliJ IDEA.

Chapter 3

Requirement Analysis

3.1 Platform Requirement :

3.1.1 Supportive Operating Systems :

The supported operating systems for client include:
Android.

As the application works on android enabled phones.Minimum 4.0 version of android needed.

3.2 Software Requirement :

The software requirements in this project include:

1) Arduino IDE:

Figure 3.1: Arduino IDE

The Arduino IDE is a open-source software used to provide instructions to micro controller. It provide an environment where you can write code and upload it to your micro controller.It is available for Windows,Linux and MAC operating system based computers.

2) Android Studio:
Android Studio is an open-source integrated environment for developing android application.

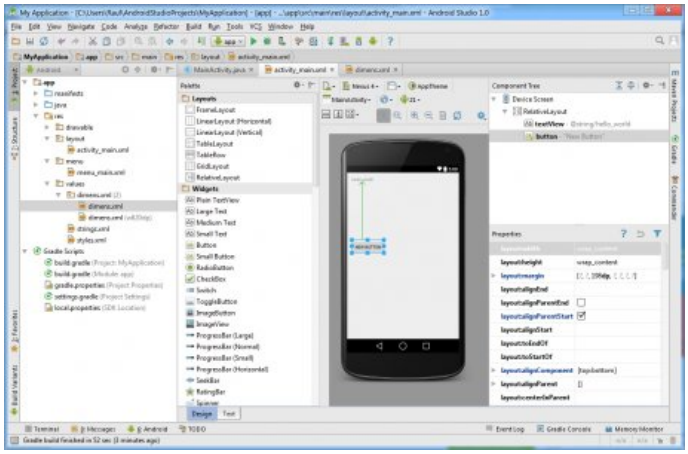

Figure 3.2: Android Studio

3.3 Hardware Requirement :

1)Flex sensors:

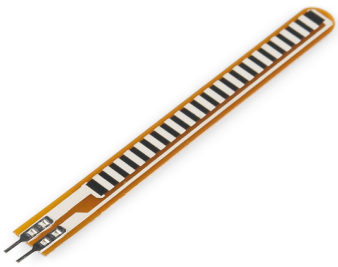

Figure 3.3: Flex Sensor

Flex sensors are sensors that change resistance depending on the amount of bend on the sensor. They are analog sensors. Now the bending of each finger results in certain voltage drop this data from flex is sent to ATMEGA328P. Next step is to combine the movement of each finger and name it a particular gesture of the hand.

2) Accelerometer:

Accelerometer (ADXL 335) in the SignTalk system is used as a tilt detector.It has an analog output which varies from 1.5 volt to 3.5 volt. ADXL335 is a three-axis analog accelerometer IC, which reads off the X, Y and Z acceleration as analog voltages. By measuring the amount of acceleration due to gravity, an accelerometer can figure out the angle it is tilted at with respect to the earth.

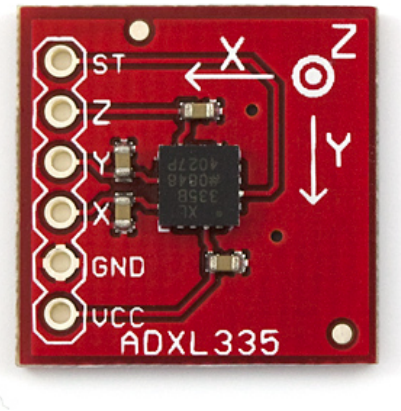

Figure 3.4: Accelerometer

3) Arduino Nano:

Arduino Nano is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack. It contains everything needed to support the microcontroller. Simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

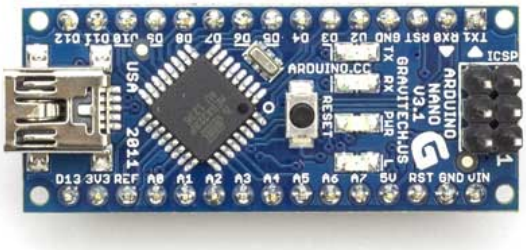

Figure 3.5: Arduino Nano

4) MPU6050 6-Axis Gyro Sensor Module:

It is a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die are the highest performance sensors in the market with the lowest noise, best temperature stability, and highest sensitivity accuracy. When external torques or rotations about a given axis are present in these devices, orientation can be maintained and measurement of angular velocity can be measured due to the phenomenon of precession.

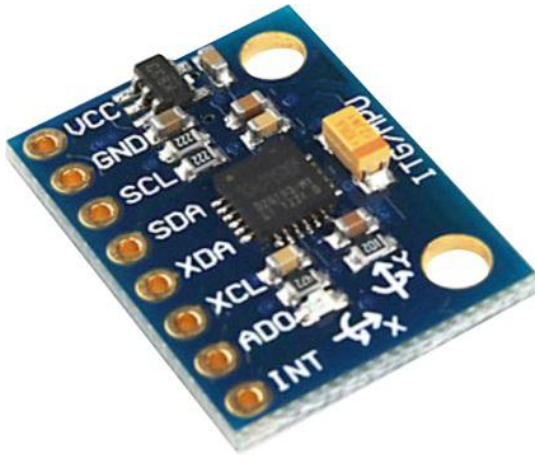

Figure 3.6: MPU 6050

5) Bluetooth:

It captures the recognized signal from Arduino and sends it to smart phone for further processing and voice generation. Here HC-05 Bluetooth module is used.

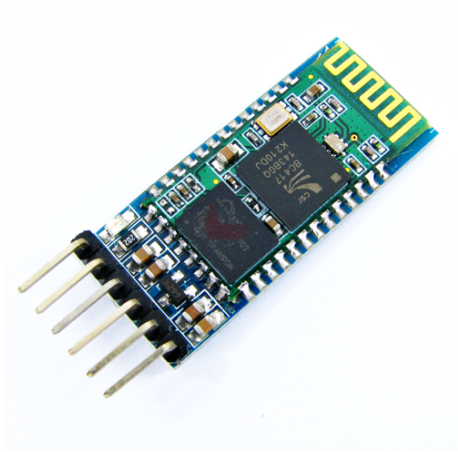

Figure 3.7: Bluetooth Module

6) Smart phone:

It receive the signal via bluetooth and compares it with the predefine values and generates audio accordingly. The android phone also compares the input text in the database and corresponding animation from database is fetched and combination of all broken text forms the sign language for the input.

Figure 3.8: Smart Phone

Chapter 4

System Design and Architecture

4.1 System Architecture

4.1.1 Sign Language Interpreter:

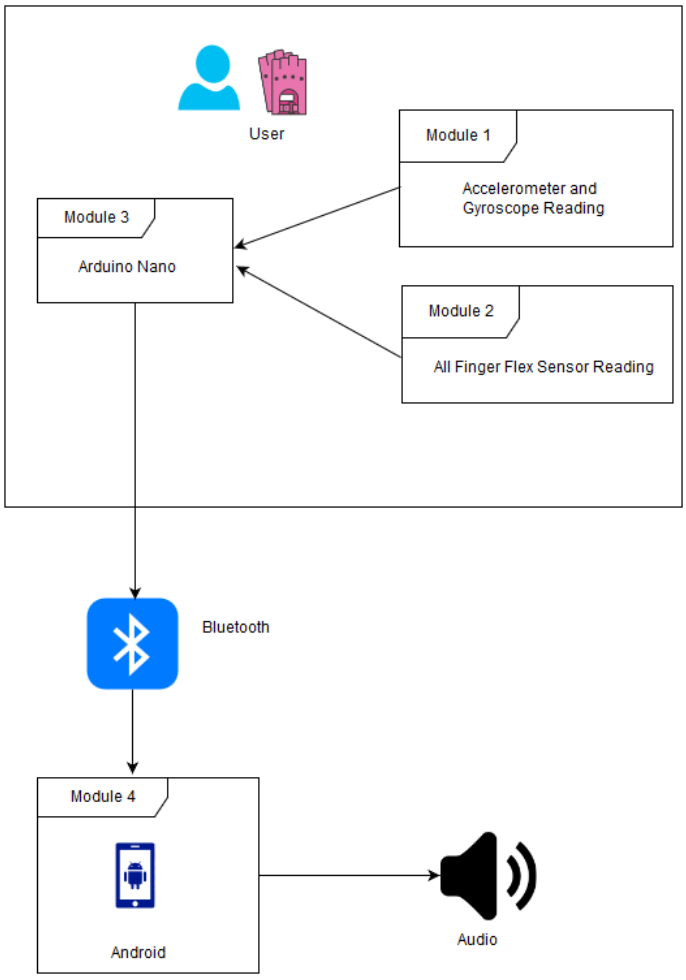

Figure 4.1: SignTalk Overall System Architecture

4.1.2 Animator:

The overall system architecture is shown below:

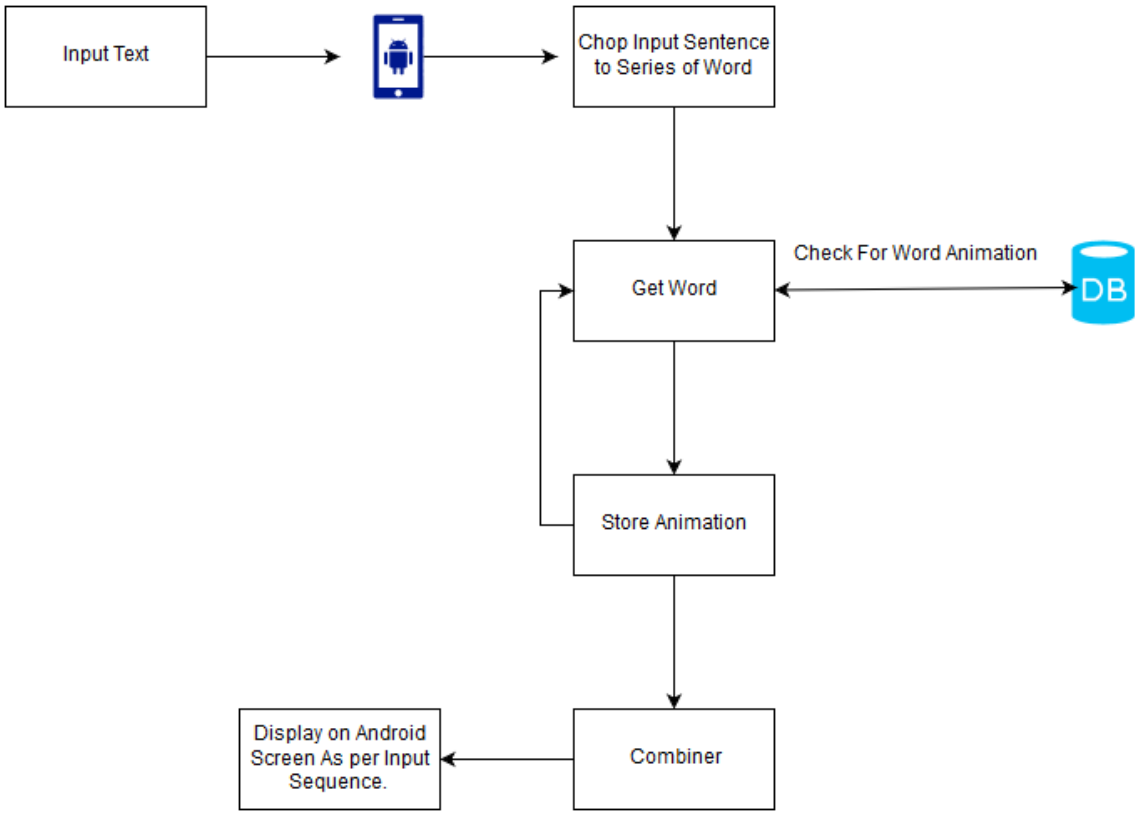

Figure 4.2: Animator overall system architecture

4.2 Use case Diagrams

4.2.1 The Use-Case Diagram for SignTalk Interpreter is shown Below:

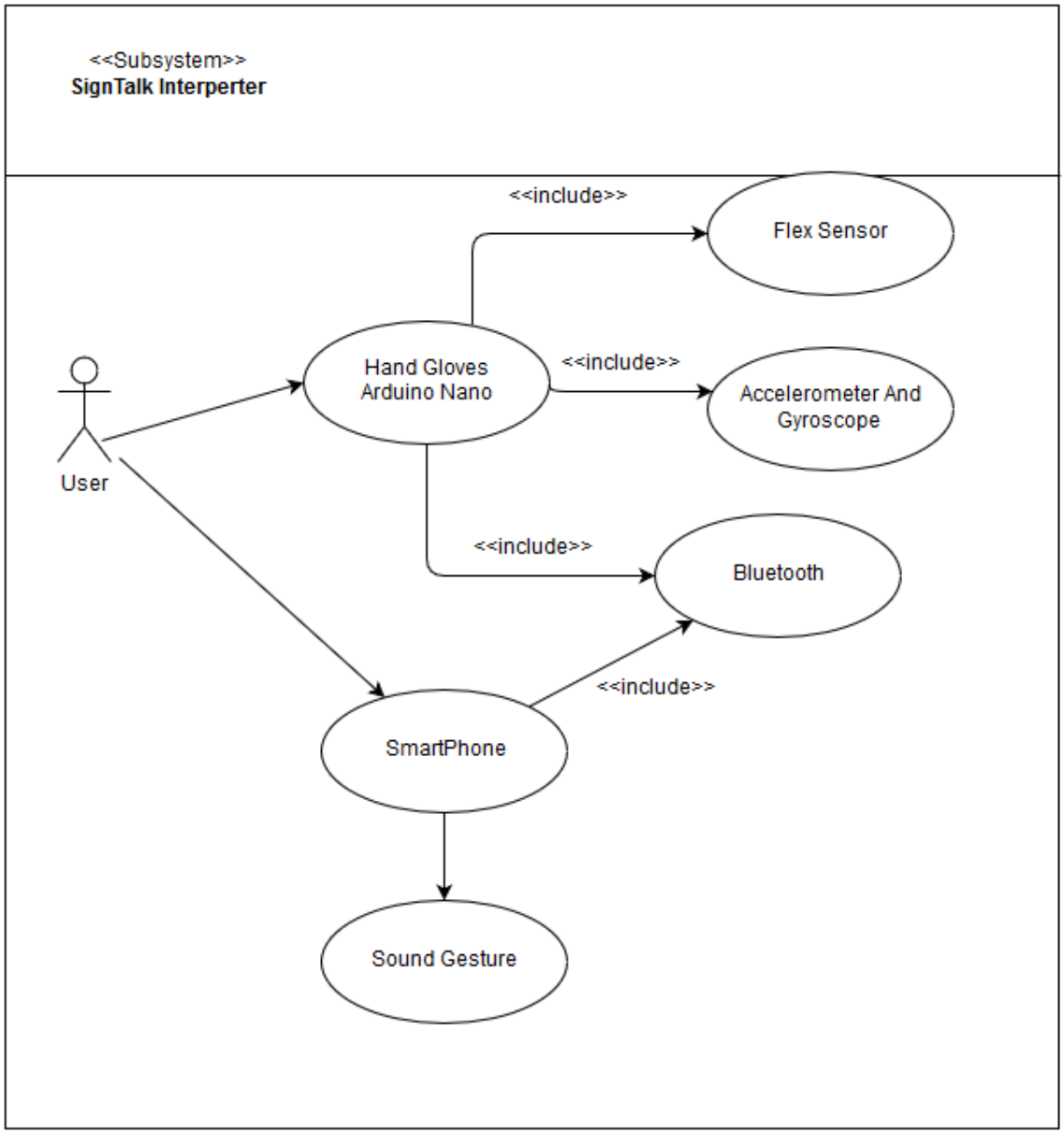

Figure 4.3: Use-case SignTalk Interpreter

4.2.2 The Use-Case Diagram for Animator is shown Below:

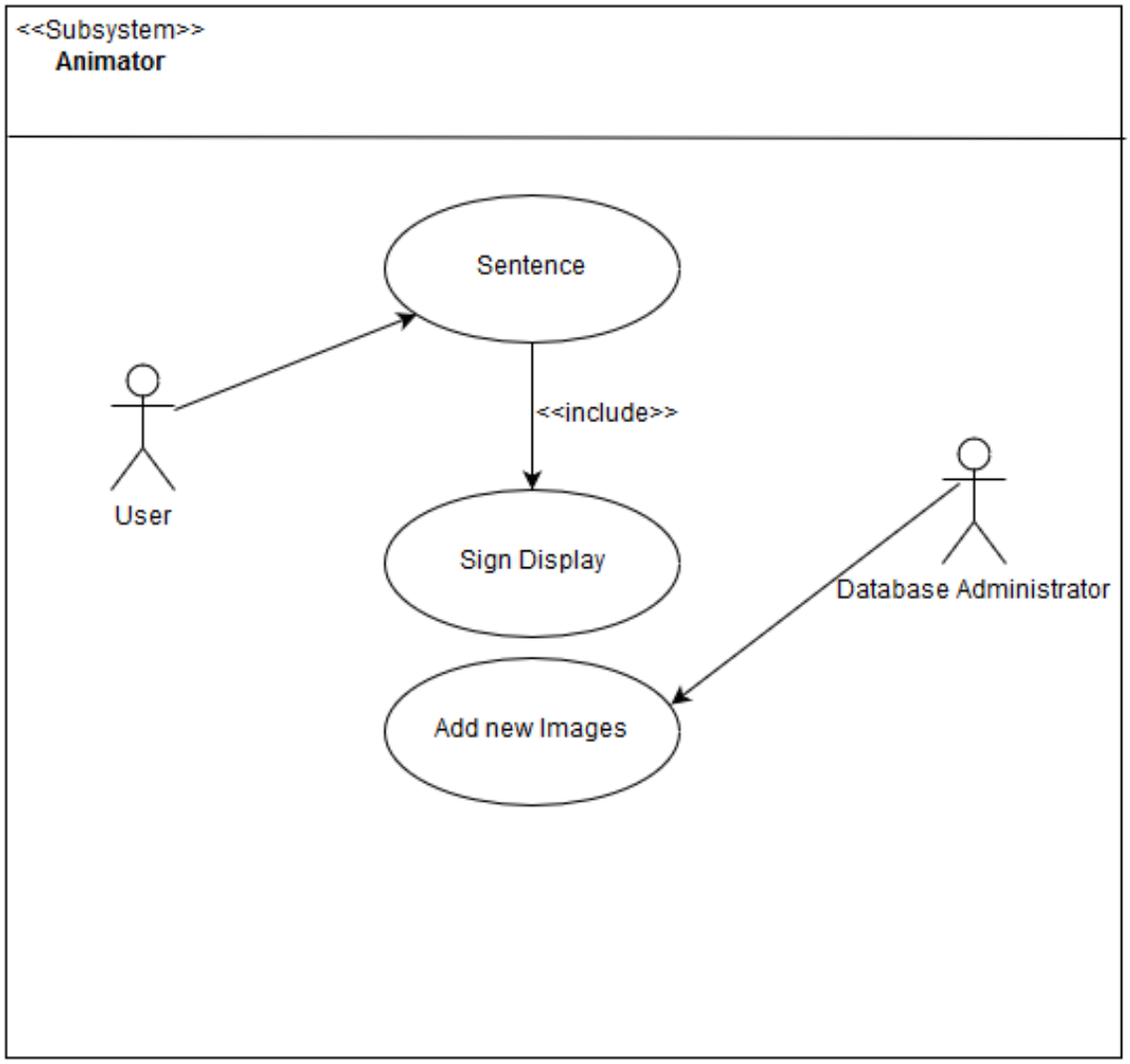

Figure 4.4: Use-case of Animator

4.3 Data Flow Diagram

4.3.1 The Data Flow Diagram For SignTalk Interpreter is shown Below:

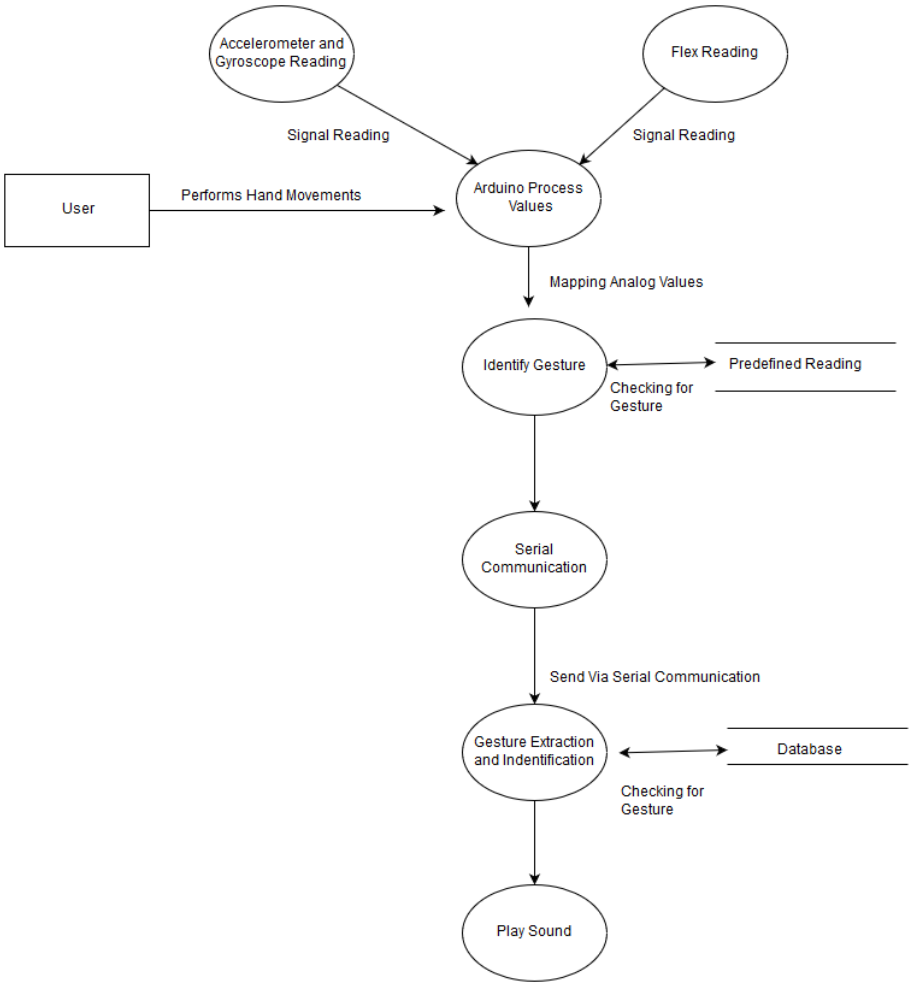

Figure 4.5: DFD SignTalk Interpreter

4.3.2 The Data Flow Diagram for Animator is shown Below:

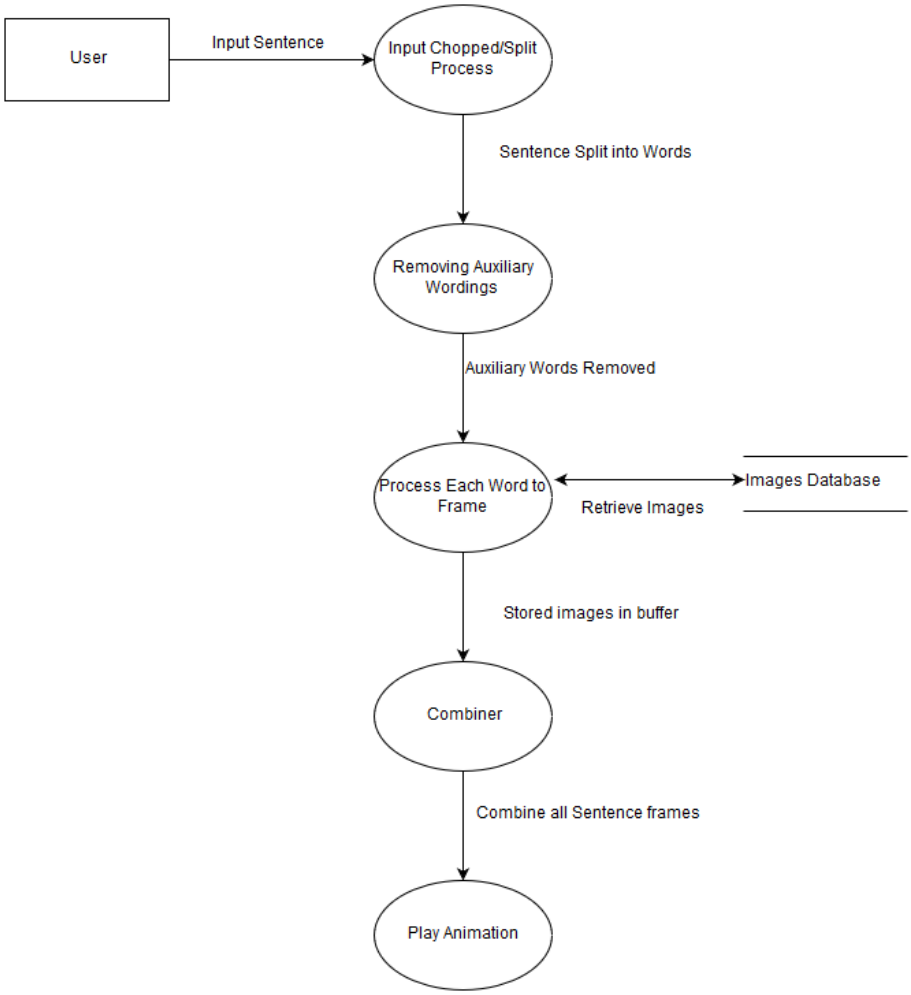

Figure 4.6: DFD Animator

4.4 System Flow

4.4.1 The SignTalk system flow is Shown Below :

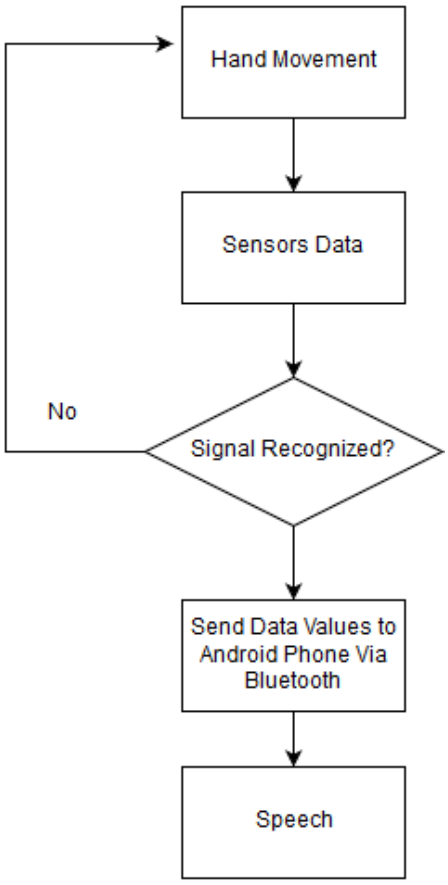

Figure 4.7: SignTalk Flow Diagram

4.4.2 The Animator system flow Shown Below :

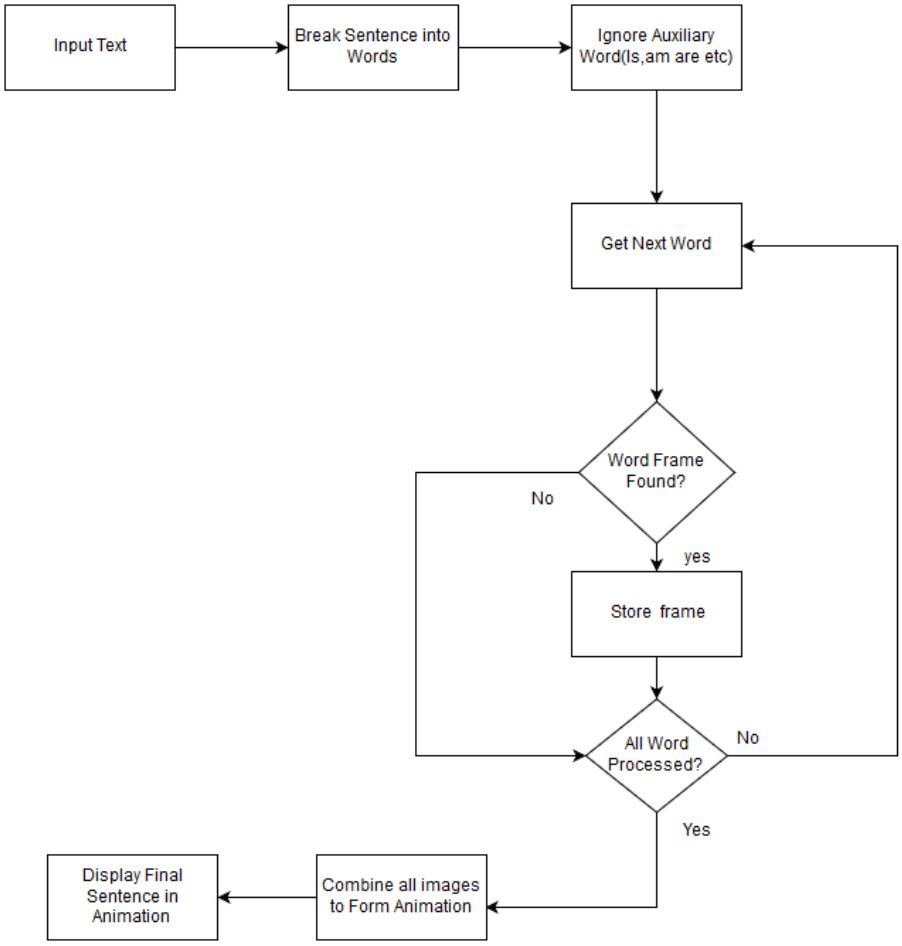

Figure 4.8: Animator Flow Diagram

Chapter 5

Methodology

5.0.1 SignTalk (Sign Language Interpreter)

SignTalk consists of sensors (flex, accelerometer, gyroscope) Arduino Nano and Bluetooth placed on the hand, then micro controller converts the hand movements into audio. The device is built as a wearable glove, which converts the hand gestures into human recognizable audio. Flex sensors are placed on the glove measures finger bend, accelerometer measures the angle made by the arm with respect to earth, gyroscope measures the angular velocity of hand movement, all these analog signals are provided to an ATmega 328P micro controller and are then converted to converted to digital values by ADC inbuilt in micro controller. Micro controller recognizes these values by comparing it to predefined range of values and sends it to smart phone via Bluetooth. Smart phone again identifies the data from Arduino and checks for its corresponding gestures values in database and plays the gesture audio accordingly.

Our system is divided into 4 modules.Each module has its own role in contributing the overall system process.The components are as Follows:
1. Accelerometer and gyroscope module
2. Fingers flex sensor module
3. Arduino Nano processing and recognition module
4. Android smart phone module.

1. Accelerometer and Gyroscope Module:

In this module data from accelerometer is captured in order to measure the angle made by hand with respect to earth.Gyroscope is used to measure change in angular velocity.All this data is collected and given to Arduino Nano for further processing.

The system architecture of module 1 is shown below:

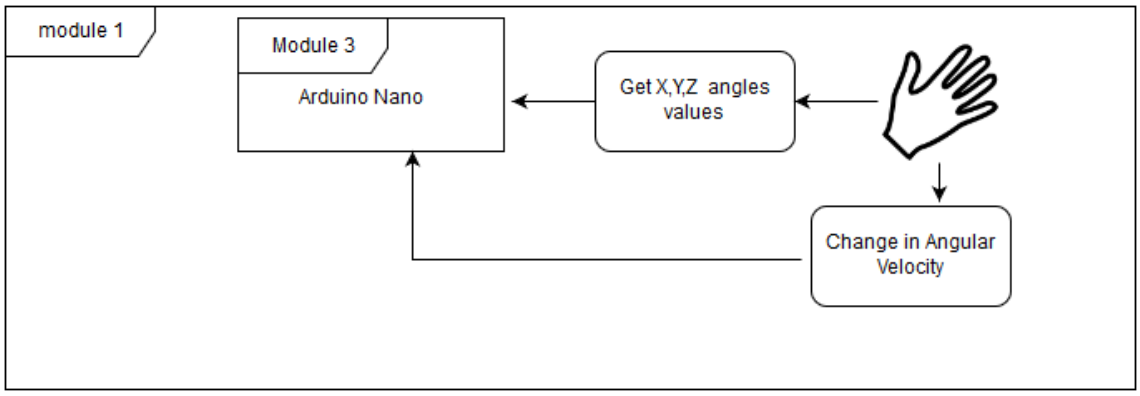

Figure 5.1: Accelerometer and Gyroscope Module

2. All Finger Flex Sensor Module:
The system architecture of module 2 is shown below:

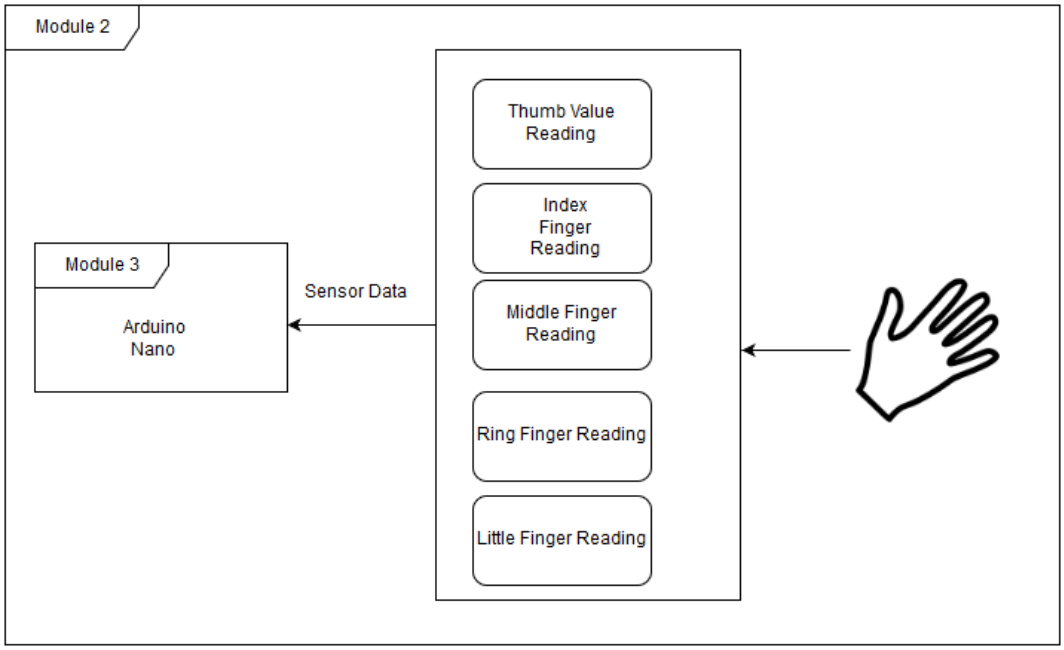

Figure 5.2: All Finger Flex Sensor Module

In this module data from flex is captured due to bending of finger.According to Ohm's Law V=IR as resistance changes their is change in voltage. Hence this change in voltage is given as analog signal to Arduino Nano for further processing.

3. Arduino Nano Processing and Recognition Module:
The System Architecture of module 3 is Shown Below:

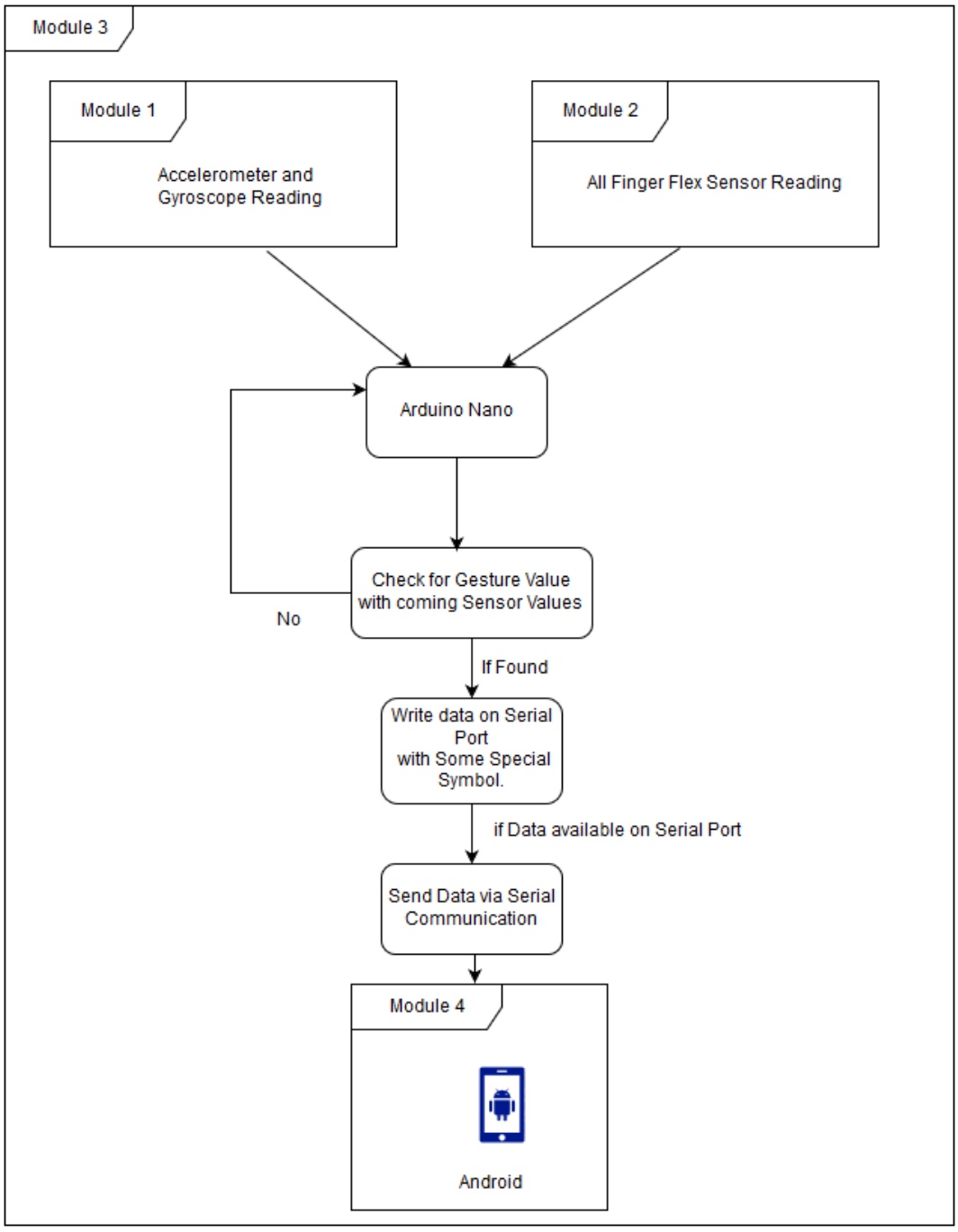

Figure 5.3: Arduino Nano Processing and Recognition Module

In this module data from flex,accelerometer and gyroscope is given to Arduino.Arduino matches this signal with pre-defined values and check for any gesture is possible.If found then write the data on serial port with some special symbol as a terminator and is ready to transmit data to smart phone Via bluetooth.

4. Android Smart Phone Module:
The System Architecture of module 4 is Shown Below:

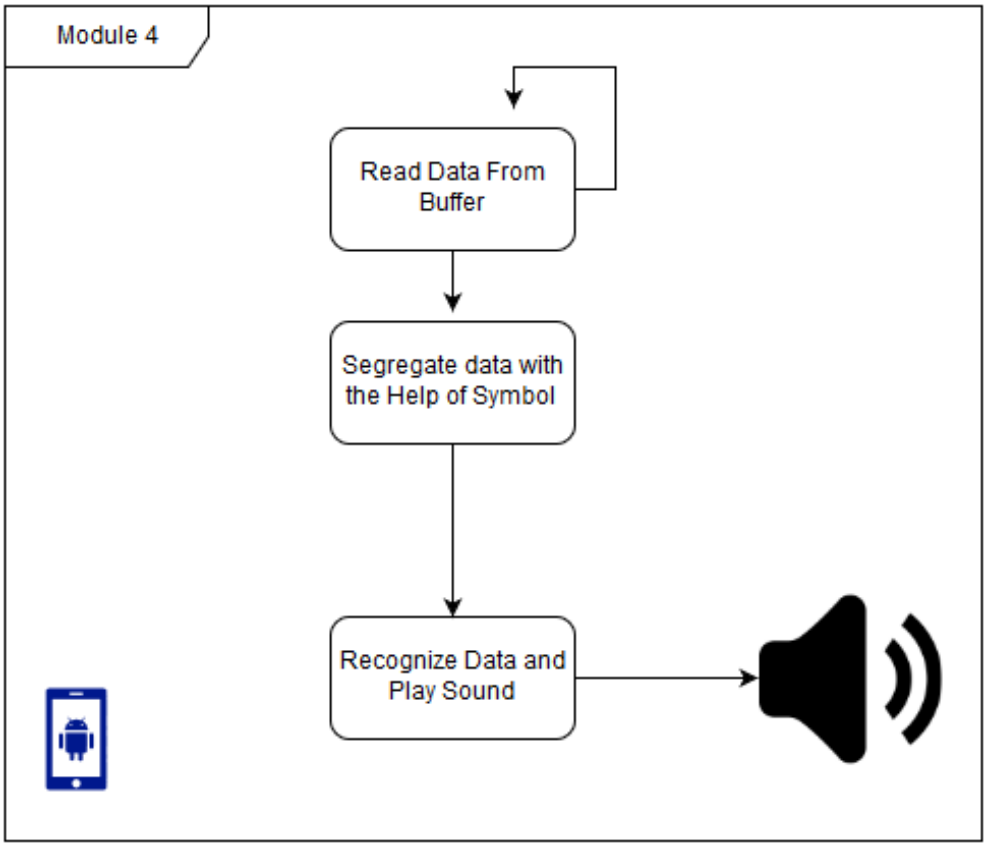

Figure 5.4: Android Smart Phone Module

5.0.2 Animator

Animator provides two way communication. Animator can be used when an abled person wants to talk to hear deaf and mute person. An abled person unknown of sign language can communicate with deaf and mute community using animator. The proposed application aims in providing an android based sign language synthesis output for the speech and hearing impaired. It based on the concept of flip book animation.In this application user gives text input for which gesture can be generated. The input text is chopped and each frame correspond to that word is fetched from database. All frames are fetched and combines in same way as the input sequence.All frames are play giving a view of 2D animation.Moreover the application may be used as a teaching tool for relatives of deaf and dumb people as well as people interested in learning the SL.

Example :

Suppose we want to convey a gesture that : "WHAT IS YOUR NAME".As per algorithm the auxiliary words are removed.In this case "is" is an auxiliary word that gets filtered by the algorithm and left with "WHAT","YOUR","NAME".Each word frame is fetched from database as shown in figure below.Each frame is stored as per order of sentence. For example "WHAT" is the first letter it's frame is fetched and stored.Likewise for "YOUR" and "NAME".This is stored and is given to the combiner which combines all this fetched frames and play each whole sentence as a 2D animation.

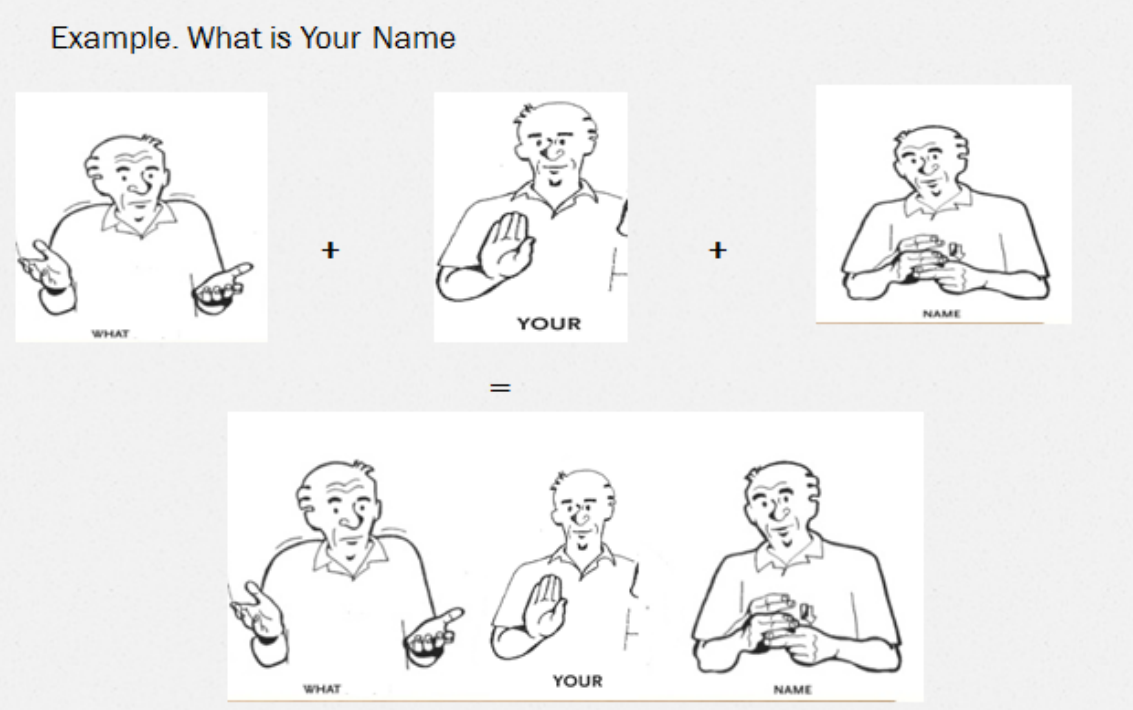

Figure 5.5: Animator Example:

Chapter 6

Implementation Details

6.1 Assumptions And Dependencies

6.1.1 Assumptions

1.We assume that the smaller flex sensor should cover the entire hand's fingers or gloves must be tightly fitted.
2.User must be trained and should know about how to perform specific action in India Sign Language.

6.1.2 Dependencies

1.Bluetooth Enabled Phone.
2.Android phone must be Above 4.3.

6.2 Implementation Methodologies

Animator

Animator is based on flip book concept.
In **Resource** we have made frames for particular word. For example what is a folder it contain(1.png,2.png....upto 5 frame) which is stored in your system.Similarly different words are stored in system in their respective folder.

In **Implementation** we have used the concept of multithreading.We have 3 threads.
1.Main thread which shows UI.
2.Change resource thread to check for existence of folder.
3.Change image thread which fetch images one by one from folder and display it.

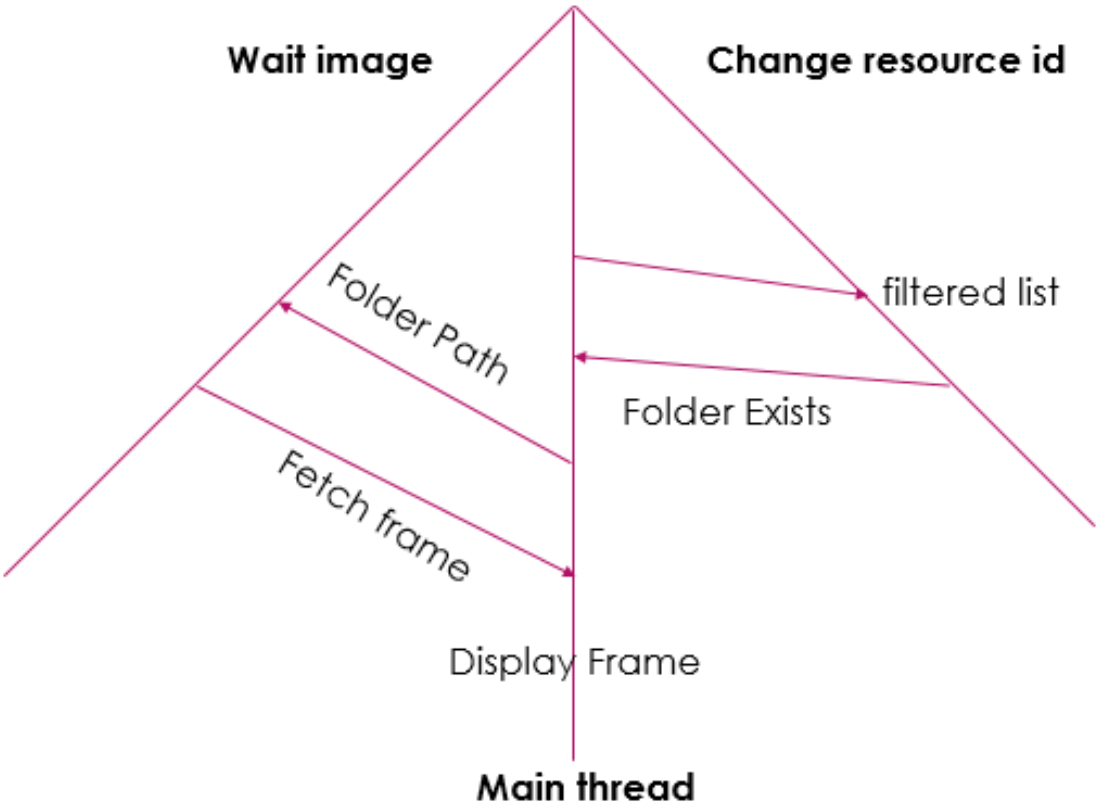

Figure 6.1: Animator Working

Interpreter
Interpreter in android receives data from arduino using serial communication.A thread is continuously running and receiving gesture identified by Arduino.With the help of handler the data is passed to main activity where we find a .wav file corresponding to gesture name received.
For example four is identified by Arduino.Arduino will append '' with Four i.e 'Four' and will send to Android phone.The thread which is running will remove '' as it acts as a delimiter and send the remaining data to main activity via handler.In main activity we search 'Four.wav' and then plays it.
Figure shows the procedure.

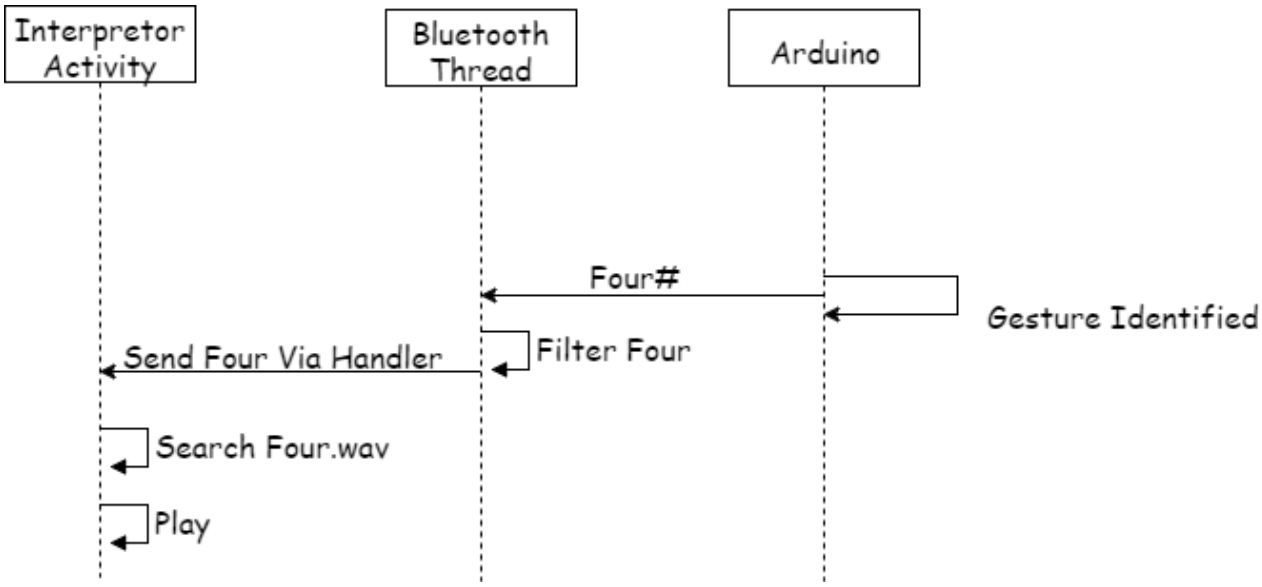

Figure 6.2: Interpretor Working

Chapter 7

Results and Analysis

7.1 Test cases and Result

Animator

Software Input Test: Input with punctuations and mispelled.
Software Output Test: Punctuations is removed and filtered.
Error: No error is found.

Software Input Test: Input with proper word.
Software Output Test: Animator show output.
Error: No error is found.

Interpretor

Software Input Test: Input with gesture related with Indian sign language.
Software Output Test: Sound output and Arduino serial port output.
Error: No error is found.

Software Input Test: Input with both hand gesture.
Software Output Test: Sound output.
Error: Little jumbled output due to synchronization.

7.2 Analytical Discussion

Animator Output
Example: What is your name.

Figure 7.1: what

In the above figure according to the input given as per arranged in queue.what is the first word to be displayed.Each frame is shown for 1.5 Sec.Fig 7.2 shows what frame

Figure 7.2: your

In the above figure according to the input given as per arranged in queue.your is the second word to be displayed.Each frame is shown for 1.5 Sec.Fig 7.2 shows your frame

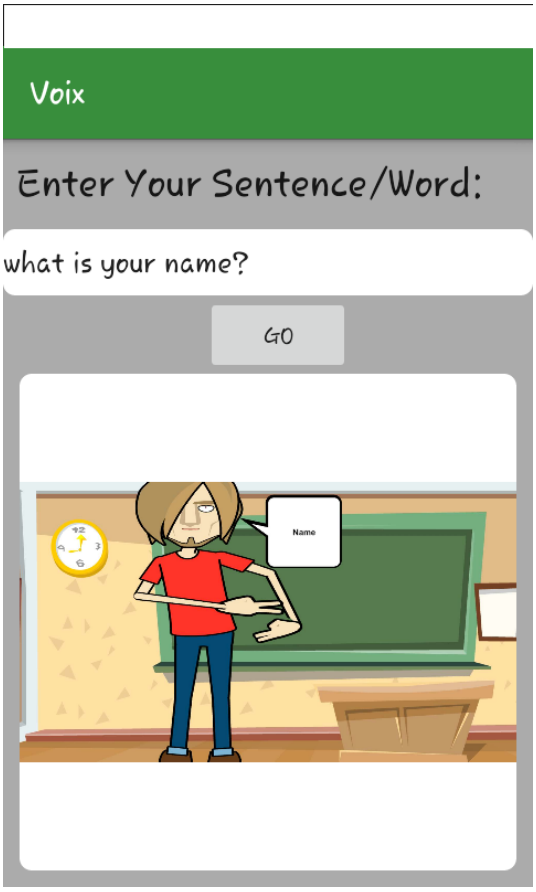

Figure 7.3: name

In the above figure according to the input given as per arranged in queue.name is the second word to be displayed.Each frame is shown for 1.5 Sec.Fig 7.2 shows Name frame

Hardware Input: In Fig. 7.6 we had given hardware input as 'my Gesture' using hand gloves.
Hardware Ouput: In Fig. 7.5 we got output at serial monitor.

Figure 7.4: my

Figure 7.5: my Detection

Hardware Input: In Fig. 7.6 we had given hardware input as 'your Gesture' using Hand Gloves.
Hardware Ouput: In Fig. 7.7 we got output at serial monitor.

Figure 7.6: your

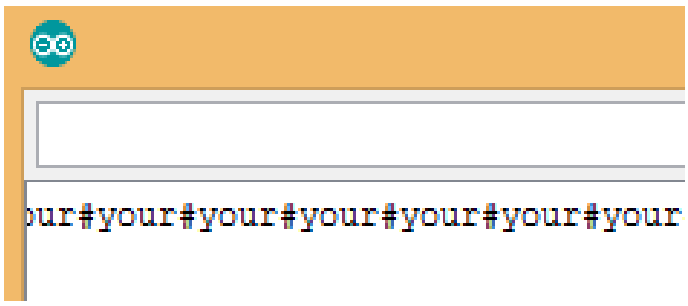

Figure 7.7: your Detection

Hardware Input: In Fig. 7.8 we had given hardware input as 'two Gesture' using Hand Gloves.
Hardware Ouput: In Fig. 7.9 we got output at serial monitor.

Figure 7.8: two

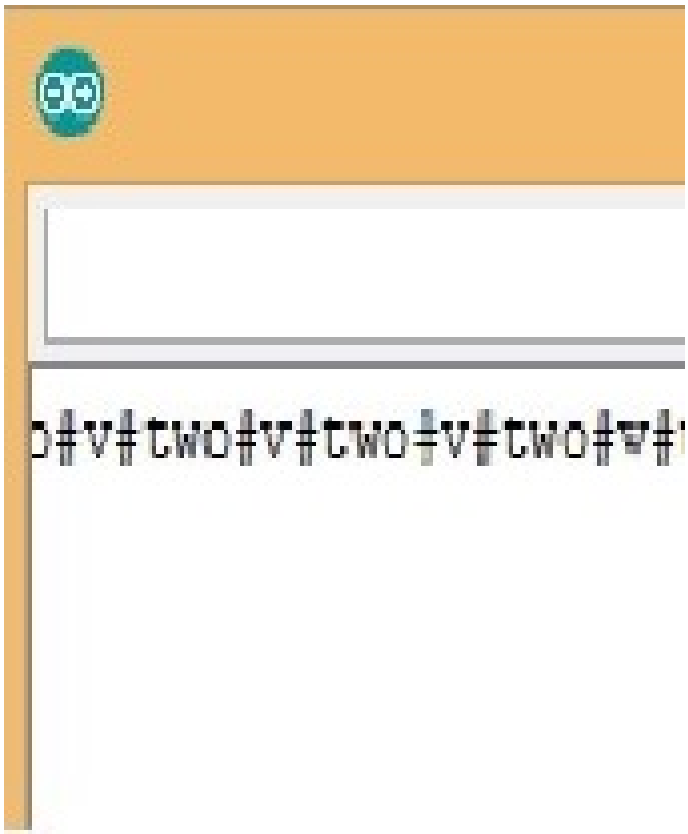

Figure 7.9: two Detection

Chapter 8

Conclusion and Future Scope

8.1 Conclusion

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 as they have to depend o human translators. This project aims to lower the communication gap between the deaf and the normal world. With this project deaf and mute people can use the gloves while communicating so that hand movements will be converted into speech, understandable by others. There are over 70 million deaf and mute people in the world, our system will revolutionize the way they interact with others. With our system, they can achieve a new level of independence and an improved quality of life. In India there are about 1.5 million people using Sign Language, so it becomes very easy for them to convey almost all gestures with the gloves .To make it more acceptable in today's world we have provided an Android application which will act as a an interpreter between them and us who are unaware of SL. Animator will help us to find appropriate SL while communicating to the deaf and mute. Also, in this project animator plays another important role in understanding and learning Sign Language. The project also provides two way communication by mapping spoken language text to animation.

8.2 Limitations

Some of the words have same hand orientation, thus the user have to wait until they get the desired output.

8.3 Future Enhancement

In future implementation the concept of learning system can be incorporated in this project, where a user can record his hand orientation in space in order to his own unique sign for particular verbal sentence. For example, a user can use a gesture telling his/her name as our finger can bend up to 90 degrees, each change in degree (Bending) can cause a different reading. Hence For 10 Fingers there are lot of possible combinations, which can be obtained by using probability. This data can be used to propose a new standard Sign Language recognized globally. Due to advancement in technology there is huge development in mobile phones with high graphics processor. Animator can be further enhanced to render 3D animation with the help of high-end Smart Phone.

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Chapter 9

Appendix A

9.1 Circuit Layout

To optimise the hand gloves, i.e. to reduce wires in the circuit, to make it as compact as possible. We have designed an optimized circuit layout for the entire system.

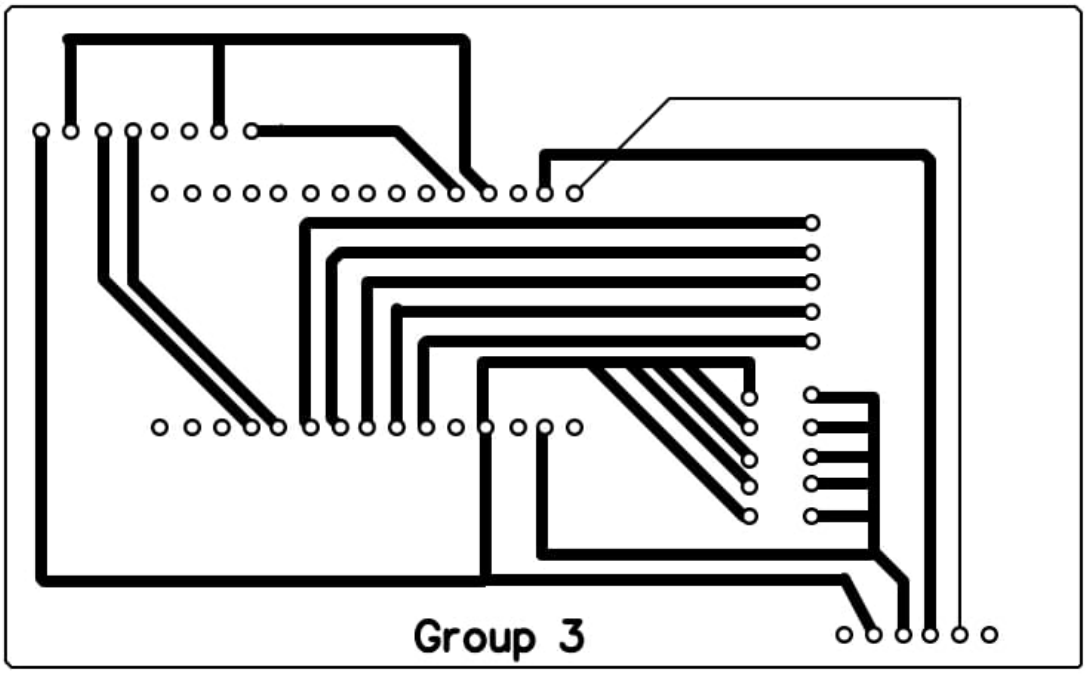

Figure 9.1: Circuit Layout

9.2 Flex Data Values Test Run Values

Letter	Thumb Value	Index Value	Middle Value	Ring Value	Little Value
A	80-110	155-190	200-240	90-130	120-150
B	90-170	70-90	120-150	60-80	70-90
C	85-120	85-140	15-190	60-90	70-90
D	110-170	80-100	210-255	100-140	95-160

Table 9.1: Flex Sensor Test Values

9.3 pin configuration

9.3.1 Gyroscope

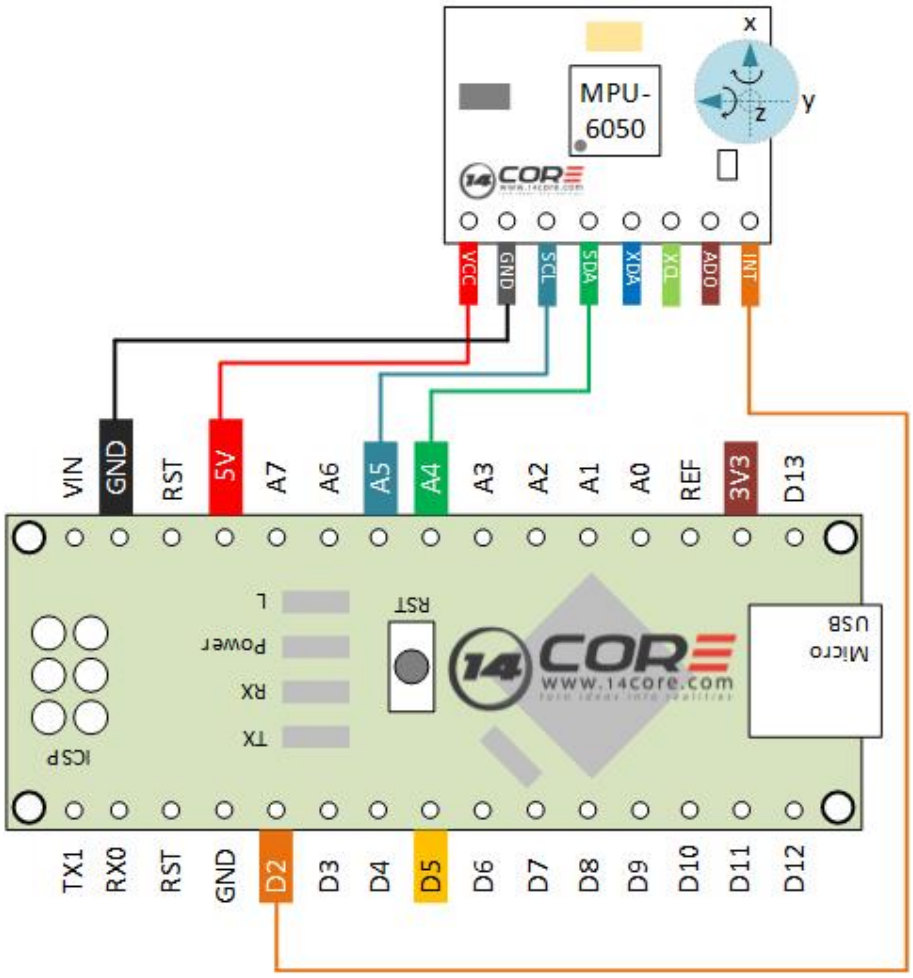

Figure 9.2: Pin diagram of Gyroscope

9.3.2 Accelerometer

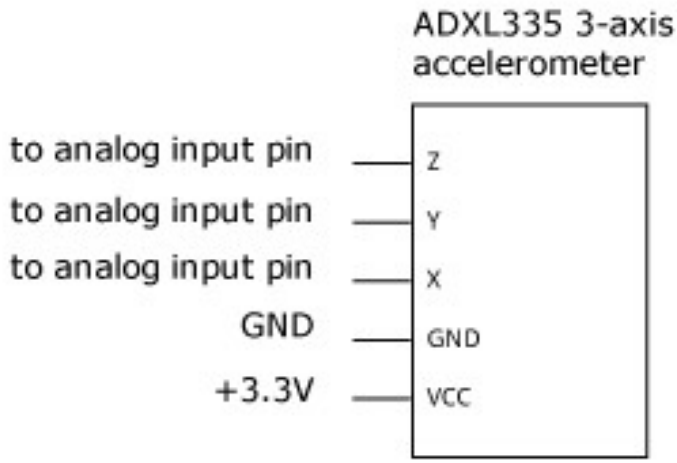

Figure 9.3: Pin diagram of Accelerometer

9.3.3 Bluetooth

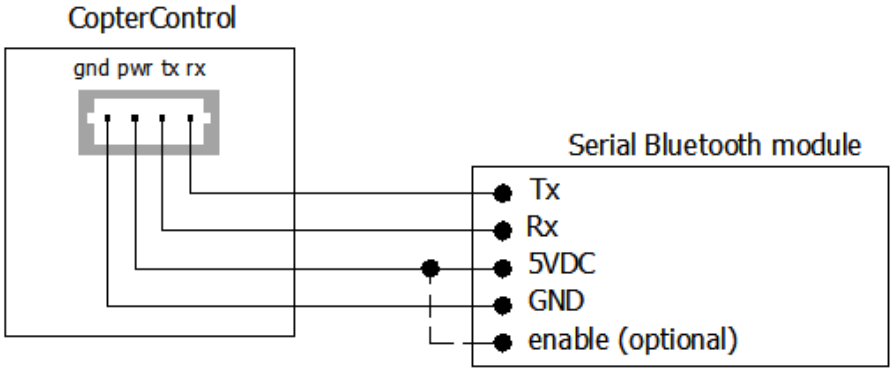

Figure 9.4: Pin diagram of Bluetooth

9.3.4 Arduino nano pin diagram

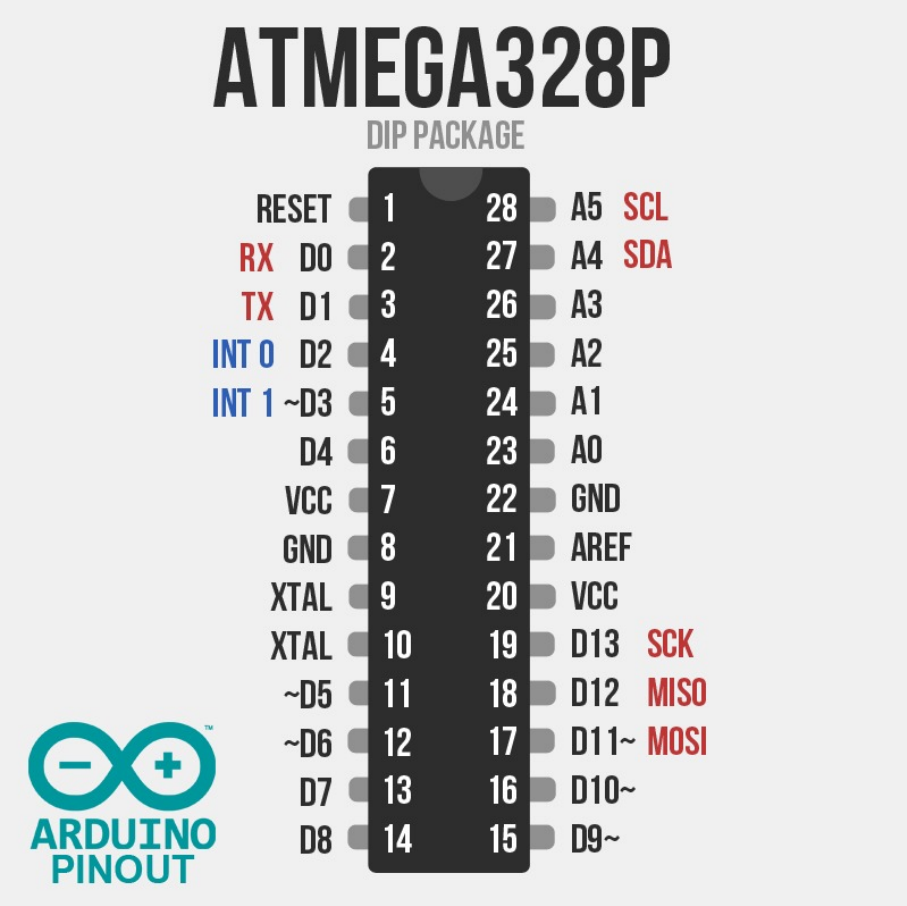

Figure 9.5: Pin diagram of Arduino nano

9.4 Connections

A0(Analog pin 0)-Thumb Finger
A1(Analog pin 1)-Index Finger
A2(Analog pin 2)-Middle Finger
A3(Analog pin 3)-Ring Finger
A4(Analog pin 4)-SDA MPU 6050
A5(Analog pin 5)-SCL MPU 6050
A6(Analog pin 6)-Little Finger
A7(Analog pin 7)-Accelerometer
RX-Bluetooth pin TX
TX-Bluetooth pin RX
D2-INT MPU 6050
VCC- MPU 6050,BLUETOOTH,FLEX
GND- MPU 6050,BLUETOOTH,FLEX

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Shaikh Ruba Iqbal Nazeema
Roll No: 13CO12

Biya Haseeb Habib Nasrin
Roll No: 13CO21

Siddiqui Sayma Atik Sabeeha
Roll No: 13CO14

Khot Sufiyan Iqbal Arifa
Roll No: 12CO41
(Department of Computer Engineering)
University of Mumbai.

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SignTalk and Animator for Speech and Hearing Imapired

Haseeb Biya[1], Ruba Shaikh[2], Sayma Siddiqui[3], Sufiyan Khot[4]

Bachelor of Engineering, Computer Department, AIKTC, Panvel, India[1,2,3,4]

Abstract: Communication is basic fundamental human right, however who are deaf and mute communicate differently than everyone else using Sign Language (SL), while we communicate verbally. This puts them at disadvantage. Our system will help them better communicate with rest of the world without changing how they already interact with each other. The system i.e. Hand gloves will translate sign language to voice. flex sensors, accelerometer, gyroscope, are placed on hand gloves to capture hand movements. Arduino Nano recognizes these signals and sends them to smart phone via Bluetooth for voice generation. Animator is an android application that takes text sentences as input and converts it to 2D animations for facilitating two-way communication.

Keywords: Arduino Nano, Bluetooth Module, Accelerometer, Smart Phone, Flex Sensors, MPU60506-Axis Gyro Sensor Module, Android Studio, Sign Language(SL).

I. INTRODUCTION

The Deaf and mute community use Sign Language for conveying their thoughts. Sign Language involves simultaneous combining hand shapes, orientation and movement of hands, arms to express thoughts. While it's easy for them to communicate amongst themselves using sign language, the general public often finds it difficult to follow these gestures.

Interpreters are needed in such cases, It can be quite frustrating for them to constantly depend on interpreter whilst communicating with their peers. These People are treated differently.Thus creating a gap between normal people and them.Sign Language is not universal.

When India ratified the United Nations Convention on the rights of persons with disabilities (UNCRPD), India made a promise to the world that she would ensure that dumb and deaf people will be treated equally and will enjoy the same rights as other Indiancitizens.

But the absence of such a common sign language proves to be a hurdle in the efforts to treat the hearing and speech impaired people equally. As most of the people prefer cell phone for completing their chores the usage of smart phones has increased tremendously, thus use of cell phone as an interpreter makes it more portable and easy to use.

II. PROJECT ARCHITECTURE

The System Has Two Modules:

A. Sign Language Interpreter (Hand gloves).
B. Animator (Android application).

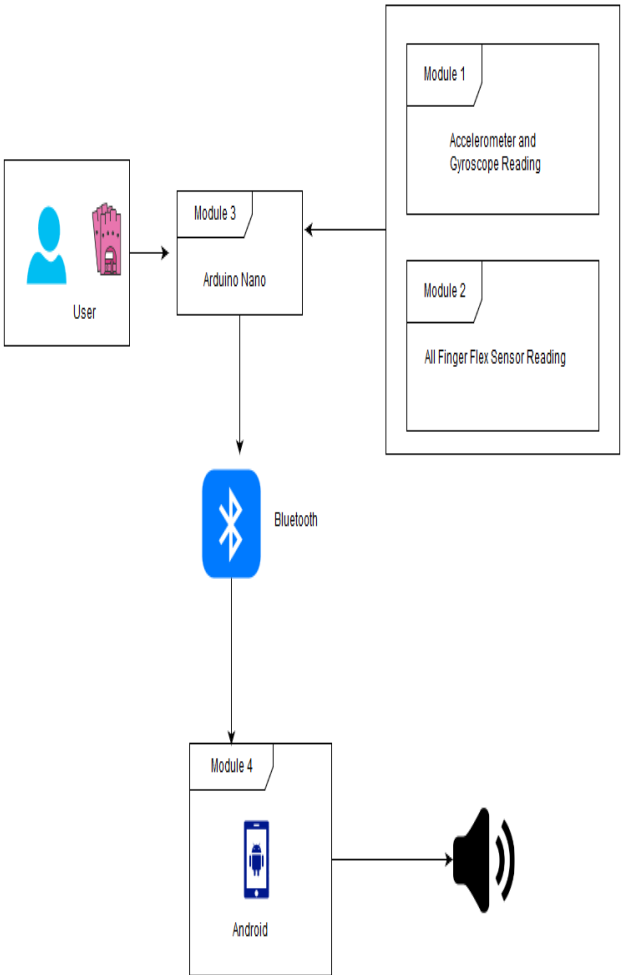

Fig. 1. Overall architecture of Interpreter

A. Sign Language Interpreter.
The overall system architecture is shown below:

B. Animator.
The overall system architecture is shown below:

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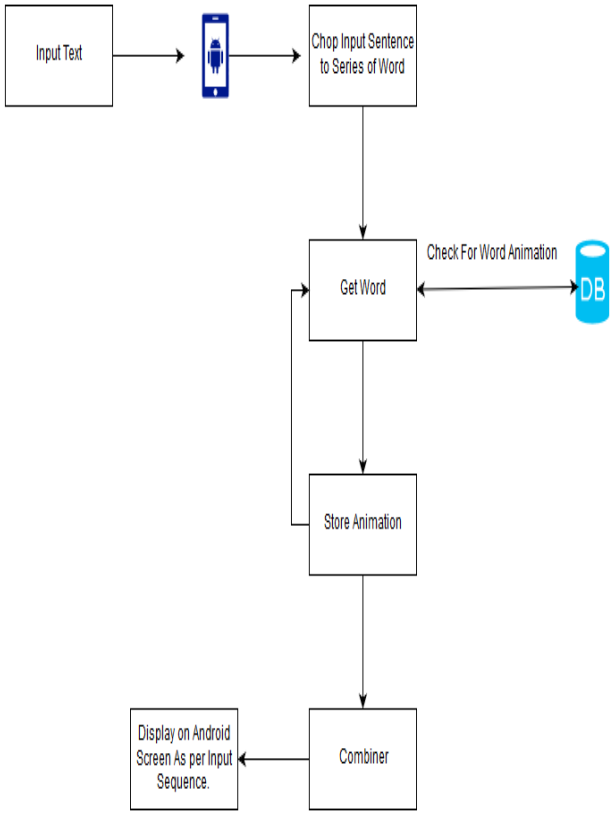

Fig.2. Overall architecture of Animator

III.METHEDOLOGY

A. SignTalk(Sign Language Interpreter).
SignTalk consists of sensors (flex, accelerometer, gyroscope) Arduino Nano and Bluetooth placed on the hand, then microcontroller converts the hand movements into audio. The device is built as a wearable glove, which converts the hand gestures into human recognizable audio. Flex sensors are placed on the glove measures finger bend, accelerometer measures the angle made by the arm with respect to earth, gyroscope measures the angular velocity of hand movement, all these analog signals are provided to an ATmega 328P microcontroller and are then converted to converted to digital values by ADC inbuilt in microcontroller. Microcontroller recognizes these values by comparing it to predefined range of values and sends it to smart phone via Bluetooth. Smart phone again identifies the data from Arduino and checks for its corresponding gestures values in database and plays the gesture audio accordingly.

Our System is divided into 4 modules. The components are as follows:

1. Accelerometer and Gyroscope module.
In this module data from accelerometer is captured in order to measure the angle made by hand with respect to earth. Gyroscope is used to measure the change in angular velocity. All this data is collected and given to Arduino Nano for further processing.

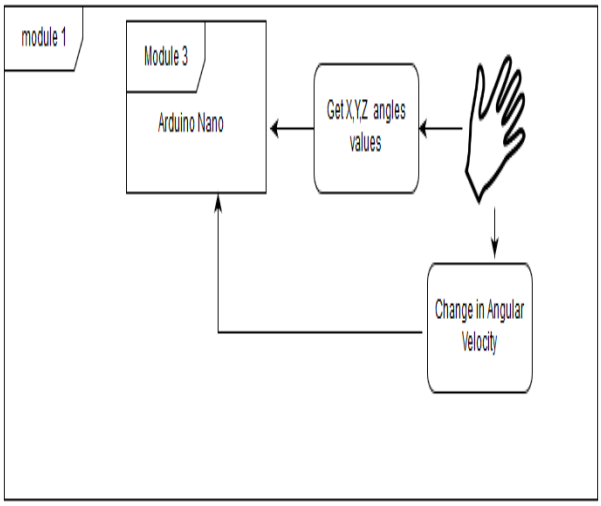

Fig. 3. Accelerometer and gyroscope module

2.All fingers flex sensor module.
In this module data from flex sensors placed over each finger is captured due to bending of finger. According to Ohm's Law V=IR as resistance changes there is change in voltage. Hence this change in voltage is given as an analog signal to Arduino Nano for further processing.

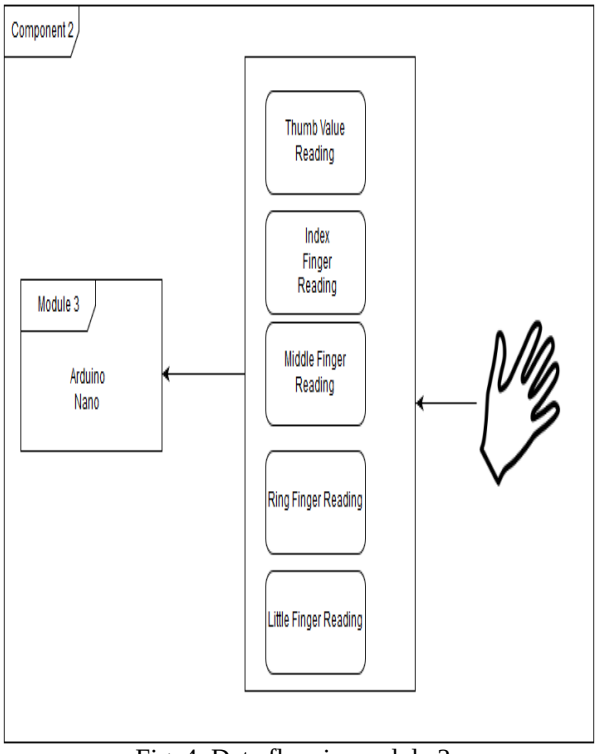

Fig. 4. Data flow in module 2.

3. Arduino Nano processing and recognition module.
In this module data from flex sensors, accelerometer and gyroscope is given to Arduino. Arduino matches these signals with pre-defined values and checks for any gesture in database. If found, then write the data on serial port with some special symbol as a terminator and is ready to transmit data to smart phone via Bluetooth.

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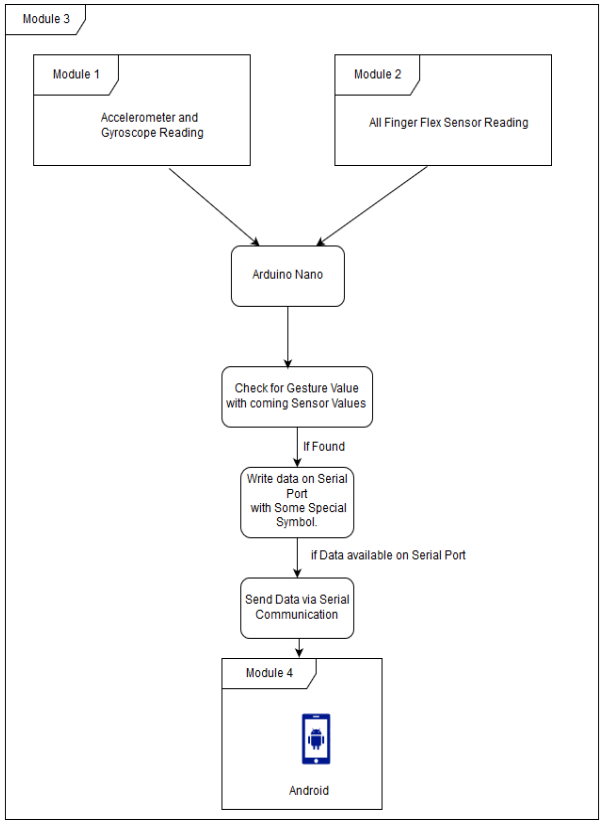

Fig.5. Data flow of module 3.

4. Android smart phone module.

In this module the Bluetooth continuously check for any data available in buffer. If found , then segregate and it checks for matching value audio and plays it.

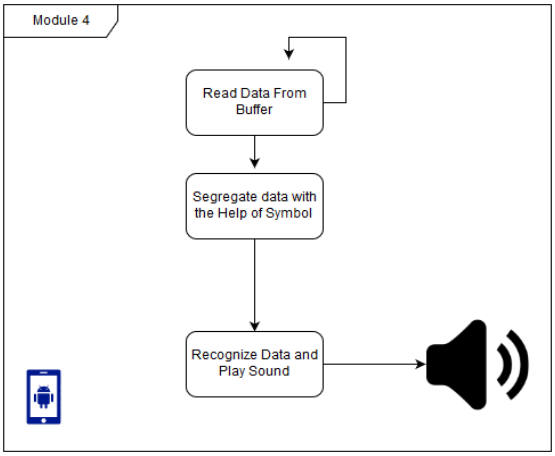

Fig.6. Data flow in module 4.

B. Animator

Animator provides two way communication. Animator can be used when an abled person wants to talk to a deaf and mute person. An abled person unknown of sign language can communicate with deaf and mute community using animator. The proposed application aims in providing an android based sign language synthesis output for the speech and hearing impaired. It based on the concept of Flip Book animation. In this application user gives text input for which gesture can be generated. The input text is chopped and each frame corresponding to that word is fetched from database. All frames are fetched and then combined in same way as the input sequence. All frames are played giving a view of 2D animation. Moreover the application may be used as a teaching tool for relatives of deaf and dumb people as well as people interested in learning the SL.

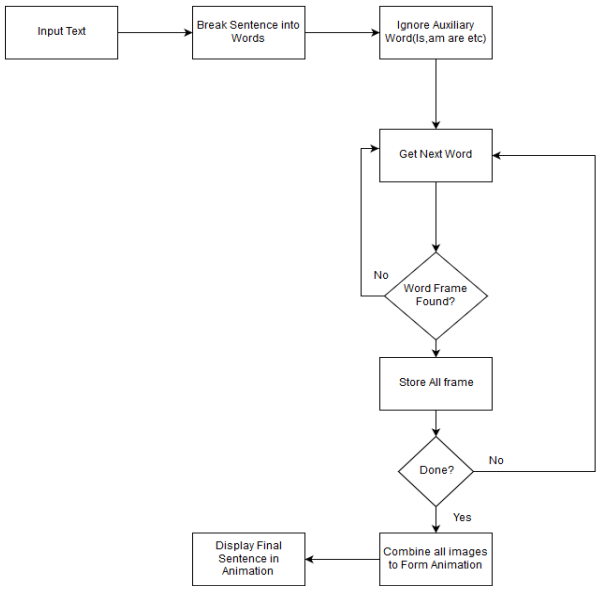

Fig.7. Animator flow chart

Example:

Suppose we want to convey: "WHAT IS YOUR NAME".As per algorithm the auxiliary words are removed. In this case "is" is an auxiliary word that gets filtered by the algorithm and left with "WHAT", "YOUR", "NAME". Each Word frame is fetched from database .Each frame is stored as per order of sentence. The stored frames are then given to the combiner which combines them and then plays the frames which appears to animate by simulating motion giving the view of 2D animation.

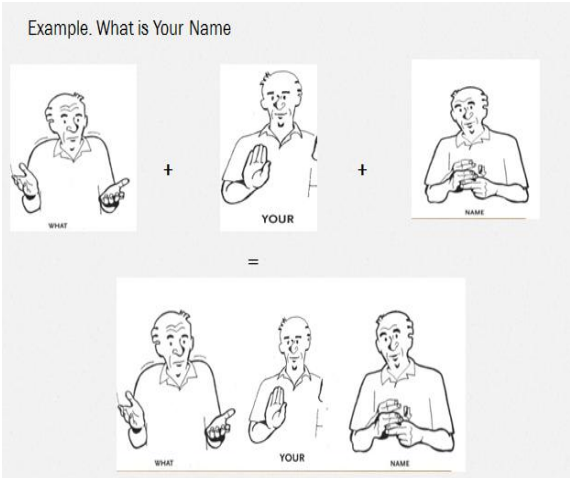

Fig. 8. Animator Example.

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IV. SOFTWARE HARDWARE REQUIREMENTS

A. Arduino IDE:
The Arduino IDE is an Open-Source software used to provide instructions to microcontroller. It provides an environment where you can write code and upload it to your microcontroller. It is available for Windows, Linux and MAC operating system based computers.

Fig. 9. Arduino IDE

B. Android Studio:
Android Studio is an Open-Source Integrated Environment for Developing Android Application.

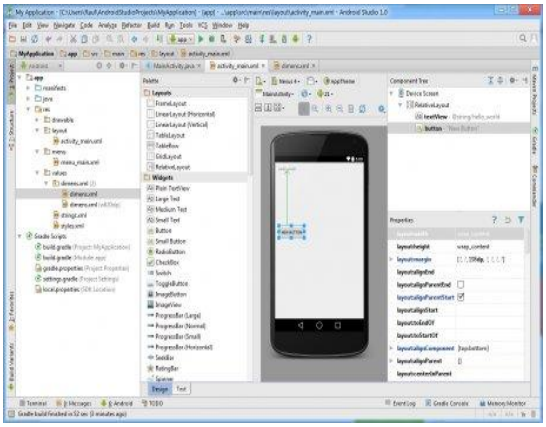
Fig. 10. Android Studio.

C. Flex Sensors:
Flex sensors are sensors that change resistance depending on the amount of bend on the sensor. They are analog sensors. Now the bending of each finger results in certain voltage drop this data from flex is sent to ATMEGA328P. Next step is to combine the movement of each finger and name it a particular gesture of the hand.


Fig. 11. flex sensor.

D. Accelerometer:
Accelerometer (ADXL 335) in the SignTalk system is used as a tilt detector. It has an analog output which varies from 1.5 volt to 3.5 volt.ADXL335 is a three-axis analog accelerometer IC, which reads off the X, Y and Z acceleration as analog voltages. By measuring the amount of acceleration due to gravity, an accelerometer can figure out the angle it is tilted at with respect to the earth.

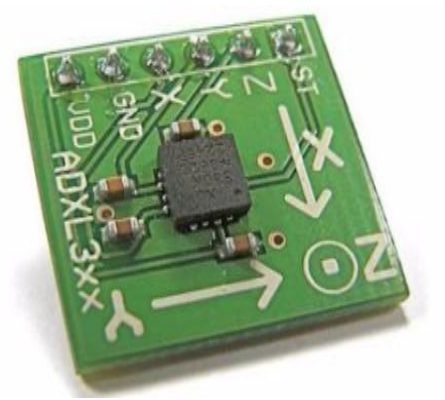

Fig.12. Accelerometer.

E. Gyroscope:
A device consisting of a wheel or disc mounted so that it can spin rapidly about an axis which is itself free to alter in direction. The orientation of the axis is not affected by tilting of the mounting, so gyroscopes can be used to provide stability or maintain a reference direction in navigation systems, automatic pilots, and stabilizers.

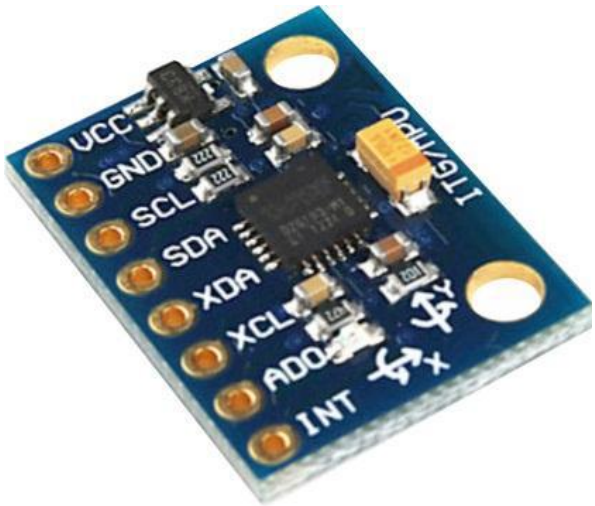

Fig.13. MPU6050 Accelerometer plus Gyroscope.

F. Arduino Nano:
Arduino Nano is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack. It contains everything needed to support the microcontroller. Simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

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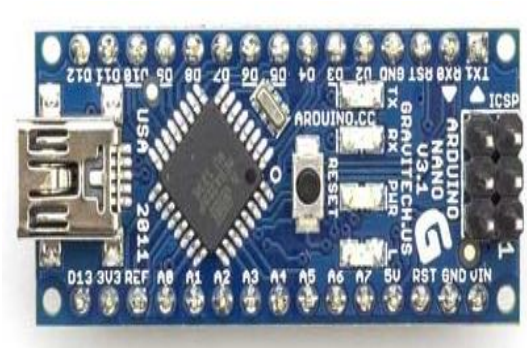

Fig. 14. Arduino Nano resolution

G. Bluetooth:
It captures the recognized signal from Arduino and sends it to smart phone for further processing and voice generation. Here HC-05 Bluetooth module is used.

Fig. 15. Bluetooth

H. Smart phone:
It receives the signal via Bluetooth and compares it with the predefine values and generates audio accordingly. The android phone also compares the input text in the database and corresponding animation from database is fetched and combination of all broken text forms the sign language for the input.

Fig. 16. Smart Phone

V. IMPLEMENTATION

A. SIGNTALK(INTERPRETER)
SignTalk is a Glove that is mounted on both the hands and has sensors over it.Depending upon the hand movements a Gesture is Generated and recognized by ArduinoThe Sensor on Hand Dynamically sets its value i.e. what we call as initialization. Initialization removes any absurd/incorrect values before using that SignTalk.If Initialization Failed, no Connection Will be Made.

Once Initialization is done now the user is allowed to perform Hand Movement that are in Strictly used Indian Sign Language. Arduino will Recognized and send data using Bluetooth.

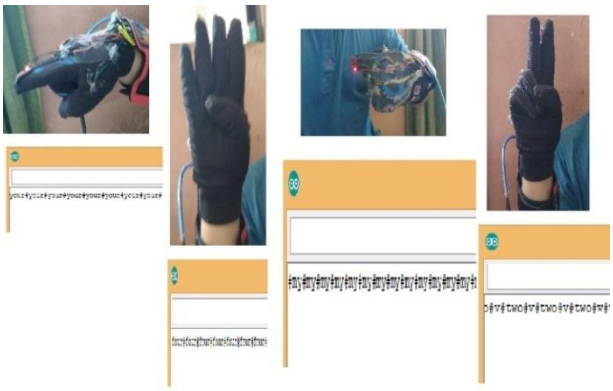

Fig.Testing

B.Animator:
We need to Provide Input of words/Sentences and then frames will be fetch from System and will be Displayed on Screen.

Fig.What

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Fig.Your

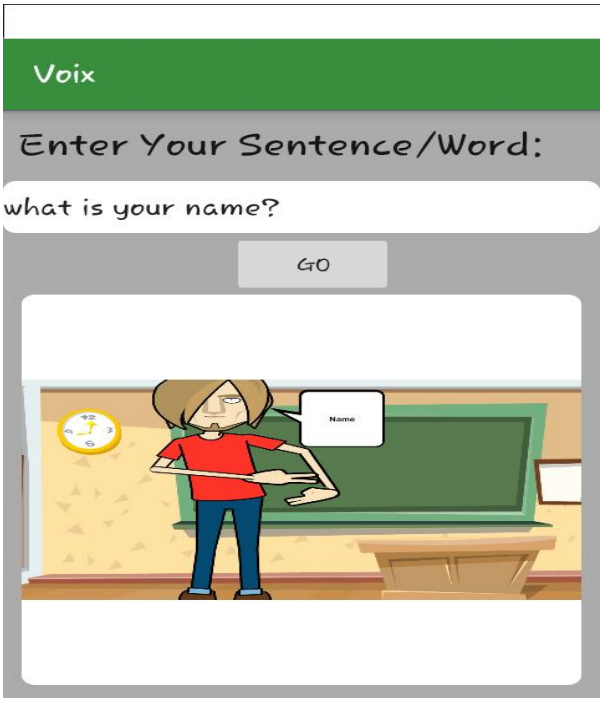

Fig.Name

V. IMPLEMENTATION

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 as they have to depend on human translators. This project aims to lower the communication gap between the deaf and the normal world. With this project deaf and mute people can use the gloves while communicating so that hand movements will be converted into speech, understandable by others. There are over 70 million deaf and mute people in the world, our system will revolutionize the way they interact with others. With our system, they can achieve a new level of independence and an improved quality of life. In India There are about 1.5 million people using Sign Language, so it becomes very easy for them to convey almost all gestures with the gloves. To make it more acceptable in today's world we have provided an Android App which will act as an interpreter between them and us who are unaware of SL. Animator will help us to find appropriate SL while communicating to the deaf and mute. Also, in this project animator plays another important role in understanding and learning Sign Language. The project also provides two-way communication by mapping spoken language text to animation.

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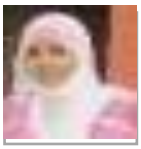
BIOGRAPHIES

SaymaSiddiiqui, currently a final year student at AIKTC, Panvel, Mumbai University. She is pursuing Bachelor of Computer Engineering Degree.



Ruba Shaikh, currently a final year student at AIKTC, Panvel, Mumbai University. She is pursuing Bachelor of Computer Engineering Degree.

HaseebBiya, currently a final year student at AIKTC, Panvel, Mumbai University. He is pursuing Bachelor of Computer Engineering Degree.

Sufiyan Khot, currently a final year student at AIKTC, Panvel, Mumbai University. He is pursuing Bachelor of Computer Engineering Degree.

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HASEEB BIYA

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RUBA SHAIKH

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SUFIYAN KHOT

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