

## HAND GESTURE VOCALIZER

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**Abstract**— Hand Gesture Vocalizer is a social purpose project that helps people to uplift who are speech, blind and hearing impaired, by facilitating them to have a better communication with the public. In various researches it has been estimated that there are about 9.1 billion people in the world who are deaf, blind and are have speech impairments and they face a lot of problems whilst trying to communicate with society in their day to day life. Generally, sign language is used by the deaf, blind and ones who have speech impairments, but this becomes difficult for them to communicate with other people who do not understand sign language. Sign language which is used to convey information between people relies various body language, orientation and movements of the arm and fingers etc. This project is designed to address the need of developing an electronic device that can translate sign language into speech and display in order to remove the communication gap between the dumb and blind and the general public.

**Keywords**—*Gesture detection, flex sensors, tilt detection*

### Introduction

Generally sign language is used by the blind, speech and hearing impaired people for communication but they find difficulty in communicating with others who don't understand sign language as Sign Language involves orientation and movement of hands, arms/body, combining of various hand shapes and various facial expressions to fluidly express the thoughts. As the sign Language is generally not a universal language. For sign language there does not exist a single standard, universally accepted scheme. So the main aims is to lower the communication barrier and make a device that can translate sign language into audio and visual form in order to make the communication between the mute communities and the general public easily. So, the main objective is to make a simple prototype by taking some of the gesture and convert it into audio and visual form so that they can understand by everyone.

It is designed to facilitate the communication among the dumb, deaf and blind communities and their communication with the normal people.

A microcontroller based Hand Gesture Vocalizer system which makes use of flex sensors and an accelerometer for gesture detection and the tilt detection respectively. In this the input values that are given or correspond to a particular gesture are then played as a voice message through a android phone using Bluetooth module as well as text on the LCD screen display.

### Literature review

Kunal Kadam, Rucha Ganu, Prof. S. D. Joshi developed American Sign Language Interpreter. A simple prototype to check the recognizing sign language using smart sensor gloves. The system was not accurate as the time taken to ensure recognition of sign was more [1]. Srinivas Gutta, Jeffrey Huang, showed the advances in the methodology of hybrid classification architectures for face and hand gesture recognition tasks. This system is highly efficient but fails in circumstances where images are blurred or there isn't enough light to efficiently identify the gesture [2]. R.L.R Lokesh Babu, S. Gagana Priyanka, P.Pooja Pravallika, Ch. Prathyusha made "Gesture Vocalizer". It uses Real Time Speech to Text Converter for Mobile Users. But this becomes difficult to always look into mobile phone application [4]. Prerana K.C, Nishu Mahato propose a method of Hand Gesture Recognition system. A system that can read the values for a particular gesture done by the user and predict the output for the gesture. This system is not that reliable because the dataset for all the alphabets and frequently used words was not created [5]. M. S Kasar, Anvita Deshmukh made a Smart Speaking Glove. A glove with portable speech synthesizer and vocalizer for the speech impaired people. The system developed was good but capable of detecting only 4 different hand gestures and convert them into voice outputs [7].

### Block diagram

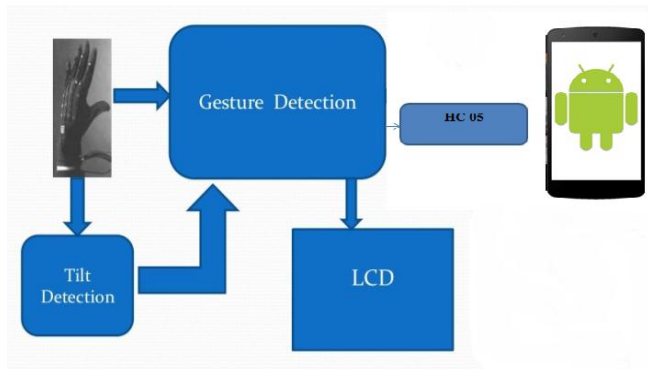


Fig. 1 - Block Diagram [5]

The input is taken from a digital glove that has 3 flex sensor attached to the glove at each finger. For the bend detection of fingers and for getting the tilt and the orientation of hand one ADXL335 3-axis accelerometer is used. For converting the hand movements or gestures into audio through an audio processing unit and visual data through an LCD display a microcontroller is used. The data of multiple gestures is stored in the controller. The gesture output is then sent to the LCD display and through Bluetooth module it is sent to the mobile. The Bluetooth module through phone gives the audio output of the gesture.

### Circuit diagram

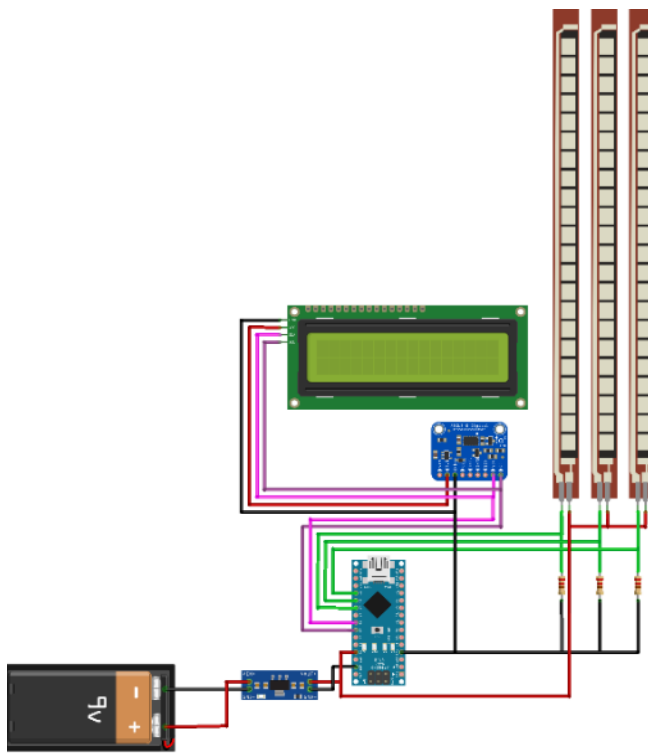


Fig. 2 - Circuit diagram

### Hardware implementation

#### GESTURE DETECTION:-

The glove is equipped with three flex sensors. The sensors are placed on the three fingers of the hand glove. These sensors are analog sensors. They can be made unidirectional or bidirectional. Each and every bend or even a little bend of the finger can be detected by the sensors. The bending of each finger can be obtained into 10 different levels. The finger must be at one of these 10 levels at any stage and it can easily determine how much the finger is bent. After this process from the flex sensor the binary data is then sent to ATMEGA328. The next step is to combine the each movement of the finger and then name it a particular gesture of the hand.

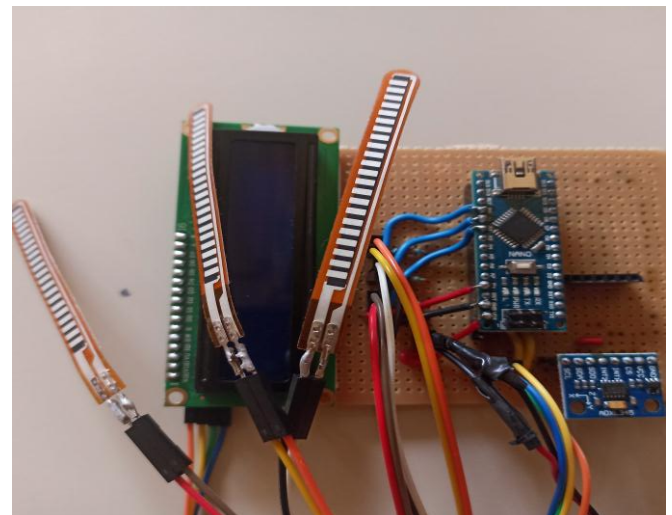


Fig. 3 - Interfacing flex sensor with arduino nano

#### TILT DETECTION :-

In the Hand gesture vocalizer system an Accelerometer (ADXL 335) used as a tilt detector. ADXL 335 is known as a three-axis analog accelerometer IC. The X, Y and Z acceleration are readed as analog voltages by the accelerometer. An accelerometer can figure out the angle it is tilted by measuring the amount of acceleration due to gravity. The accelerometer can find out how fast and in what direction the device is moving, by sensing the amount of dynamic acceleration. The main and the basic function of the accelerometer is detecting the tilting of the hand. After this process it sends some binary data against meaningful gestures, to the microcontroller. After that the Microcontroller receives the data and saves them.

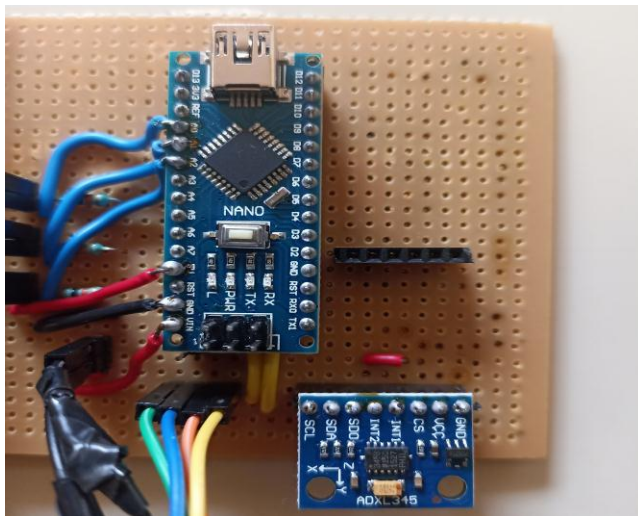


Fig. 4 - Interfacing accelerometer with arduino nano

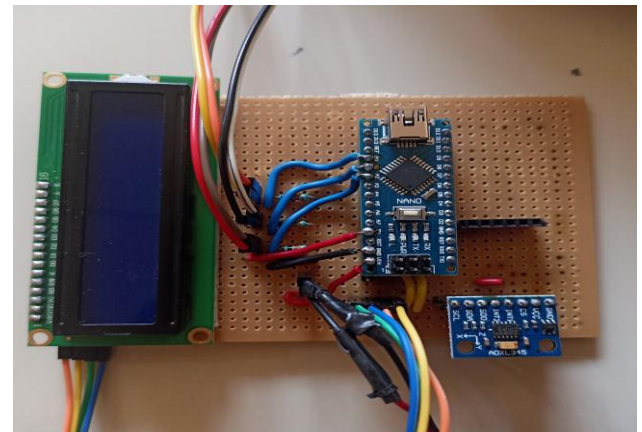


Fig. 5 - Interfacing accelerometer with lcd

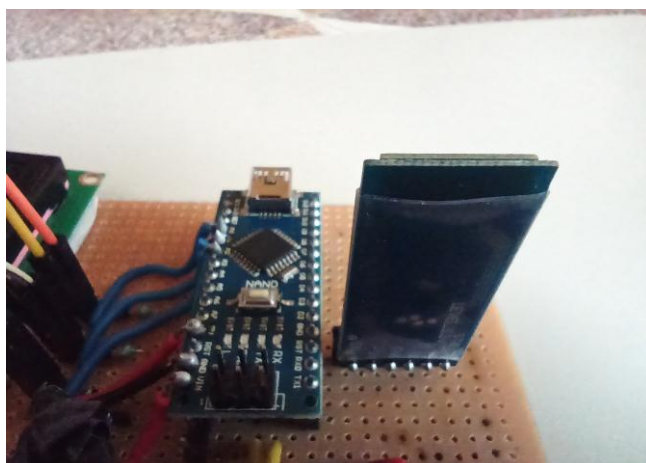
**BLUETOOTH MODULE :-**

HC 05 Bluetooth module is also known as Master/Slave module and by default it is Slave. The role of Blue tooth module configured only by AT Commands. Master can initiate connection with other Bluetooth module while slave can receive data .It cannot initiate the connection with other module.

**Software implementation**

The software used for the preparation of the project is Arduino IDE. In the open source software Arduino(IDE) it is easy to write the code and upload it to the board.

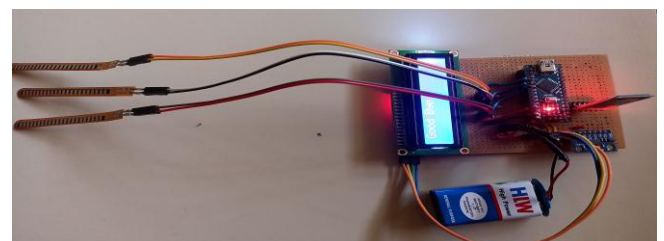
This software runs on Windows, Mac and Linux. This was the software to draft the final code for this project. The code is written in C++ and is based on processing and other open source software.



**LCD DISPLAY :-**

The output from the Flex sensor and accelerometer are also sent to the LCD display. The microcontroller checks each signal which is received and compares it with the already stored value.

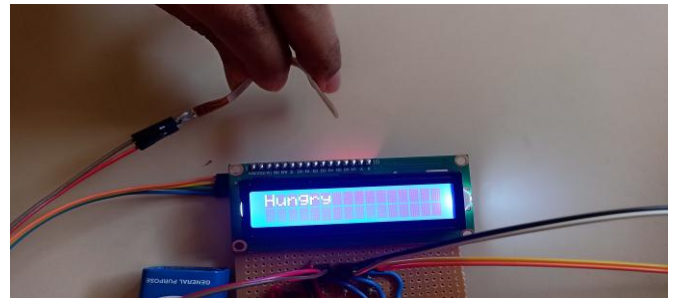
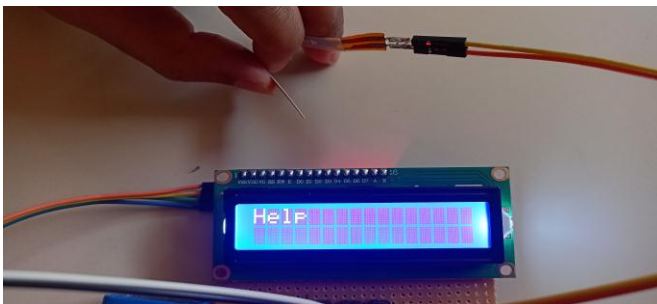
**Result**



ACCELEROMETER VALUES	GESTURES	MESSAGE
X > 0.5	Gesture 1	Hello
X < -0.5	Gesture 2	How are you?
Y > 0.5	Gesture 3	Good Morning
Y < -0.5	Gesture 4	Good Night
Z > 0.5	Gesture 5	Not feeling well
Z < -0.5	Gesture 6	Good Bye
FLEX VALUES	GESTURES	MESSAGE
700 < FLEX 1 < 900	Gesture 7	Help
700 < FLEX 2 < 900	Gesture 8	Thirsty
700 < FLEX 3 < 900	Gesture 9	Hungry







## Conclusion

Hand Gesture vocalizer is a gesture based interface for reducing the communication gap and facilitating communication among normal people and people with speech, blind and hearing disabilities. A normal glove is used which is fitted with three flex sensors along the length of each finger. A microcontroller and sensor based gesture to voice and display converter is created in this project. This can be helpful to recognize the commonly used gestures and convert them into the form voice message as well as a text message for the benefit of the blind, speech and hearing impaired persons.

A microcontroller based Hand Gesture Vocalizer system which makes use of flex sensors and an accelerometer for gesture detection and the tilt detection respectively, so with the help of this the input values which correspond to a particular gesture are then played as a voice message through android phone using Bluetooth module as well as displayed as text on the LCD screen .

## Future enhancements

Hand Gesture Vocalizer is a social purpose project that helps people to uplift, who are speech, blind and hearing impaired, by facilitating them to have a better communication with the public. This system makes the communication among the dumb, deaf and blind communities and their communication with the normal people very easy.

Designing a system like wireless transceiver for " Sensors and Microcontroller Based Gesture Vocalizer". Perfection in monitoring and sensing of the dynamic movements is involved in Microcontroller and Sensors Based Gesture Vocalizer". Designing a jacket, which would be capable of vocalizing the gestures and movements of animals. Virtual reality application such as in videogames replacing the conventional input devices like joy sticks with the data glove. The Robot control system to regulate machine activity at remote sensitive places, tele-operators to perform surgeries with the help of expert surgeons remotely are another useful applications of such an implementation.

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