# 10. SIGN LANGUAGE INTERPRETER

Project Description:

SIGN LANGUAGE INTERPRETER is a wearable system designed to translate sign language into text, making communication more accessible for individuals with speech and hearing impairments. The system utilizes flex sensors attached to a glove to detect finger movements, which are then processed by an Arduino Uno. The detected gestures are mapped to predefined sign language symbols, and the corresponding text is displayed on a 16x2 LCD screen using an I2C module for efficient data transmission.

Powered by a battery, the system operates as a standalone device with minimal power consumption. The 10K resistor ensures accurate sensor readings, while jumper wires interconnect all components. By converting hand gestures into readable text, SignSense provides a cost-effective and portable solution to bridge the communication gap between sign language users and non-signers, enhancing accessibility in daily interactions.

Apparatus:

Serial No.	Component	Description
1	**Flex Sensor**	Detects finger bending and converts it into electrical signals.
2	**Arduino Uno**	Microcontroller board that processes sensor data and maps it to predefined gestures.
3	**LCD Display (16x2)**	Displays the interpreted text output for easy communication.
4	**I2C Module**	Reduces the number of pins needed for LCD communication, making wiring more efficient.
5	**10K Resistor**	Helps in stabilizing the sensor output and ensures accurate readings.
6	**Battery**	Powers the system for standalone operation.
7	**Jumper Wires**	Connects all components for seamless data transfer.

Connection Diagram:
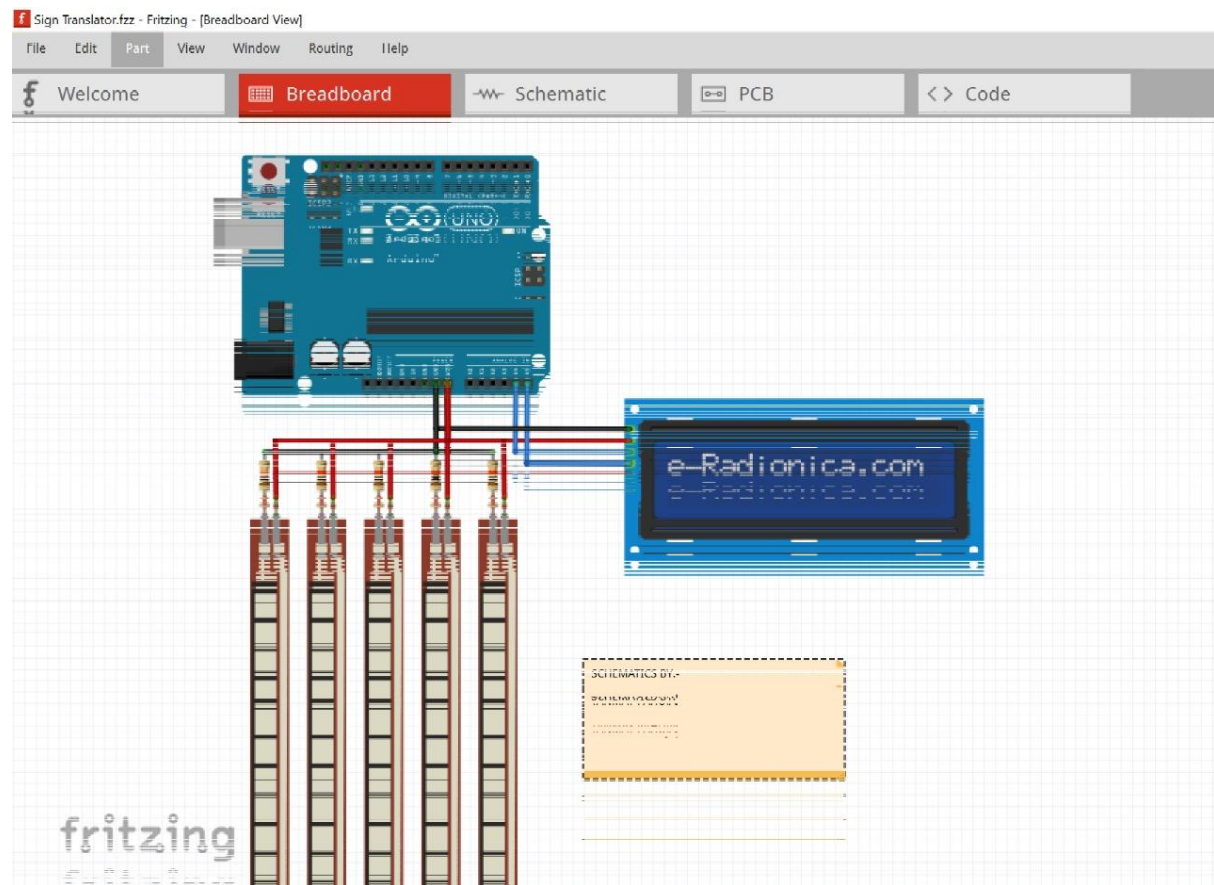
Code:

```cpp
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2);
const int flexPins[5] = {A0, A1, A2, A3, A4};
int flexValues[5];

void setup() {
    lcd.begin();
    lcd.backlight();
    lcd.setCursor(0, 0);
    lcd.print("Sign Detection");
    delay(2000);
    lcd.clear();
    Serial.begin(9600);
}

void loop() {
    for (int i = 0; i < 5; i++) {
        flexValues[i] = analogRead(flexPins[i]);
    }
    lcd.clear();
    lcd.setCursor(0, 0);
    String gesture = identifyGesture();
    if (gesture != "Nothing") {
        lcd.print(gesture);
    }
    Serial.println(gesture);

    delay(500);
}

String identifyGesture() {
    if (flexValues[0] > 600 && flexValues[1] > 600 && flexValues[2] > 600 && flexValues[3] > 600 && flexValues[4] > 600) {
        return "OK";
    } else if (flexValues[0] < 400 && flexValues[1] > 600 && flexValues[2] > 600 && flexValues[3] < 400 && flexValues[4] < 400) {
        return "How are you";
    } else if (flexValues[0] > 600 && flexValues[1] < 400 && flexValues[2] > 600 && flexValues[3] > 600 && flexValues[4] < 400) {
        return "Good morning";
    } else if (flexValues[0] > 600 && flexValues[1] < 400 && flexValues[2] < 400 && flexValues[3] > 600 && flexValues[4] > 600) {
        return "Welcome to VIT";
    } else if (flexValues[0] > 600 && flexValues[1] > 600 && flexValues[2] < 400 && flexValues[3] < 400 && flexValues[4] < 400) {
        return "I am really sorry";
    } else if (flexValues[0] < 400 && flexValues[1] < 400 && flexValues[2] > 600 && flexValues[3] > 600 && flexValues[4] > 600) {
        return "Thank you";
    } else if (flexValues[0] > 600 && flexValues[1] > 600 && flexValues[2] < 400 && flexValues[3] > 600 && flexValues[4] < 400) {
        return "Please help me";
    } else if (flexValues[0] > 600 && flexValues[1] > 600 && flexValues[2] < 400 && flexValues[3] > 600 && flexValues[4] < 400) {
        return "Please help me";
    } else if (flexValues[0] < 400 && flexValues[1] > 600 && flexValues[2] < 400 && flexValues[3] > 600 && flexValues[4] > 600) {
        return "Excuse me";
    } else if (flexValues[0] > 600 && flexValues[1] < 400 && flexValues[2] > 600 && flexValues[3] < 400 && flexValues[4] > 600) {
        return "See you soon";
    } else if (flexValues[0] < 400 && flexValues[1] < 400 && flexValues[2] < 400 && flexValues[3] < 400 && flexValues[4] < 400) {
        return "Nothing";
    }

    return "Unknown";
}
```

Project Outcome:

This project successfully demonstrates how sign language can be converted into text using sensor-based technology. By integrating flex sensors, an Arduino Uno, and an LCD display, we create a wearable assistive device that helps bridge the communication gap between sign language users and non-signers. The system effectively captures hand gestures, processes them through a microcontroller, and displays the corresponding text, making communication more accessible and inclusive.

Through this project, we gain valuable insights into sensor interfacing, microcontroller programming, and embedded system integration. We also develop a deeper understanding of I2C communication for efficient LCD operation and the role of resistors in stabilizing sensor readings. Beyond technical learning, this project highlights the real-world impact of assistive technology, showcasing how engineering solutions can improve accessibility for individuals with speech and hearing impairments.