A Real Time System for Two Ways Communication of Hearing and Speech Impaired People

L. LATHA, M. KAVIYA

Abstract: ***Generally Sign language uses hand gestures for communication; it is used by the hearing and the speech impaired people to interact with others. But it is very difficult for the normal people to understand it, so this paper proposes a real time system for better communication with normal people and disabled people. The gestures shown by the impaired people will be captured and the corresponding voice output is produced as one way and the voice input by normal people is taken and the periodic gesture will be displayed to them as another.This system uses RASPBERRY PI kit as the hardware, where a Pi camera, LCD display, Speaker and Microphone will be attached along with it. First the image acquisition is carried where it captures the input image and then image pre-processing is done to extract the foreground image from the background, then feature extraction is carried out to extract the necessary details. The extracted image is matched with the dataset and the corresponding voice output is generated for that gesture. Likewise, a microphone is used to capture the speech input of the normal people, then it is pre-processed to remove the extra noise in the speech signal and feature extraction is carried out to identify the necessary details and finally extracted voice is matched with the dataset and the corresponding hand gestured image will be displayed in LCD display. By using this method the communication gap between the impaired and normal people get reduced.***

Keywords: Feature extraction, pre-processing, matching

I. INTRODUCTION

Gesture recognition is an important aspect when it comes to the communication between impaired and normal people. Normally disabled people will use sign language for communication. Generally gestures are the movements of the hand, fingers, face and arm. Human Computer Interaction has paved the way for the gesture recognition. It is the interaction between the people and the computer. This project helps the disabled people by developing a real time system using raspberry pi, where an input gesture is taken as input and image processing techniques are used in that image[1].

An image is a 2-Dimensional array; it is a visual representation of something like persons, objects. Image processing is used to process the image to obtain a better image using mathematical operations. This proposed will have a speaker, camera and MIC attached to it [12]. At first Image Acquisition is carried out where an input image is taken from the camera.

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L.Latha, Professor, Computer science and Engineering dept, Kumaraguru College of Technology Coimbatore, India,

M.Kaviya, PG student, Computer science and Engineering dept.,Kumaraguru College ofTechnology, Coimbatore, India,

Then image pre-processing is made to subtract the foreground from the background and remove unwanted noise [2]. With that result Feature extraction is done to get the required features of the fingers, and finally feature matching is carried out to match the extracted image with the image in the dataset and corresponding Voice output is generated [11] as shown in Fig1.

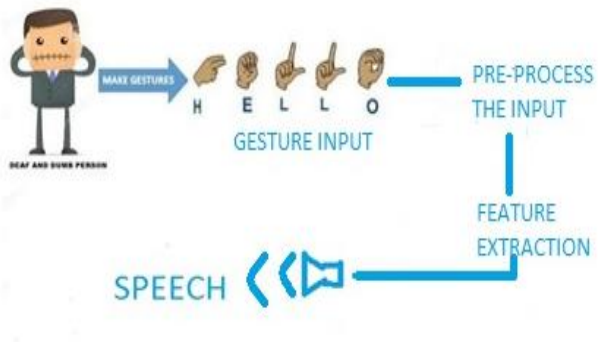

Fig 1: Overall process

Likewise, MIC is used to take the voice input, then voice pre-processing is done to make enhancement in the voice and remove noise [3]. Then feature extraction is done to extract the necessary words, finally the extracted words are matched with the dataset and correlated images with gestures are displayed.

The gesture recognition can be done in many ways:

1. Data glove recognition
2. Vision based recognition
3. Color glove based recognition

This proposed system recognises the gestures using the RASPBERRY PI kit with a camera attached along with it.

II. EXISTING SYSTEM

The existing system is done using MATLAB software. It is also a two way communication, gesture to speech conversion and speech to gesture conversion. In gesture to speech, the inbuilt camera in system is used to acquire the input image. Then background subtraction and image pre-processing is done to remove noise in image. Then edge detection feature extraction algorithm is used to extract the necessary details in image. Finally feature matching is done to match the input image to the image in dataset.

In speech to gesture conversion, the input voice is acquired using the inbuilt microphone in the system. Voice pre-processing is done to remove the noise in the image and also it removes the impurities in the voice. Feature extraction is done using used mel frequency cepstrum coefficients and dynamic time warping, where the necessary details are extracted.

Finally feature matching is done to match the feature extracted voice to the voice in dataset and after matching, the corresponding image is displayed [1].

III. PROPOSED SYSTEM

A. Gesture To Speech Conversion System

The proposed system is implemented using raspberry pi hardware. The methods include:

B. Image Acquisition

RRASPBERRY PI model 3 is used for this proposed method. The Pi camera is connected with it to capture the input gestured image from the impaired people. Python is used as the coding language in raspbian. OpenCV is a python library which is used for the image processing techniques [10].

C. Image Pre-Processing

The image taken from Pi camera is taken as input and it is converted to a Grey-Scale image, where the RGB image will be converted to black and white image [9]. Then Background subtraction id done to subtract the foreground image from the background image as shown in fig 2. The threshold value is set from this subtraction. In this paper, mean-threshold is being used [4].

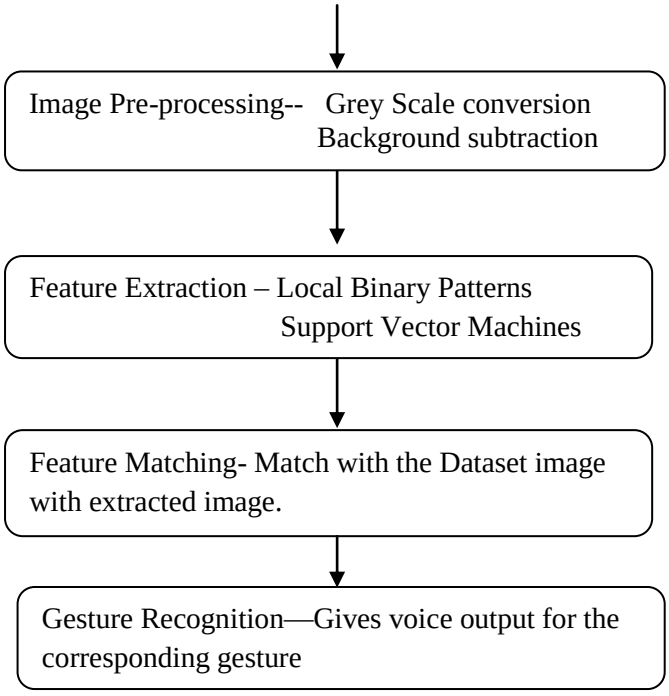

Fig 2: Detailed process in recognition

D. Feature Extraction

After subtracting the background image, it is given as input to feature extraction. The features of this hand finger are being taken using the Edge detection algorithm. In the proposed method, Local Binary Patterns and Support Vector Machine algorithms are used [6]. Local Binary Pattern is a feature extraction algorithm used to separate the hand colour from the background colour and then it extracts the feature of each alphabet. The feature extraction is carried out for alphabet A, B, C, D and E, and the given input image [8].Support Vector Machine algorithm is used to ground the extracted feature of each and every alphabet. The extracted feature varies for each alphabet and the grouping is based on it.

E. Feature Matching

A dataset containing the gestures of alphabets from A-Z and some necessary words are being stored in the database. The dataset images are also feature extracted and stored [5]. The Local binary pattern algorithm is used to separate the colour of the hand from the background colour and also it does the feature extraction to separate each gesture. Support vector machine algorithm is used to ground and label all the gestures.

F. Speech To Gesture Conversion

Speech input is acquired using the microphone and by using the Google speech recognition, the recognition is done.

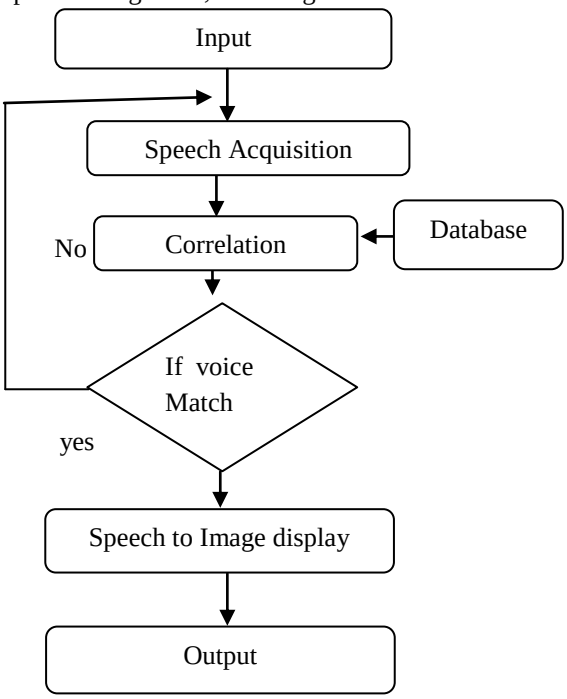

Fig 3: Speech to gesture conversion

Images of alphabet A to E with numbers 1,2,3,4 and 5 and some important sentence like, where is this address, what is your name and please help emergency are stored in the database. When the voice recognition is carried out, its corresponding images is been displayed as shown in fig3.

IV. RESULTS AND DISCUSSION

The proposed system is processed, matching with the dataset, with letters containing A, B, C, D and E with each letter having 30 images, so totally it is tested with 150 images [7].

Once the input gesture is given in camera, it pre-process it, extracts the gesture, matches with the dataset and finally gives the voice output of that gesture. Fig 4 shows the output of gesture A and output for gesture B.

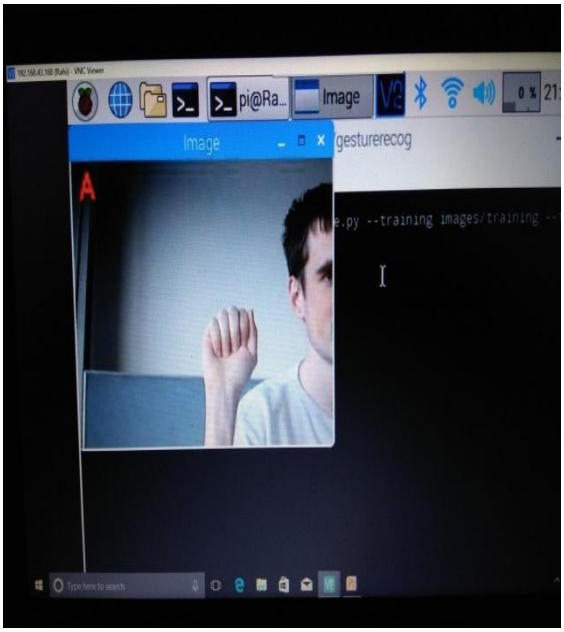

Fig 4: Alphabet A Matched with the dataset

The alphabet B is matched based on the given input, where the dataset contains about 30 images for alphabet B and the voice command is generated for that comparing the input with the dataset as shown in Fig 5.

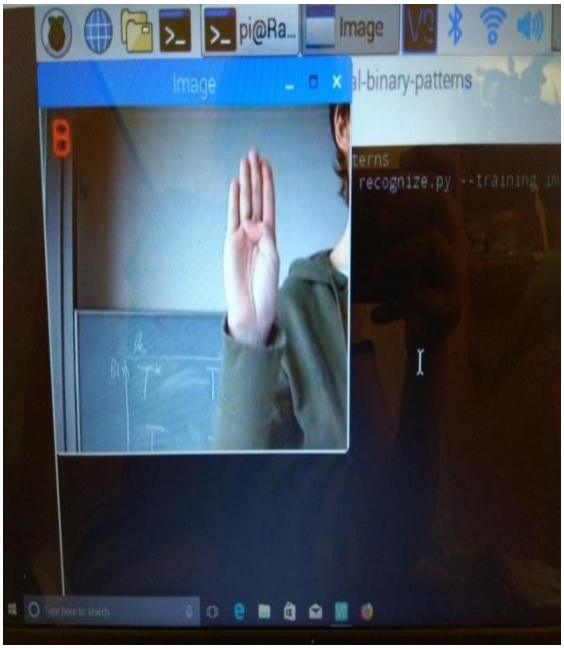

Fig 5: Matched image for alphabet B

In the speech to gesture conversion, the input voice is given in the microphone, it is analysed with the help of Google and its equal image is displayed. Fig 6 displays the output, when the input is given as One, it displays its corresponding image. The dataset contains the images of 1 to 5 along with alphabets A to E. The input is been tested for multiple times using various criteria and it shows the accuracy of about 70%. Each input is tested separately.

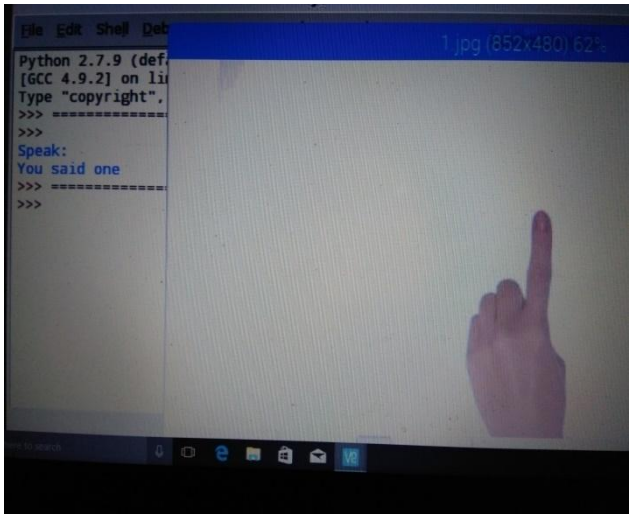

Fig 6: Speech to Image for alphabet one.

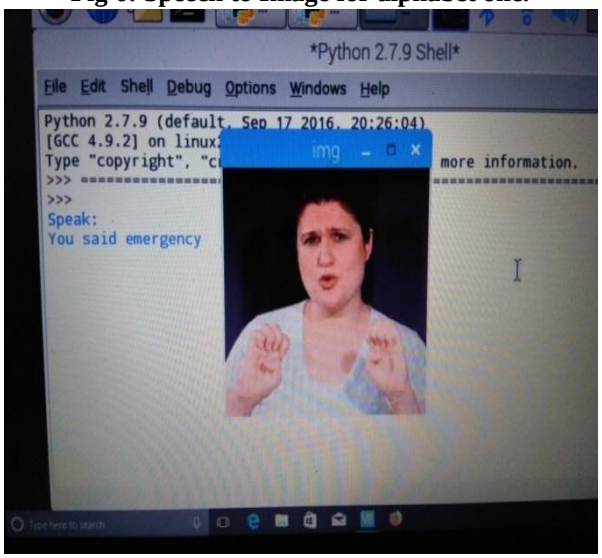

Fig 8: Image for voice output Emergency

The input emergency is given as the input in the microphone and it displays its corresponding image in the display as shown in Fig 7.

The dataset is taken in GITHUB as Sign-Language-and-Static-gesture-recognition-using-sklearn-master containing about 1000 images. For this proposed system the alphabets A, B, C, D and E are alone taken, which consist of about 150 images where 30 images in each alphabet. The accuracy drawback is due to the photo of angle taken and not accurate during feature extraction. Accuracy details for every alphabet are shown in Table1.

LETTERS	NO. OF IMAGES	ACCURACY
A	30	70
B	30	68
C	30	69
D	30	65
E	30	70

Table 1: Accuracy for each gesture

V. CONCLUSION

The proposed system mainly aims to overcome the communication gap between the disabled and the normal people. This system is easy and implement and shows the accuracy of about 70%. The input is been tested for multiple times by considering various criteria's. This system works for gesture to speech conversion and speech to gesture conversion, so it's a two way communication. Since this system is developed using hardware, the disabled persons can easily carry it along with them. This system server the society by finding solution for an important problem in the society. The hardware used is Raspberry pi. The drawback of this system is, speed of the system is a bit slower. There is a need for research to increase the speed of the system by concentrating on the feature extraction part.

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