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# Electronic Hand Glove for Speech Impaired using MATLAB

**Nikita Ratnani [1], Mrs. Manisha Sharma [2],**

M.Tech Scholar , Department of ET&T, Bhilai Institute of Technology, Durg , India[1]

Head of Department , Department of ET&T,Bhilai Institute of Technology, Durg , India[2]

**Abstract**: Sign language is the principle means of communication for many deaf people. But most of the normal people faces difficulty in communication in this way with the speech impaired people. Thus, we proposed a system in which piezoelectric vibration sensors are installed on the hand gloves and the data obtained from the sensors are calibrated accordingly using MATLAB programming language. On tapping the vibration sensor, the data is send to the vibration sensor module. This sensor module sends the analog data to the Arduino board. Then this microcontroller board sends the analog output to the MATLAB via USB which is converted into predefined words in the MATLAB. The predefined words can be hello, good morning, welcome etc. In this way, we will understand what the user wants to say.

**Keywords**: Speech impaired, Piezoelectric , Vibration , Arduino , MATLAB.

## I. INTRODUCTION

Around nine billion people in the world are dumb i.e. they cannot speak. The communication between blind person and normal person is quite easier as compared to communication between a dumb person and a hearing person. Today many of the dumb people are using sign languages to communicate with the normal people but this is not all time applicable because there are so many sign languages available such as Indian sign language , British sign language, American sign language etc.

Hence, gesture recognition is mainly classified into two categories : 1) Data-Glove based 2) Vision based. The level of accuracy is higher in case of data-glove based technique and it also offers higher mobility whereas in case of vision based technique various problems are encountered such as noise interference while capturing the data and the algorithms for this technique are also quite complex. In previous paper , Prakash B. Gaikwad and Dr. V.K. Bairagi[1] proposed a hand gesture recognition system using ISL(Indian Sign Language).

In this data glove based technique is used and with the help of flex sensors and accelerometer hand gesture movement is recorded. The cell phone is used to recognize the hand gesture data which is already stored in the memory. Shoaib Ahmed V.[2] proposed another system in which flex sensors are installed on the hand gloves. These sensors output a stream of data that varies with degree of bend.This output is send to microcontroller and finally to gesture recognition section via RF transmitter and receiver.

S. Nilashree Wankhede[3] discussed about the speech training aids and the possible speech processing that can be done to obtain visual feedback for the hearing impaired children so that they get an opportunity to learn , speak and communicate properly.Thus, various papers discussed different speech aid implementation techniques.

## II. SYSTEM ARCHITECTURE AND IMPLEMENTATION

In this research paper, the piezoelectric vibration sensors are fitted on a hand glove. These sensors acts like a transducers hence converts the vibration into an electrical signal. This signal is then fed to the vibration sensor module(LM 358) which works on +5V DC power supply. The anaog outputs from the sensor module is then send to the Arduino board which is a microcontroller board. Then , the analog outputs from the Arduino is given to the MATLAB software which is interfaced via USB.

### 2.1 SYSTEM ARCHITECTURE

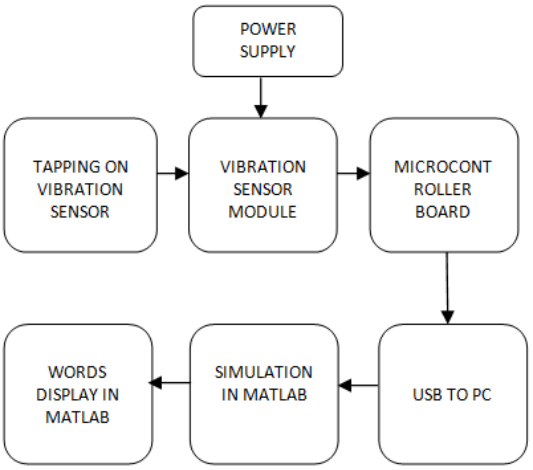


Fig. 1 : Block diagram of Speech aid implementation using MATLAB

### 2.2 PIEZOELECTRIC VIBRATION SENSOR MODULE :

The piezoelectric vibration sensors are fitted on the glove, one sensor on each finger. A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, temperature, acceleration, strain or force by converting them to an electric charge.

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The vibration sensor module works on +5V DC power supply and gives the output in the form of voltages.

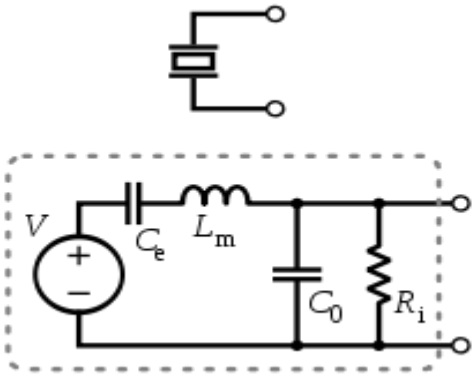


Fig. 2 : Schematic symbol and electronic model of a Piezoelectric Sensor

Fig. 3 : Piezoelectric vibration sensors 801S

Fig. 4 : Vibration sensor module

In Fig. 3 and Fig. 4 the vibration sensors and the module is shown. The dumb people taps on the vibration sensor which produces an output voltge which is fed to sensor module itself.

### 2.3 : ARDUINO BOARD

The microcontroller used for this research is Arduino Mega 2560. The analog output from the sensor module is fed to this board. The Arduino board works very well with the vibration sensors hence it is used. The Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.The board gets the power supply internally from the computer system. Through USB, it is interface to MATLAB software.Some of the features of Arduino are as follows:

| | |
|---|---|
| Microcontroller | ATmega2560 |
| Operating Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limit) | 6-20V |
| Digital I/O Pins | 54 (of which 15 provide PWM output) |
| Analog Input Pins | 16 |
| DC Current per I/O Pin | 20 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 256 KB of which 8 KB used by boot loader |
| SRAM | 8 KB |
| EEPROM | 4 KB |
| Clock Speed | 16 MHz |
| Length | 101.52 mm |
| Width | 53.3 mm |
| Weight | 37 g |

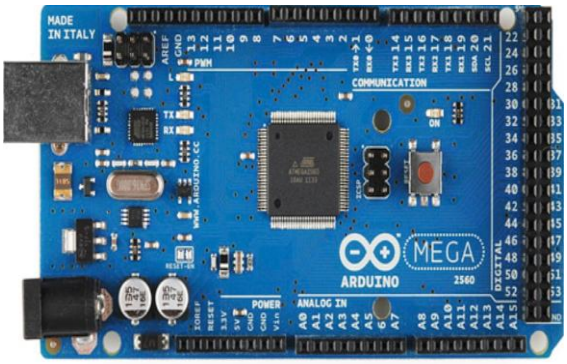


Fig. 5 : Arduino Mega Microcontroller

### 2.4 SYSTEM IMPLEMENTATION

The complete hardware implementation of the speech aid system is as shown below :

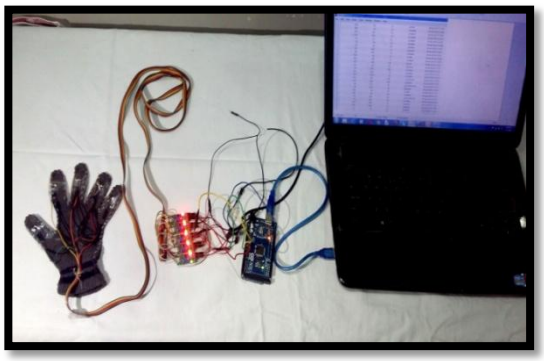

Fig. 6 : Hardware implementation of Speech aid system

In this, five vibration sensors are used. For sensor no. 1, the predefined word stored in MATLAB is “HELLO”. For sensor no. 3, the predefined word stored is “GOOD MORNING” and for sensor no. 5, the predefined word stored is “WELCOME”. The threshold value is set as 150.


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Hence when the impaired person taps the sensor1, the output displayed in the MATLAB as “HELLO” and so on.

No. Of combinations of words possible in the system is $2^n$,where n is the no. of sensors fitted.

In this case, the no. of combinations possible are 32. Thus, combination sensor output is also possible in this prototype system.

## III. RESULTS AND DISCUSSIONS

Thus in this prototype system , the user taps the sensor and the corresponsing output will be displayed on the MATLAB screen. Thus the system is capable of recognizing very quickly what the user wants to say within no time. Hence it is a low time consuming approach.

## IV. FUTURE SCOPE

The completion of this prototype system suggests that the touch sensors can also be used to increase the accuracy of the device. Also it can be made wireless with the help of LED display. Thus a portable device can be converted so that a dumb person can communicate to normal person anywhere.

## V. CONCLUSION

We presented a system which is a blend of hardware and software for the speech impaired people.This paper aims to reduce the communication gap between the mute community and the normal ones. MATLAB software is a very user friendly software hence it is used for the research work.Also the system works very fast and gives results in very less time.

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