# ENGINEERING CLINICS PROJECT

On

## SPEECH GENERATION DEVICE FOR THE MUTE PEOPLE USING HAND GESTURES


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# ABSTRACT

According to the recent statistics about 7.5% of Indians are speech challenged. Indian Sign Language is the only mode of communication used by them. Sign languages are not easy to recognize as they are difficult to understand and highly complex to learn. The day-to-day functioning of people with disabilities as well as their independence can be developed and improved by use of products based on Assistive Technology. A cogently operating sign language recognition system can provide a room for a speech challenged person to communicate with non-signing people without the need of a decoder. It can be used to accomplish speech or text, making the mute more self-dependent. Sadly, here hasn't been a system with these facilities so far. All research till now have been restricted to small scale systems competent of recognizing only a nominal subgroup of a full sign language. However, these systems have not been effective enough to make them independent. During emergency, a mute person who is travelling amongst new people and if he/she wants to communicate with them becomes a difficult task. For the operation of the system and processing the data raspberry pi is used. Battery powered circuit is used to power the system and to run it. The system comprises of about stored messages which will help deaf people to communicate their primary messages like "need help", "Where is the particular address located?" and so on. For different variations of hand movement, the system reads persons hand motions. The system consists of trigger sensor, which helps in automatically activating the system whenever the person wants to speak something. Whenever the mute person makes hand motions just impulsively, the system ensures that it does not speak. The brain of the system i.e., Microcontroller processes the input sensor values which are constantly received. Now for the set of received sensor values messages are matched. From memory the message is retrieved once it is found, and through the speaker it is spoken out using text to speech process. Thus, a smart speaking system which is fully functional is useful which helps deaf people convey their messages with normal people using wearable system.

In the present work, we propose a Sign Language Glove which will assist those people who are suffering for any kind of speech defect to communicate through gestures i.e. with the help of single handed sign language the user will make gestures of alphabets. The glove will record all the gestures made by the user and then it will translate these gestures into visual form as well as in audio form. This paper uses microcontroller to control all the processes and flex sensors along with accelerometer sensors will track the movement of fingers as well as entire palm. A LCD will be used to display the user's gesture and a speaker to translate the gesture into audio signal is planned if possible for execution. This paper can be further developed to recognize complex like food, water, etc.

# CONTENTS

## INTRODUCTION

It is very difficult for mute people to convey their message to regular people. Since regular people are not trained on hand sign language, the communication becomes very difficult. In emergency or other times when a mute person travelling or among new people communication with nearby people or conveying a message becomes very difficult. Here we propose a smart speaking system that help mute people in conveying their message to regular people using hand motions and gestures. The system makes use of a hand motion reading system equipped with motion and flex sensors along with a speaker unit. This system is powered by a battery powered circuitry to run it. A raspberry pi is used for processing the data and operating the system. The system consists of around 10 stored messages like “need help”, “where is the toilet/washroom” and so on that help mute people convey basic messages.

## BACKGROUND

The use of speech and gestures in human communication is thoroughly organized. As a result, we decided to make 'Gesture' the focal point of our project. Computer gesture and sign language identification is the recognition of gestures and sign language. Here we suggest a smart speech device that allows mute people to express their message to ordinary people by using hand movements and gestures. The system uses a hand motion monitoring system fitted with motion and flex sensors and a speaker unit . A microcontroller can be used for data processing and device operation. The device consists of about 10 recorded messages such as “ need help” where is the toilet/washroom” and so on to help mute people communicate simple messages. The machine reads hand gestures of individuals for various variations of hand movements. It also comprises of a trigger sensor to signify that the person wishes to enable the device and to speak something. This means that the computer is silent while the person makes involuntary hand movements. The processor of the microcontroller continuously receives input sensors data and then analyses them.

## PROBLEM DEFINITION:

Indians are speech challenged . Indian Sign Language is the only mode of communication used by them. Sign languages are not easy to recognize as they are difficult to understand and highly complex to learn. The day-to-day functioning of people with disabilities as well as their independence can be developed and improved by use of products based on Assistive Technology. Here we propose a smart speaking system that help mute people in conveying their message to regular people using hand motions and gestures. The system makes use of a hand motion reading system equipped with motion and flex sensors along with a speaker unit.

## OBJECTIVES:

At the end of the project, we achieve the success towards the problem faced by the mute people by developing a project of speaking system for the mute people using hand gestures.

## HARDWARE COMPONENTS USED

1) **Flex Sensors** : A flex sensor, also known as a bending sensor, measures the amount of deflection or bending. Typically, the sensor is fixed to the surface, and bending the surface changes the resistance of the sensor component. It is used as a goniometer and is also known as a flexible potentiometer since the resistance is directly proportional to the bend. A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck the surface, and resistance of sensor element is varied by bending the surface.

Fig-1 Flex Sensor

2) **LCD Display** : Liquid crystal displays are popular in digital watches and a variety of portable computers. A liquid crystal solution is sandwiched between two sheets of Polarising material in LCD displays. The electrical current that flows through the liquid causes the crystals to align, preventing light from passing through as a result, each crystal acts as a shutter, either allowing light to pass through or blocking it.


Display

LCDs have become very popular for displaying information in many smart devices in recent years. The utensils. Microcontrollers are commonly used to operate them. They simplify the operation of complex machinery. LCD's come in a variety Fig-2 LCD of shapes and sizes, but the most popular is a backlit 20-character x 4 line display. It only needs 11 connections: eight data bits (which can be reduced to four if necessary) and three control lines (we have only used two here). It take just 1mA of current and runs on a 5V DC supply. Moving the voltage to pin 3 of the monitors. Usually with a trim pot, will change the display's contrast.

3) **Bluetooth Module** : The HC-05 Bluetooth module is a MASTER/SLAVE computer. The factory settings are SLAVE by nature. Only AT COMMANDS can trigger the Module Function (Master or Slave). Slave modules are unable to establish a connection with another Bluetooth computer, but they do accept connections. The Master module may establish a link with other devices. It can simply be used to replace a serial port when connecting to another Bluetooth device.


Fig-3 Bluetooth

4) **Raspberry Pi :** Raspberry Pi refers to a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom.

Raspberry Pi Pico is a low-cost, versatile microcontroller development board from the Raspberry pi foundation. It is constructed around the RP2040 chip.

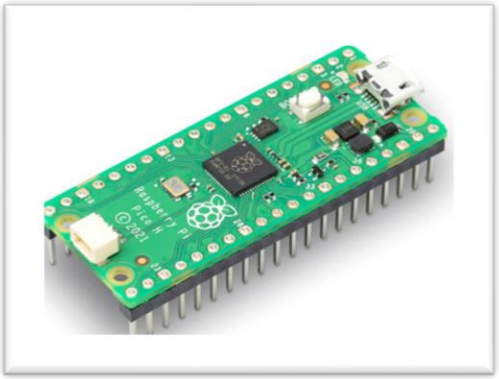


Fig-4 Raspberry Pi

**5) IR Sensor:** An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Passive infrared (PIR) sensors only detect infrared radiation and do not emit it from an LED. PIR sensors are most commonly used in motion-based detection, such as in smart parking systems.

An infrared sensor includes two parts namely the emitter & the receiver (transmitter & receiver)

Connecting Wires – Male to Male
Male to female
Female to Female

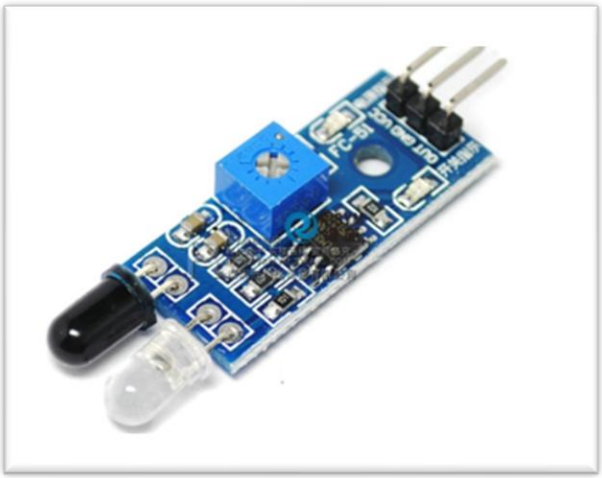


Fig-5 IR Sensor

Connecting wires allows an electric current to travel from one point on a circuit to another because electricity needs a medium through which to move. The gauge or size of the wire must be large enough to support the amount of current flow.

In electrical and mechanical trades and manufacturing, each half of a pair of mating connectors or fasteners is conventionally assigned the designation male or female. The male ends meant for insertion into standard 0.1 inch (2.54mm) female sockets and the female ends are meant for insertion onto standard 0.1 inch (2.54mm)

6) **Resistors :** A resistor is a passive electrical two-terminal component that as a circuit element implements electrical resistance. Resistors are used, among other applications, in electronic circuits to decrease current flow, change signal levels, separate voltages, bias active components, and terminate transmission lines.

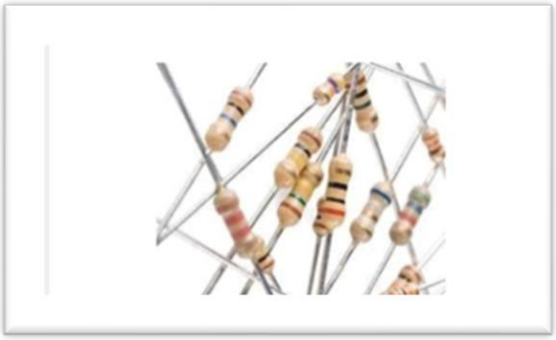


Fig-6 Resistors

## Features:

• Raspberry Pi 3 • LCD Display • Cables and Connectors

• Accelerometer • Crystal Oscillator • Diodes

• Flex Sensor • Resistors • PCB and Breadboards

• Gloves • Capacitors • LED Transformer/Adapter Push Buttons

• Speaker • Transistors • Switch

**Gesture input:** Flex sensors are used as gesture input. They are placed on gloves which can be easily operated by the user by making gestures. According to the gesture made by the user the resistance values will change, and sensor produces voltage correspondingly.

**Processing the data:** The output voltage of flex sensors is in the analogy form which is converted into digital form by using inbuilt ADC RP2040. Predefined gestures with corresponding messages are stored in the database of

the microcontroller in different languages. RP2040 checks whether the input voltage from the flex sensors exceeds the threshold value that is stored in the database.

**Voice output:** The output from the Raspberry pi is sent to APR33A3 and LCD. LCD displays the message that was assigned to the gesture in the database. Speech signal is produced using APR (Auto Playback Recorder) through speaker.

## WORKING PRINCIPLE :

In this system flex sensors are placed on gloves according to the gesture made by the user the resistance values will change, and sensor produces voltage. The output voltage of flex sensors is processed using RP2040. Predefined threshold values for each gesture and its corresponding messages are stored in the database of the microcontroller. When the input voltage of the microcontroller exceeds the threshold value, LCD

displays the message that was assigned to the gesture in the database and the speech signal is produced through speaker (English) in our system. Flex sensors are placed on gloves which can be easily operated by the user by making gestures. According to the gesture made by the user the resistance values will change, and sensor produces voltage correspondingly. The output voltage of flex sensors is in the analogy form which is converted into

digital form by using inbuilt ADC of At RP2040. Predefined gestures with corresponding messages are stored in the database of the microcontroller in different languages. Microcontroller matches the motion with the database and produces the speech signal using APR (Auto Playback Recorder). The output is given out through the speaker and GSM module is used to send text messages.

### ADVANTAGES, DISADVANTAGES AND APPLICATIONS

**ADVANTAGES:**

- Easy to operate.
- Low power consumption.
- It is user friendly.
- It is single equipment with multiple applications.
- When extended further in the hardware section, numerous applications can be added.
- The communication between a normal person and speech impaired person becomes easier.
- There is an option for user input.

**DISADVANTAGES:**

- Processing speed depend upon quality of processor.
- Gesture must be stationary.
- Recognition limited to numbers only.

**APPLICATIONS:**

• It can solve the daily difficulties suffered by the people, who cannot speak or one who has recently undergone an accident.

• It can also be used by elderly people.

• This can also be integrated in the field of automation.

• Defence sector and war equipment.


Fig-7 LCD Display


Fig-8 Project Connection

## METHODOLOGY

• It consists of microcontroller, LCD Display, Speaker, Flex Sensor, and Accelerometer.

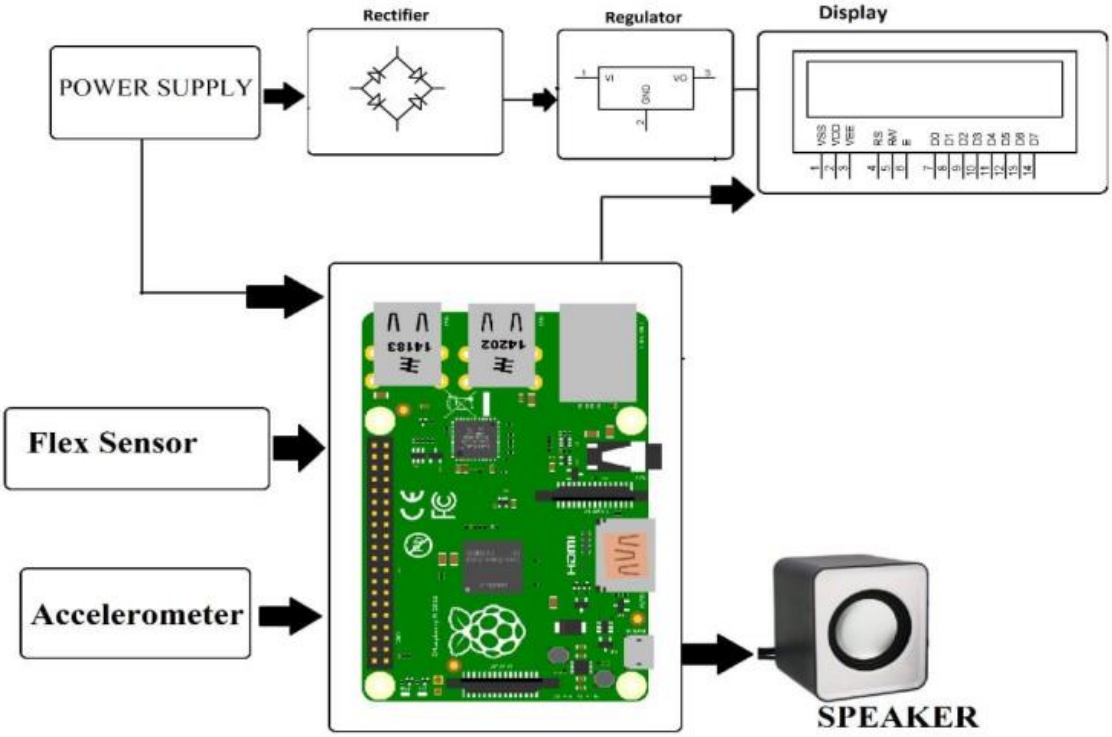
• Flex sensors are used to detect hand posture.

• The five flex sensors are setup on the five fingers of the user.

• User makes a hand gesture to express a specific word the flex sensors get folded.

• As the posture of each finger is different, so resistance value of each flex sensor is also different.

## System Architecture



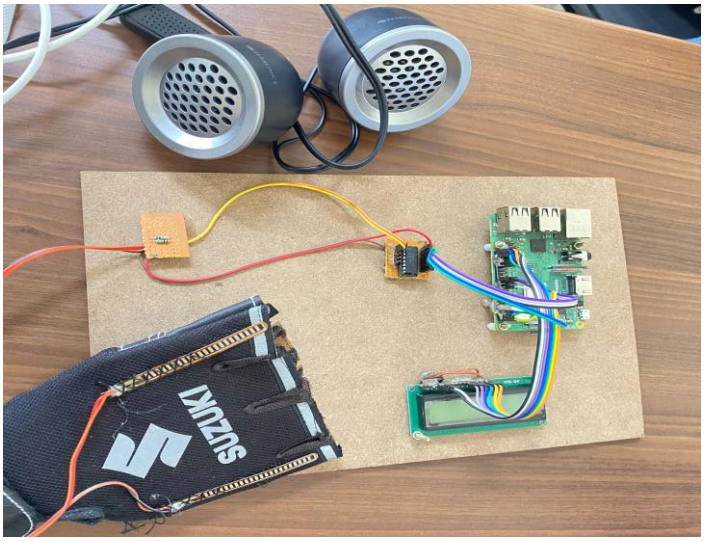




Fig-9 Working Model

## Entering Text:

First, a little tip: it is manually a lot easier to enter characters and commands in hexadecimal rather than binary (although, of course, you will need to translate commands from binary couple of sub-miniature hexadecimal rotary switches is a simple matter, although a little bit into hex so that you know which bits you are setting). Replacing the d.i.l. switch pack with a of re-wiring is necessary.

The switches must be the type where On = 0, so that when they are turned to the zero position, all four outputs are shorted to the common pin, and in position "F", all four outputs are open circuit.

All the available characters that are built into the module are shown. Studying the table, you will see that codes associated with the characters are quoted in binary and hexadecimal, most significant bits ("left-hand" four bits) across the top, and least significant bits ("right-hand" four bits) down the left.

Most of the characters conform to the ASCII standard, although the Japanese and Greek characters (and a few other things) are obvious exceptions. Since these intelligent modules were designed in the "Land of the Rising Sun," it seems only fair that their Katakana phonetic symbols should also be incorporated. The more extensive Kanji character set, which the Japanese share with the Chinese, consisting of several thousand different characters, is not included! Using the switches, of whatever type, and referring to Table 3, enter a few characters onto the display, both letters and numbers. The RS switch (S10) must be "up" (logic 1) when sending the characters, and switch E (S9) must be pressed for each of them. Thus the operational order is: set RS high, enter character, trigger E, leave RS high, enter another character, trigger E, and so on.

The first 16 codes in 00000000 to 00001111 refer to the CGRAM. This is the Character Generator RAM (random access memory), which can be used to hold user-defined graphics characters. This is where these modules really start to show their potential, offering such capabilities as bar graphs, flashing symbols, even animated characters. Before the user-defined characters are set up, these codes will just bring up strange looking symbols. Codes 00010000 to 00011111 are not used and just display blank character ASCII codes "proper" start at 00100000 and end with 01111111 . Codes 10000000 to 10011111

are not used, and 10100000 to 11011111 are the characters.

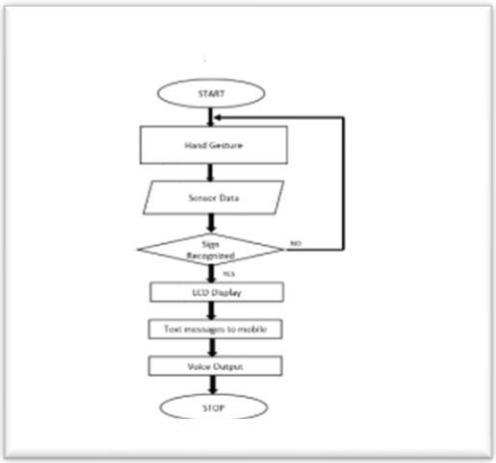



Fig-10 Data Flow Diagram

## CONCLUSION

In this project work, the sign language will be more helpful for the ease of communication between the mute people and normal people. The project mainly aims at reducing the gap of communication between the mute people and normal people. Here the methodology intercepts the mute signs into speech. In this system it overcomes the difficulties faced by mute people and helps them in improving their manner. The projected system is very easy to carry to any places when compared to existing systems. To help the mute people, the language gets converted into text kind and on the digital display screen it will be displayed. Who cannot communicate with normal people i.e., deaf, and dumb people the system is very much helpful. The primary feature of the project is the one which will be applied in common places that the recognizer of the gestures may be a standalone system.

## FUTURE SCOPE

1. This device can be developed into a device that includes various sign languages in different countries.

2. We want to make it into a complete product that makes the dumb people to communicate like a normal people.

3. We want to produce a product for blind people that convert the information in any handwritten notes, newspaper or books into a audio signal that these people can here.

4. Designing of wireless trans receiver system for “Microcontroller and Sensors Based Gesture Vocalizer”.

5. Perfection in monitoring and sensing of the dynamic movements involved in “Microcontroller and Sensors Based Gesture Vocalizer”.

## RESULT

A Smart Speaking Glove for Speech impaired People is designed and implemented with four gestures. Each gesture specifies basic needs such as “NEED WATER”, “PARDON ME”, “PLEASE MOVE”. This system is more reliable, efficient, easy to use and a lightweight solution to the user as compared to other proposed systems. This bridges the communication gap between speech impaired people and others. During this project we have faced various challenges and we have tried to minimize the problem. Since we observed that they cannot handle bulky and delicate in structure. We have minimized the communication problem as: The output is in the form of speech which is easily understood by others. This system will provide assistance to the speechless people to express their needs using gestures. The voice output can be manipulated in any language according to the user.

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