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HAND GESTURE RECOGNIZATION GLOVES WITH VOICE CONVERSION FOR NORMAL PERSON

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Abstract: Hand Gesture Recognition Gloves with Voice Conversion for a Normal Person are gloves that help people who are suffering from speaking and hearing disabilities convert the affected person's sign language into human-understandable language, or, as we can say, into spoken English. So a normal person can understand the sign language of a deaf or mute person. In our proposed methodology, we used flex sensors, an Arduino Uno, a Df Mini MP3 player, a 10k ohm resistor, jumper wires, gloves, and an I2C LED with Arduino. A flex sensor is a type of sensor that detects and measures the degree of bending or flexing in a material. These flex sensors are placed on the finger of the gloves, and when the patient wears these gloves, the flex sensors measure the degree of bending of the finger of the deaf person. An LCD is used in this model to display the command that the user wants to display. These commands are saved in the DF Mini Player, and according to the bending, the DF Mini Player gives a command to the speaker, and the speaker will play that command, and the same command will display on the I2C LED display screen. By using this technology, a normal person can understand the sign language of a deaf or mute person. Our proposed methodology is very helpful to both normal people and deaf and mute people. Also, the proposed model is cost-effective; users can easily buy these gloves at an affordable cost.

I. Introduction

We can communicate our ideas, messages, and information through vocal communication. However, due to various physical impairments, not all of us are endowed with the ability to verbally convey our views to others. The people who have the hardest time communicating with others are the deaf and the mute. Sign language is typically used by the deaf and mute to communicate, but it can be challenging when others cannot understand what is being signed.

There are several gadgets that translate human gestures into text and speech in English, but there isn't one for Hindi. India's national language, Hindi, is spoken and utilised extensively throughout the nation. In our propose system, we suggest utilizing a customized glove fitted with flex sensors to provide a tangible interface. The thumb and fingers have these sensors spaced evenly along their length. The digital glove can record hand motions, which are subsequently translated into text or voice that the general public may easily understand.

II. Problem

The primary challenge encountered during the endeavour is the variation in human anatomy. Everybody's bone structure is unique by nature. We must address this issue and ensure that the product is effective in the hands of diverse individuals because various people have different ways of making the same gesture. We also encounter numerous issues with sensor calibration. Because the available sound only has 8 channels, which means it can only play 8 audio voices, we also need to conduct a lot of research and choose a sound module in which we can save the sound file in huge quantities. We are also encountering issues with communication between the MP3 module and the microcontroller.

III. Literature Survey

- The human motion of a hand in 3D space can potentially be tracked and recorded using flex sensors complemented with IMU modules**[1]**. The flex sensor distinguishes different orientations of fingers and IMU modules, one placed on the forearm is capable of tracking the movement of the arm. This technology will aid speech and hearing-impaired people to communicate with the external world by voicing out gestures**[.**

- A device to convert finger/hand action into speech is developed. It is going to help deaf and dumb people to communicate effectively. The movement of fingers is converted to audio snaps over the cell phone and it is a low-cost solution for improving the communication of deaf and dumb people with normal people**[2]**. The glove has been designed using feasible and affordable technology It uses low-cost but effective flex sensors and commonly available Android phones. Android app is used to convert sign language into text and speech To further make it economically feasible and comfortably wearable, NodeMCU is used.

IV. Hardware Description

1. Flex Sensor

In our propose system we use 4 flex sensor as part of our instrument to measure the left hand's finger bending value. When flex sensors bend, they emit different voltages. By accumulating the data from these bends, we can determine the curvature of each finger. Figure 1.1 shows that the flex sensors which are used in this thesis have two pins. In the proposed circuit, as shown in Figures 1.2 and 1.3, the positive pins are connected to each other and then connected to one of the Arduino analogue pins, and the negative pins are connected to the Arduino analogue pins separately. The bending values of the thumb, index, middle, and ring fingers are measured by four flex sensors that are attached to the glove in the suggested implementation. We utilize a voltage divider, which is: To change the flex sensors' output voltage to a range that the Arduino can handle with little error and without causing damage to the board:

Figure 1.1: Flex sensor with two pins for producing voltage on them.

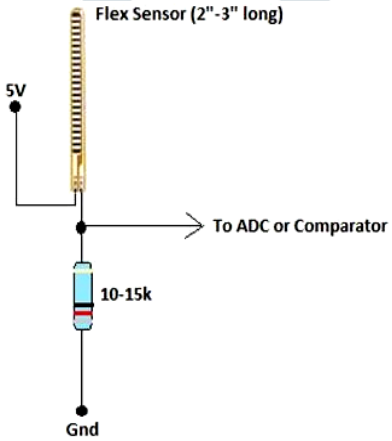

Figure 1.2: Circuit of a flex sensor connection.

The connection between the flex sensor and the voltage divider is indicated in Figure 1.3.One of the Arduino 5-volt pins is connected to the positive pins of every flex sensor in the suggested smart glove. 10KΩ resistors are also connected to the remaining analogue pins of the flex sensors. Every flex sensor's other resistor pin is linked to the Arduino ground (GND) pin. One of the flex sensor pins is linked to the Arduino 5-volt pin, while the other flex sensor pins are connected to the common

connection between the flex sensors and resistors, as shown in Figure 1.3. The flex sensors are calibrated through the Arduino program. The highest value is set when the fingers are bent, and the minimum value is set when the fingers are entirely straight because these sensors are used to measure the bend in each finger of the left hand in order to recognize its motion.

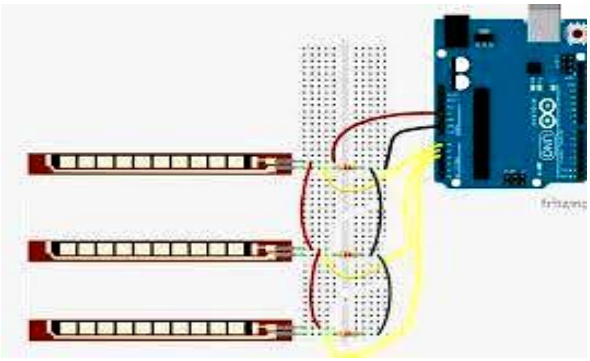

Figure 1.3: Connection between all flex sensors and Arduino pin

2. Arduino UNO :

A microcontroller board based on the ATmega328P is called the Arduino UNO. Six analogue inputs, fourteen digital input/output pins (six of which can be used as PWM outputs), a reset button, a USB connector, a power jack, an ICSP header, and a ceramic resonator operating at 16 MHz are all included. You just need to power the microcontroller using a battery, an AC-to-DC converter, or a USB connection—all the parts required to support it are already present. To begin, connect a USB cord to your computer. The sensor can be connected to a variety of electronic devices (such as LED lights, buzzers, buttons, photoresistors, etc.) and is suitable for basic applications.

- Digital I/O Pins: 14
- PWM Pins: 6 (Pin # 3, 5, 6, 9, 10 and 11)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Size: 68.6 mm x 53.4 mm
- Weight: 25 g
- ICSP Header: Yes
- Power Source

USB port. The voltage range for the USB bus specification is 4.75 to 5.25 volts. Third-party boards may have a mini USB, microUSB, or USB-C connector in place of the USB-B connector found on genuine Uno boards.

Barrel jack connector, 5.5 mm/2.1 mm. Although it is advised to use 7 to 12 volts, official Uno boards support 6 to 20 volts. Because several voltage regulators are utilised, each with a different maximum input rating, the maximum voltage for third-party Uno boards differs between board manufacturers. In order to guard against unintentional reverse voltage scenarios, power entering this connector is routed via a series diode before connecting to the VIN.

The shield header's VIN pin. Its voltage range is comparable to that of the barrel jack. This pin is susceptible to pulling or injecting electricity because it lacks reverse voltage protection. In the event that a barrel jack is used, an external series diode is needed for powering the VIN pin. This pin can draw power when the board is powered via the barrel jack.

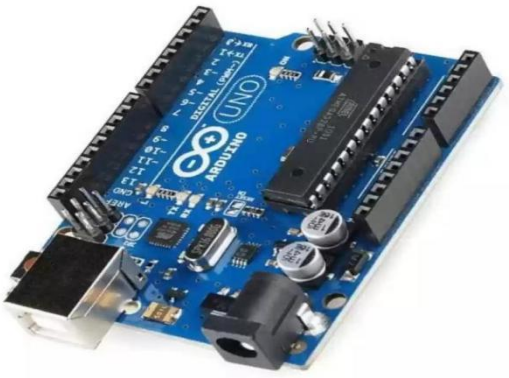

Figure 2.1 : Arduino UNO

3. DFPlayer mini MP3 Player :

The tiny and inexpensive DFPlayer Mini MP3 Player for Arduino is an MP3 module with a straightforward output that goes straight to the speaker. With a battery, speaker, and push buttons installed, the module can be used independently or in conjunction with other microcontrollers, including Arduino, ESP32, Raspberry Pi, and any other a microcontroller that has UART.

3.1 Technical Specifications:

1. Accommodates the following sample rates (KHz): 8 / 11.025 / 12/16 / 22.05 / 24/32 / 44.1 / 48 Dynamic range is supported.
2. 24-bit DAC output: 90dB Support for SNR: 85dB.
3. Maximum support for FAT16 and FAT32 file systems fully supported Support for 32G TF cards to 32G 64M bytes on U disc Not Flash.
4. There are numerous control modes to choose from. Serial port AD button control mode for IO control.
5. The language function for radio spots allows you to halt the background music. After the advertisement has concluded, the background sound keeps playing.
6. Up to 100 folders can be supported when sorting the audio data by folder. You can allocate folders to each of the 255 tracks. Six EQ levels with customisable volume and 7.30 levels.

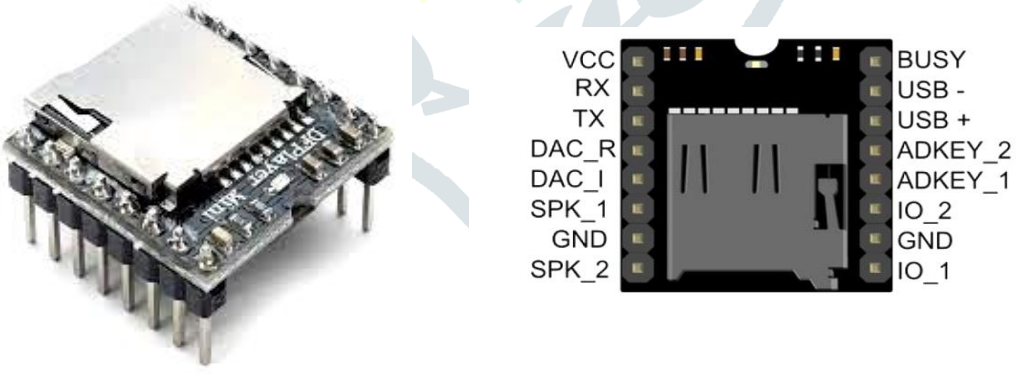

Figure 3.1 : DFPlayer A Mini MP3 Player.

4. I2C LCD :

The I2C LCD component powers a 2-line by 16-character LCD interfaced with I2C. The I2C LCD component is simply an I2C Master wrapper since it makes use of an existing I2C Master component. A project's operation requires an I2C Master component if one does not already exist. The 8-bit I/O expander chip, PCF8574, is the brains behind the adaptor. This chip transforms the parallel data needed for an LCD from the I2C data from an Arduino. Go to Sketch > Include Library > Manage Libraries to install the library. Await the download of the library index and the updating of the installed library list by the Library Manager. Enter " liquidcrystal " to narrow down your search. LiquidCrystal I2C library can be found.

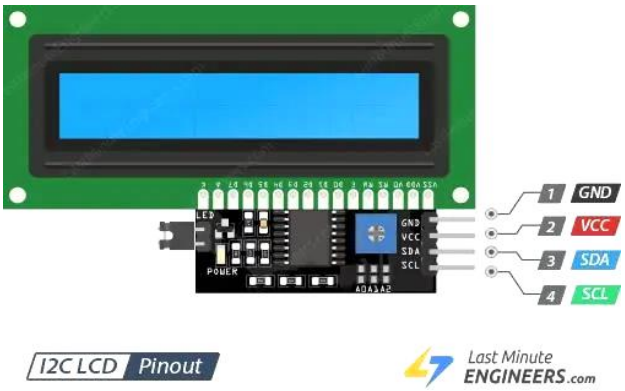

Figure 4.1: I2C LCD

5. Gloves :

Glove: a hand covering that has distinct portions for the thumb and fingers; occasionally, it covers the wrist or a portion of the arm. This study presents the concept of a smart glove that can translate sign language output into voice. Flex sensors and an Inertial Measurement Unit (IMU) are integrated inside the glove to detect the gesture. A brand-new state estimation technique has been created to monitor hand mobility in three dimensions. The viability of the prototype's voice output conversion from Indian Sign Language was evaluated. Despite being designed to translate sign language to speech, the glove has multiple uses in the gaming, robotics, and medical fields.

Figure 5.1: Hand Gloves.

6. Resister 10k ohm :

Despite being a passive resistor, a 10k resistor can be a big assist in regulating how much current flows through the circuit. Because of its 10,000 ohm resistance, it is known as a 10k ohm resistor. With the aid of its colour band, identification is straightforward.

6.1 Uses Of 10k Resistor :

A 10k resistor can be used for a variety of purposes, but these are some common ones.

1. Circuits for voltage dividers.
2. Performing arts boards and breadboards as current limiters.

Figure 6.1: Resister 10k ohm

7. Power Bank :

A power bank is a portable electrical energy storage device that may be used to charge other electronic devices, including laptops, tablets, smart-phones, and any other device with a USB or comparable interface. A lithium-ion battery, charging circuitry, and one or more USB ports for connecting devices are the standard components of power banks. They are available in a range of shapes, sizes, and capacities, from compact, pocket-sized devices to bigger, higher-capacity ones. When a conventional power outlet is not available, as is the case when travelling, engaging in outdoor sports, or in an emergency, power banks are frequently utilized.

Figure 7.1: Power Bank

V. Working of System :

It is challenging for people with speech impairments to communicate in a culture where the majority of people do not know sign language. This study presents the concept of a smart glove that can translate sign language output into voice. Flex sensors and an Inertial Measurement Unit (IMU) are integrated inside the glove to detect the gesture. A brand-new state estimation technique has been created to monitor hand mobility in three dimensions. The viability of the prototype's voice output conversion from Indian Sign Language was evaluated. Despite being designed to translate sign language to speech, the glove has multiple uses in the gaming, robotics, and medical fields.

People who are mute can wear these light devices, which translate their gestures from sign language to spoken language and then pronounce them using a smartphone application. In our propose system, we suggest utilising a customised glove equipped with flex sensors to provide a tactile interface. These sensors run the length of the fingers, and the digital Grove can record the thumb and gesture. It then converts the data into text or speech such that the average person can understand it.

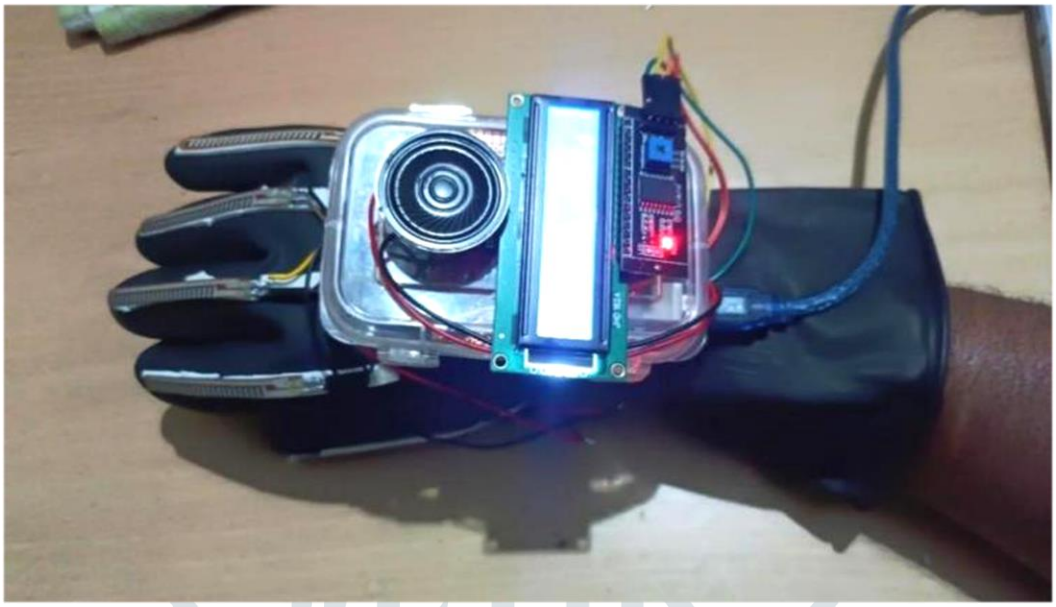

Figure 8.1: Final Prototype.

VI. Conclusion :

Our proposed methodology, the hand gesture recognization glove with noise conversion for normal person was developed for understanding the language of deaf and mute people and these gloves successfully give the output according to the moment of deaf and mute people's fingers. In our propose system it was started to create a glove that could identify hand gestures and translate them into speech for non-mute or deaf individuals. The primary aim of this project was to help people understand the language of deaf and mute individuals. Flex sensors were used to identify the bending of the fingers, and the gloves provided the output based on the bending. The project was a success, and the gloves effectively provided real-time output in line with the movements of the fingers of deaf and mute individuals.

VII. Future Scope :

The potential applications of hand gesture gloves are quite promising, particularly in the areas of improving contact and communication for people with different needs. When hand gesture recognition gloves are paired with voice converter technology, common people can expect to see significant benefits for future applications and industries. Some potential areas for development and application are as follows: Let's explore a few fascinating possibilities:

1. Enhance the recognition capability for various lighting conditions.
2. Achieving more accuracy by implementing more number of gestures.
3. Provide an editing mechanism by using gestures.
4. Identifying multiple gestures applying gesture recognition for ascending internet applications.
5. These hand gesture recognition gloves with voice conversion for normal people gives an alternate way for communicating with deaf and dumb people.
6. Hand gesture recognition glows with voice conversion for normal people is now advanced topic used to increase human and Internet of Things interaction. Which are recognized by the hand gesture and give different output.

VIII. Reference :

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