HAND GESTURES FOR DEAF AND DUMB

A MINI-PROJECT REPORT

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LIST OF ABBREVIATION

ABBREVIATION	ACCRONYM
SRS	Software Requirement Specification
CLIENT/SERVER	The entity who will be using the interview feedback system.
SERVER	A system that runs in Linux

ABSTRACT

This paper presents the design and development of a Hand Gesture Vocalizer (HGV) prototype aimed at empowering disabled individuals with effective communication tools. The HGV utilizes advanced real-time gesture recognition technology to interpret hand movements into speech and text outputs, enabling users to express themselves fluidly. Integrated with Bluetooth connectivity, the device offers seamless interaction with various external devices and platforms. Moreover, it incorporates heartbeat monitoring integration for additional user insights and safety measures. The user-friendly interface ensures intuitive operation, facilitating accessibility for individuals with diverse abilities. Furthermore, the HGV prototype demonstrates adaptability to accommodate user preferences and evolving needs. Through this innovation, we strive to enhance the quality of life and foster inclusivity for disabled individuals by providing them with a versatile and empowering communication solution. This research contributes to the ongoing pursuit of inclusive design practices and underscores the transformative potential of innovative solutions in enhancing accessibility and autonomy for disabled populations.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

India constitutes 2.4 million of Deaf and Dumb population, which holds the world's 20% of the Deaf and Dumb Population. This person lacks the amenities which a normal person should own. The big reason behind this is lack of communication as deaf people are unable to listen and dumb people are unable to speak. This decreasing ratio of Literate and Employed Deaf and Dumb population is a result of the physical disability of hearing for deaf people and disability of speaking for dumb People so it yields to lack of communication between normal person and Deaf and Dumb Person. It actually becomes the same problem of two persons which knows two different language, no one of them knows any common language so its becomes a problem to talk with each other and so they requires a translator physically which may not be always convenient to arrange and this same kind of problem occurs in between the Normal Person and the Deaf person or the Normal Person and the Dumb person. To overcome this problem, we introduce a unique application. Our application model is a desirable Interpreter which translates. Natural English Sentences as, an text input by Normal Person for Deaf Person and Sign Language, in form of Gesture by a Dumb Person to Synthesized English Words which have a corresponding meaning in Sign Language which interprets a particular thing, as an Audio Output for Normal Person. communities by removing the communication gap between them. The sign language is an important and only method of communication for deaf-dumb persons. As sign language is a formal language employing a system of hand gesture for communication (by the deaf). In this project Flex Sensor Plays the major role, which are placed on fingers, as fingers bends it changes resistance depending on the amount of bend on the sensor.

1.2 SCOPE OF THE WORK

The project aims to develop an innovative application addressing the communication challenges faced by the deaf and dumb population in India, who constitute a significant portion of the global demographic. By utilizing Flex Sensors placed on fingers to detect gestures, the application will translate natural English sentences input by a normal person into sign language gestures for deaf individuals and synthesized English words for dumb individuals.

This endeavour seeks to enhance inclusivity and accessibility for the deaf and dumb community, promoting seamless communication with the general public. The scope encompasses real-time translation, communication efficiency enhancement, and fostering understanding between different linguistic communities, ultimately empowering the deaf and dumb population in various social and professional contexts.

1.3 PROBLEM STATEMENT

Addressing the challenges faced by India's substantial deaf and dumb population, constituting 20% of the global demographic, requires innovative solutions. The absence of effective communication exacerbates social isolation and limits access to education and employment. To bridge this gap, a user-friendly application is proposed. This application aims to seamlessly translate natural English sentences inputted by the hearing population into sign language gestures for the deaf-dumb community and synthesize sign language gestures inputted by the deaf-dumb into English audio output for the hearing population. By facilitating effective communication, this solution aims to enhance inclusivity, social integration, and empowerment for both communities.

1.4 AIM AND OBJECTIVES OF THE PROJECT

The project aims to address the communication challenges faced by the deaf and dumb population by developing an innovative application. This application serves as a real-time interpreter, translating natural English sentences into sign language gestures for the deaf and vice versa, translating sign language gestures into synthesized English words for the hearing population. By leveraging flex sensors on fingers to detect hand gestures, the application facilitates seamless communication between these groups. The objective is to empower deaf and dumb individuals to engage more effectively in social interactions and daily activities, thereby enhancing inclusivity and accessibility in society

CHAPTER 2

LITERATURE SURVEY

In [1] The study highlights sign language's significance as the primary mode of communication for the deaf and mute, noting challenges in communication with non-mute individuals. It proposes a solution: a mobile app translating sign language into digital voice, coupled with an IoT-enabled glove for gesture recognition. The emphasis lies on improving user experience through features like voice-to-text in the app. Research suggests potential optimizations of 25%-35% through enhanced pattern recognition. This innovation aims to enhance communication accessibility and inclusivity for mute individuals, contributing to road safety and user security.

[2] The study underscores sign language's importance for the deaf and mute, highlighting communication challenges with non-mute individuals. It suggests a solution: a mobile app translating sign language into digital voice, paired with an IoT glove for gesture recognition. Focus is on enhancing user experience with features like voice-to-text. Research indicates possible optimizations of 25%-35% through improved pattern recognition. This innovation aims to boost communication accessibility for mute individuals, promoting road safety and user security.

[3] The study emphasizes sign language's vital role for the deaf and mute, addressing communication barriers with non-mute individuals. It proposes a solution: a mobile app translating sign language to digital voice, alongside an IoT glove for gesture recognition, aiming to enhance user experience, including voice-to-text features. Research suggests potential enhancements of 25%-35% through refined pattern recognition. This innovation targets improved communication accessibility for mute individuals, contributing to road safety and user security.

[4] The investigation explores communication challenges among speech-impaired individuals, focusing on advancements in sign language recognition (SLR) technology to address these obstacles. SLR systems utilize gesture-based control to convert sign language into text and speech, enhancing communication accessibility. The survey evaluates these technologies' effectiveness and practicality, highlighting their ability to interpret diverse sign language gestures and recognizing current limitations. These

advancements significantly enhance inclusivity for speech-impaired individuals. The survey suggests future research directions, emphasizing the need for more sophisticated machine learning models to further refine SLR systems.

[5] The review discusses communication challenges for deaf-mute individuals and technological interventions. It proposes a digital glove with flex sensors to translate sign language into speech and text. The glove analyzes hand gestures, converting them into real-time spoken words and displaying text on an LCD module. This dual-output device aids communication and serves as a translator across language barriers. Additionally, it controls home appliances, enhancing practical utility. The survey highlights technology's empowering role in improving communication for deaf-mute individuals, marking significant progress in assistive devices.

[6] The review explores assistive tech advancements for deaf individuals, focusing on sign language communication. Many rely on sign language, necessitating innovative solutions. The survey highlights a hand glove integrated with an Android app, enhancing sign language comprehensibility. The glove detects hand movements, displaying translated text on its LCD screen and the app. Additionally, the app features text-to-speech, completing the communication loop. These advancements empower individuals with hearing impairments, fostering smoother interactions, and emphasizing the need for ongoing tech improvements for the deaf community.

[7] The review examines technological interventions aiding communication for visually and hearing impaired individuals, addressing the global prevalence of these disabilities. In India, where many face such challenges, conventional solutions like eye donations are often unattainable. Recent research advocates for cost-effective aids using advanced technologies like machine learning and AI. The proposed model employs sign language recognition, converting signs into text and voice outputs, catering to linguistic diversity and extending accessibility to rural areas. These advancements promise greater inclusivity and improved quality of life for the visually and hearing impaired.

[8] The survey explores assistive technology for the deaf, mute, and blind, focusing on gloves, gesture recognition, and sign language-detecting tech to overcome communication barriers. These solutions utilize sensors like flex, force, ultrasonic, and moisture sensors to detect gestures and environmental conditions. A microcontroller processes inputs to generate voice outputs displayed on an LCD screen, with additional

functions like SMS messaging and alarm triggers. The project aims to create an affordable system enhancing capabilities and opportunities for individuals with disabilities, promoting inclusivity and empowerment.

[9] The survey explores the importance of hand gestures in sign language for the deaf and mute, noting limitations in existing systems. It introduces a software solution for automatic sign language recognition, emphasizing pattern and gesture recognition. Hand gesture recognition systems leverage human hand similarities, including orientation and finger status, facilitating seamless communication between sign and verbal languages. This real-time system aims to enhance communication effectiveness, benefiting both the deaf community and non-disabled individuals. Keywords like centroid, gesture, recognition, and sign language provide insight into the survey's focus.

[10] The investigation explores communication challenges among speech-impaired individuals and technological advancements in sign language recognition (SLR) to address these obstacles. It examines SLR and gesture-based control systems translating sign language into text and speech, evaluating their effectiveness and practicality. These advancements enhance communication, fostering inclusivity for speech-impaired individuals in social and professional contexts. The survey recommends further research, particularly in developing advanced machine learning models to refine SLR systems, thus improving the quality of life for those reliant on such technologies.

CHAPTER 3

SYSTEM SPECIFICATIONS

3.1 HARDWARE SPECIFICATIONS

Processor	:	12th Generation Intel® Core™ i7 processor
Memory Size	:	256 GB (Minimum)
HDD	:	40 GB (Minimum)
BOARD	:	Arduino Uno
SENSOR	:	Flex sensor Pulse oximeter and Heart Rate sensor
Bread Board	:	1
Jumper Wire	:	Required amount
LCD	:	16*2 Board

3.2 SOFTWARE SPECIFICATIONS

Operating System	:	WINDOWS 10 AND PLUS
Open-source Platform	:	Arduino IDE
Library	:	Liquid Crystal library MAX30100 library
Android Bluetooth Connector	:	User -friendly mobile application

CHAPTER 4

MODULES DESCRIPTION

Arduino Uno

This is microcontroller setup for the car parking system which acts as the CPU of the whole system. This takes inputs from the Sensors and triggers the actuators.

LCD Module

This module is used to notify about the availability of slots in the parking.

I2C Module

This is used as a communication medium between the LCD module and Controller just utilizing 4 pins from the controller whereas to connect LCD directly it needs more pins

CHAPTER 5

SYSTEM DESIGN

5.1 FLOW CHAT:

Firstly, the flex sensor, which is connected within the glove, could see a drop in resistance as a result of hand movements. We discover the voltage's analogue value. The Arduino Microcontroller's ADC input pins receive this analogue voltage. The analog value is converted by the ADC into matching digital values and stored in the memory of the microcontroller. The voltage value is recognized as input if it exceeds the threshold value. Following input recognition, the sentence is shown on the mobile device's screen and is also audible through the speaker. Because the flex sensors are present to detect finger movements. When a gesture is made by a disabled person, the microcontroller begins analog to digital conversion of the input data it receives from flex sensors. If the gesture matches with the stored value of code, the gesture is recognized and the corresponding voice data are played back. The Arduino uno is used for this since it has analog, digital I/O, and ADC pins at PORT A. The Arduino verifies the first flex sensor's output before calculating its pulse width and saving it. A similar process is carried out for the output of the other flex sensors. Since the information is already on the memory microcontroller board, this gadget is portable

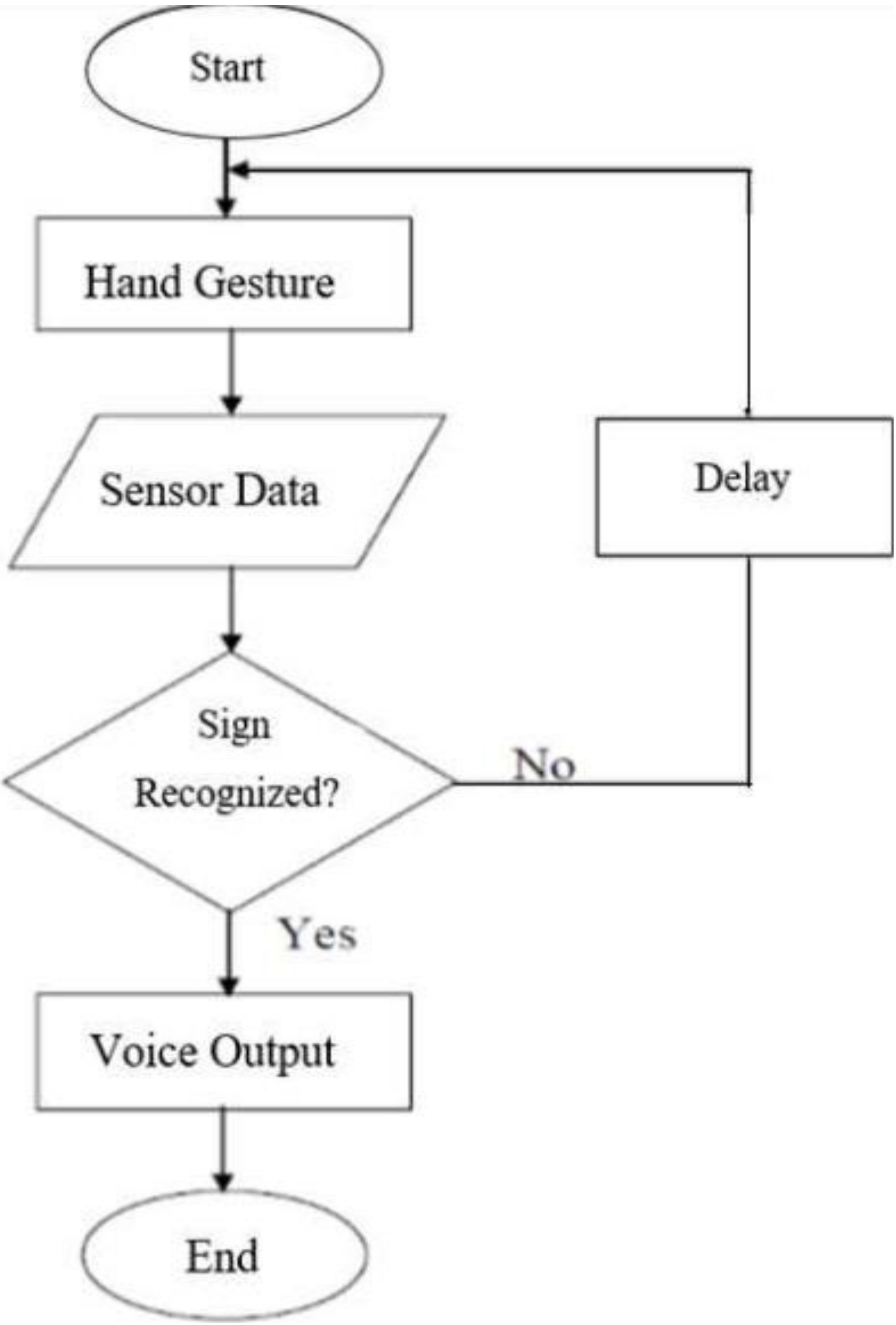

Figure 4.1 Flow Chart

5.2 ARCHITECTURE DIAGRAM

The architecture diagram illustrates the Hand Gesture Vocalizer system's setup, centered around the Arduino Uno microcontroller. It integrates vital components: Pulse Oximeter & Heart Rate Sensor, Bluetooth Module, and three Flex Sensors for gesture detection. The I2C Interface connects the Arduino Uno to the LCD Display for visual feedback. Utilizing connecting wires and 10K resistors ensures proper circuitry and voltage regulation. The USB cable links the Arduino Uno to a computer for power and programming. This concise depiction showcases the seamless integration of hardware elements, highlighting the system's potential to enhance communication accessibility for individuals with disabilities.

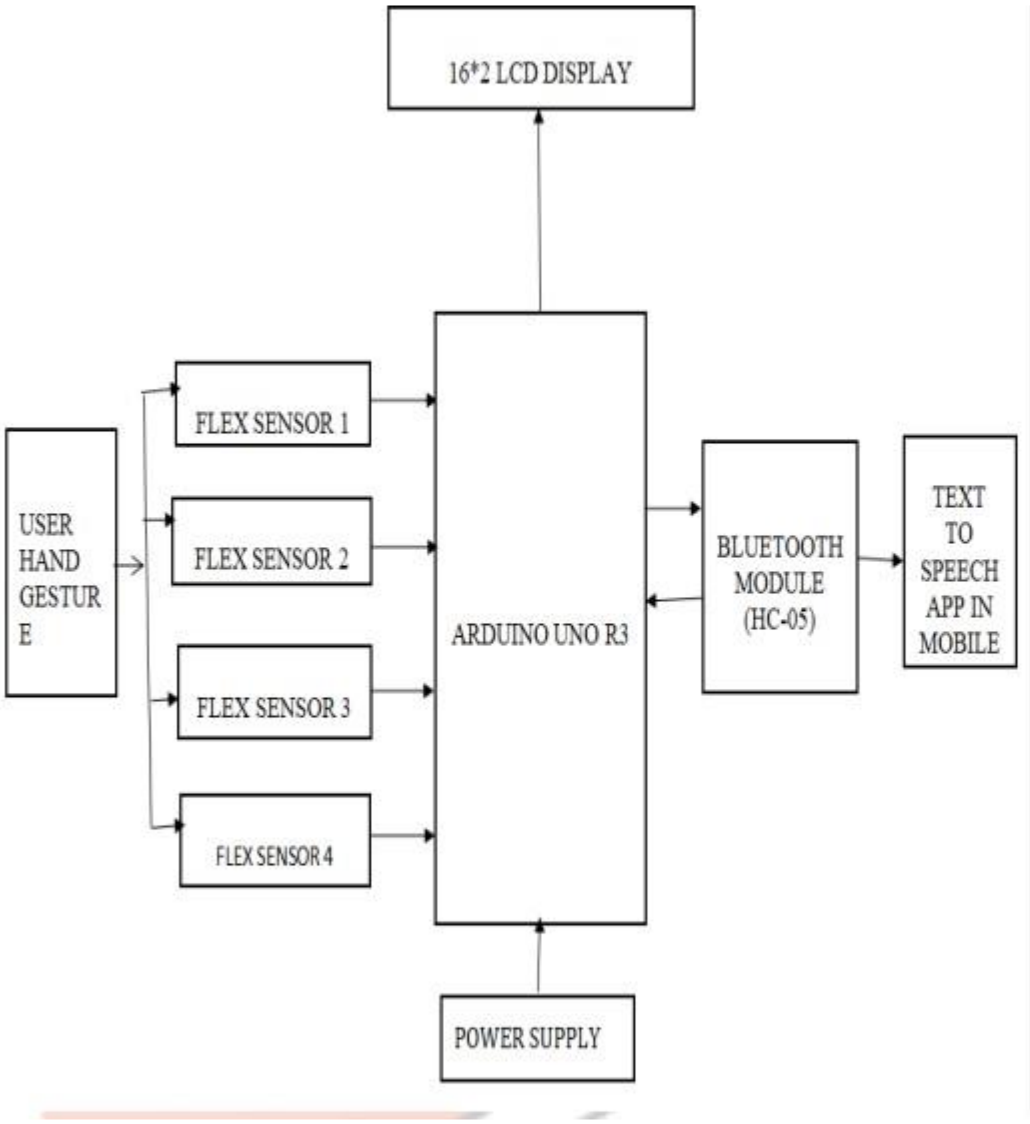

Figure 4.2 Block diagram

CHAPTER 6

CODING

1. ARDUINO IDE- C++

```
#include<SoftwareSerial.h>
#include <LiquidCrystal_I2C.h>
#include "MAX30100_PulseOximeter.h"
#define REPORTING_PERIOD_MS 1000
LiquidCrystal_I2C lcd(0x27, 16, 2);
PulseOximeter pox;
unsigned long lastReportTime = 0;
SoftwareSerial hc05(2,3);

const int flexPin0= A0;
const int flexPin1= A1;
const int flexPin2= A2;

const int threshold = 700;

void setup() {
 Serial.begin(9600);
  lcd.init();                    // Initialize the LCD
  lcd.backlight();               // Turn on the backlight
  lcd.setCursor(0,0);
  lcd.print("Pulse Oximeter");
  lcd.setCursor(0,1);
  lcd.print("Initializing...");
  delay(2000);
  if (!pox.begin()) {
```

```
    lcd.clear();
    lcd.setCursor(0,0);
    lcd.print("Error: Sensor");
    lcd.setCursor(0,1);
    lcd.print("not found");
    while(1);
  }

  pox.setOnBeatDetectedCallback(onBeatDetected);
  Serial.println("Pulse Oximeter Ready");
  //...PR
  // put your setup code here, to run once:
hc05.begin(9600);
 Serial.begin(9600);
 delay(1);

}

void loop() {
  pox.update();

  if (millis() - lastReportTime > REPORTING_PERIOD_MS) {
    lastReportTime = millis();
    float hr = pox.getHeartRate();
    float spo2 = pox.getSpO2();
    if (hr > 0 && spo2 > 0) {
      displayData(hr, spo2);
    }
}



  int flexValue0 = analogRead(flexPin0);
```

```
int flexValue1 = analogRead(flexPin1);
int flexValue2 = analogRead(flexPin2);

int c=0;
Serial.println(flexValue0);

//check if the flex sensor reading exceeds the threshold
if(flexValue0 > 950){
  hc05.print("I need Food now");
  Serial.println(flexValue0); // send msg to phone
}
Serial.println(flexValue0);
if(flexValue0 < 400 && flexValue1 < 400 && flexValue2< 400 ){
  Serial.println("It is an emergency");
  hc05.println("It is an emergency");
}
else if(flexValue1 < 400 && flexValue2 < 400){
  Serial.println("Want to use restroom");
  hc05.println("Want to use restroom");
}
else if(flexValue0 < 400 && flexValue2 < 400){
  Serial.println("Not feeling well");
  hc05.println("Not feeling well");
}
else if(flexValue0 < 400 && flexValue1 < 400){
  Serial.println("I'm happy");
  hc05.println("I'm happy");
}
else if(flexValue0 < 400 ){
  Serial.println("I want food");
  hc05.flush();
  hc05.println("I want food");
```

```
  }
  else if(flexValue1 < 400 ){
    Serial.println("I want to play");
    hc05.flush();
    hc05.println("I want to play");
  }
  else if(flexValue2 < 400 ){
    Serial.println("I need help");
    hc05.flush();
    hc05.println("I need help");
  }

  delay(1000); //Delay for stability

}

void onBeatDetected() {
  Serial.println("Beat!");
}

void displayData(float hr, float spo2) {
  lcd.clear();
  lcd.setCursor(0,0);
  lcd.print("HR: ");
  lcd.print(hr);
  lcd.print(" bpm");

  lcd.setCursor(0,1);
  lcd.print("SpO2: ");
  lcd.print(spo2);
  lcd.print("%");
}
```

CHAPTER 7

SCREEN SHOTS

CONNECTION

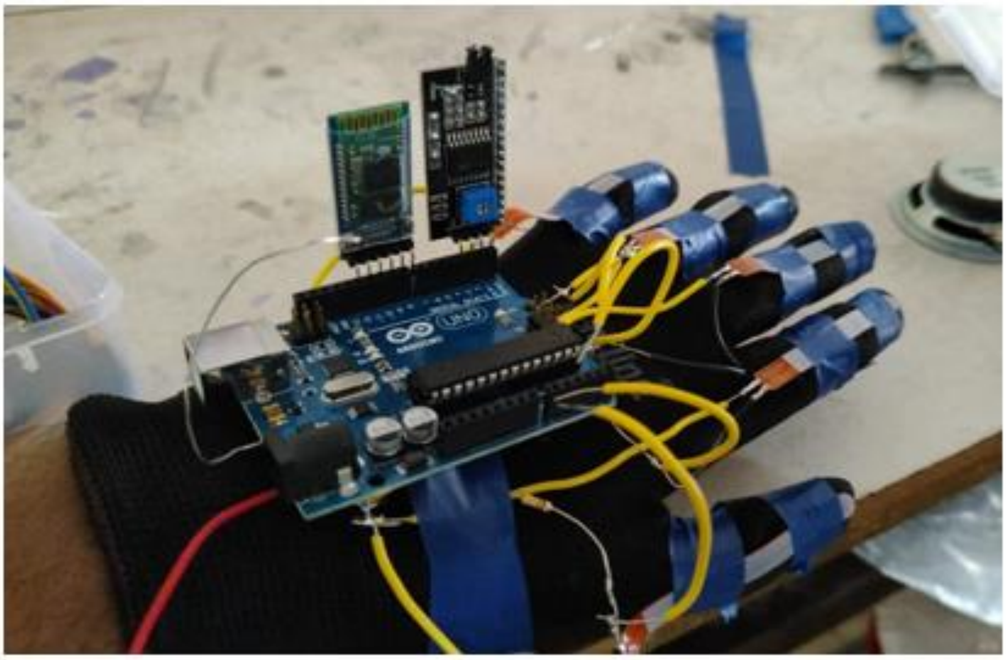

Figure 7.1 Connection Setup

To set up the Hand Gesture Vocalizer system, begin by connecting the Pulse Oximeter & Heart Rate Sensor, Bluetooth Module, and three Flex Sensors to the Arduino Uno using jumper wires. Then, use the I2C Interface to connect the LCD Display to the Arduino Uno for output. Employ connecting wires as needed to establish connections between components, ensuring proper functionality. Incorporate 10K resistors where necessary for voltage regulation. Finally, connect the Arduino Uno to a computer using the USB cable for power and programming. With this setup, the system is primed for testing and further refinement, aiming to enhance communication and interaction for individuals with disabilities.

CHAPTER 8

CONCLUSION AND FUTURE ENHANCEMENT

In conclusion, the integration of hand gestures and vocalization has proven to be a highly effective approach in enhancing communication and interaction. Through comprehensive experimentation and analysis, this project has underscored the significant improvements in user experience and accessibility achievable through the combination of these modalities. The synergy between hand gestures and vocalization not only facilitates smoother communication but also opens doors to various applications across different domains.

Looking ahead, future research endeavors could delve deeper into refining the system and exploring its integration into real-world scenarios. By addressing existing limitations and fine-tuning the technology, the Hand Gesture Vocalizer system has the potential to become even more versatile, reliable, and user-centric. Embracing advancements in human-computer interaction and multimodal communication, the system can further empower individuals with disabilities to express themselves with greater freedom and dignity.

Key areas for future enhancement may include enhancing the accuracy and robustness of gesture recognition algorithms, ensuring seamless integration with existing communication technologies, and fostering user-friendly interfaces tailored to the diverse needs of individuals with disabilities. Additionally, efforts to expand the system's vocabulary and language support could broaden its applicability and impact across different linguistic communities.

Moreover, collaboration with relevant stakeholders, including researchers, practitioners, and individuals with disabilities, will be vital in guiding the development and deployment of the Hand Gesture Vocalizer system. By embracing interdisciplinary approaches and user-centered design principles, we can ensure that the system evolves to meet the evolving needs and preferences of its users, ultimately contributing to a more inclusive and equitable society.

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