Abstract — This paper presents a prototype Indian Sign Language (ISL) translation system. The sign language glove seems to be a very useful tool to aid in communication with the deaf. Our implementation of the glove is going to deal with the 26 letters of the English and digits from 0 to 9 that can be directly translated into Sign Language. The glove is outfitted with flex sensors to detect the position of each finger, contact sensors and accelerometers to gather data from finger and hand motions to differentiate between letters.

Index Terms—Indian Sign Language, Flex sensors, Accelerometers, Contact Sensors

INTRODUCTION

The All India Federation of the deaf estimates around 4.0 million deaf people and more than 10.0 million hard of hearing people in India. More than 1 million deaf adults and around 0.5 million deaf children in India uses Indian Sign Language as a mode of communication [2][6].

Many research works related to Sign languages detection have been done as for example the American Sign Language (ASL), the British Sign Language (BSL), the Japanese Sign Language (JSL), and so on. But very little research has been done in Indian Sign Language (ISL) recognition till date [3].

This project is aimed to develop an automatic Indian Sign Language recognition platform for hearing impaired students of India. Another important aspect of this project is that, the proposed system will be able to recognize different hand gestures of Indian Sign Language and the system can give the interpretation of the recognized gestures in the form of some text messages displayed on LCD screen.

SYSTEM DESCRIPTION

The deaf wears the glove and makes the letter gesture according to the Indian Sign Language dictionary. The Flex sensors, the contact

Sensors and the accelerometers that were placed on the glove will deliver a analog voltage value that specifies the concerned letter. The conversion from analog to digital will be done in the microcontroller and the selection of the letter will be done according to voltage signal [1].

The main electronic board will contain a microcontroller that handles the program used to detect the analog voltage levels captured from the sensors, converts them to digital using the ADC of the microcontroller, makes the recognition of the letter signed and sent data to the base station.

Then the signal is transmitted to the base station using Radiotronix W1.232FHSS-25-FCC-R transceiver. The Base Station receives its input through a radio receiver and outputs its results to an LCD screen.
The block diagram of Sign Language Translator Using Hand Gloves is as shown below in Fig 1.

Fig 1a. Detection Unit

Fig 1b. Base Station

THEORETICAL BACKGROUND

Every Sign Language is a well-structured body gesture; every gesture has meaning assigned to it. Sign Language helps with the communication for deaf people [3].

The Indian sign language used by the deaf is mainly learnt through oralist approach. There are number of varieties of sign languages used in India that can be classified on regional basis. There are a lot more informal sign languages. Though all these sign languages seem to be interrelated, it is very difficult to find the exact path of development of any sign language. It has been shown through earlier researches that the interrelatedness of these languages and they all contribute to the development of the ISL (Indian Sign Language).

Fig 2. Manual Alphabets of Indian Sign Language (twoemu.com)

MATERIALS USED

A. Flex Sensors:

The Flex sensors (Fig. 3) are bend sensors that changes its resistance depending on the amount of bend on the sensor. They convert the change in bend to electrical resistance; the more the bend, the more the resistance value increase. They are usually in the form of a thin strip from 1” to 5” long that vary in resistance; they could be made in a unidirectional or bidirectional form [1].

Fig 3. Unidirectional Flex Sensor
Fig 4. Flex Sensor offers Variable Resistance Readings

B. Accelerometers:

The accelerometers are used for movement and orientation detection. There are two accelerometers, one x-y axis and one z-axis accelerometer. The x-y accelerometer (Analog Devices ADXL203) has ground and Vcc inputs, and two outputs. The z axis accelerometer (Free scale Semiconductor MMA1260) has ground and Vcc inputs, and one output.

C. Contact Sensors:

Contact sensors are taped to the top of the middle finger and the sides of the little, ring, and middle fingers.

When they are not in contact with anything, the input on the microcontroller is high. Also, there are contact sensors on the thumb and the top of the index finger, which are wired to ground.

When the little, ring, and middle fingers come into contact with the index finger and thumb, the corresponding inputs on the microcontroller are pulled to ground, resulting in an active low signal.

D. Microcontroller:

1) Detection Unit’s Microcontroller

The accelerometers are wired to inputs A6 and A7. Port A is used for the accelerometers because the internal ADC’s of the Mega32 are only on port A. The contact sensors are wired to inputs D2 to D5. The transceiver is wired to output D1.

2) Base Station Microcontroller

The Base Station uses port B3 as an output as it is internally connected to OCR0A. Output B.3, which is connected to the internal OCR0A, is connected to the low pass filter for the audio output. Input D.1 is wired to the transmit of the transceiver.

E. Transceiver:

1) Detection Unit’s Transceiver

The detection unit’s transceiver (Radiotronix WL232FHSS-25-FCC-R) is used only for transmission of the translated letters.

The receive signal of the transceiver is wired to the transmit of the microcontroller.

2) Base Station Transceiver

The base station’s transceiver (Radiotronix WL232FHSS-25-FCC-R) is used only for receiving the translated letters. The transmit of the transceiver is wired to the receive of the microcontroller.

RELATED WORK

The impedance buffer in the Basic Flex Sensor Circuit is a single sided Operational Amplifier, used with these sensors because the low bias current of the Op-Amp reduces error due to source impedance of the flex sensor as voltage divider (Fig. 5). Suggested Op-Amps are the LM358 or LM324 [1].

Fig 5. Basic Flex Sensor Circuit

We have implemented this basic flex sensor circuit in Orcad software for different values of R1 as 10kΩ, 25kΩ, 40kΩ & obtained the output voltage VO which can be represented graphically as shown in Fig 6.

Fig 6. Basic Flex Sensor Circuit Output for different values of flex sensor.
Fig. 7. Digit ‘5’ according to sign language.

If the deaf person has to convey digit ‘5’, then we can see in Fig 7, there is no bend on any of the finger. Hence all flex sensors are at rest for digit ‘5’. Flex sensor has nominal resistance of 25KΩ. For this nominal resistance, analog voltage of 2.34V is transmitted to microcontroller using accelerometers.

The outputs from the accelerometers are inputted to the microcontroller ATMega32, where digit ‘5’ is read through the microcontroller’s on-chip ADC and is transmitted to base station.

FUTURE WORK

Future work for this Project may extend to the entire alphabet. This will require the addition of acelerómetros.

Recognize the transition from the current letter to the next letter without an indicative hand position.

We can concaténate sign language letters to speak words and sentences.

REFERENCES


