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Innovative Approach for Gesture to Voice Conversion: Review

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Abstract:
This paper presents hand gesture based interface for facilitating communication among speech- and hearing- impaired disabilities. In this system a data glove is used as input device which is normal cloth driving gloves fitted with five flex sensors along the length of each finger and the thumb. Generally mute people use sign language for communication but the communication is become difficult with others who do not understand sign language. In this paper, microcontroller and sensor based gesture to voice converter is presented. This is basically, a data glove and microcontroller based system. Flex sensor based data glove can detect all the movements of a hand and microcontroller based system converts some specified movements into human recognizable voice. This paper provides the map for developing such a digital glove. It also presents the characteristics of the device and discusses future wok.

Keywords: *Hand Gesture, Sign language, Data Glove, Flex sensor, microcontroller*

1. Introduction

The development of the most popular devices for hand movement acquisition, glove-based systems, started about 30 years ago and continues to engage a growing number of researchers. Communication means exchange of information, it becomes effective if all are using same media/language for conveying information. Generally mute people uses sign language for communication in which gestures are used to convey meaning instead of sound. It is non verbal form of language uses gestures to convey thoughts gesture is a particular movement of the hands with a specific shape made out of them. Signs are used to communicate words and sentences to audience. In this system flex sensor plays the major role, flex sensors are sensors in which resistance changes according to degree of bending. This microcontroller and sensor based data glove helps to lower the communication gap between deaf, dumb and normal person. This paper contains the map to develop a gesture vocalizer. It gives the related works, explains the system architecture, characteristics and operation of each component in the system architecture. Provides the discussion, advantages, applications and future works, of this device.

2. Related Work

Sign language recognition system mainly have two well known approaches these are Image processing technique and another is microcontroller and sensor based data glove [5]. These approaches are also known as vision based and sensor based techniques. In the image processing technique camera is used to capture the image/video, in this static images are analyzed and recognition of the image carried out using algorithms that produce sentences in the display. The algorithms used in vision based sign language recognition system are Hidden Markov Mode (HMM), Artificial Neural Networks (ANN) and Sum of Absolute Difference (SAD) Algorithm use to extract the image and eliminate the unwanted background noise [4]. In sign language recognition system which uses image processing technique, image acquisition process has many environmental apprehensions such as background condition and lightning sensitivity. Higher resolution camera take up more computation time and occupy more memory space, user always need camera forever and cannot implement in public place. These are the drawbacks of this system.

In the another approach data gloves are used for sign language recognition. In this user need to wear glove consist of flex sensor and motion tracker [3]. Data are directly obtained from each sensor depends upon finger flexures and computer analysis sensor data with static data to produce sentences. It's using neural network to improve the performance of the system.

Another approach is using a portable Accelerometer (ACC) and tactile sensors used to measure the hand gesture [1]. ACC used to capture movement information of hand and arms. EMG sensor placed on the hand, it generates different sign gesture [3]. Sensor output signals are fed to the computer process to recognize the hand gesture and produce speech/text. In the instrumented approach [2] of sign language recognition instrumented part of the system combines an AcceleGlove and a two-link arm skeleton.
This paper presents Microcontroller and sensor based data glove approach for sign language recognition cause of less computational time and fast response. It is portable device so easy to use and cost of device is also low.

3. Proposed Work
In this project data glove is implemented to capture the hand gestures of a user. The data glove is fitted with flex sensors along the length of each finger and the thumb. The flex sensors output a stream of data that varies with degree of bend.

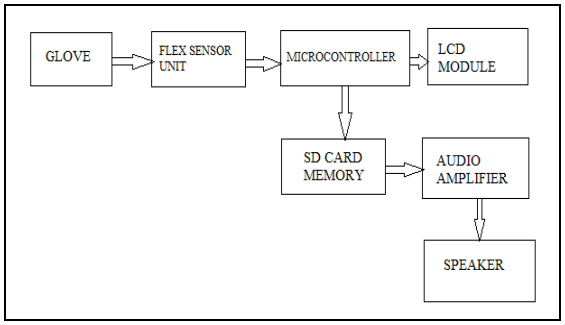

Fig. 1 Block Diagram of Sign Language Recognition System

Figure illustrates the proposed system architecture; the system is mainly composed of several modules including the flex sensors, ARM 7 microcontroller, LCD, SD card, Audio amplifier and speaker. The first module (input) acquires signs performed by a dumb person communicating with the system using sign language; Flex sensors outputs data stream depending on the degree and amount of bend produced by the sign. A set of signs that represent words are collected as the data base for this system. The output data stream from the flex sensor is fed to ARM 7 Microcontroller where it is processed and converted into digital form.
The analog outputs from the sensors are then fed to the inbuilt ADC of the ARM 7 microcontroller. These analog readings are then digitized and stored in internal RAM memory of microcontroller. The microcontroller will compare these readings to the look up table stored in internal program memory, whichever reading is closest to the look up table microcontroller will select that word. After this microcontroller will search the SD card for .wav file with similar name. That text will be displayed on LCD and played out via speaker. By using this wearable data gloves mute person can easily communicate with normal people

3.1. Algorithm used

- *Stage 1:* The data glove is fitted with flex sensors along the length of each finger and the thumb. The flex sensors output a stream of data that varies with degree of bend.
- *Stage 2:* Flex sensors outputs data stream depending on the degree and amount of bend produced by the sign. A group of signs that represent words are collected as the data set for this system.
- *Stage 3:* The output data stream from the flex sensor is fed to ARM 7 Microcontroller where it is processed and converted into digital form.
- *Stage 4:* The microcontroller will compare these readings to the look up table stored in internal program memory, whichever reading is closest to the look up table microcontroller will select that word.
- *Stage 5:* After this microcontroller will search the SD card for .wav file with similar name.
- *Stage 6:* That text will be displayed on LCD and played out via speaker.

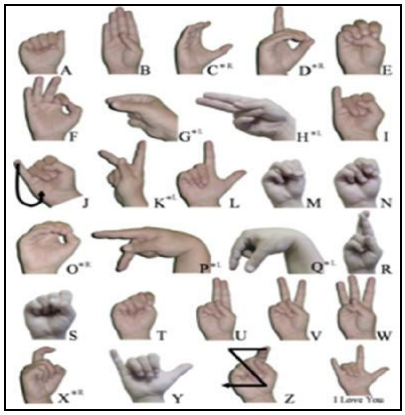

Fig. 2 Equivalent English cue symbols for Database

4. Flex Sensors

The Flex Sensors are analog variable resistors, they works as variable analog voltage dividers. They are usually in the form of a thin strip having length 1"-5" width 0.25"and thickness upto 0.19", they can be made uni-directional or bi-directional, as the size changes according to that resistance varies. The Flex Sensors are mounted on each finger and thumb of the glove. These are fitted on the fingers by using threads and needle. Flex sensor basically made up of carbon resistive elements, which have greater form factor on a thin flexible substrate, more carbon means less resistance. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value. In this way flex sensor offers variable resistance readings.

Flex sensor operate at 5-volt input voltage d output between 0 and 5 V, resistivity varying with the sensor's degree of bend and the voltage output changing accordingly. The sensors connect to the device via three pin connectors. The flex sensor pictured below changes resistance when bent. It will only change, the resistance increases to 30- 40 kilo ohms at 90 degrees.

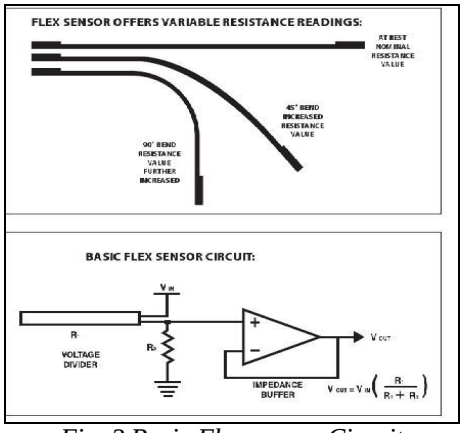

Fig. 3 Basic Flex sensor Circuit

Flex sensor basically consists of voltage divider circuit and the buffer as shown in above circuit diagram. The outputs from the flex sensors are inputted into non inverting style op-amps to amplify their voltage. The greater the degree of bending the lower the output voltage. Using the voltage divider concept the output voltage is determined and it ranges from 1.35v to 2.5v. A potentiometer can be added to the Circuit to adjust the sensitivity range. In this way you can use the flex sensor as a switch without going through a microcontroller. Resistance to Voltage Converter - use the sensor as the input of a resistance to voltage converter using a dual sided supply op-amp.

4.1. Characteristics of flex sensors

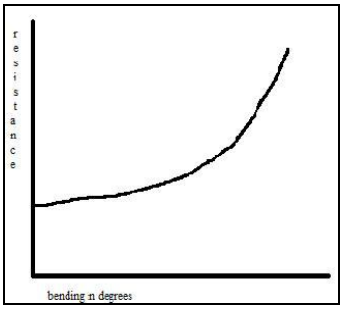

Fig. 4 Bending VS Resistance

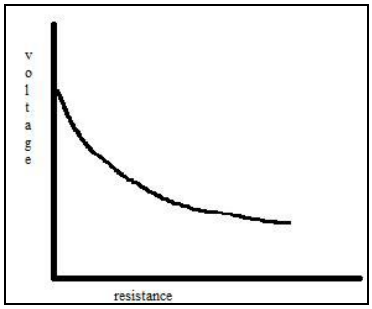

Fig. 5 Resistance VS Voltage

5. Discussion

In this project we are going to make a electronic speaking glove, by simply wearing that data glove mute person can easily communicate with the normal people. In this system LCD display is also used, after sign recognition the recognized word will be displayed as text on LCD display so it becomes easy for mute person to communicate with deaf person. In this way this project will help to lower the communication gap between mute, deaf and normal people.

While making the system we should consider certain performance measures these are recognition time and recognition accuracy. The user should forms a sign and holds it for two seconds to ensure recognition. The system should be capable of recognizing signs more quickly than this arbitrary two seconds limit.

5.1. Advantages

- Low cost
- Compact systems
- Flexible to users
- It takes less power to operate system

5.2. Applications

- Gesture recognition and conversion.
- As a translating device for Mute people.
- It can be used for Mobiles for SMS sending.
- Translation of sign language in many regional languages.

6. Future work

The completion of this project suggests that these wired gloves can be used for partial sign language recognition. In future work of this proposed system supporting more number of signs and different language mode. One can make this system wireless so that it becomes handy and portable for commercial use.

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