The Gesture Vocalizer using Arduino Uno

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1.INTRODUCTION:

Humans have the ability to communicate and engage with one another using their voices. Unfortunately, not everyone has the ability to communicate and hear. Sign language is a method of communication used by those who are unable to speak or hear. Sign language is a form of gesture representation that requires integrating hand shapes, hand orientation and movement, and facial expressions to express fluently with a speaker's thoughts. People who are unable to communicate verbally use sign languages to communicate with other people who are also unable to communicate verbally, as well as with other normal people who are aware of the meanings of sign languages.

Modules and their Description:

1.ARDUINO UNO:

The Arduino Uno is a microcontroller board that is based on the 8-bit ATmega328P microcontroller. It includes auxiliary components to assist the microcontroller, such as a crystal oscillator, serial communication, a voltage regulator, and so on, in addition to the ATmega328P. The Arduino Uno contains 14 digital I/O pins (six of which can be used as PWM outputs), six analogue I/O pins, a USB connection, a power barrel port, an ICSP header, and a reset button.

Technical features of Arduino:-

- Microcontroller ATmega328 Operating Voltage 5V
- Input Voltage (recommended) 7-12V Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output) Analog Input Pins 6
- DC Current per I/O Pin 40 mA DC Current for 3.3V Pin 50 mA
- Flash Memory 32 KB of which 0.5 KB employed by bootloader

- SRAM 2 KB
- EEPROM 512 bytes Clock Speed 16 MHz

2.Flex Sensors (Bend Detection):

A flex sensor is a type of sensor that measures the degree of defection or bending. This sensor can be designed utilizing materials such as plastic and carbon. The carbon surface is set on a plastic strip, and as this strip is turned away, the sensor's resistance changes. As a result, it is also known as a bend sensor. Because its variable resistance is precisely proportional to the number of turns, it can also be used as a goniometer. These sensors are divided into two sorts based on their size: 2.2-inch flex sensors and 4.5-inch flex sensors. Except for the operating principle, these sensors differ in size and resistance.

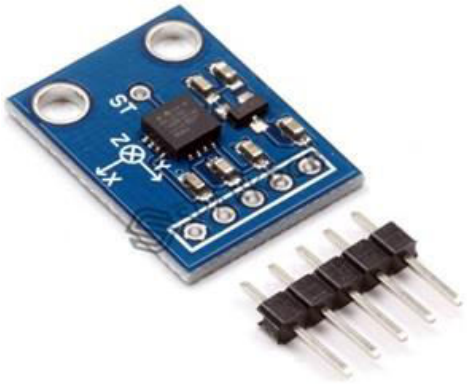
The flex sensor's pin arrangement is given below. It is a two-terminal gadget, with terminals labelled p1 and p2. This sensor does not have any polarized terminals, such as a diode or a capacitor, hence there are no positive and negative terminals. This sensor's necessary voltage spans from 3.3V to -5V DC, which can be obtained using any method of interface.

In our project we have used 4 flex sensors each of which is connected to A0,A1,A2,A3 analog pins of the Arduino Uno respectively.

Pin P1: This pin is generally connected to the +ve terminal of the power source.
Pin P2: This pin is generally connected to GND pin of the power source

3.Axis Detection(ADLX-335):

The ADXL 335 accelerometer is a gadget that is used to measure the acceleration of any object. It monitors acceleration using analogue inputs in three dimensions, such as X, Y, and Z. It is a low-noise and low-power gadget. When used to measure acceleration, it is interfaced with any form of controller, such as a microprocessor or an Arduino



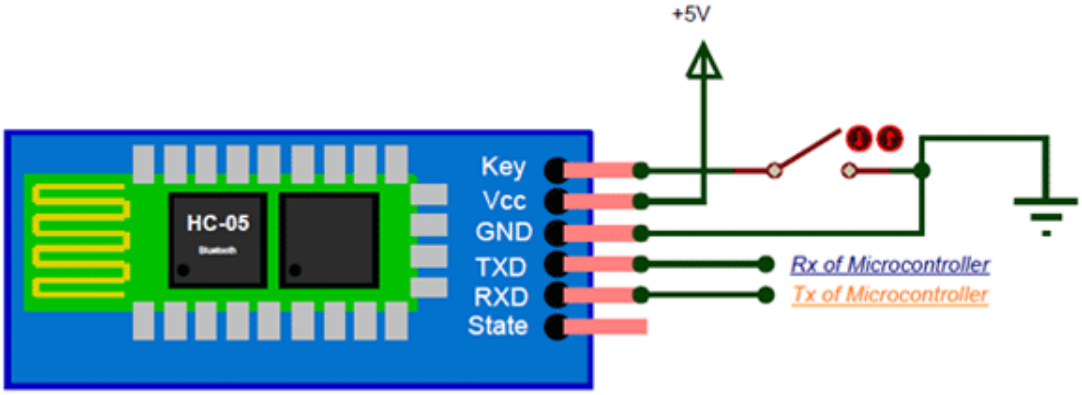
The ADXL335 accelerometer is analogue, it operates on the capacitive sensing principle. When a capacitive sensing accelerometer is moved in any direction, its capacitance changes. When the capacitance changes, the analogue voltages change, which is detected by the interface controller.

HC-05(BLUETOOTH MODULE):

The HC-05 is a great module for adding two-way (full-duplex) wireless capabilities to the projects. One can use this module to communicate between two microcontrollers, such as Arduino, or to interact with any Bluetooth-enabled device, such as a phone or laptop. Many Android applications are currently accessible, making this process much easier. The module communicates using USART at 9600 baud rate, making it simple to interface with any microcontroller that supports USART. Using the command mode, we can also configure the module's default values.

The HC-05 has two operating modes: data (in which it may send and receive data from other Bluetooth devices) and AT command (in which the default device settings can be altered). We can use the key pin as described in the pin description to operate the device in either of these two

modes.Because it uses the Serial Port Protocol, it is very simple to connect the HC-05 module to microcontrollers (SPP). Simply supply +5V to the module and connect the Rx pin of the module to the Tx pin of the MCU and the Tx pin of the module to the Rx pin of the MCU.



4.Android Text-To-Speech App:

TTS may translate words on a computer or other digital device into audio with the click of a button or the TTS (text-to-speech) is an assistive device that reads digital text out loud. It's also known as "read aloud" technology.

touch of a finger.

TTS is compatible with practically all personal digital devices, such as PCs, smartphones, and tablets. All types of text files, including Word and Pages documents, can be read aloud. Even web pages can be read out loud.

The usage of app in out project is to read aloud the message associated to the gesture which are predefined(in accordance with gesture table mentioned below).

Steps to use the app:

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- First turn on the Hc-05 module so that’s it`s in pairing mode
- Then turn on Bluetooth on our android Mobile and pair it with HC-05.
- The pin for connecting the Bluetooth module is 1234.

- Then open the app and u will find the device under the paired devices section.
- Click on the device name to connect it to the app.
- On the successful connection the Led present on the Bluetooth will blink in a rhythmic pattern
- Try the process again if the device doesn't pair.

Existing Approach:

An interpreter is required to translate the meanings of sign languages to people who are able to communicate verbally but are unaware of the meanings of sign languages. However, it is not always possible for someone to be present all of the time to interpret sign languages, and not everyone is capable of learning them. As a result, another option is to employ a computer or a smart phone as a mediator. A computer or a smart phone could take a vocally impaired person's input and provide textual as well as audio output.

Proposed Approach:

Hence the project we propose to tackle this issue is by using a gesture vocalizer module, which is a smart glove which interprets the gestures made by the vocally impaired and coverts them into speech format(speech output from android phone). This helps them convey their message clearly eliminating the need of a mediator.

2. PROJECT IMPLEMENTATION:

Functional Requirement

A functional requirement identifies a function that a system or system component must be able to fulfil. It can be documented in a number of ways. Written descriptions in documents and use cases are the most popular

Hardware requirements:

1.Flex sensors

2.HC-05(Bluetooth module)

3.ADXL-335(Accelerometer)

4.Arduino uno

5.Bread board

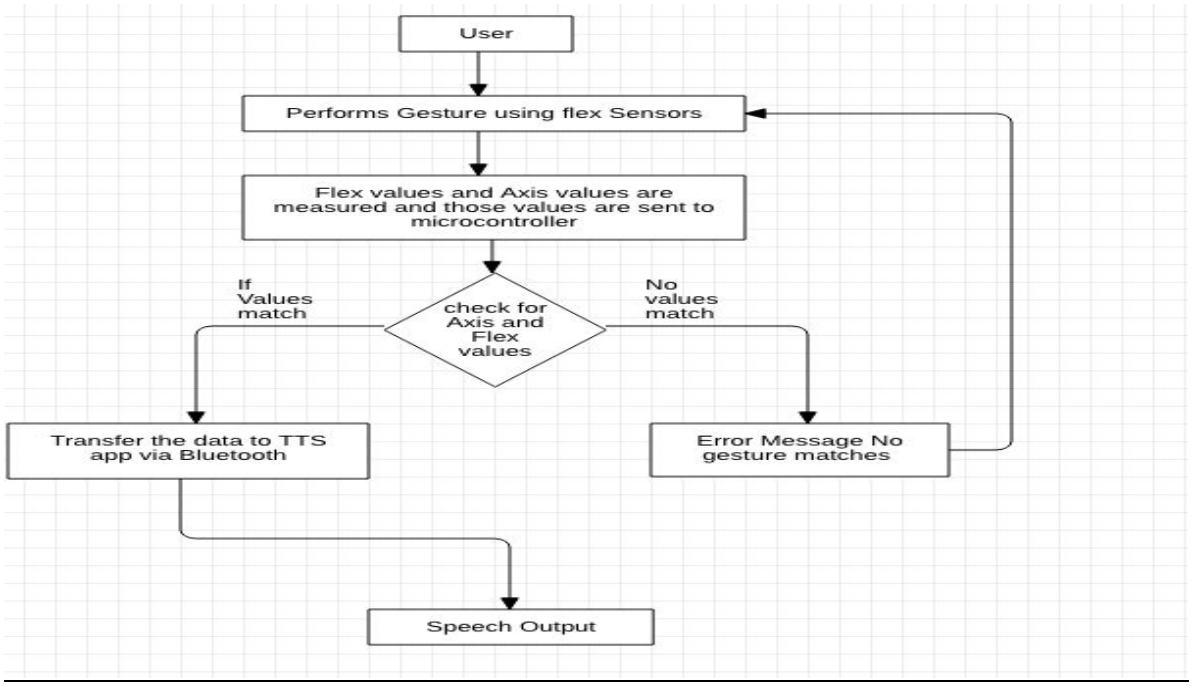
6.Resistors(1k OHM)

Software requirements:

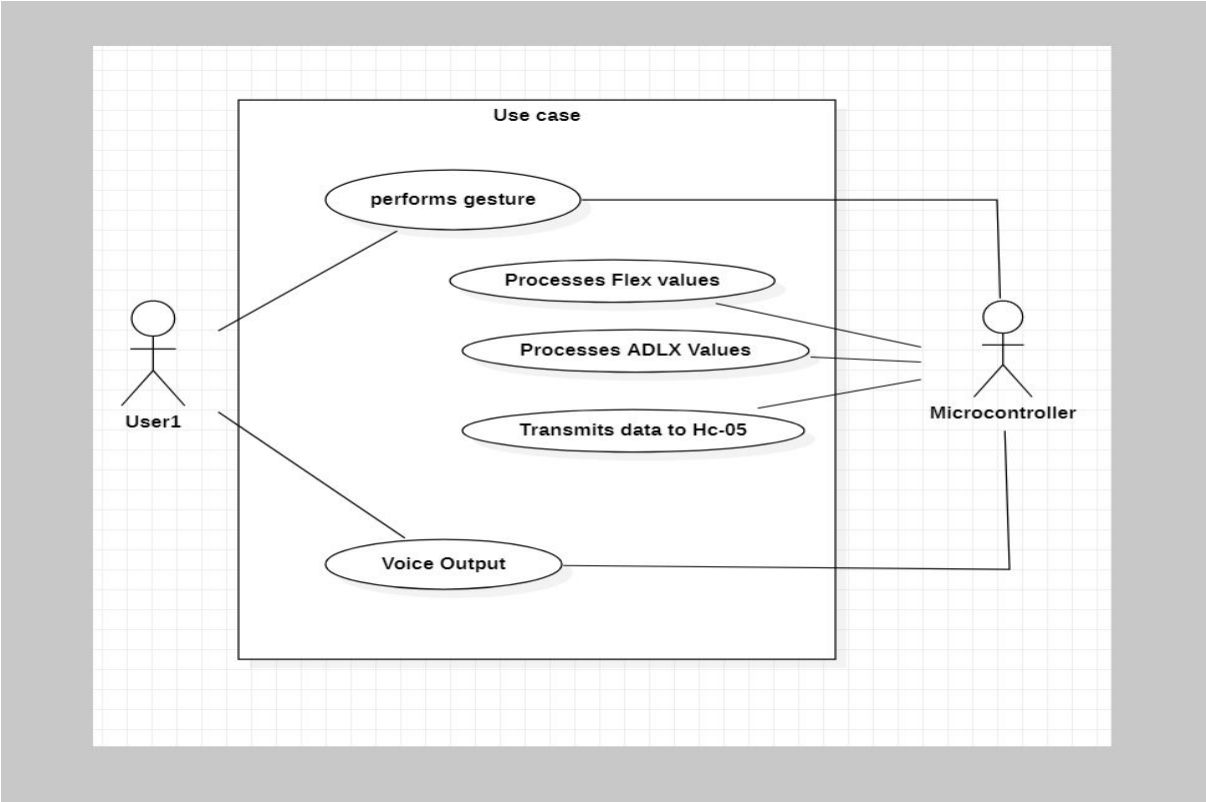
1.text to speech app

Project Design:

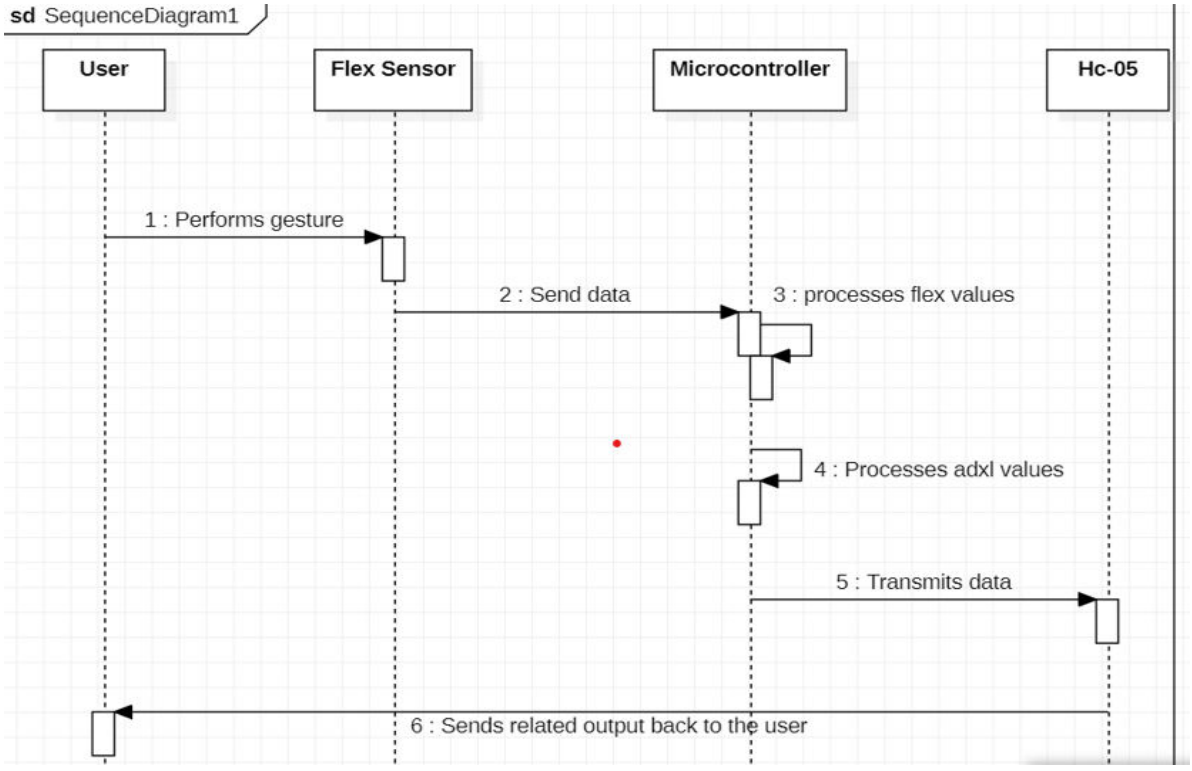
Flow diagram



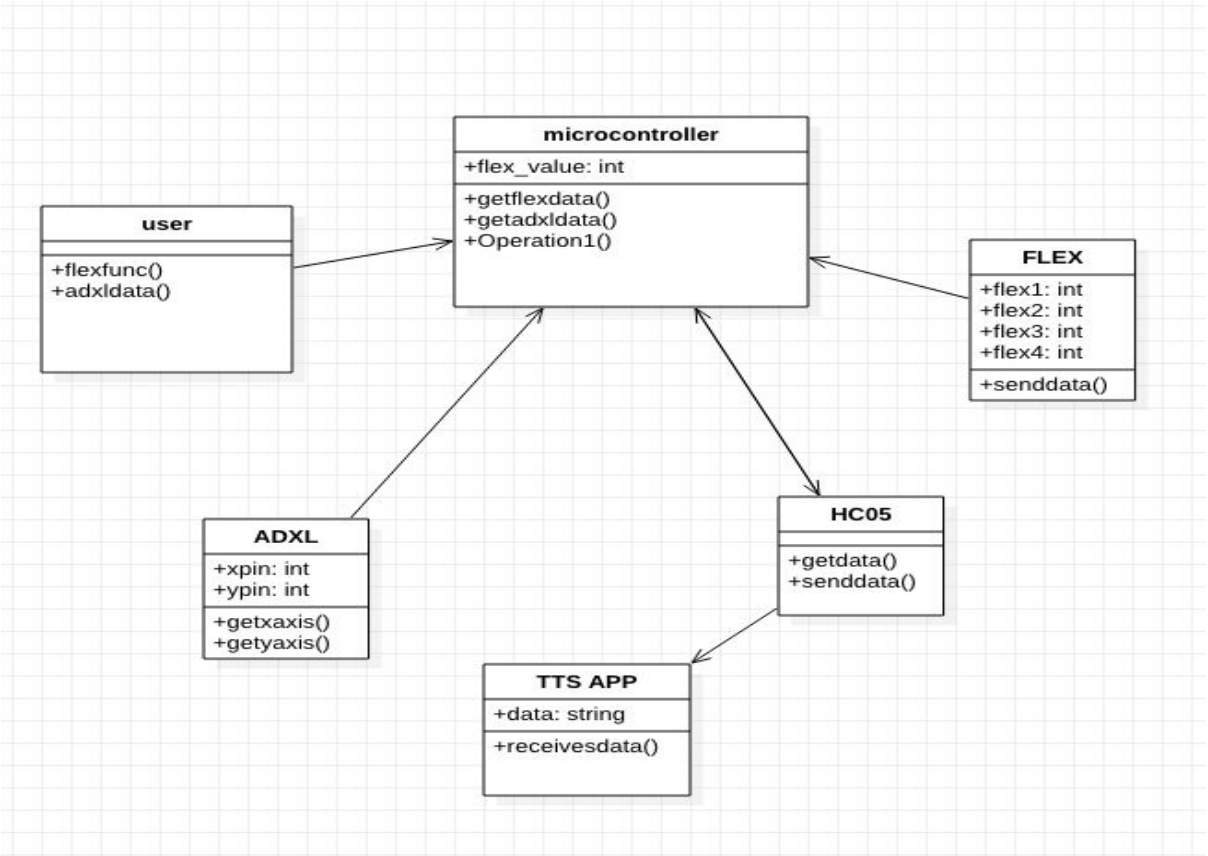
Use case diagram:



Sequence diagram:



Class diagram:

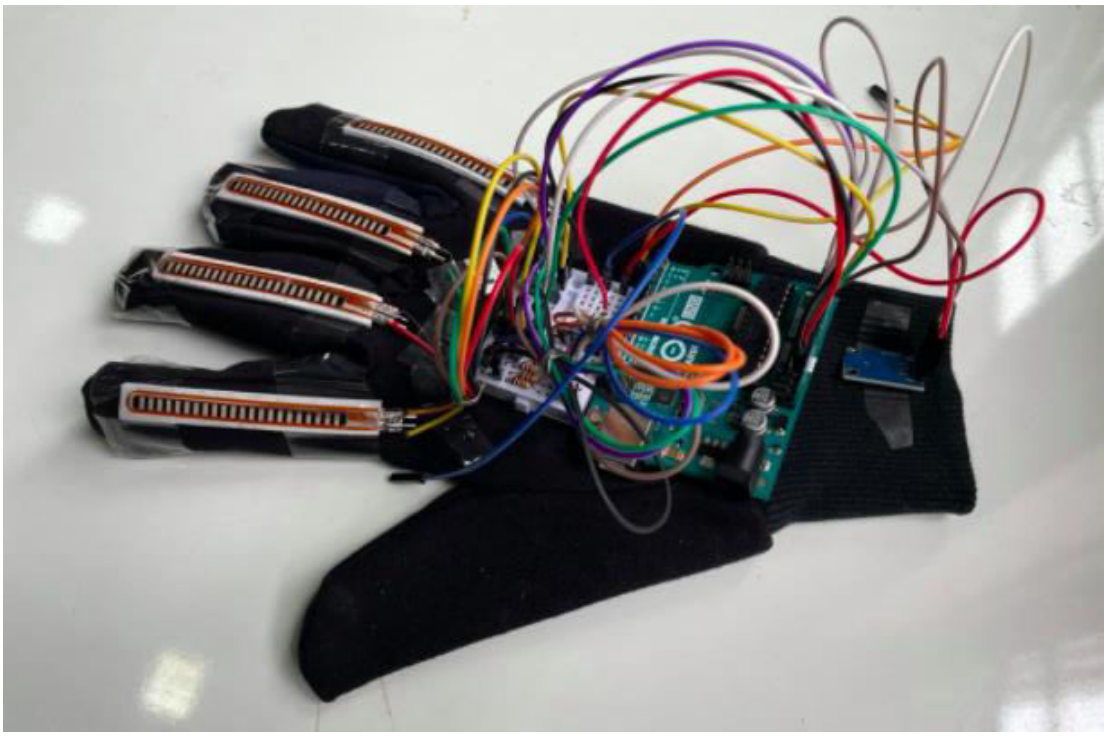


WORKING OF THE SYSTEM:

The implementation of our project was done in the following 3 methods:

1. Bend Detection using flex sensors
2. Axis Detection
3. Processing & Sending data over to smartphone via Bluetooth

When the user bend his fingers, resistance values are measured and these values are sent to Arduino uno along with the axis values which are measured using ADXL-335(Axis detection). Both the values are compared with the values given by the user and generates an output in the form of a statement. This statement is sent to the mobile through Bluetooth and using an app called text-to-speech the statement is converted into speech.



GESTURE TABLE

S.no	SIGN	Y-axis Output(Orientation 1)	X-axis Output(Orientation 2)
1)		**Thank You**	**Turn on the Lights**
2)		**Emergency** **Washroom**	**Switch on TV** **Help**
3)		**I can do it**	**Breathing Problem**

4)		**Hold on**	**Water**
5)		**come here**	**Hello mom**
6)		**Listen Up** **How are you**	**See You** **Have a good day**

7)		**I am Fine**	**Hi Dad**
8)			
9)			

Usefulness:

• This device helps deaf and dumb people to communicate with normal people in an easy manner.

• Virtual reality applications for example replacing the inputs like joy sticks in video games with the data glove.

• User can define his own gestures which he uses more often.

Future scope:

The project we proposed is at a very naïve stage, it can further be improved to include more gestures. More gestures may be performed with the addition of one more glove, which can be integrated with standardized sign language. The same data glove can be used in VR Technology, replacing conventional joystick, controllers and other input devices. It can also be integrated with a Robotic Arm and can be operated remotely. Testing and enhancements to the online interface, with the goal of making it more interactive for users and speeding up the system.

Conclusion:

This technology allows dumb, deaf, and blind persons to communicate with one other as well as with the general public. The deaf employ a standard sign language that is difficult for the general public to grasp, and blind persons are unable to perceive their movements. This method translates sign language into a voice that both blind and non-blind persons can comprehend. To make life easier for deaf persons, the sign language is also translated into a text format. The outputs can also be assigned based on the user's requirements. The system developed is capable of detecting 8 different hand gestures and convert them into voice outputs.

References:

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