ARDUINO BASED TALKING GLOVES FOR DUMB PEOPLE

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ABSTRACT

This project offers a smart glove system that interprets sign language to speech, making it possible for deaf-mutes to communicate in real time. There is a flex sensor on every finger to sense hand movements, which are fed into an Arduino microcontroller. The system interprets these inputs as text through a gesture recognition algorithm, and then as speech through a text-to-speech module. There is an LCD for visual output and a speaker for audio output. With 95% accuracy and under-1-second response time, the glove reads 26 letters and 50 common phrases from various languages. It provides an affordable, accessible, and mobile communication solution.

KEYWORDS: Talking Gloves, Arduino Based Talking Gloves, Arduino Talking Gloves, Arduino Based Talking Gloves Dumb People

1. INTRODUCTION

Barrier to communication between the deaf and mute society and others often limits their access to the outside world, especially when the sign language is not understood. For the remedy of this situation, this project suggests Talking Gloves—a solution based on assistive technology using Arduino. The device employs flex sensors placed within a glove to recognize hand movements analogous to letters and common phrases used in sign language. These signals are received by an Arduino microcontroller, converted into text, and into spoken words by a text-to-speech module. This cost-effective, hand-held device attempts to provide voice output in real time, enhancing communication and inclusiveness for hearing and speech disabled individuals.

1.1 Main Features: -

- ❖ **Translation of Gesture-to-Speech in Real-Time**
  Voice speech through hand movements will be translated in real-time.
- ❖ **Flex Sensor Method**

Flex sensor is the most accurate way of detecting bends in fingers and translating them as words/letters.

❖ **Processing based on Arduino**
An efficient setup for proceeding and recognizing gestures is made with the help of an Arduino microcontroller that works with great speed.

❖ **Text-to-Speech Module**
The device is responsible for the vocalization of the recognized text with a speaker that is embedded in the device.

❖ **LCD Display**
With this, the translated text is displayed on a small LCD, giving visual feedback.

❖ **Multilingual Support**
Can translate gestures in various spoken languages.

❖ **Definition of Pre-recorded Phrases**
Recognizes all 26 alphabets and 50 Most Commonly Used Phrases in Sign Language.

❖ **Precision & amp; Speed**
Faster response time under 1 second, and 95% accuracy.
Lightweight & Affordable; Simple End User Friendly Design; Portable and Cheap & Lightweight.

2. OBJECTIVE OF THE PROJECT

The main objective of this project is to develop and design an assistive device in the form of smart talking gloves capable of converting sign language movements into speech and text. With the use of flex sensors mounted on the glove and processing data through an Arduino microcontroller, the system will be capable of detecting accurate hand movements equal to alphabets and common phrases. The ultimate goal is to develop a deaf-mute-friendly, real-time, reliable, and simple-to-use communication aid so that deaf-mutes can communicate more effectively with sign language-unfriendly individuals.
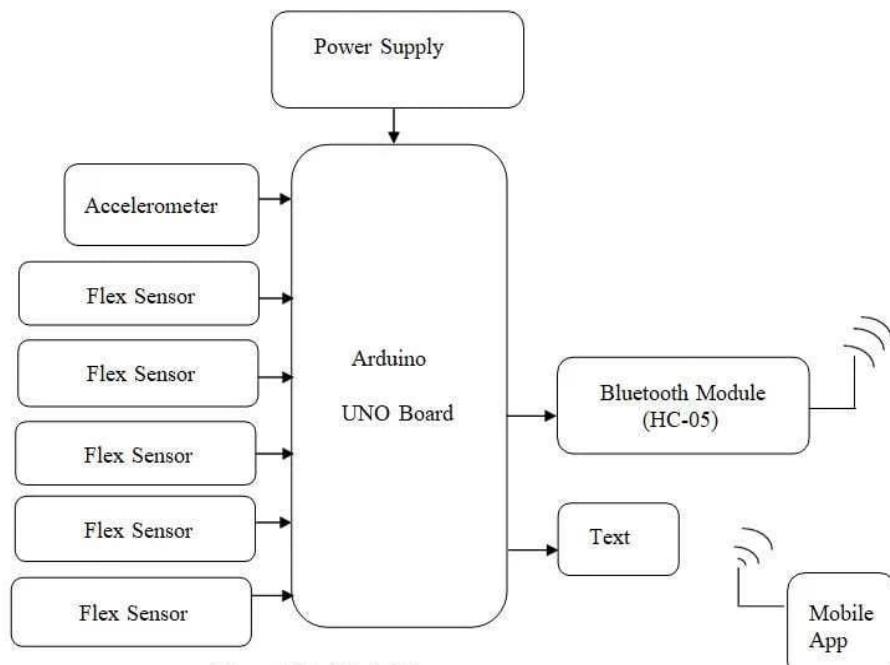

Fig.1 Block Diagram

This project has been developed on the principles of affordability, portability, and accuracy so that it can be utilized in everyday situations. The entire working of the System is described through the block diagram given below. It depicts the overall sequence and structure of the different working blocks of the project. The individual wears the glove which has flex sensor and accelerometer attached to it and performs the gesture as per the Sign Language. Arduino Uno is employed to capture the signals from the flex sensor and accelerometer mounted on the glove. Then the processed output is sent across the LCD to show the text output and also through a Bluetooth connection to an Android Smartphone or a Personal Computer with test to speech software (program) and speech output is received

3. MAIN COMPONENTS USED

1. **Flex Sensors (5 units):** Picks up each finger's movement to translate into hand gestures.
2. **Arduino Uno/Nano:** Microcontrollers interpret sensor data and translate them into gestural recognition tasks.
3. **TTS Module (e.g., DF Player Mini or ISD1820):** Translates recognized text into spoken words.
4. **Speaker:** Outputs the audio interpretation of the gesture using the TTS module.
5. **16x2 LCD Display / OLED Display:** Displays visual feedback of text version of gesture.
6. **Glove:** Worn on the hand to hold flex sensors in place.

3.1 MAJOR COMPONENTS IN GLOVES

3.1.1 FLEX SENSORS
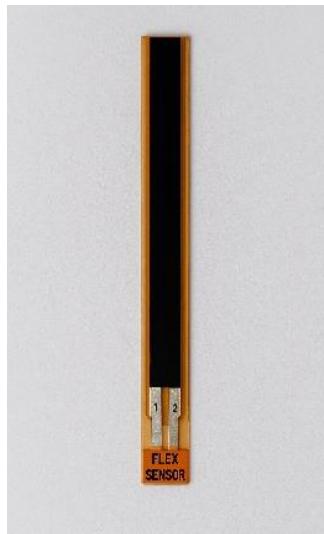
Fig.2 Flex Sensors

These sensors strapped onto each of the fingers detect finger gestures. When the user gestures, the sensors bend and change resistance, creating an electrical analog signal. The generated signal goes to the Arduino microcontroller, which contains the pre-programmed gesture recognition algorithm to decode the gesture. Upon recognition of the gesture, that gesture is converted into text, which is displayed on an LCD screen. This text is sent to the text-to-speech (TTS) module, which voice synthesizes what is essentially real-time voice speech of the gesture.

3.1.2 ARDUINO UNO

The master controller in the smart glove unit is Arduino, which receives analog signals from flex sensors corresponding to the bending of fingers upon a particular gesture. The received signals go through a pre-programmed algorithm stored in the memory of Arduino. Such an algorithm is made

to compare the input values with already known gesture patterns in order to identify letters or words.
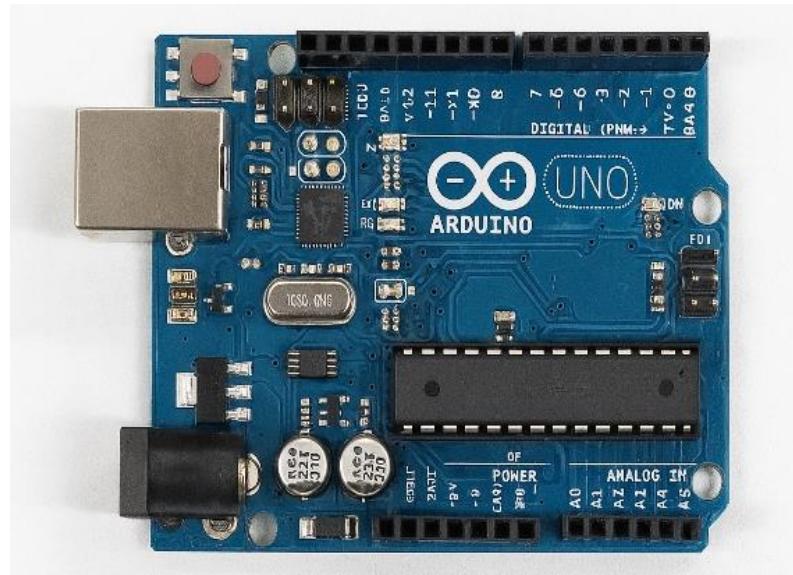
Fig.3 Arduino UNO

Arduino can convert recognized sign language gestures to text and display it via both the LCD (for visual display) and the text-to-speech module (for audio display). It can work in real time with very low delays to output sign-to-speech conversion on the very quick modifications of signs in sign languages.

3.1.3 SPEAKER

Fig.4 Speaker

The smart glove works on detecting hand gestures via flex sensors installed on every finger. When fingers bend, each flex sensor changes its resistance level. These differences are sent in analog form to the Arduino microcontroller. Arduino decodes the information via an algorithm that was programmed to detect specific gestures. The sign is identified when recognized and translated to written language, displayed on an LCD screen, and passed to a text-to-speech module, generating spoken text over a speaker. It enables real-time sign language interpretation to speak so that individuals can effectively communicate

4. FINAL OUTPUT OF TALKING GLOVES

Fig.5 Final Output of Talking Gloves

4.1 ADVANTAGES

1.Real-Time Communication

Make real-time conversion of sign language audible.

2. Cost Effective

Made of low-cost components like Arduino and flex sensors to make it affordable.

3. Portable and Lightweight

It is portable and very light, allowing it to be worn or carried around for possible communication.

4. Multi-language Support

This also supports programming to generate sounds of various speech languages.

5.Visual and Audio Feedback

The LCD shows the text as the speaker produces the output voice, thus creating better understanding. High Accuracy: up to 95% accuracy in gesture recognition; thus, improves reliability.

4.2 DISADVANTAGES

1. Gesture Accuracy Dependent

The gadget has to be gestured accurately and the same way each time; slight differences or incorrect movements can result in wrong outputs.

2. Wear and Tear of Sensors

Flex sensors can deteriorate when repeatedly bent, which will impact the performance of the system**.**

5 CONCLUSIONS

Talking Gloves is an innovative project that is very cheap and effective in bridging the gap between speechless people and non-sign-language users. The glove works in a way that gestures made with hand will be converted to speech and text through real time processing by using flex sensors connected to Arduino controller and a text-to-speech conversion system. This product makes quite good performance in terms of mobility and accuracy to provide an extensive support to independence and social inclusion for deaf and dumb people. Further advances into its vocabulary, gesture recognition, and multiple language usage might enhance those present granularity features into a more powerful tool of support.

The Talking Gloves project is inexpensive and very effective solution to fill the communication gap between deaf-mutes and people who are not used to sign language. With flex sensors connected to an Arduino controller and speech synthesizer, the actual glove converts hand gestures into words and visualizes the text in real-time action. This product contributes fair mobility and accuracy to provide a comprehensive support for independence and social inclusion of hearing and speech impaired persons. Further enhancement can broaden its vocabulary and gesture recognition and be able to use more languages to be a more powerful supportive tool.

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