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VOICE FOR MUTE

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Abstract : Communication between mute and a normal person have always been a difficult task. By using hand motions and gestures we put forth a smart speaking system which will help deaf people to communicate with normal people. During emergency, a mute person who is travelling amongst new people and if he/she wants to communicate with them becomes a difficult task. The system is provided with sensors like flex sensor consisting of hand motion reading system in addition with a unit of speaker. The System also consist of GUI which will display the text which the speaker has decoded. There will be some GUI buttons with pre-installed voice notes for instant output.

Keywords:- Sign Language ,Raspberry pi, Flex Sensor

INTRODUCTION

The ability to communicate is fundamental to human interaction and plays a crucial role in expressing thoughts, emotions, and needs. However, there are individuals in our society who face challenges in this area due to conditions that render them mute, making it difficult for them to communicate verbally. In such cases, technological interventions can greatly enhance their quality of life and provide them with a means to express themselves effectively.

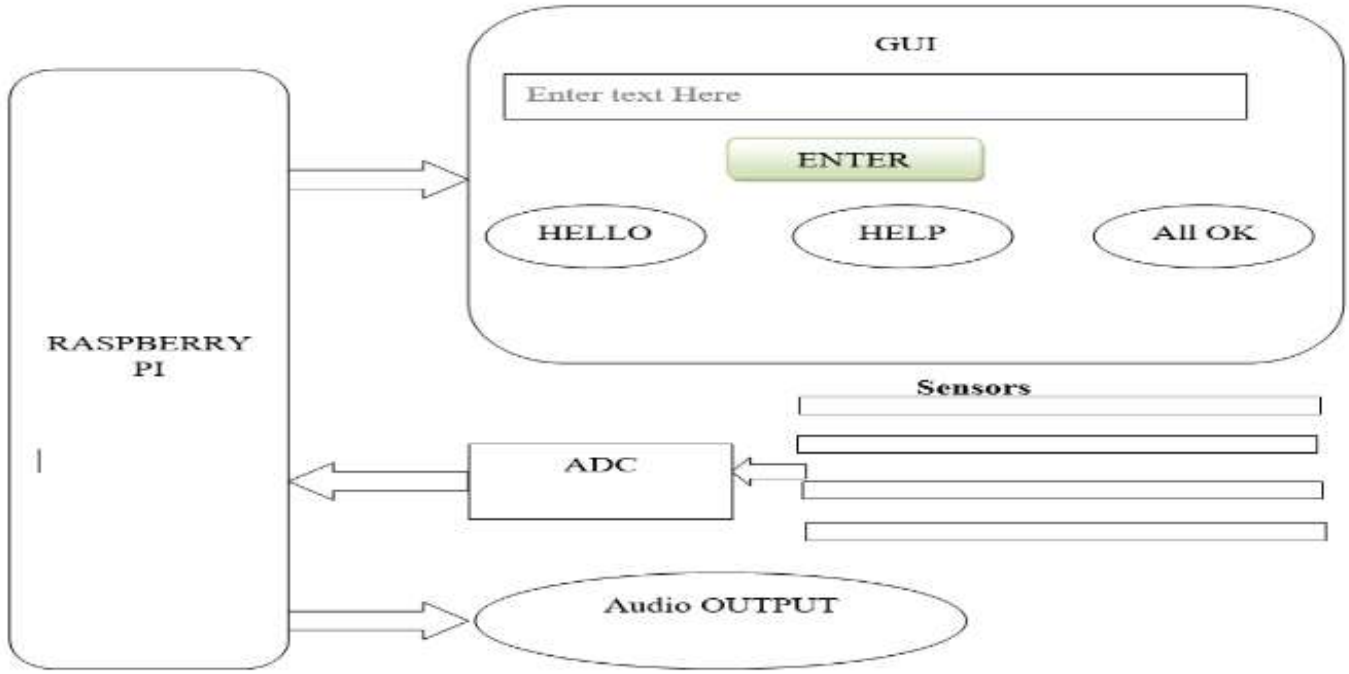
This project focuses on developing a voice generation system for mute individuals using a Raspberry Pi, a low-cost, credit card-sized computer known for its versatility and accessibility. The system integrates a graphical user interface (GUI) and gesture recognition technology with text-to-speech functionality to facilitate communication for individuals who cannot speak.

The GUI component of the system serves as an interface between the user and the voice generation system. It enables users to input text using a keyboard or select predefined phrases from a menu. This visual interface is designed to be user-friendly and intuitive, ensuring that individuals with limited or no ability to speak can easily interact with the system.

In addition to the GUI, the project incorporates gesture recognition technology, allowing users to generate voice output through hand gestures. This feature offers an alternative communication method for individuals who may find it challenging to use the GUI or prefer a more natural and intuitive interaction. By assigning specific gestures to predefined phrases or sentences, users can convey their message by performing recognized hand movements or finger positions.
The heart of the system lies in the text-to-speech technology, which converts the entered text or recognized gestures into audible speech. The Raspberry Pi is equipped with a text-to-speech engine capable of generating high-quality voice output based on the provided input. This technology ensures that the voice generated by the system is clear, natural, and easily understandable.

By combining the GUI, gesture recognition, and text-to-speech capabilities, this project aims to provide individuals who are mute with a comprehensive voice generation system. The Raspberry Pi's affordability and accessibility make it suitable for deployment in various environments, such as educational institutions, rehabilitation centers, or personal use settings. Ultimately, this project empowers individuals with speech impairments, enabling them to communicate effectively, express themselves independently, and participate more actively in social interactions.

BLOCK DIAGRAM:



COMPONENTS

1. Graphical User Interface (GUI):
- Design an intuitive GUI that allows users to input text through a keyboard or select predefined phrases from a menu.
- The GUI should provide a display area to show entered text, recognized gestures, and generated voice output.
- Options for adjusting voice parameters such as pitch, speed, and volume can be incorporated within the GUI.

2. Gesture Recognition:
- Select appropriate sensors such as cameras or motion sensors to capture hand gestures or motion.
- Develop a gesture recognition algorithm or utilize existing libraries to interpret the captured data and recognize specific gestures.
- Define a mapping between recognized gestures and predefined phrases or sentences to enable gesture-based voice generation.

3. Text-to-Speech Synthesis:
- Choose a suitable text-to-speech engine that can run on the Raspberry Pi.
- Implement the text-to-speech functionality, converting entered text or recognized gestures into clear and natural speech output.
- Consider allowing users to customize voice parameters such as pitch, speed, and volume within defined ranges.

Mathematical/Computational Model:
The voice generation system may involve mathematical or computational models depending on the specific components and algorithms used. For example:
- Gesture recognition may employ computer vision techniques such as image processing, feature extraction, and pattern recognition algorithms.
- Text-to-speech synthesis can utilize computational models like speech synthesis markup languages (SSML) or speech synthesis algorithms based on signal processing techniques.

Limitations and Assumptions:
- The accuracy of gesture recognition may vary based on the quality of the captured data and the complexity of the gestures being recognized.
- The text-to-speech synthesis may have limitations in generating speech output that exactly matches the natural speech patterns and nuances of human voice.
- The system assumes that users can interact with the GUI using a keyboard or touchscreen and can perform the required hand gestures for gesture recognition.

Possible Design Options:
- Integration with external devices: Explore options to integrate the system with external devices such as sensors, wearable technology, or other assistive devices to expand its capabilities.
- Personalized phrase libraries: Allow users to create and customize their own libraries of frequently used phrases or sentences.
- Language support: Incorporate multiple languages to cater to the diverse communication needs of users.

- Integration with speech recognition: Combine speech recognition capabilities to enable voice input for users who may have limited dexterity or prefer speech-based input.

It is important to evaluate these design options based on the project's scope, feasibility, and the specific needs of individuals who are mute. Regular user feedback and usability testing can help refine the system design and optimize its performance.

Hardware Required:

1. Raspberry pi
2. Power supply
3. Flex sensors
4. ADC(PCF8591)
5. Memory card

Raspberry pi

Raspberry Pi Foundation has launched a new upgraded version of this model i.e Raspberry Pi 3 Model B Plus(+). It has an updated 64-bit quad core processor running at 1.4GHz with built-in metal heatsink, dual-band 2.4GHz and 5GHz wireless LAN, faster (300 mbps) Ethernet, and PoE capability via a separate PoE HAT.

It has 1GB of RAM, faster dual-band 802.11 b/g/n/ac wireless LAN, Bluetooth 4.2, and significantly faster 300Mbit/s ethernet. The Pi 3 B+ is to provide with the same Pi as before, but now with Gigabit and PoE capable Ethernet, as well as better overheating protection for the 64-bit processor.

Why choose Raspberry Pi 3 Model B+?

If we're looking for great speed and connectivity, the Raspberry Pi 3 Model B+ is for you. Whether you want to learn computer programming, or trying to incorporate Internet-of-things into your workplace, the B+ model can help you achieve your goals.

It would be impossible to tell you everything that a Raspberry Pi can do as, with some help from add-on devices, there are no limits to your imagination. From media players to full IOT integration, education to gaming, monitoring working conditions to work productivity, and even controlling your own robot, Raspberry Pi covers a huge range of applications.

Pi 3 Model B vs. Pi 3 Model B+

The new B+ board is actually uses the same footprint as the previous B model and the Raspberry Pi 2. Therefore you can use it as an upgrade to existing projects or even use most existing cases.

The new B+ model features upgraded board components to help your applications and calculations run faster and smoother.

The B+ also features an exciting 64-bit quad core processor running at least 10% faster than the previous model. It also has improved thermal management.

Specifications:-

- Processor: Broadcom BCM2837 Processor Quad core A53 (ARM v8) 64-bit SoC
- Memory: 1GB LPDDR2 SDRAM
- Bluetooth: Cypress BLE chip 2.4Ghz/5.0GHz IEEE 802.11ac
- Ethernet: Gigabit Ethernet over USB 2.0 (300Mbps max)
- USB: Four USB 2.0 ports
- Connection: GPIO Header 40-pin
- HDMI: 1 x full size
- Video: MIPI DSI display port, MIPI CSI camera port & 4 Pole stereo output and composite video port
- Multimedia: H.264, MPEG-4 decode (1080p30). H.264 encode (1080p30). OpenGL ES 1.1, 2.0 graphics.
- Storage: microSD card slot for loading operating system and data storage
- Power: USB connector for 5.1V / 2.5A dc
- POE enabled

Flex Sensor

A simple flex sensor 2.2″ in length. As the sensor is flexed, the resistance across the sensor increases. Patented technology by Spectra Symbol – they claim these sensors were used in the original Nintendo Power Glove. I love the Nintendo Power Glove. It's so bad!

The resistance of the flex sensor changes when the metal pads are on the outside of the bend (text on inside of bend).

PCF8591 ADC

This is a breakout board/Prototype Board for PCF8591 IC. The PCF8591 is a single-chip, single supply low power 8 bit CMOS data acquisition device with four analog inputs, one analog output, and a serial I²C bus interface. Three address pins A0, A1, and

A2 are used for programming the hardware address, allowing the use of up to eight devices connected to the I²C bus without additional hardware. Address, control, and data to and from the device are transferred serially via the two-line bidirectional I²C bus.

The functions of the device include analog input multiplexing, on-chip track and hold function, 8-bit analog to digital conversion, and an 8 bit digital to analog conversion. The maximum conversion rate is given by the maximum speed of the I²C-bus.

PCF8591 Module Features:-

- The module supports external voltage input of the 4-way acquisition (voltage input range of 0-5v)
- The module integrated photoresistor by AD collection precise value of the ambient light intensity
- Module integrated thermistor by the precise value of the ambient temperature of the AD acquisition
- Modules with power indicator (for the module power supply indicator lights)
- Modules with DA output indicator, when the module DA output interface voltage reaches a certain value, will be lit panel the DA output indicator, the higher the voltage, the more obvious indicator brightness
- Module PCB size: 3.6cm x 2.3cm
- A standard double panel, thickness 1.6mm, nice layout, surrounded by a through-hole, aperture: 3mm, convenient fixed.

PCF8591 IC Features:-

- Single power supply
- A PCF8591 operating voltage range of 2.5V-6V
- Low standby current
- Via I2C bus serial input/output
- PCF8591 by 3 hardware address pins addressing
- PCF8591 I2C bus speed sampling rate decided
- 4 analog inputs programmable single-ended or differential input
- Automatic incremental channel selection
- PCF8591 analog voltage range from VSS to VDD
- PCF8591 built-in track-and-hold circuit
- 8-bit successive approximation A / D converter
- 1 analog output DAC gain

Module interface specification:-

The Left:-

- AOUT chip DA output interface
- AINO chip analog input interface 0
- AIN1 chip analog input interface 1
- AIN2 chip analog input interface 2
- AIN3 chip analog input interface 3

The Right:-

- SCL – IIC clock interface connected to microcontroller IO port
- SDA – IIC digital interface connected to microcontroller IO port
- GND – connected to ground
- VCC – connected to 3.3v-5v

Four red jumper-cap instruction:-

- P4 – connected to P4 shorting cap, select thermistor access circuit
- P5 – connect P5 shorting cap, select photoresistor access circuit
- **P6 – connected to P6 shorting cap, select 0-5V adjustable voltage access circuit**

RESEARCH METHODOLOGY

The methodology for Project Voice for Mute would involve the following steps:

a. Research and Requirement Analysis: The first step is to conduct thorough research to understand the needs and requirements of people who are mute or have difficulty speaking. This would involve studying the existing solutions and identifying the limitations and gaps. The research would also include understanding the different types of non-verbal communication used by people, such as sign language, gestures, and facial expressions.

b. Design and Prototyping: Based on the research findings, the next step is to design a prototype of the system that can convert non-verbal communication into audible speech. The design should be intuitive and user-friendly, allowing the user to communicate effectively and efficiently. The prototype should be tested with a small group of users to identify any usability issues and gather feedback.

c. Development and Integration: Once the design is finalized, the next step is to develop the system using appropriate technologies such as machine learning algorithms, speech recognition, and natural language processing. The system should be integrated with the user's communication devices such as smartphones or tablets, making it easily accessible to the user.

d.Testing and Evaluation: The system should be tested extensively to ensure that it meets the required standards of accuracy, reliability, and usability. The testing should involve both technical and user testing, with a focus on user feedback to make improvements to the system.

e. Deployment and Maintenance: The final step is to deploy the system for wider use, ensuring that it is accessible to those who need it. Maintenance should be provided to ensure the system remains up-to-date and effective.

In summary, the methodology for Project Voice for Mute would involve thorough research and requirement analysis, design and prototyping, development and integration, testing and evaluation, and deployment and maintenance. This would ensure that the system is effective, efficient, and accessible to those who need it.

RESULTS AND DISCUSSION

The result of a GUI and gesture-based voice generation system with text-to-speech capabilities for mute individuals using a Raspberry Pi is to create a communication system that can help individuals with disabilities communicate more effectively. The system is allow users to generate speech by selecting words and phrases through a graphical interface or by using gestures recognized connected to the Raspberry Pi. The selected words and phrases will then be converted to speech using a text-to-speech engine.

The device (glove) uses the flex Sensors is already Set to the Initial normal degree and is connected using the raspberry pi. The bending of the flex sensors cause change in output voltage, every angle bend of the flex sensor causes changes in output voltage. And depending on the degree in the flex sensors bent the variations in output voltage passes on variable signals to the raspberry pi, wherein the signal is processed and then the respective signal depending on the degree in bend are output is generated through the speaker or headphones.

ACKNOWLEDGMENT

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[2] "Design and Implementation of a Speech Enabled System for Mute Individuals Using Raspberry Pi" by S. S. Dhillon and S. K. Sharma. This paper presents a speech-enabled system for mute individuals using Raspberry Pi and a speech recognition tool. The system allows individuals to communicate using pre-defined phrases and sentences.

[3] "Gesture Based Communication System for Mute and Deaf People using Raspberry Pi" by P. B. Patil and S. M. Kamble. This paper describes the development of a gesture-based communication system using Raspberry Pi and a gesture recognition library. The system allows individuals to communicate using hand gestures, which are converted into speech using a text-to-speech engine.

[4] "Text-to-Speech Synthesis for Mute Individuals Using Raspberry Pi" by A. B. Patil and S. K. Sutar. This paper presents a text-to-speech synthesis system for mute individuals using Raspberry Pi and a text-to-speech engine. The system allows individuals to type messages using a GUI, which are then converted into speech.

[5] "Speech-Enabled System for Mute Individuals Using Raspberry Pi" by Shweta R. Patil and Dr. S. B. Patil. This paper describes the development of a system that uses speech recognition technology to convert spoken words into text, and then uses text-to-speech technology to generate speech for mute individuals. The system is designed using Raspberry Pi and Python programming language.

[6] "Gesture-Based Communication System for Mute and Deaf People Using Raspberry Pi" by Dr. K. R. Mohan Reddy and Dr. M. S. Ravi. This paper presents a gesture-based communication system that allows mute and deaf individuals to communicate using hand gestures. The system uses Raspberry Pi, OpenCV library, and Python programming language for gesture recognition and text-to-speech capabilities.

[7] "Gesture-based communication for people with severe motor disabilities" by S. K. Gupta and C. Breazeal. This paper describes the use of gesture recognition technology to develop a communication system for individuals with severe motor disabilities, including those who are mute. The system uses a combination of hand gestures and speech synthesis to convert the user's gestures into spoken words.

[8] "Design and implementation of a gesture recognition system for the disabled" by A. K. Das and S. K. Das. This paper discusses the development of a gesture recognition system using a Raspberry Pi and a camera module. The system is designed to recognize basic hand gestures and convert them into speech using a text-to-speech engine.

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