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HAND GESTURE BASED SPEAKING SYSTEM FOR THE MUTE PEOPLE

Gaurav Dharankar[1], Devavrat Yende[2], Prachi Ghadge[3], Snehal Gawhale[4]

[1]*Gaurav Sunil Dharankar, Student at PES Modern COE in Department of E&TC Engineering, Pune, Maharashtra, India*
[2]*Devavrat Prashant Yende, Student at PES Modern COE in Department of E&TC Engineering, Pune, Maharashtra, India*
[3]*Prachi Hanumant Ghadge, Student at PES Modern COE in Department of E&TC Engineering, Pune, Maharashtra, India*
[4]*Snehal Shrikrushna Gawhale, Student at PES Modern COE in Department of E&TC Engineering, Pune, Maharashtra, India*
[5]*Anuradha Kasangottuwar, Assistant Professor at PES Modern COE in department of E&TC Engineering, Pune, Maharashtra, India*

Abstract - - *Communication between Mute community has become more unfavourable in day-to-day life. Approximately 432 million people across globe are deaf and mute, and around 34 million out of these are children. Mute groups in the world mosty use gestural type of communication called Sign language. We ideated a verbal exchange device for the Deaf-Mute which translates hand gestures into audio message as an intermediatory. The aim behind developing this plan, is to assist the humans using a deaf-mute communication intermediatory device. In the Prototype, we utilized Flex sensor module to understand hand motions. The motions of the fingers of mute people is captured by flex sensor, raspberry pi 3B+ identifies these gestures. Now using text to speech conversion these gestures are then converted into adequate and predefined audio messages and audio output is given through speaker module. Thus more effective communication is enabled. The developed system it is easy to operate and capable to building efficient and effective interaction between human and computer and also user friendly.*

Key Words: **Text to speech conversion, Raspberry pi 3B+, Flex Sensors, ADC ADS1115.**

1. INTRODUCTION

It becomes difficult for mute people for conveying their message to regular people. As, regular people are not trained on hand sign language, Hence the communication becomes very difficult. In emergency situations or other times communicating to nearby people or effectively explaining their thoughts becomes a major task. So to solve the we propose a smart speaking system which makes use of hand motions and gestures and hence assists mute community in imparting their message to normal population. The device hardware includes a system of hand motion reading incorporated with Flex sensor and microcontroller. For processing the received input and operating the system a Raspberry pi processor is used. The devices includes some inbuilt messages like "I need water", "I want to use the washroom" and a few more messages that help mute in imparting basic messages through finger actions.

1.1 Objective

Focused on developing a device for Mute community that is independent of hardware and feasible to use.

- In several fields Hand gestures are used as a form of non-verbal communication.
- The device consists of a Flex Sensor, to capture the finger gesture performed by the user, connected with raspberry pi and captures the signal as the input to the proposed algorithm and produce voice messages as output through the speaker module.
- The sample algorithm divided into four main steps, which includes capturing, analog signal conversion to digital, pattern matching and classification.
- The final output is given through speaker module.

1.2 Applications

- Gesture recognition and conversion.
- As a translating device for Mute people.
- **Education and Learning:** It can aid in classroom participation, enabling students to interact with teachers and classmates more effectively. Additionally, it facilitates language learning and vocabulary development.

- **Medical and Healthcare**: to assist patients with speech and hearing impairments in conveying their needs, symptoms, or medical history to healthcare professionals.

- **Accessibility in Public Spaces:** such as libraries, museums, or transportation hubs, using it mute individuals can easily communicate with staff or access information without barriers.

2. RELATED WORK

[1] Bhavana Deore, Rachana Bansode, Vaishnavi Kokate, the proposed system makes use of a hand motion reading system equipped with IR sensor and Mobile Application. This system is powered by a battery powered circuitry to run it. Major Drawbacks were Lesser accuracy due to IR technology, also Hefty and immobile.

[2] Tripathy, A. K., Jadhav, D., Barreto, S. A., Rasquinha, D. & Mathew S. S., A system that using real time images to convert them to speech with text using web cam and image processing, the system was Inaccurate and unreliable in darker environment and More time consuming for processing.

[3] **Ruize Xu, Shengli Zhou, and Wen J. Li,** A system consisting gesture recognition model producing output based on the input signals from MEMS 3-axes accelerometers. The system had Lesser and Limited hand gestures recognition and regular system updating is hectic due to outdated technology usage.

3. PROPOSED METHODOLOGY

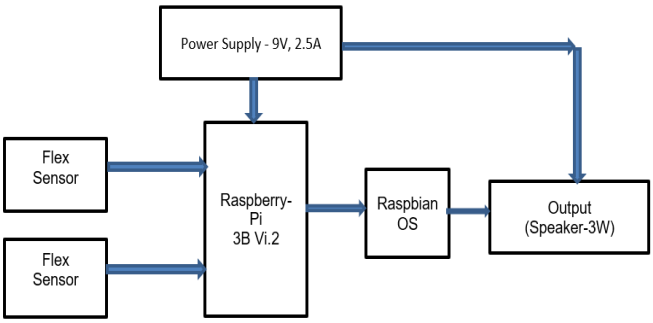

Fig-1: System Block Diagram

Description:

The block diagram consists of different blocks which shows the entire schematic of the project.

- **Flex Sensors**: they are used to detect the motion of the hand. Based on the pattern of bending of fingers the appropriate signal is generated and sent to the processor through ADC.

- **Raspberry-Pi**: Raspberry-Pi processor constantly receives input sensor values and then processes it. Now we match this signal using the if-else ladder algorithm search for messages form the predefined values.

- **Speaker Module:** after message matching, this message is captured and is converted using text to speech processing and spoken out through the speaker.

Thus we have a designed a fully operational smart speaking glove system which assists the mute community to efficiently convey, effectively explain their message and easily communicate with regular people using a simple wearable system.

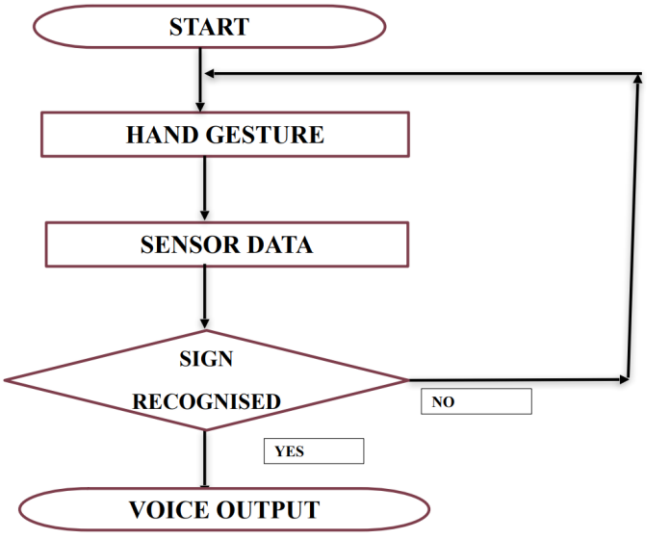

Fig -2: Flowchart

Algorithm:

The Pattern Searching algorithms are sometimes also referred to as String Searching. Here If else ladder is used to generate the audio output. Upon bending the flex sensors, a change is observed in the threshold value of the sensor output. There are predefined threshold ranges, and if the received threshold value falls within any of the predefined ranges the audio message associated with that range is given at the voice output.

1. Based on the combination of the fingers gestures an appropriate pattern is sent to the raspberry pi using Flex sensor through the ADC.

2. For every 1 second the processor checks for sensor data.

3. The received pattern is then allowed to pass through a if – else ladder.

4. This signal is matched to the pre-defined text messages.

5. Signal matching in if-else:

- YES - If the signal patter matches to the condition of the if statement, the body of the if statement gets executed, and message associated with it is converted to audio through text to speech libraries and audio output is given.

- NO - If signal pattern does not match then the loop terminates and wait for the next hand motion for every 1 second to check for the adequate match.

4. RESULTS

1. **Testing and Quality assurance:**

We tested our projects giving various inputs using different hand gestures, it was giving all the samples successfully as output. It provided output with 90-95% accuracy. The flex sensors are very sensitive, hence even as slight bend will change the input instantly and hence give the output. Hence, the user does not need to bend it too much, a little also is fine. This gives the assurance of quality of our product. Also, the flex sensors are very light weight. So the user won't feel trouble in handling the gloves at all. Hence, we have formed a user-friendly product.

2. **Problems Faced:**

The most challenging part of our project was calibrating the flex sensors. The main problem was that every sensor gives a different set of values when it is straight as well as for when it is bent. The only thing that could be used was that all the sensors gave higher values for when it was bent than when it was straight. So we used this logic to solve the issue. We coded the Raspberry in such a way that threshold ranges where set for each sensors and if any sensor values is encountered in between this range adequate output was given. Also interfacing flex to raspberry was a difficult task so we need ADC to do so.

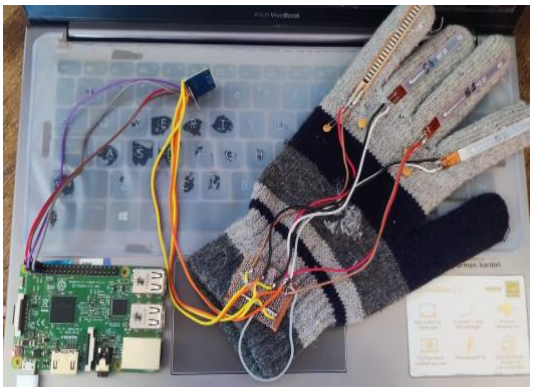

Fig-3: Hardware Implementation

5. CONCLUSION

In this work, the gestures made by the speech impaired people are caught by the flex sensors which produce a certain voltage these reading have a specific meaning in the procured data and would be shown. This helps in covering the communication gap between normal people and speech impaired as the message in converted to speech. The connection of these flex sensors to the gloves gives an advantage of carrying around easy and very efficient.

6. ACKNOWLEDGEMENT

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