SIGN LANGUAGE INTERPRETOR FOR LETTERS AND DIGITS USING AN ELECTRONIC GLOVE

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ABSTRACT

Sensors play an important role in robotics. Sensors detect change and are used to determine the current state of the system. The flex sensors used in the proposed solution can efficiently identify the bending angle of each of the five fingers. This data can be processed by a microcontroller and used to correctly identify the respective letters and numbers. A database was created that stored the values of each of the five fingers for each if the letters.

1. INTRODUCTION

There are a large number of signers around the world without an effective means of communication. The sign language translator glove technology is an efficient means of translating sign language to a written form. Sign language is a language through which communication is possible without the means of acoustic sounds. Instead, sign language relies on sign patterns, i.e., body language, orientation and movements of the arm to facilitate understanding between people. We exploit this use of finger movement in the design of the translator glove. Here user can simply bend the fingers and spell out a word that will appear on a screen where it can be read by non-signers.

In this paper, we present a design that displays letters on an LCD screen by capturing the movement of fingers. The movement of the fingers are determine by the five flex sensors. We have pre-programmed an array that hold the respective values of the five fingers for each letter. The microcontroller will compare the readings obtained by the sensor with those stored in the database and use this information to correctly identify the letters.

Figure 01: The Sign Language Translator Glove

Background

Most of the letters will be distinguished by the flex sensors. Flex sensors are analog resistors. They act as variable resistors in a circuit, where the resistors vary with changing bending angle. Inside the flex sensor are carbon resistive elements with thin flexible substrate. More carbon means less resistance. The resistance increases as the substrate is bent.

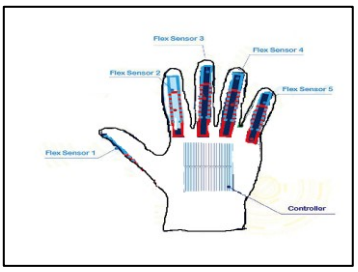

Figure 02: Sensor Arrangements of The Sign Language Translator Glove

2.DESIGN AND IMPLEMENTATION

The design will be divided in three basic units, the motion capturing unit, the control unit and the display unit.

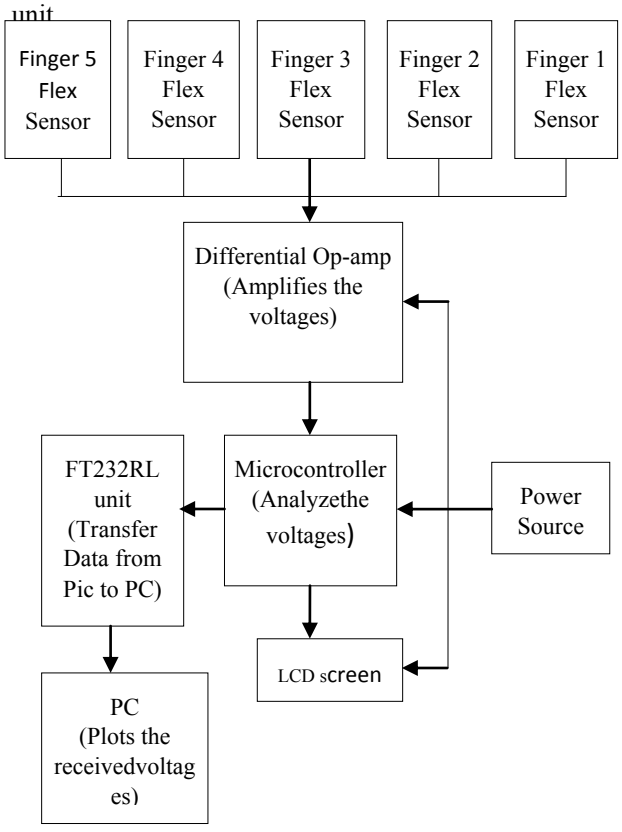

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Figure 03: Main components of the glove

Motion capturing unit

The glove is composed of a five flex sensors and a contact sensors. The five sensors 2.2'' are attached to the glove over the lower joint.
When attaching the sensor the glove elastic bands had to be used. Since the Elastic is a material which bends with the sensor and recovers to its original position in par with the sensor and does not do any damage to the sensor as well.

The contact sensors will be attached to the finger tips. Those letters that cannot be distinguished by flex sensor will be distinguished by contact sensors. The resistance of the bend sensor varies as with bending angle. It is connected as shown below via a differential amplifier circuit. This circuit helps us obtain a linear range of voltages between 0-5V depending on the bending angle.

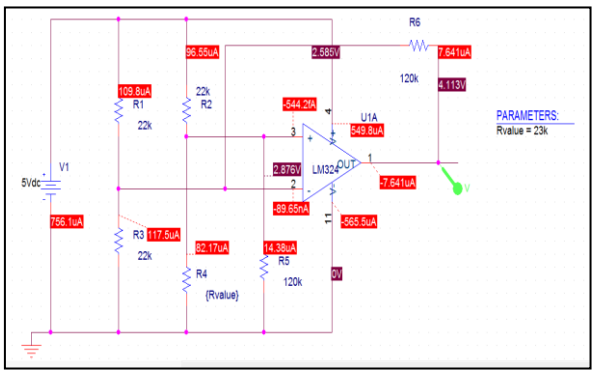

Figure 04: PSpice Simulation

Control Unit
Readings from each sensor will be obtained for a combination of a letter and cross checked with value combination that have been originally obtained. The correct match will display the letter assigned to it. The values previously obtained through trial and error are entered into an array. The program goes through the entire array and selects the best combination.

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FT232RL UNIT
This is a TTL module. Due to the unavailability of serial ports in modern laptops this module has to be used as to convert the USB port to a SERIAL port so as to transmit data between the microcontroller and the computer which was interpreted via MatLab.

2.1 Op-Amp Calculation

V= voltage reading at Vout

$$\frac{5}{22} = \left(\frac{600 + 22V}{262}\right)\left(\frac{71}{1320} + \frac{1}{R}\right)$$

$$V = \frac{1}{22}\left(\frac{78600R}{71R + 1320} - 600\right)$$

3. RESULTS

The result indicated in the graph below shows how the voltage varies with the bending of the sensor. By considering this graph the typical resistor were values were chosen so as to obtain a considerable voltage range even with a small flex in the finger.

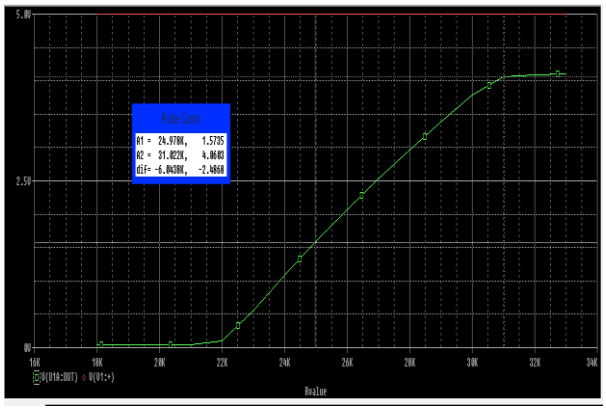

Figure 05: Graph (Resistance vs Voltage) glove

4. CONCLUSION

This device can be considered very advantageous when it comes to avoiding the barrier of sound between the signers and those who are not. Due to the usage of Flex Sensors and Op-Amps précised values can be obtained from each sign and displayed on the LCD while the voltage readings are sent to the PC to be plotted.

5. DIFFICULTIES AND SOLUTION

The sensors used for the fingers are very fragile and tend to get damaged even with a slight negligence. Apart from being expensive the sensors were not readily available in the stores. Thus they were handed carefully, soldered and wereattached carefully to the glove.

Driver Software for the TTL module for windows 8 was unavailable. Hence had to install windows 7compatibility mode and then install drivers.

6. REFERENCE

[1] Artificial Intelligence and Evolutionary Algorithms in Engineering – Volume 2edited by L Padma Suresh, Subhransu

[2] http://www.gizmag.com/enabletalk-sign-language-gloves/23268