

Electronic Support System for Deaf and Dumb to Interpret Sign Language of Communication

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ABSTRACT: Communications between deaf-dumb and a normal person have always been a challenging task. About nine 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. Human hand plays an important role while conveying information in between deaf and normal person. Gestures are powerful tools of communication among humans and are of particular interest to the deaf and dumb community.

KEYWORDS: Hand Gesture, Text To Speech Conversion, ARM7TDMI, Flex Sensor

I. INTRODUCTION

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 developed uses a hand glove fitted with flex sensors that can interpret the English letters, numbers and some words in American Sign Language (ASL) & some one-handed letters in Indian sign language (ISL) [1].

The proposed system is sign language recognition system for the vocally disabled people who use sign language for communication. 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.

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

II. RELATED WORK

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. [1] 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,

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edge method, using orientation histogram & thinning method. Present technologies for recognizing gestures are divided into vision based, data glove based, and colored marker approaches. Jonathan Alon et al. [6] 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. Shoaib Ahmed .V et al. [2] proposed the Prototype version, in which system the user forms a sign and holds it for two seconds to ensure recognition. Thad Starner et al. [10] 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 unadorned hands.

Laura Dipietro et al. [8] 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. However using data gloves become a better approach than camera as the user has the flexibility of moving the hand around freely, unlike the camera where the user has to stay in position before the camera. Light, electric or magnetic fields or any other disturbance does not affect the performance of the glove. Nils Karlsson et al. [9] proposed a method where a glove generates commands based on position measurements. When the angles of the fingers change the output of the sensors will change. The combined sensor outputs form a pattern that corresponds to different finger flexions. Different finger flexion's generates different Commands. The glove is simple and it generates sufficient signals for a fuzzy control system.

Hwan Heo et al. [5] 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. Xu Zhang et al. [4] developed a framework for hand gesture recognition which can be utilized in both SLR and gesture based control. The presented framework combines information from a three-axis accelerometer and multichannel EMG sensors to achieve hand gesture recognition. Vasiliki E. Kosmidou et al. [7] proposed an SL recognition scheme based on the application of the IMEn on sEMG and 3-D-Acc data acquired from the dominant hand. In this system data from five-channel Surface Electromyogram (sEMG) 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.

III. PROPOSED METHODOLOGY

3.1 BLOCK DIAGRAM OF PROPOSED SYSTEM:

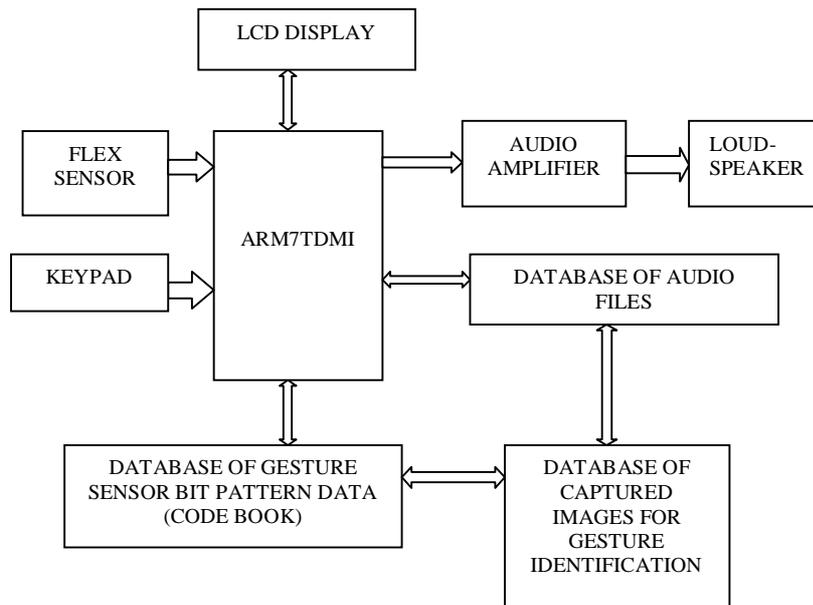


FIGURE 1: BLOCK DIAGRAM OF PROPOSED SYSTEM

3.2 DESCRIPTION:

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 speech in 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].

In this electronic support system data glove is implemented to capture the hand gestures of a user. s the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor [2]. The data glove is fitted with flex sensors along the length of each finger and the thumb. The flex sensors output is a stream of data that varies with degree of bend. The analog outputs from the sensors then fed to the ARM7TDMI. It processes the signals and perform analog to digital signal conversion. The resulting digital signal is fed to the gesture recognition section [1]. In this section the gesture is recognized and the corresponding text information identified. Text to speech conversion takes place in the voice section and play out through the speaker.

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3.3 American Sign Language (ASL)

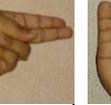
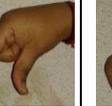
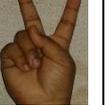
									
A	B	C	D	E	F	G	H	I	J
									
K	L	M	N	O	P	Q	R	S	T
									
U	V	W	X	Y	Z				

Table 1: Gesture for American Sign Language (ASL) for A-Z letters

									
0	1	2	3	4	5	6	7	8	9

Table 2: Gesture for American Sign Language (ASL) for 0- 9 numbers

American Sign Language (ASL) is a sign language. It is used by deaf and dumb people for communication. Table 1 and 2 shows the gestures for English letters and number used in American sign language.

IV. EXPERIMENTAL RESULTS

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 resistance value depending on bending. The output of flex sensor is given to the ADC of ARM7TDMI LPC-2148 which used to convert analog signal into digital signal. The required program written in embedded c language. Depending on code generated by hand movement text is displayed on LCD and also the text is converted into speech by the Visual Basic 2008 software installed on computer.

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SR. NO.	ALPHABET	HAND GESTURE OF SIGN LANGAUGE FOR ALPHABET	LOGIC LEVELS AS PER VALUES OF FLEX SENSOR				
			F1	F2	F3	F4	F5
1	A		0	2	2	2	2
2	B		2	0	0	0	0
3	C		0	1	1	1	1
4	D		1	0	1	1	1
5	E		1	2	2	2	2

Table 3:Hand gesture of sign language for alphabet A,B,C,D& E with Logic Levels as per values of Flex Sensor

SR. NO.	NUMBER	HAND GESTURE OF SIGN LANGAUGE FOR NUMBER	LOGIC LEVELS AS PER VALUES OF FLEX SENSOR				
			F1	F2	F3	F4	F5
1	0		1	1	1	1	1
2	1		1	0	2	2	2
3	2		1	0	0	2	2

Table 4:Hand gesture of sign language for Number 0,1& 2 with Logic Levels as per values of Flex Sensor

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As shown in Table 3 it gives information of gesture for English letters A to E with logic levels, similarly we can obtain for remaining English letters and as shown in Table 4 it gives information of gesture for numbers 0 to 2 with logic levels, similarly we can obtain for remaining numbers. The snapshot of project hardware in Figure 2 shows flex sensors are placed on hand gloves and hand gloves are connected to the ADC of ARM7TDMI. The recognized gesture values are displayed on LCD display .

Snapshot of Project Hardware:



Figure 2 Snapshot of project hardware

V. CONCLUSION

In the proposed support system we have recognized alphabets (A-Z), Numbers (0-9) and some words by using hand gloves with flex sensor. The proposed support system is useful for communication between deaf and dumb people with normal person.

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