

# International Journal of Innovative Research in Science, Engineering and Technology

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## Detection of Finger Motion using Flex Sensor for Assisting Speech Impaired

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**ABSTRACT:** This paper is mainly focused on aiding the speech impaired and paralysed patients. Our work helps in improving the communication with the deaf and dumb using flex sensor technology. A system is developed that can translate different signs including Indian sign language to corresponding text. About 9 billion people in the world come into this category which is quite large number to be ignored. Flex sensors placed on hand gloves pick up gestures and translate that to text data with the help of Analog to Digital convertor and microcontrollers. The main aim of the system is to develop a cheap glove that disabled people can use for communication. When the gesture of an alphabet is made respective alphabet is shown in the LCD. Sign language is prevalent amongst the deaf, dumb or blind individuals. With the conventional sign language not acknowledged to the signers, it affects their interpersonal relationships in the society in an adverse manner. A sophisticated method is required as deaf-dumb people use sign language for their communication which is difficult to understand by the normal people.

**KEYWORDS:** Sensor, Gesture, LCD

### I. INTRODUCTION

Sign language is a way by which the gestures made by the user are used for communication. Human gestures are an efficient and powerful way of interaction. These are sometimes used to express ourselves. This project focuses on developing a help for disabled people using this gesture recognition technique. In this system, the gestures are converted into text messages for communication. The basic idea is using gloves using Flex Sensors for the disabled people. The five flex sensors are normally attached to the glove. When a flex sensor is bent there is a change in resistance, which is recorded by the ADC of the microcontroller.

Sign language is a language through which communication happens without the means of acoustic sounds. It relies on sign patterns like orientation and movements of the arm that aids in communication between individuals. A gesture in a sign language can be defined as a movement of part of the body, mainly hand or the head, to express an idea or meaning. Facial expressions also count toward the gesture, at the same time. A sign language usually provides signs for whole words or letters. A sign language editing apparatus includes a glove-type sensor that converts movement of fingers in the sign language into an electrical signal to produce time series data of sign language words.

Deaf people have used sign languages throughout the past. In 1620, Juan Pablo Bonet published "Reduction of letters and art for teaching mute people to speak" which is considered as the first modern article of sign language phonetics. There are more than hundred sign languages in the world today for example the American Sign Language (ASL), the British Sign Language (BSL), International Sign Language and so on. Research have been done on Sign Language detection and techniques to convert sign to text by using American Sign Language and International Sign Languages. It is the Indian Sign Language which needs to be worked upon. Interpreters were used by deaf people to translate the sign language into speech signals. However interpreters were very costly and they are difficult to acquire on a moment's notice. Note writing was used by the dumb individuals to communicate with others, but it is difficult when the two individuals involved in a conversation are at a distance. This proposed work provide a representation to Indian sign language (ISL) translation system.

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## II. OVERVIEW OF RESEARCH

Although data gloves are available in the market but they are used for gaming and other virtual reality applications and there is no such complete system available in the market for the translation of Sign Language gestures into speech. However, research is being done to develop some portable, efficient and highly accurate system for the translation of standard sign language gestures through a hand glove. There are two main approaches to gesture recognition: a machine vision based approach which consists of taking the input through a single/set of cameras or a haptic based approach which consists of using a sensory device to take in physical values for processing.

Knowledge about sign language is required about deaf and dumb people for communicating with each other. Here, we made Indian Sign Language's alphabets using one hand. For making this, Flex sensor glove is used. Using this alphabet, We made sentence forming for example, "I WANT TEA", "WELCOME". To display this message, the output shown in LCD. In this system, five flex sensor were used and voltage required for each flex sensor is +5V. When power is ON, each flex sensor receives +5v supply. When user makes any movement , then signals coming from all the five flex sensor are amplified using an amplification circuitry and then is given to microcontroller which is having an in-built analog to digital converter. If the motion matches the database then the output will be displayed on the LCD. If there is no letter that matches the current state of hand, output will not be shown on LCD. The following flow chart depicts the functioning of our project.

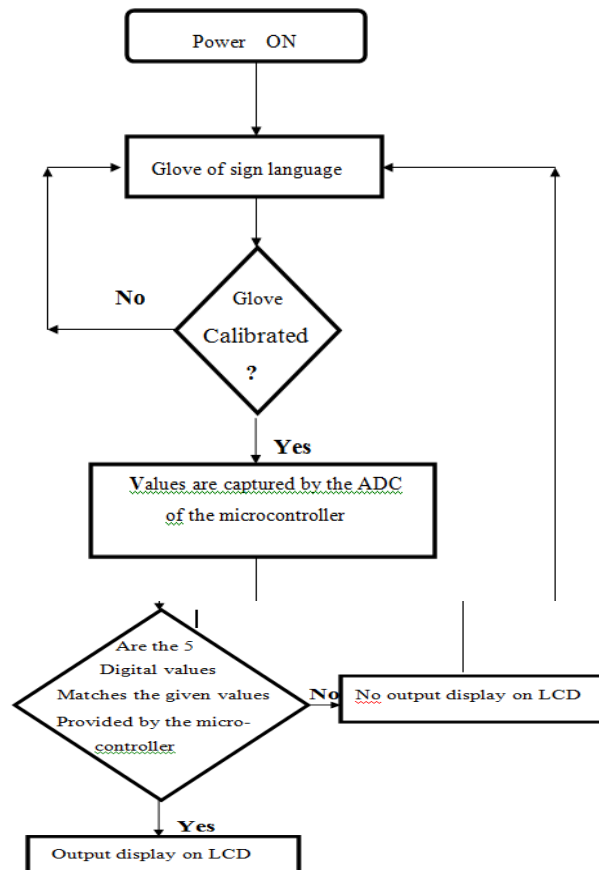


Fig. 1 Flow Chart of proposed research

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## III. EXPERIMENTAL CONTENT AND SYSTEM FUNCTIONALITY

We have smart phones full of apps that help us streamline everyday tasks, watches that count our steps and monitor our heart rates and even eyewear that can connect us to internet. Four flex sensors are used and voltage required for each flex sensor is +5V. When power is ON, Each flex sensor get +5V supply. When user made gesture of a letter, the four signals coming from each flex sensor goes in microcontroller which are then converted from analog signals to digital values. Then display the output in the LCD. If there is no statement that matches current state of the hand, there is no output shown in the LCD. The output can be shown on an Android device via Bluetooth Module HC-05. The Android device must have Bluetooth Terminal app installed. The flowchart of this system is shown below.

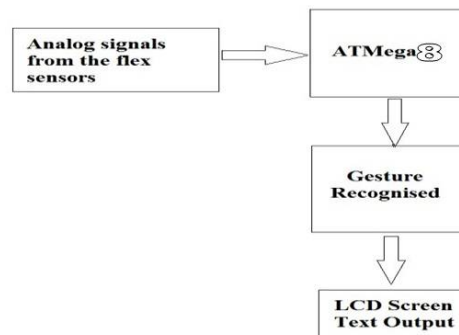


Fig. 2 Block Diagram of System Functionality

### Arduino Details, Wireless (Bluetooth) Link and Android Application with programming:

HC-05 (Bluetooth to Serial Port Module) was used because of its ease of availability and its low cost. Service Discovery Protocol (SDP) was used to allow devices to discover what services each other support, and what parameters to use to connect them. Each service was identified by a universally unique identifier. The default setting of serial port of HC05 was: baud 38400 and our serial communication was happening at a baud rate of 9600, thus baud rate of Bluetooth module was needed to be matched. To change it, a command was entered through the AT mode on the module. The module was set as Master mode.

### Transmitting Data from Circuit to Smartphone via Bluetooth Module:

For sketching and uploading the code, we used Arduino IDE Software. It is an Open-Source software and with the help of this, it was easy to write code and upload it to AVR AtMega8 microcontroller. It runs on Windows, Mac OS X and Linux. The environment is written in Java and based on Processing and other open-source software. This software is developed by Arduino Company to support its various boards as well as AVR microcontrollers. A program for Arduino may be written in any programming language for a compiler that produces binary machine code for the target processor. Atmel provides a development environment for their microcontrollers.

It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. It is possible to open these files with version 1.0, you will be prompted to save the sketch with the .ino extension on save. The Arduino IDE employs the program argued to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

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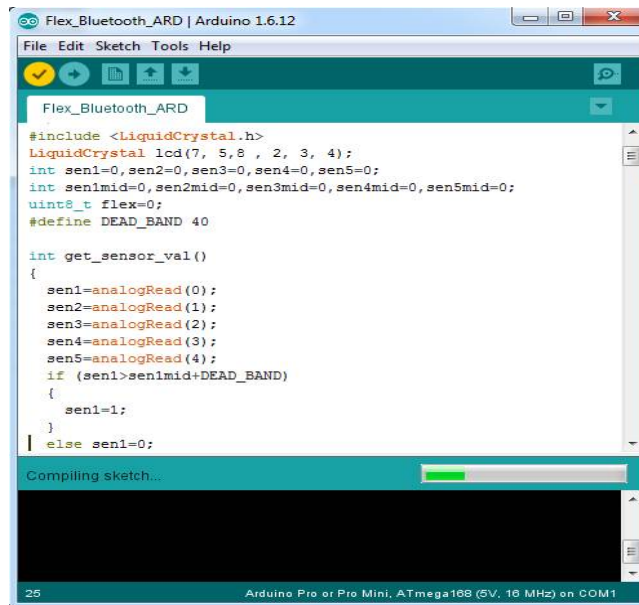


Fig. 3 library designing in Arduino

Before uploading the sketch, we need to select the correct items from the Tools > Board and Tools > Port menus. The boards are described below. On the Mac, the serial port is probably something like /dev/tty.usbmodem241 (for an Uno or Mega2560 or Leonardo) or /dev/tty.usbserial-1B1 (for a Duemilanove or earlier USB board), or /dev/tty.USA19QW1b1P1.1 (for a serial board connected with a Keyspan USB-to-Serial adapter). On Windows, it's probably COM1 or COM2 (for a serial board) or COM4, COM5, COM7, or higher (for a USB board) - to find out, we look for USB serial device in the ports section of the Windows Device Manager. On Linux, it should be /dev/ttyACMx, /dev/ttyUSBx or similar.

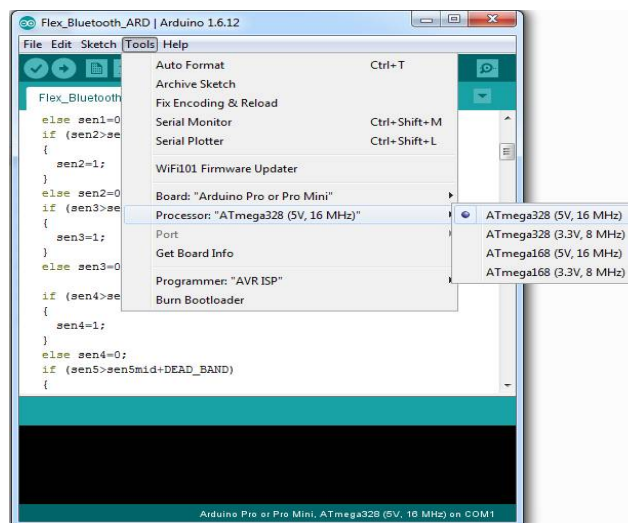


Fig. 4 library designing options in Arduino

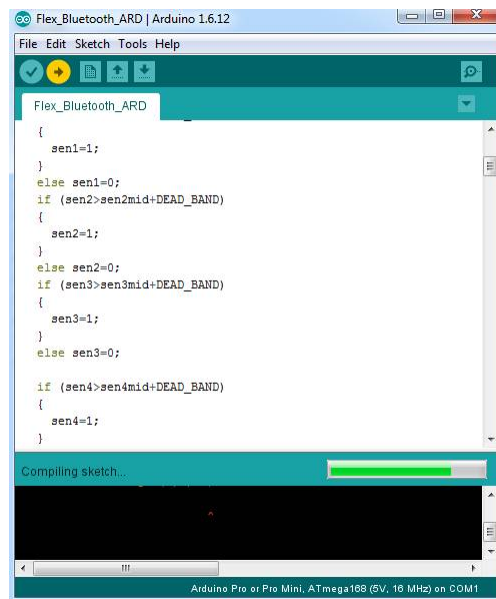
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Vol. 6, Issue 10, October 2017

Once we've selected the correct serial port and board, press the upload button in the toolbar or select the Upload item from the Sketch menu. Current Arduino boards will reset automatically and begin the upload. With older boards (pre-Diecimila) that lack auto-reset, you'll need to press the reset button on the board just before starting the upload. On most boards, you'll see the RX and TX LEDs blink as the sketch is uploaded. The Arduino Software (IDE) will display a message when the upload is complete, or show an error.



**Fig. 5** Program designing in Arduino

### Realization for Design:

MATERIAL	SPECIFICATIO N	QUANTITY	COST (IN Rs.)
FLEX SENSOR	2.2 inch ultra thin	5	2500
ATMEGA 8	Low power Atmel AVR 8 bit MC	1	150
LCD SCREEN	16x2 alphanumeric display	1	300
PCB BOARD	Glass epoxy	1	100
RESISTORS	10K,4.7K ohm	5	50
CONNECTING	Berg connectors	As per	250

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WIRES		required	
CAPACITORS	100 micro farad, 25V	2	20
GLOVE		1	300
PUSH BUTTON	6x6mm	1	10
BLUETOOTH MODULE	HC-05	1	340
ANDROID SMARTPHONE		1	2000
USB AVR PROGRAMMING CABLE		1	350
7805 IC	VR7805-5	1	40
TOTAL			16410

Once the code is uploaded, LCD screen will show the output and Bluetooth modules LED will start blinking. Before transmission, it was necessary to pair the device with the smart phone. The smart phone must have an Android application installed named Bluetooth Terminal. This application uses Bluetooth of the smart phone and pairs the device HC-05. This application accepts serial text data over Bluetooth and can also send the serial text data. At pairing, LED connected to PI09 of Bluetooth module blinked very fast and slowed down when a connection was established. When the module is transmitting data, LED connected to PI08 blinks twice at slow intervals to indicate data transfer. At the programming side of microcontroller, serial print functions were used to send text to the Smart phone.

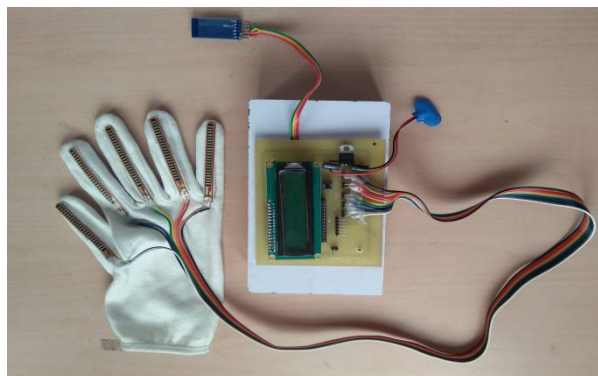


Fig: Experimental Setup



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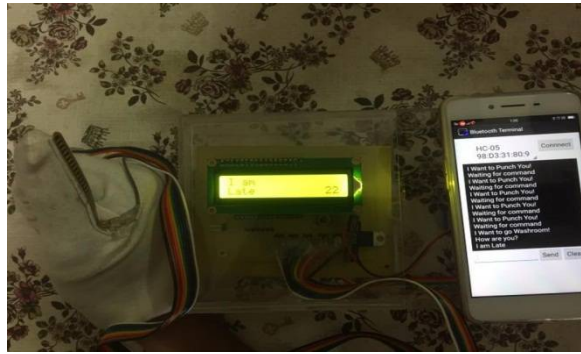


Fig: Experimental Setup connected to the Bluetooth terminal

## VI. SIMULATION RESULTS

The averaging we do at each interval helps to account for any noise or glitches that the flex sensors are sometimes prone to. The accuracy of the glove is also somewhat limited by the size of the person's hands. The accuracy of each flex sensor is limited beyond a certain point. Smaller hands will result in a larger degree of bend. As a result, the difference between slightly different signs with a lot of flex might be too small for users with small hands. The device uses a low voltage environment, and extremely low frequency communication. The sensors are well attached, and there are no sharp edges. As a result, we don't see any large safety issues associated with the glove. Furthermore, since all communication is done via cables, our device does not interfere with other designs. The glove can be used by anyone who fits into it, they would only have to train on it and generate new datasets if they wish for a higher prediction accuracy than the standard or to incorporate new signs.

## VII. CONCLUSION

This paper gives a brief about the project that is useful for speech impaired and paralysed patient. This work was able to meet our expectations quite well. This project was meant to be a prototype to check the feasibility of recognizing sign languages using sensor gloves. The completion of this prototype suggests that sensor gloves can be used for partial sign language recognition. More sensors can be employed to recognize full sign language.

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