# Glove for Gesture Recognition using Flex Sensor

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**Abstract** — There are 2.78% of the total population of India who can't speak. Sign language is a non-verbal form of communication method which is found among all deaf and dumb communities in world. Normal people do not learn the sign language. It causes barrier in communication between deaf dumb and normal people. Hence Deaf-Mute communication required interpreter who will convert hand gestures into auditory speech. The past implementation of this project involved using image processing concept and accelerometer. But the drawback of these implementations are projects were non portable and too expensive. Therefore system is being proposed with the use of flex sensors and android technology. System includes two modules. First module is a hand glove with flex sensors and Atmel ATmega168 microprocessor to convert hand gestures to auditory speech. Second module is an Android App with Google Speech API to convert speech to readable text.

**Keywords** — Communication Assistant, Deaf and Dumb, Arduino, Indian Sign Language.

## I.     INTRODUCTION

Being disabled shouldn't mean being disqualified from having access to each side of life. According to census 2011, In India there are 1,640,868 citizens who can't speak as well as 1,261,722 citizens who can't listen. More than 70% of Deaf population of India is working in Government as well as Private sectors. For communication they are dependent on Sign Languages. In India most popularly Indian Sign Language is used. This sign language is also used in many other countries in South Asian Region.

In rest of the population of India very few citizens are able to use Indian Sign Language, as they really don't need to learn sign language. This causes a communication barrier between Deaf Dumb and Normal person. This leads to disqualification of hearing impaired from main stream of the society. To overcome this problem a communication assistant is required, to convert Sign Language to auditory speech. Some systems were previously developed to achieve same outcome but they had disadvantages such as being non-portable, practically not implantable or expensive. All previous systems were focused on one way communication.

In this paper, thus, we propose a hardware system to complete this need. Proposed system is completely portable and focuses on two way communication. System is being proposed with the use of flex sensors and android technology. Main goals of the system are to convert hand gestures to auditory speech for communication between mute and normal people and to convert speech to readable text for communication between deaf to normal people. System includes two modules. First module is a hand glove with flex sensors and Atmel ATmega168 microprocessor to convert hand gestures to auditory speech. Second module is an Android App with Google Speech API to convert speech to readable text. The system is based on Indian Sign Language and covers all the words required in day to day life. Special

customised section for personal information is also included. Due to different structure of grammar in sign language, a language processing algorithm is designed to arrange the words in grammatically proper English sentence.

The rest of the paper is organized as follows. In Section 2 the existing systems are discussed. Section 3 introduces the proposed system and the conclusion is given in Section 4.

## II. EXISTING SYSTEMS

This section introduces the previously developed systems with same intent. Keeping the same concern in mind many developers have come up with innovative systems. Few of such systems are as follows-

*A. Embedded Based Hand Talk Assisting System for Deaf and Dumb.*
This system was developed in March 2014. This system uses a simple method by storing and running audio using keypad. This system has a drawback that it does not use sign language.

*B. Sigh language to speech converter.*
This system was developed in May 2014. This system converts the gesture to audio with the help of MATLAB. But the major drawback about the system is that it always requires a computer for conversion and it is non-portable.

*C. Interactive Glove.*
This system was developed in November 2015. This system only converts alphabet from sign language to audio. So, this system creates limitation by only allowing alphabets and no words are converted of sign language.

*D. Talk Aloud Gloves.*
This system was developed April 2016.This system senses gestures with the flex sensors and audio is produced with the help of computer. The major drawback of this system is that it requires computer and there is no way for other person to communicate.

## III. THE PROPOSED SYSTEM

In this section the proposed system is presented, which supports the two way communication between disabled and normal person. System is consists of two modules i.e. gloves with flex sensor to convert gestures to speech and android app to convert speech to text.
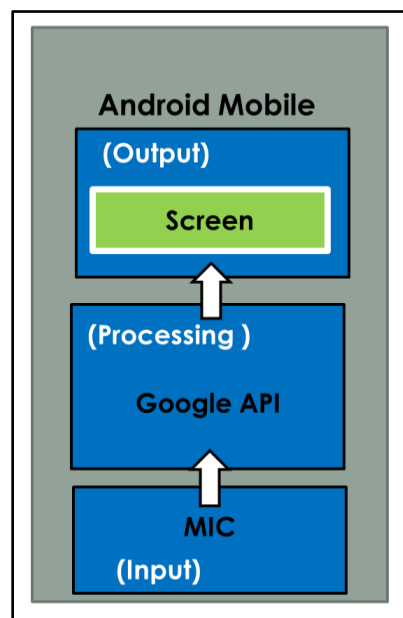
Overall view of system and its basic function is given below.

*A. Module 1- Gloves with flex sensor and Arduino*
This module is a wearable device consisting of a glove with five flex sensors and Arduino Nano. Speaker will be attached with the glove to give output as an audible speech.
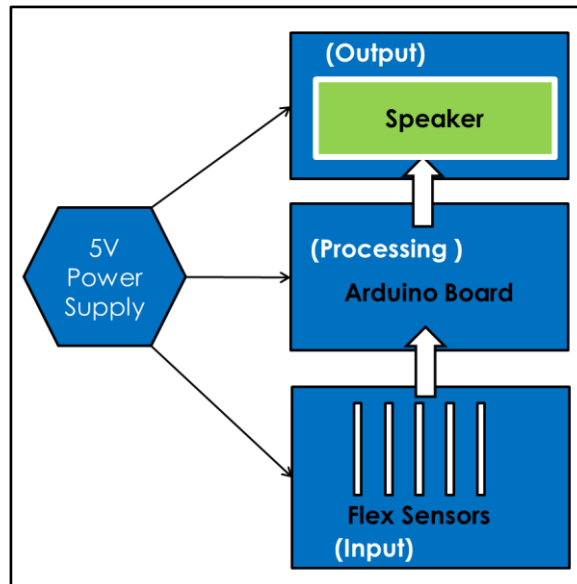
*B.  Module 2 – Android App to convert Speech To Text*



This module is an Android App, with Google API. It converts a Speech into text and displays on Mobile Screen. This modules functionality is limited to English language. It also works in offline mode

## IV.    COMPONENTS USED

*A. Hardware Used*
For development of first module of the System, following Hardware Components are used.

- Flex Sensors

FLEX SENSOR OFFERS VARIABLE RESISTANCE READINGS:
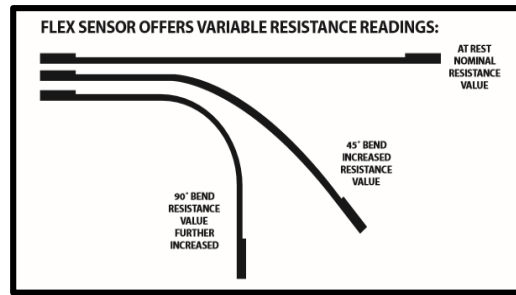
The Flex Sensor is based on resistive carbon elements. As a variable printed resistor, the Flex. Resistance in sensor Increases with respect to bent. These sensors are used in system to get the state of single finger, to recognize the gesture of hand.

- Arduino Nano



1. Get input from sensors.
2. Build a Ternary String from input signals.
3. Check the Repetational flag,
   If flag_R=1 then store the string in Input Buffer and go to state 4
   If flag_R=0 then go to state 5
4. Check current state of input.
   If more condition required go to state 1
   If no more conditions are required set R=0 and go to state 6
5. Check the type of String,
   If string is conditional set flag_R=1 and store the string in Input Buffer and go to state 4
   If string is not found in database then drop the string and goto state 1
   If simple Word is detected then go to state 6.
6. Word Selection Process will convert ternary string into words and the words are stored to sentence buffer.
7. Sentence formation process will form Sentence from the words in buffer.
8. Arranged words are stored in output buffer and one by one word is give to output until buffer is empty.
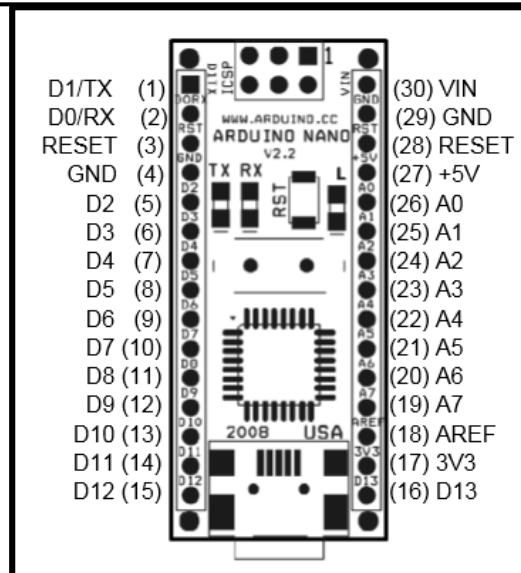


The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328. Analog Inputs makes this board more feasible for this system. Arduino Nano is used as a processing unit in this system.

- SD card Module and SD card
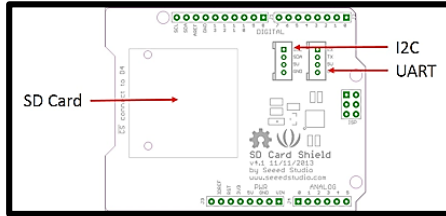


SD Cards work only at 3.3V. This module and Card is used to store sound files i.e. .wav file and language library.

## B. *Software Used*

For development of second module of the System, following Software tool is used.

- Android Studio

    Android Studio is the official integrated development environment  for Android platform development. Android Studio is freely available under the Apache License 2.0.

## C.  WORKING

### A. *Model 1 - Gloves with flex sensor and Arduino*

This module is consists of five Flex Sensors Arduino Nano. One flex sensors gives the current state of one finger, thus five sensors gives the state of whole hand in the form of analog signals. Following algorithm is used to convert these signals into auditory voice.

Sentence formation process follows the following algorithm.



## D.  CONCLUSION

This project include the use of Arduino, Flex sensor  to convert hand gesture into audible speech as well as an android application is used to convert speech to text which will be displayed on mobile screen. This project aims to lower the barrier of communication between mute and deaf community with the normal world. This project will be used by dump and deaf people as Assistant for themselves.

## REFERENCES

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