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Sign Language to Text and Speech Converter A Sensor based Gesture Recognition System

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***Abstract*—The differently abled mute people cannot converse with the others through the sign language. This paper proposes a device that will help them to overcome their challenges and remove the communication barrier between the mute and the common people. Here, an embedded glove senses the movements through the flex sensors that detect the different patterns of motion of fingers. The embedded glove needs to be worn on the hand by the needy and depending on the variations in the finger movement; the device will convert it into voice and this expressive system can be customized based on the specific individual's requirement. The device can sense each and every movement of the fingers. The change in the resistance of flex sensors leads to the change in voltage levels, which helps to different signs. This paper is useful for specially abled, speech-impaired and paralyzed patients who could not communicate properly.**

Keywords— Sign language, flex sensors, gesture, finger movement, Micro Controller

I. INTRODUCTION

The differently abled mute people cannot converse with others normally. They use a sign language with the combination of gestures and expressions that it is extremely difficult to have a proper communication. This paper proposes a device that will help to overcome the challenges and remove the communication barrier between the challenged and the normal people by converting gestures into speech. There are several different possibilities for the sign to speech converter for the disabled person while this is the easiest alternative. So the basic principle is an embedded glove senses the movement of fingers through flex sensors to sense the different patterns of their motion. The device can sense each and every movement of the fingers. The change in the resistance of flex sensors results in the change in the voltage levels through them, which helps to interpret different signs. The embedded glove needs to be worn on the hand by the needy and depending on the variations of the finger movements, the device will interpret and convert them into voice and the text will be displayed.

II. VISION BASED APPROACH

Numerous scientists have been working in this field. There are two approaches for this problem one is vision based and the other sensor based. In vision based approach, Machine learning algorithms are used to identify a gesture. In sensor based approach, input is taken through sensors attached to hand and classifies different gestures

Flex sensors are more accurate and sensitive than vision based system as they allow complete hand movement. Over vision-based system ,the sensor-based approach is more preferrable as it only calls for portable motion sensor rather than a expensive camera. In real time a flex sensor-based system recognizes gestures in no time with recognition rate of 99% reducing the computational time.In [1] Zhou Ren et al proposed distance metric for hand dissimilarity measure, called Finger-Earth Mover's Distance (FEMD). Being a robust hand gesture recognition system, it can better distinguish hand gestures of slight differences.a survey on gesture [2] recognition with particular emphasis on hand gestures and facial expressions provides applications involving hidden Markov models, particle filtering and condensation, finite-state machines, optical flow, skin color, and connectionist models in detail. The various prevailing methods of deaf-mute communication interpreter system has been covered in [3]. The five methods for Online Learning System has been explained in this paper. The prototype Unmanned Ground Vehicle (UGV) developed for the military purpose has been proposed in [4]. In this work, the motion of the robot could be controlled from remote in wireless mode manually as well as if the manual control is difficult, the vehicle is capable of reaching the pre-programmed destination on its own (automatic mode). UGV can use gesture mode and raptor mode. Technologies behind Hand-tracking devices have been explored [5]. Natural interfaces, systems for understanding signed languages and robotic control, computer-based puppetry, and musical performance are the few applications of glove technologies. A development of a glove-based gesture recognition system for Vietnamese sign language has been addressed and illustrated in this paper [6]. A sensor glove is attached ten flex sensors and one accelerometer. Here, flex sensors are used for sensing the curvature of fingers and the accelerometer is used in detecting a movement of a hand. Vietnamese alphabets can be divided to category on the basis of the hand's postures, i.e., vertical, horizontal. Correspondingly, the matching algorithm

and dynamic time warping algorithm is applied for identification of the letters. Latest reported systems on activity monitoring of humans based on wearable sensors and issues to be addressed to tackle the challenges has been reported in [7].

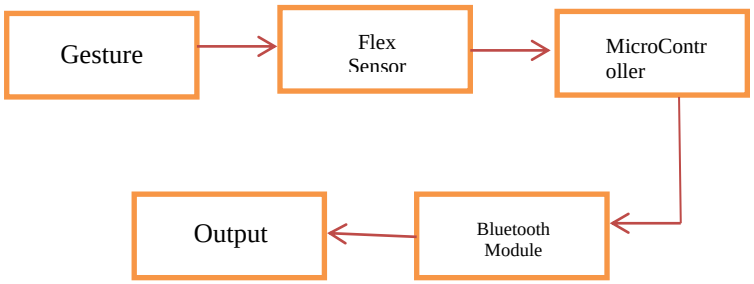
III. HAND GESTURE RECOGNITION SYSTEM

The Hand gesture recognition system uses flex sensors which senses the hand movements. .It is atriculated with Atmega328 microcontroller digital ports to distinguish hand gesture.The abstracts for every gesture made is handled by Arduinomicrocontroller.The output from the microcontroller is given to the Bluetooth module. The system is built to generate different voltage values for each gesture made.

The output of the Bluetooth module is sent to the

Fig1.Blockdiagram of Hand gesture recognition system

Smart Phone. Fig. 1 shows the block diagram of Hand gesture recognition system for sign language to speech conversion.



In the proposed system,flex sensors are used for computing the degree to which the fingers are bent and that output is transmitted to the Arduino microcontroller unit where predefined values and sensor output data are examined.The matched gestures are then transmitted to the bluetooth module as a text. The major traits of this system are
1)Widely applicable in daily life 2) portable 3)Affordable.

IV METHODOLOGY

Four flex sensors are attached to fingers of a glove. Each finger with the flex sensor index, middle, ring fingers and pinky finger are connected to the Arduino analog pins A1, A2, A3, A4 through voltage divider circuits using connectors.

- Bending in the fingers (flex sensors) results in change in the resistance value of the flex sensor, which results in the change in the voltage drop across the sensors.
- This results in the change in the voltage given as the input to the Arduino through the analog pins.
- The Arduino senses the analog input, the analog signal is fed to the analog to digital converter in the Arduino converts this analog data to digital data and sends it to Atmega328 processor.
- The processor stores the data in buffer and using analogRead function and gets the data from buffer and returns the value (integer 0-1023).
- The processor executes the set of instructions present in the permanent memory of the micro controller.
- The Bluetooth module's Tx-Rx pin receives the message transmitted from Tx-Rx pin of Arduino.
- The Bluetooth module is connected to the serial communication ports of Arduino.
- Then the data is sent by the bluetooth module to the smart phone via bluetooth.
- The Arduino Bluetooth Text to Speech app vocalizes the text and displays it.

The below table depicts the various signs used in our paper and their corresponding words.

Table 1: Various Gestures

GOOD  Figure 2a	WASHROOM  Figure 2b	TEA/COFFEE  Figure 2c	I AM FINE  Figure 2d
HELP  Figure 2e	I AM SICK  Figure 2f	EXCUSE ME  Figure 2g	OK  Figure 2h
WATER  Figure 2i	FOOD  Figure 2j	FROM TIRUPATHI  Figure 2k	MEDICINE  Figure 2l
HELLO  Figure 2m	MY NAME IS ___  Figure 2n	THANK YOU  Figure 2o	-----  Figure 2p

V RESULTS AND DISCUSSIONS

Practical model of our paper is shown in the following Figures.

Fig. 3a illustrates the guesture of folded fingers and resembles the Fig. 2a This symbolizes the word GOOD.

Fig. 3a

Fig. 3b shows the guesture of little finger out and resembles the Fig. 2b This symbolizes that the person needs to go to washroom.

Fig. 3b

Fig. 3c shows the guesture of little finger out and resembles the Fig. 2c This symbolizes that the person needs to go to washroom.

Fig. 3c

Fig. 2d shows the guesture that the concerned person is fine by showing Ring and little finger out and it is reflected by the Fig. 3d. Similarly, from Fig. 3e to 3o the guesture symbolizes various information through gestures viz., the person seeks help, informs that he/she is sick, asking excuse, telling ok, needs water, needs food, the location (Tirupati), wants medicine, sharing the name and thanking respectively.

Figure 3d

Figure 3h

Figure 3l

Figure 3e

Figure 3i

Figure 3m

Figure 3f

Figure 3j

Figure 3n

Figure 3g

Figure 3k

Figure 3o

CONCLUSION

Sign language is a useful tool to ease the communication between the deaf or mute community and the normal people. Yet there is a communication barrier between these communities with normal people. This paper aims to reduce the communication gap between the deaf or mute community and the normal world. This paper was meant to be a prototype to check the feasibility of recognizing sign language using sensor gloves. With this paper the mute people can use the gloves to perform sign language and it will be converted in to speech so that normal people can easily understand.

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