DEAF AND MUTE TO NORMAL PEOPLE COMMUNICATION ASSISTANT GLOVES

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Abstract: Communication between deaf and mute people and normal people always has been a challenging task. About 9 billion people in the world come into this category which is a quite large number to be ignored. This paper aims at eradicating the barrier between them by developing an electronic device system which can be helpful for easing the understanding of normal people about the hand sign language used by deaf and mute people while communicating with others. The term used for this particular device system throughout this document is transliterator. This transliterator is made such that it requires a glove be wore by the deaf and mute person who is using the sign language. The hand gestures will be interpreted into a voice signal using a series of electronic devices. This way a normal person and a deaf and mute person will be facilitated to have a better conversation.

***IndexTerms* -** Transliterator, Arduino Circuit Boards, deaf, Dumb, Flex Sensor, Gesture

I. INTRODUCTION

Humans communicate with each other by conveying their ideas, thoughts, and experiences to the people around them. There are numerous ways to achieve this and the best one of all is the gift of "Speech". The only means of communication for deaf and mute people is the sign language[1]. It will be an injustice if we ignore those who are deprived of this invaluable gift. Deaf and mute people need to communicate with normal people for their daily routine.

India constitutes 2.4 million of deaf and mute population. These people lack the amenities which a normal person should own. When a deaf and mute person meets with a normal person then they cannot understand because none of them knows a common language and so they require a translator physically which cannot be continually convenient to rearrange. To overcome this drawback, we have a tendency to introduce a novel application. Our application model is a desirable transliterator which transliterates sign language to synthesized text and voice.

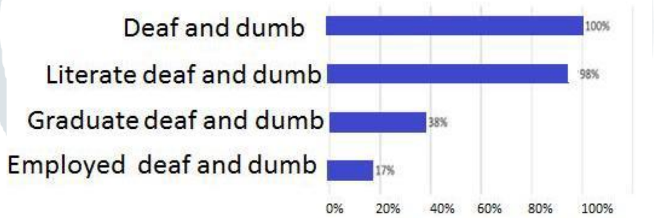


Fig 1 : Employment analysis of deaf and mute population of India

II. LITERATURE SURVEY

Research in the sign language system has two well-known approaches are image processing and data glove. The image processing technique [2][3] using the camera to capture the image/video. Vision based sign language recognition system mainly follows the algorithm are Hidden Markov Mode(HMM)[4], Artificial Neural Network(ANN) and Sum of Absolute Difference (SAD) use to extract the image and eliminate the unwanted background noise.

The main disadvantage of vision primary based sign recognition system acquisition method has several environmental apprehensions like the place of the camera, background condition, and lighting sensitivity. A user continuously has to carry a camera and can't be used in public places.

Another research approach is a sign language recognition system using a data glove[5]. In this approach, detection of hand is eliminated by the sensor glove consists of flex sensor and gyroscope. Data are directly obtained from each sensor depends upon finger flexures and computer analysis sensor data with static data to produce sentences. The main advantage of this approach is less computational time and fast response in real-time applications. It is a portable device and cost is also low. Another approach using a portable Accelerometer (ACC) and Surface Electro Myogram (sEMG) [6] sensors used to measure the hand gestures. ACC used to capture movement information of hand and arm. EMG sensors placed, it generates different sign gesture. Sensor output signals are fed to the computer process to recognize the hand gesture and manufacture speech/text. But none of the above methods provide users with natural interaction[7]. This proposed system will be capable of performing the conversation without any wearable devices instead of using human motion and gesture recognition.

III. BLOCK DIAGRAM

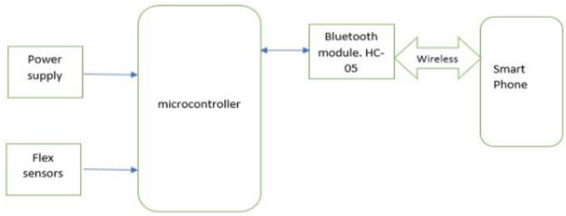


Fig 2: Block Diagram

IV. MATERIALS AND METHODS

Above figure shows the whole block of transliterator for deaf and mute people. The controller employed in the device is an Arduino LilyPad. Five flex **sensors** are accustomed to measure the degree of bending of the fingers. The flex sensors are interfaced with the controller using the voltage divider circuit. This is interfaced with the digital ports of the controller to feed in the digital data. Arduino LilyPad processes the data for each particular gesture made. The controller has two modes of operation – training mode and operational mode[8]. In training mode, the gestures are made by the user and the voltage levels are stored in EEPROM. In operational mode, the data is being compared with predefined values and the matched gestures are sent to text to speech conversion application. The application mode allows selecting an option between the languages which the other person can understand.

Table 1 : words and corresponding values

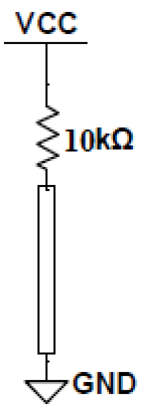
Sr. No.	Binary value	English Meaning	Hindi Meaning	Marathi Meaning
1	00000	Water	Paanee	Pani
2	00001	Food	Bhojan	Anna
3	00011	Heart	Dil	Hradaya
4	00111	Eye	Aankh	Dola
5	01111	Sleep	Neend	Jhop
6	11111	Care	Dhyaan	Kalaji
7	11110	Mother	Maan	Aai
8	11100	Father	Pita	Wadil
9	11000	Night	Raat	Raatree
10	10000	Light	Roshanee	Prakash

1. ARDUINO LILYPAD WITH BUILT IN ATMEGA168V

Arduino is an open source platform based on a simple microcontroller board. The controller used in the device is Arduino with inbuilt atmega168v in it. Atmega168v has 32KB on-chip flash memory for storing codes of which 2KB used for the boot loader. It also includes a 2KB for SRAM and 1KB of EEPROM. The program that is developed is is to be stored on the flash memory of the controller. The Arduino software also includes a serial monitor which allows data to be sent to or from the Arduino board.

2. FLEX SENSOR

Flex sensors are resistive carbon components. When bent, the sensor produces a resistance output related to the bend radius[9]. The variation in resistance is roughly 10 to 30 KOhm's. An inflexed sensor has 10KOhm resistance and when bent the resistance increases to 30KOhm at 90^{o} [3]. The sensor is about a ¼ inch wide, 2 ½ inches long.



$$V_{out} = V_{in} [R_1 / R_1 + R_2]$$

Fig 3 : Flex Sensor in a Voltage Divider Circuit

The sensor is incorporated in the device using a voltage divider network. A voltage divider is used to determine the output voltage across two resistances connected in series i.e. basically resistance to voltage converter. The resistor and flex form a voltage divider which divides the input voltage by a ratio determined by the variable and fixed resistors.

3. MOBILE APPLICATION

The mobile application is used to convert text to speech. The text to be converted into speech is relayed by the Arduino LilyPad to this application[10]. The mode of this continuous communication between the microcontroller and this mobile is Bluetooth. Another feature offered by this application is multilingual support. The application supports English, Marathi and Hindi language. The app gives user an option to choose the language of his choice into which the signs are needed to be converted.

4. BLUETOOTH MODULE HC-05

HC-05 is a Bluetooth module that is meant for wireless communication. This module is often employed in a master or slave configuration. Bluetooth serial modules permit all serial enabled devices to communicate with each other using Bluetooth. When we want to speak with another through mobile application with the HC-05 Bluetooth module, connect this HC-05 module to the mobile phone via Bluetooth.

V. SIMULATION RESULTS

The averaging we do at each interval helps to account for any noise or glitches that the flex sensors are sometimes prone to go. The accuracy of the glove is additionally somewhat restricted by the dimensions of the person's hands. The accuracy of every flex sensor is limited beyond a certain point. Smaller hands can end in a bigger degree of bend. As a result, the difference between slightly different signs with a lot of flex might be too small for users with small hands. The device uses a low voltage environment and extremely low-frequency communication. The sensors are well connected and there are not any sharp edges. As a result, we don't see any large safety issues associated with the glove. Furthermore, since all communication is done via cables, our device does not interfere with other designs. The glove can be used by anyone who fits into it, they would only have to train on it and generate new datasets if they wish for a higher prediction accuracy than the quality or to incorporate new signs.

VI. RESULT

This prototype version, the user forms a sign and holds it for two seconds to ensure recognition. The system is capable of recognizing signs additional quickly than this absolute two seconds limit. Hence it is a low time-consuming approach.

VII. CONCLUSION

The project proposes a translational device for deaf-mute people using glove technology. The proposed technique has enabled the placement of five flex sensor. The device will be an apt tool for the deaf-mute community to learn gesture and words easily. This work was able to meet our expectations quite well. This project was meant to be a prototype to check the feasibility of recognizing sign language using sensor gloves. The completion of this prototype suggests that sensor gloves can be used for partial sign language recognition. More sensors can be employed to recognize full sign language. The project can be enhanced to include two or more accelerometers to capture the orientation of hand movements once the gesture is made. This will expand the capability to translate larger gestures.

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