NEW HORIZON
COLLEGE OF ENGINEERING
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade.

SMART GLOVES FOR THE DEAF AND DUMB

A MINI PROJECT

REPORT

Submitted by

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In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRONICS & COMMUNICATION
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the Mini project entitled **"Smart Gloves for The Deaf and Dumb"** is carried out by Miss. Nivedita Salimath, bearing USN: 1NH18EC080 bonafide students of NHCE, Bengaluru, in partial fulfillment for the award of Bachelor of Engineering in Electronics and Communication of the Visveswaraya Technological University, Belagavi during the year 2020-21. It is certified that all corrections and suggestions indicated for Internal Assessment have been incorporated in the report deposited in the department library. The mini project report has been approved as it satisfies the academic requirements in respect of the mini project work prescribed for the said degree.

Signature of the Guide	Signature of the HoD
Mr. Santhosh Krishna B V	Dr. Sanjeev Sharma
Senior Assistant Professor	Professor & HoD
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2. ____________________	2. ____________________

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The satisfaction that accompanies the successful completion of any task would be, but impossible without the mention of the people who made it possible, whose constant guidance and encouragement helped us succeed.

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ABSTRACT

This project aims to aid auditory and speech impaired people by providing them a

means to communicate basic lines without having to learn sign language, or as a temporary communication device until they can learn sign language. The glove has three flex sensors, that run along the length of any three fingers. The flex sensors detect when a finger has been moved due to a change in their bend angle and produce an accordingly varying output resistance. This change is given as input to Arduino Uno, that in turn, activates a pre-determined sentence to be displayed on a 16X2 LCD module. The pre-determined sentences can be changed by changing the Arduino source code accordingly and thus, the device can be easily customized to the user's needs.

CHAPTER 01

INTRODUCTION

Smart Hand Gloves assist genuinely tested individuals with carrying on with an ordinary existence with typical individuals. As speech disabled individuals can't talk, these gloves enable them to change over their hand signal into text and pre - recorded voice. Gloves, likewise, assist ordinary individuals with understanding what they are attempting to state and reply or act appropriately. This Smart Glove has the advantage of simple control from which a disabled individual becomes free to live. The fundamental goal of the executed venture is to build up a solid, simple to utilize, light weight keen hand gloves framework which can limits the impediments for debilitate individuals where they can remain with the race. Abstract: Smart Hand Gloves assist impaired individuals with living with typical individuals. As impaired individuals can't talk, these smart gloves enable them to change over his hand signal into text and if required, pre - recorded voice. This additionally assists typical individual with understanding what he is attempting state and answer likewise. The principal objective of the executed task is to build up a solid, simple to utilize, light weight keen hand gloves framework which can limits the hindrances for incapacitate individuals where they can remain with the race.

In this project, we attempt to aid users who are not very sharp. Around nine billion individuals on the planet are hard of hearing and unable to speak. The correspondence between a hard of hearing ordinary visual individuals is very cumbersome. This makes a next to no space for them with correspondence being a principal part of human existence.

The visually impaired individuals can talk unreservedly by methods for ordinary language though the hard of hearing have their own manual-visual language known as communication via gestures. Gesture based communication is a non-verbal type of communication which is found among hard of hearing networks in world. The dialects don't have a typical beginning and subsequently hard to decipher. The venture plans to encourage individuals by methods for a glove-based correspondence mediator framework.

The glove is inside outfitted with three flex sensors. For every motion, the flex sensor creates a relative change in opposition. The handling of these hand motions is in Arduino uno Board which is a development rendition of the Arduino microcontroller and the Arduino IDE programming.

It contrasts the information signal and predefined voltage levels put away in memory. As indicated by that necessary sound is created which is put away is memory with the assistance of speaker. In such a manner it is simple for not too sharp to speak with ordinary individuals.

In our life we as a whole go over many crippled individuals, some of them are incompletely and some are totally impaired. The somewhat debilitated individuals like who are imbecilic, hard of hearing, loss of motion in one leg or hand deals with their existence with troubles and feel confined from others. For their situation correspondence assumes a significant job to feel somebody better and humoring them in a movement where they may state themselves as free individual. By this idea the task Smart Hand Gloves for disabled people is grown so that impair individual can carry on with his life as he needs.

In this undertaking, Flex Sensor assumes the significant job. The glove is fitted with flex sensors along the length of each finger and the thumb. The flex sensors give yield as voltage variety that differs with level of curve. This flex sensor yield is given to the ADC channels of microcontroller. It measures the signs and perform simple to computerized signal change. Further the prepared information is sent in a remote way to the beneficiary area. In this part the signal is perceived, and the relating yield is shown on LCD and all the while a discourse yield is play sponsored through speaker. The versatility of this undertaking is a significant bit of leeway. Consequently, with the assistance of this undertaking, the obstruction looked by these individuals in speaking with the general public can be diminished by and large.

CHAPTER 02

LITERATURE SURVEY

paper	Author & Year of publication	Outcome	Limitation
1. On design and implementation of sign to speech/text system	Anwar Jamdal Ahmed Al-Maflehi Published in 2017 International Conference on Electrical, Electronics, Communication, Computer and Optimization Techniques (ICEECCOT)	Implementation of sign to speech/text translator.	Only limited signs are allowed.
2. Smart glove for sign language communication	Abhinandan Das, Lavish Yavad, Mayank Singhal Published in 2016 International Conference on Accessibility to Digital World (ICADW)	Creating a device hearing or speech impaired persons to communicate with others.	Heavier and Expensive.
3. Development of sign language using Flex sensors	Ajay Suri, Sanjay Kumar Singh, Rashi Sharma, Pragati Sharma Published in 2020 International Conference on smart electronics and communication (ICOSEC)	To reduce the communication barrier between a normal individual and a deaf/dumb individual.	Facial expressions are not considered.
4. Sign language interpreter using a smart glove	Nikhita Praveen, Naveen Karanth, M S Megha Published in 2014 International conference on Advances in Electronics, Computers and communications (ICAECC).	Upon reception, the letter corresponding to the received ASCII code is displayed on the computer and corresponding audio is played.	Not all words and letters are recognised.
5. A Cost-Effective Design and	Anirbit Sengupta, Tausif Mallick, Abhijit Das Published in 2019 Devices	To transform data into text liable to the hand shape detected and will	Complex Construction.

Implementation of Arduino Based Sign Language Interpreter	for intergrated circuits (DevIC)	produce the voice signal.	
6. Techno-talk: An American Sign Language (ASL) Translator	Arslan Arif, Iqra Jawaid Published in 2016 International Conference on control, decision and information technologies (CoDIT)	A simpler, easier and efficient solution to fill the gap between normal ang disabled people.	Only for American language.
7. Electronic speaking glove for speechless patients, a tongue to a dumb.	Syed Faiza Ahmed, Syed Mohammad Baber Ali Published in 2010 IEEE Conference on Sustainable utilization and development in engineering and Technology.	The Processing of the information sends a unique set of signals to the AVR microcontroller.	Hardware components are more and handling is bit difficult.

CHAPTER 03

EXISTING SYSTEM AND PROJECT DESCRIPTION

Existing systems:

1. American Sign language (ASL): It is a complete and natural language that has the similar linguistic properties as spoken language, with grammar that is different from English. American Sign Language (ASL) is expressed by movements of the hands and face. It is the language of many North Americans who are deaf and hard of hearing and is used by many hearing people as well.

Fig 3.1: American Sign Language

2. Glove – Sensor: Various sensor technologies are used to capture physical data such as bending of fingers Often a motion tracker, such as a magnetic tracking device or inertial tracking device is attached to capture the global position of the glove.

These movements are then interpreted by the software that accompanies the glove, so any one movement can mean any number of things. Gestures can then be categorized into useful information, such as to recognize standard sign language or other symbolic functions.

Fig 3.2: Existing smart-gloves system

Gesture based communication is the one method of specialized apparatus utilized by hard of hearing individuals to impart to one another and with the general public. Notwithstanding, ordinary individuals don't comprehend gesture-based communication, and this will make a huge correspondence hindrance between hard of hearing individuals and typical individuals. Moreover, the gesture-based communication is likewise difficult to learn because of its regular contrasts in sentence structure and language. Hence, there is a need to build up a framework which can help in making an interpretation of the communication via gestures into text and voice to guarantee the successful correspondence can be effectively occur in this network.

There are existing gloves that utilization this innovation to change standard gesture-based communication over to text or discourse. This, notwithstanding, requires the debilitated individual to learn standard gesture-based communication, which probably won't be conceivable in all cases. Consequently, they profit nothing by this innovation.

Our project intends to improve the current model to having essential signals, for example, twisting a finger, to impart restricted however significant data. This empowers crippled individuals who don't realize gesture-based communication to perform little, fundamental correspondence.

Objectives of the project:

- To study the existing data glove technologies commercially available in market.
- To arrive at the specific sensors and technical parameters of the hardware used in the project.
- To come up with basic gestures for certain lines of communication.
- To measure the sensor responses for various gestures and record the data sets for training the software.

Proposed Methodology:

Humans, being social animals, center almost all activities around communication and thus, not being able to communicate presents as a serious hindrance in even the most basic of activities. The age-old method of communicating with auditory and voice impaired people has been using sign-language. However, this method is impractical as most people are not familiar with the language. Our project aims to bridge this gap by building a framework that can perceive communication based on gesturing.

The proposed glove houses an electronic circuit that certain hand movements for the deaf and dumb in order to eradicate the information transmission barrier between the mute and the general public.

The crux of this project lies in the Arduino Uno chip and flex sensors. The proposal is to rely on a system that can effectively, within acceptable error, translate gesture-based communication to linguistic communication.

The flex sensors convert motion caused by gesturing into a varying output voltage, that can be interpreted by the Arduino and converted into visible text that can be displayed on the LCD.

Block Diagram:

Given below is a basic block diagram describing the project:

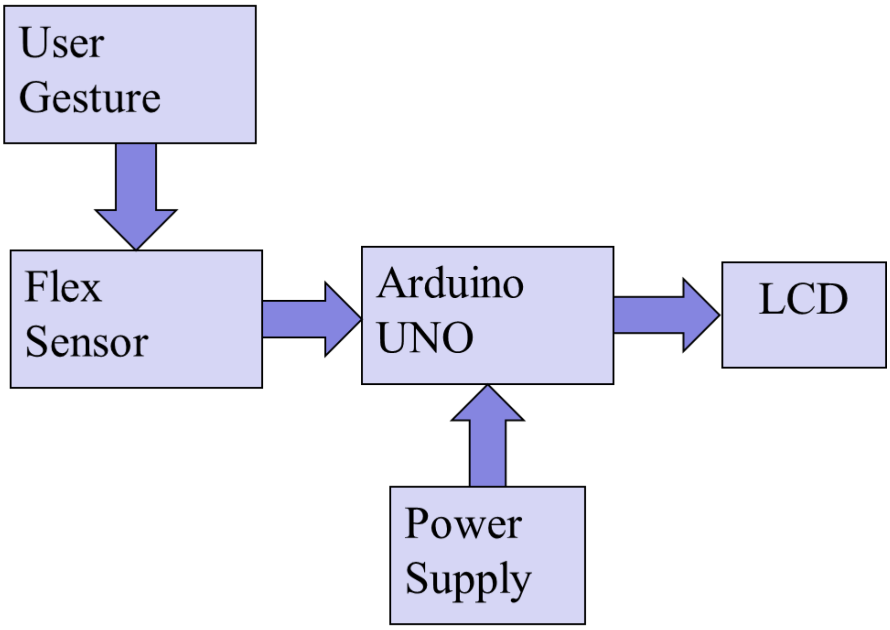


Fig 3.3: Block Diagram of the Smart Glove

3.1. Hardware Description:

The hardware components used in our project are as follows:

- Arduino Uno
- Flex Sensors
- Resistors
- LCD
- A Glove

3.1.1. Arduino Uno:

The **Arduino Uno** is an open-source microcontroller board based on the ATmega328P microcontroller and it is developed by Arduino.cc. The board is equipped with sets of both digital and analog input/output (I/O) pins that may be interfaced to various boards (shields) and other circuits.

The board has 14 digital I/O pins (six capable of PWM output), 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable It can be powered by the USB cable or by an external 9-volt battery though it accepts voltages between 7 and 20 volts.

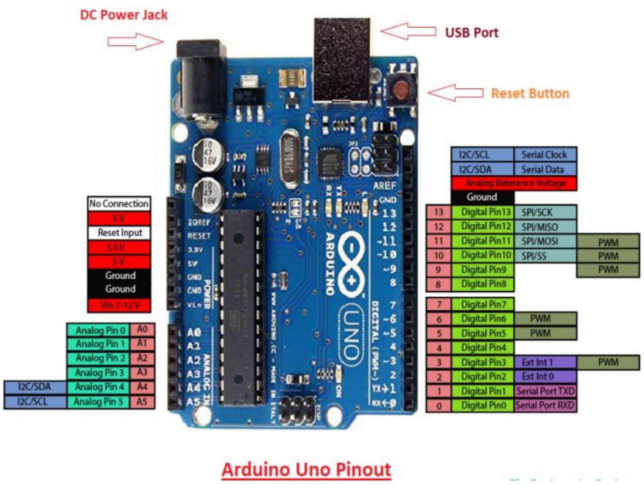


Fig 3.4: Pin Description of Arduino Uno

Features:

- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Clock Speed: 16 MHz
- Length: 68.6 mm
- Weight: 25 g
- Width: 53.4 mm
- Digital I/O Pins: 14 (of which 6 can provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB

3.1.2. Flex Sensors:

A flex sensor is also called as bend sensor which is a sensor that measures the amount of bending or deflection. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface.

Flex sensor is a 2-terminal device. It does not have polarized terminals like diode. So, there is no positive and negative.

Pin number	Description
P1	Usually connected to positive of power source.
P2	Usually connected to ground.

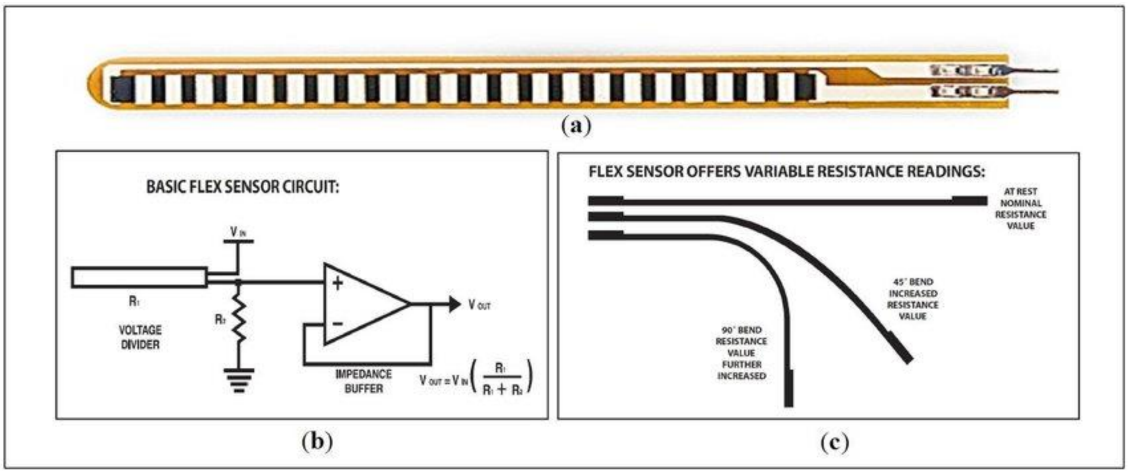


Fig 3.5: (a) A flex sensor
(b) A basic flex sensor circuit
(c) Variable resistances of a flex sensor

Features:

- Operating voltage of FLEX SENSOR: 0-5V
- Can operate on LOW voltages
- Power rating: 0.5Watt (continuous), 1 Watt (peak)
- Operating temperature: -45ºC to +80ºC
- Flat Resistance: 25K Ω
- Resistance Tolerance: ±30%
- Bend Resistance Range: 45K to 125K Ohms (depending on bend)

How to use a Flex Sensor:

As mentioned earlier**, FLEX SENSOR** is basically a **VARIABLE RESISTOR** whose terminal resistance increases when the sensor is bent. Depending upon the surface linearity sensor resistance increases. So, it is usually used to sense the changes in linearity.

As shown in the above figure, when the surface of FLEX SENSOR is completely in a linear pattern it will be having its nominal resistance. When it is bent 45º angle the FLEX SENSOR resistance increases to twice as before. And when the bent is 90º the resistance could go as high as four times the nominal resistance. So, the resistance across the terminals rises linearly with bent angle. So, in a sense the FLEX sensor converts flex angle to RESISTANCE parameter.

For convenience we convert this RESISTANCE parameter to VOLTAGE parameter. For that we are going to use **VOLTAGE DIVIDER circuit.** A typical VOLTAGE DIVIDER circuit is shown below.

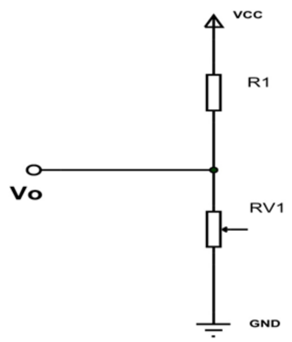


Fig 3.6: A Voltage Divider Circuit

In this resistive network we have two resistances. One is constant resistance (R1) and other is variable resistance (RV1). Vo is the voltage at midpoint of VOLTAGE DIVIDER circuit and is also the output voltage. Vo is also the voltage across the variable resistance (RV1).

So, when the resistance value of RV1 is changed the output voltage Vo also changes. So, we will have resistance change in voltage change with VOLTAGE DIVIDER circuit. Here we will replace the variable resistance (RV1) with FLEX SENSOR. The circuit will be as shown below.

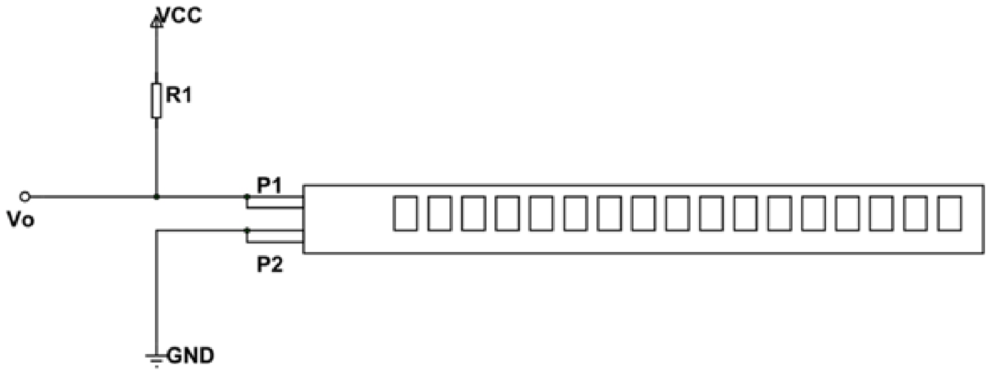


Fig 3.7: Pin Description of a Flex Sensor

As shown in the figure, R1 here is a constant resistance and **FLEX SENSOR** which acts as a variable resistance. Vo being output voltage and the voltage across the FLEX SENSOR.

$V_o = V_{CC}(R_x/(R_1+R_x))$.

R_x – flex sensor resistance

Now, when the FLEX SENSOR is bent the resistance increases. This increase also appears in VOLTAGE DIVIDER circuit. With that the drop across the FLEX SENSOR increases so is Vo. So, with increase in bent of FLEX sensor Vo voltage increases linearly. With that we have VOLTAGE parameter representing the flex.

We will take this voltage parameter and feed it to A_{DC} to get the digital value which can be used conveniently.

Applications:

- Robotics
- Gaming (Virtual Motion)
- Medical Devices
- Computer Peripherals
- Musical Instruments

- Physical Therapy

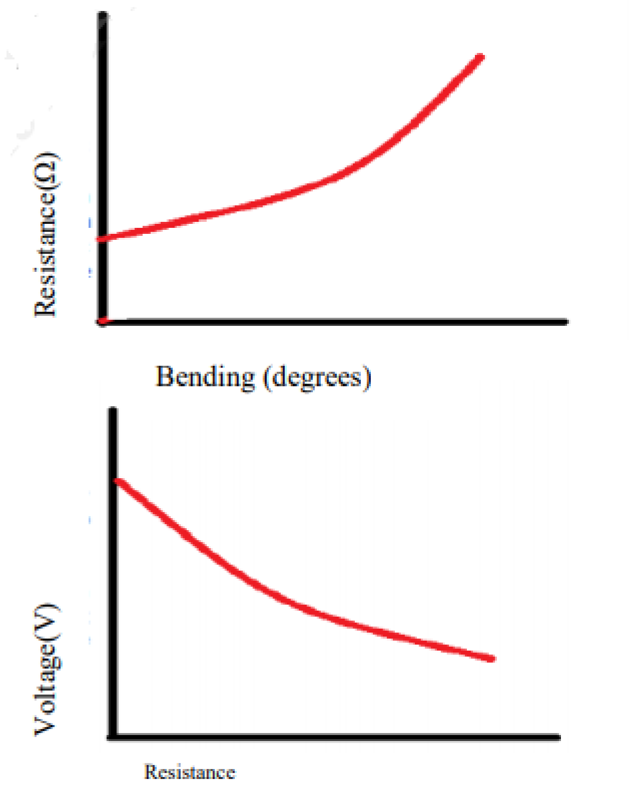


Fig 3.8: Characteristics of a flex sensor

3.1.3. LCD:

An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 LCD display is a very basic module. The 16×2 translates a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7-pixel matrix.

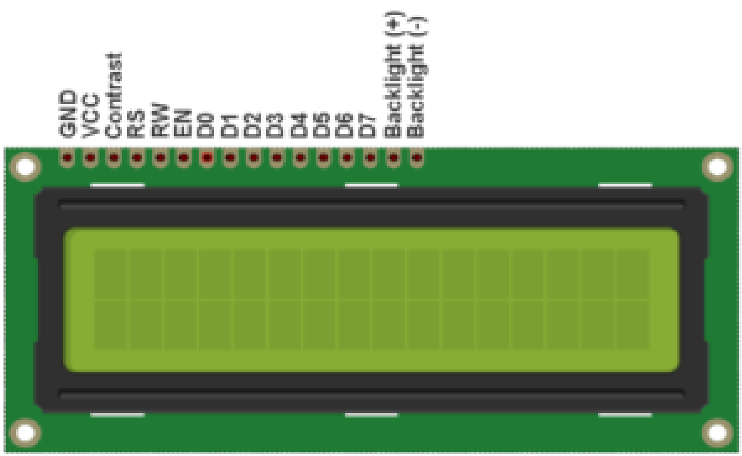


Fig 3.9: A 16X2 LCD Display

3.2. Software Description:

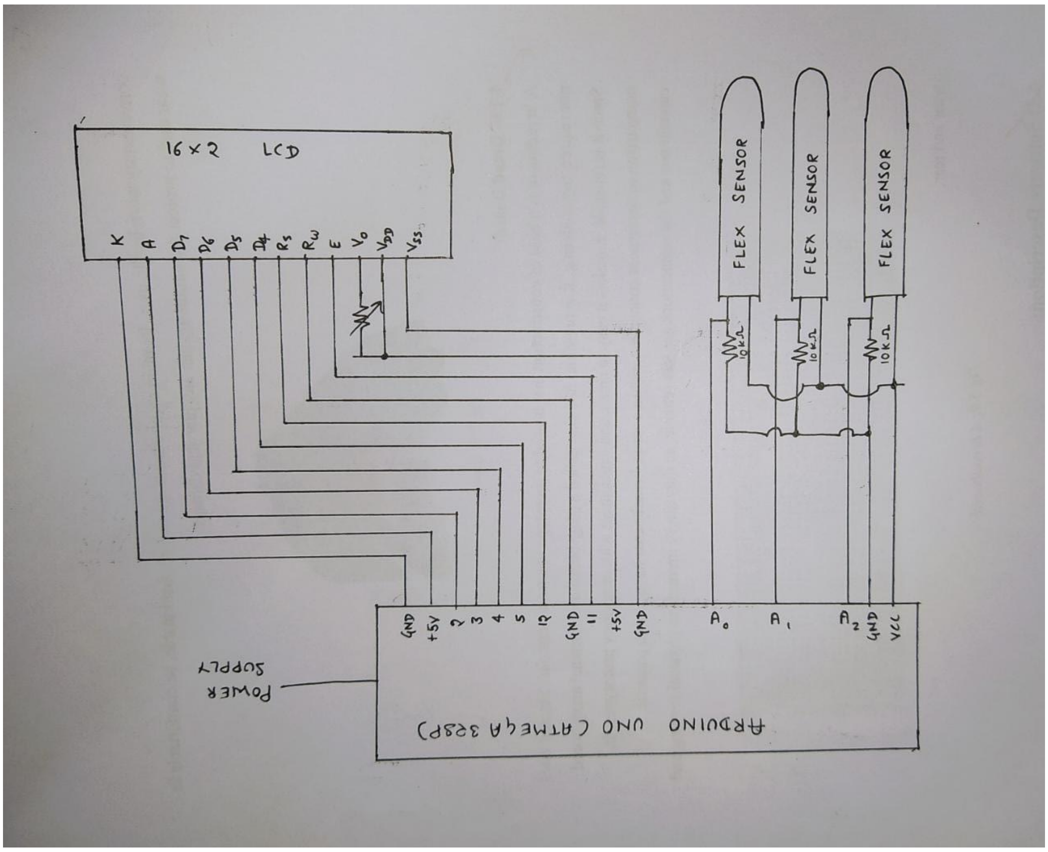
3.2.1. Arduino IDE

The Arduino Integrated Development Environment (Arduino Software (IDE)) – which is having a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. The software is used to connect the Arduino and the Hardware to upload programs and to communicate with them.

- ✓ Written in – C, C++, JAVA
- ✓ Supported Operating Systems – Windows, iOS, Linux

Fig 3.10: The Arduino Logo

CIRCUIT DIAGRAM:



STEPS OF WORKING

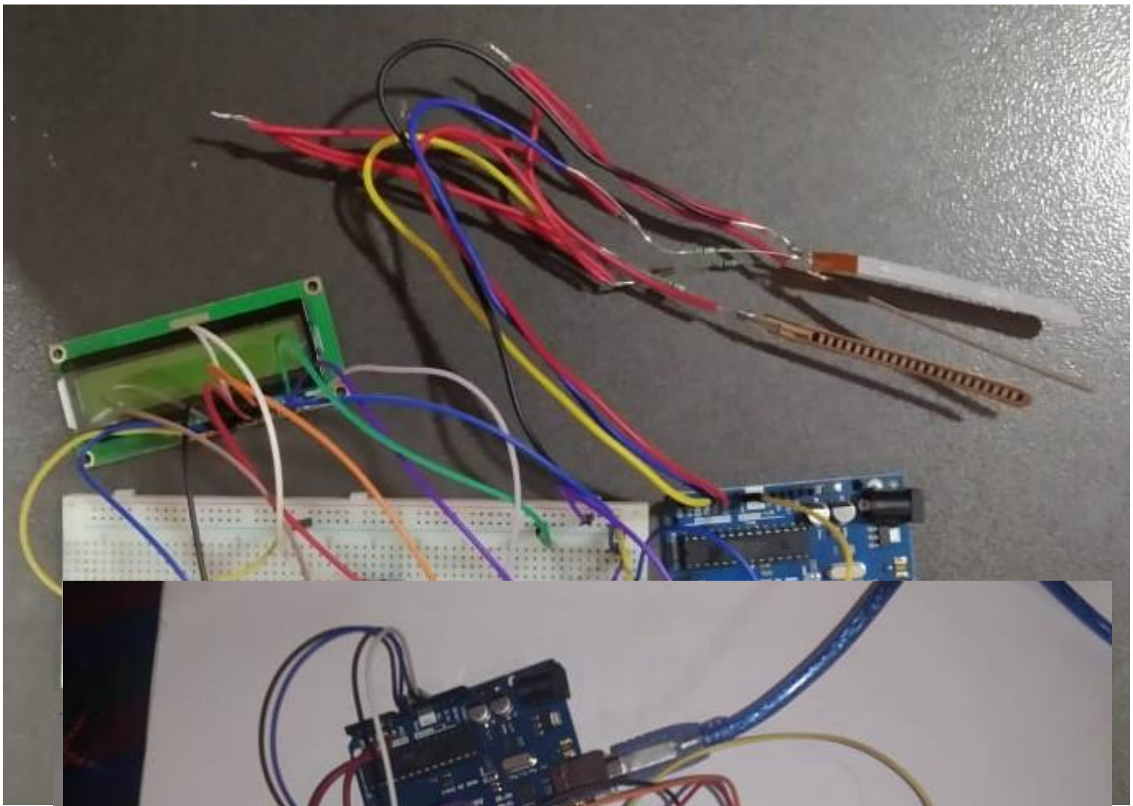
1. When the user bends one of the three fingers- thumb finger, index finger or middle finger, for more than 45 degrees, a stimulus is sent to the Arduino UNO board.
2. The Arduino UNO board, based on the program loaded on it, converts it into a text message output.
3. The Arduino UNO board send its output to the LCD Display.
4. The LCD display displays the predetermined message for that particular finger movement.

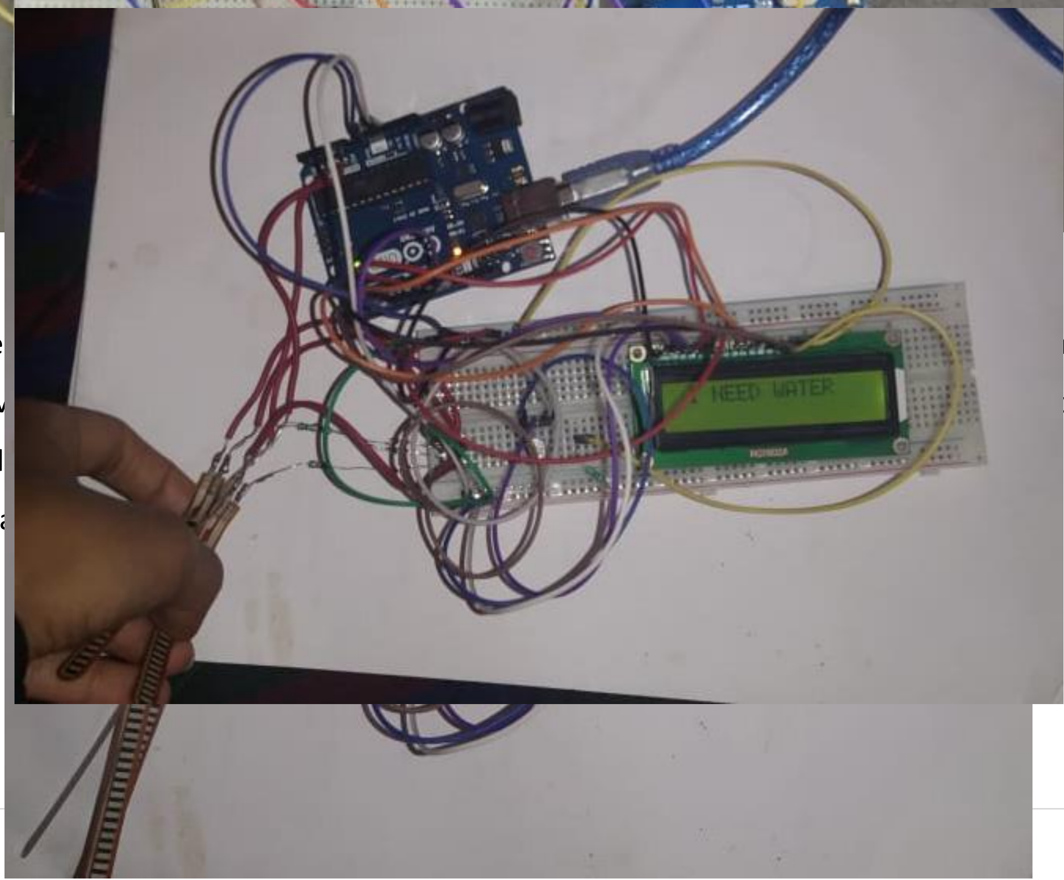
CHAPTER 04

RESULTS AND DISCUSSION

The flex sensors attached to three fingers had three individual stimuli, which could be converted to one of three lines of basic communication. The circuit was realized on a breadboard and the Arduino was programmed on Arduino IDE. It was observed that finger motion successfully generated the predetermined messages assigned to it.

The circuit and the results of the project are as shown below.





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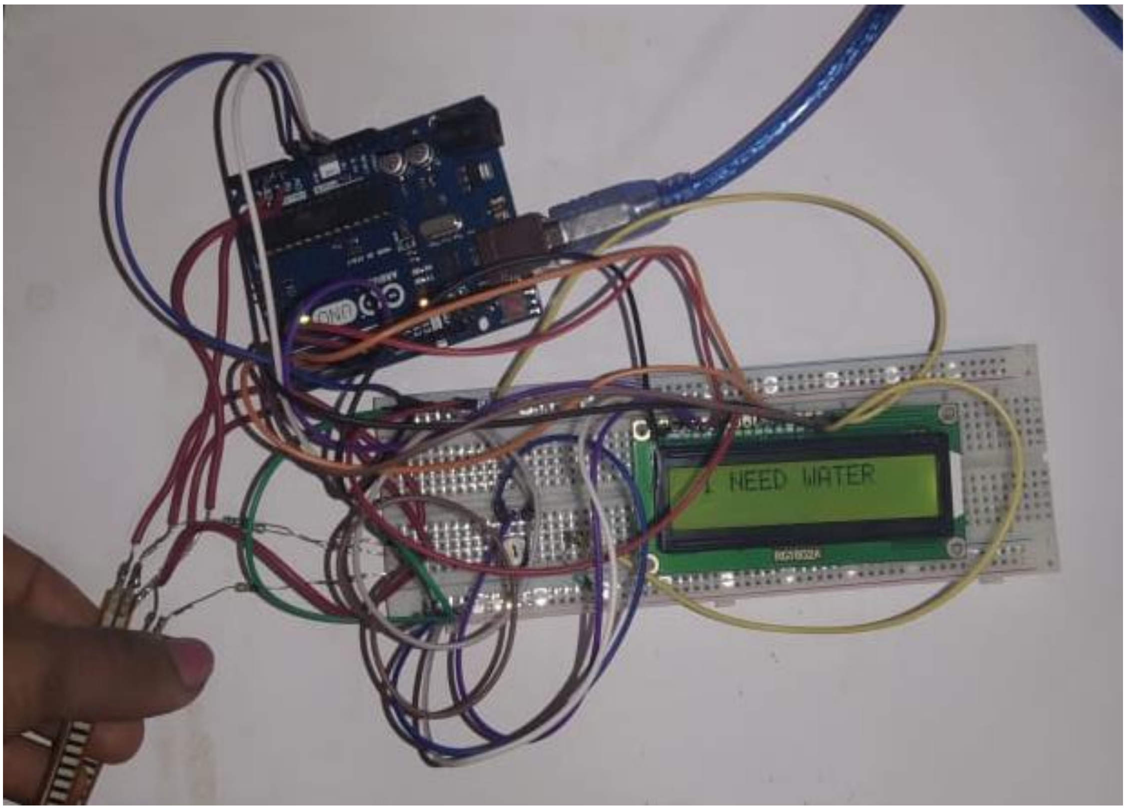

Fig 4.4: Output 3 of the smart glove

CHAPTER 05
CONCLUSION, APPLICATIONS AND FUTURE SCOPE

Advantages:

1. The gloves enable auditorily and vocally disabled people to carry out basic communication that is very much required to function in a society.
2. The gloves do not require either the user or the person the user intends to communicate with to know American Sign Language.
3. The gloves save time by converting a single gesture into a line of text.

Applications:

As discussed earlier, the project is of great use to auditorily and vocally impaired people who do not know American Sign Language to communicate their basic needs.

A less obvious application of the circuit is helping temporarily impaired people, such as people who have undergone surgical procedures or suffered accidents, to communicate their basic needs.

The Smart glove hardware is utilized to capture the finger flexion data as well as the orientation of the hand along with acceleration data for various types of gestures. The glove, unlike existing systems, can be used by disabled people who aren't haven't familiarized themselves with standard American Sign Language, to convey basic information, like feeling hunger or needing to use the bathroom.

Future Scope:

The project in discussion uses only three flex sensors and converts three individual finger motions into one of three predetermined lines of text. This can be improved upon by adding more sensors and more combination of motions to translate into a message from a much larger sample set of predetermined messages, while keeping in mind the simplicity of gestures.

A speaker can also be included in the circuit to read the output message out loud, for more convenience.

These smart gloves can be used as handy and hardware system along with pair of data gloves can be established in order to communicate with anyone at anywhere. It can be perfectly utilized in different fields like in railway stations, airports to gather certain information regarding ticket reservation etc, in present scenario metro stations are in lead so shortly these smart gloves will be showcased notably around the world.

In future it can be implemented by increasing the quality of the mobile application which improves a lot in assisting them more significantly and peacefully. This system has spectacular application in home automation which can be further used in future for reliability of resources.

These smart gloves can be used along with IOT domain and still many features can be added for it in order to cope with any situation significantly.

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APPENDIX-1
SOURCE CODE FOR ARDUINO

```
int thumb;
int first_finger;
int second_finger;

#include<LiquidCrystal.h>

 //initialize the library by associating any needed LCD
interface pin
 //with the arduino pin number it is connected to
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 =
2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
void setup() {
   //put your setup code here, to run once:
  pinMode(A0, INPUT);
  pinMode(A1, INPUT);
  pinMode(A2, INPUT);
  Serial.begin(9600);
  lcd.begin(16, 2);

}



void loop()
{
   //put your main code here, to run repeatedly:
     int thumb = analogRead(A0);
     int first_finger = analogRead(A1);
     int second_finger = analogRead(A2);
     Serial.print(thumb);
     Serial.print("\t");
```

```
Serial.print(first_finger);
Serial.print("\t");


Serial.print(second_finger);
Serial.print("\t");




if(thumb >=470 )
{
      lcd.clear();
      lcd.setCursor(1,0);
      lcd.print("I NEED WATER");
      delay(500);

}

else if(first_finger >=470 )
{
     lcd.clear();
     lcd.setCursor(1,0);
     lcd.print("I NEED FOOD");
     delay(500);

}

else if(second_finger >=470 )
{
      lcd.clear();
      lcd.setCursor(1,0);
      lcd.print("RESTROOM");
      delay(500);
```

```
        }

        else
        {
              lcd.clear();
              lcd.setCursor(1,0);
              lcd.print("NOTHING");
              delay(500);

       }

}
```