ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 4, Issue 5, May 2015

Talking Glove- A Boon for the Deaf, Dumb and Physically Challenged

Sruthi Dinesh

***Abstract*— The paper describes an aiding device for the deaf, dumb and physically challenged people .Such people are made to wear gloves fitted with flex sensors whose resistance change with each gesture shown by them. This produces a voltage change and the PIC microcontroller will display the codes corresponding to each gesture on LCD and the sound code is heard via speaker. Also this device helps to control on-off of devices like fan, bulb etc. by means of RF transmitters and receivers. A wireless camera fitted near the door enables image recognition and automatic control of door opening. The system can also send an sms to a prestored mobile number via GSM modem in case of an emergency.**

***Index Terms*—Flex sensor, gesture, glove, sign language**

I. INTRODUCTION

Deaf and dumb people normally communicate by means of sign-language. A gesture in a sign language, is a particular movement of the hands with a specific shape made out of them. Gesture recognition is classified into two main categories, that is vision based and sensor based. The disadvantage of vision based techniques includes complex algorithms for data processing and requirement of more computing power. But glove-based gesture recognition is simple and user-friendly.

The device described in this paper which converts hand gestures to sound codes and also controls the working of devices like door, fan, bulb etc. will be a great blessing for such people and the physically challenged ones, reducing the communication gap between the deaf-dumb community and the normal world. It is a low cost, compact, flexible system and only takes less power to operate.

II. LITERATURE SURVEY

A. Glove-based systems [1]

Glove-system is composed of an array of sensors, electronics for data acquisition or processing ,power supply and a support for the sensors that can be worn on the user's hand. Sayre glove, LED glove, data gloves (used here) and cybergloves are the different types of gloves used. Gesture-based applications of glove systems involves extraction and classification of features to automatically understand gestural languages used by the deaf community.

B. GloveTalkII

Neural networks [2] were used to implement an adaptive interface, called GloveTalkII, which maps hand gestures to control the parameters of a parallel formant speech synthesizer to allow a user to speak with his hands. It is used to implement an artificial vocal tract.

C. Real-time gesture recognition [3]

A prototype system [3] has been implemented with a lexicon of 250 vocabularies in Taiwanese Sign Language (TWL). On detecting the beginning of posture holding, the system extracts features, including position, orientation, and posture, and also starts tracking motion trajectory.

D. Thai finger spelling sign language recognition system (TFRS) [4]

TFRS receives data from a data glove and a motion tracker, where the data glove provides signals of flexures of each finger and abductions between fingers, and the motion tracker provides signals of positions and orientations.

E. American sign-language interpreter [5]

When the user makes a hand gesture, the binary values of fingers were checked for 5 times and if they matched, then the microcontroller indicated the gesture as valid and perfect match and dislayed the corresponding codes on LCD.

III. WORKING OF THE SYSTEM

Flex sensors are attached to gloves which can be easily handled by a deaf or dumb person. There will be change in resistance values and thereby, output voltage of flex sensors corresponding to different gestures. Analog voltage is converted to digital value by in-built ADC of PIC 16f877a. PIC finds the code corresponding to the digital voltage from program stored in its flash memory. The code is displayed on LCD connected to its port D. When speech IC connected to port B gets trigger from PIC, it plays back the voice tags stored in it corresponding to the codeword. The sound code is amplified and heard via the speaker. When emergency situation is indicated by the user through a gesture, PIC sends sms to a prestored mobile no. using GSM modem and also reproduces voice tag. PIC operates the devices connected to its relays like fan, bulb etc. and also determines the door lock control when user indicates it through a gesture after obtaining the captured camera images on the receiver side.

Sruthi Dinesh, *Mtech Digital Electronics, Kannur University, Malabar Institute of Technology, Anjarakkandy, Kannur, Kerala, India.*

IV. SYSTEM BLOCK DIAGRAM

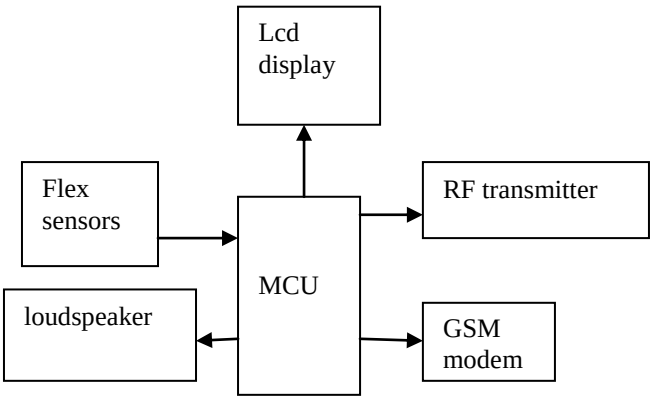

Fig. 1. Block diagram of transmitter side

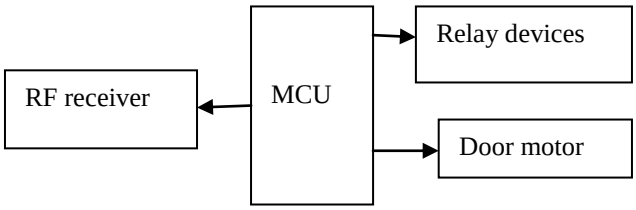

Fig. 2. Block diagram of receiver side

V. HARDWARE DETAILS

A. *Flex sensors*

Fig. 3. Flex sensor

Gloves worn by the deaf and dumb people are fitted with flex sensors made of resistive carbon elements. Resistance of these flex sensors change with change in the degree of bending. As they are interfaced to the PIC microcontroller via a voltage divider circuit, the change in resistance produces a corresponding change in analog voltage.

B. *PIC 16f877a*

The output of flex sensors is given to the PIC input. The inbuilt analog-to-digital converter of PIC 16f877a will convert the analog voltage from flex sensors to digital voltage. The flash memory of PIC is programmed in such a way that there is a code corresponding to each of the digital value generated by the ADC.

C. *16 x 2 LCD*

Port D lines of the PIC are connected to data lines of the LCD so that when a gesture is shown, corresponding ASCII codes of letters,numbers or words are sent by the PIC to display them on the LCD module.

D. *Speech module and Loudspeaker*

APR89341 one-time programmable speech IC is used here so that speech codes corresponding to each gesture can be initially recorded and later played back when it gets a trigger signal from the PIC. Port B pins of the PIC are connected to s1 to s8 pins of the PIC which serve as address bits to address the memory location corresponding to each code.Output of speech IC is given to sound amplifier LM386 and is heard via the speaker.

E. *GSM modem*

The purpose of GSM modem is to send message to the prestored mobile number when the emergency switch is pressed.The modem is interfaced to the PIC via MAX232 IC which can convert between TTL and RS232 voltage levels.

F. *RF encoder and transmitter*

RF encoder ST3654 receives data input from the PIC as per the gesture and converts it into coded form before giving it to 2.4 Ghz RF transmitter which transmits the signal.

G. *RF receiver and decoder*

2.4 Ghz RF receiver receives the transmitted signal and gives it to RF decoder ST3654 which recovers the original data.

H. *PIC 16F873*

It is a 28-pin device with program memory capacity of 4 kb which can be programmed to control the operation of devices, camera and door lock.

I. *Relays and Relay-driver circuits*

According to gesture shown, devices connected to the 12 volt relays can be switched on or off. Relays are interfaced to the PIC through a relay driver circuit ULN2803 which is a current amplifier and works on Darlington emitter configuration.

J. *Wireless Camera*

It is fixed near front door, captures images from outside area. Received signal from video receiver is given to the monitor.

K. *Door motor and Driving Circuitry*

PIC receives data regarding door lock control and initiates opening or closing of the door via motor driver circuit L293D which is an H-bridge circuitry.

VI. SOFTWARE DETAILS

A. *MPLAB IDE*

The software used for programming PIC 16F877A is Embedded C in MPLAB IDE. Codes corresponding to various gestures and actions in case of emergency and actions for device control are programmed in the PIC.

B. OTP Programmer and System Development Software

The OTP Programmer and System Development Software is designed to support Aplus' aP89 series Voice OTP chips.

Goldwave software can be used to open a sound file, then followed by cut, paste and other commands, sound can be edited. When finished editing, use the "save as" command to convert the sound into wav, mono 8 bit format. The Compiler is used to combine edited voice files into the chip to form the desired voice groups .Voice data and user selectable options must be set up and combined together to form a DPM file before it can be programmed into the Voice OTP device. After finishing DPM file generation, OTP device can be programmed. The"Write" tab is clicked to enter the OTP programming section. **"**Load File**"** option loads the DPM file into the speech IC.

VII. ALGORITHM

Step 1: Start
Step 2: Initialise ports, memory locations, LCD, ADC, serial communication and GSM modem.
Step 3: Select ADC channels for the 6 flex sensors.
Step 4: Check whether the code is for speech reproduction. If yes, go to step 5, else go to step 6
Step 5: Find the code for the voice tags corresponding to voltage of sensor output, trigger speech IC to playback already recorded speech codes.
Step 6: Check whether the code is for data transmission.
Step 7: Check whether the code is for device1 to be on. If yes, send serial data to switch on device1.Else go to step 8.
Step 8: Check whether the code is for device2 to be on. If yes, send serial data to switch on device2.Else go to step 9.
Step 9: Check whether the code is for camera to be on. If yes, go to step 10.
Step 10: Check whether the code is for door to be open. If yes, send code to the PIC to operate motor. If no, go to step 11.
Step 12: Check whether the code is for emergency. If yes, send emergency message to prestored mobile number via modem.
Step 13: Stop.

VIII. RESULTS AND DISCUSSION

The device has been successfully tested.
It was found that for 4.5" flex sensors used, resistance was around 7.5 kiloohms when straight and around 20 kiloohms when fully bent. Voltage output of flex sensors was found to be linearly proportional to resistance.

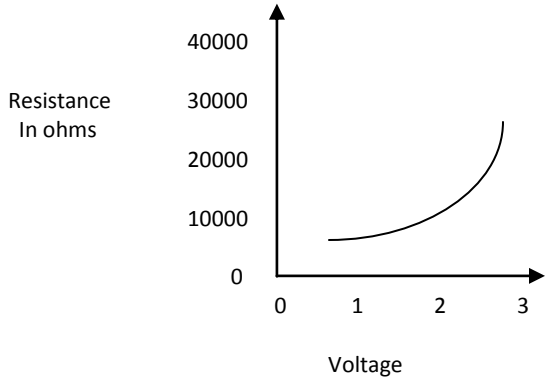

Fig. 4. Resistance of flex sensors versus analog output voltage

6 flex sensors used can produce 64 binary combinations of gestures.Binary codes for 1 to 26 represented alphabets A to Z, that for 27 to 36 represented numbers 0 to 9 .Remaining binary codes were used to represent certain important words, emergency codes, code to switch on or off the devices connected to relays, code to operate wireless camera, opening and closing of door motor etc. Sound codes could be heard instantaneously once the gestures were shown.

IX. CONCLUSION

"Talking glove" will indeed be a dream come true for the millions of deaf, dumb and physically challenged people in this world. The device can also produce words by concatenation of letters. It can be enhanced to include two or more accelerometers to translate larger gestures. In future it can be used in applications like remote handling, smooth traffic control and for rehabilitation of patients affected by trauma.

ACKNOWLEDGMENT

I wish to thank our Principal Dr. S .K. Masud Hossain ,Head of the Department, Prof. Jacob Zachariah, our co-ordinator Asst. Prof. Sreetha Sreedhar and my guide Asst. Prof .Shruti.K. for their valuable advice and technical assistance.

REFERENCES

[1] Laura Dipietro, Angelo M. Sabatini, Senior Member, IEEE, and Paolo Dario, Fellow, IEEE, "A Survey of Glove-based Systems and their Applications",*IEEE Transactions on Systems, Man and Cybernetics,-Part C: Applications and Reviews, Vol.38, No.4, July 2008*

[2] S.Sidney Fels and Geoffrey E. Hinton,"Glove-TalkII- A Neural-Network Interface which maps gestures to parallel formant Speech Synthesizer Controls" *IEEE Transactions on Neural Networks, Vol.9,No.1, January 1998*

[3] Rung-Huei Liang , Ming Ouhyoung ,"A Real-time Continuous Ges ture Recognition System for Sign Language**" ,***IEEE International Conference on Automatic Face and Gesture Recognition, pp 558-567, Japan 1998*

[4] Supawadee Saengsri, Vit Niennattrakul, and Chotirat Ann Ratana mahatana, "TFRS: Thai Finger-Spelling Sing Language Recognition System" , *2012 March, IEEE, pp: 457- 462, 2012.*

[5] Kunal Kadam, Rucha Ganu, Ankita Bhosekar, Prof.S.d.Joshi, "American Sign Language Interpreter", *2012 July ,IEEE Fourth International Conference on Technology for Education*

[6] Michela Borghetti, Emilio Sardini, and Mauro Serpelloni, "Sensorized Glove for Measuring Hand Finger Flexion for Rehabilitation Purposes", *IEEE Transactions On Instrumentation And Measurement, Vol. 62, No. 12, December 2013*

[7]. Anbarasi Rajamohan, Hemavathy R., Dhanalakshmi M.," Deaf-Mute Communication Interpreter"**,** *International Journal of Scientific Engineering and Technology (ISSN : 2277-1581) Volume 2 Issue 5, pp : 336-341 1 May 2013 IJSET@2013 Page 336*

[8] Syed Faiz Ahmed, Syed Muhammad Baber Ali, Sh. Saqib and Munawwar Qureshi, "Electronic Speaking Glove for Speechless Patients: A Tongue to a Dumb " , *Proceedings of the 2010, IEEE Conference on Sustainable Utilization and Development in Engineering and Technology,*

[9] Neha V. Tavari , Prof. A. V. Deorankar , Dr. P. N. Chatur, "Hand Gesture Recognition of Indian Sign Language to aid Physically impaired People**",** *International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622*

[10] Ambika Gujrati, Kartigya Singh, Khushboo, Lovika Soral, Mrs. Ambikapathy, "Hand-talk Gloves with Flex Sensor"*International Journal of Engineering Science Invention ISSN ,pp 43-46.*

Sruthi Dinesh is currently pursuing masters degree program in Digital Electronics from Kannur University, Malabar Institute of Technology,Kerala,India , PH-+919995025885
E-mail: sruthidinesh11@gmail.com