

A SURVEY ON VARIOUS COMMUNICATION SYSTEMS FOR HEARING AND SPEECH IMPAIRED PEOPLE

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ABSTRACT

In this modern era, scientific technologies are updated for every 3 seconds and people get updated with that, where some people cannot even communicate properly with the others. Their only source of communication is sign language, but normal human being cannot understand that. This survey is made to develop a real time system for hard of hearing and speech impaired people by which the communication gap get reduced.

For this, hand gesture detection is an important step. Using of sign language for communicating with normal people is called hand gesture detection. This survey is based on using image acquisition method to capture the hand signals from the deaf people in the RASPBERRY PI kit. Then, image pre-processing is done, and then the feature extraction is done where it identifies the hand gesture. Finally the identified gesture will be converted in to speech and vice versa.

Keywords: *Gesture, Acquisition.*

I. INTRODUCTION

Sign language is an important mode of communication for hearing impaired and mute people. It uses Gesture recognition for better communication. Gesture recognition is the translation of human emotions by a computing device. The gestures can be the movements of fingers, hand, face, arm, head etc. The increase in the use of Human Computer Interaction (HCI) has paved the way for gesture recognition.

Image processing is defined as the analysing and manipulation of digital images to improve its quality. This paper is based on using Raspberry Pi system. It is a hardware module which supports camera, SD card, Ethernet, audio and more. The use of Raspberry Pi's camera are included for processing and monitoring real-time data as Raspberry Pi is a low cost device, easy to implement and has its computing processor [7].

The Gesture recognition can be done in 3 different methods:

1.Data glove based recognition

This approach uses glove based devices to detect the motion of hand, hand position, movement and finger bending. The impaired people should wear glove in the hand. The advantage is high accuracy and fast reaction speed.

2. Vision based recognition

This method uses the camera module for capturing the handgesture movements. Further, the captured gesture is processed and finally speech or text output is produced as shown in fig 1.

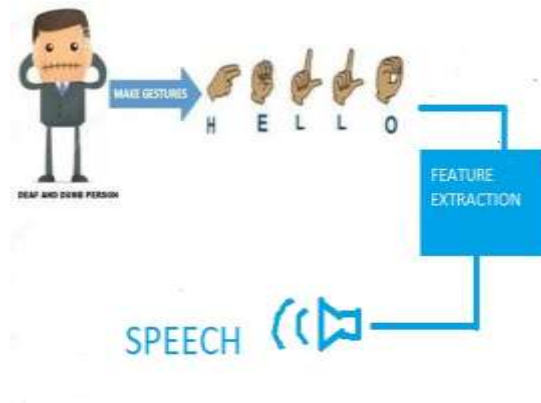


Fig 1: Vision based approach

3. Color glove based approaches

It is the combination of data glove approach and vision based approach. It is worn with some colors to direct the process of tracking the hand and locating the palm and finger.

II.METHODOLOGIES

The process used in this communication system is:

2.1Image Acquisition

Image acquisition is the process of getting an image as input. The hand signs by the hearing impaired people are being captured using a camera, which is attached in the Raspberry Pi kit.

Image Pre-Processing

Image pre-processing is performed to remove the impurities in the image like removing noise and also it enhances some important features in the image. Enhancement is modifying image by increasing the brightness value. Some techniques include stretching the contrast and modifying the histogram.

2.2Feature Extraction

The feature extraction technique takes only the needed features for further processing to get high results. Features are those items which uniquely describe a target, such as size, shape, location etc. It is done to identify the hand gestures by using angle calculations, different types of sensors, peak calculations and more.

Feature Matching

The hand gestures identified will be matched with the pre-defined hand gestures which are stored already in the database. If both get matched, then the speech output of that sign is produced.

2.3IMAGE ACQUISITION

The input image can be obtained in many different forms,

Image captured using 20 mega pixel web cam using MATLAB inbuilt command [1].

1. It uses CMOS camera to capture the hand gesture image and then edge detection and peak detection is done [2].
2. The sign language capturing is done using a sensor glove, its complex embedded system capture the variations of movements of fingers and hand [3].
3. Hand gloves will be worn by deaf people. Gloves are attached with five accelerometers. For every gesture there will be changes in the coordinates of accelerometer [4].
4. Camera module connected to Raspberry Pi model B to monitor the hand gesture .It sets the resolution at 800x600 pixels [7].
5. It is a fusion of tilt sensor and accelerometer. Tilt sensor measures the tilt of its axis with respect to a fixed reference. The accelerometer is used to detect gesture motion by setting a threshold in the axis of motion (x, y or z) since it is placed in the palm of the glove [12].
6. It uses RPI NOIR CAMERA BOARD to connect directed to the Raspberry Pi. It is connected directly to the CSI connector. It delivers 5MP resolution image [14] as shown in fig 2.



. Fig: 2 Camera connected with raspberry pi

2.4IMAGE PREPROCESSING

Obtained image is pre-processed to make the image more usable.

1. The RGB colour images are captured using a 20 MP webcam and converted into gray Images. Background segmentation is used to separate the gestured image from its background. Noise elimination is used to remove impurities in image [1] as shown in fig 3.
2. The RGB colour image converted to grey scale which in turn converted to black and white image. The images are then processed using Canny Edge Detection technique to extract outline images (edge) of palm [5].
3. Haar features are used to detect front view of face and use skin detection by Gaussian distribution and threshold of skin probability image and motion detection is identified [6].
4. Flex sensor is used to identify the bends and curves. Flex sensor is a resistive sensor which changes its resistance as per the change in bend or curvature of it into analog voltage [2].
5. In the Greyscale image, the background subtraction is done using the Gaussian filter.The image is converted to binary image and also it removes noise [7].

6. Blob detection algorithm is used to draw rectangle around a particular area that differ in properties, such as brightness or colour, compared to surrounding regions. And also skin colour recognition is used [8].
7. The capturing use Microsoft Kinect and LMC as an input device, and all of the signals that the LMC device captured were activated, but only the depth and colour frames were activated in Kinect. Gestures will be identified using the skeleton movement from these two devices [9].
8. The noise is reduced by using 3x3 median filters. The iterative thresholding algorithm is used where the Pixels corresponding to gesture are set to 1 and the background is set to 0 [11].

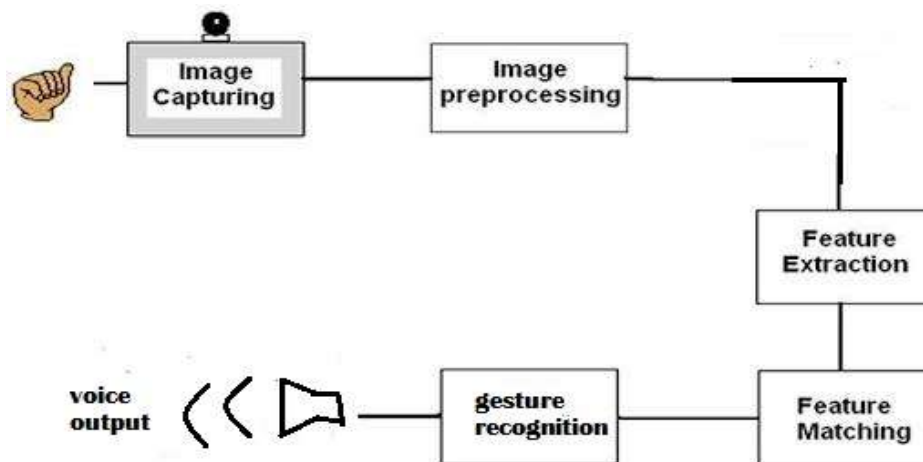


Fig 3: Detailed process in recognition

2.5FEATURE EXTRACTION

The pre-processed image is taken as input to the feature extraction

1. It uses the angle and peak calculation to extract the features of hand gestures. Peak calculation calculates the number of raised and folded fingers for classification 12 bit binary sequence is generated for each hand gesture which classifies the different hand gestures [1].
2. Canny Edge Detection technique is used to determine the height of every finger, and angel determination is done by referring to the middle finger [5].
3. The hand gestures are identified and saved as a sequence. This sequence is called key point sequence. The key point sequence is used to extract feature for recognition. The feature is extracted among consecutive key points as saved in the sequence and classification is done by Hidden Markov Model [6].
4. The SIFT approach, for image feature generation takes an image and transforms it into a large collection of local feature vectors. The SIFT uses scale-space extrema detection, key point Localisation, Orientation Assignment, Gesture Recognition [10].
5. Image Moments is used to identify the centre mass, variance, orientation. Contour detection is used to identify the curves of the hand. Convex extraction is used to draw the convex hull [7].
6. This method uses the border information, the centre of area, and the gesture direction to extract a feature vector for the gesture. It depends on calculating the originating vectors from the centre of area to the portion of the border that bears the most important information about the gesture (finger tips region) [11].

7. Use vision based hand gesture recognition with 3D kinematic hand model with considerable DOF's. It tries to estimate the hand parameters by comparison between the input images and the possible 2D appearance projected by the 3D hand model. 3D is classified into volumetric and skeletal models [13].

GESTURE TO SPEECH

Finally the feature extracted image is matched with the pre-defined image and the speech output is produced as shown in fig 4.

1. Adaptive Neuro-Fuzzy Inference Systems (ANFIS) is used as a recognition system. This model is built and trained to identify the corresponding gesture [11].

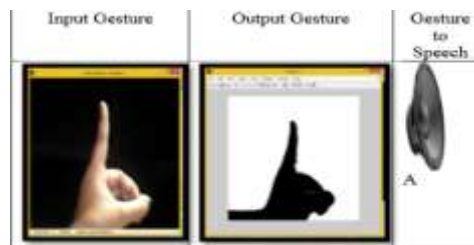


Fig 4: speech output produced

III.HARDWARE COMPONENTS

The hardware component required is Raspberry Pi.

Raspberry Pi is developed in U.K. It is a credit card sized computer. Raspberry Pi 3 is the latest version with ARM processor. It has the extended features of camera module, Audio output, SD card, Display as shown in fig 5.

Python is the programming language used in Raspberry Pi. It is used in the LINUX operating system with Raspberry Pi software called RASPBIAN.

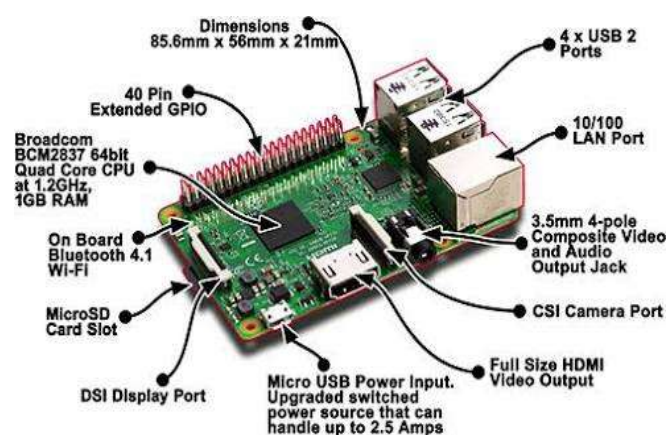


Fig 5: Raspberry pi kit

IV. CONCLUSION

This survey is made mainly to bridge the communication gap between hearing impaired and normal people. Various communication types are shown in this survey for two way communication. The communication

systems so far are carried out either in data glove or in MATLAB software, but this is a real time system using Raspberry pi. It produce ease of use and reliable.

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