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Interactive System for Deaf and Dumb People using Hand Gestures

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Abstract - *Every day we see many people who are facing illness like deaf, dumb, blind etc. Generally deaf-dumb people use sign language for communication, but they find difficulty in communicating with others who don't understand sign language. Due to which communications between deaf-dumb and a normal person have always been a challenging task. We propose to develop a device which can convert the hand gestures of a deaf-mute person into speech. An image processing technique called Histogram of gradient (HOG) along with artificial neural network (ANN) has been used to train the system. Web Camera is used to take the image of different gestures and that will be used as input to the system. The software will recognize the image and identifies the gestures which will then compare it with the given database and gives the output through speaker and LCD. An audio module is also interfaced with the controller as a input which will take voice from the user, convert it to text form and display it to LCD.*

Key Words: **HOG, ANN, LCD, Audio module, Web Cam, Raspberry pi 3b+**

1. INTRODUCTION

In our country around 2.78% of peoples are not able to speak or hear. Their communications with others are only using the motion of their hands and expressions. The serious issue for the deaf and dumb community is obviously the difficulty in communicating with normal people. These people communicate via sign language; however, the main issue is that the majority of people are not familiar with sign language and they are not willing to learn this language. This generated an idea to propose this project in which it will drastically facilitate and improve a communication method between the non-vocal and vocal people. The main objective of the system is taking the basic step in bridging the communication gap between normal people and deaf and dumb people using sign language.

This paper focus on developing a help for deaf and dumb people using the gesture recognition technique. In this system the gestures are converted into text messages and voice for communication. A number of techniques are used to convert these gestures into required output.

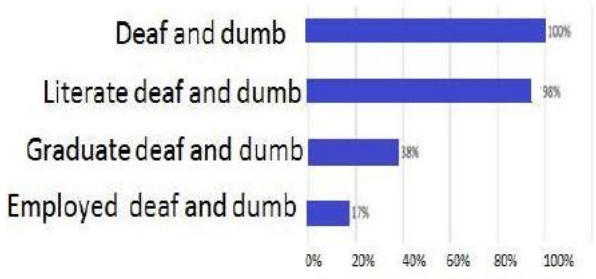


Fig -1: Employment analysis of deaf and dumb population of India

1.1PROBLEMS IN SOCIETY

Dumb people use hand signs to communicate, hence normal people face problem in recognizing their language by signs made. Hence there is a need of the systems which recognizes the different signs and conveys the information to the normal people.

The hearing-impaired people always have problem in communicating with normal people. They have problem in conveying their thoughts and ideas to normal people who have very limited or sometimes no knowledge in sign language. This makes the hearing-impaired community lose interest in common activities and they avoid communicating with normal people at times and live in isolation. To overcome this situation many sign language recognition systems were developed by researchers but there is still a need for accurately and more effectively recognizing the signs. Currently the systems proposed by earlier researchers are based on the conversion of an action-based verb to an equivalent sign. These systems have the restriction of handling maximum number of action verbs in the specific language. The research aims to develop a sign language recognition system for the English phonemes. The proposed system should be easier to use and more user friendly for the hearing-impaired people.

2. PROPOSED SYSYEM

This will make the two-way communication easy between the normal people and deaf, dumb people. It provides a solution for those people who are not able to hear or speak. Deaf and dumb people are going to do the gestures. The gestures will be captured by camera and will give to the controller. The controller has a saved dataset of images having the result of the gestures. It will compare the extracted image and when the image will match it will give result in audio-text form and display it to the LCD. The

normal person can also communicate with them. It has an audio module which will take the voice of user and give it to the controller which will recognize the voice with the help of goggle API and display the result in LCD. So, in this way it is providing a two-way communication.

2.1 PROPOSED SYSTEN BLOCK DIAGRAM

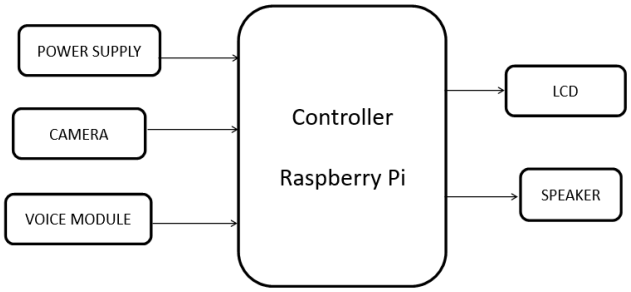


Fig 2: Block Diagram

When the power supply is given to the circuit the camera interfaced with the raspberry pi controller will start capturing the images. We are using python language and PyCharm which is an IDE. When the image is captured then it will compare the image with the already given datasets of images. When image is matched then it gives the respective output through the speaker and LCD. If it is not able to detect the image then it will show no output. The audio module is used to take the voice of the user and the controller will convert it into text form and display it to LCD.

2.2 Block diagram components

- Power supply: - It is used to provide power to the curcuit.
- Controller: - We are using Raspberry Pi our controller. It will we having a saved dataset of images. It will compare the image extracted with the saved dataset and give the output to LCD and speaker. Also, it will convert the voice into text using google API as it has inbuilt Wi-Fi.
- Camera: - It is an optical instrument to capture still images or to record moving images.
- Voice Module: - It will take voice input from the user. We are using microphone as a voice module.
- Speaker: - Speakers are transducers that convert electromagnetic waves into sound waves. The speakers receive the signal from controller and give the output.
- LCD: - LCD will display the output in text form.

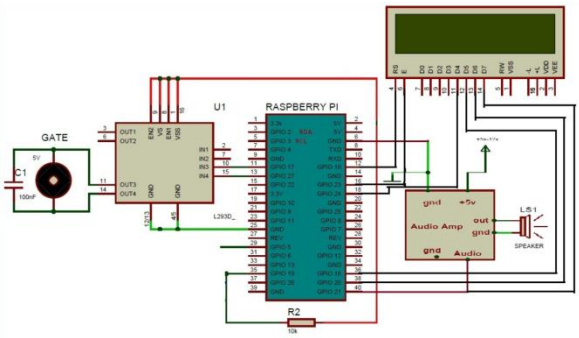


Fig 3: Circuit diagram

Raspberry pi

- Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz
- 1GB LPDDR2 SDRAM
- 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE
- Gigabit Ethernet over USB 2.0 (maximum throughput 300 Mbps)
- CSI camera port for connecting a Raspberry Pi camera
- Micro SD port for loading your operating system and storing data
- 5V/2.5A DC power input

Camera

- Image sensor: Cmos Sensor
- Frame rate:upto 30 frame f/s.
- Image Flip:Horizontal and Vertical
- Monitor type:CRT and LCD
- Focus distance:4 cm to infinity
- Lens view angle:54 degree
- I/O Interface:USB 2.0
- Power consumption:160mw

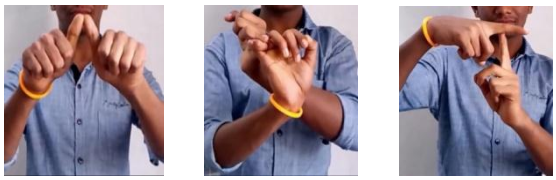
LCD (16*2)

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is built by a 5×8-pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

3. SYSTEM DESCRIPTION

For deaf and dumb people, Indian Sign language is very necessary because of sign language impaired people can

express their thinking not only among themselves but also with the normal people. So, the proposed system presents some pictures of some alphabets by taking one or both hand for representing particular sign as given in Fig1.



a) A b) S c) T

d) W e) Q

Fig. 4: Various alphabets sign using both hands

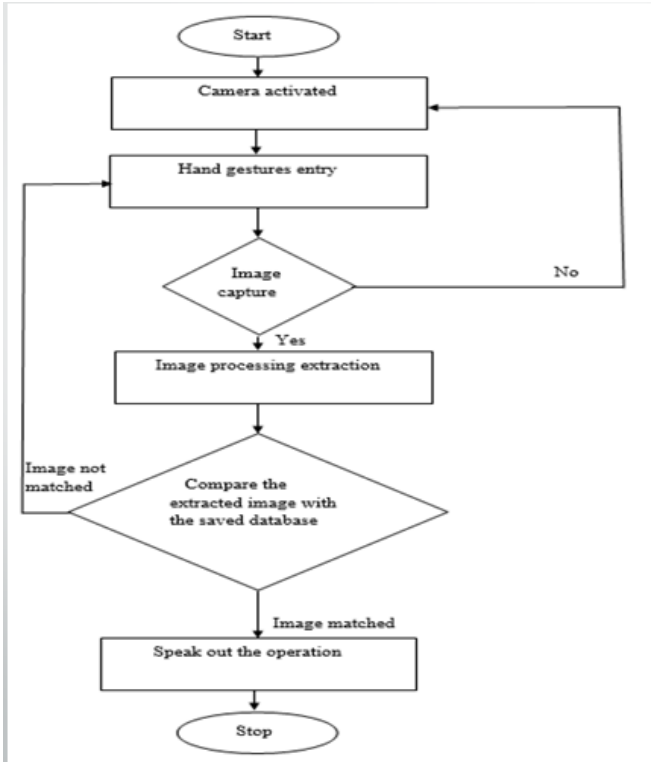


Fig. 5: Proposed system overview

When the power supply is given to the circuit the camera interfaced with the raspberry pi controller will start capturing the images. When the image is captured then it will compare the image with the already given datasets of images.

A. Dataset collection –

Due to the lack of dataset of Indian sign language, the first step of the proposed system is to create our own dataset.

B. Grayscale image processing –

As the image is captured, image is converted into greyscale image which is a range of monochromatic shades from black to white. Therefore, a grayscale image contains only shades of gray and no color.

C. Thresholding –

Thresholding is used to split an image into smaller segments, or junks, using at least one color or gray scale value to define their boundary. This technique isolates objects by converting grayscale images into binary images. Hence image become most effective in images with high levels of contrast.

D. Edge detection –

Edge to is used to finding the boundaries of objects within the images. It works by detecting discontinuities in brightness.

E. Feature extraction –

Feature extraction is used to taken out certain features from the hand image which is unique foe each sign. Feature extracted image will compare with the given datasets.

4. CONCLUSION

A neural network-based method for automatically recognizing the finger spelling in sign language will be made. The signs are identified by the features extracted from the hand shapes. We will use skin color-based segmentation for extracting the hand region from the image. A new shape feature based on the distance transform of the image is proposed in this work. The features extracted from the sign image are used to train a feed forward neural network that recognizes the sign. The method will be implemented completely by utilizing digital image processing techniques so the user does not have to wear any special hardware device to get the features of the hand shape. Our proposed method has low computational complexity and very high accuracy when compared to the existing methods

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