Electronic Support System to Interpret Sign Language of Communication used by Deaf and Dumb Community

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***Abstract*— Communication is the best media used by the people to communicate with each other. The problem arises when normal people and deaf-dumb people want to communicate with each other. Sign Language is a language which is used for communication by the deaf and dumb people. This project is used to reduce the communication barrier between the deaf-dumb people and the normal people. The Sign language interpreter we are developed uses a hand glove fitted with flex sensors that can interpret the English letters and numbers in American Sign Language (ASL) & some one-handed letters in Indian sign language (ISL).**

***IndexTerms*--Gesture, Flex Sensor, ARM7TDMI, Text To Speech Conversion**

I. INTRODUCTION

In real word, there are many people who are deaf and dumb, they cannot communicate easily. For communication of deaf-dumb people & normal people, the proposed system is used to make electronic hand glove for those people. Communications between deaf-dumb and a normal person have always been a challenging task. About billion people in the world are deaf and dumb. The communication between a deaf and hearing person poses to be a serious problem compared to communication between blind and normal visual people. The blind people can talk freely by means of normal language whereas the deaf-dumb have their own manual-visual language known as Gestures and sign language [1]. While conveying information in situations where other forms like speech cannot be used at that place Human hand plays an important role. Deaf and dumb community use gestures as a one of the powerful tools of communication.

The Proposed system is portable and easy to handle. The proposed system is sign language recognition system for the vocally disabled people who use sign language for communication. This system basically involves the use of specially designed sensor gloves connected to system while a disabled person wearing the gloves makes the signs and gestures. System will analyze these gestures and synthesize the sound for the corresponding word or letter for normal people to understand. Sign languages used globally are as follows: ASL (American Sign Language), ISL (Indian Sign Language), BSL (British Sign Language) Etc.

Proposed system is utilizes single handed gestures for American Sign Language (ASL) and some single-handed gestures for Indian sign language (ISL) for implementation of Sign Language Interpreter.

II. LITERATURE REVIEW

Traditionally, the technology of gesture recognition was divided into two categories, vision-based and glove-based methods and also the colored marker approaches. In vision-based methods, computer camera is the input device for observing the information supplied by various gestures of hands & fingers. In glove based systems data gloves are used which can archive the accurate positions of hand gestures as its positions are directly measured.

Kamalpreet Sharma et al. reviewed various methods and techniques which are provided by different authors for recognition of hand gestures. Hand gesture recognition is carried out by the methods like pixel by pixel comparison, edge method, using orientation histogram & thinning method [1]. Present technologies for recognizing gestures are divided into vision based, instrumented (data glove), and colored marker approaches.

Shoaib Ahmed .V proposed the Prototype version, in which system the user forms a sign and holds it for two seconds to ensure recognition. Hence it is a low time consuming approach [2].

Laura Dipietro et al. proposed an Instrumented (data) glove approaches system in which sensor devices used for capturing hand position, and motion. In this approach, detection of hand is eliminated by the sensors on the hand and it can easily provide exact coordinates of palm and finger's location and orientation, and hand configurations [8].

Nils Karlsson et al. proposed a method where a glove generates commands based on position measurements. Output of sensors will change due to change in angle of the finger. The combined sensor outputs form a pattern that corresponds to different finger bending angles. Different finger bending angles generates different Commands. The glove is simple and it generates sufficient signals for a fuzzy control system [9].

Jonathan Alon et al. proposed a novel gesture spotting algorithm which is accurate and efficient, is purely vision-based. This system robustly recognizes gestures, even when the user gestures without any aiding devices in front of a complex background [6]. The proposed algorithm can recognize gestures using a fairly simple hand detection module that yields multiple candidates.

Thad Starner et al. proposed two real-time hidden Markov model based systems for recognizing sentence-level continuous American Sign Language (ASL) using a single camera to track the user's bare hands [10].

Hwan Hoe et al. proposed a realistic game system using a multi-modal interface based on gaze tracking, gesture recognition, and the measurement of bio-signals, such as PPG, GSR, and SKT. To calculate the gaze position, designed the gaze tracking module which attached below the HMD. Gaze tracking used for the navigation interaction in a game. The gesture recognition performed by a commercial data glove, which used to perform the selection events in the game [5].

Xu Zhang et al. developed a framework for hand gesture recognition which can be utilized in both SLR and gesture based control. The hand gesture recognition is achieved by the presented framework which combines information from a three-axis accelerometer and multichannel EMG sensors.[4].

Vasiliki E. Kosmidou et al. proposed an SL recognition scheme based on the application of the intrinsic mode entropy (IMEn) on surface electromyogram (sEMG) and 3-D-Acc data acquired from the dominant hand. In this system data from five-channel surface electromyogram and 3-D accelerometer from the signer's dominant hand is analyzed using intrinsic mode entropy (IMEn) for the automated recognition of Greek sign language (GSL) isolated signs. Recognition performed on the isolated 60 GSL signs. The combination of sEMG signals with 3-D-Acc ones introduced here sets a novel pathway for creating an efficient wireless wearable system that combined with portable devices (e.g. PocketPC) and text-to-speech/speech-to-text engines, which integrated into a portable SL recognition device [7].

III. PROPOSED METHODOLOGY

Problem definition:-

To develop an electronic support system that can translate sign language into text and speech in order to make the communication between the deaf & dumb people with the normal people easier.

Objective of the Project:-

Generally dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. The aim of proposed system is to reduce the barrier in communication. Now days it's a need of developing an electronic support system that can translate sign language into text and speechin order to make the communication between the deaf & dumb communities with the general public. A data gloves is used which is normal cloth driving gloves fitted with flex sensors along the length of each finger and the thumb. Deaf & dumb people will use the gloves to perform hand gesture and it will be converted into text and speech so that normal people can understand their expression [2].

METHODOLOGIES OF IMPLEMENTATION:-

BLOCK DIAGRAM:

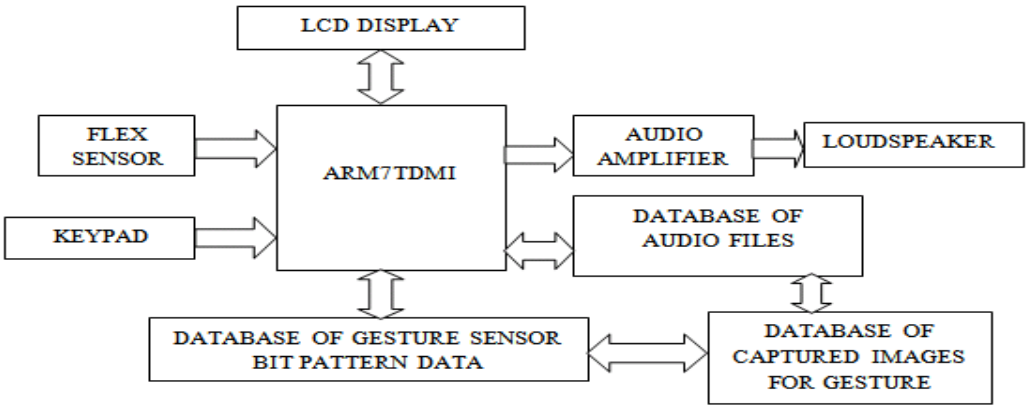


Fig.1. Proposed block diagram of the system

DESCRIPTION:

In this electronic support system data glove is implemented to capture the hand gestures of a user. Flex sensors are the sensors whose change in resistance depends on the amount of bend on the sensor [2]. The data glove will be fitted with flex sensors along the length of each finger and the thumb. The flex sensors output will be a stream of data that varies with degree of bend. The analog outputs from the sensors are then fed to the ARM7TDMI. In-built 10-Bit ADC processes the signals and perform analog to digital signal conversion. The resulting digital signal will fed to the gesture recognition section [1]. In this section the valid code for gesture will be recognized and the corresponding text information identified and displayed on LCD display. Text to speech conversion takes place in the voice section and play out through the speaker.

SYSTEM SOFTWARE AND HARDWARE:

HARDWARE:

- ARM7TDMI(LPC-2148)
- Flex sensor
- LCD display

SOFTWARE:

- Programming language: Embedded c
- Complier: keil-uVision3/4
- Software: Visual basic 8

TABLE OF GESTURES:

American Sign Language (ASL):

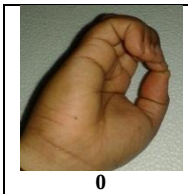
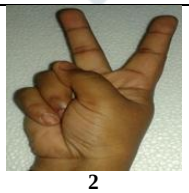
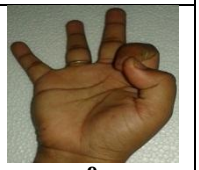
 0	 1	 2	 3	 4
 5	 6	 7	 8	 9

Table 1 American Sign Language (ASL) for 0 to 9 numbers

Table 2 American Sign Language (ASL) for A to Z letters

CASE STUDY:

For symbol A & B:

Flex sensors are fitted on hand gloves. As per the hand gesture movement it will bend the flex sensors of all fingers. The value of bending is in resistance. All fingers give different resistances depending on bending. The output of flex sensor is given to the ADC of ARM7TDMI LPC-2148 which used to covert analog signal to digital signal. The required program is written in embedded c language. The relevant code of each character/text is saved in ARM memory.

Depending on code generated by hand movement text is displayed on LCD and also the text is converted into speech by the Visual Basic8 software installed on computer. Fig 2 & 3 shows the snapshot for alphabet A & B.

RESULTS:

SR. NO.	ALPHABET	HAND GESTURE OF SIGN LANGAUGE FOR ALPHABET	LOGIC LEVELS AS PER VALUES OF FLEX SENSOR				
			A	B	C	D	E
1	A		0	2	2	2	2
2	B		2	0	0	0	0

Table 3 Hand gesture of sign language for alphabet A & B with Logic Levels as per Values of Flex Sensor

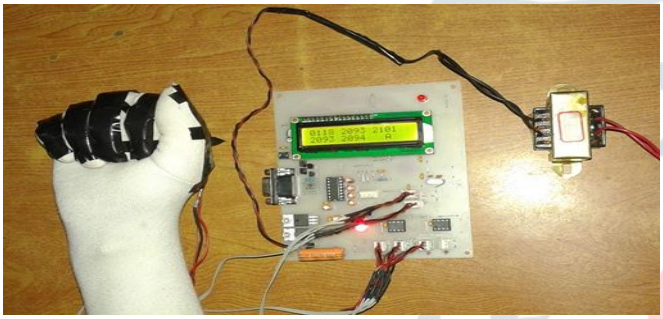


Fig.2 Snapshot of system for A alphabet

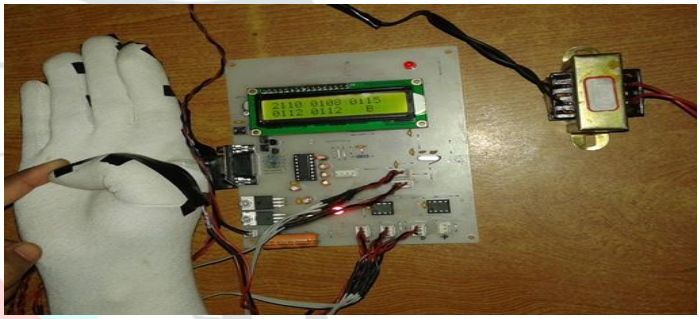


Fig.3 Snapshot of system for B alphabet

CONCLUSION

In the proposed support system we have recognized alphabets by using hand gloves with flex sensor. The proposed support system is useful for deaf and dumb people who cannot communicate with normal person.

IV. ACKNOWLEDGEMENT

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