An Electronic Glove- A Boon to the Deaf and Dumb

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Abstract

Disabled people find it very difficult to communicate with normal people as these people are trained to communicate using sign language which most of the normal people can’t understand. This project will help the disabled to communicate smoothly and convey the messages regarding their basic needs in the most efficient manner. The paper proposes an electronic glove which will be worn by the disabled person and the letter made by him will be recognized by microcontroller atmega328 which will be having an inbuilt ADC, it will compare the digital value obtained by the gesture with the pre stored values and will display the corresponding letter on the LCD screen thereby forming a word.

1. Introduction

Today we see that the dumb and deaf people find it difficult to communicate or to convey their messages about their basic needs like going to washroom, feeling hungry, want to have bath etc. The means used by them to communicate is sign language instead of sound. The paper comes up with a portable device that will ease out the communication between both the normal as well as the deaf and the dumb. The paper mainly focuses on how the signs or gestures are converted to words. The important component used is the flex sensor whose resistance changes depending on the degree of the bend. More the bend more is the resistance. The project deals with conveying messages using half sign language wherein the glove will be fitted on only one hand and not the full sign language wherein both the hands are involved for making the gesture. A sign language provides sign for entire words or for letters which can be used to form a word not having the standard sign in that sign language.

2. System Design

The Flex sensors will be fitted on the glove along the length of each fingers and one sensor will be fitted across the wrist to get more variation in values such that the letters don’t overlap. The voltage required by each flex sensor is +5v which will be provided from the controller itself. Output from flex sensors is analog voltage which will be given to atmega328 controller having a 6 channel 10 bit inbuilt ADC, this voltage will be converted to digital form. The digital value obtained will be compared with the pre stored range and letter corresponding to that particular range will be displayed on the LCD screen. If the sign is not valid then nothing will be displayed on the screen or it can be programmed to display a message “invalid sign”.

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2.1. Flex sensors
A flex sensor used in this project is a sensor that measures the amount of bending or deflection. The sensor is fitted onto a surface and resistance of the element of the sensor is varied by bending the surface. It is often called as flexible potentiometers since resistance is directly proportional to the amount of bend. The technique used in Flex Sensor is based on resistive carbon elements. When the sensor is bent substrate is also bent and hence the sensor produces a resistance output variation to the bend radius that is, the higher the resistance value smaller will be the radius.

Figure .1 Block diagram

Figure .2 Shows the range corresponding to the letter C.

The system consists of
- Glove fitted with flex sensors
- Microcontroller Atmega328
- Contact sensor
- LCD display

Figure .3 Flexible Potentiometer
Two sizes are available for Flex Sensors: one is 2.2" (5.588cm) long and another is 4.5" (11.43cm) long. The sensor look like a 40kΩ resistor. As the sensor bends, the resistance between the two terminals and internal bus increases as much as 70kΩ at a 90° angle. The Flex sensor can be combined with a static resistor to create a variable voltage divider so as to produce a variable voltage that can be read by a microcontroller’s analog-to-digital converter. In order to turn the flex sensor’s variable resistance into a voltage that can be read by ADC of the microcontroller it will be combined with a static resistor to create a voltage divider as shown in Figure 4.

3. Arduino UNO

The Arduino UNO is an open-source uC board based on the ATmega328P microcontroller. It is developed by Arduino.cc. The board consists of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits. Other features of the board include 6 Analog pins and 14 Digital pins. It can be powered by an external 9 volt battery or by an USB cable. It is programmable with the Arduino Integrated Development Environment (IDE) via a type B USB cable.

3.1. ATmega328 microcontroller

8-bit AVR RISC-based microcontroller which is a high-performance Microchip consists of 1KB EEPROM, 32 general purpose working registers, 6-channel 10-bit A/D converter, 32Kb ISP flash memory having read-while-write capabilities, SPI serial port, 23 general purpose I/O lines, five software selectable power saving modes. Three flexible timer/counters with compare mode, 16 internal and external interrupts, 2KB SRAM, serial programmable USART, 2-wire serial interface which is byte-oriented and programmable watchdog timer with internal oscillator. Operating range is between 1.8-5.5 volts. The device achieves throughputs approaching 1 MIPS per MHz by executing powerful instructions in a single clock cycle, thereby balancing power consumption and processing speed.
Figure .6. ATmega328 microcontroller

Features of the ATmega328 controller:
- Programmable Brown-out Detection and Power-on Reset
- Has Internal Calibrated Oscillator
- Internal and External Interrupt Sources
- Has six Sleep Modes: ADC Noise Reduction, Idle, Standby, Power-save, Power-down, and Extended Standby

4. American Sign Language

American Sign Language (ASL) is a language that is helped large numbers of deaf communities in the United States as well as Canada. Now, it is one of the extensively used languages across the world. The signs can be made using both the hands or it can be done using one hand. This project uses American Sign Language wherein the gestures will be made using one hand.

5. CONTACT SENSOR

Looking closely we see that the alphabets U and V are similar in their orientation. In this case, the flex sensors for 2 fingers are fully unflexed and if you make the gesture for U or for V the range will be same also the flex sensor fitted at the wrist side will not be of any help in this case thereby a need arises to make use of the contact sensors.
5.1. LCD 2x16 a module

![](image)

Figure 9. LCD

LCD 2x16 A Module provides versatile display functions. The name 2x16 indicates that there are 2 rows and 16 columns. Hence there are two display lines and maximum 16 characters can be displayed on each line. There are various commands for controlling the cursor position on the screen. In this module, the backlight can be changed by using the backlight function to allow the message to be read easily. For the command or data to enter the screen the enable pin has to go from high to low. The contact sensor acts as switches which will pull the controller input pins to ground whenever there is a contact.

![Diagram](image)

Figure 10. interfacing LCD Module with Arduino UNO

- Voice IC could be used so that the glove can be used by the blind people. Wherein the gesture or the sign made will get converted to speech.
- Sensors with better sensitivity could be used.
- For implementing the project using full sign language more number of flex sensors will be required as both the hands will be used in making the gesture.
- Improvements in the glove can be done by assigning to the movement of a finger, phrase, greeting or common questions and answers by means of an intelligent algorithm which is based on fuzzy logic so that the person could communicate in a way even faster and he/she would not need to write a letter at all.

6. Results and Discussion

The letters as well as the words where successfully displayed onto the screen. After making a sign, the user has to wait for some delay for the sign to be recognised and displayed onto the screen in text form. The signs can be recognised quickly so the delay won’t be large.
7. Conclusion

This paper is providing the system for mute and deaf as an aid to easily convey their messages without much stress, the device is portable and compact.

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