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SMART GLOVE FOR SIGN LANGUAGE TRANSLATION USING ARDUINO

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ABSTRACT- The easiest way for communication in the world is speech. Whereas it becomes difficult for speech impaired and hearing impaired people to communicate as they use sign language for the communication. It becomes difficult for normal people to understand. Smart Glove for Sign Language Translation is a work that aims to present an easy way of communication for speech impaired and hearing impaired people. This work consists of a glove equipped with sensors which senses different sign language gesture, these senses data are fed to arduino and transfer data to android phone via Bluetooth module, a common android phone is used in this work for sign to voice translation and voice to sign language translation.

In real life, the sign language users mostly use both hands. Thus, this is a prototype work presenting an ease in communication for the speech impaired and hearing impaired people.

Keywords- Sign Language Translation, Sensor Based, Communication, Bluetooth module

I. INTRODUCTION

The number of speech impaired and hearing impaired people are increasing day by day. About 70 million people in the world are speech impaired and hearing impaired [1]. We often come across these people communicating with the normal world. These people communicate with the help of sign language. When a speech impaired person tries to communicate with normal person and vice-versa, they feel difficult to understand. To bridge the gap between speech impaired, hearing impaired and normal masses, gesture recognition system is being used. Gesture recognition is a widely explored field. A lot of work has been done in the past few years. An electronic device has been used as a language interpreter and provides convenient way for communication between speech impaired, hearing impaired and normal people. Gesture for American standard language is shown in figure 1. Gesture recognition is classified into two main categories i.e. image processing based and sensor based. The main disadvantage of image processing based techniques includes complex algorithms for data processing. Another challenge in image and video processing includes variant lighting conditions, backgrounds and field of view constraints. The sensor based technique offers greater mobility.

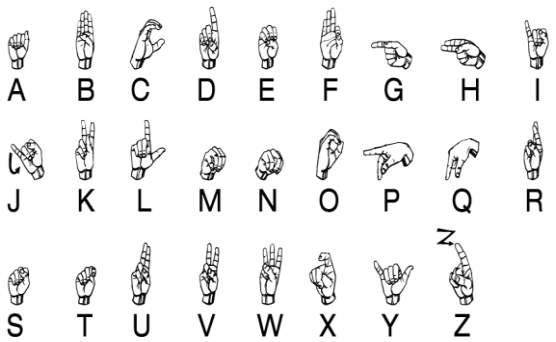


Figure 1: American Standard Sign Language

This work uses sensor based technique instead of image processing based technique. First of all, sign language is converted to analog voltage signal using flex sensor and accelerometer. Using ADC from the microcontroller board analog signal is converted to digital signal. Now, the microcontroller processes this digital signal, detects respective characters and transmits through Bluetooth module to Android phone. An application on android is used to display the characters received from Bluetooth module in the form of text and text is transformed to voice using Google-text-to-speech. Also, voice is transformed to display text and convert it into sign language using speech recognizer.

II. LITERATURE REVIEW

Sign language is the only communication tool used by speech impaired and hearing impaired people to communicate to each other. However, normal people do not understand sign language and this will create a large communication barrier between speech impaired, hearing impaired and normal people. In addition, the sign language is also not easy to learn due to its natural differences in sentence structure and grammar. Therefore, there is a need to develop a system which can help in translating the sign language into voice and voice to sign language in order to ensure effective and easy communication between different communities.

Many methods for hand gesture recognition using image processing have been proposed. “Hand Gesture Recognition System using Image Processing” uses digital image processing techniques using modified SIFT algorithm. With the help of the algorithm the sign language is decoded successfully. The advantage using this algorithm is high processing speed which can produce result in real time. Although the proposed system is fast requires expensive materials also [2].

“Sign Language Recognition Using Image Processing” uses image processing with the help of SURF (Speed up Robust Features) algorithm. Video camera is used to record hand movements, and the input video is partitioned into frames, for each frame, a set of features are extracted. The system is implemented in MATLAB [3].

“Deaf-Mute Communication Interpreter” uses sensor based technique comprising of flex sensor, tactile sensors and accelerometer to translate American Sign Language gestures to both text and auditory voice. Although, they were only able to translate thirteen sign into their respective alphabets namely letters ‘A’ ‘B’ ‘C’ ‘D’ ‘F’ ‘I’ ‘L’ ‘O’ ‘M’ ‘N’ ‘T’ ‘S’ ‘W’ and tactile sensor were used to improve the accuracy of three letters M, N and T [4].

“Sign Language to Speech Translation System Using PIC Microcontroller” consists of flex sensors that is used to detect finger gestures and gyro sensors for providing a signal corresponding to the orientation of the motion of the hand [5].

“Design of Smart Gloves” uses pair of gloves with flex sensors along each finger, thumb and arm is used to capture

the movement of user. The problem with this work is it can detect only few letters [6].

"A Review Paper on Smart Glove - Converts Gestures into Speech and Text" uses five flex sensors and accelerometer attached on the back of the glove to measure the bending and motion of the hand. The problem with this work is to recognize some letters. Besides that, letters M, N, O, R, S, T, V and X cannot be displayed due similar in gesture with another letters [7].

"Digital Text and Speech Synthesizer Using Smart Glove for Deaf and Dumb" uses five flex sensor to detect gesture and accelerometer used for sensing axis x, y and z, find the angle of the glove tilted with respect to the. The glove is capable of translating their sign language gestures into speech through android phone. This smart glove focuses the translation of gestures of words only [8].

, "Smart Glove: Gesture Vocalizer for Deaf and Dumb People" uses glove at the transmitter side which has to be worn by the user. This glove is mounted with 4 flex sensors each on the 4 fingers of the glove namely thumb, index, middle and ring. This work also focuses the translation of gestures of words only [9].

III. WORKING PRINCIPLE

The flex sensor measures the bending of fingers according to gesture and outputs change in resistances corresponding to the amount of bending. Accelerometer sensor measures the linear movements of hand in X-axis and outputs different values of X corresponding to the movement in X-axis. Touch sensor measures if there is any contact between two fingers. All the data's from sensors are then processed on Arduino UNO involves combination of all the sensor outputs in order to match the resultant output with pre-stored values of different signs regarding the alphabets. For this, appropriate ranges are set for each alphabet and the words that can be recognized with single hand based on the measured data obtained from repeated measurements. A Bluetooth module is connected to Arduino UNO. The Processed data's are then transferred to the Bluetooth module (transmitter) obtained in string format. The Android mobile also have an inbuilt Bluetooth capability. These two Bluetooth devices are then paired, and string is transmitted to Android mobile. Android mobile receives data via Bluetooth in bytes format, convert them into string. Finally, the string is converted into voice using the text to speech application of Android mobile. This overall system is mounted over a normal glove for easy handling and recognizes the hand gestures accurately.

The work also transforms voice to respective text and sign. Speech recognizer detects the speech and converts into respective text. The image of used letters and words are stored in database. The text from speech recognizer is compared with name of image and required image is displayed.

The work also transforms text to respective voice and sign. Google-text-to-speech converts the typed text into respective speech. The text from speech recognizer is compared with name of image and required image is displayed.

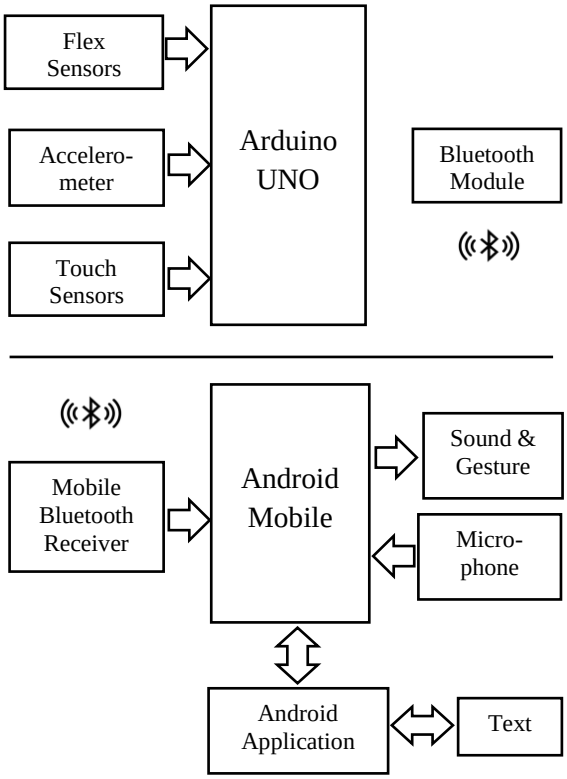


Figure 2: Block diagram for smart glove

VI. FLOW CHART OF SMART GLOVE

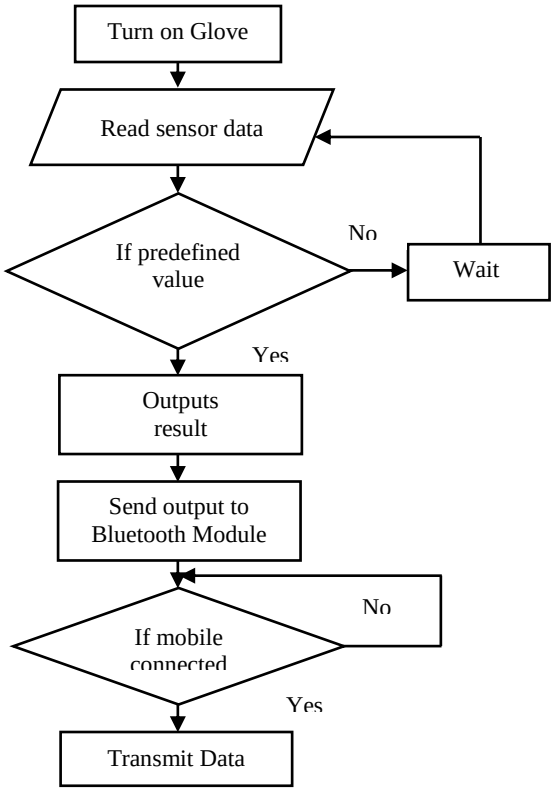


Figure 3: Flowchart of Transmitting Section

VII. FLOW CHART FOR ANDROID APPLICATION

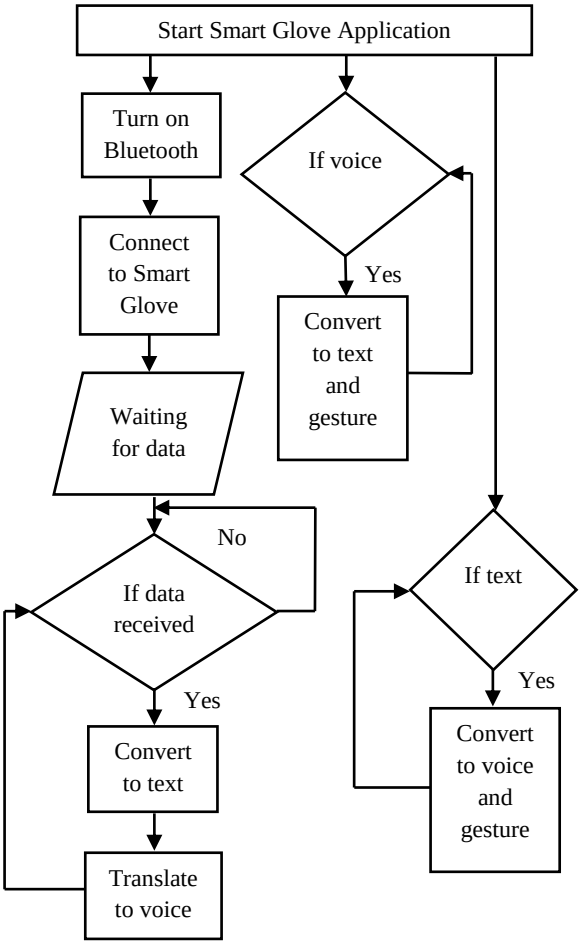


Figure 4: Flowchart of Receiving Section

VIII. RESULT AND DISCUSSION

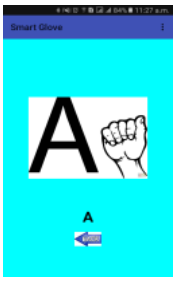
The outcome of this work was estimated where all the American standard sign language with their respective 26 alphabets and some words were successfully displayed in to text and voice which can help speech impaired and hearing impaired people to communicate with normal people easily. There is another feature also of this system which makes normal people to communicate with them also through an android application which can convert people voice in to text and sign language. So, this project is quite feasible to develop two way

communication between speech impaired hearing impaired and normal people.

All of the works mentioned, deals only with one way communication from impaired people to normal mass. This work allows two way communications between these groups. Also, this works converts all of the letters and some words unlike others. The only work that converts all letters and some word is “Digital Text and Speech Synthesizer Using Smart Glove for Deaf and Dumb” but this work deals with converting gestures into text and speech only.

For convenience, four alphabets ‘A’ ‘C’ ‘U’ and ‘V’ with sign language, output and graph have been shown below.

Table 1: Output of hand gesture ‘A’ in android application in text and in graph

Sign	Output
	

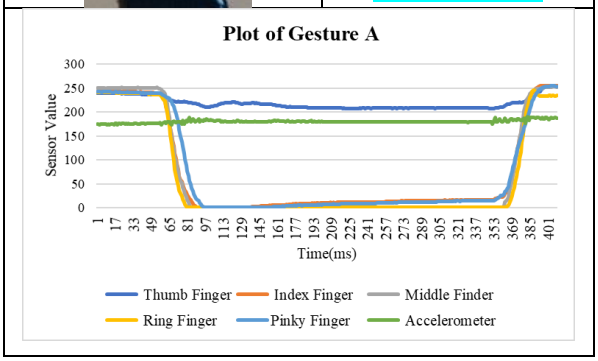
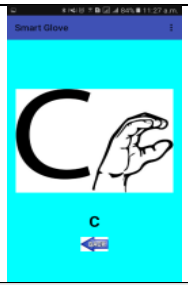


Table 2: Output of hand gesture ‘C’ in android application in text and in graph

Sign	Output
	

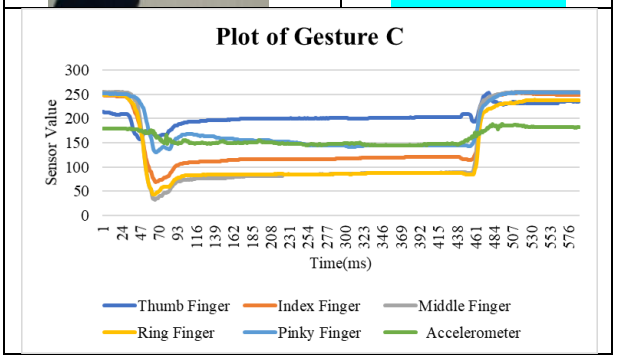
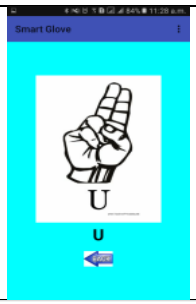


Table 3: Output of hand gesture ‘U’ in android application in text and in graph

Sign	Output
	

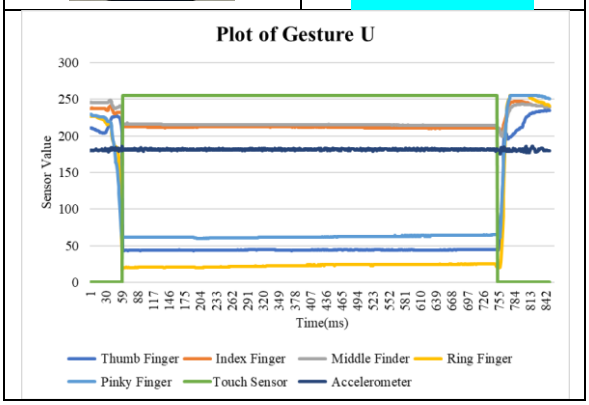
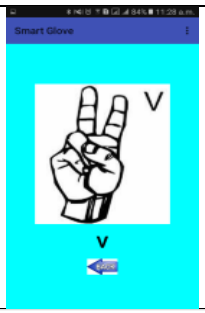


Table 4: Output of hand gesture ‘V’ in android application in text and in graph

Sign	Output
	

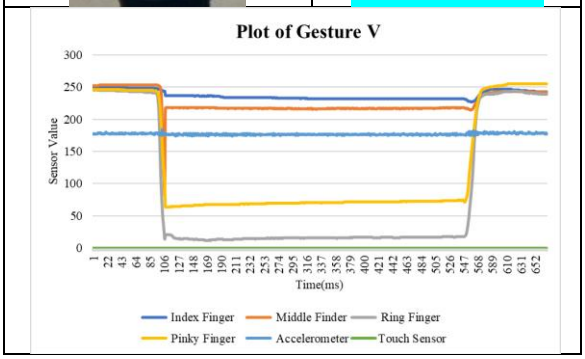


Figure 5 depicts the feature of system which helps normal people to communicate with speech impaired and hearing impaired people by voice to sign language.

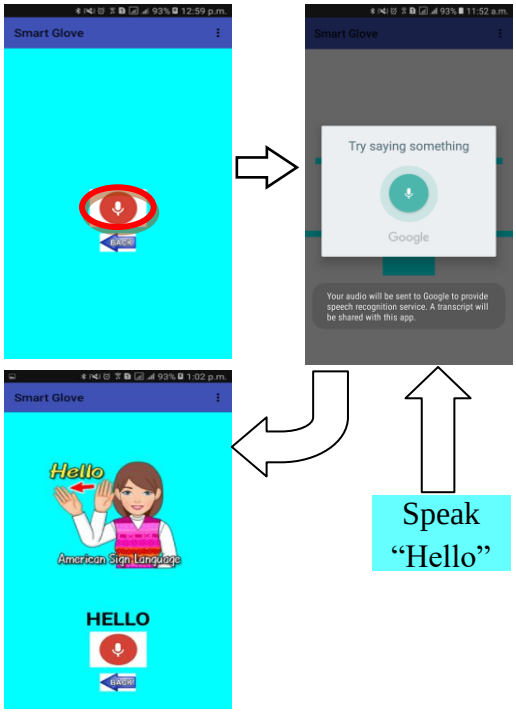


Figure 5: Voice to Text and Sign language

Figure 6 and 7 depicts another feature of system that can help people disability due to any diseases and accidental causes etc. It can help them to learn gesture through android application easily.

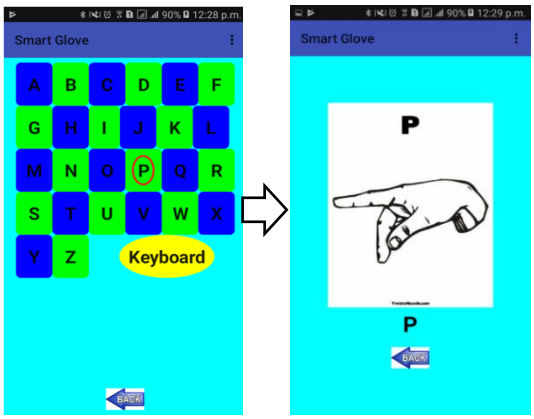


Figure 6: Text to Sign language

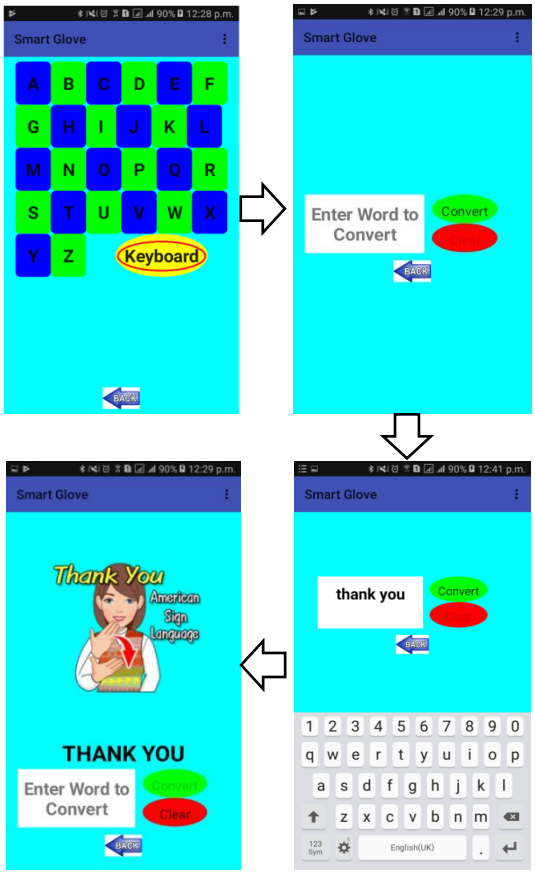


Figure 7: Word to Sign language

IX. CONCLUSION

The project proposes a system for speech impaired and hearing impaired people using glove technology and enable normal people to communicate with them too. The use of five flex sensor, touch sensors and an accelerometer on to a glove demonstrate that it is helpful to beak the gap between speech impaired hearing impaired and normal people. This device will be an apt tool not only for the people got such disability naturally rather it also helps disability due to oral diseases and accidental cause make them to learn gesture through application easily. The project can be enhanced further by including more words and different standard sign language.

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