TWO WAY SIGN LANGUAGE COMMUNICATION USING SMART GLOVE

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ABSTRACT: Communication is the only medium by which we can share our thoughts or convey the message but for a person with disability (deaf and dumb) faces difficulty in communication with normal person. Because of this, a person who lacks in hearing and speaking ability is not able to stand in race with normal person. Generally, dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. So, there is a barrier in communication between these two communities. The main aim of the project is to provide a solution to these deaf and dumb people by creating an automation system that can work in two way communication such that sign can be converted to speech with the help of flex sensors as well as the speech can be converted to text using the Bluetooth module. With the help a smart gloves, disabled person can also get chance to grow in their respective carrier.

1 Introduction

India constitutes 2.4 million of deaf and dumb population, which holds the world's 20% of the deaf and dumb population. These persons lack the amenities which a normal person should own. The big reason behind this is lack of communication as deaf people are unable to listen and dumb people are unable to speak.

The disability of Deaf And Dump People (DDP) will stop them from communication with the normal people. This causes a decrease in ratio of literate and employed. When there is no common language to communicate with any two person, there comes a need of translator which may not be always convenient to arrange and this same kind of problem will occur in between the normal person and the deaf person or the normal person and the dumb person [2-4].

To overcome this problem an unique application is introduced. It translates normal person's sentences text format or sign language according to the disability of the opponent i.e., deaf or dumb. The action of our application is it can convert the text format or sign language by the disable people into audio output for normal people. It helps to remove the communication gap between them. This will help normal and DDP communities by removing the communication gap between them [5-8].

The sign language is an important and only method of communication for deaf-dumb persons. Sign language is a formal language employing a system of hand gesture for communication (by the deaf). Sign language symbol is shown in fig.1 [9]. In this project, flex sensor plays a major role, which are placed on the fingers, as fingers bends it changes the resistance depending on the amount of bending on the sensor [11].

Fig. 1 Sign Language Symbols

II. PROBLEM FORMULATION

The main aim of the proposed project is to develop a cost effective system which can give voice to voiceless person with the help of smart gloves. Using smart glove by the deaf person, can enable them to communicate with others which also helps to bridge the gap between person with disability and normal person.

Problems faced by the deaf person regarding employment can be overcome by this method. So in the proposed work an intelligent microcontroller based system using Flex sensors is developed which will be able to:

- To develop a microcontroller based cost effective system to recognize gesture and convert into coded form so that it can be displayed. If the code matches with predefined codes.

- Normal person can also communicate by using voice to text application (Bluetooth Transceiver).

The wireless arrangement makes the device more comfortable to be used by the disabled person. Wireless transmission and reception of signals are done with the help of Bluetooth transceiver.

III. BLOCK DIAGRAM

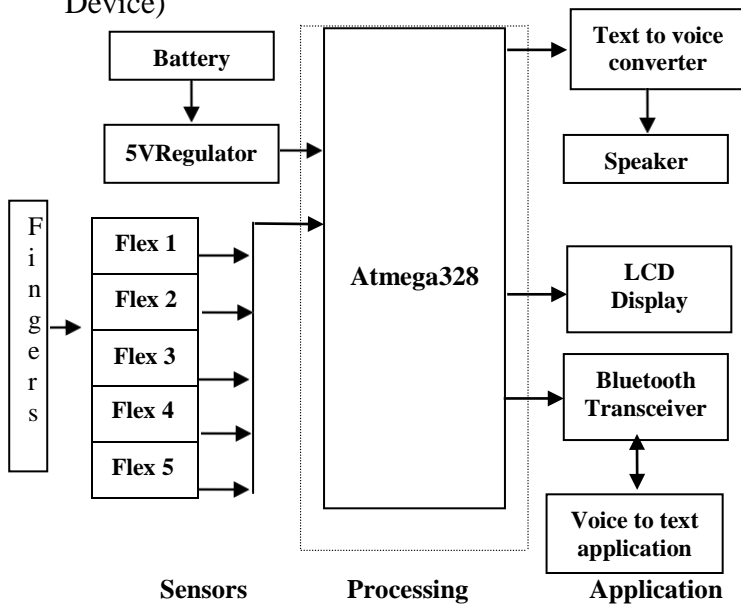For Transceiver section using smart Gloves (Wearable Device)

Fig. 2 Overview of two way sign language communication system that consists of three modules, namely sensors module, processing module and application module.

Hardware Design and System Flow

This study aims at the development of a two way sign language communication system by analyzing hand and finger gestures from a smart wearable device shown in the fig. 2. The wearable device is designed in order to hold the hardware components and it is flexible with good elasticity. A smart glove consists of three modules, A. sensor module, B. Processing module, C. application module.

Smart gloves is implemented to capture the hand gestures of a user. Gloves are aimed to convert gesture into voice. Smart gloves having sensors will captures the hand movement of user and converts analog input (sign language) into digital output (voice and text) utilizing voltage divider rule. Then, the hand movement is given to microcontroller for further processing.

Recognized gestures are matched with pre-defined data and if it matches gesture is converted into its equivalent text or voice. Also, text is displayed by using LCD display. Bluetooth transceiver act as, a RF transmitter and receiver for two way communication and home appliance control.

A. Sensor Module

The gesture manager is the principle part of the recognition system. It contains data to match with incoming data. The system tries to match incoming data with existing posture.

The bend values of the fingers and for each posture definition, the distance to the current data is calculated. Then, the position orientation data is compared in a likewise manner [26-29].

Signed letters are determined using flex sensor on each finger. The flex sensors change their resistance based on the amount of bent in the sensor as shown in fig. 3 [12]. As a variable printed resistor, the flex sensor achieves great form-factor on a thin flexible substrate. When a sensor placed in a gloves is bent, it produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value. They require a 5V input and output between 0 and 5V. The sensors are connected to the device via three pin connectors (ground, live, and output) . In this device sensors are activated in sleep mode. It enables them to power down mode when not in use.[13-14].
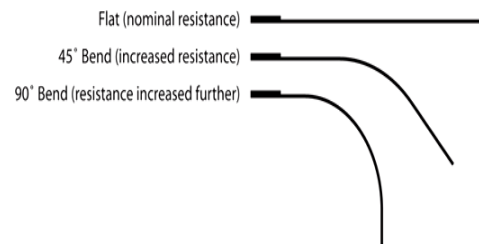

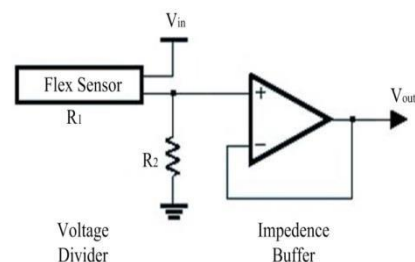Fig. 3 Flex Sensor Offers Variable Resistance Reading

Fig. 4 Basic Flex Circuit

Fig.4 shows the circuit of basic flex sensor which consist of two or three sensors. The output from the flex sensors are given as input to op-amp and used a non-inverted style setup to amplify their voltage [16].

The greater the degree of bending, the lower is the output voltage. By voltage divider rule, output voltage is determined and given by Vout = Vin *R1 / (R1 + R2), where R1 is the other input resistor to the non-inverting terminal.

B. Processing Module

Microcontroller is the heart of the device. It stores the required data and make use of if whenever the person uses the device. This device helps deaf and dumb person to announce their requirement. By this, the person who is near can understand their need and help them.

All output signals generated from flex sensors are in analog form and these signals need to be digitized before they can be transmitted to encoder. Therefore, microcontroller Atmega328 is used as the main controller. It has inbuilt ADC module, which digitizes all analogue signals from the sensor and inbuilt multiplexer for sensor signal selection.

Feature extractor in processing is used to extract the accurate data from the flex sensor. Hand gesture recognition serves as a key for overcoming many difficulties and providing convenience for human life. It supports both serial and parallel communication facilities [22].

C. Application Module

After gesture recognition system, data is sent to voice section. The text to voice converter module is shown in fig.5. In this, data is matched with pre-defined data. If the data is matched with pre-defined data then it is given to the speaker and display system [30-31].

Fig. 5 Text to voice Converter Module

Bluetooth Transceiver

HC05 module is an easy to use bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. It is used as transceiver for data exchange and home automation purpose by using microcontroller Atmega 328 shown in fig. 7. In this, data is matched with pre-defined data. If the data is matched with pre-defined data then it send input to the relay with driver circuit to turn on the load like light, fan, etc,..
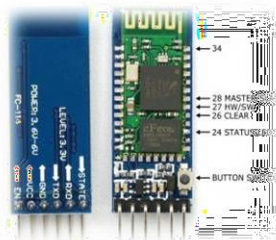

Fig. 6 Bluetooth Module

Voice To Text Application

Voice-to-text application is a type of software that effectively takes audio content and transcribes it into written words in a word processor or other display destination.

This type of speech recognition software is extremely valuable to anyone who needs to generate a lot of written content without a lot of manual typing. It is also useful for deaf and dump people for whom the keyboard usage is difficult. Speech-to-text software may also be known as voice recognition software.
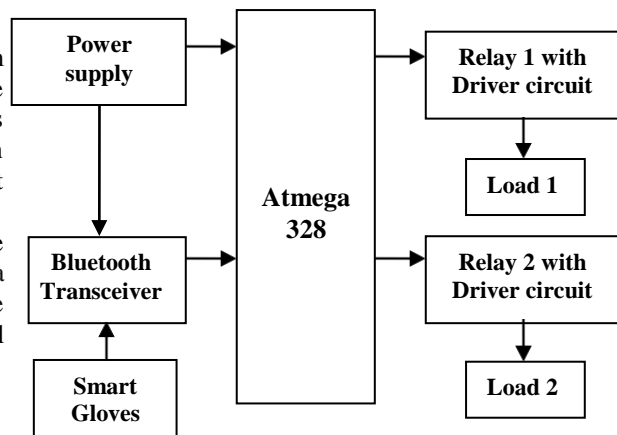
IV. BLOCK DIAGRAM FOR HOME AUTOMATION

Fig. 7 For Receiver section (Home automation)

The data from the smart gloves (wearable device) is transmitted to Atmega 328 by using the bluetooth transceiver. If the data from the bluetooth transceiver matched with pre-defined data the controller will send the input to the relay with driver circuit to turn on the load like light, fan, etc,.. A relay is an electrically operated switch. The data from the RF transmitter section is received by RF receiver section by using the Bluetooth module. If the data is match with pre-defined data then the microcontroller Atmega328 send the data to relay with driver circuit

VII. RESULT AND DISCUSSION

- Deaf and dump people use these gloves to convert sign performed by them into speech.

- From the convenience of simple flex sensors, a user is able to interact with others in more comfortable and easier manner.

- This makes it possible for the user to not only interact with their community but with others and they can also lead a normal life.

- The end product will have a cheap and simple design making it easy for users to interact with.

CONCLUSION

In this study, we successfully designed and implemented a two way sign language communication using smart gloves system. Sign language is a method used for communication by disabled person. Here we are converting sign language into text and speech so that communication is not limited between them only, utilizing data gloves communication barrier between two different communities is eliminated.

Using data gloves, disabled person can also grow in their carrier and makes nation grow as percentage of disabled person are millions in count. However, despite of all the progress discussed in this paper, this system still requires further improvements, in order to get practically implemented. In future, by using nano technology the device can be more compact for the user.

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