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Gesture Verbaliser : Smart Glove

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ABSTRACT—Gesture Vocalizer is a societal purpose initiative that helps people who have disability related to speech or is hearing impaired in communicating with the society. According to research and several studies, there are around 9 billion people all over the world who are facing these kinds of disabilities, and they must come across numerous challenges in their daily interactions with society. The deaf and those with hearing impairments commonly use sign language, but they face difficulties while communicating with others who are unable understand them. Mostly American sign languages is preferred worldwide as it uses only one hand to communicate. This project aims to address the need of an electronic device which is capable of translating sign language into speech and converting it into audio, thereby reducing the communication challengesfor the physically disabled people.

KEYWORDS—Gesture Vocalizer,sign language,hearing impairments,communication challenges

I. INTRODUCTION

People who have speech and hearing impairments mostly use sign language to communicate with other people, but they face challenges when they try to communicate with those who don't understand their language. Sign language entails the use of gestures, visual communication, and various hand shapes to express thoughts. However, since sign language is not a standardized language, the challenge of breaking down communication barriers still exists in our society. Our project motive is to manufacture a smart device which is able to translate gestures into both audio and visual formats, making it easier for both the deaf community and the other people to communicate efficiently.

The objective is to improve communication between individuals with speech, hearing, and visual impairments, as well as between these communities and the public. One solution to this challenge is the Hand Gesture Vocalizer, a device that uses microcontroller to recognize hand gestures and movements using flex sensors and vibration sensor. The device then converts input data into a voice message that is played on an Android phone through a Bluetooth connection.

II. LITERATURE SURVEY

1. Srinivas Gutta, Jeffrey Huang, The fusion classing architecture for facial and hand gesture identification has shown improvement in its methodology, but it may not perform well in low light conditions or when the images are blurred.
2. M. S Kasar, Anvita Deshmukh built a Smart Speaking Glove. A portable speech synthesizer and vocalizer in the form of a glove has been developed to assist speech-impaired individuals. While the system is effective, it can only recognize 4 hand gestures and translate them into vocal outputs.
3. Lokesh Babu, S. Gagana Priyanka , P.Pooja Pravallika , Ch. Prathyusha made “Gesture Vocalizer”. It uses Real Time Speech to Text Converter for Android Users. But this becomes difficult to always look into mobile phone application
4. Sanish Manandhar et al. proposed the Gesture Vocalizer for Dumb and Deaf people. A system has been developed that utilizes components such as Arduino Mega, Flex sensors, and Accelerometer to translate the signs used by disabled individuals into written, aural, and graphical forms that can be understood by the general population. The current training model uses the Random Forest algorithm to achieve an accuracy of 85% in predicting the correct output.
5. Mali Pooja Dadaram suggested Sign Language to Speech Conversion Gloves using Arduino and Flex Sensors. The given system employs a microcontroller (Arduino UNO) and a flex sensor-based data glove to translate hand gestures into actionable data. The LED lights up during data transfer. The gloves have flex sensors embedded in them, and a rotation detector measures the hand's shape by detecting uniform changes in resistance to each touch. The microcontroller processes the hand signals to complete the system's functionality.

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6. Mangesh T Nikam et al proposed Talking Hand for dumb and deaf people. This system is designed to assist disabled individuals and consists of a 3-axis accelerometer sensor mounted on the hand or head. The microcontroller, with the help of ADC, senses the movement of the hand or head through the accelerometer. Specific words are assigned to each significant movement, and the microcontroller reads the movement, giving a order to the voice IC to speak a pre-recorded note to that movement.
7. Reserch done by Kshirasagar Snehal et al presented gesture vocalizer for dumb and deaf. The system is integrated into an AVR microcontroller (ATmega16) and consists of a flex sensor, LCD display, speaker, speech synthesizer , and accelerometer. The glove is transistorized with flexible sensors and an accelerometer, which the AVR microprocessor compares to stored values. The nearest value, which is the description of the action, is selected and displayed on the LCD as text and uttered through the speaker.

III. METHODOLOGY

The project uses four flex sensors and one tilt sensor.Flex sensors are made-up of conductive ink and with the bending, their resistance value changes. The resistance of the flex sensor is directly dependent on to the amount of bending, more the bending higher is the resistance.

Reading from flex and tilt sensor are added. These readings are fed to an Arduino, which consistof a built-in ADC and compares the digital values to pre-defined codes. If the values are tracked, corresponding gesture is identified, and the text is sent wirelessly to an output device (such as a phone) via a Bluetooth module. The HC-05 Bluetooth module is a versatile solution for wireless communication. It can act as either a master or slave device and can connect to other serial devices through its Bluetooth capabilities.

The text is then converted into audio using a Bluetooth application and both text as well asaudio outputs are displayed (as shown in Figure 1).

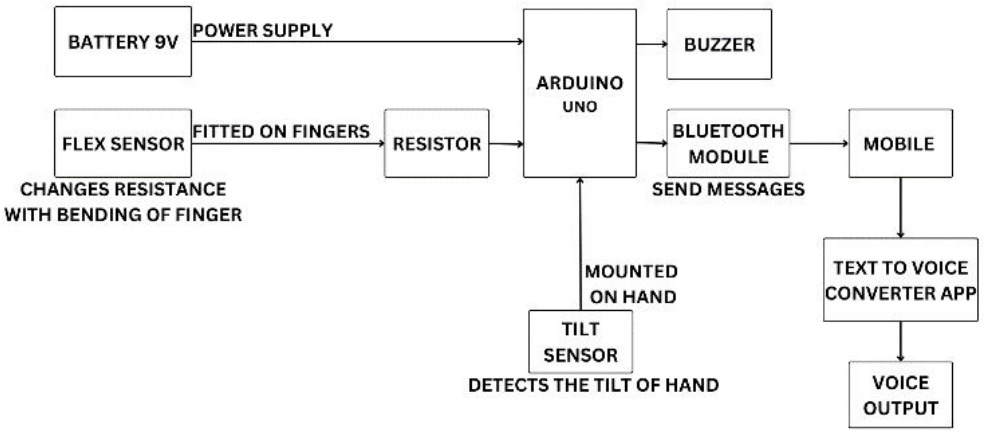

Fig 1: Architectural DiagramofGesture Vocalize

IV. ALGORITHM

The Arduino Software Integrated Development Environment (IDE) is used to write and upload code to the board. This software is compatible with all Arduino boards and provides a user-friendly interface for coding. The Arduino device operates as a computer software and hardware with a UART connection, which is accessible through the TX (1) and RX (0) digital pins on the Arduino. The software also features a serial monitor that enables fast data input. When data is transmitted through USB, the two LEDs, one labelled as reception and the other as transmission, will flash.

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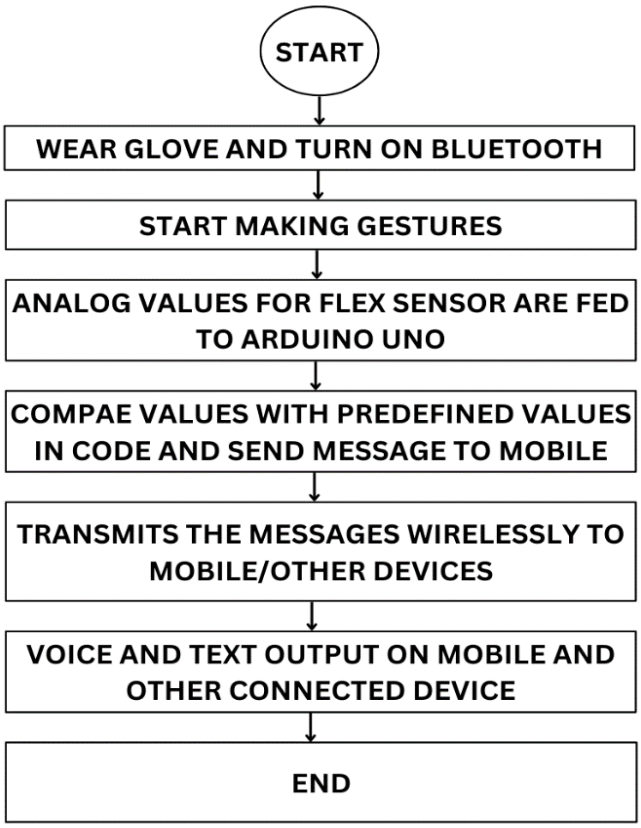

Fig 2: Working Algorithm of Smart Glove

V. RESULT AND DISCUSSION

Fig 3 shows the hardware implementation of smart glove connected with Bluetooth Text-to-Speech app using Bluetooth module. When gestures are performed, Bluetooth module sends a signal to app and then text is converted to audio message. As shown in Fig 4 and Fig 6 six shows the gesture performed and Fig 5 and Fig 7 shows their respective outputs.

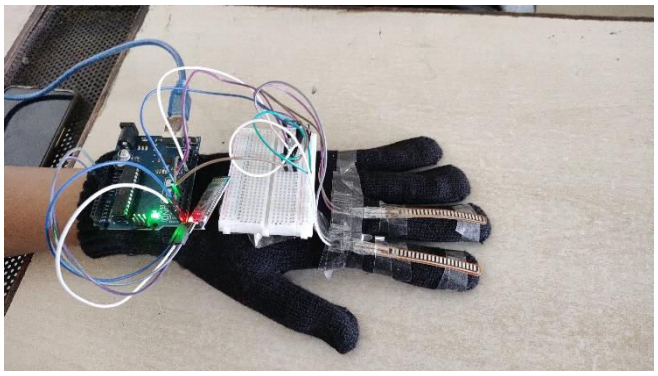

Fig 3: Hardware implementation

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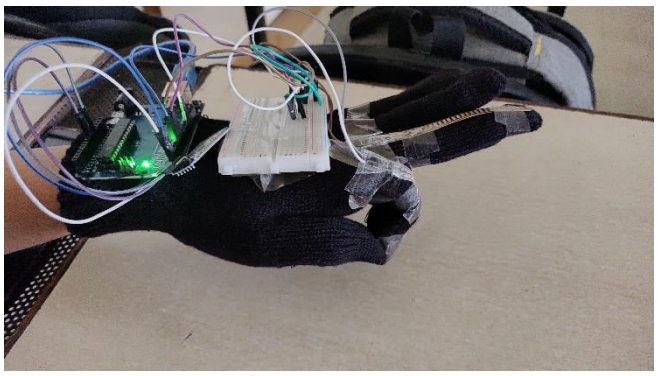

Fig 4: 1st Gesture

Fig 5: Output for 1st Gesture

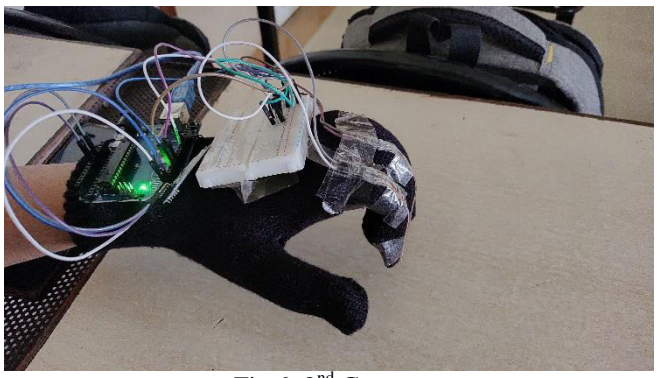

Fig 6: 2nd Gesture

VI. CALCULATIONS

To calculate the Output Voltage

$$Vo = Vcc \left(\frac{R}{R+Rflex}\right)$$

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VII. CONCLUSION

The Gesture Vocaliser is a hand glove instrument that enables the deaf and hard of hearing to be in touch with the world through voice messages. By interpreting hand gestures of hand as input, the device outputs speech and text via an Android application. The device is designed with hand gestures as the primary input method, as they are supposed to be the quickest way to reflect the user's intention. Unfortunately, people without hearing disabilities often do not take the time to learn sign language, leading to isolation and marginalization of the deaf and hard of hearing community. The Gesture Vocaliser aims to address this issue by offering an accessible means of communication and making life easier for those with hearing disabilities.

VIII. FUTURE SCOPE

In the future, there is wide scope for the development of a standalone application specifically for the Gesture Vocalizer. This would give users the opportunity to personalize their gestures, customizing the device to their specific needs. Additionally, the application could allow users to personalize the output voices for certain gestures. Integrating with devices like Alexa and Google Assistant could further enhance the device's capabilities and support basic home automation functions like controlling lights and adjusting the thermostat.

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