Audile Gloves

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Abstract— Deaf mute individuals all over the world use gesture-based communication to speak with others, which is feasible for the individuals who have experienced unique training. Everyday citizens face trouble in understanding sign language. To defeat these continuous issues, this framework is created. The framework is employed to detect any gesture-based communication, and plays recorded voice. This diminishes the issues among customary individuals and enables a free flow of interactions between public citizens. This work has three modules, they are detecting, handling and voice stockpiling unit. It can be done using a flex sensor and text to speech conversion application. This model can be used by the people of all age groups and people can easily communicate between the normal individuals. By using this model, they can be normal as other individuals and lead the life by using their knowledge, earn and start a business too. The output from the device has high accuracy in identifying the sign languages executed, using the highly responsive flex sensors.

Index Terms— Flex sensors, audio, gesture, communication, text, sign language, bend.

I. INTRODUCTION

The World Health Organization (WHO) estimates that about five percent of the total population in the world suffers from hearing loss. The major disadvantage for these individuals lies in the reduced or nullified proximal interactivity with peers having normal hearing and speech. Their interaction with the digital world is also very limited due to the lack of affordable support technologies that aid in their communication. Due to this, deprivation from access to modern technology is also an impediment to their progress in the present scenario. The evolution of gesture-based recognition systems was initiated with the invention of the Sayre Glove in 1977 which extends to the modern-day gesture-based applications in the field of sign language translation. Researchers are now trying to bridge the gap between the advancements in interpersonal communication technology and its adoption by the audio-vocally impaired. However, the major demerit of these systems is that they are complex and are not cost effective. Developing a low cost, gesture recognition engine along with a detailed study of the construction and calibration of custom-designed open-source sensors is the main aim of this work. In this work , a sensor-based glove, designed using custom made flex sensors and contact sensors, aid in gesture recognition of the American Sign Language (ASL). The choice of ASL was done based on the fact that it is widely learned as a second language, serving as a bridge language. In this work, the positioning of the flex and contact sensors are done so as to obtain maximum character recognition efficiency of the English alphabet. This work also expounds on the construction and calibration of a flex sensor. The very widely available, industrially manufactured flex sensors are not cost effective. Due to this, the objective to achieve a low-cost recognition engine is faltered. Hence open source, low cost, lab-made, bidirectional, sensors were constructed and calibrated to The World Health Organization (WHO) estimates that about five percent of the total population in the world suffers from hearing loss.

II. MOTIVATION

The main motivation behind developing this system is to design a system which can recognize hand movements and gestures and facilities a medium of communication to the people who cannot communicate by talking. These hand movements should be recognized and should be converted into words and provide natural way of communication just like talking. Giving 4- 5 instructions to the Gloves and converting those instructions in words are easy but giving the functionality of natural communication similar to talking is very difficult the device or the prototype should be economical to the pocket of the middle class then only it will be used frequently in the hospitals, homes and rehabilitation centres. Its low cost will make it affordable by the masses.

III. LITERATURE SURVEY

1.According to ***"A review paper on evolution of smart glove" by Harmeet Kaur, Amit Saxena, Abhishek Tandon, Keshav Mehrotra, Khushboo Kashyap.*** (Year: 2019 | Volume: 7 | Journal Article | Publisher: IEEE) This review paper comprises of the brief introduction about the past attempts that were made for constructing a device which converts sign language to speech. In this paper, they reviewed numerous attempts and initiations taken by different persons to overcome the communication barriers. Majority of the attempts included converting the American Sign Language to the audible signals. Some designers used flex sensors while others used image processing algorithms and contact sensors for efficient gesture recognition. To take into account whole of the sign language, a huge library of functions is required which is a very tedious job in itself.

2. According to ***"A Systematic Review of Commercial Smart Gloves: Current Status and Applications" by Manuel Caeiro-Rodrígez, Iván Otero-González, Fernando A.Mikic-Fonte, Martín Llamas-Nistal Fernanda Irrera , Academic Edito***

(Year:2021|Volume:5| Conference Article| Publisher:IEEE) This paper introduces a sensor taxonomy for gloves distinguishing among bend (flex) sensors, stretch (strain) sensors and other types, such as inertial measurement units (IMUs) and magnetic sensors. This paper provides a review of current commercial smart gloves focusing on three main capabilities: (i) hand and finger pose estimation and motion tracking, (ii) kinesthetic feedback, and (iii) tactile feedback. It analyzed 23 fingertip devices and 23 haptic devices for the whole hand. These devices were prototypes described in papers available in the scientific literature and were used to provide kinesthetic and tactile (pressure, contact or vibration) stimuli. No commercial devices are analyzed.

3. According to ***"A Prototype of Flex Sensor Based Data Gloves to Track the Movements of Fingers" Junseung Bang, Jinho You, Youngho Lee*** *(Year: 2021| Volume: 8 | Journal Article |Publisher: IEEE* In this paper, they proposed a flex sensor-based data glove to track the movements of human fingers for virtual reality education. The primary functions of this data glove were implemented at the cost of a few tens of dollars. According to the measurement results, it can be seen that a data glove optimized for one person is difficult for others to use. The error of thumbs was found to be the largest, and the errors of index fingers and ring fingers were small. The values of the two flex sensors attached to the middle finger were also relatively large, but small compared to the error of thumbs. They have combined HTC VIVE controller to the data gloves to verify usability. The data glove could measure finger movements and hand tilt by sensors. They calculated the moving distance with a 3-axis acceleration value using acceleration sensors. If it has flexibility, there is a danger of being separated from the sensor, and if it does not have flexibility, the feeling of fit is terrible, so it is necessary to worry about the material.

4. According to ***"The Hand-gesture-based Control Interface with Wearable Glove System" by by Vladislav Berezhnoy, Dmitry Popov, Ilya Afanasyev and Nikolaos Mavridis*** (Year:2021|Volume:5| Conference Article |Publisher:IEEE) This paper presents an approach to building a gesture-based control interface with a wearable glove system and a real-time gesture recognition algorithm. To test the system's recognition rate and demonstrate the advantages of gesture-based control, we decided to provide experiments to control UAV. This paper presents a glove-based system hardware and software implementation, which organize the user-friendly hand-gesture-based control interface based on fuzzy finite state automata gesture recognition methods. The future work may include extension of control interface capabilities to manipulation of larger number of robots, additional testing with a real quadcopter and comparison with alternative methods to clarify the learning time, control accuracy etc.

IV. AIM & SCOPE

A. Aim

The main aim of this work is a make efficient system which can give voice to voiceless person. This will remove the communication barrier between the disable person with the normal person. With the help of audile glove, the life of the individuals will be much easier and they will get a chance to express themselves more and can get more opportunities in their life.

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B. Existing Devices

Currently the communication is majorly done by hand gestures and certain non-verbal languages which is not understood by most of us.

Fig1 – basic sign language

C. Proposed System

As discussed in the previous sections, the major barrier between the people who communicate verbally and non-verbally can be overcome by using audile gloves where it converts hand gestures to certain text and speech.

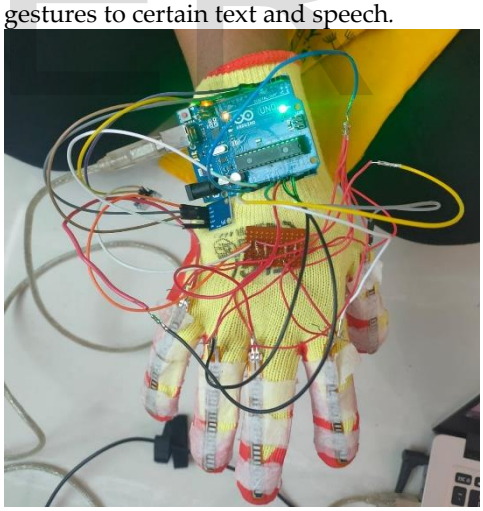


Fig 2 – Design mounted product

V. METHODLOGY

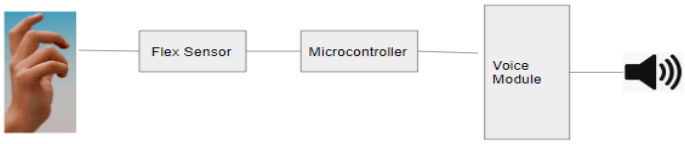
A . HARDWARE IMPLEMENTATION

Components used in this system are:

1. Arduino UNO
2. Flex Sensors
3. Accelerometer

4. Resistors

B. BLOCK DIAGRAM



C. ABSTRACT SPECIFICATIONS OF SUBSYSTEMS

1)Arduino Uno

Fig 3 – Arduino UNO

The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits.

2) Flex sensor

Fig 4 – Flex sensors

A flex sensor or bend sensor is a sensor that measures the amount of deflection or bending. Usually, the sensor is stuck to the surface, and resistance of sensor element is varied by bending the surface. Since the resistance is directly proportional to the amount of bend it is used as goniometer, and often called flexible potentiometer.

3) Jumper wires

Fig 5 – jumper wires

A jump wire (also known as jumper wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

4) Accelerometer

Fig 6 – Accelerometer

Accelerometers can be used to measure vibration on cars, machines, buildings, process control systems and safety installations. They can also be used to measure seismic activity, inclination, machine vibration, dynamic distance and speed with or without the influence of gravity. Here we used it to measure the angle of bend of flex sensors.

5) Resistor

Fig 8 – resistor

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor.

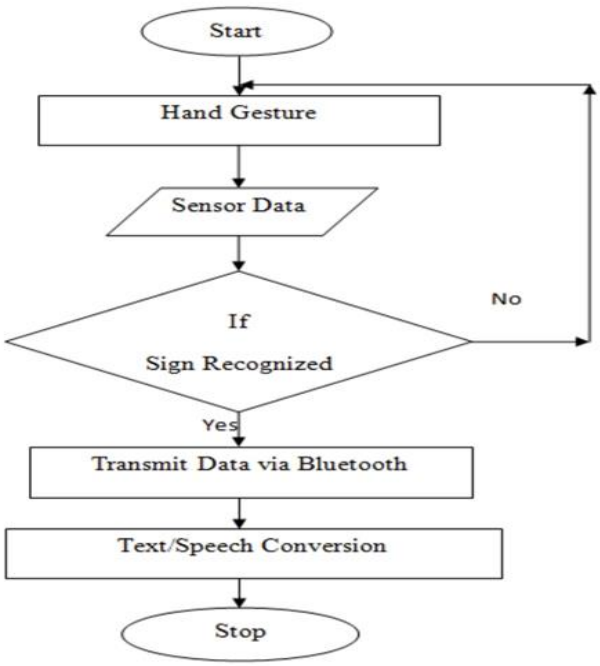
6) 16*2 LCD Display

Fig 8 – LCD display

An LCD is an electronic display module that uses liquid crystal to produce a visible image. The 16×2 translates16 characters per line in 2 such lines. In this LCD each character is displayed in a

5×7-pixel matrix.

D. SOFTWARE ALGORITHM



The steps involved are:
Stage 1- Start
Stage 2- Gather the bend values from each of the sensors
Stage 3- If the values fall under the mentioned range, then the assigned statement is displayed and converted to audio.
Stage 4- The android application will then display the assigned text on to the screen.
Stage 5- Stop

The software used is UiPath Studio. UiPath Studio is advanced automation software that gives everyone, the right automation canvas to build great software robots—and organizations the right governance tools to manage them all.
It is being used in various fields, and majorly in the field of health.
The software here fetches the information displayed on the output window then stores it in the form of a variable, the same variable is given as input to the speech conversion. The desired browser is used to open the required URL, and further speech conversion takes place. Thus, the audio is converted, by fetching the input from Arduino output.

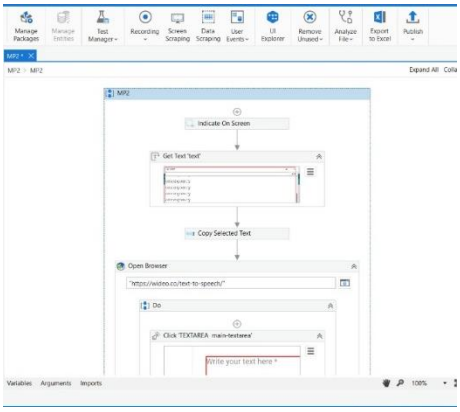


Fig 9 – UiPath Studio

VI .RESULTS & DISCUSSION

A) Results

- It works by recognizing the gestures made by hand with help of flex sensors placed on fingers, flex sensor varies its resistance based on how much a finger is bent.
- Resistance is sensed by the Arduino and based on the amount of resistance of each sensor, it prints the letter of the gesture on serial monitor
- The mobile application reads the serial monitor, prints it on screen and pronounces it.
- Since each flex sensor has a range of resistances, each sensor was tested apart and its voltage values were taken for different symbols.
- While testing, the values altered, so the problem was solved by taking different ranges for each flex position.

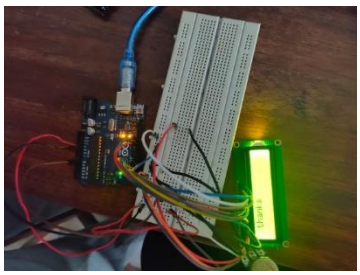


Fig 10 Output for the pressure applied is >120 units

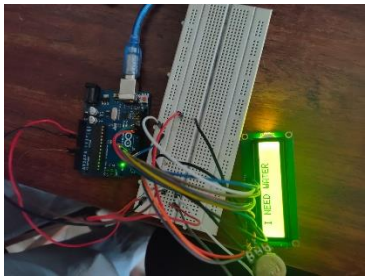


Fig 11 Output for the pressure applied is between 90-120 units

Resistance Value table

FLEX SENSORS	CHANGE IN RESISTANCE VALUE (OHMS)	OUTPUT
A0	900	EMERGENCY
A1	35	WHERE ARE YOU
A2	970	HI, I NEED WATER
A3	10	THANKYOU
A4	0-5	HOW ARE YOU

B) Discussion

Smart glove provides a lot of help in removing the communication barrier between deaf and dumb with the normal people so they easily understand each other. So, it provides opportunity to deaf and dumb community to express themselves more to the society. But there are many safeties and precautions that should be followed while using the smart glove for the long-time use. Following is the few safeties and precautions while using the smart glove by a disable person

- Smart glove should not be used while eating or drinking.
- Smart glove should not be used while carrying something in the hands.
- Smart glove should not be used while the hands are wet.
- Smart glove should be kept in a dry place while not in use.
- Protect smart glove from long time exposure to sun.
- Smart glove should not be used while cooking.
- Smart glove should not be used while washing clothes.
- Smart glove should not be used while eating or drinking.
- Smart glove should not be used while playing sports.
- Smart glove should not be used while driving.

If the user of the smart glove follows these safety precautions without any hesitation, and does not ignore the above points, then the glove will be handy for a longer period.

VII.CONCLUSION

Our work, audile gloves will remove the communication barrier between mute and people with normal people. Audile gloves are an effective system which can give voice to deaf and mute. It is an independent glove designed for the help of deaf and dumb person and to serve humanity which translates the sign language gestures into sound. We have used a glove which is fitted with flex sensor on each finger along the length of each finger. The flex sensor output value changes according to the amount of the bending of the finger movement.

VIII.ADVANTAGES

- Easy to control

As the name only suggests that the gloves and its design should be easy to control. i.e., its speed should be easily controllable and does not require any alternative system for its control, which ultimately increase the expenditure.

- Less bulk

The gloves should not be bulky since all the load of the gloves has to be carried by the user itself. Thus, the weight to power ratio should be as good as possible. The components used are all pretty light weight. The frame work we are going to use should use the material light weight.

- Compact

The gloves are made to be compact so that the user will be able to use them with utmost comfort. Can be worn by anyone as the gloves are flexible.

- Less Maintenance Work

Here in this system little maintenance means no maintenance. As the maintenance is less the operating cost is also less. And hence the gloves become convenient to use. Gloves are of great utility.

- Cost Effective

The factor which affects most of the design are the cost of the products. The gloves and the components should be in inexpensive and should be as low as possible because the customer will only choose the material which is affordable.

IX. APPLICATIONS

This device is useful for deaf and dumb people to communicate with normal people. It is portable i.e., people with disabilities like hearing and speaking disability can carry this glove wherever they want to be.

X. SCOPE FOR FUTURE WORK

We can make the glove wireless so that the user can feel more ease and comfortability while using our widget. We can make a system to control different home appliances like fan ,light ,TV etc from anywhere at home just by making a gesture.

XI. ACKNOWLEDGMENT

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