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Sign Language Recognition System Using Fingern Spelling

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Abstract: Abstract- Sign Language is a system which is translates hand gestures to speech through an adaptive interface. Since most people do not understand sign language, making it almost impossible to have daily-life communication with people who are deaf or mute. Past research works in Sign Language Recognition which employs Neural network techniques still do not perform well due to its hand gesture action based does not produced the accurate output. This proposed model consist of four modules, they are sensing unit, processing unit, voice storage unit and wireless communication unit. This method is more precise on hand movement and different languages can be installed without altering the code in PIC microcontroller.

Key words: Sign Language · PIC Microcontroller · Hand Gesture

INTRODUCTION

Now a days embedded system emerging as an important trend in all applications. More recently developed embedded applications are changing our lifestyle in a smart way. Sign language is an expressive and natural way for communication between normal and dumb people (information majorly conveys through the hand gesture) [1]. The intension of the sign language translation system is to translate the normal sign language into speech and to make easy contact with the dumb people. In order to improve the life style of the dumb people the proposed system is developed. Sign language uses both physical and non-physical communication [2]. The physical gesture communication consist of hand gestures that convey respective meaning, the non physical is head movement, facial appearance, body orientation and position. Sign language not a universal language and it is different from country to country.America developed American sign language (ASL) [3], British developed British sign language system (BSL) and Thailand developed Thai sign language system (TSL) [4]. Most of spoken English countries follow same sign language but Same sign represents the different meaning and depends upon to their own language. Research in the sign language system has two well known approaches are 1. Image processing and 2. Data glove. The image processing technique [5] [6] using the camera to capture the image/video

Analysis the data with static images and recognize the image using algorithms and produce sentences in the display, vision based sign language recognition system mainly follows the algorithms are Hidden Markov Mode (HMM) [7], Artificial Neural Networks (ANN) and Sum of Absolute Difference (SAD) Algorithm use to extract the image and eliminate the unwanted background noise.

The main drawback of vision based sign language recognition system image acquisition process have many environmental apprehensions such as the place of the camera, background condition and lightning sensitivity. Camera place to focus the spot that capture maximum achievable hand movements, higher resolution camera take up more computation time and occupy more memory space. user always need camera forever and can not implement in public place. Another research approach is a sign language recognition system using a data glove [8] [9]. user need to wear glove consist of flex sensor and motion tracker. Data are directly obtained from each sensor depends upon finger flexures and computer analysis sensor data with static data to produce sentences. Its using neural network to improve the performance of the system.

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Fig. 1: Illustration of signs that have similar hand gestures

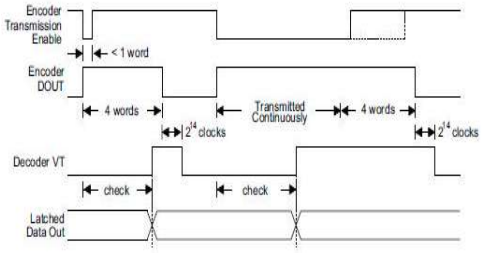


Fig. 2: Encoding and decoding signal

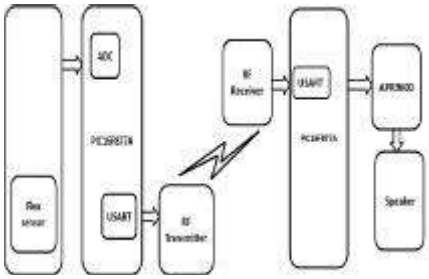


Fig. 3: Block Diagram of Signal recognition

The main advantage of this approach less computational time and fast response in real time applications. Its portable device and cost of the device also low. Another approach using a portable Accelero meter (ACC) and Surface Electro Myo Gram (SEMG) [10] sensors using to measure the hand gesture. ACC used to capture movement information of hand and Arms. EMG sensor placed on the hand, its generate different sign gesture.

Sensor output signals are fed to the computer process to recognize the hand gesture and produce speech/text. Gunasegaram. K *et al*. / International Journal of Engineering and Technology (IJET) ISSN: 0975-4024 Vol 5 No 2 Apr-May 2013 1024

The proposed system using the data glove technique [9] [10] [4], Data glove especially made up of electronic glove worn by the user. It consists of flex sensors that used to detect finger gestures and transmit the information to a PIC microcontroller.

Microcontroller processes the gesture of the user and plays the audio file corresponding gesture. The voice signals are stored in APR9600. This system avoids PC intervention for processing and all operations are controlled by microcontroller. Its lead in fast response of the system.

Most of the commercial sign language system uses the glove technique. It's simple to attain data concerning the bending of finger flexure and three dimensional position of the hand. Computer analysis the data and produces the output like sentence or voice, compared with existing data glove and image processing technique, low computational power, highly portable and real time operation much easier to attain.

This RF module comprises of an RF Transmitter and an RF Receiver. The transmitter/receiver (Tx/Rx) pair operates at a frequency of 434 MHz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

Flex Sensor is a unique component that changes resistance when bent or flexed .An flexed sensor has a nominal resistance of approximately 10,000 ohms (10 K). As the flex sensor is bent in one direction the resistance gradually increases. Range of resistance's of the flex sensor may vary between 10K and 40K depending upon the degree of the flex.

PROPOSED SYSTEM

Systems Description: In this system microcontroller receives data from the glove, it consists of 4.2 inch flex sensors and gyro sensors. These sensors provide a corresponding signal of finger flexures and hand motion. PIC microcontroller contains 10-bit inbuilt ADC and use to receive the analog value from the sensor. An ADC converts analog to digital value and store the value in the buffer. Then Controller compares the static data and digital value for processing to determine the gesture.

According to the finger movements microcontroller play the voice (speech).

Voice is stored using APR9600 is a single chip used to store high quality voice recording and Non-volatile flash memory, playback capacity for 40 to 60 seconds. APR provides random and sequential multiple messages and designers can adjust storage time depends upon user needs. The chip integrated with microphone amplifier, Output amplifier and AGC circuit [11-16].

TAPE mode provides the Auto Rewind and normal option. The six pins of APR use for voice storage and playback capability, each pin plays the voice for 60 second duration. The voice transmitter to receiver by the help of RF transmitter and it also a portable device. The RF transmitter and receiver used for long distance communication which are specifically designed for wireless speaker and earphone. Figure 2 and 3 as the circuit diagram of transmitter and receiver state.

The a.c. input value i.e., 230V is fed to a rectifier in the program. The output obtained from the rectifier program output is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to removeany a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage.

Flash program memory may only be written to if the destination address is in a segment of memory. Flash program memory must be written in four-word blocks. The write operation is edge-aligned and cannot occur across boundaries. To write program data, it must first be loaded into the buffer registers. This is accomplished by first writing the destination address to EEADR and EEADRH

The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a TE trigger on the HT12E enhances the application flexibility of the 212 series of encoders.

Hardware setup: Figure 5 shows the hardware model of automatic sign language translator which consists of

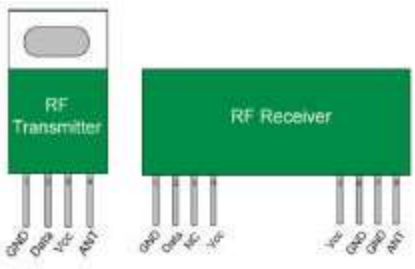


Fig. 4: Block Diagram of RFtransmitter and receiver

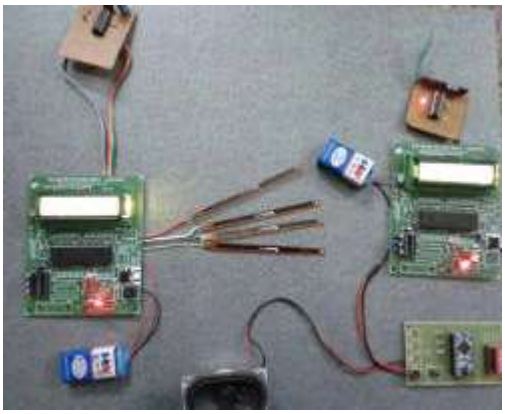


Fig. 5: Block Diagram of hardware model

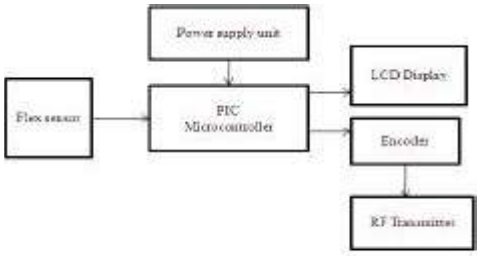


Fig. 6: Block diagram of transmitter

transmitter and receiver modules. The transmitter module contains a flex sensor and RF transmitter, the flex sensors are connected to analog channels(AD0-AD4) in PIC microcontroller and RF transmitter connected to Port B(RB0- RB7). Each pin transmits different sign language signal.

Figure 4 Hardware Setup of the System Receiver module contains PIC microcontroller,RF Receiver and APR9600. The RF Receiver connected to PORT B(RB0-RB7) in PIC Microcontroller, received signal depends upon the sign to enable the Pin of PORT B. APR9600 is connected to PORT D (RD0-RD7) and plays recorded voice depends upon the RF enable pin. Fig. 8. Simulation output for Gunasegaram. K *et al*. / International Journal of Engineering and Technology (IJET) ISSN : 0975-4024 Vole 5 No 2 Apr-May 2013 1026

In the proposed system Fig. 6 and Fig. 7 there exist an two state transmitter and receiver in transmitter flex sensor as input as used to convert analog to digital conversion signal producing the micro controller to fetch in power supply conversion signal value display in lcd display signals to convert encoding then transmitting then RF signal in receiver RF frequency as input as using decoding the signal producing the microcontroller processing an voice will produce in speaker.

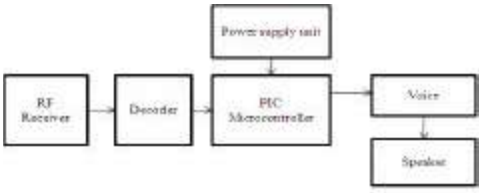
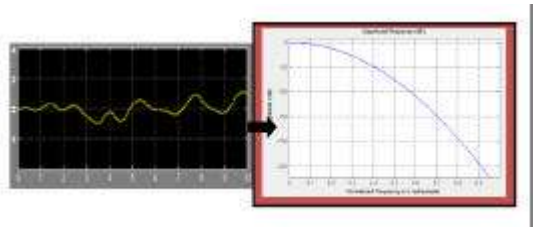
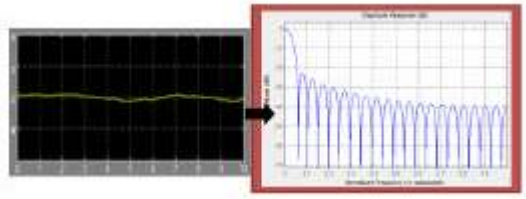


Fig.7: Block diagram of receiver

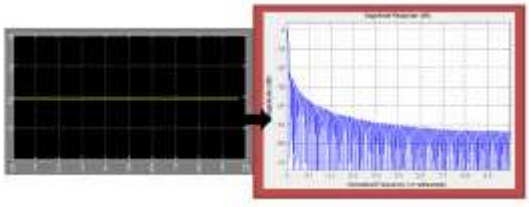
Finger Signal with Gaussian Filtering: To ensure the smooth transmission of signals during the process of finger bending, the used of Gaussian Filtering is very important to add in the system. Figure 8 shows the application of finger signal with Gaussian filtering, whereas the grasping of Glove MAP was analyzed. The signal appeared was much better and the waveform are very smooth. By using the Gaussian filtering all noise that appeared can be eliminated.



(a)



(b)

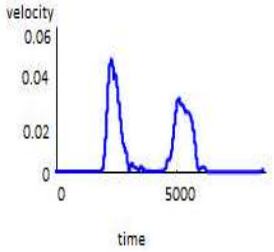


(c)

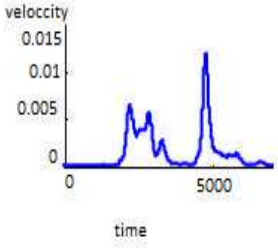
Fig. 8: Individual Gaussian setting
(a) BT=0.5, N=10 (b) BT=0.1, N=10 (c) BT=0.1, N=50

Figure 8 as to ensure the smooth transmission of signals during the process of finger bending, the used of Gaussian Filtering is very important to add in the system. Figure 14 shows the application of finger signal with Gaussian filtering, whereas the grasping of Glove MAP was analyzed. The signal appeared was much better and the waveform are very smooth. By using the Gaussian filtering all noise that appeared can bee eliminated.

1) Segmention using data from the data glove.



(a)



(b)

Fig. 9: (a) the velocity of hand movement
(b) the sign state identified by the threshold

The segmentation method is similar to the segmentation of the motion tracker data. Figure 9(a) shows the velocity of hand generated the sign state identified by the threshold. In addition, a threshold is applied to identify the sign state; in other words, the sign state is the period that has the velocity of the hand lower than the threshold as shown in Fig. 9(c).

To identify the sign state where both hand movement and hand shape are stable, the velocity of hand=s movement from the motion tracker and the velocity of hand=s shape from the data glove are plotted together with the threshold. The overview of the proposed TFRS is shown in Fig. 7 **(Check the Figure Number)**.

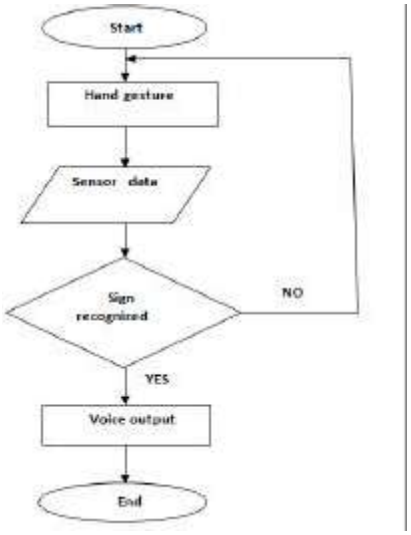


Fig. 7: System overview of the proposed FSL

RESULTS AND DISCUSSION

Output data are directly obtained from data glove and each sensors produce different resistance value through the combination of resistance value. Then the respective voice plays according to the combination of resistance value. Figure 10 shows the simulation output of the sign language translator, switches are consider flex sensors and connected to the analog voltage generator.

On the opening and closing of switch produce some analog voltage and feed to the controller. It depends upon the switch input led glow (it's similar to play s voice) at the same time virtual terminal shows the analog value.This proposed system is useful for dumb people to communicate with the normal people using their sign language.

Taking accuracy and efficiency into consideration, the prposed system is simulated using MATLAB software. System shows the hand gesture recognition technique to interact with machines. The hand gesture output is tested for various inputs. It improves the performance and makes human computer interaction more convenient.

CONCULSION

It is completely based on the time period as per the finger movements and also based on the frequency. As we decode the source file the above waveform will be obtainted. It is completely based on the time period as per the finger movements and also based on the frequency.

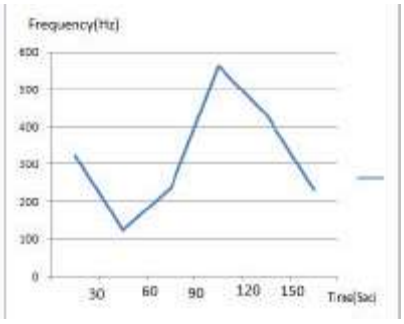


Fig. 10: Numeric simulation

The Fig. 10 shows that the variation of voice signal according to the hand movements through the flex sensor. The proposed method translates sign language to speech automatically and satisfies them by conveying thoughts on their own.The system overcomes the real time difficulties of dumb people and improves their lifestyle.

System efficiency is improved with the help of PIC microcontroller and APR9600, also integrated with RF wireless transmission is help in long distance communication.

By implementing this system speaking dream of dumb people becomes true. Compared with existing system its possible to carry to any places. We have currently developed more reliable and flexible system. Which manufacture at low cost sign language translator for commercial purpose In future work of the proposed system supporting more no of sign and Different language mode.

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