Sign Language to Speech Translation System Using PIC Microcontroller

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Abstract-The advancement in embedded system, provides a space to design and develop a sign language translator system to assist the dumb people. This paper mainly addresses to facilitate dumb person's lifestyle. Dumb people throughout the world use sign language to communicate with others, this is possible for those who has undergone special trainings. Common people also face difficult to understand the gesture language. To overcome these real time issues, this system is developed. Whenever the proposed system senses any sign language, it plays corresponding recorded voice. This reduces the communication gap between dumb and ordinary people. This proposed model consist of four modules, they are sensing unit, processing unit, voice storage unit and wireless communication unit. It is achieved by integrating flux sensor and APR9600 with PIC16F877A. The flux sensors are placed in gloves, which respond to gesture. By using suitable circuit response of the sensor is given to the microcontroller based on the response microcontroller plays the recorded voice using APR9600. A snapshot of the entire system, advantage over existing methods and simulation output of the process is discussed in this work. This system offers high reliability and fast response. This method is more precise on hand movement and different languages can be installed without altering the code in PIC microcontroller.

Keyword: Flux sensor, APR9600, Bluetooth, PIC Microcontroller

I. INTRODUCTION

Nowadays 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. 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 Myogram (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.

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.
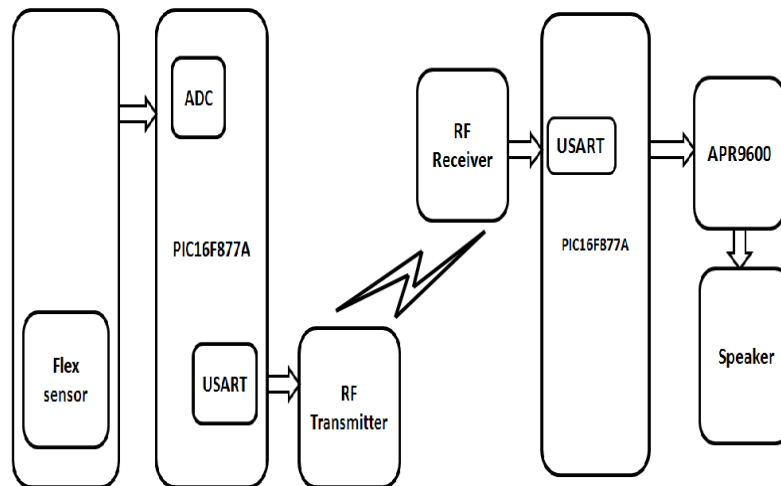
II. PROPOSED SYSTEM

Fig 1. Block Diagram of SLT

A. *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 contain 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. 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.

B. *Hardware setup*

Figure (2) shows the hardware model of automatic sign language translator which consists of 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.

Fig 2. 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.

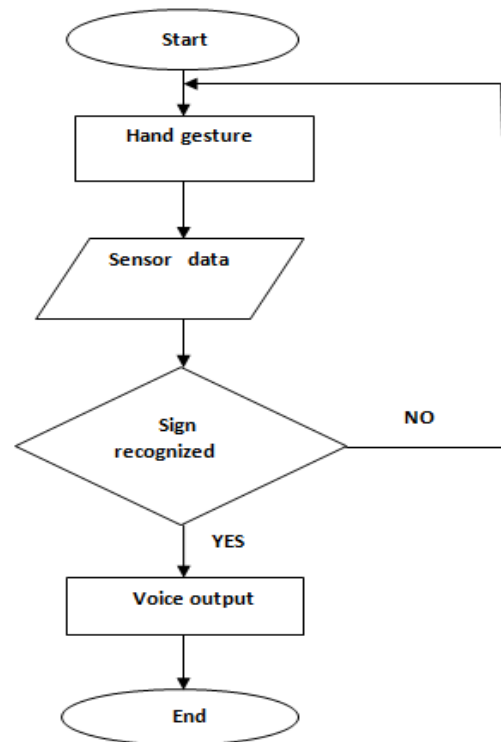Fig 3. Simulation output for SLT

III. SYSTEM FLOW

Fig 4. Flow chart of system execution

IV. RESULT AND DISSCUSION

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 (3) 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

V. CONCULSION AND FUTURE WORK

The proposed method translates sign language to speech automatically and satisfy them by conveying thoughts on their own. The system overcomes the real time difficulties of dumb people and improve 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

VI. ACKNOWLEDGEMENT

VII. REFERENCES

[1] P. Buehler and M. Everingham, "Upper body detection and tracking in extended signing sequences.International Journal of Computer Vision", vol. 95, 180-197, 2011
[2] Oya Aran.B.S and in CmpE.M.S, in CmpE."VISION BASED SIGN LANGUAGE RECOGNITION:MODELING AND RECOGNIZING SOLATED SIGNS WITH MANUAL AND NON-MANUAL COMPONENTS".Graduate Program in Computer Engineering.Bo¸gazi»ci University.1-169,2008
[3] Steven Douglas Collins. May,"ADVERBIAL MORPHEMES IN TACTILE AMERICAN SIGN LANGUAGE. GRADUATE COLLEGE OF UNION INSTITUTE AND UNIVERSITY".1-131,2004
[4] Supawadee Saengsri and Vit Niennattrakul,"Thai Finger-Spelling Sign Language Recognition System".IEEE.457-462, 2012
[5] Rini Akmeliawatil, Melanie PO-Leen Ooi et al,"Real-Time Malaysian Sign Language Translation using Color Segmentation and Neural Network. Instrumentation and Measurement Technology Conference Warsaw", Poland.IEEE.1-6,2007
[6] Yang quan,"Chinese Sign Language Recognition Based On Video Sequence Appearance Modeling",IEEE.1537-1542,2010

[7] Wen Gao and Gaolin Fanga,"A Chinese sign language recognition system based on SOFM/SRN/HMM. Journal of Pattern Recognition".2389-2402,2004

[8] Nicholas Born.,"Senior Project Sign Language Glove", ELECTRICAL ENGINEERING DEPARTMENT. California Polytechnic State University,1-49,2010

[9] Kirsten Ellis and Jan Carlo Barca."Exploring Sensor Gloves for Teaching Children Sign Language. Advances in Human-Computer Interaction".1-8.,2012

[10] Yun Li, , Xiang Chen et al,"Sign-Component-Based Framework for Chinese Sign Language Recognition Using Accelerometer and sEMG Data",IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING, VOL. 59, NO. 10,2695-2704, 2012