Design And Implementation Of Sign Language Translator Using Microtouch Sensor

Nithyakalyani.K, S.Ramkumar, K.Manikandan

Abstract: Background: Use of sign language alone can impair the communication between the aurally impaired and the rest of the world. Lack of understanding by the unimpaired and environmental conditions such as darkness also affect communication when sign language is used. Objective: To develop a sign language translator for the aurally impaired, that will translate the signs to speech and display the output for better communication. Methodology: A glove incorporated with microtouch switch is used for the gesture recognition of Indian Sign Language (ISL). The output of the microtouch switch is given as an input to the Arduino based unit for converting it into speech and text. Results: The developed system was able to successfully detect signs for gestures such as I, Hello, Thank you, Know, Sorry, Yes, and No. Conclusion: This system was efficient in detecting the gestures with minimal time delay. This device was efficient in translation, and performed satisfactorily during the bench testing. However, a feasibility study with the intended patient group is required, where the efficacy of this device can be evaluated.

Index Terms: Arduino, Aurally impaired, Indian Sign Language, Microtouch Switch

1 INTRODUCTION

Sign language is a visual language initially used by people who are aurally impaired by making gestures with hand and facial expressions. There are about 300 different gestures in Practise around the world which have resemblance and difference with each other. British and American sign languages are considered as different spoken languages. Some countries have more than one sign language. This diversity leads to confusion when people travel from one country to other. Even in their own country, normal people may not be familiar with the sign language which may limit the communication with the aurally impaired pepole, especially in dark it becomes even hard to interpret the gestures. Several projects to translate the sign language have been developed in these years but are poorly deployed.

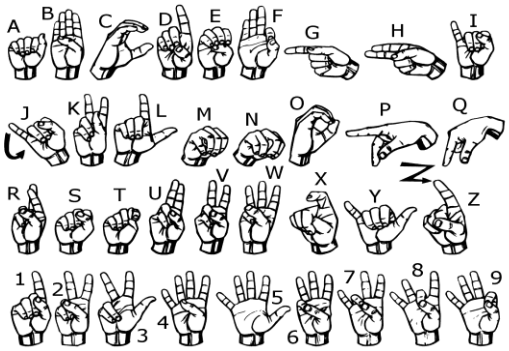

Fig 1: *Sign language and alphabet [8]*

- *Nithyakalyani.K is currently working as Assistant professor in the department of Biomedical Engineering, Veltech Multitech Dr.Rangarajan Dr.Sakunthala Engineering College, MOB-9566569664. E-mail: nithyagtec@gmail.com*
- *S.Ramkumar is currently working as Assistant professor in the department of Biomedical Engineering, Veltech Multitech Dr.Rangarajan Dr.Sakunthala Engineering College, MOB-9894815528. E-mail: sramkumar@veltechmultitech.org*
- *K.Manikandan is currently working as Assistant professor in the Department of Biomedical Engineering, Veltech Multitech Dr.Rangarajan Dr.Sakunthala Engineering College, MOB-.9940175742. E-mail: kmanikandan@veltechmultitech.org*

Sign language dictionaries for American Sign Language (ASL) such as 'HandSpeak', 'Signing Savvy', 'Lifeprint', 'ASL Pro' etc., have been developed to find an equivalent word for ASL. First Indian Sign Language Dictionary of 3000 words was launched in 2018 which contains words of five categories: everyday terms, legal terms, academic terms, medical terms and technical terms. Sign language translation basically uses two methods, based on computer vision, and based on the sensor data .As discussed earlier both the techniques are differ in way of input acquisition.In order to improve recognition accuracy, the researchers use methods such as Hidden Markov Model, Artificial Neural Network[1]. Effective algorithms for segmentation, matching the classification, and pattern recognition have evolved [1].

2 PROPOSED SYSTEM

The objective of the project is to develop and implement a sign language translation system incorporated with a microtouch switch and to help the speech and aurally impaired persons to communicate in real time by performing Indian sign language [2]. Hence we have developed a Indian sign language translator device for the ease of communication, as the device converts the gestures performed by the user into text and voice along with displaying what the other person says[8]. As depicted in the block diagram in Fig 1, the device employs Microtouch switch, Arduino UNO, LCD display, Speaker, DF mini player and Bluetooth module (HC-05). The connections are manifested in the circuit diagram represented in the Fig 2. Microtouch switch is an on/off electronic switch that is only on when there is some pressure put on it or when the button is pressed. As soon as the microtouch switch button is released and the pressure has been took off, the circuit is then broken. The output from the sensing device is given as an input to the analog pins of the Arduino UNO. The controller unit recognises the change in voltage and provides the necessary output corresponding to the fingers pressed. The output section consists of a 16x2 LCD display and a speaker, which are connected to the digital pins of the Arduino. The speaker is connected to the Arduino via a DF mini player with a SD card to store the voice signal and give it to the speaker. The bluetooth module is connected to the arduino in order to serially transmit the voice recognised by the mobile application (Arduino voice control) installed in the android mobile. This enables the user to understand

what the other person says paving way for a two way communication. The power supply for the device is given by a 12V battery and is regulated using l7805cv voltage regulator with a bridge circuit. The battery can be avoided if the power supply is given using a standard A-B USB cable or AC to DC adapter (7-12V).

3 METHODOLOGY

The gestures are performed by pressing the fingers either on the palm or other body parts such as forehead or in front of the chest. The words such as, 'I', 'HELLO', 'YES', 'NO', 'THANK YOU', 'SORRY' and 'KNOW' are the words for which signs can be performed and recognised using the proposed system.

- To convey the pronoun "I", point the whole hand towards the chest while pressing the tips of index, middle and ring finger against the chest.
- To show the word "HELLO", place the hand flat, touch the tip of the thumb below the small finger, press the tip of the index finger against forehead and then move the hand away from your forehead.
- To present the word "YES", move the hand in up and down direction while pressing the middle, ring and little finger on the palm.
- To display the word "NO", press the index and the middle finger against the thumb alongside bending the remaining two fingers.
- To indicate the word "SORRY", make a fist and rub on the chest in clockwise direction.
- To communicate the word "KNOW", press the index finger on the side of the forehead, bend the remaining fingers such that the thumb is pressed on the other three fingers (middle, ring &little).

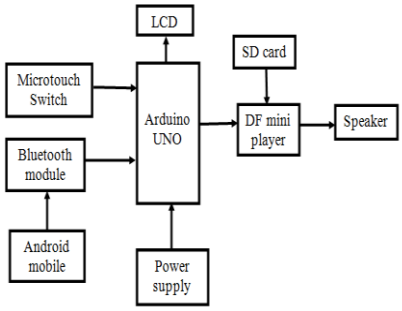

Fig 2: *Proposed Block Diagram*

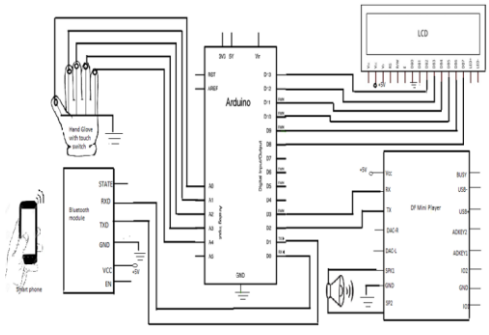

Fig 3 *Circuit Diagram*

3.1 Implementation of different Signs using micro touch matrix.

The input values for the different set of sensors which is placed in the hand gloves may differ for each and every signs. The input matrix for the signs which is considered in this approach is given below

Signs / Finger	*Thumb*	*Index*	*Middle*	*Ring*	*Little*
I	*0*	*1*	*1*	*1*	*1*
Hello	*1*	*0*	*0*	*0*	*0*
Thank you	*0*	*1*	*1*	*1*	*0*
Sorry	*1*	*1*	*1*	*1*	*1*
Know	*1*	*1*	*0*	*0*	*0*
Yes	*0*	*0*	*1*	*1*	*1*
No	*1*	*1*	*1*	*0*	*0*

Table 1: *System input*

4 RESULTS AND DISCUSSION

The system has microtouch sensor switch for detecting the hand gestures of the subject. These sensor values are stored on the arduino unit. Based on the hand motions the stored outputs are displayed in the LCD and also played through the speaker. Embedded C language is used to write the Arduino program. In this system the hand motions are detected in few seconds. This prototype version, the user forms a sign and holds it for two seconds to ensure recognition. The system is capable of reducing the time limit for translation. So we can say this kind of approach is a low time consuming method and can be easily achieved for the 9 user defined words I, Hello, Thank you, sorry, know, yes, no. The designed Prototype is shown in Figure

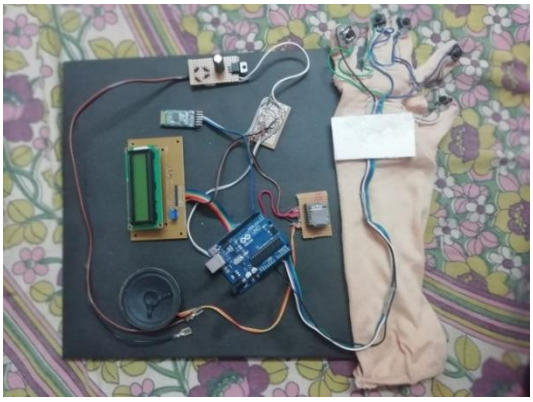

Fig 3: *Prototype*

The Indian sign language translation system developed gives three outputs,

- ✓ Display of the sign word as text.
- ✓ Conversion of the sign into voice.
- ✓ Display of the normal person's speech as text.

The gestures performed using the glove fitted with microtouch switch is recognized by detecting the output from the switch to be high or low. Based on the combination of the fingers pressed, a corresponding Textual and voice output which are prestored in the Arduino is obtained, is

shown in the Figure 4

Fig 4: *System output*

5 CONCLUSION AND FUTURE SCOPE

In this proposed approach, we have successfully designed and implemented a sign language interpretation system for Indian Sign language with the help of a wearable hand glove. This device allows translation of single handed signs using microtouch switch and Arduino.The gestures performed by the user are converted into text and speech with the help of input matrix assigned in the microtouch sensor, this can be easily understood by the normal people. Also in this proposed work the reverse operation was carried out by using the mobile application. (ie) A Recognized speech from the normal person to text service for the user (hearing impaired) to understand what the other person is speaking, this was performed by an Android-based mobile application. Hence this device allows two way communications. This kind of translator device provides a social compatibility to the user who is both speech and aurally challenged. The system can be improved by allowing multi-language to be displayed and converted to speech. Furthermore other sensors (accelerometers, capacitive flex sensors etc.,) can be integrated with the system for recognition of movement of the hand such as swapping, rotation, tilting etc. Mobile applications can be developed for replacing the LCD display and the speaker which minimizes the hardware.

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