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SIGN LANGUAGE TO SPEECH CONVERSION FOR MUTE PEOPLE

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ABSTRACT

Mute people use different modes to communicate with others. There are many methods available for communicating, one such common method of communication for mute people is sign language. Sign language allows mute people to communicate with human body language. Our motive is to convert the human sign language to Voice with human gesture understanding. By using sign motions and gestures we put forth a smart speaking system which will help deaf people to communicate with normal people. The system is provided with sensors like flex consisting of hand motion reading system. ESP32 is used for operation of the system and processing the data. Battery powered circuit is used to power the system and run it. Smartphone is used to display and speak the signed language. The system incorporates a text to speech conversion block that interrupts the signs that match i.e. text to speech out. Once the message is sent on smartphone it is recovered through the speaker and is spoken out and also displays the text.

Keywords: Sign Language To Speech Conversion, ESP32, Flex Sensors, Smart Speaking System, Smart Gloves.

I. INTRODUCTION

As we know communication is playing major role in human beings. Unlike animals we are blessed with all the six senses but not all are lucky enough. Some have the disability in speaking and hearing. In the whole world approximately about nine thousand million people are mute (deaf). How frequently will we come across the mute people communicating with the normal people? On comparison of communication between the blind and a normal sight person, the communication between a deaf and normal person is a serious problem. Mute people communicate with normal people using sign language. Sign language is system of communication using signs and visual gestures. There are various categories in sign language, but none of them are universal or international. This sign language doesn't have a common origin and hence it is difficult to understand and translate for normal people. Using this system, we are converting Sign language into voice output, which will be easier and efficient way for communication of deaf and dumb people. This prototype consists of Controller Board, group of Flex Sensors, Accelerometer and power supply. For the operation of the system and processing the data ESP32 is used. Battery powered circuit is used to power the system and to run it. Sign gesture is sensed through Flex sensors. Bluetooth sensor will send those sign gesture on smartphone and it will convert it into voice output.

II. LITERATURE REVIEW

In paper, Speaking System for Mute Peoples by Jyoti Nigde, Omkar Parit, Sagar Parab, Dr. S. D. Shribahadurkar4, Prof. D. P. Potdar [1] states that, the mute person will go through the complete sentence which he wants to communicate with others. Then the sentence read by the person will be able to translate it into speech, which will be understood audible to everyone.

H.K.Nishihara et al. [2] (US patent, 2009), generate silhouette images and three-dimensional features of bare hand. Further, classify the input gesture by comparing it with predefined gestures.

K Gunasekaran et al. [3] in the paper "Sign Language to Speech Translation" modeled a system composed of four modules viz., sensing unit, processing unit, voice storage unit, and a wireless communication unit. The system is im- plemented by integrating a flux sensor and APR9600 with PIC16F877A. Users wear gloves that are fitted with flex sensors which respond to hand gestures. Suitable circuit response is used to provide the Micro-controller with input and the microcontroller hence plays the recorded voice using APR9600.

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The author Sunchan Park, et. al. [4] The Convolutional neural network (CNN) acoustic models showed lower word error rate (WER) in distant speech recognition than fully- connected DNN acoustic models. To improve the performance of reverberant speech recognition using CNN acoustic models, the proposed method uses the multiresolution CNN that has two separate streams: one is the wideband feature with wide- context window and the other is the narrowband feature with narrow-context window. The experiments on the ASR task of the REVERB challenge 2014 showed that the proposed multiresolution CNN based approach reduced the WER by 8.79% and 8.83% for the simulated test data and the realcondition test data, respectively, compared with the conventional CNN based method.

Bantupalli et al., [5] have used a convolutional neural network for spatial feature extraction, long short term Memory and recurrent neural networks for temporal feature extraction and then used ADAM optimizer and a softmax layer for prediction.

III. HARDWARE DESCRIPTION

The hardware for Sign Language to Speech Conversion system includes the following components:

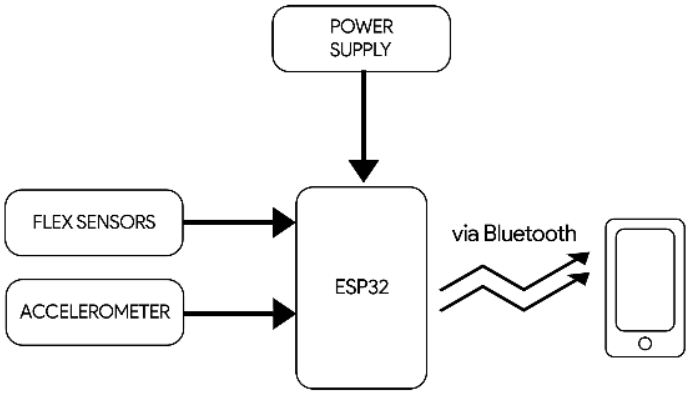

Fig 1. System Hardware Design

A. ESP32

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules.

B. Flex Sensors

Flex sensors are usually available in two sizes. One is 2.2 inch and another is 4.5 inch. Although the sizes are different the basic function remains the same. They are also divided based on resistance. There are LOW resistance, MEDIUM resistance and HIGH resistance types.

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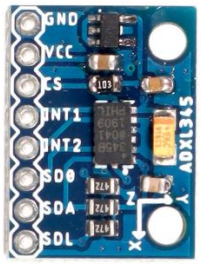
C. Accelerometer

It is the device that measures vibration or acceleration of motion of a structure. The force caused by vibration causes mass to squeeze the piezoelectric material which produce electric charge that is proportional to the force exerted upon it.



The system uses ESP32 microcontroller which is connected with all flex sensors and accelerometer (MPU6050). To power the system, we uses Lithium Polymer 3.7V battery (1000 mAh). Overall, the hardware components used in the system are relatively inexpensive and widely available, making the system accessible and affordable for visually impaired individuals.

IV. SOFTWARE DESCRIPTION

We uses C++ programming language for this project, TTS (Text-To-Speech) application and Visual studio code for firmware development. While writing code in C++ language, we pre-defined gestures by putting different messages or text to different gestures. It becomes easy for controller to detect or recognize gestures. Once it matches the gestures with pre-defined messages or text then it will gives output in TTS (Text-To-Speech) application on smartphone.

V. IMPLEMENTATION

The system is implemented as follows:

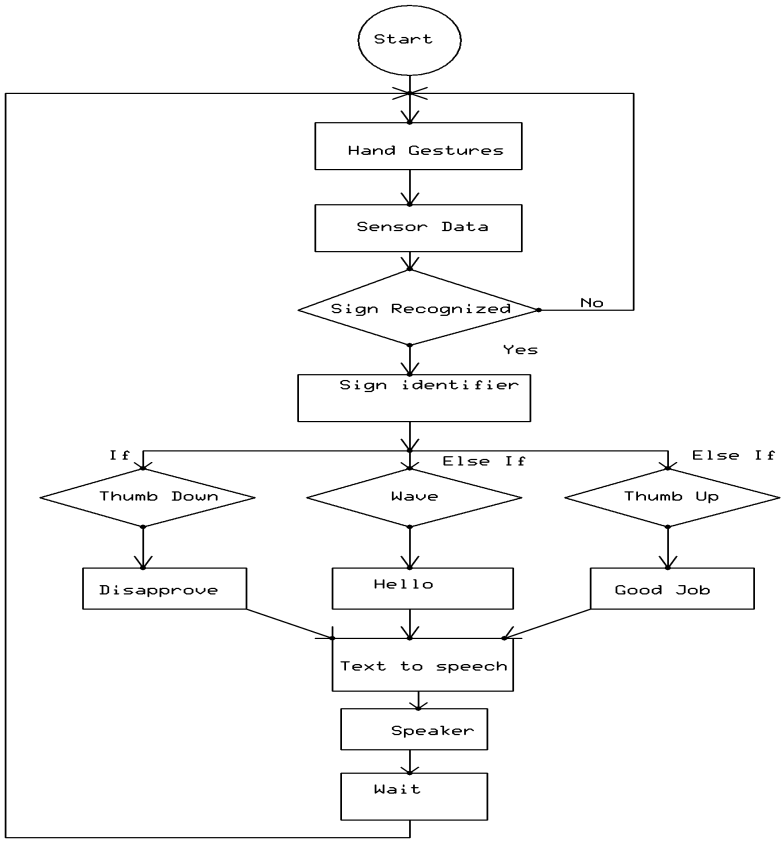


Fig 2. Project Flow Chart

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1. Connect the ESP23 controller with all components and make sure that power supply is connected properly with controller.
2. Then install TTS (Text-To-Speech) app in smartphone.
3. Open VS Code to write a program.
4. Then pre-defined message for sign language for different hand gestures.
5. Upload the code on controller.
6. Connect TTS application from smartphone with controller with bluetooth.
7. And make movement of hand or make gesture.
8. Controller with try to recognize the gesture with pre-defined language in its program.
9. If controller recognizes gesture then it will send message on TTS application and that app speak as well as displays the message.
10. If controller does not recognizes the gesture then it will start process again for recognition.

VI. WORKING

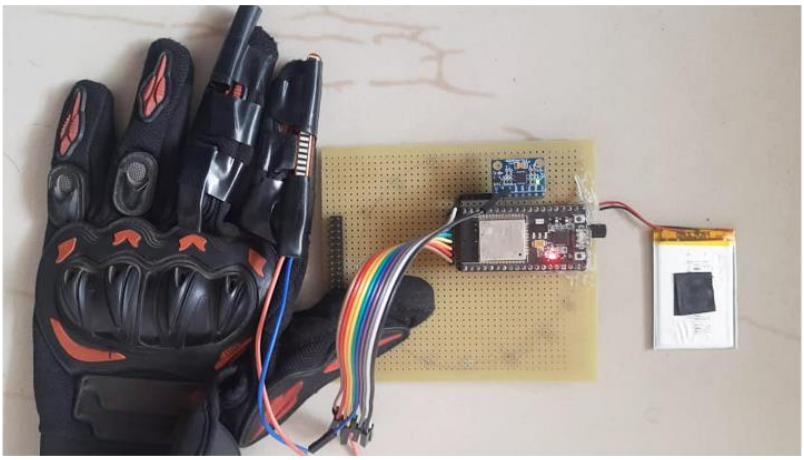
The System Architecture of the proposed Sign Language to Speech Conversion for Mute People is as shown in the fig 1. It consists of ESP32 controller board, flex sensor, accelmelator and smartphone for output which is connected with ESP32 controller board with Bluetooth.

Here flex sensors are used to detect hand posture. When the sensor is bent, corresponding to the bend radius it produces the output resistance. Approximately from 10K to 30K ohm the resistance value is varied. When sensor is bent at 90 degree the resistance increases to 30K ohm and an unfixed sensor resistance is decreased to 10K ohm. The sensor is about 4-1/2 inches long and ¼ inch wide,. The four flex sensors are set up on the four fingers of the user. When user makes a hand gesture to express a specific word the flex sensors gets folded. As the posture of each finger is different, so resistance value of each flex sensor is also different.

In this system, it reads person's hand motion for various hand movements. It senses the motion of the hand using flex sensors. To get the right information from the user a sign language is pre-defined in the ESP32. For each gesture movement it is given by flex sensors in a glove is processed and has pre-defined functions in the system code and it looks for the messages which are matching for the set of flex sensor value. The gestures are recognized by the processor and the search for the matching message according to the processed gesture. These messages are retrieved from the processor and sent to smartphone with Bluetooth and it will display the text and speak the message for user.

VII. RESULT

HARDWARE :



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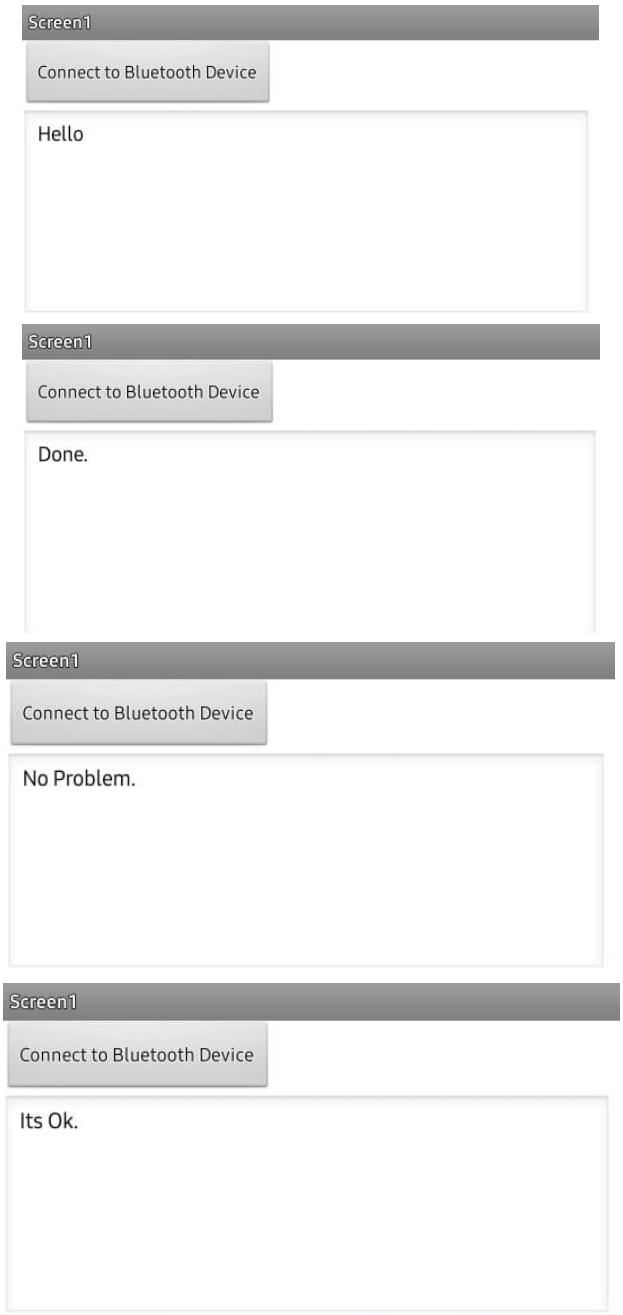
SOFTWARE :



VIII. CONCLUSION

The main purpose of this project is to help the deaf and dumb people. The project mainly aims at reducing the gap of communication between the mute people and normal people. This system overcomes the difficulties faced by mute people and helps them in improving their manner. The projected system is very easy to carry to any places when compared to existing systems. To help the mute people, the sign language gets converted into text kind and that displayed on smartphone screen and also speaks the text. The system is very much helpful for those who cannot communicate with normal people i.e. deaf and mute people. This sign language recognition and speech conversion system will make a revolutionary change in the communication process of speech impaired people.

IX. FUTURE SCOPE

Sign language to Speech conversion system for mute people is quite promising, as it has potential to significantly improve communication and quality of life for individuals who uses sign language to communicate.

In future, it will support multiple language, improve accuracy, enhance user experience, etc. Overall, future of sign language to speech conversion looks bright and it has potential to make positive impact on lives of mute people around the world.

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