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[ICEMESM-18]
IC™ Value: 3.00
ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

OVERVIEW OF AN EMBEDDED COMMUNICATION AID FOR SPEECH IMPAIRED PEOPLE

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DOI: 10.5281/zenodo.1232235

ABSTRACT

In our country around 2.78% of people are not able to speak (dumb). Their communications with others are only using the motion of their hands and expressions. We proposed a new technique called artificial speaking system for dumb people. It will be very helpful to them for conveying their thoughts to others. Some peoples are easily able to get the information from their motions. The remaining is not able to understand their way of conveying the message. In order to overcome the complexity this system is introduced for the deaf and dumb people.

This system is based on the motion sensor (Flex sensor). According to speech impaired people, for every motion they have a meaning. That message is kept in a database. Likewise all templates are kept in the database. In the real time the template database is fed into a microcontroller and the motion sensor is fixed in their hand with the help of glove. For every action the motion sensors get accelerated and give the signal to the microcontroller. The microcontroller matches the motion with the database and produces the speech signal. The output of the system is using the speaker. By properly updating the database the dumb will speak like a normal person using this system. This system has teach and play, teach mode enables to store different audios for particular sign whereas play mode **enables to recognize it according to the stored data. The system can also convert the output into text**.

Keywords: *Flex sensor; Atmega16, Accelerometer; Gesture recognition module; Text-to-speech synthesis module*

I. INTRODUCTION

The speech impaired communicates with normal people in everyday life and they use sign language for communication, but they find difficulty in communicating with others who do not understand sign language. And often they need a support for effective communication. Aiming to extend the communication capabilities of those with hearing and speech disabilities after interacting with hearing and speech impaired athletes at their school, the quadSquad team set out to develop a way for those who know sign language to more easily communicate with those who don't. Their solution includes a hardware component – the gloves fitted with various sensors – and a software component – which translates the hand signals into speech in real time. Most of the existing systems are image based gesture recognition system and hence highly expensive, whereas this work has developed a low cost Glove based system. This project uses ATMEGA 16 controller to control all the processes and flex sensors along with accelerometer sensors will track the movement of fingers as well as entire palm. A GLCD will be used to display the user's gesture and a speaker to translate the gesture into audio signal is planned if possible for execution. It is based on the need of developing an electronic device that can translate sign language into speech and text, in order to make the communication take place between the mute communities with the general public. The prototype is a complete portable communication aid for the speech impaired which includes converting the sign language into speech and text using flex sensor-based gesture recognition module to recognize English alphabets and few words. This work aimed to lower this barrier in communication.

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II. LITERATURE SURVEY

1. HenrikBirk and Thomas BaltzerMoeslund, "Recognizing Gestures From the Hand Alphabet Using Principal Component Analysis", Master's Thesis, Laboratory of Image Analysis, Aalborg University, Denmark 2011 [4], presents simple as well as effective method of realizing hand gesture recognition using Covariance Method. First an image database is created which constitutes various static hand gesture images. These images are a subset of American Sign Language (ASL). Preprocessing of the image is done so as to reduce the amount of noise present in the image. Eigen values of the Eigen vectors are calculated. A pattern recognition system is used to transform an image into feature vector i.e. Eigen image, which will then be compared with the trained set of gestures. Thus method used was successful to retrieve the correct match.
2. Andrew Wilson and Aaron Bobick, "Learning visual behavior for gesture analysis," In Proceedings of the IEEE Symposium on Computer Vision, Coral Gables, Florida, pp. 19-21, November 2009 [13], proposed the development of an algorithm for recognition of hand gestures with reasonable accuracy. The segmentation of gray scale image of a hand gesture is performed using Otsu thresholding algorithm. Total image level is divided into two classes one is hand and other is background and image processing is done. Depending on optimal threshold value the output is generated.
3. Jennifer Schlenzig, Edward Hunter, and Ramesh Jain, "Recursive spatio-temporal analysis: Understanding Gestures", Technical report, Visual Computing Laboratory, University of San Diego, California, 2012 [12], presents a novel technique of recognizing hand gestures i.e. A-Z alphabets, 0-9 numbers and 6 additional control signals (for keyboard and mouse control) by extracting various features of hand ,creating a feature vector table and training a neural network. The proposed work has a recognition rate of 99%.
4. V.Ramya, B.Pallaniappan, "Designing An Embedded Communication Aid For Speech Impaired Using Xbee And Gsm" JTAIT 30th April 2014. Vol. 62 No.3 [14], This paper focuses on developing an aid for speech impaired and physically impaired, who can control the home appliance through hand gesture. The proposed system presents a design and working of a hand- gesture based interface for facilitating communication among speech impaired with the normal people using Handheld Device instead of PC. The system considers only single handed gestures and converts the sign language into voice, which could be heard by the visually impaired and normal people.
5. Aarthi M, Vijayalakshmi P , "Sign Language To Speech Conversion" 2016 Fifth ICRTIC [7], defines a work in which a flex sensor-based gesture recognition module is developed to recognize English alphabets and few words and a Text-to-Speech synthesizer based on HMM is built to convert the corresponding text.

III. BLOCK DIAGRAM

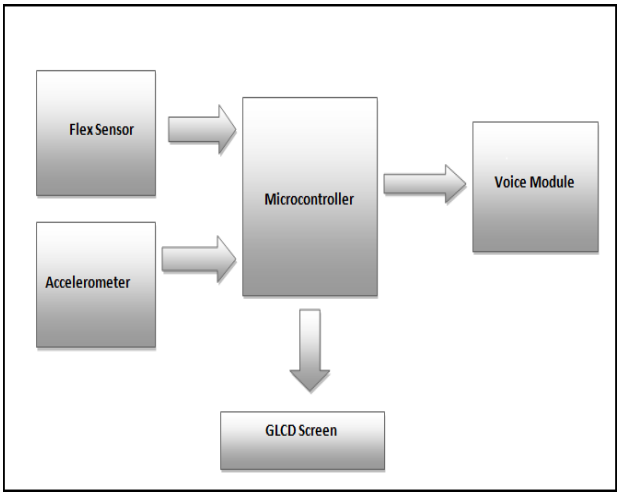

Figure 1: Proposed Block Diagram.

As per the block diagram, there will be two types of sensor used to generate the analog voltage for detecting the movement of the fingers. The analog voltage will be directly processed by the microcontroller for sending

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the control signal using by the Voice Module for Speech conversion. The status of the sensor ADC values will be displayed in the GLCD Screen.

A. Methodology

Embedded computing systems often involves the design of hardware as well as software. Fig.1 shows a design methodology for a combined hardware/software project. Front-end activities such as specifications and architecture simultaneously consider hardware and software aspects. Similarly, back-end integration and testing consider the entire system. In the middle, however, development of hardware and software components can go on relatively independently. The proposed system is designed based on this methodology in which the requirement and specifications are first clearly specified and then the hardware and software design of the communication aid is designed.

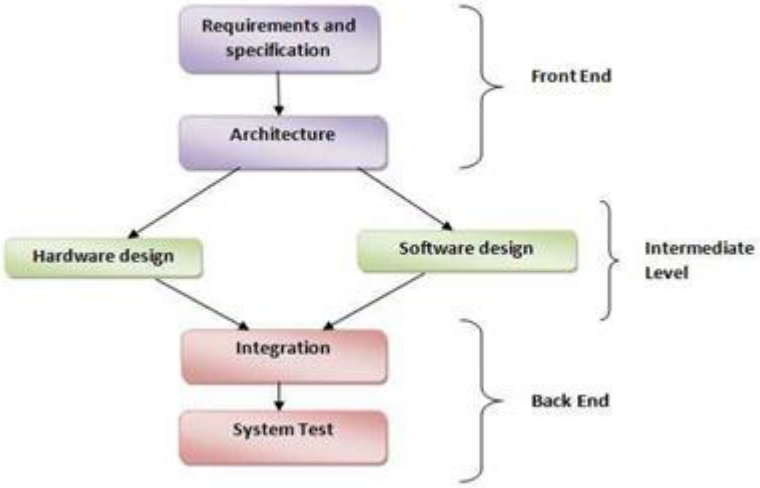

Figure 2: A Simple Hardware/Software Co-Design Methodology

B. Description Of The Proposed System

Generally dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. This project aims to lower this barrier in communication. In this electronic system we design one glove which is fitted with the flex sensor in our hand then the flex sensor sense the signal and this signal given to the ATMEGA 16 controller whereas all the data kept in the database. Then ATMEGA 16 controller matches the motion of hand with the database and produces the speech signal i.e. we will get the output through the speaker. There are two modes namely, teach and play mode and the desired mode is selected through the switch, which is interfaced with the controller. The first mode is the teach mode, in which the controller stores the sign values in EEPROM corresponding to a letter or word, along with an address and the corresponding voice is recorded . The second one is the play mode, in which the microcontroller recognizes the sign for the corresponding letter/word and plays back the sound values from the voice IC.

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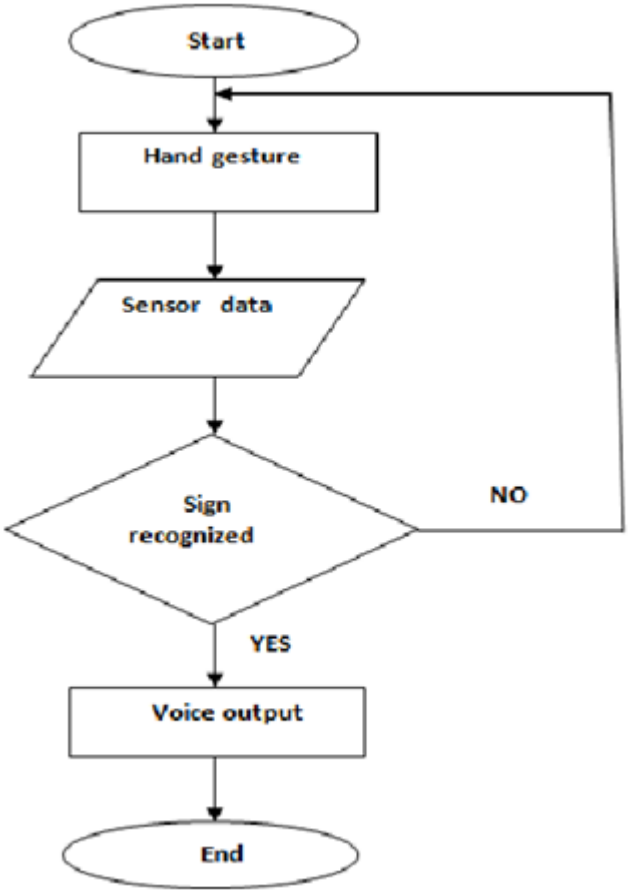

Figure 2: Flow Chart of Working of Proposed System

C. Hardware Components

Sr. No.	Type of Component	Specification
1.	Glove	Hand Glove
2.	Microcontroller	AVR Atmega16
3.	Flex Sensors	Spectra Symbol 4.5"
4.	GLCD	128x64 (Pixel)
5.	Audio Amplifier	APR 9600
6.	Speaker	8 Ω
7.	Accelerometer	ADXL 335 (3 Axis)
8.	DC Battery	12V
9.	Development board	AVR

D. Software Components

1) AVR Studio
2) PCB Artist
3) Win AVR

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E. Language to be used

1) Embedded C

IV. CONCLUSION

In this proposed project an electronic speaking system is to be developed to ease the communication process of speech impaired people. With this project, deaf or dumb people can use the gloves to form gestures according to sign language which will be converted into speech and text. Our proposed system helps to mute people which to communicate with normal people.

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