Gesture Vocalizer for Impaired

Mini-project report by

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CERTIFICATE

This is to certify that the project titled **"Gesture Vocalizer for Impaired"** has been successfully implemented during the academic year **2020-2021** by the following students.

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REPORT APPROVAL

This mini project report titled "**Gesture Vocalizer for Impaired"** by Divya Chouhan, Dharmik Desai and Ankita Dodamani is approved for the degree of Third Year of Engineering in Information Technology from University of Mumbai.

Examiners:

1. _____

2. _____

Date:

Place:

DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand That any violation of the above will bring disciplinary action upon us by the Institute and can also evoke penal action from the sources which have thus not been properly. cited or from whom proper permission has not been taken where needed.

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ABSTRACT

Gesture Vocalizer for Speech Impaired is a device that can be used for various purposes such as communication, health monitoring, gaming and many more. The medium through which we can communicate with deaf and dumb people is sign language. It is a non-verbal form of interaction which is found among deaf communities in the world. We designed a Gesture Vocalizer that will make the sign language understandable to everyone. Deaf-mute people can easily communicate using this glove. This project converts Sign to text and also text to speech (basic commands) which can be delivered through devices like speakers, watches, neck pieces etc. The basic idea is to synthesize speech to audio using a speaker. The glove is equipped with flex sensors, an accelerometer which is further connected to AVR Atmega16, IC AP8942A speech synthesizer. Serial Monitor of Arduino IDE is used to display result on the basis of specific gestures. Gesture Vocalizer for Speech Impaired decreases the communication barrier between two different communities and they will be able to communicate easily with the normal person. For this, Wireless Sensor Network (WSN) is integrated with Internet of Things (IoT) to achieve the above objective

TABLE OF CONTENT

		Page no.
1.0	**Introduction**	**1**
1.1	Problem Statement	1
1.2	Scope of the Project	2
2.0	**Literature survey**	**3**
2.1	Gesture vocalizer for deaf and dumb	3
2.2	Hand gesture recognition based on karhounen-love transform	4
2.3	Smart glove for deaf and dumb patients	5
2.4	Smart gloves as a communication tool for the speech impaired and hearing impaired	6
2.5	Smart speaking glove-virtual tongue for deaf and dumb	7
2.6	Electronic speaking system for speech impaired people	8
3.0	**System methodology**	**9**
3.1	Block Diagram	9
3.2	Hardware Component	10
3.3	Software Component	13
3.4	Sensors Required	14
4.0	**Conclusion and future scope**	**15**
5.0	**References**	**16**

LIST OF FIGURES

Figure No	Figure Name	Page No.
1.	Block Diagram	9
2.	AVR Atmega 16	10
3.	Accelerometer	10
4.	Speech Synthesizer (IC AP8942A)	11
5.	LCD	11
6.	Speaker	12
7.	Arduino	13
8.	Flex Sensors	14

1.0 INTRODUCTION:

Since the beginning of era humans have kept evolving and adapting to their available habitat and this evolution has led to many physical and mental changes. Our senses have evolved to a major extent. Evolution is a necessary part of our survival, but it's not the same for everyone. Unfortunately, there are some people who are born different, born special and do not have the ability to use their senses to the best extent possible. Deaf and dumb population is a result of the physical impaired of hearing for deaf people and disability of speaking for dumb people. In the recent years, there has been a run riot in the number of hearing impaired and speech disabled victims due to birth defects, oral diseases and accidents. When a speech impaired person speaks to a normal person, the normal person finds it strenuous to understand and asks the deaf and dumb person to show gestures for his/her needs. Those people have their own language to communicate with us. The only thing is that we need to comprehend their language. Hand signs are used by deaf and mute people and it is a communication skill that uses gestures instead of sound to convey meaning simultaneously combining hand shapes, orientation and movement of hands, arms or body and facial expressions to express fluidly a speaker's thoughts. But most of the time normal people find it difficult to understand this sign language. This presents a major drawback for people in the deaf and dumb communities when they try to engage in interaction with others, especially in their educational, social and professional environments. Ergo, it is necessary to have an advance gesture recognition or sign language detection system to bridge this communication gap. Gesture Vocalizer has been designed to give voice to voiceless as this cause has been championed throughout history, as it's safe to say that none of those efforts involved packing a bunch of sensors in to a glove. The main objective is to help deaf and dumb people by removing communication barrier so they are not restricted in a small social circle and are also able to convey their feelings and emotions.

1.1 PROBLEM STATEMENT:

Developing a Gesture Vocalizer based on hardware (Arduino UNO) and Speech Synthesizer that bridges the communication gap between the normal people and the impaired through the use of sign language.

1.2 SCOPE OF PROJECT:

- Virtual reality application i.e.: replacing the conventional input devices like joystick in videogames with data glove**.**
- Designing of whole jacket which would be capable of vocalizing the gesture and language of animals.
- Virtual reality application i.e. replacing the conventional input devices like joystick in videogames with data glove.
- In future of this proposed system supporting a greater number of Signs and different language mode**.**
- The device can be further integrated with GPS positioning system to ensure their safety**.**

2.0. LITERATURE SURVEY

2.1 GESTURE **VOCALIZER FOR DEAF AND DUMB**

This paper provides information about the way in which the deaf and dumb people will communicate with each other through a device that will overcome most of the difficulties being found by deaf and dumb people. Deaf and dumb people use sign language for communication. That sign language cannot understand by normal people; so, it creates barrier in communication between normal peoples and deaf and dumb peoples. Hence there must a midway that would convert this gesture into text and speech format, so normal people would understand it. In this paper, we used sensor-based method. We use two sensors such as flex sensor and accelerometer which is mounted on gloves. Flex sensor is used to measure bending of fingers. Accelerometer is used to measure static and dynamic acceleration. In this paper we use AVR microcontroller and speech synthesizer. Data glove is giving most promising result with high accuracy and sensitivity.

Advantages:

- As it is portable, cost effective.
- Requires low power operating on a single lithium-ion rechargeable battery and having less weight and robust gives patient liberty to carry it anywhere at their will.
- This paper will give dumb a voice to speak for their needs and to express their gestures.
- The text is also forwarded as SMS via Bluetooth or modem for better convenience and for security purposes.

Disadvantages:

- All the signs were not converted into text.
- Delay in result due to fluctuations in resistance.

2.2 HAND **GESTURE RECOGNIZATION BASED ON KARHOUNEN-LOEVE TRANSFORM**

In our country around 2.78% of peoples are not able to speak (dumb). Their communications with others are only using the motion of their hands and expressions, but they find difficulty in communicating with others who don't understand sign language. This system is based on the motion sensor. According to dumb people, for every motion they have a meaning. That message is kept in a database. Likewise, all templates are kept in the database. In the real time the template database is fed into a microcontroller and the motion sensor is fixed in their hand. For every action the motion sensors get accelerated and give the signal to the microcontroller. The microcontroller matches the motion with the database and produces the speech signal. The output of the system is using this paper presents four very simple but efficient methods to implement hand gesture recognition namely Subtraction, Gradient, Principal Components Analysis and Rotation Invariant. First create an Image Database consisting of four different hand gesture images. Before populating the database for an images of various gesture categories in Hand Gesture Recognition system, each image was first processed i.e., the images were converted to 8-bit grayscale images and filtering was performed to minimize any noise present in the images. The method mentioned above were applied on the input test images captured form the sensor device of the system to find This project aims to lower this barrier in communication. It is based on Android Application that can translate sign language into speech in order to make the communication take place between the mute communities with the general public possible the suitable match form the database. The methods used were successful to retrieve the correct matches. The results based on speed and accuracy was analyzed.

Advantage:

- Speech Recognition helps dump people to communicate easily.
- Use of Android Application makes it more efficient.

Disadvantages:

- Only Basic commands are converted
- Every time we bend the flex sensor decreases the sensor value.

2.3. SMART GLOVE FOR DEAF AND DUMB PATIENTS

In this paper we represent smart glove for deaf and dumb patient. About nine billion people in the world are deaf and dumb. The communication between a deaf normal visual people. This creates a very little room for them with communication being a fundamental aspect of human life. The blind people can talk freely by means of normal language whereas the deaf-dumb have their own manual-visual language known as sign language. Sign language is a non-verbal form of intercourse which is found amongst deaf communities in world. The languages do not have a common origin and hence difficult to interpret. The project aims to facilitate people by means of a glove-based communication interpreter system. The glove is internally equipped with five flex sensors. For each specific gesture, the flex sensor produces a proportional change in resistance. The processing of these hand gestures is in Arduino uno Board which is an advance version of the microcontroller and the LABVIEW software. It compares the input signal with predefined voltage levels stored in memory. According to that required sound is produced which is stored is memory with the help of speaker. In such a way it is easy for deaf and dumb to communicate with normal people.

Advantages:

- As it is portable, it is cost effective.
- Requires low power operating on a single lithium-ion rechargeable battery and having less weight and robust gives patient liberty to carry it anywhere at their will.
- This paper will give dumb a voice to speak for their needs and to express their gestures.
- The text is also forwarded as SMS via Bluetooth or modem for better convenience and for security purposes.

Disadvantages:

- All the signs were not converted into text.
- Delay in result due to fluctuations in resistance

2.4 SMART GLOVES AS A COMMUNICATION TOOL FOR THE SPEECH IMPAIRED AND HEARING IMPAIRED

In this paper, five flex sensors are attached on the back of each glove to detect human operator's finger activity. The sensors are connected to bread board then connected to microcontroller for analog signal detection. The data is then transmitted by RF transceiver and received by RF receiver which is at the right-hand glove then the data combing and thresholding is done by microcontroller at right hand glove. The data is then sent to Bluetooth module via its transmitter and receiver connected to transmitter and receiver pin of microcontroller respectively. The data is then collected by Android application on Smart phone having the Bluetooth connectivity ON. The application will then convert the received text into appropriate speech.

Advantages:

- The android application will convert alphabet into voice and display it on android screen and the particular word will speak out.
- The use of this glove eliminates the necessity to learn sign language for communication with speech and hearing impaired.

Disadvantages:

- Hardware issues were generated.
- Difficulty in detection of many signs due to their same resemblance in sign language.

2.5 SMART SPEAKING GLOVE-VIRTUAL TONGUE FOR DEAF AND DUMB

In this paper, they have designed the project that overcome the problem & make the smooth communication of speechless patient with normal people. They have used flex sensors which are fitted with glove to sense the finger movements. According to the finger movement microcontroller ATmega328 will display message on LCD. The text message is converted into voice using speak jet & this voice is heard via speaker.

Advantages:

- This glove is used to convert Indian Sign Language.
- Speak jet is used to convert text data into voice.

Disadvantages:

- The amount of deflection by the flex sensor was not accurate.
- Cost increases, as Indian Sign Language uses two hands

2.6 ELECTRONIC SPEAKING SYSTEM FOR SPEECH IMPAIRED PEOPLE: SPEAK UP

In this paper, we came ac Sign Language is the only way of communication for speech impaired people. But general people can't understand the sign language so it becomes difficult for a speech impaired person to communicate with them. In this project an electronic speaking system was developed to ease the communication process of speech impaired people. A glove was developed which consists of five flex sensors. When gesture is made with the glove, the change in resistance of flex sensors fed into the Arduino Nano and specific prerecorded audio command for that gesture is played from SD card through speaker and the text command for that gesture is displayed on the LCD. There are four gestures that are designed for user input so that user can play his/her chosen audio commands using those gestures. This device not only helps a speech impaired person to communicate with a normal person via audio commands but also helps him/her to communicate with a hearing impaired person by displaying the text commands on the LCD.

Advantages:

- The communication between a normal person and a speech impaired person become easier.
- As here LCD is used to show the user command so one speech impaired person can also communicate with a deaf person.
- There is an option for user input.
- This device is portable. So, user can bring it anywhere he/she wants.
- It is cost effective. So, everyone can afford it.

Disadvantages:

- The amount of deflection by the flex sensor was not accurate.

3.0 SYSTEM METHODOLOGY:

3.1 Block Diagram

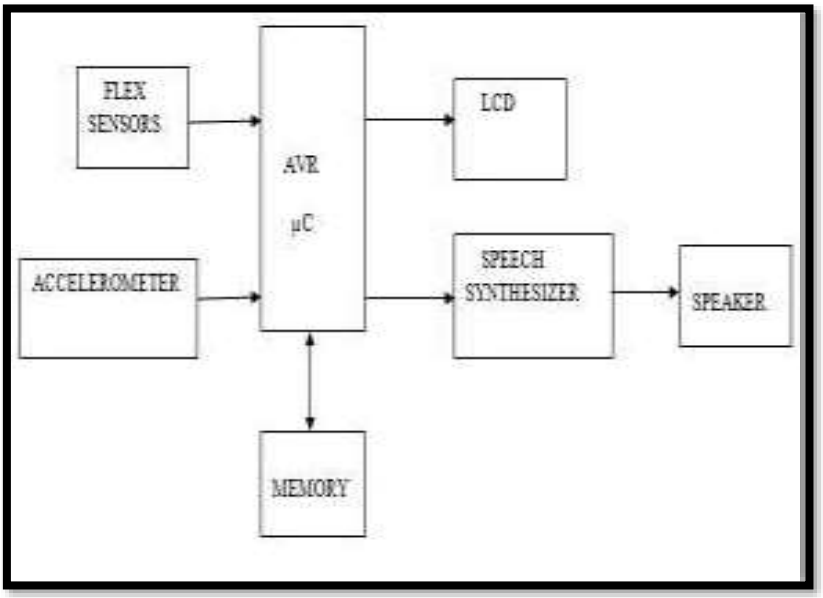

Figure 1: Block Diagram

Components:

- AVR Atmega16
- Flex sensor
- Accelerometer
- Speech synthesizer
- LCD
- Speaker

3.2 Hardware Components:

- **AVR Atmega 16**

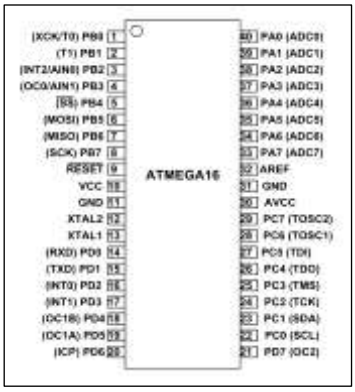

Figure 2 :AVR Atmega 16

The **ATmega16** is a low-power **CMOS 8-bit microcontroller** based on the AVR enhanced RISC Architecture. By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

- **Accelerometer**

Figure 3:Accelerometer

The accelerometer is nothing but ADXL335. It is a small, thin, low power; three axis accelerometers with outputs that are signal conditioned. The static acceleration of gravity in sensing the tilt & the dynamic acceleration due to motion, shock, and vibration is measured with the help of this module. But the most basic function of this module is to measure the tilt of the hand. The output produced by this module is in analog form. This output is given to AVR microcontroller to convert it into a suitable digital form.

- **Speech Synthesizer (IC AP8942A)**

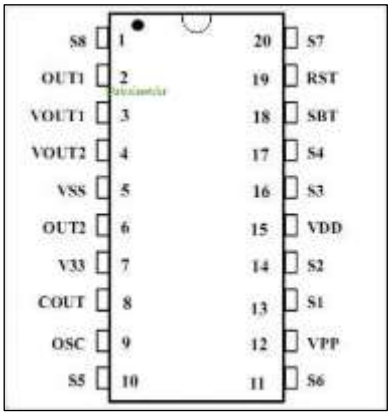

Figure 4:IC AP8942A

Here the voice IC used is AP8942A. This is a high-performance voice OTP which is fabricated using standard CMOS process. This IC stores a voice message of about 42sec.With 4-bit ADPCM compression which is done at the sampling rate of 6KHZ. There are 2 trigger modes, simple key trigger mode & parallel CPU mode.

- **LCD**

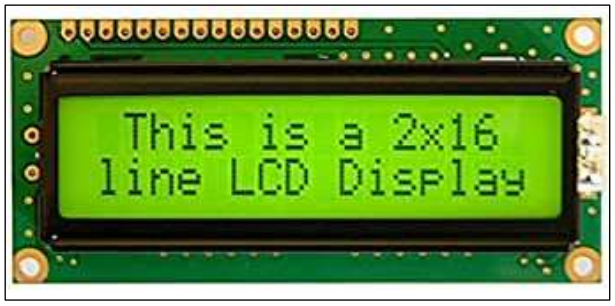

Figure 5:LCD

The LCD displays the text which is nothing but the gesture mode by dump people. The gesture detection module detects the gesture & sends the signal to voice IC module & also to the LCD display module. LCD is controlled by AVR. LCD displays text for each gesture. The LCD display used is a 16*2.

- **Speaker**

Figure 6: Speaker

speaker is connected with Arduino and speech synthesizer to show the output generated by IC AP8942A.

3.3 Software Components:

- **Arduino IDE:**

Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems. Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems.

Figure 7:Arduino

3.4 SENSORS REQUIRED

1. Flex Sensor

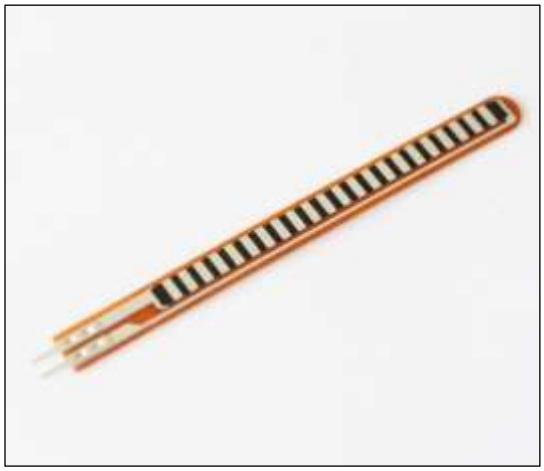

Figure 8: Flex Sensors

Flex sensors are attached to the hand gloves. These flex sensors are attached & fixed on the hand glove to monitor & sense the static movements of the fingers. The output of the flex sensor is a square wave. The frequency of this sensor varies when the amount of bend of the flex sensors. When the fingers bend, there is change in the resistance of the flex sensors & this change is output of the flex sensors. This output is given to the AVR microcontroller used in the system where this data is processed & converted into digital form. Flexors are thin strips with length 1”-5” & a width of 0.25” & thickness of about flex sensors are made up of carbon resistive elements. Flex sensors operated at 5v.

4.1 CONCLUSION:

Sign language is one of the useful tools to ease the communication between the deaf and mute communities and normal society. Though it is not easy to understand by normal people our project lowers such barriers and makes it easy to understand. The glove is capable of translating their sign language gestures into text and the pulse rate of an individual and display it in Serial Monitor of Arduino IDE.

4.2 FUTURE SCOPE:

- Designing of whole jacket which would be capable of vocalizing the gesture and language of animals.
- Home Automation using these gloves is also possible.
- Virtual reality application i.e replacing the conventional input devices like joystick in videogames with data glove.
- In future of this proposed system supporting a greater number of Signs and different language mode.
- The device can be further integrated with GPS positioning system to ensure their safety.

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