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Intelligence Sign Language Recognition by Pan

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ABSTRACT: Sign language (SL) is a visual-gestural language used by deaf and hard-hearing people for communication purposes. In this world communication between normal people and mute people is difficult process. This work examines use of flex sensor with MEMS accelerometer to recognize the sign language gestures. Generally flex sensor gloves are get used in gaming applications. But in this project it gets utilized for the sign language recognition. This project is to detect the sign language gestures using flex sensors and convert it into voice and text so that mute people can also able to communicate with normal people like others.

KEYWORDS: Human computer interacting, Flex sensor, Sign language recognition and MEMS Accelerometer.

I.INTRODUCTION

Sign language (SL) is a hand gesture language used by mute people to communicate with normal people. Even in this modern era also, the complete communication between the mute people and normal people is very difficult. So that in order to solve this sign language recognition helps in many ways. Researchers proposed large number of method s to detect sign language gestures. Recognize may be using location, using neural networks, using Depth silhouettes and using quadratic curve based methods. [1][2][3][4] Sign Language Interpretation system is a good technique to help mute people to interact with normal people.[5] The development of this project work is mainly for dumb people who are having difficulty to communicate with normal people in the society. It can be observed easily that they can't able to communicate easily with normal people using their hand gestures. Only few normal people understand the sign language. The work done in this project is with an aim of developing a system for dumb people to translate their sign language to normal language using sign language recognition system into voice and text. Generally Cyber gloves used commonly in most of the previous sign language recognitions including [6][7][8][19]. Kadous [10] reported a system using power gloves to recognize a set of 95 isolated Australian sign languages with 80% accuracy. In this it uses flex sensor and MEMS accelerometer to detect the sign language and use voice IC to produce preloaded audio as output. [11] The existing system for sign language recognition is that to detect the gestures using EMG signal and accelerometer. But by using EMG we can't able to detect inner muscles and large amount of sensors are needed to get placed to detect the sign language. [12] Another method is capturing the hand gesture using the camera and best frame gets selected and using image processing the gesture is identified. It has large delay due to the long processing technique. The accuracy is less in the image processing technique.

II.HARDWARE DESIGN

Hardware framework of the sign language recognition system is shown in Fig 1. This System contains high Performance PIC microcontroller, flex sensors, MEMS controller and APR9600 Voice IC. This hardware system is used to recognize sign language gestures and convert it into voice using voice IC. This system is recognizing the bend of the finger using flex sensor. Microcontroller unit form the heart of this system unit, which acquires and process the analog input value and produce corresponding voice output. Bluetooth modem is connected to microcontroller using UART.

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FLEX SENSOR

The flex sensor has certain features so that it can be used for many applications including sign language recognition. It has angle displacement measurement. It bends and Flexes physically with motion device. It has very Simple Construction So that it can easily employ in any environments. It is having Life Cycle >1 million. It is having Temperature Range of -35°C to +80°C. It is adaptable to any circumstances.

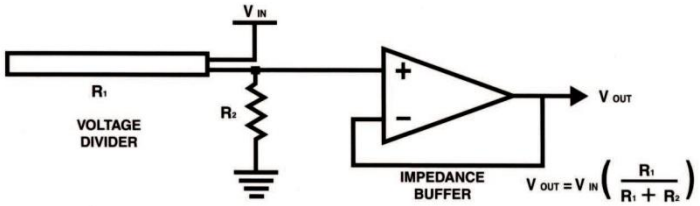

Fig.1 Basic Flex Sensor Circuit

The impedance buffer is a single sided operational amplifier, used with sensors because the low bias current of amplifier reduces error due to source impedance of flex sensor as voltage divider. The LM358 or LM324 op amps are the suggested. To adjust the sensitivity range in circuit a potentiometer adjustable buffer can be added. For variable deflection threshold switch, an op amp is used and high or low outputs depending on the inverting input voltage. In this way flex sensor can be used as a switch without going to a microcontroller. In resistance to voltage converter using a dual sided supply op-amp and the sensor uses as the input of a resistance to voltage converter. The positive output is derived by a negative reference voltage in flex sensors. When the need of the low degree of bending then it is get utilized and applied.

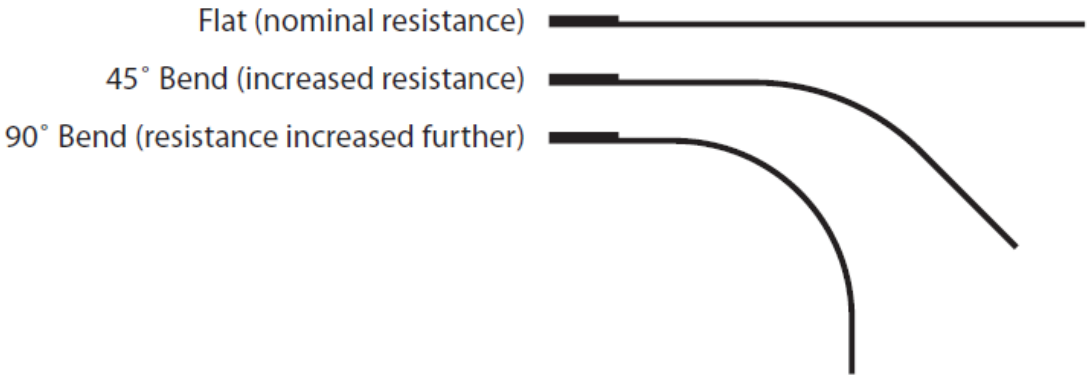

Fig.2 Working of Flex Sensor

MEMS Accelerometer

The LIS302DL is a compact three axes linear accelerometer. It having sensing element and IC interface which able to give measurement of acceleration to the external devices through I2C/SPI Serial interface. The sensing element in MEMS accelerometer capable of detecting the acceleration which is manufactured using a dedicated process. It has certain features so that only it is often get utilized in the systems. It has very low power consumption as low as <1mW. It has I2C/SPI digital output interface. It is an Programmable multiple interrupt generator.

Sensitivity explains the gain of the sensor and it can be determined by applying 1g acceleration to the accelerometer. The sensor can measure DC accelerations by points the axis of interest towards the center of the earth. By doing this ±1g acceleration to the sensor. Subtracting larger output value from the smaller output value and dividing the derived value by 2 gives the actual sensitivity of the sensor. This value is stabilized in most of the conditions it changes very

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little over temperature and little over the time. The range of sensitivities of sensor can be described by sensitivity tolerance.

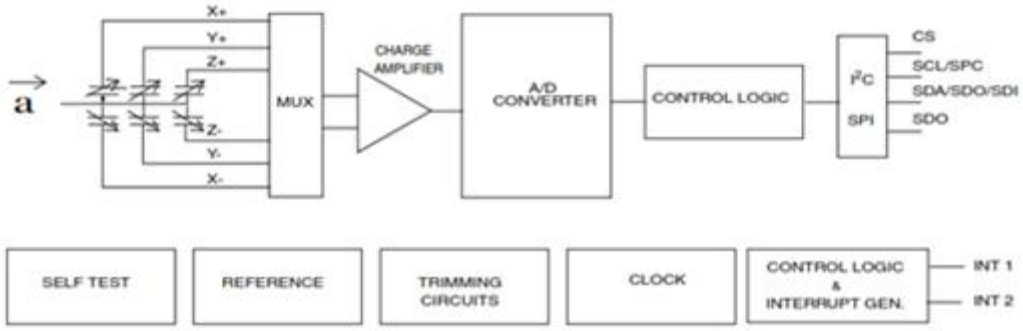

Fig.3 Block Diagram of MEMS Accelerometer

A proprietary process is used in order to create surface micro-machined accelerometer. In this technology suspended silicon structures attached to the substrate in few places called anchors and free to move in the direction of acceleration. A cap is placed at the top of the sensing element to avoid moving parts movement in the moulding process of the plastic encapsulation. The proof mass displaced from its normal position when acceleration is applied to the sensor. It causes imbalance in the capacitive half bridge. The imbalance is measured using charge integration in response to sense capacitor's voltage pulse.

WTV-SR VOICE RECORDING MODULE

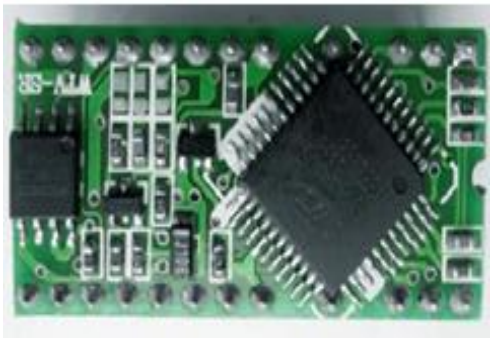

Fig.4 APR9600 Voice IC Module

Both random and sequential accesses of multiple messages are the available in this module. It has user selectable sample rates. So designers can allow customizing their design for their quality and storage time needs. Microphone amplifier, integrated output amplifier, and AGC circuits are greatly simplifying system design.

It is single-chip, high-quality voice recording & playback system. For this No external ICs required. It is a non-volatile flash memory technology so, no battery backup required. It has user-selectable messaging options. Both random and sequential access of multiple fixed-duration messages is available. Programming & development systems not required. The chip Enable pin for simple message expansion

It Support plug-in 64M bit SPI-FLASH, recording time up to 1600 seconds. It supports upload and download of the voice via USB.

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MICRO CONTROLLER

This system uses the PIC18F46J11 microcontroller which having 44pins. This is a 8-Bit microcontroller it has high stack memory so more number of interpret (sub-operations) is possible. The power supply required to operate is 3.3V DC.

The operating frequency is 4MHZ but by the program which is flash into the microcontroller multiplies the operating frequency into 16MHZ so the execution speed of the operation is increased. The registers in the microcontroller is accessed by the 8-bit address. This microcontroller has 32 I/O ports. These 32 I/O ports are divided into port A, port B, port C, port D, port E and each having the pins 5, 8, 8, 8, 3.

Fig.5 Microcontroller

The sensors are connected to the ADC ports. This ADC port has 3 pins in the microcontroller. The data is transferred to the external device through serial to parallel interface (SPI) which having 3pins this port requires the synchronization. The UART port is to interface with the GPS and the GSM modem. The UART port has one TX and one RX pin but in this system there are two UART is used. The easy handling and flexibility make PIC applicable to this system. PIC18 series microcontroller is shown in fig.

III. SIGN LANGUAGE RECOGNITION SYSTEM

The flex sensor connected with microcontroller. The flex sensor is nothing but a analog resistor. Which produce high resistance when it bend. The flex sensor's analog resistance value is given to analog to digital converter in microcontroller. The APR9600 voice IC is connected with microcontroller using IO port. The LCD is connected with microcontroller using I2C protocol. The MEMS accelerometer is also connected with microcontroller using I2C protocol. Using combination of flex sensors with MEMS accelerometer produces high accuracy rather than single channel detection technique.

It discussed for the single channels and for feature-level fusion for the bichannel sensor data.[13][14] . This combining method proves is very effective. [15][16] When a gesture is made, the flex sensor gets bend. The more it bends the more it produces resistance. So when flex sensor is not bend it produce low resistance and when it bends it produce high resistance. That analog resistance value is converted into digital value by using analog to digital converter. Then it fed into microcontroller. MEMS accelerometer also gets connected with microcontroller. It measures the acceleration. Depending upon in which combination all the fingers bends, it produces regarding voice outputs which are preloaded in the APR600 voice IC. Voice IC connected with microcontroller by using I2C. LCD screen also used to get visual output. Bluetooth modem used to get output in mobile devices. Depending on the different combination of resistance in flex sensors in the fingers different voice output can be derived.

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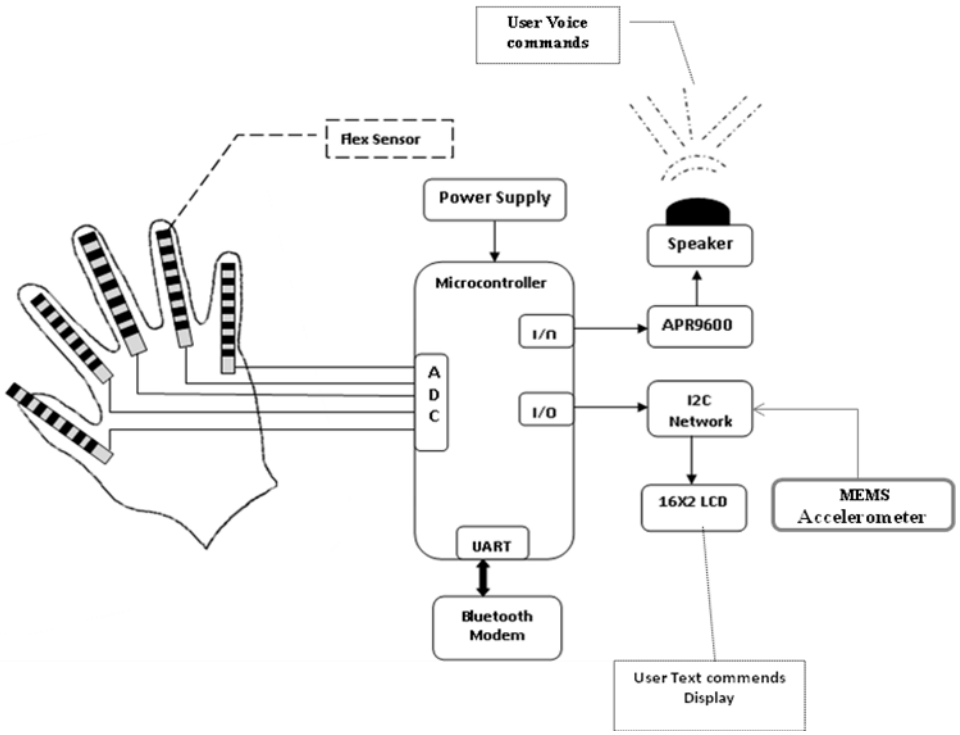

Fig.6 Block diagram of sign language recognition system

IV.ALGORITHM

Step 1: Start the Program.
Step 2: Check whether there is change in Flex Resistance or Not.
Step 3: If there is change in Resistance pass it with MEMS data.
Step 4: Play the corresponding voice for the given input.
Step 5: Else wait for period and again detect the sensor.
Step 6: Check UART whether there is any key received.
Step 7: Display the data according to key
Step 8: Stop the program.

V.CONCLUSION

This project was to check the possibility of recognizing sign languages using flex sensors. In this work it justified that sign language can be recognized using finger movement. To recognize the sign language completely more sensors are needed in our human body. There are some more advantages of the combination of the flex sensors with MEMS accelerometer. With the supplementary accelerometer data, the recognition system overcome problems related to flex sensor measurements. The combination of the flex sensors with MEMS Accelerometer sets a impression for creating a efficient portable system that can be combined with other portable devices such as portable computers. The completion of this work suggests that flex sensor can used for partial sign language recognition. People also use facial expressions and body language as a part of their communication. So that the extension of this project is to concentrate on both the body language recognition and capturing the facial expression along with the hand gestures. Capturing the facial expressions and detect the body language by placing more sensors in body improves the work and the accuracy of the system.

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