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Talking Hand Glove for the Disabled

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Abstract: As humans we are blessed with a 'Boon of speaking' as a medium of communication with each other. Unfortunately, few humans are born with the disability in speaking and finds it difficult to communicate in the society. In olden days, Sign language was the most common way used by the disabled for communication. It is often very difficult for a normal human being to understand the sign language or the gestures made by the disabled. In recent years as technology grew many researches have been made in this context and to make communication much easier and reliable. Our paper presents a system consisting of Accelerometer sensors to record gestures, Micro controller- Arduino Lily Pad, a micro controller designed to suit fabrics like gloves and also a Speech Synthesizer module-TTS256 chip which converts text into speech.
Keywords: Speaking, Communication, Gestures, Accelerometer, Micro controller, TTS256 Chip.

I. INTRODUCTION

The most common way of expressing or communicating between two individuals is by Speech. Over the years, there has been rapid increase in the count of people with speech disability either due to birth defects or accidents. Earlier, before the advancement in the fields of Science and Technology people with speech disability used Sign Language to communicate with normal people. Sign Language basically comprised of gestures, hand movements and finger indications as shown in Figure 1. But these sign languages created a communication barrier between the disabled and normal person as they couldn't understand the signs. This created a need for a system which could effectively reduce the communication barrier and help the disabled in the society to communicate with ease.

As technology grew researchers came up with unique ideas to reduce this barrier of which the most commonly used method was converting hand gestures of the disabled into text format so that the normal person could read and understand.

Our system TALKING HANDGLOVE is a societal project consisting of a hand glove which is worn by the disabled. The system uses Internet of Things (IoT) which is one of the trending technologies in the world now. With the help of the IoT it is possible to transfer data from one region to another over the network without human or computer intervention. IoT consists of sensors, which collect the data from the surrounding they are placed in. This hand glove is attached with Accelerometer sensors which detects the change in coordinates due to gestures or bending fingers, which is then sent to a micro controller for processing the gestures into 8-bit data and decode this data into equivalent text and display on an LCD screen. The most interesting feature of our system is the use of a Speech Synthesizer module which converts the 8-bit data received from the micro controller corresponding to each gesture into sound or voice.

Thus, our system reduces the communication barrier between the disabled and normal human significantly and helps the disabled lead a happier life in the society.
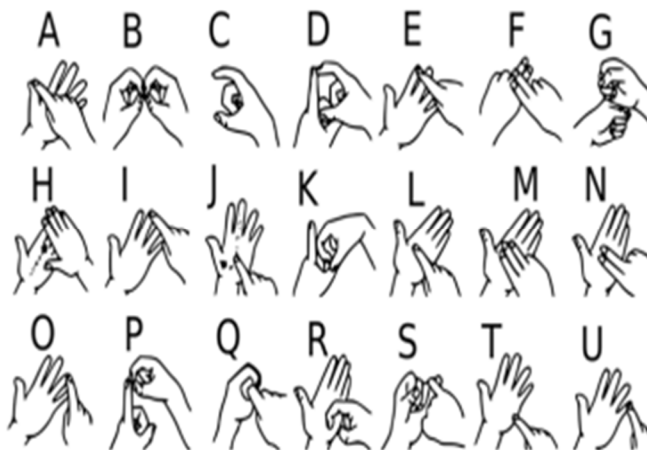

Figure 1. Sign language

II. EXISTING SYSTEM

The existing system uses Flex Sensors as shown in figure 2 to detect the hand gestures. The system consists of two sections namely

A. Transmitter section
B. Receiver section

The Transmitter section consists of a hand glove with 5 flex sensors attached to them, micro controller and RF Transmitter. The Receiver section consists of RF receiver, micro controller and an LCD. This hand glove is worn by the disabled and perform gestures, these gestures and recorded by the flex sensors mounted on them. The output of flex sensors depends on the bend angle and variation in resistance. This output is passed on to Analog to digital converter (ADC) channels of the micro controller. The output of ADC converter is compared with the predefined values for each gesture. The corresponding gesture is recognized by the micro controller and transmitted to an LCD screen using RF receiver.
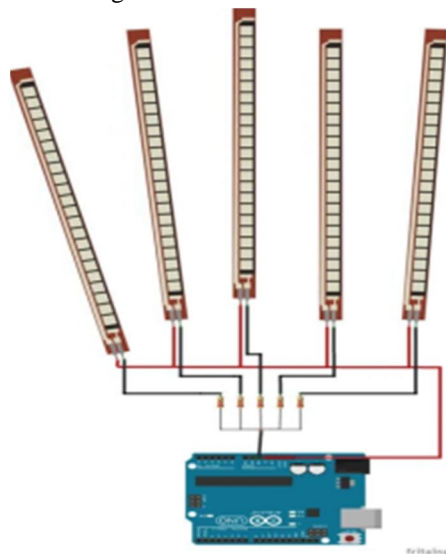
Figure 2. Flex sensors

III. PROPOSED SYSTEM

The proposed system TALKING HANDGLOVE uses Accelerometer sensors instead of Flex sensors to detect hand gestures. The block diagram of our system is shown in figure 3. The system consists of the following blocks:
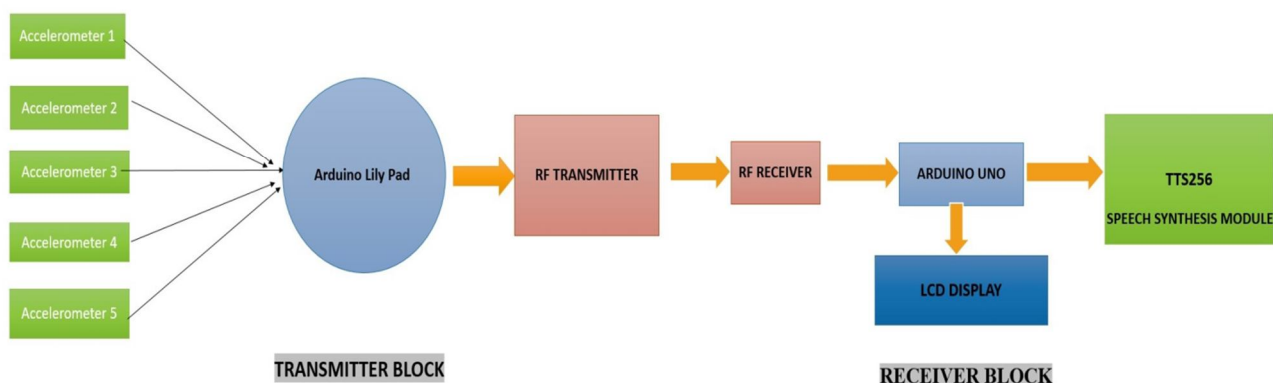
1) Transmitter block
2) Receiver block

Figure 3. Block diagram of talking hand glove

The Transmitter block consists of Hand glove, accelerometer sensors, Arduino Lily Pad.

A. Hand Glove
This is a fabric glove worn by the disabled.

B. Accelerometer Sensors
The sensors used in our system is ADXL335 which is Lily Pad compatible sensors shown in figure 4.These sensors are thin, low power, have good temperature stability and measure 4mm x 4mm x 1.45mm in size. The sensors are used in the glove as they detect gesture based on the change in coordinates along all 3-axis namely X-axis, Y-axis, Z-axis.
Accelerometer sensors can be used in various applications like motion and tilt-sensing applications, Gaming applications, health and sports devices etc.

Figure 4 ADXL335 Accelerometer Sensor

C. Arduino Lily Pad
Arduino Lily Pad is a micro controller designed for wearable devices and e-textiles as shown in figure 5. The micro controller processes the data received from the sensors and converts them into digital form ie, 8-bit data corresponding to each gesture which is then transferred to the receiver part along the RF transmitter.
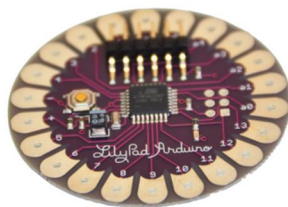

Figure 5. Arduino lily pad

The Receiver block consists of Arduino UNO, Speech Synthesizer module , LCD screen and Speaker.

D. Arduino UNO
It is a Micro controller shown in figure 6 used to process the data receiver from RF receiver. The micro controller compares the 8-bit data with the predefined values for each gesture loaded into it. It then transfers this compared value for the gesture to the speech synthesizer module.
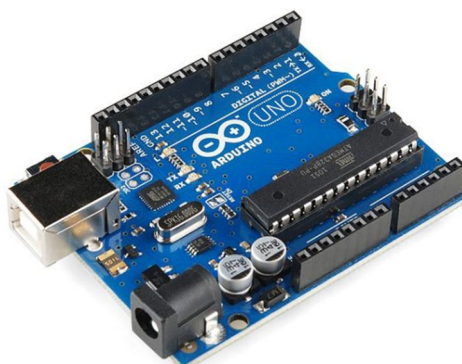

Figure 6 Arduino Uno

E. Speech Synthesizer Module

This module is used to provide voice to each gesture identified by the micro controller. This module uses Text to speech chipset-TTS256 as shown in figure 7. This chip set is an 8-bit microprocessor programmed with a built-in algorithm which performs automatic real-time translation of English ASCII characters into allophonic addresses. These allophonic addresses are compatible with the Magnetic Speak Jet Speech Synthesizer IC.
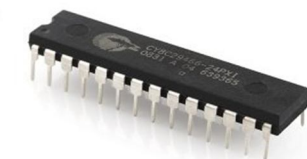

Figure 7. Tts256 IC chip

F. LCD Screen

This is used to display the text corresponding to each gesture. The text corresponds to the output received from the micro controller as shown in figure 8.
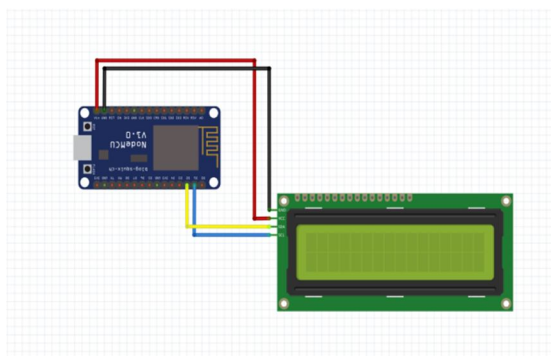

Figure 8. Lcd screen

G. Speaker

The output of TTS256 is connected to the speaker. This module is used for audio amplification and output the audio received to the normal people.

IV. ADVANTAGES OF THE PROPOSED SYSTEM OVER EXISTING SYSTEM

A. The system is compact as Arduino Lily Pad is designed to suit e-textiles.

B. The system identifies gestures at a faster rate compared to existing system with the use of 3-axis accelerometer sensors.

C. TTS256 uses a built-in algorithm to produce speech from text and supports two languages English and Chinese.

D. The system supports wireless approach making it more portable.

V. CONCLUSION

Our system TALKING HAND GLOVE provides a simple design for communication between the disabled people and normal people shown in figure 9.

The summary of the paper is as follows:

A. More compatible and portable design.

B. Quicker response time of 2-3 minutes.

C. Effectively reduces the communication barrier between the disabled people and normal people.

D. This project can be used to control other applications like Television, Computer, home appliances etc.

Figure 9. Pictorial representation of hand glove

VI. FUTURE ENHANCEMENTS

A. A mobile application can be designed to control the system remotely and make is user friendly.

B. Wireless technology such as Zigbee can be used instead of RF Transmitter and RF Receiver.

C. GSM module can be combined with this system to assist in times of emergency.

D. On the same lines, a fabric jacket to record the movement and gestures of animals can be developed.

E. This system can be developed for virtual reality games to replace input devices like joysticks.

VII. ACKNOWLEDGEMENT

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