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SIGN LANGUAGE TO TEXT CONVERSION USING FLEX SENSORS

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ABSTRACT
A large portion of the population in India consists of individuals who are deaf and mute. So, the system is working on a glove-based device which will be used for conversion of sign language (ASL) to text. The basic system consists of two parts; sign language recognition and conversion to text. The sign language glove is a basic hand glove equipped with flex sensors, which are used to monitor the bending of the fingers. The term "flex" refers to bending, and these sensors vary their resistance based on the degree of bend. The sensor data is sent to a control unit—an Arduino Uno—where the analog signals are converted into digital form. These digital values are then compared with predefined values to recognize the corresponding sign, which is subsequently displayed as text on a 16x2 LCD screen. Currently we are working on a simple prototype that will convert the basic signs which will be further extended for recognition of words

Keywords:
Arduino Uno, Sign language, Gesture recognization, Flex sensor

INTRODUCTION

Sign language is a natural form of communication between hearing individuals and those who are mute. It primarily relies on the recognition of hand gestures. However, it can sometimes be difficult for hearing people to accurately interpret these gestures and understand what the person is trying to convey. The intention behind the gloves is to simplify and improve the lifestyle of individuals who are deaf and mute. The gloves translate the hand gestures to text so that the normal people can read the recognized gesture and understand what that person wants to tell, which will make the communication more efficient. The system consists of both physical and non-physical communication. Sign language differs across countries and is not universally standardized. America developed American Sign Language (ASL); British developed British Sign Language and so on. Most countries use American Sign Language (ASL), and our system is also designed based on it. The gloves convert the specific gestures to text using Arduino as heart of the system. The flex sensors are used in the system which is attached onto the gloves which convert the gesture into resistance which is further converted to the text through Arduino uno. Flex sensors belong to the family of flexible sensors and are known for their high flexibility. Along with flex sensors accelerometer and contact sensors are also used for accurate output. The selection of the sensors is based on the signs the language is consisting. Some signs are dependent on the contact of the fingers so to get the specific output if that signs contact sensors are used. The output of the sensors is processed on Arduino uno to get text as an output displayed on LCD. However, research is being made to convert sign to text and make it portable, efficient and highly accurate.

OBJECTIVES

The primary objective of the project is to help dumb and deaf people to communicate with people and help normal people to understand the sign language via the text generated and displayed on the LCD. It helps in providing a tool that can be used in various settings, such as education, employment, healthcare, and social interactions, to improve accessibility and promote equal opportunities.

LITERATURE SURVEY

Thomas Pryor and Navid Azodi are UG students who made the Gloves that translate sign language into text as sign aloud. They had won Lemelson-MIT student price for this project. Which inspired me to make a system of

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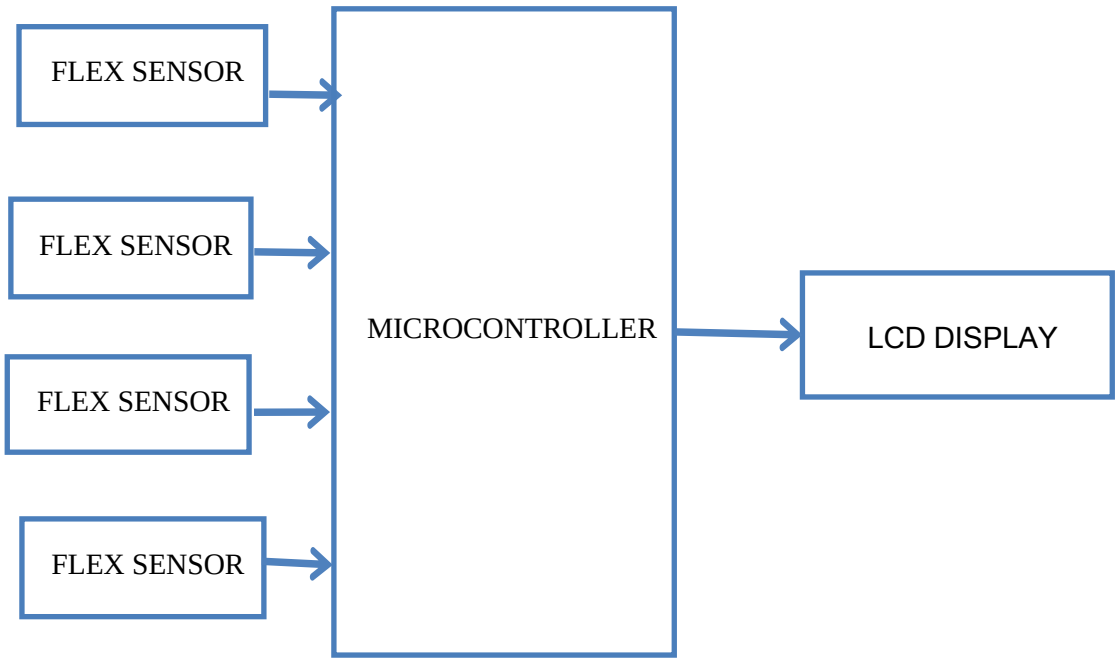
my own which can be used for public welfare [1].The 1st Hand Text glove was designed by Ryan Patterson in the year 2001. This model had the limitation of requiring a computer or laptop for operation, which reduced its portability. in 1620, Juan Pablo Bonet published R, education of letters and art for teaching mute people to speak which is considered as the first modern treatise of sign language Phonetics laid the foundation for a method of oral education for deaf individuals, including the use of a manual alphabet [2]. Kuldeep Singh Rajput, Shashank Deshpande, and Uma Mudenagudi proposed a system aimed at creating an interface between hearing-impaired individuals and those without impairments, with the goal of enhancing communication efficiency and enabling smoother interaction [3].Hand Gesture Recognition System: Swapnil D. Badgujar , GourabTalukdar ,Omkar Gondhalekar, Feb. 2014. Implemented by real time gesture recognition a user can control a computer by doing a decided gesture in front of a video camera which is linked to the computer. [4]

PROPOSED SYSTEM

The project we are proposing where by using the flex sensors and Arduino as a heart of the system we convert different signs to text and further display it on the LCD . So, the message by the sign is displayed on the LCD and normal human can understand the sign and communicate further

DESIGN METHODOLOGY

The overall operation of the system is illustrated in the block diagram shown in the figure. It outlines the general sequence and hierarchy of the various functional components of the project. The person wears the glove which has flex sensors stitched to it and makes the gesture according to the American Sign Language (ASL). Arduino Uno is used to gather signals from the flex sensors placed on the glove. Then the processed output is send over the LCD to display the text output obtained.



FLOW CHART

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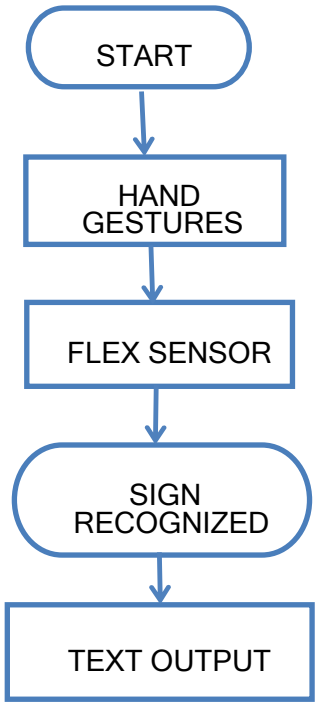

Figure above shows the flow of algorithm used in the system. The sign language gloves are stitched with 5 flex sensors over the thumb, index, middle, ring, pinkey fingers on the hand, contact sensor and the accelerometer so recognize the exact movement of the fingers. Each flex sensor is supplied with the initial voltage as per the When the fingers move, the bending of the flex sensors causes a change in resistance, resulting in a voltage drop. The voltage thus obtained will be analog in nature. This analog voltage is then converted to digital voltage using an analog to digital converter (ADC) using the Arduino Nano.

COMPONENTS USED

Flex Sensor

A flex sensor, also known as a flexible sensor, changes its resistance based on the amount of bending it experiences. The more the bend the resistance is also more.

Fig: Flex Sensors

Flex sensor also work as variable analog voltage divider. Flex sensor consists of carbon resistive element within a thin flexible substrate. When the substrate is bent, the resistive element generates an output resistance that corresponds to the radius of the bend. The system consists of 5 flex sensors which are stitched on the fingers of the gloves because the main part of the gestures are fingers so for each finger a separate sensor is required. The hand gesture is inputted to the system via flex sensors the bent of each finger describes as shown in American Sign Language. As the fingers bends the sensors also starts bending and as the sensors bends the resistances also changes accordingly and that resistance value is inputted to the Arduino Uno.

Liquid Crystal Display (LCD)

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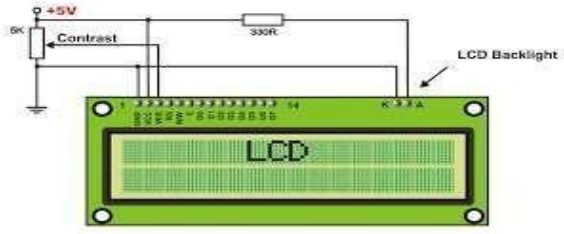

Fig: LCD

A 16x2 LCD (Liquid Crystal Display) is used in the system to display 16 characters. Each line displays 8 characters. Each character is represented in a 5x7 pixel matrix format. LCD contains tow registers namely command register and data register to send command to the LCD command register is used whereas to send data on the LCD screen to be displayed is saved on data register. The intensity of the screen can also be controlled by using 10k pot connected to V0 pin of LCD. The LCD works on 4 bit mode as well as on 8 bit mode according to system requirement. **[**

Arduino uno

Fig: Arduino uno Board

Arduino, an open-source electronics platform, is used for rapid prototyping and creating interactive electronic projects, particularly in fields like robotics, home automation, and the Internet of Things (IoT), due to its ease of use, affordability, and extensive online resources.

RESULTS

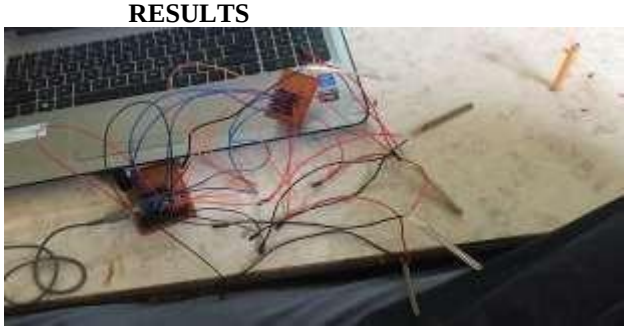

Figure : - Initial Setup

The above system provides with conversion of Sign gestures to a limited scope; recognition of alphabets from A-Z and numeric's from 0-9.It displays the output on a LCD screen and sound output is obtained on the android Smartphone which is still in process. Hardware setup is show in the figure which shows the general components used in the system i.e. Arduino Nano, flex sensors, LCD, Bluetooth device HC-05, Accelerometer.

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Figure (a): - Final Prototype

Figure (b): - Final Prototype

The figure 12(a) & 12(b) shows the final prototype whereas the figure 11 shows the initial prototype of the system. Initially, the glove was made using net fabric with the sensors stitched onto it. However, it did not provide accurate readings as expected. And as we have stitched the sensor on the net the fabric started tearing so due to which the output was not accurate. The net gloves were also having a problem of fitting. To overcome to the problem, we have replaced the net gloves with

CONCLUSION

The system is a bridge between normal and dumb\deaf people; it fills the gaps of communication between dumb\deaf people and normal people. The gloves are independent and it is portable with minimum weight and low power. The system converts the hand gestures to the text and further to speech. In situations where the person is unable to hear the sound produced, the system includes a text display feature that allows the person to read and understand the message understand what another person wants to convey.

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