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AVR Based Gesture Vocalizer Using Speech Synthesizer IC

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Abstract- AVR based Gesture Vocalizer using Speech synthesis IC is a multi AVR microcontroller based system being designed to communication among the dumb, deaf and blind communities and their communication with the normal people [2]. Generally dumb people use sign language for communication but they find difficulty in communicating with others who do not understand sign language. It is based on the need of developing an electronic device that can translate sign language into speech & text in order to make the communication between the mute communities with the general public possible. Mute people can use the gloves to perform hand gesture and it will be converted into speech so that normal people can understand their expression. Data glove can detect almost all the movements of a hand and AVR microcontroller based system converts some specified movements into human recognizable voice and also display in text form on LCD display for the deaf people. The paper provides the map for developing such a digital system.

Index Terms -Gesture Recognition; Data Glove; Liquid Crystal Display (LCD); Advanced Virtual Risc (AVR).

1. INTRODUCTION:

In human communication, the use of speech and gestures is completely coordinated. A number of hardware techniques are used for gathering information about body positioning; typically either image-based (using cameras, moving lights etc) or device-based (using instrumented gloves, position trackers etc). This research paper analyses the data from an instrumented data glove for use in recognition of some signs and gestures. A system is developed for recognizing these signs and their conversion into speech and the text. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for whole words. It can also provide sign for letters to perform words that don't have corresponding sign in that sign language. This digital glove aims to lower this barrier in communication**.** It is electronic device that can translate Sign language into speech in order to make the communication take place between the mute communities with the general public possible.

By using the gesture vocalizer the dumb people can communicate with the normal people and with the blind people as well, but the question arises that how can the dump people communicate with the deaf people. The solution to this problem is to translate the gestures, which are made by the hand, into some text form. The text will displayed on LCD.

2. LITERATURE SURVEY:

Generally dumb people use sign language for communication but they find difficulty in communicating with others who do not understand sign language. Mute people can use the gloves to perform hand gesture and it will be converted into speech so that normal people can understand their expression. This paper provides the map for developing such a digital glove [1].

In this paper, AVR microcontroller and sensors based gesture vocalizer is presented. Gesture vocalizer discussed is basically a data glove and a AVR microcontroller based system. Data glove can detect almost all the movements of a hand and AVR microcontroller based system converts some specified movements into human recognizable voice [2].

An objective is to develop a computerized Indian Sign Language (ISL) recognition system is described here. The basic concept involves the use of computer interfaced data gloves worn by a disabled person who makes the signs. The computer analyzes these gestures, minimizes the variations and synthesizes the sound for the corresponding word or letter for normal people to understand [3].

3. MODIFICATION:

Two AVR microcontrollers are used at both transmitter & receiver side instead of PIC

AVR microcontroller [1]. The LCD is interfaced to the transmitter side to display the readings for error detection [2]. The data glove is equipped with flex sensors and an accelerometer instead of potentiometers & we are not using the computer to interface the data glove instead of that it is interfaced to AVR microcontroller [3].

4. TECHNOLOGY:

In this system data glove is implemented to capture the hand gestures of a user. The data glove is fitted with flex sensors along the length of each finger and the thumb. The flex sensors output a stream of data that varies with degree and amount of bend produced by the sign. In this device Flex Sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor The first module (input) acquires signs performed by a dumb person communicating with the system using sign language; Flex sensors outputs data stream depending on the degree and amount of bend produced by the sign.

A set of signs that represent words are collected as the data base for this system. The output data stream from the flex sensor is fed to AVR microcontroller where it is processed and converted into digital form. The analog outputs from the sensors are then fed to the inbuilt ADC of the AVR microcontroller. These analog readings are then digitized and stored in internal RAM memory of AVR microcontroller. The AVR microcontroller will compare these readings to the look up table stored in internal program memory, whichever reading is closest to the look up table AVR microcontroller will select that word. After this, AVR microcontroller will search for .wav file with similar name. That text will be displayed on LCD and played out via speaker. By using this wearable data gloves mute person can easily communicate with normal people.

5. SYSTEM DESCRIPTION:

5.1. General Block Diagram:

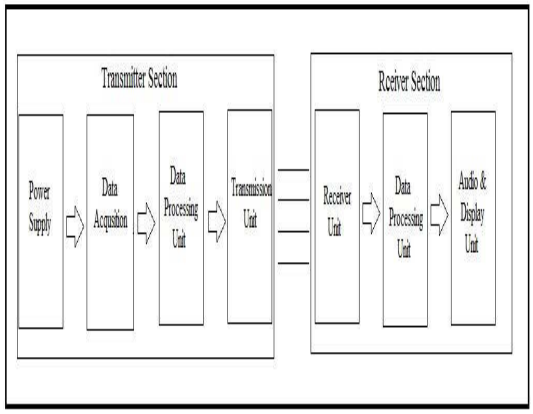

Fig.1. General Block Diagram of System Architecture

5.2. Block Diagram Description:

5.2.1. Data acquisition:

This part involves gesture detection. For gesture detection we are using data glove which consists of two types of sensors flex sensors and accelerometer as a tilt sensor. From flex sensors and accelerometer we get analog signals. These signals are processed in AVR microcontroller.

a) Flex sensor:

Fig.2. Flex Sensor

Data glove is equipped with four flex sensors. Each of the flex sensor is meant to be fixed on each of the finger of the hand glove for the monitoring and sensing of static movements of the fingers of the hand. Flex Sensor plays the major role. The output of the bend sensor is a square wave. Frequency of this output wave varies with the bending of the bend sensor. Flex sensors are sensors that change in resistance depending on the amount of bend of the finger. Output of flex sensors is a data stream depending on the degree and amount of bend produced by the sign. A group of signs that represent words are collected as the

data set for this system. The output data stream from the flex sensor is fed to AVR microcontroller where it is processed and converted into digital form.

b) Accelerometer:

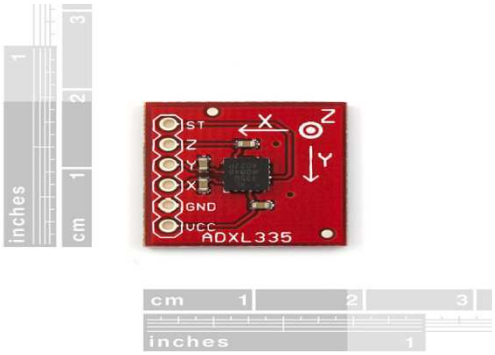

Fig.3. Accelerometer

The ADXL335 is a small, thin, low power, complete 3-axis accelerometer with signal conditioned voltage outputs. It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. Here the basic function of this module is to detect the tilting of the hand. We are using accelerometer for sensing tilt of hand.
The output, which is obtained from the accelerometers after amplification, is an analog output. To deal with this analog output, and to make it useful for the further use, it is required to change it into some form, which is detectable for the AVR microcontroller. The analog output of the accelerometer is converted into digital form. A dual channel ADC can be used to convert the outputs of two accelerometers in to digital form.

5.2.2. Data processing unit:

a) AVR microcontroller:

Here the high performance low power 8 bit AVR microcontroller is used. It is having 8 channel 10 bit inbuilt ADC. Output from flex sensors and accelerometer is given to the ADC. The first ADC converts the analog signal to the digital form and then the second ADC converts the analog signal of second accelerometer into digital form. The AVR microcontroller checks the data from ADC. It compares the values received from the ADC's with the predefined values, which are present in the memory of the AVR microcontroller and on the basis of this comparison the AVR microcontroller decides that, is the gesture a meaningful gesture [6].

5.2.3. TRANSRECEIVER UNIT:

a) RF Transreceiver:

Fig.4. RF Transreceiver

The RF transreceiver of 2.4GHz is used. This is an FSK Transreceiver module. It is a high performance and low cost module. It gives 30 meters range with onboard antenna. In a typical system, this trans-receiver will be used together with an AVR microcontroller. It provides extensive hardware support for packet handling, data buffering, burst transmissions, clear channel assessment, link quality indication and wake on radio. It could easily design for product requiring wireless connectivity. It can be used on wireless security system or specific remote-control function and others wireless system. Operating Range is 30 meters without requiring any external antenna [4].

5.2.4. AUDIO AND DISPLAY UNIT:

a) Speech Synthesis IC aP8942A:

IC aP8942A high performance Voice OTP is fabricated with Standard CMOS process with embedded 1M bits EPROM. It can store up to 42sec voice message with 4-bit ADPCM compression at 6 KHz sampling rate. 8-bit PCM is also available as user selectable option. Two trigger modes, simple Key trigger mode and Parallel CPU trigger mode facilitate different user interface. User selectable triggering and output signal options provide maximum flexibility to various applications. Built-in resistor controlled oscillator, 8-bit current mode D/A output and PWM direct speaker driving output minimize the number of external components [5].

b) LCD display:

Fig.5. LCD Display

The text is display on LCD. The gestures are already being detected by the "Gesture Detection" module. This module sends signal to the speech synthesis module, the same signal is sent to the LCD display module. The AVR microcontroller is controlling the LCD. A signal against each gesture is received by LCD display module. The LCD display module checks each signal, and compares it with the already stored values. On the basis of this comparison the AVR microcontroller takes the decision what should be displayed, having taken the decision the AVR microcontroller send an eight bit address to the LCD, this eight bit address, tells the LCD, what should be displayed.

6. ADVANTAGES:

1) Compact System:
The AVR based Gesture Vocalizer is very compact digital device and is easily portable.
2) Flexible:
This system is flexible. That is the sign conversion can be made in any language.
3) Power consumption:
It takes less power to operate system.
4) RF Transceiver:
Here we are using the transreceiver of 30 meter range.Transmitting & receiving range can be increased by increasing RF range.

7. LIMITATIONS:

1. Only one hand gesture recognition is implemented in this system.
2. High cost because RF transceiver module is used.

8. APPLICATIONS:

1. Gesture recognition and conversion.
2. As a translating device for Mute people.
3. It can be used for Mobiles for SMS sending.
4. Translation of sign language in many regional languages.

9. EXPERIMENTAL RESULTS:

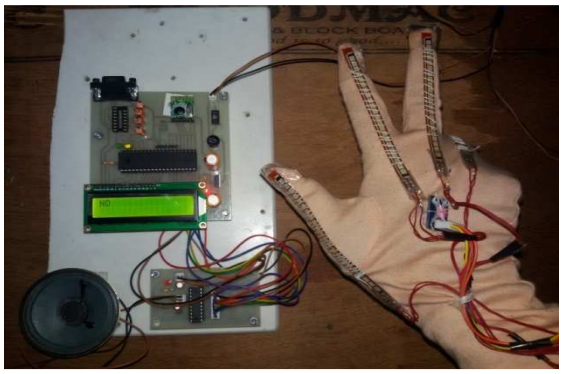
Fig.7.Gesture Movement

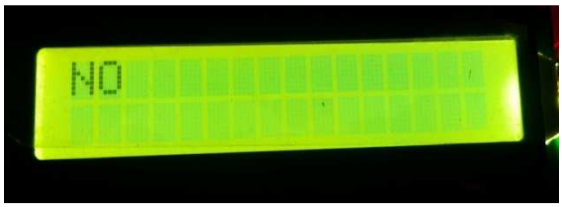

Fig.8. Output of the Gesture

The user forms a sign and holds it for one second to ensure recognition. The system is capable of recognizing signs more quickly than this arbitrary one second limit. Hence it is a low time consuming approach Furthermore real time recognition ratio of nearly 99% can be easily achieved.

10. FUTURE SCOPE:

1. Designing of a whole jacket, which would be capable of vocalizing the gestures and movements of animals.
2. Virtual reality application e.g. replacing the conventional input devices like joy sticks in Video games with the data glove.
3. The Robot control system to regulate machine activity at remote sensitive sites.
4. In future work of this proposed system supporting more number of signs and different language mode.

11. CONCLUSION:

The dumb people use their standard sign language which is not easily understandable by common people and blind people cannot see their gestures. This project aims to lower the communication gap between the deaf or mute community and the normal world. This project was meant to be a prototype to check the feasibility of recognizing sign language using sensor gloves. With this project the deaf or 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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