***ABSTRACT***

**Generally dumb people use sign language for communication but they find it difficult to communicate with people who don’t understand sign language. This project aims to lower this barrier in communication with the help of an electronic device that can translate sign language into audio in order to make the communication take place between the mute and the general public. A Wireless data gloves is used which is attached with flex sensors along the length of each finger and the thumb. Flex sensors measures change in resistance depending on the amount of bend on the sensor. The final implemented design is using homemade flex sensor by using aluminum, cardboard, paper, lead. It is portable as we are using lithium-ion rechargeable battery which weighs less and is robust gives user the liberty to carry it anywhere at their will. Here we are using raspberry pi and ads1115 for design .Hence this project is an attempt to make it easy to understand the actions of the dumb people by getting the output in the form of voice.**

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# TOPIC: 1

**INTRODUCTION**

#### Introduction

* **Generally dumb people use sign language for communication but they find difficulty in communicating with others who don’t understand sign language. This project aims to lower this barrier in communication.**
* **It is based on the need of developing an electronic device that can translate sign language into visual in order to make the communication take place between the mute communities with the general public possible.**
* **A Wireless data gloves is used which is normal cloth driving gloves fitted with flex sensors along the length of each finger and the thumb. Mute people can use the gloves to perform hand gesture and it will be converted into visible character so that normal people can understand their expression.**
* **Sign language is the language used by mute people and it is a communication skill that uses gestures instead of sound to convey meaning simultaneously combining hand shapes, orientations and movement of the hands, arms or body and facial expressions to express fluidly a LCD thoughts.**
* **Signs are used to communicate words and sentences to visual. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for whole words.**
* **It can also provide sign for letters to perform words that don’t have corresponding sign in that sign language. In this project Flex Sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. The final implemented design is using cupper plate based glove.**
* **This glove can be made using small metal strips that are fixed on the five fingers of the glove. It is better to use a ground plate instead of individual metal strips is because the contact area for ground will be more facilitating easy identification of finger position. We are in process of developing a prototype using this process to reduce the communication gap between differentially.**

#### HISTORY

* **The first Hand Talk glove was designed by Ryan Patterson in the year 2001. He began his mission with his Sign Language. Sign Language Translator consists of two separate components, a leather golf**
* **Glove that has ten flexible sensors sewn into it which monitor the position of the fingers by measuring the electrical resistance created by the fingers as they bend.**
* **A small micro controller on the back of the hand converts the change in the electrical current into digital signals and transmits them wireless to a computer. The computer then reads the numerical values and converts them into the letters which appear on the screen.**
* **The main disadvantage with this model was that a computer or a laptop was always required for its functioning which made it less portable.**

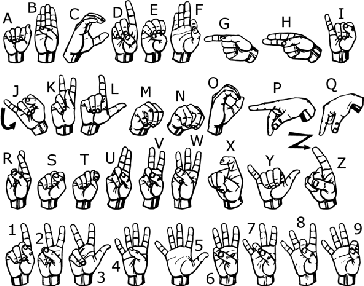
#### SIGN LANGUAGE

* **Sign language is a movement language which expresses certain semantic information through hands and fingers motion. It is the basic communication medium between the deaf people and or deaf and mute people. A translator is usually needed when an ordinary person wants to communicate with a deaf one. Deaf and dumb people use sign language as their medium of communication.**
* **Wherever communities of deaf people exist, sign languages develop. Singing is also done by person who can hear, but cannot physically speak. A sign language can provide an opportunity for a mute person to communicate with non-signing people without the need for an interpreter. Sign languages are well structured languages with phonology, Morphology, syntax and grammar distinctive from spoken languages. In this project flex sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. Sign languages are not mime-in other words, signs are conventional, often arbitrary and do not necessarily have a visual relationship to their referent, much as most spoken language is not onomatopoeic.**
* **In these sign languages there are different types of position of fingers made for different sign. A common misconception is that sign languages are somehow dependent on spoken languages, that is, that they are spoken language spelled out in sign, or that they were invented by hearing people.**
* **In this I make Indian sign language’s alphabets. For this I define four fingers for different name. For first finger the name given as pointer finger and for second finger name given as middle finger and for third finger name given as ring finger and for last finger name given as little finger.**



**Fig. Name of finger**

#### Indian sign languages

* **For making ‘A’ closed fist with thumb extended for ‘B’ flat palm with thumb touching pointer finger. For ‘C’ a letter c with fingers and thumb. For ‘D’ a letter d with thumb and three fingers with thumb and pointer r finger extended upward. For, ‘E’ open first with thumb curled across palm. For ‘F’ thumb and pointer forming a circle, reaming fingers extended upward. For ‘G’ closed first with pointer finger extended to side. Foe ‘H’ closed first with pointer and middle fingers and thumb extended to side. For ‘I ’closed with little finger extended upward. For ‘K’ pointer and middle finger at angle with thumb. For ‘L’ thumb and pointer finger at a right angle.**
* **FOR ‘m’ pointer middle and ring fingers resting on thumb, with little fingers trucked. For ‘N’ pointer and middle fingers resting thumb, with ring and little fingers tucked. For ‘O’ all fingers forming on o. For ‘P’ pointer and middle fingers extended downward. For ‘Q’ pointer finger extended downward. For ‘R’ closed first with pointer and middle fingers extended and crossed. For ‘S’ closed fist with thumb curled over fingers. For ‘T’ closed fist with thumb between pointer and middle fingers. For ‘U’ closed with pointer and middle finger extended upward and touching. For ‘V’ closed fist with pointer and middle finger extended upward and separated. For ‘X’ closed fist with pointer fingers extended and curled. For ‘Y’ closed fit with thumb and ring fingers extended. ‘J’ and ‘Z’ are different form all other alphabets so it is not f o r m a k i n g u s i n g o n l y f l e x s e n s o r .**

### Fig .sign language

#### USE OF SIGN LANGUAGE

* **A sign language (also signed language) is a language which chiefly uses manual communication to convey meaning, as opposed to acoustically conveyed sound patterns. This can involve simultaneously combining hand shapes, orientation and movement of the hands, arms or body, and facial expressions to express a speaker's thoughts.**
* **Sign languages share many similarities with spoken languages (sometimes called "oral languages"), which depend primarily on sound, and linguists consider both to be types of natural language. Although there are some significant differences between signed and spoken languages, such as how they use space grammatically, sign languages show the same linguistic properties and use the same language faculty as do spoken languages.[1][2] They should not be confused with body language, which is a kind of non-linguistic communication.**
* **Wherever communities of deaf people exist, sign languages have developed, and are at the cores of local deaf cultures. Although signing is used primarily by the deaf, it is also used by others, such as people who can hear but cannot physically speak, or have trouble with spoken language due to some other disability (augmentative and alternative communication).**
* **It is not clear how many sign languages there are. A common misconception is that all sign languages are the same worldwide or that sign language is international. Aside from the pidgin International Sign, each country generally has its own, native sign language, and some have more than one (although there are also substantial similarities among all sign languages). The 2013 edition of Ethnologies lists 137 sign languages.[3] Some sign languages have obtained some form of legal recognition, while others have no status at all.**
* **Linguists distinguish natural sign languages from other systems that are precursors to them or derived from them, such as invented manual codes for spoken languages, home sign, "baby sign", and signs learned by non-human primates.**

#### PROBLEM DURING INTERFACE TO SIGN LANGUAGE

1. **DEVICE USE FOR THE GLOVE INTERFACE PROBLEM OF DIFFERENT COUNTRIES HAVE DIFFERENT SIGN LANGUAGES.**

* **This is the sign for the word "math" in two different sign languages—American Sign**

Language on the left, and Japanese Sign Language on the right. This question would make sense if sign language was a system invented and then handed over to the deaf community as an assistive device. But sign languages, like spoken languages, developed naturally out of groups of people interacting with each other. We know this because we have observed it happen in real time.

1. **SIGN LANGUAGE DOES NOT REPRESENT SPOKEN LANGUAGE.**

* **Because sign languages develop within deaf communities, they can be independent of the surrounding spoken language. American Sign Language (ASL) is quite different from British Sign Language (BSL), despite the fact that English is the spoken language of both countries. The above picture shows the sign WHERE in BSL (on the left) and ASL (on the right).**
* **That said, there is a lot of contact between sign language and spoken language (deaf people read and write or lip-read in the surrounding language), and sign languages reflect this. English can be represented through fingers palling or artificial systems like Signed Exact English or Cued Speech. But these are codes for spoken or written language, not languages themselves.**

#### LEARNING ABOUT SIGN LANGUAGE.

* **Learning of sign language is difficult because there is many problems during interface the gaining of sign language. This is done with help of finger movement and mind power control on the finger.**
* **The finger movement is important to show the word which you want to represent.**

#### UNDERSTANDING THE SIGN LANGUAGE BY OTHER.

* **It is very important part of sign language in which interpretation of finger movement is important.**
* **Main the interpretation of finger movement shows word. If interpretation is not perfect then**

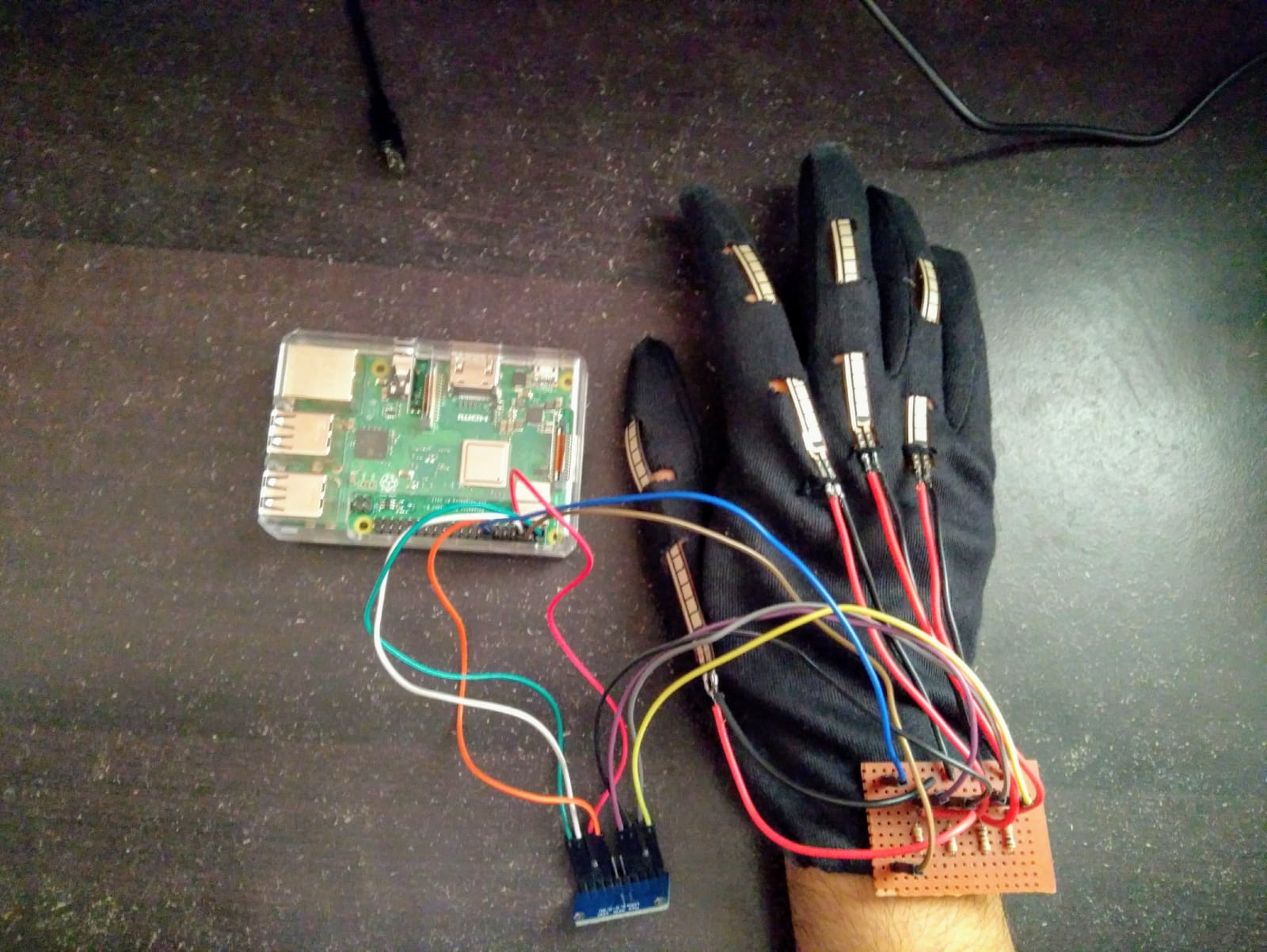
meaning of word is change.

* **So that it is important that the other person should know the sign language.**

#### DEVICE USE FOR THE GLOVE INTERFACE PROBLEM OF SIGN

**LANGUAGE**

* **In general, deaf people have difficulty in communicating with others who do not understand sign language. Even those who do speak aloud typically have a “deaf voice” of which they are self-conscious and that can make them reticent. The Hand Talk glove is a normal, cloth driving glove fitted with flex sensors.**
* **The sensors output a stream of data that varies with degree of bend made by the fingers. Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. They convert the change in bend to electrical resistance - the more the bend, the more the resistance value. The output from the sensor is converted to digital and processed by using micro controller and then it responds in the voice using speaker.**
* **In this project we have used a ,t. Hardware Components used are raspberry pi , LCD display (16x2), flex sensors, Power supply and ads115.**



### Fig .Hand talk glove

***TOPIC: 2***

**WORKING PRINCIPLE**

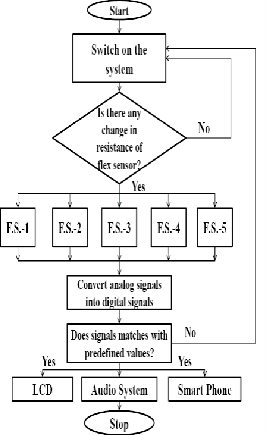
#### WORKING PRINCIPLE

* **The Flex sensors are mounted on the hand gloves. This hand gloves are worn by the person. The sensors can detect the hand movement done by the person. And the sensors can convert these movements into the electrical signal. The voltage and resistance range for each movement is recorded and it is programmed in the micro controller as a reference voltage.**
* **The output coming from the sensor is given to the micro controller for the comparison with**

the reference voltage. After comparison, the measured voltage would lie in the particular range as programmed in the micro controller.

* **. The sentence belonging to that range would be displayed on the display by using particular**

software such as Terminal software.



### Fig. Working process of device HAND TALK GLOVES

***TOPIC: 3***

**BLOCK DIAGRAM**

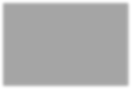
#### BLOCK DIAGRAM

POWER SUPPLY

(5 V, D.C)

OUTPOT (LCD)

SENSOR (FLEX **)O**



* Raspberry

pi and adc

.

**Fig. Block diagram of HAND TALK GLOVES.**

* **FLEX(SENSOR):**
* **It is a analog component. A simple flex sensor 2.2" in length. As the sensor is flexed, the resistance across the sensor increases. The resistance of the flex sensor changes when the metal pads are on the outside of the bend (text on inside of bend). Connector is 0.1" spaced and bread**

board friendly.

* **The usable range of the sensor can be flexed without a problem, but care should be taken to minimise flexing outside of the usable range. For best results, securely mount the base and bottom portion and only allow the actual flex sensor to flex.**

#### Raspberry pi:

* **Raspberry pi is an open source, computer hardware and software company, project, and user community that designs and manufactures microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world.**

#### LCD(OUTPUT):

* **LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various**

devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

* **The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.**

#### POWER SUPPLY:

* **A power supply is an electronic device that supplies electric energy to an electrical load. The primary function of a power supply is to convert one form of electrical energy to and, as a result, power supplies are sometimes referred to as electric power converters. Some power supplies are discrete, stand-alone devices, whereas others are built into larger devices along with their loads.**
* **Examples of the latter include power supplies found in desktop computers and consumer electronics devices.**

# TOPIC: 4

**CIRCUIT DIAGRAM**

**Circuit diagram**

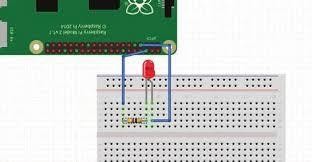


fig. Raspberry pi connection with flex sensor

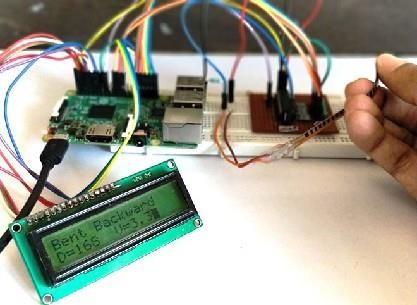
* **This raspberry pi flex sensor circuit might seem to be a bit complex with lots of wires, but if you take a closer look most of the wires are directly connected from the LCD and 8-bit**

data pin to the Raspberry pi.

* **Like all ADC modules, the ADC0804 IC also requires a clock signal to operate, luckily this IC has an internal clock source, so we just have to add the RC circuit to the CLK in and CLK R pins as shown in the circuit. We have used a value of 10K and 105pf, but we can use any value close like 1uf, 0.1uf, 0.01uf should also work.**
* **Then to connect the Flex sensor we have used a potential divider circuit using a 100K resistor. As the Flex sensor is bent the resistance across it will vary and so will the potential drop across the resistor. This drop is measured by the ADC0804 IC and 8-bit data is generated accordingly.**
* **Once we are done with the connections, we should read the status of these 8-bits using Raspberry Pi and convert them to Decimal so that we can make use of them. The program**

for doing the same and displaying the resulting values on the LCD screen is given at the end of this page. Further the code is explained into small junks below.

**•**



**fig. raspberry connection with lcd**

* **We need an LCD library to interface LCD with Pi. For this we use the library which will help us to interface a 16\*2 LCD display with a Pi in four wire mode. Also we need libraries**

to make use of time and Pi GPIO pins.

#### Components

* + **There are main components in circuit of HAND TALK GLOVE ,**
  1. **Flex sensor (2.2 inch)**
  2. **LCD(liquid crystal display) 16X2**
  3. **Connecting wire**
  4. **Resistor**
  5. **glove**
  6. **raspberry pi and adc**

Mainly those components are use to built up HAND TALK GLOVES.

#### Flex sensor:

* + **It is a analog component. A simple flex sensor 2.2" in length. As the sensor is flexed, the resistance across the sensor increases. The resistance of the flex sensor changes when the metal pads are on the outside of the bend (text on inside of bend). Connector is 0.1" spaced and bread board friendly.**
  + **The usable range of the sensor can be flexed without a problem, but care should be taken to**

minimise flexing outside of the usable range. For best results, securely mount the base and bottom portion and only allow the actual flex sensor to flex.

Features

* + **Angle Displacement Measurement**
  + **Bends and Flexes physically with motion device**
  + **Possible Uses**
  + **Low profile**
  + **Simple construction Applications**
  + **Robotics**
  + **Gaming (Virtual Motion)**
  + **Medical Devices**
  + **Computer Peripherals Specifications**

Parameter Value

* + - Life cycle >1 million
    - Height <0.43mm
    - Temperature range -35C to +80C
* **In simple words, flex sensors are analog resistors which work as variable analog voltage dividers.**

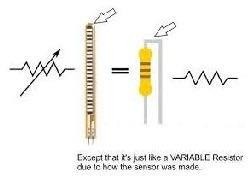


Fig8.Flex sensor basic

* **They contain carbon resistive elements within a thin flexible substrate. More carbon means less resistance.**
* **Usually a flex sensor is used in voltage divider configuration. It is shown below:**

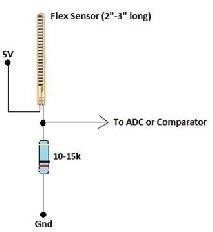


Fig9.flex sensor in voltage divider configuration

#### Resistor:

Fig10.resister

* **A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits resistors are used to limit current flow, to adjust signal levels, bias active elements, terminate transmission lines among other uses.**
* **High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage**
* **. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.**

#### LCD:

Fig11.LCD 16X2

* **LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.**
* **A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD**

each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

* **The command register stores the command instructions given to the LCD. A command is an**

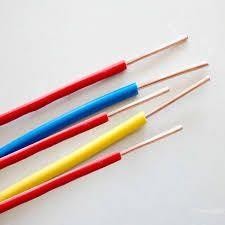
instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

|  |  |  |
| --- | --- | --- |
| **Pin No** | **Function** | **Name** |
| 1 | Ground (0V) | Ground |
| 2 | Supply voltage; 5V (4.7V – 5.3V) | Vcc |
| 3 | Contrast adjustment; through a variable resistor | VEE |
| 4 | Selects command register when low; and data register when high | Register Select |
| 5 | Low to write to the register; High to read from the register | Read/write |
| 6 | Sends data to data pins when a high to low pulse is given | Enable |
| 7 | 8-bit data pins | DB0 |
| 8 | DB1 |
| 9 | DB2 |
| 10 | DB3 |
| 11 | DB4 |
| 12 | DB5 |
| 13 | DB6 |
| 14 | DB7 |
| 15 | Backlight VCC (5V) | Led+ |
| 16 | Backlight Ground (0V) | Led- |

### Table no: LCD pin configuration

#### Connecting wire

* **A wire is a single, usually cylindrical, flexible strand or rod of metal. Wires are used to bear mechanical loads or electricity and telecommunications signals. Wire is commonly formed by drawing the metal through a hole in a die or draw plate. Wire gauges come in various standard sizes, as expressed in terms of a gauge number. The term *wire* is also used more loosely to refer to a bundle of such strands, as in "multistranded wire", which is more correctly termed a wire rope in mechanics, or a cable in electricity.**
* **Wire comes in solid core, stranded, or braided forms. Although usually circular in cross- section, wire can be made in square, hexagonal, flattened rectangular, or other cross-sections, either for decorative purposes, or for technical purposes such as high-efficiency voice coils in loudspeakers. Edge-wound[1] coil springs, such as the Slinky toy, are made of special flattened wire.**



### Fig. Connecting wire

#### Gloves:

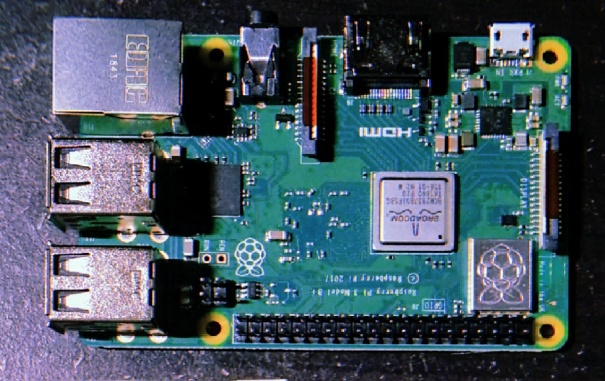
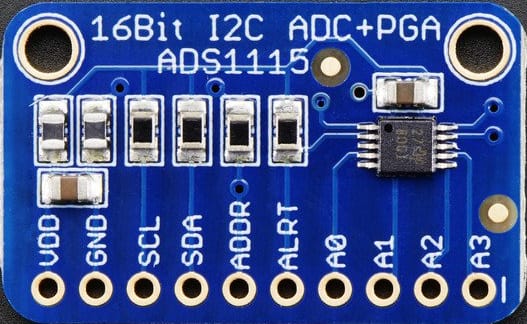
* **A glove is a garment covering the whole hand. Gloves have separate sheaths or openings for each finger and the thumb; if there is an opening but no covering sheath for each finger they are called “fingerless gloves”. Fingerless gloves with one large opening rather than individual openings for each finger are sometimes called gauntlets.**
* **Gloves which cover the entire hand or fist but do not have separate finger openings or sheaths are called mittens. Mittens are warmer than gloves made of the same material because fingers maintain better when they are in contact with each other. The following glove which is shown in figure is normal glove that we worn in winter.**
* **A hybrid of glove and mitten also exists, which contains open-ended sheaths for the four finger (as in fingerless glove, but not the thumb) and also an additional compartment encapsulating the four finger as a mitten would. This compartment can be lifted off the fingers and folded back to allow the individual fingers ease of movement and access while the hand remains covered. The usual design is for the mitten cavity to be stitched onto the back of the fingerless glove only, allowing it to be flipped over (normally held back by a button) to transform the garment from a mitten to a glove.**
* **Gloves protect and comfort hands against cold or heat, damage by friction, abrasion or chemicals, and disease; or in turn to provide a guard for what a bare hand should not touch. Latex, nit riles rubber or disposable gloves are often worn by health care professionals as hygiene and contamination protection measures.**
* **Gloves are made of materials including cloth, knitted or felted wool, leather, rubber, latex, neoprene, and metal. Gloves of Kevlar protect the wearer from cuts. Gloves and gauntlets are integral components of pressure suits and spacesuits. Generally particular sign, the most obvious requirement is timing. The sensor glove must be part of a real time system that detects and processes information fast enough such that so sign is missed. Sensor gloves are normally gloves made out of cloth with sensors fitted on it.**
* **Mute people can use the gloves to perform hand signs so that normal people can understand their expression. The idea of electronic gloves is not a new one, and appropriate technology to making the sign of amount of finger bending has been researched in the past as a result.**



### Fig.glove with flex sensor

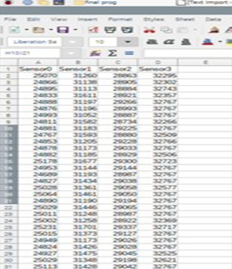
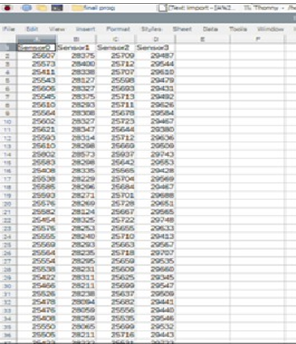
#### 6.Raspberry pi and ADC:

* **The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python**
* **ADC. Stands for "Analog-to-Digital Converter." Since computers only process digital information, they require digital input. Therefore, if an analog input is sent to a computer, an analog-to-digital converter (ADC) is required**

***Topic* :5 Readings**

figure A figure B

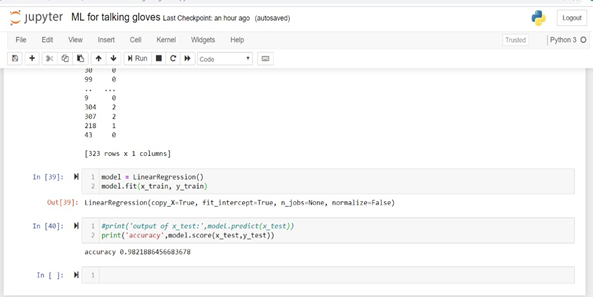
 

* These are the reading for various signs.100 readings for each sign is taken.

Sign readings for letter A

Sign readings for letter B

figure C



* We used machine learning to check the accuracy of the sensors.

Accuracy=98%

# TOPIC: 6

## ADVANTAGE AND DISADVANTAGE

#### It can be used for computer gaming. It is loaded with touch sensors on the thumb, the fingers and the palm. It allows the wearer to forego using the keyboard.

* + **Another application can be in the field of fire extinguishing by fire extinguishers in a situation where members of a team can't even see each other; these gloves will be able to transmit signals via simple hand gestures.**
  + **The gloves have symbols on them that light up according to the signal received. Matlab, while programming for serial communication is integrate into Arduino UNO.**
  + **COM9 is location of Arduino connect to USB ports while gain block is calculation for conversion value from Arduino pin via serial port into corresponding voltage references. Gain block is block that multiplies input data by a constant value (gain) .**
  + **The unfiltered data from Glove activities for Index and Middle finger at a range of 0º, 45º and 90º.**
  + **Low in cost**
  + **Small in size and handy**
  + **Lighter**
  + **Flexible**
  + **Easy to operate**

**DISADVANTAGES and LIMITATIONS**

* + **Different countries have different sign languages.**
  + **Sign language does not represent spoken language.**
  + **Learning about sign language.**
  + **Understanding the sign language by other.**

***TOPIC: 7***

**APPLICATION**

* + **It can be used for computer gaming.**
  + **It is loaded with touch sensor’s on the thumb, the fingers and the palm.**
  + **It allow the wearer to forego using the keyboard.**
  + **Another application can be in the field of fire extinguishment by fire extinguishers in a situations where members of a team can’t even see each other;**
  + **These gloves will be able to transmit signals via simple hand gestures.**
  + **The gloves have symbols on them that light up according to the signal received.**

***TOPIC: 8***

**FUTURE SCOPE**

#### Raspberry pi , it makes this easily portable and easier to use. Even though the less advanced

**flex sensors are used, still a large number of sounds can be pr- recorded in the recorder and can be used through the programming. The flex sensors working in the two planes provide a lot of options for movement of the fingers and the thumb which is later transmitted into voice.**

* + **It can be seen from figure 5 and 6 that using simulation techniques that the clarity of the signals can be improved. Future work to do is;**
  + **To give more advanced features .**
  + **Reduce the size of the project even more.**
  + **High quality sensors can use.**
  + **The range can be increased.**

***TOPIC: 9***

**CONCLUSION**

#### This project is a useful tool for speech impaired and partially paralyzed patients which fill the communication gap between patients, doctors and relatives.

* + **As it is portable, requires low power operating on a single lithium-ion rechargeable battery.**
  + **It has less weight and robust so it gives patients to carry it anywhere with ease.**
  + **This project will give dumb people voice to speak for their needs and to express their gestures.**
  + **Hence this project is an attempt to make it easy to understand the actions of the dumb people by getting the output in the form of text and voice.**

***TOPIC: 10***

**PROBLEM FACED DURING THE PROJECT WORKING**

Problems faced during the project are as follows:

1) Circuit designed

2) Resistor selection

3) Finding components

4) Soldering

5) Stitching

6) Implementation of Machine Learning

7) Setup of Raspberry Pi

8) Coding

***TOPIC: 11***

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