SMART GLOVE SIGN LANGUAGE CONVERTER

Submitted in partial fulfillment of the requirements

for the degree of

Bachelor of Engineering

by

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Certificate

This is to certify that the project entitled **Smart Glove Sign Language Converter** is a bonafide work of **Akshay Dongare (Roll No:09)**,**Prathamesh Inamdar (Roll No:19)**,**Rahul Iyengar (Roll No:21)**,**Ganesh Kumble (Roll No:37)** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Undergraduate** in **DEPARTMENT OF INFORMATION TECHNOLOGY**.

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This project report entitled **SMART GLOVE SIGN LANGUAGE CONVERTER** by **Akshay Dongare (Roll No:09)**,**Prathamesh Inamdar (Roll No:19)**,**Rahul Iyengar (Roll No:21)**,**Ganesh Kumble (Roll No:37)** is approved for the degree of **DEPARTMENT OF INFORMATION TECHNOLOGY**.

Examiners

1.....

2.....

Date.

Place.

Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I 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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Abstract

In Abstract—Human beings interact with each other to convey their Ideas, thoughts, and experiences to the people around them. But this is not the case for deaf-mute people. Sign language paves the. Way for deaf-mute people to communicate. Through sign language, Communication is possible for a deaf-mute person without the means of acoustic sounds.

The aim behind this work is to develop a system for recognizing the sign language, which provides communication between people with speech impairment and normal people, thereby reducing the communication gap between them.

Compared to other gestures (arm, face, head and body), hand gesture plays an important role, as it expresses the user's views in less time. In the current work flex sensor-based gesture recognition. Module is developed to recognize English alphabets and few words and a Text-to-Speech synthesizer based on HMM is built to convert the corresponding text

Acknowledgements

It is an opportunity of immense pleasure for us to present the Mini project report on" SMART GLOVES AND SIGN LANGUGAE CONVERTOR." expressing our heart left gratitude to all those who have generously offered their valuable suggestions towards the completion of this report. It's rightly said that we are built on the shoulders of others for all our achievements. The credit goes to my professor Prof V.M. Kharche whose positive attitude, moral support and encouragement lead to the success of the report. Her generous help, excellent guidance, lucid suggestions and encouragement throughout the course of this work have greatly helped us in successful completion of this work, KONKAN GYANPEETH COLLEGE OF ENGINEERING, KARJAT Last but not least we thankful to all those who helped directly and indirectly in completion of this work.

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Chapter 1

INTRODUCTION

1.1 Introduction

Deaf-mute people need to communicate with normal people for their daily routine. The deaf-mute people throughout the world use sign language to communicate with other people. However, it is possible only for those who have undergone special training to understand the language. Sign language uses hand gestures and other means of non-verbal behaviors to convey their intended meaning. It involves combining hand shapes, orientation and hand movements, arms or body movement, and facial expressions simultaneously, to fluidly express speaker's thoughts. The idea is to create a sign language to speech conversion system, using which the information gestured by a deaf-mute person can be effectively conveyed to a normal person. The main aim of this work is to design and implement a system to translate finger spelling (sign) to speech.

1.2 Objectives

The project came into existence for one sole purpose, to help the deaf community to easily communicate and interact with their nearby surrounding. The aim is to convert basic symbols that represent the 26 English alphabet as mentioned under ASL (American Sign Language) script and display them on a smart phone screen using Bluetooth app. The following points are the tasks done in this project :

1. Construct a glove that recognizes hand gestures with help of flex sensors.
2. According to hand gestures the glove will recognize the gesture and will display the corresponding output.
3. Built an android app in which the output will be displayed and will be shout out loud via device speaker.

1.3 Purpose, Scope, and Applicability

Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:

1.3.1 Purpose

- Purpose of this project is to help the blind and deaf people and to make them capable to understand alphabets and to learn them by using hand gestures and sign language .
- The project was inspired with the idea of controlling robotic arm with the help of hand movements,most of the working is same but implementing the remaining part is rather a complex task.
- Accelerometer is used to measure the tilt in the palm. Five bend sensors are placed on a glove, four for the fingers and one for the thumb.

1.3.2 Scope

This tool can be:

- Further integrated with various services and help to generate employment for the deaf and dumb people.
- Geared up with the controller to provide home automation on finger tips.
- Paired up with fitness sensor to monitor health of the individual.

1.3.3 Applicability

There are various field in which this concept can be applied :

- This project can be used to helf blind and deaf community to understand alphabets and various characters .
- This concept can be used in robotics for arm moments or other parts moment .
- It can be use in home automation to control various parts of home such as lights , fan ,ac , tv etc.
- It can be used for narration purpose in library or other places such as schools or university.

1.4 Achievements

Achievements: Explain what knowledge you achieved after the completion of your work. What contributions has your project made to the chosen area? Goals achieved describe the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.

1.5 Organisation of Report

The materials presented at the workshop are organized into Seven chapters.

After this introductory

- Chapter1 is Introduction
- Chapter2 describes the literature survey in which we are going to discuss about the following literature that is related to our project .
- Chapter 3 summarizes the survey of technology that is been observed by various literature papers and case studies .
- Chapter 4 provides an account on project proposal which will include topics such as
    1. problem definition .
    2. requirements specification.
    3. software and hardware requirements
    4. preliminary product description .
    5. project plan .
- Chapter 5 presents the conclusions of our project .

Chapter 2

LITERATURE SURVEY

2.1 Literature Survey

In literature, the usage of data gloves has been found to be cumbersome and restrictive in the gestures which are possible in real applications and use of light weight sensors and reduced.

Number of bend sensors help in alleviating this problem while maintaining a high degree of recognition accuracy.

The main reason behind using flex Sensors is that the bend sensors have a limited sensing capability and unable to sense further bending beyond a certain threshold.

As mentioned in the abstract the glove is aimed at benefiting people with hearing and speech impairment. It can enable such differently abled persons to communicate normally with other people without a sense of inferiority or embarrassment.

The further modifications to the decoding procedure it can even enable a differently abled person to give a speech in a conference, thereby helping the truly talented minds, lacking the powers of speech and hearing, in expressing their ideas. Such a method has been tried and reported in literature

Flex sensors are sensors that change resistance when bent therefore its change in resistance can either be increasing or decreasing depending on the type of flex sensors used.

This concept shows that if flex sensors are placed at the joints of fingers, they can be used to determine if fingers are bent or not. Given five fingers with two states each, one for bent and one for relaxed, finger gestures could easily be given a numeric code which be used as command signals for device control and virtual simulation.

This concept, flex sensors along with a digital accelerometer, which can be used to detect the hand tilting movements, can be placed in a glove allowing hand movements to be captured and be used as commands for device control and virtual simulation.

Thus, it was aimed to create a low-cost wireless glove controller through the use of flex sensors and a digital accelerometer which allows the user to define specific finger gestures to be used to control robotic devices and generate 3d visual environment.

The first prototype was brought up byDaniel Sandin and Thomas de Fanti named Sayre Glove in 1977 in which each finger of the glove had flexible tubes having a photocell and a light source.

However, a difficulty faced by the gesturer wearing such a glove is the restriction he feels while wearing it. Bend sensors and accelerometers were used in a data glove that was used as an alternative to keyboards and mice for air writing and 3D sketching

2.2 Lists Of Research Papers

1. Indian Sign Language Converter System Using An Android App.
2. Smart Glove With Gesture Recognition Ability For The Hearing And Speech Impaired.
3. Low Cost Tangible Glove For Translating Sign Gestures To Speech And Text In Hindi Language.
4. Android Software Based Multi-touch Gestures Recognition for Secure Biometric Modality.
5. User-Oriented Finger-Gesture Glove Controller With Hand Movement Virtualization Using Flex Sensors and a Digital Accelerometer

2.3 Paper Comparison

Sr No	Title	Author Name	Description
01	Indian Sign Language Converter System Using An Android App.(2017)	Pranali Loke, Juilee Paranjpe, Sayli Bhabal	Sign language is a large set of hand gestures that are used to communicate with the hearing impaired and mute. The proposed system uses Hue, saturation, Intensity (HSV) colour model for hand tracking and segmentation. We have used supervised learning for training the neural network which is responsible for data classification. An android application is used to capture images of hand gesture.
02	Smart Glove With Gesture Recognition Ability For The Hearing And Speech Impaired (2014)	Tushar Chouhan, Ankit Panse, Anvesh Kumar Voona and S. M. Sameer	we have developed a smart system which would be able to serve as best friend to the hearing and speech impaired person cost wired interactive glove, interfaced with a computer running MATLAB or Octave, with a high degree of accuracy for gesture recognition.
03	Low cost tangible glove for translating sign gestures to speech and text in Hindi language (2017)	Suraksha Devi, Suman Deb	The deaf and dumb people make up a huge proportion of India's population. Sign Language is used by this fragment of the society to communicate. Sign language uses gestures to convey meaning by merging together the alignment, form and movement of hands along with the facial expressions and the body movements.
04	Android Software based Multi-touch Gestures Recognition for Secure Biometric Modality (2015)	Kalyani Devidas Deshmane, Prof. S.A. Ghodake	In this paper, the experimental result shows the feasibility of a new behavioural biometric modality based on multi-touch gestures. Firstly we defined the multi-touch gesture specifically for biometric verify purpose and identified a set of 12 gesture candidates for our experiments. In order to design a classifier we developed a feature set that is invariant to translation and orientation Our results show that multi-touch interaction has a potential not only in the design of a novel user-interface, but also to develop a biometric based authentication app.
05	User-Oriented Finger-Gesture Glove Controller with Hand Movement Virtualization Using Flex Sensors and a Digital Accelerometer (2014)	Monique Bernice H. Flores, Charles Mholen B. Siloy, Carlos Oppus, Luisito Agustin	Through this thesis, a low-cost glove controller which allows the user to define desired gestures for wireless device control and virtual environment simulation was developed, thus, paving way for various technological advances for alternative device control, medical rehabilitation, body-oriented gaming, and other applications that calls for wireless control

FIGURE 2.1: Paper Comparison

Chapter 3

SURVEY OF TECHNOLOGIES

3.1 SURVEY

- A low-cost wireless glove controller that detects finger gestures was developed using makeshift flex sensors and a digital accelerometer.
- The performance of the makeshift flex sensors was compared to that of commercially available ones.
- A system using Arduino, Bluetooth, and Processing was developed to allow the user to specify desired finger gestures for controlling a variety of robotic devices and generate virtual characters for alphabets.

3.1.1 The implementation of this this was divided into five parts:

- The creation of the glove controller.
- The process of how finger gestures are to be interpreted.
- The programming of the Arduino micro-controller for processing flex-sensor and digital accelerometer data.
- The development of a program for the user-definition of gestures and device control.
- The creation of a 3D environment for virtual simulation of hand movements and device control.

3.2 Glove Controller .

- The glove controller was created using flex sensors and a digital accelerometer connected to a micro-controller and a Bluetooth shield for wireless implementation. Two kinds of glove controller was created, one using commercial flex sensors and one using makeshift flex sensors.
- In order to reduce the cost for the creation of the glove controller, commercial flex sensors were recreated using low-cost materials

3.3 Finger Binary System.

- The concept of the Finger Binary System was used for the detection of finger gestures, Since there are two states of the fingers, flexed and relaxed, each state was given a bit value, 0 for relaxed and 1 for flexed.
- Thus, with the thumb being the most significant bit and the digital accelerometer being the least significant bit, the Binary Coded Decimal (BCD) equivalent can be used to refer to each gesture.

3.4 Arduino IDE And Micro-controller.

- Through the use of a Micro-controller programmed via Arduino IDE.
- The data from the flex sensors and the digital accelerometer were read and interpreted.
- These data were then sent to the user-definition program and the virtual environment.

3.5 User-Definition and Device Control via Processing IDE

- A user-definition program was created using Processing IDE to allow the user to define his/her desired gestures for device control.
- The user was given the liberty to define his/her desired gestures for the actions to be performed by a device and/or the elements inside the virtual environment.
- Once was user was done in defining his/her desired gestures, the program created via Processing IDE will serve as an access point for device control. Through this, the user will now be able to use his defined gestures to control a device.

3.6 Display via Android App

- We have used android Appliaction to generate a virtual space on which the alphabets will be displayed and can be heard from the smart phone speaker itself.
- The control signal used for device control was also used inside the virtual environment. These were similarly used to let elements inside the virtual environment perform actions.
- The glove controller serves as the link for human interaction with the elements inside the virtual environment. this opens a lot of applications such as human motion capture for animations or simulations, and even an alternative means of input for human-software interaction.

Chapter 4

REQUIREMENTS AND ANALYSIS

4.1 Problem Definition

- Similar type of hand gestures such as “u” and “v” were confused by the sensor. It was a problem to identify the difference between similar looking alphabets.
- The person who does not have a hand or finger will not be able to use this glove as he/she cannot use the glove to make gestures.
- If there is any electromagnetic interference or any other heavy wireless network interference then the glove will be struggling to send the data to app.
- The glove has to be connected to the computer hence there will be a portability issue.
- Bend sensors are costly hence we are using generic flex sensors to reduce the cost.

4.2 Requirements Specification

Those are the hardware and software requirement of our smart glove project to make it work easily and efficiently.

4.2.1 Software Requirement

- Arduino IDE version 6.4.1.
- Android Application (Bluetooth Terminal).
- OS: windows 7 /8/10 64 bit , MAC os .

4.2.2 Hardware Requirement

- Arduino uno / nano R3.
- HC-05 Bluetooth module.
- Flex sensor.
- Analog accelerometer: ADX335.
- Speaker

4.3 Planning And Scheduling

Till now we have completed the basic idea of planning and research of various literature's to conclude what our project is going to be and how it is going to work.

In further semesters we are going to construct a glove with flex sensor and micro controller connected to it so that it can be used to generate alphabets using gestures and various sign language standards.

After that we are going to construct an Android app that will be used to display that output of the gestures generated by the smart glove and the app will be operated using a smart phone. The same smart phone will be used as a speaker to hear out loud the alphabets as an audio medium using the same android app.

4.4 Gantt chart

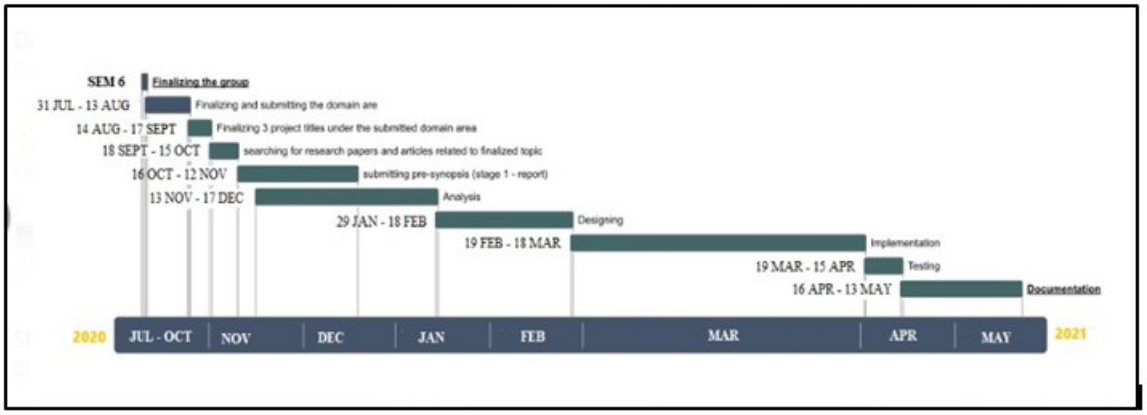


FIGURE 4.1: Gantt Chart

Chapter 5

SYSTEM DESIGN

5.1 Architecture And Design

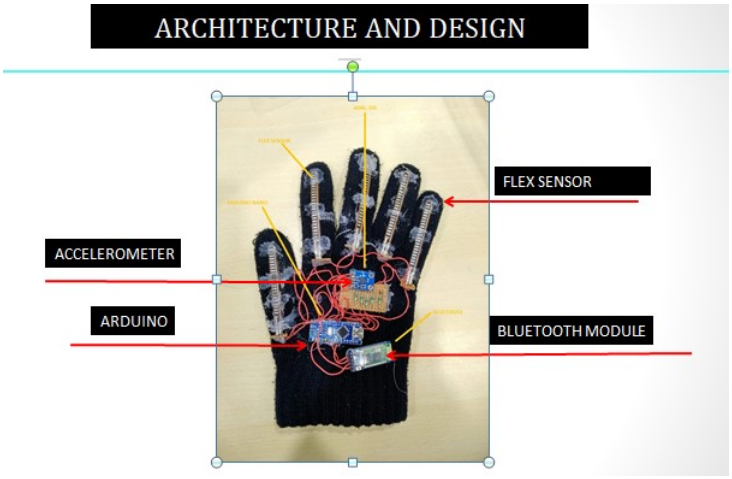


FIGURE 5.1: Architecture and design

In This Following are Hardware Used

- Acceleometer: Accelerometer is used to measure the tilt in the palm ADXL335.
- FlexSensor: Flex sensor are used to measures the bend in the finger 4 for finger 1 for thumb according to bend angle value .
- Bluetooth Module :It will display and speak the symbol generated from glove to smartphone into android app.
- Arduino : Arduino is used as our central processing unit

5.2 Circuit Diagram

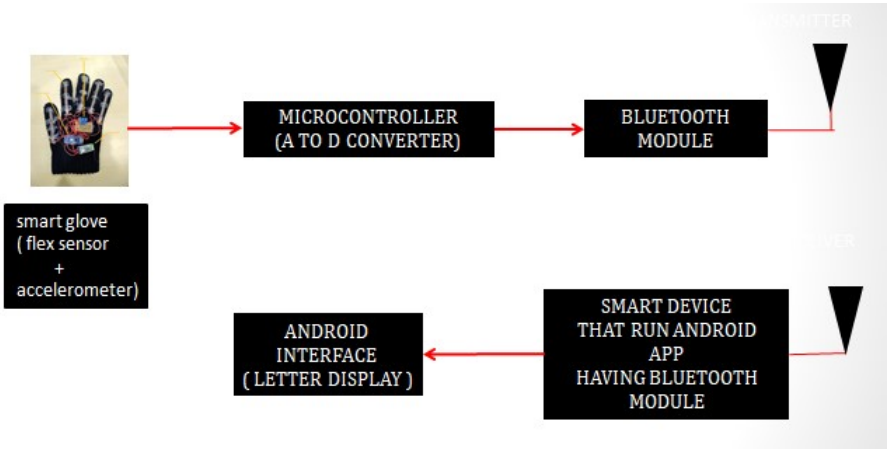


FIGURE 5.2: Circuit diagram

- First the Glove is connected with all the hardware components where with use of flex sensor used to measures the bend in the finger 4 for finger 1 for thumb according to bend angle value.
- Microcontoller is used to convert signal analog to Digital.
- Through the Bluetooth module It will display and speak the symbol generated from glove.
- At the end by using Android Application (Bluetooth Terminal) by pairing it our blue tooth module with Mobile phone.
- Then It will Display the Following Output.

5.3 Data Flow Diagram

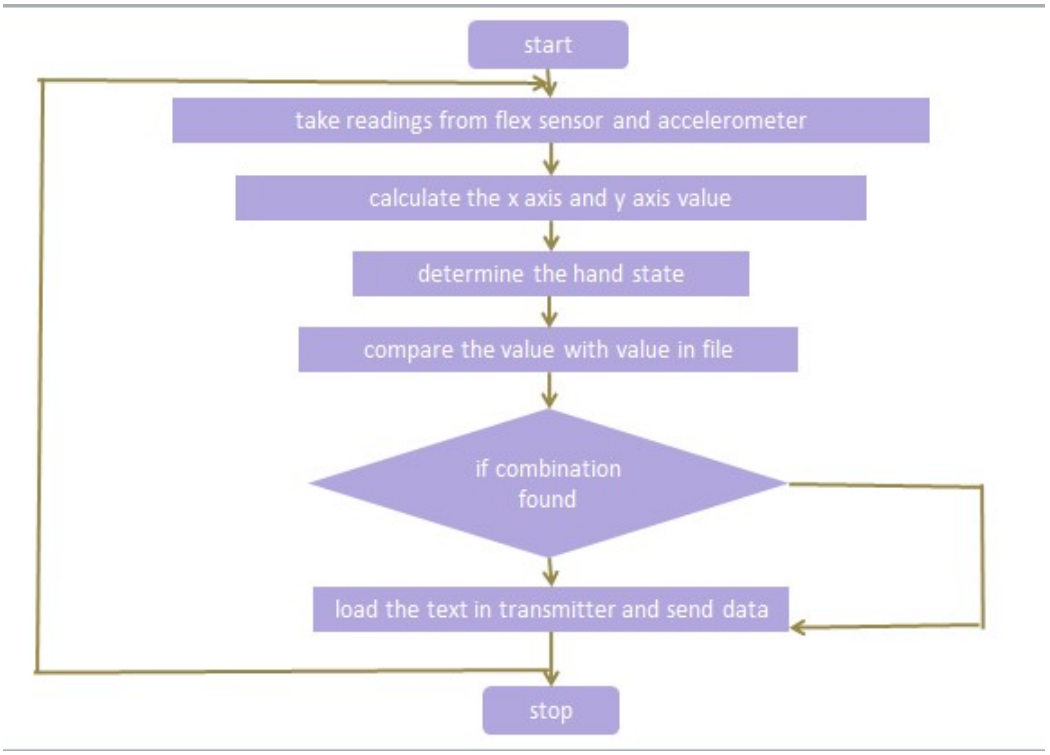


FIGURE 5.3: Data Flow Diagram

- Start
- Taking Co-ordinates from the sensor and accumulator x y axis
- It will Calculate the X-axis and Y-axis and get proper gesture .
- By Identifying The Co-ordinates getting actual hand gesture.
- It will compare value with 26 English alphabet as mentioned under ASL (American Sign Language) script.
- If combination is found is Send data to application.
- If not then It will start with beginning .

5.4 26 Alphabet ASL(American Sign Language)

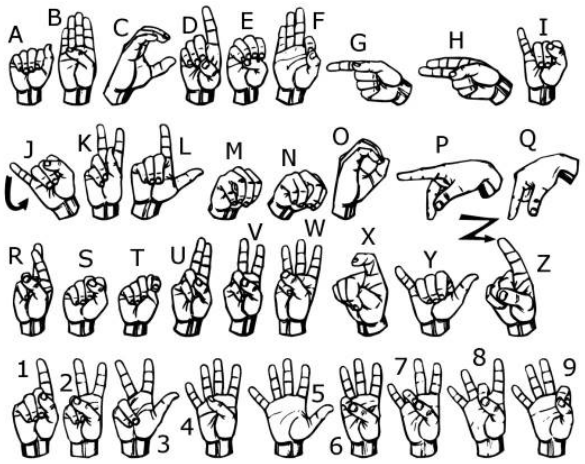


FIGURE 5.4: 26 English alphabet ASL (American Sign Language) script

- The aim is to convert basic symbols that represent the 26 English alphabet as mentioned under ASL (American Sign Language) script and display them on a smartphone screen.

Chapter 6

IMPLEMENTATION

6.1 Data Flow Explanation

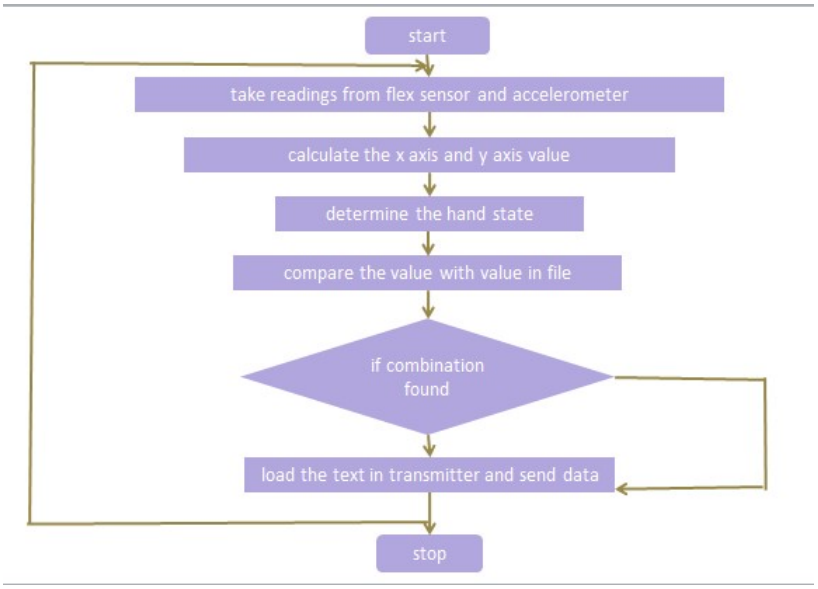
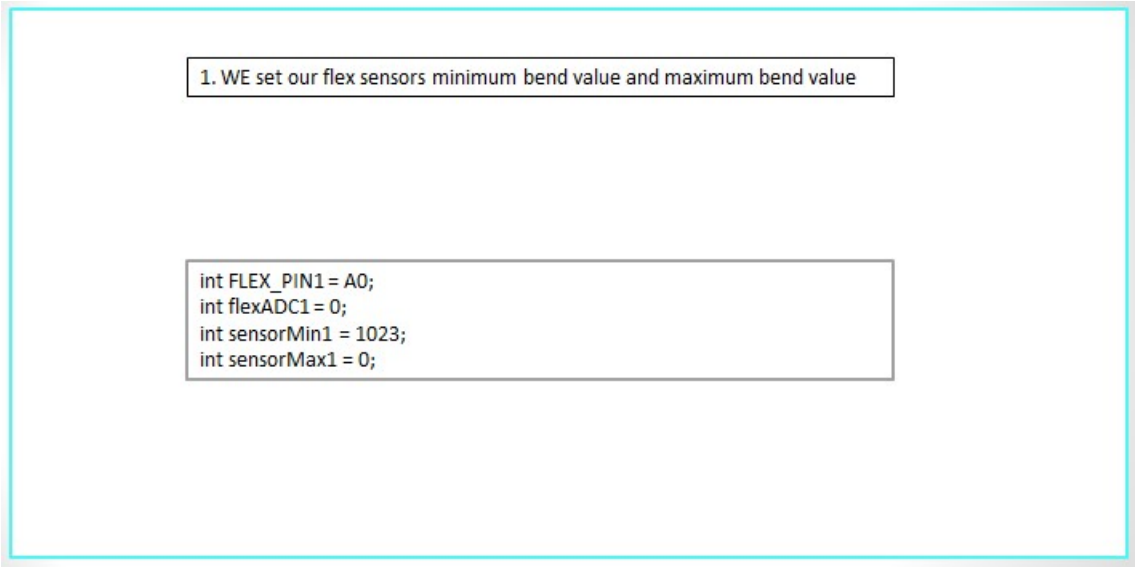


FIGURE 6.1: Data Flow Explanation

6.1.1 Explanation Data Flow Diagram

- Start
- Taking Co-ordinates from the sensor and accumulator x y axis
- It will Calculate the X-axis and Y-axis and get proper gesture .
- By Identifying The Co-ordinates getting actual hand gesture.
- It will compare value with 26 English alphabet as mentioned under ASL (American Sign Language) script.
- If combination is found is Send data to application.
- If not then It will start with beginning .

6.2 Code Explanation



2. calibrating the sensors for adaptivity with different bends

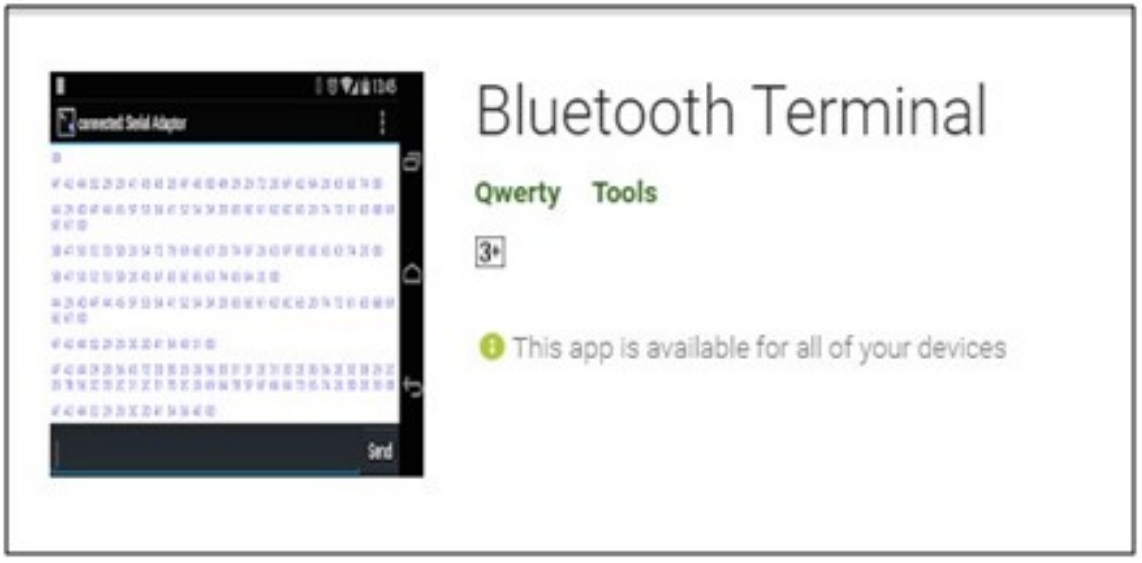
```
if(flexADC1<sensorMin1)
{
sensorMin1=flexADC1;
}
if(flexADC1>sensorMax1)
{
sensorMax1=flexADC1;
}
```

3. read the sensor value

```
if(flexADC1<sensorMin1)
{
sensorMin1=flexADC1;
}
if(flexADC1>sensorMax1)
{
sensorMax1=flexADC1;
}
```

1. WE set our flex sensors minimum bend value and maximum bend value

```
int FLEX_PIN1 = A0;
int flexADC1 = 0;
int sensorMin1 = 1023;
int sensorMax1 = 0;
```



The app is terminal application, it can transaction data between Bluetooth device. it's can save all send and receive data to file. file save in /sdcard/********.log ******** is yyyyMMdd.

6.3 Description for setup in menu

Display hexadecimal : show data of hexadecimal format.

Send hexadecimal : send hexadecimal text. ex, "ABC 39 30", client will receive "ABC90". hex 39 = "9" hex 30 = "0".

Append newline(˚) : sent data append newline automatically. Keep screen on : keep the screen on.

NOTE:

1. Your data must have a newline. the APP is relying newline to display data.
2. This application is reprogramming of Bluetooth Chat. that's sample code of android.com

Chapter 7

RESULTS AND DISCUSSION

7.1 Conclusion

Through this thesis, a low-cost glove controller which allows the user to define desired gestures for wireless device control and virtual environment simulation was developed, thus, paving way for various technological advances for alternative device control, medical rehabilitation, body oriented gaming, and other applications that calls for wireless control.

The primary objective of this work is to enable the speech impaired and the mute to have a seamless communication and independent living in the society.

The proposed prototype and accompanying algorithm accomplished the initial objective. The glove is cost effective and is capable of translating sign gestures (conventional Indian Sign Language) into speech-text in real time using android application on the phone.

The significant recording of hand movements and feature extraction is done by applying Principle Component Analysis. The glove prototype is independent of the surrounding light or any other kind of interference.

As a result, precise and accurate recognition gesture is possible in less time. This paper emphasizes on the translation of sign language with the help of the glove.

However, the glove could be used for various other applications such as for the virtual reality interaction, gaming, entertainment, education technology, robotics etc. This is an ongoing work, the of the algorithm and prototype are going on.

7.2 Future Scope Of the Project

- The glove is modeled base on a particular hand. Since hand differ in size and freedom of motion, we can improve the glove to work with every hand size by giving it adaptive learning capabilities.
- In the current project ,the output is displayed using a personal computer to improvise the portability, an android application is used displaying the text and speech output on Android device.
- If and When the product is produced in a large scale, the entire circuit can be embedded into a single chip.
- It can be paired up with fitness sensor system to monitor the health.
- We can generate help for disable person or deaf person for hearing and visual.
- The system can be paired with controller to implement and provide home automation to the electrical devices.

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