Sign Language Based Trigonometry Identify Interpreter System Using LABVIEW

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Abstract : In the recent years, there has been rapid increase in the number of deaf and hard of hearing people. Since deaf and dumb people cannot communicate with normal person so they have to depend on some sort of communication. Gesture shows an expressive movement of body parts such as physical movements of head, face, arms, hand or body which convey some message. The aim of this system is to design teaching learning module for a person who are deaf and hard of hearing. This system is used to translate sign language gesture to equivalent trigonometric identity. It is basically motion based system. In this system we introduce new sign language gestures for higher mathematics. The flex sensor are used to identify the gesture. The change in resistance across each flex sensor is recorded as high or low resistance for each finger position. Arduino is used to process this data.10 trigonometric identities are successfully interpreted. In this system we are going to used Indian sign language. Sign language is defined as the language of the deaf and hard of hearing people by which they are able to express there thoughts. This system will help to the impaired children to study the higher mathematics and trigonometric identity.

Keywords : Deaf and Dump, Arduino, Flex Sensor, LABVIEW Software, LCD Display.

1. INTRODUCTION

People who are deaf and hard of hearing often tend to feel uncomfortable around other people. It is observed that according to disabled population in India as per census 2011. In India out of 121 Cr population, 2.68 Cr person are disabled which is 2.21% of total population. In education of deaf & hard of hearing people the mathematics education has become a major problem. Deaf and hard of hearing people finding difficulty in studying the trigonometric identities. The American sign language has more than 1000 math terms , but it is not enough to express the trigonometric identity.

For many hearing impaired and dumb person, sign language serves as their primary language creating a strong sense of social and identity. Sign language is basically a non-verbal form of communication it uses voice, sound and body language to convey information. Sign languages are used to convey thoughts with symbols, and objects etc. They also convey combination of words and symbols (i.e. gestures). Gestures are different patterns made by the curls and bends of the fingers. Gestures are the best medium for their communication .There are 3 Basic hand forms i.e. Hand shape with open or close finger position, Hand position in the middle of forehead or in front of chest and Hand movement in upward and downward direction. This device is used to translate sign language into the equivalent trigonometric identity, act as a translator. System basically consist of 2 types vision based and sensor based. This technique uses sensor based technique for better mobility. It has the inbuilt sensors which are mounted on hand gloves. It is Instrumented glove approach simplifies the recognition and complicate the hardware. In vision based technique the Camera is used to capture images, and the Image processing is carried out to perform recognitions. In this system we uses a hand gloves fitted with the flex sensor on it. This flex sensor produces equivalent resistance according to bend, this analog input is given to the arduino analog pin. The arduino compare the data with saved data and equivalent trigonometric identity is displayed. LCD display is used to display the equivalent identities. The LABVIEW software is used to display the gestures with trigonometric identity, which make the study of trigonometric identity very easy. This is user friendly and affordable.

2. RELATED WORK

The under mentioned research reviews are related to my research topic but my research topic is specifically different in view that it works in real time “higher mathematics” sign gesture to trigonometric conversion.

As per the Anita S. Walde [1] "Higher Mathematics Sign Language interpreter" it discuss One of the important problems observed in society is that the deaf mutes are finding it hard to cope up with the fast growing technology. The aim of proposed topic is to introduce new sign language gestures for higher mathematics. It also focuses on design of portable interpreting device which convert this math’s sign language into corresponding text and voice. The flex sensors are used to identify the gesture.

The change in resistance across each flex sensor is recorded as high or low resistance for each finger position. Arm Cortex M3 is used to process this data. Total 13 alphabets, 9 digits, 13 math's notation notations and 17 trigonometry identities are successfully interpreted by the module.

As per the Sulabha M Naik [2] "Rehabilitation of hearing impaired children in India" it discuss the prevalence of deafness in India is fairly significant. It is the second most common cause of disability. Approximately 63 million people (6.3%) in India suffer from significant auditory loss. Rehabilitation of hearing impaired children in India remains a challenging task. Early detection and intervention are the mainstay of this initiative. We discuss here the resources and options available in India for the education of deaf children and the role of the Government bodies in rehabilitation. Awareness about education and rehabilitation of hearing handicapped is low among the general public and even among the medical fraternity.

As per the Elizabeth Ray [3] Deaf/hearing-impaired children to develop cognitively, particularly in a mathematical sense, the learning environment must have a wide range of meaningful mathematical experiences that are visually engaging and hands-on. The difficulties that deaf/hearing- impaired children may encounter when learning mathematics in early childhood settings. The objective was to enhance teacher practice by identifying possible ways in which barriers to learning could be overcome. The key issue arising revealed that deaf/hearing-impaired children's limited language base may prevent them from understanding and developing mathematical language.

As per the Nicoletta Amado-Villani Edward Carpenter Laura Arns [4] "An immersive virtual environment for learning sign language mathematics" the paper present the development of a new immersive 3D learning environment to increase mathematical skills of deaf children. The application teaches mathematical concepts and ASL (American Sign Language) math terminology through user interaction with fantasy 3D virtual signers and environments. The program can be displayed in immersive devices and includes a gesture control system comprised of a pair of pinch gloves and a 6-degrees- of-freedom wrist tracker.

As per the Prof.A.H.Ansari [5]"Givening voice to mute people using flex sensor" The paper illustrate to aid people by means of a glove based deaf-mute communication translator system. The glove is internally fitted out with five flex sensors, tactile sensors and accelerometer. For each particular movement, the flex sensor produces a proportional change in resistance and accelerometer measures the emplacement of hand. The processing of these movements is done by Microprocessor. The system includes a text to speech conversion (TTS) block which interprets the matched gestures i.e. text to speech output. Hand gesture is one of the typical methods used in sign language for non-verbal communication.

As per the Sachin Bhat [6] "Translating Indian Sign Language to text and voice messages using flex sensors" Communication plays an important role for human beings. A device is developed that can translate different signs including Indian sign language to text as well as voice format. Flex sensors are placed on hand gloves for the use of above said people. Flex sensor‟s resistance changes according to the flexi on experienced. Sensors in the glove pick up gestures and transmit that to text data with the help of Analog to Digital convertor and micro controllers. This converted text data will be sent wire lessly via Bluetooth to a cell phone which runs Text to Speech software and incoming message will be converted to voice. Here device recognizes Indian sign language alphabets, numbers and symbols based on sensor movement.

3. System Configuration

In this system hand glove fitted with flex sensor is implemented to capture the hand gestures of a user. The gloves are having flex sensors along the length of each fingers and the thumbs. The five flex sensor are placed on fingers and thumbs. The flex sensors output a stream of data that varies with degree of bend, it produces the equivalent resistance according to the bend. The analog outputs from the sensors are then fed to arduino. It processes the signals and perform analog to digital signal conversion. This data is compare with the already saved data and then accordingly trigonometric identity is displayed. The output is display on LCD display. The user need to know the signs of particular alphabets and he need to stay with the sign for two seconds. There are no limitations for signs it is hard to build a standard library of signs. The new gesture introduced must be supported by the system. These sensors are attached along the fingers and thumb. The degree of bending of fingers and thumb results in the output of voltage variation, which while converting to analog form, produces required voice. A pair of gloves along with sensors enables mute people to interact with the public in the required language.

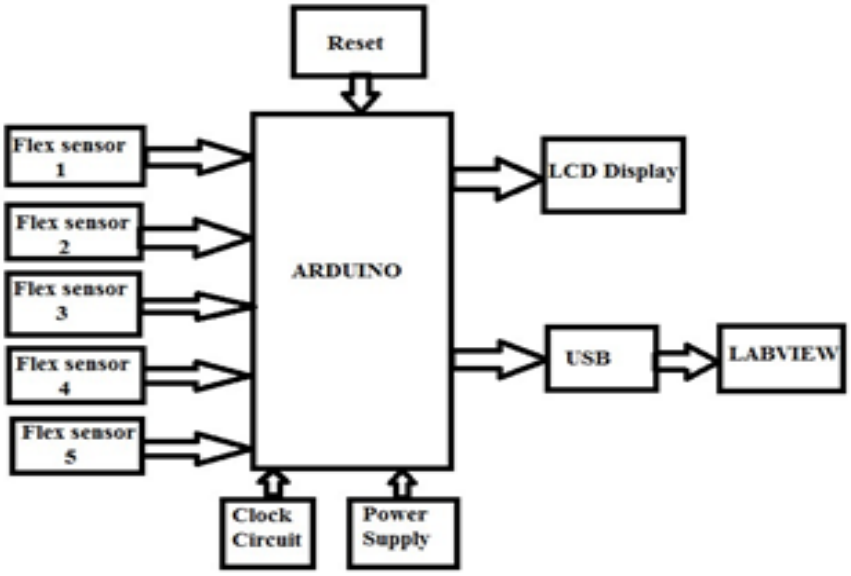


Fig.1 BLOCK DIAGRAM

ARDUINO :

Arduino is an open source platform platform used for buildingelectronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuits boards, the Arduino does not need a separate piece of hardware i.e Programmer in order tp load new code onto board. You can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++.

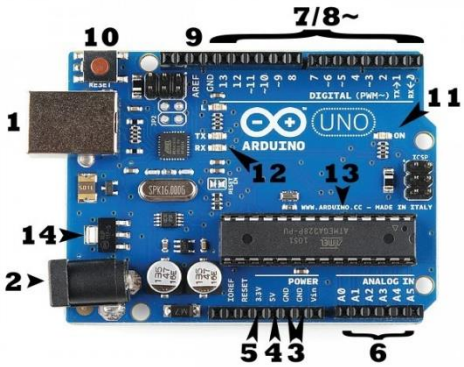


Fig 2. Aduino board

FLEX SENSORS :

Flex sensors has the length from 1 inch to 5 inch i.e. near about 73mm in length and 6.35mm in width. The resistance of the flex sensor vary above or below 550Ω. The flex sensors are the sensors that change in resistance depending upon the amount of bend on the sensor. They convert the change in bend to electrical resistance. They can be unidirectional and bidirectional. Available in thin strip form. The Flex Sensor patented technology is based on resistive carbon elements. As a variable printed resistor, the Flex Sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius—the smaller the radius, the higher the resistance value.

Fig 3. FLEX SENSOR

Liquid Crystal Display (LCD) :

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (L Cs). LCD's need a light source and are classified as "passive" displays. The most commonly used Character based LCD's are based on Hitachi's HD44780 controller. We get the definition of LCD from the name "Liquid Crystal" itself. It is actually a combination of two states of matter – the solid and the liquid. They have both the properties of solids and liquids and maintain their respective states with respect to another. Solids usually maintain their state unlike liquids who change their orientation and move everywhere in the particular liquid. Further studies have showed that liquid crystal materials show more of a liquid state than that of a solid. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment and other multi segment LED's.

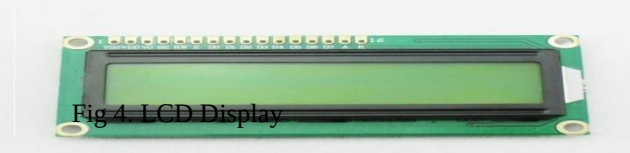


Fig 4. LCD Display

The reasons being: LCD's are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments). A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

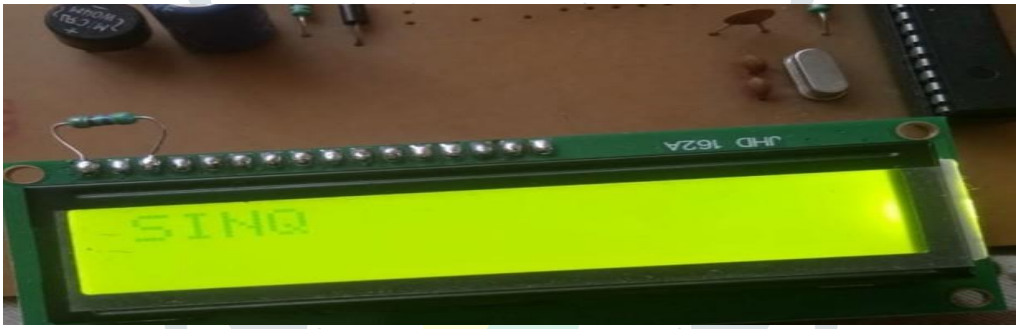
LABVIEW :

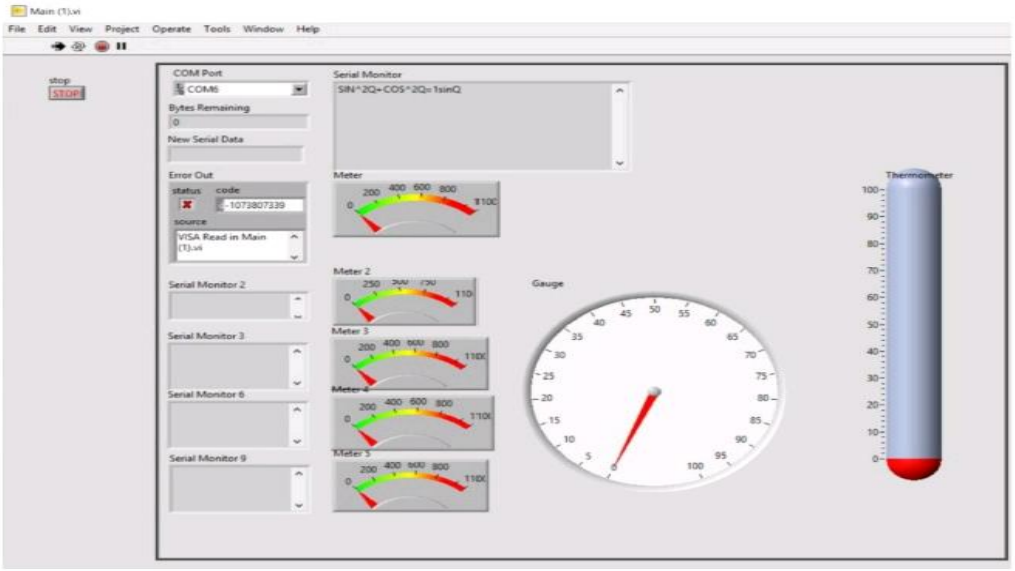
LABVIEW(Laboratory Virtual Instrument Engineering Workbench) is a graphical programming language that is manufacturezby National Instruments.LABVIEW programming uses icons instead of hand written programs to create applications. LabVIEW based Sign Language trainer can be used by the institutes which train speech impaired people. This is an effective teaching tool which translates hand gestures into text and speech. This will help the person with speech impairment to learn the sign language using the haptic glove and the visual & audio translations of all gestures. LabVIEW software gives the advantage of real time graphical display and translation of various hand gestures. This feature makes the system interactive and easy for the users. . Data from all the sensors from the haptic glove is received by LabVIEW via Arduino Mega interface. This is serial communication where data is sent sequentially one bit at over a communication channel. Raw data corresponding to every sensor is processed and converted into digital form within the LabVIEW program. For bending of each flex sensor, '1' (HIGH) is generated by the LabVIEW. Similarly, for each contact sensor, '1' (HIGH) is generated when the contact is made between the fingers. These patterns of 1's and 0's are recognized by the LABVIEW and correct gesture is apprehended. The alphabet corresponding to each gesture is displayed on the front panel (computer screen) and eventually converted into speech. LabVIEW is so so programmed that it keeps track of the consecutive letters made by the person to form words and sentences.

4. Obtaining and Processing of Physiological Parameters

Sr.No	Flex Sensor 1	Flex Sensor 2	Flex Sensor 3	Flex Sensor 4	Flex Sensor 5	Results
1	Down	Up	Down	Down	Down	SINQ
2	Down	Up	Up	Down	Down	COSQ
3	Up	Up	Up	Down	Down	TANQ
4	Down	Up	Up	Up	Up	COTQ
5	Down	Up	Up	Up	Down	SECQ
6	Down	Up	Up	Down	Up	COSECQ
7	Down	Down	Up	Up	Up	SINQ/COSQ= TANQ
8	Down	Up	Down	Down	Up	COSQ/SINQ= COTQ
9	Down	Down	Down	Down	Up	SIN^2Q+COS^2Q= 1
10	Up	Down	Down	Down	Down	1+TAN^2Q= SEC^2Q
11	Up	Up	Down	Down	Down	1+COT^2Q= COSEC^2Q
12	Up	Down	Down	Down	Up	COTQ=1/TANQ
13	Down	Down	Down	Down	Down	COSECQ=1/SINQ

5. Experimentation and Result Obtained





6. CONCLUSIONS

The proposed system is easy to implement. This system provides us accuracy 90% within minimum time. The system aims to lower the communication gap between deaf people and normal world, since it facilitates dual communications. The projected methodology interprets hand gestures into trigonometric identity. The system overcomes disadvantages of previous existing system and improves their manner. With this project the deaf-mute people can use the hand gestures to perform sign language and it will be converted into trigonometric identity with accuracy 93%; so, study of higher mathematics has become easy. This system that enables deaf and dumb people to further connect with their society and aids them in overcoming communication obstacles created

by the society's incapability of understanding and expressing sign language.With this project, deaf or dumb communities can use the gloves to form gestures according to sign language and the gestures will be converted to trigonometric identity.The proposed system has successfully interpreted 17 trigonometry identities It is hoped that the proposed system, which solely concerned with higher mathematics function will be the first one to explore the need and importance of system in deaf community. Learning mathematics will become learning like a language. For deaf/hearing-impaired children proposed language of mathematics features as their third/fourth language, using more than one language to express mathematical ideas is additive in itself. It will give sufficient proficiency in both languages, students are liable to have better understanding because they have two modes in which to think and communicate.

REFERENCES

[1] Anita S. Walde, Dr. Ulhas Shiurkar "Higher Mathematics Sign Language Interpreter" International Journel of science and research.

[2] Sulabha M Naik Mahendra S Naik Akriti Sharma "India"International Journal of Advanced Research in Computer and communication engineering.

[3] Nicoletta Adamo-Villani Edward Carpenter Laura Arns "language mathematics " Purdue university

[4] Sachin Bhat, Amruthesh M, Ashik, Chidanand Das, Sujith "Translating Indian Sign Language to text and Voice messages using flex sensors" International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 5, May 2015

[5] Yasmeen Raushan, Abhishek Shirpurkar, Vrushabh Mudholkar, Shamal Walke, Tejas Makde, Pratik Wahane"Sign Language Detection For Deaf And Dumb Using Flex Sensors" International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 04 Issue: 03 Mar 2017

[6] P. Varnsi Praveen, K. Satya Prasad "Electronic voice to Deaf & Dumb People Using Flex Sensor"International Journal of Advance Research in Computer and Communication engineering ,Vol. 4, Issue 8, august 2016.

[7] Anetha K, Rejina Parvin J "Hand Talk – A Sign Language Recognition Based On Accelerometer and SEMG Data" International Journal of Advance Research in Computer and Communication engineering (An ISO3297; 2007 Certified Organization) Vol. 2, Special Issue 3, July 2006.