

# SMART GLOVES AS A COMMUNICATION TOOL FOR THE SPEECH IMPAIRED AND HEARING IMPAIRED

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**Abstract**—In order to share thoughts and to communicate with person with disability (dumb and deaf) the communication is the only medium so that they can convey the message to others. But there are lots of issues in communication with the person with disability. Therefore, a person with disability is not able to stand in the race with normal person. As we know that communication for a person who cannot hear is visual, not auditory. Usually dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign languages. So this creates barrier in the communication between these two communities. This paper aims to lower this barrier in communication with normal person. The main aim of the proposed system is to develop a cost effective system which can give voice to voiceless person with the help of Smart Gloves. It means that using smart gloves communication will not be barrier between two different communities and they will be able to communicate easily with the normal person. Use of smart glove by person with disability makes nation grow and also they will not differ themselves from the normal people.

**Index Terms**—Sign language, Smart Gloves, Flex Sensors, Bluetooth, Android

## I. INTRODUCTION

This India constitutes 2.4 million of Deaf and Dumb population, which holds the world's around 20% of the Deaf and Dumb peoples. Deaf and Dumb person lacks the amenities that a normal person owns. The reason is lack of communication between deaf and dumb people and normal people. This paper has a solution for those people which have speech disability to have normal conversations in their daily routines.

In this paper, different gesture recognition techniques and approaches are discussed. Previously proposed design of a hand glove for gesture recognition into speech and text is shown.

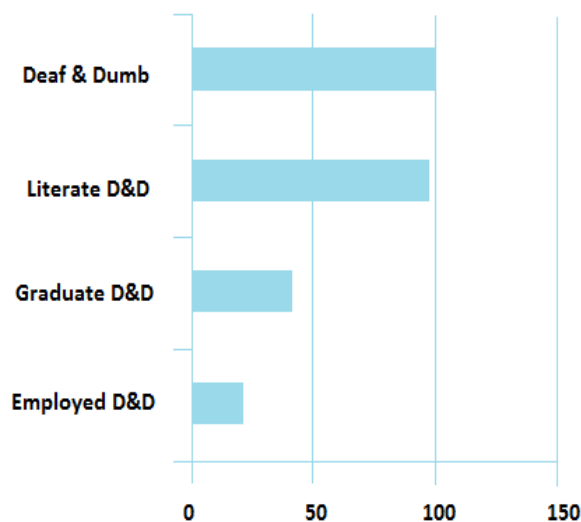


Fig. 1: Dumb and deaf Survey

Deaf and Dumb person and normal person communication is as same as two different persons from different countries uses two different languages for communication without any common language then they will have problem of understanding each other. Deaf and Dumb population is a result of the physical disability of hearing for deaf people and disability of speaking for dumb people. Because of lack of communication between normal person and deaf and dumb person the ratio is decreasing of Literate and Employed Deaf and Dumb. Deaf and Dumb person uses sign language for communication which is not known to normal person for communication they requires a translator physically which is not always convenient to arrange. To overcome this problem, we developed a unique application. Our application model work as a desirable Interpreter used to translates Sign Language in form of Gesture by a Dumb Person to Synthesized English Word which have a corresponding meaning in Sign Language which interprets a particular thing, as an Audio Output for Normal Person. This will help to remove communication gap between Normal and Deaf and dumb communities.

Deaf and Dumb people uses sign language as an important and only method of communication. Sign language is a formal language and a system of communication using hand gestures and signs. Sign Language symbols are shown in figure 2. In this project Flex Sensor Plays the major role, which are placed on fingers, as fingers bends it changes resistance depending on the amount of bend on the sensor.

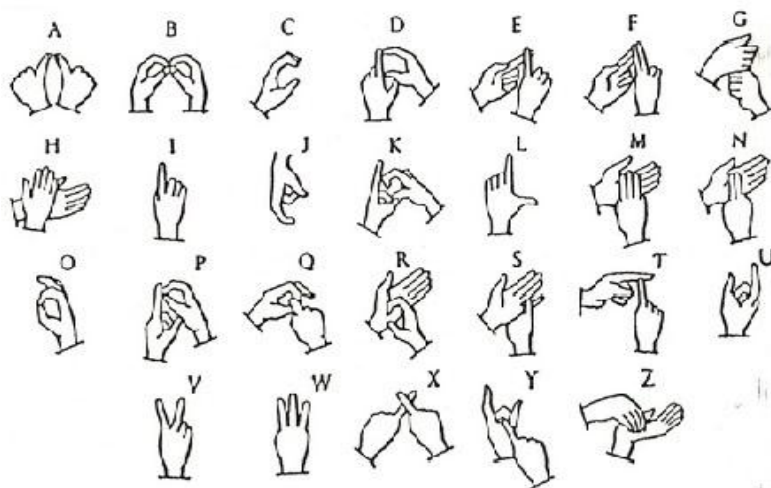


Fig. 2: Indian Sign Language Symbol

## II. RELATED WORK

Wherever Using the concept of gestures, few systems had been developed in the past to recognize the gestures made using hands but with limitations of recognition rate and time which include:

1. Using CMOS camera
2. Using image processing technique
3. Leaf switches based glove
4. Copper plate based glove
5. Flex sensor based glove

### Using CMOS Camera

CMOS camera is used for transmission of image data via UART serial port. Serial to parallel conversions is done by UART on data received from a CMOS camera and parallel to serial conversion is also done on data received from the CPU.

Hand gestures were detected by CMOS camera using following 3 steps:

- Capturing the image of the gesture
- Edge detection of that image
- Peak detection of that image

Disadvantage: High latency, Expensive and 50 KB of memory is occupied by each image.

### Using Image Processing Technique

In the image processing technique, the gestures are captured by using camera. Images are used as gestures data captured by camera. Different algorithms are used to analyze these images for recognizing the meaning of each particular gesture. A sequence of hand gestures are created by the corresponding key gesture frames from the extracted information.

Disadvantage: Complex computational algorithms are requires for detecting the gestures. Also this technique needs proper background and lighting condition.

### Leaf switches based glove

Leaf switches are similar to normal switches but designed such that the two ends come into contact and the switch will be closed as pressure applied on the switch. These leaf switches are used with gloves by placing it on the fingers of the gloves in such a way that when finger is bent then the two terminals of the will be come into contact.

Disadvantage: After a very long usage, the switch will be closed instead of open even when the finger is straight and it will result in improper transmission of gestures.

### Copper plate based glove

In this prototype, a copper plate is used and placed on the palm as ground. In rest position, the copper strips will indicate a voltage level of logic 1. The voltage associated with copper strips and ground plate will be drained when copper strips and ground plate comes into contact and will indicate a voltage level of logic 0.

Disadvantage: The glove is uncomfortable for long use because use of copper plate makes it bulky.

### Flex sensor based glove

Flex means "curve" or "bend". Flex sensor is also called as resistive sensor. Flex sensor is used as a transducer because it converts physical energy into electrical energy. As per the bend of Flex Sensor it changes its resistance into analog voltage.

Flex sensor based glove is haptic approach which uses flex sensors for providing physical values for processing.

## III. OVERVIEW OF SMART GLOVE

There are two important and major parts for developing the project are:

1. Circuit Design and Construct
2. Development of software and Algorithm

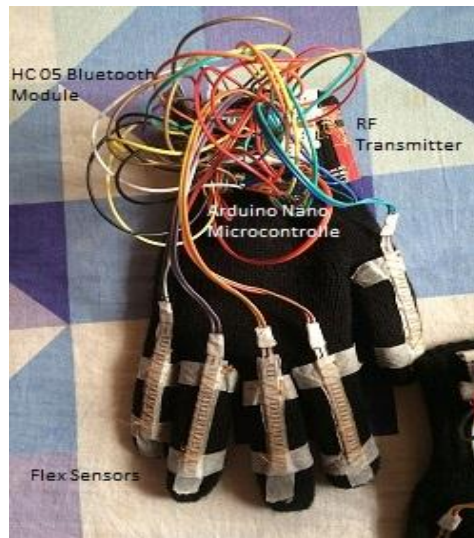


Fig. 3: Indian Sign Recognition Glove

**Microcontroller (Arduino Nano)**

Arduino Nano is the main controller used in this project. It is a microcontroller based board on the Atmega 328k. It has 20 digital input and output pins with 7 pins for PWM

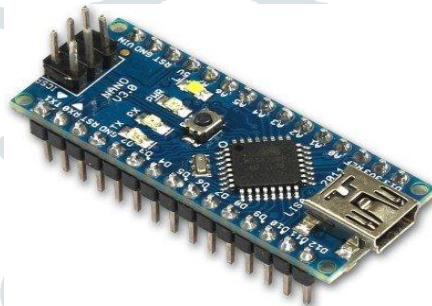


Fig. 4: Arduino Nano Atmega328 Microcontroller

**Flex Sensor**

Flex sensor is the most used and suitable sensor to capture and measure the bends of the fingers. The Flex sensor is so flexible that even with small bend it bends easily. It is very comfortable as it is light weight and thin. Within a thin flexible substrate it consist carbon resistive elements. According to curvature of substrate a resistance output relative to the bend radius is produced by flex sensors.

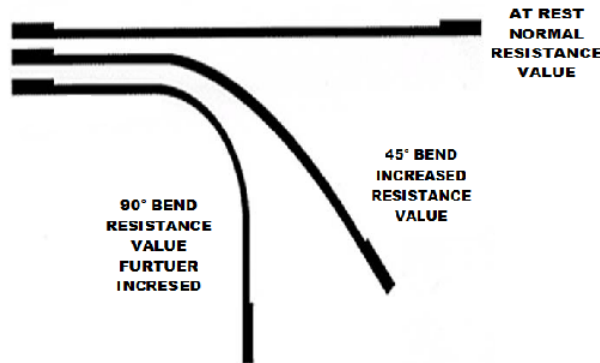


Fig. 5: Flex Sensor

The resistance range of bending varies from 45Kohm to 125Kohms for flex sensor. Relation between Bend and Resistance is shown in Fig. 4

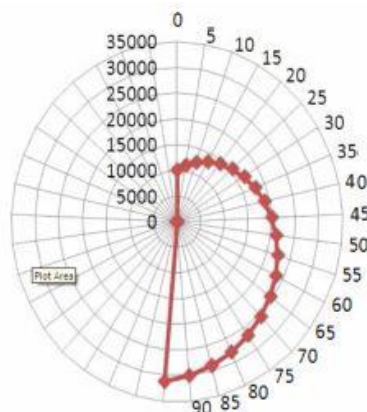


Fig. 6: Relation between Bend and Resistance

### HC 05 Bluetooth Module

For Data transmission from microcontroller to smart phone Bluetooth module is used. This Bluetooth module has an on-board antenna. It can be work with variety of Phone and Bluetooth adapter and also acts like a transparent serial port. Operating voltage is 3.0-3.6V.



Fig. 7: HC 05 Bluetooth Module

### Arduino Software

The Arduino IDE (Integrated Development Environment) is a written java cross platform application. It includes a code editor with features such as brace matching, automation indentation, syntax highlighting and. It is capable of uploading and compiling programs to the board with a single click.

### RF 433Mhz Transmitter and Receiver

These RF modules are used to transmit data from one arduino to another. Operating voltage for Receiver is 5V and for Transmitter is 3-12V.



Fig. 8: RF Transmitter and Receiver

### Android Studio

Android Studio is used for Android application development. Android Studio is known as the official IDE (Integrated Development Environment) for developing android app. It only supports Android application design and testing for new application created. It provides graphical interface which allows users to drag and drop visual object to create an application that can run on the Android system.

## IV. WORKING OF SMART GLOVE

The components used in glove have been already discussed above. Five flex sensors are attached on the back of the each glove to detect human operator's finger activity. The sensors are connected to bread board then connected to microcontroller for analog signal detection. The data is then transmitted by RF transceiver and received by RF receiver which is at the right hand glove then the data combining and thresholding is done by microcontroller at right hand glove. The data is then sent to Bluetooth module via its transmitter and receiver connected to transmitter and receiver pin of microcontroller respectively. The data is then collected by Android application on Smart phone having the Bluetooth connectivity ON. The application will then converts the received text into appropriate speech.

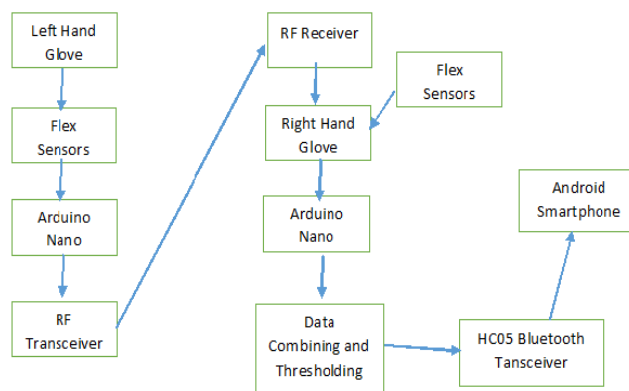


Fig 9: Block diagram for working of gloves

## V. RESULT

- In our system, the person who wears the glove should hold it for about 2 seconds in order to detect the particular gesture. Every gesture consists of bending of fingers of hand in a particular order with specific angle correspondingly. The sensor values that are being generated by each of the Flex sensors fed to the microcontroller. For every bending of Flex sensors produces different analog values based on positions of these sensors. The different gestures are assigned with different sensor values to identify a particular alphabet. Once an alphabet is identified, it is being sent by Bluetooth module to android application on smart phone with enabled Bluetooth.
- The android application will convert alphabet into voice and display it on android screen and the particular word will speak out.
- The use of this glove eliminates the necessity to learn sign language for communication with speech and hearing impaired.

## VI. CONCLUSION

Disabled person uses sign language for communication with other person. Conversion of sign language into text and speech is done so that communication is not limited between them. Utilizing smart gloves for communication, the barrier between two different communities is eliminated. Using smart gloves disabled person can also grow in their carrier and makes nation grow as percentage of disabled person are millions in count as now. Making their future better, making nation better.

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