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ANDROID BASED PORTABLE HAND SIGN RECOGNITION SYSTEM

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Abstract - *When thinking about how deaf and dumb people live, most of us often wonder how they communicate. One of the best methods of communication between them is the sign language. Using the sign language, they can share their thoughts and knowledge with the normal people. In this paper we have presented an approach that gives a technique for improving Sign Language Recognition System using glove. It consists of flex sensors that sense the hand gestures, a microcontroller to convert input analogue data to digital data and power supply is to provide voltages to specific units and finally Bluetooth module to send the data from micro controller to android mobile.*

Key Words: **Flex sensor, Microcontroller, Gesture Recognition, Android, Sign Language Translation, and Bluetooth.**

1. INTRODUCTION

The number of deaf-mutes in the world are roughly calculated to be from 700,000 to 900, 000 and of these 63 percent, are said to be born deaf, the others losing their hearing by different accident. Sign Language is a language of gestures and symbols that is used not only by deaf and dumb people but also by others with normal hearing to communicate with them. It is based on ideas rather than words. When deaf and dumb people communicate with each other, they commonly use a standard sign language such as American Sign Language or British Sign Language developed in USA and UK respectively.

Fig -1: The letters of the English alphabet in ASL

There is a connection among human languages such as gestures, facial expressions and emotions which are inseparable. Hence communication will become meaningless and incomplete if they are uttered individually. So, to understand these links use of more complex processes becomes necessary than those used for simple peripheral preprocessing of signals. To understand how human communication exploits information from several channels it is necessary to know about the constitution of cross-cultural database comprising verbal and non-verbal (gaze, facial expressions and gestures) data. Gathering data across a spectrum of disciplines in a structured manner will reinforce the ability to portray the underlying meta-structure and will lead to new mathematical models and approaches. Though scientific study of speech, gestures, gaze and emotions are of integrated system appears to have great strides in the last two decades, analysis has been at snail's pace due to the limitation in determination of boundaries among them. This opens door for automation of these processes.

According to medical science, a child brain develops drastically during early stages i.e. 1-5 years. It is a crucial period during which a child acquires most of its knowledge including languages and other skills. Hence early introduction to sign language becomes inevitable in developing linguistic skills among deaf children. Gestures used for sign language recognition is useful for processing information from man which is not conveyed through speech or type. There are various types of gestures which can be identified by computers just as speech recognition, speech to text, gesture recognition represented through sign language into text or voice. The letters of English alphabet in American Sign Language (ASL) is as shown in Fig -1.

Here, a custom-designed data-glove is developed using android database with the help of hardware such as flex sensors, microcontroller and Bluetooth module.

2. EARLIER WORK

The previous works mainly focused on a third person perspective or also known as vision-based technique for hand gesture recognition using image processing [3][4][5]. We have referred these papers for understanding their limitations and learning the basic gesture detection techniques. But currently, due to availability of variety of sensors and scope of application in

real life, many of the researchers have started using more portable techniques for gesture recognition [1][2].

P. Subha Rajam[3] had proposed a system that recognizes hand sign gestures using image processing. The gesture is captured using a camera and an outline of the image is generated. According to the finger positions, the system generates a binary code of the gesture. The binary code is mapped to a text and the text is shown on a monitor. In [4] this work author uses Hidden Markov Models (HMM) as an approach for recognizing and modeling dynamic hand gestures for the User Interface of in-vehicle information. The proposed method in [5] had recognized signs for all alphabets using Scale Invariant Feature Transform which extracts the features of image by finding and Describing key points and then converts them into text.

In [1] the project decodes the captured signs of American Sign Language into simple English sentences using a sensor glove. In order to recognize the sensor values, form the sensor glove artificial neural networks were used. These values received were categorized into 26 alphabets of the English language and two punctuation symbols were introduced by the author. In [2], a similar kind of approach was proposed by the author that included flex sensors and an accelerometer to detect the bend in fingers and the gesture of the hands and Arduino to convert. The flex sensors and accelerometer send the different voltage readings to the PIC microcontroller which will be mapped to the text.

Celestine Preetham [6] had proposed a system to make the gloves communicate wirelessly with another Bluetooth device. The device has a speech synthesizing software that will produce the translated speech for the hand gesture.

By referring to all these works, we have tried to provide our contribution towards society. We have extracted the best of the techniques from each of these papers, combined it under a common framework and extended it for multiple applications.

3. GESTURE DETECTION SYSTEM

3.1 System Overview

The gesture detection system is divided into following sections:

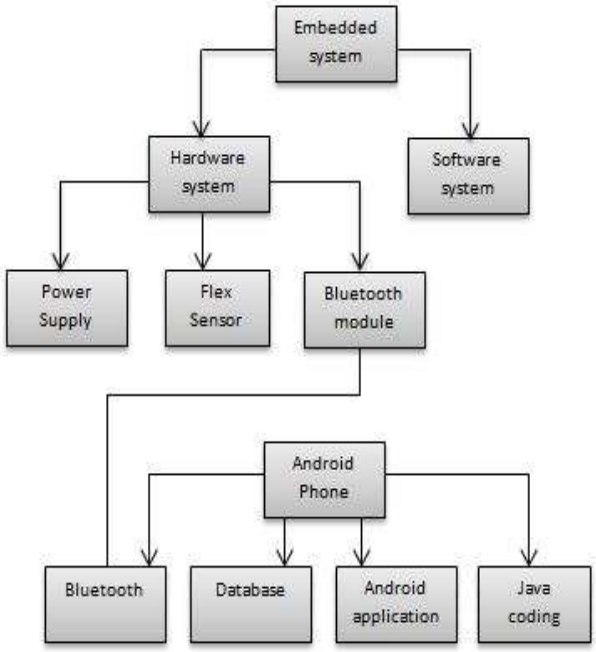

Fig -2: System overview

3.2 Block Diagram

The block diagram of the gesture detection system is given below:

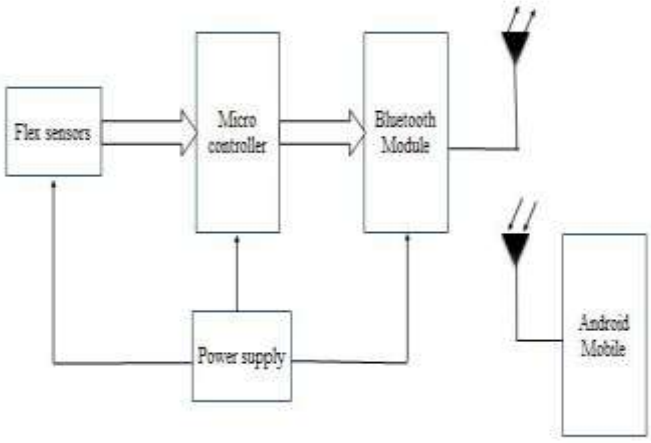

Fig -3: Block Diagram

3.3 Working Principle

The working principle of the various major blocks or sections used in the gesture detection system is given below

3.3.1 Flex sensor

Fig -4: Flex Sensor

A flex sensor is a sensor that measures the amount of deflection and bending. It changes in resistance depending upon the angle of bend on the sensor.

They convert the changes in bend to electrical resistance, more the change more the value of resistance. Flex sensors are usually is in the form of strips. They can be made unidirectional and bidirectional. The unidirectional changes its resistance, when it is bent in only one direction and the bidirectional change its resistance for both directions. Here, bidirectional flex sensor is used.

Carbon resistive elements within a thin flexible substrate are inside the flex sensors. The sensor produces a resistance output relative to the radius, when the substrate is bent. In typical flex sensors, a flex of degree with 90 will give a resistance of 20 – 30 K ohms. They require 5 – volt input and output between 0 – 5 V. The sensors are connected to the device through 3 pin connectors. In that device, sensors are activated in sleep mode and when not in use, it enables them to power down mode.

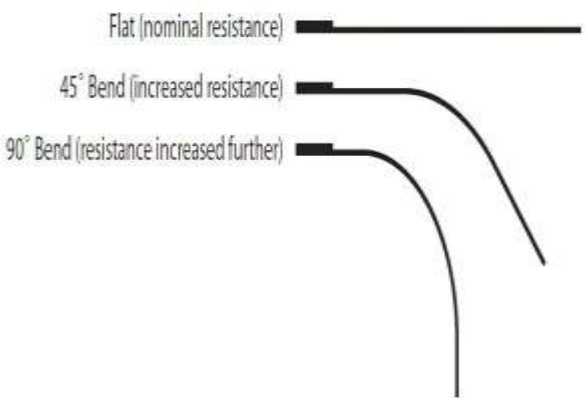

Fig -5: Variation of resistance with degree in bend

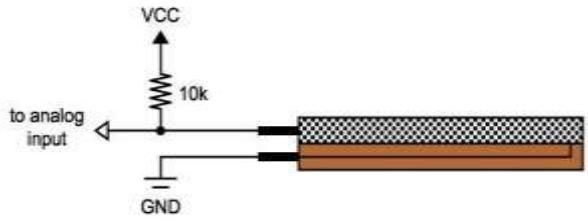

Fig -6: Basic Flex Circuit

Figure 3 shows circuit of basic flex sensor. By voltage divider rule, output voltage is given by $V_{out} = V_{in} *$ R1/ (R1+R2). Here, R1 is the other input resistor to the non-inverting terminal. Fig -7 shows the characteristics: (a) Resistance V/S Bending (b) Voltage V/S Resistance

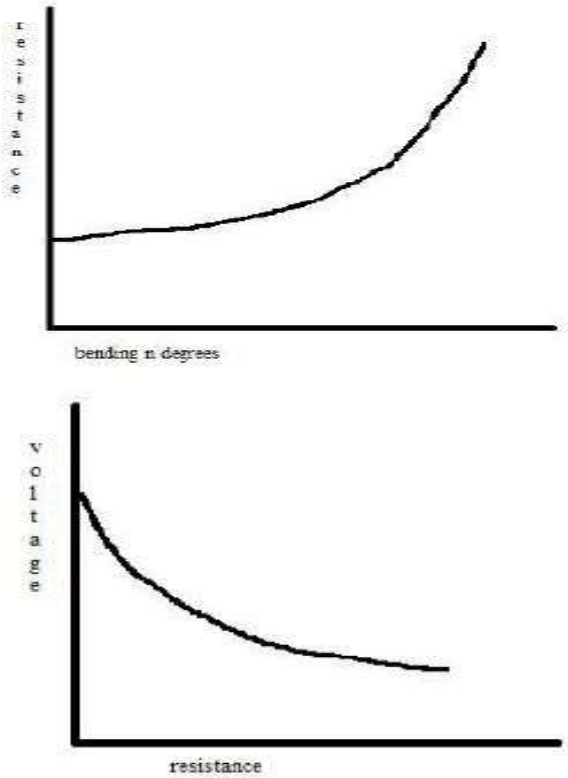

Fig -7: Characteristics of Flex Sensor

Table: Resistance and corelated Bending

Resistance in KΩ	Voltage in volts	Angle in degree
26.18	0.82	90
40.26	0.67	75
48.74	0.45	60
52.92	0.40	45
57.10	0.37	30
60.40	0.32	15
63.50	0.30	00

3.3.2 PIC Microcontroller

Fig -8: PIC16f877a Microcontroller

The PIC microcontroller PIC16f877a is one of the most reowned microcontrollers.This microcontroller is very practical to use, the programming of this controller is also easier.

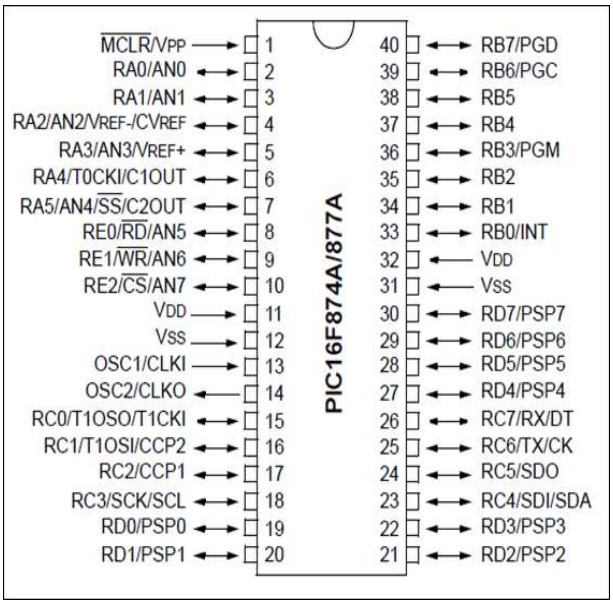

Fig -9: PIC Microcontroller Pin Configuration

The advantage of this microcontroller is that it can be write and erase as many times as possible due to the use of FLASH memory technology. Fig -9 shows the pin configuration of PIC Microcontroller. It contains total number of 40 pins and in that 33 pins for input and output.The Microcontroller convert input analogue data to digital data and for further processing.

3.3.3 Bluetooth Module

Fig -10: Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication for transferring Digital signal that is being converted by microcontroller. This module can be used as a model of asymmetric communication which is a master or slave configuration. The digital signal is sent to android phone by using Bluetooth module.

3.3.3 Android Smart Phone

At server side the android smartphone takes the input from the microcontroller through Bluetooth and based on those input it will match the pattern with the alphabets pattern which have already fed into the database. The database is created for 26 alphabets of American Sign Language in the android smartphone. Then the text of the corresponding sign language is being displayed. The pattern that does not match with database will respond with error message.

4. ADVANTAGES & APPLICATIONS

- The normal people don't need to learn sign language to understand what the dumb people are trying to say.
- It is a portable device and can be easily carried anywhere.

- The cost of the device is low.
- Power consumption for this system is also low.
- Easy interpretation
- Flexible to user

5.CONCLUSION

Sign language is the way of conveying information and thoughts of deaf and dumb people. This system will helpful for those people who communicate with the normal people. The sign language recognition system converts the hand gestures into text with the help of flex sensors which is connected to the gloves.In order to enhance and facilitate the different hand gestures recognition,we have added the option to include more hand gestures into the database.

6. FUTURE WORK

In this system, more sensors can be include to recognize the hand gestures easily with more perfection and accuracy. The system can also translate the words from one language to another using some advanced technologies and it will become wireless to transmit data to a smart phone. This should eliminate the use of an LCD display and it will have the advantage of text to voice applications which is available in the smart phones.

Using centralized IoT hub,the gloves can also used for interacting with a set of electronic devices across house. We can teach the glove to understand the gestures by introducing the concept of machine learning. By using the different software development strategies and various programming techniques the systems efficiency can be increased.

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