

Full Duplex Communication System for Deaf & Dumb People

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Abstract— One of the important problems that our society faces is that people with disabilities are finding it hard to cope up with the fast growing technology. The access to communication technologies has become essential for the handicapped people. Generally deaf and dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. Sign language is an expressive and natural way for communication between normal and dumb people (information majorly conveyed through the hand gesture). So, we need a translator to understand what they speak and communicate with us. The sign language translation system translates the normal sign language to speech and hence makes the communication between normal person and dumb people easier. But the question arises, how the deaf person understands the speech of a normal person and hence we need a system which converts the speech of normal person to text and the corresponding gesture is displayed on display. So, the whole idea is to build a device that enables two way communications between deaf-mute person and a normal person

Keywords— Image Processing, Speech processing

I. INTRODUCTION

The About nine billion people in the world are deaf and dumb. It has been a challenging task to communicate between deaf and normal person. How often we come across these people communicating with the normal world? The communication between a deaf and hearing person poses to be a serious problem compared to communication between blind and normal visual people. This creates a very little room for them with communication being a fundamental aspect of human life. The blind people can talk freely by means of normal language whereas the deaf-dumb have their own manual-visual language known as sign language. Sign language is a non-verbal form of intercourse which is found amongst deaf communities in world. The languages do not have a common origin and hence difficult to interpret.

Generally dumb people make use of this sign language for communication; but they find difficult to communicate with people who are unable to understand sign language. A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. Facial expressions also count toward the gesture, at the same time.

But sign language not serves an effective way of communication between mute people and normal people. Thus there is a need of developing an electronic device that can translate sign language into speech in order to make the communication between the mute communities and the general public possible. So the only way to enhance the communication between dumb-deaf people and normal people is recognition of sign language and converting it to the corresponding voice signal. Further the automatic speech recognition system aims to convert the speech signals from the normal person into the text form as well as in sign language.

Thus, we propose a new technique called artificial speaking mouth for dumb people which will be very useful to them for conveying their views to others. Mute people can use the gloves to perform hand gesture and it will be converted into speech so that normal people can understand their expression. The speech of normal person is converted into text and the equivalent gesture for that speech signal will be displayed. Hence the two way communication is possible.

II. LITERATURE SURVEY

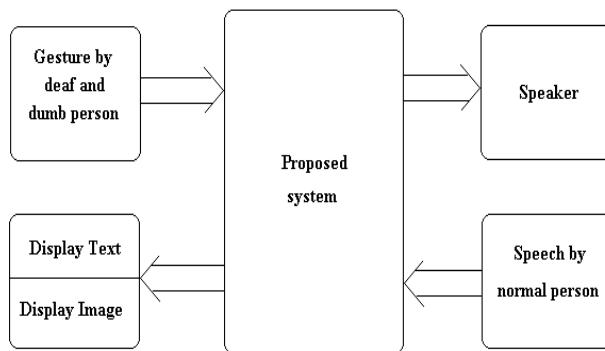
The communication between a dumb and hearing person poses to be an important disadvantage compared to communication between blind and ancient visual people. This creates an extremely little house for them with communication being associate degree elementary aspect of human life [1]. The blind people can speak freely by implies that of ancient language whereas the dumb have their own manual-visual language referred to as sign language. Sign language is also a non-verbal form of intercourse that's found among deaf communities at intervals the planet. The sign languages haven't got a typical origin and hence hard to interpret. A Dumb communication interpreter is also a tool that interprets the hand gestures to sensibility speech. A gesture in associate degree extremely language is also a certain movement of the hands with a particular kind created out of them [1] [2].

A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for whole words. It can also provide sign for letters to perform words that don't have corresponding sign in that sign language.

In this device Flex Sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor [1]. This digital glove aims to lower this barrier in communication. It is electronic device that can translate Sign language into speech in order to make the communication take place between the mute communities with the general public possible [2] [5].

Speech recognition technology provides ways in which computer technology can be utilized to tasks which uses natural (human) languages or speech. It has changed the way we communicate with computer and other intelligent devices of same caliber like smart phones. The most appreciating areas for the application of speech recognition are in helping handicapped and disable people. It utilizes audio input for entering data rather than a keyboard. Speech Recognition is technology that can translate sounds, words or phrases spoken by humans into text [3] [4]. Also it is converted into electrical signals, and these signals are transformed into coding patterns to which meaning has been assigned [6].

III. PROPOSED METHODOLOGY



A. Image to sound conversion

Most of the researchers classified gesture recognition system into mainly three steps after acquiring the input image from camera(s), videos or even data glove instrumented device. These steps are: Extraction Method, features estimation and extraction, and classification or recognition.



Figure 2. Gesture recognition system steps.

a. Extraction Method

Segmentation process is the first process for recognizing hand gestures. It is the process of dividing the input image (in this case hand gesture image) into regions separated by boundaries. The segmentation process depends on the type of gesture, if it is dynamic gesture then the hand gesture need to be located and tracked, if it is static gesture (posture) the input image have to be segmented only. The hand should be located firstly, generally a bounding box is used to specify the depending on the skin color and secondly, the hand have to be tracked, for tracking the hand there are two main approaches; either the video is divided into frames and each frame have to be processed alone, in this case the hand frame is treated as a posture and segmented, or using some tracking information such as shape, skin color using some tools such as Kalman filter.

b. Features Extraction

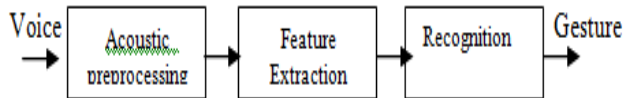
Good segmentation process leads to perfect features extraction process and the latter play an important role in a successful recognition process. Features vector of the segmented image can be extracted in different ways according to particular application. Various methods have been applied for representing the features can be extracted. Some methods used the shape of the hand such as hand contour and silhouette while others utilized fingertips position, palm center, etc. created 13 parameters as a feature vector, the first parameters represents the ratio aspect of the bounding box of the hand and the rest 12 parameters are mean values of brightness pixels in the image used Self-Growing and Self-Organized Neural Gas (SGONG) neural algorithm to capture the shape of the hand, then three features are obtained; Palm region, Palm center, and Hand slope calculated the Center Of gravity (COG) of the segmented hand and the distance from the COG to the farthest point in the fingers, and extracted one binary signal (1D) to estimate the number of fingers in the hand region divided the segmented image into different blocks size and each block represents the brightness measurements in the image. Many experiments were applied to decide the right block size that can achieve good recognition rate.

c. Gestures Classification

After modeling and analysis of the input hand image, gesture classification method is used to recognize the gesture. Recognition process affected with the proper selection of features parameters and suitable classification algorithm. For example edge detection or contour operators cannot be used for gesture recognition since many hand postures are generated and could produce misclassification.

Euclidean distance metric used to classify the gestures. Statistical tools used for gesture classification, HMM tool has shown its ability to recognize dynamic gestures besides, Finite State Machine (FSM), Learning Vector Quantization, and Principal Component Analysis (PCA). Neural network has been widely applied in the field of extracted the hand shape, and for hand gesture recognition. Other soft computing tools are effective in this field as well, such as Fuzzy C.

B. Voice to image conversion



a. Acoustic pre processing

In this step the input voice signal recorded using microphone is used for further pre processing. The recorded signals are converted to .wav file. For processing with matlab platform .wav sound files are needed. Acoustic pre processing involving removal of noise from the speech signals.

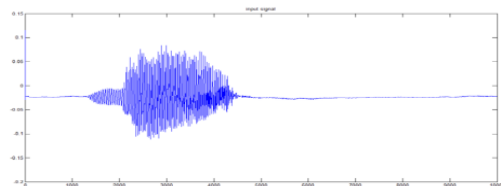


Figure 11: Input Speech Signal

b. Feature Extraction using MFCC

The proposed gesture recognition system is divided into three important stages as shown in figure 12 Image conversion from 2D to 1D signal, feature extraction and feature matching also known as classification process. The 2D converted image is given as input to MFCC for coefficients extraction. By doing feature extraction from the given training data the unnecessary data is stripped away leaving behind the important information for classification. The output after applying MFCC is a matrix having feature vectors extracted from all the frames. In this output matrix rows represent the corresponding frame numbers and columns represent corresponding feature vector coefficients.

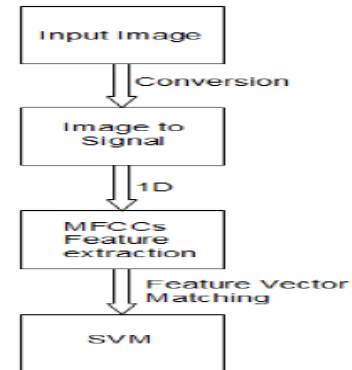


Figure: Step by step procedure of recognition system

c. Speech-Recognition Algorithm

Hidden-Markov models (HMMs) are popular statistical models used to implement speech-recognition technologies. The time variances in the spoken language are modelled as Markov processes with discrete state spaces. Each state produces speech observations according to the probability distribution characteristics of that state. The speech observations can take on a discrete or a continuous value. In either case, the speech observations represent fixed time duration (i.e., a frame). The states are not directly observable, which is why the model is called the hidden-Markov model.

IV. CONCLUSION

Sign language is a useful tool to ease the communication between the deaf person and normal person. The system aims to lower the communication gap between deaf people and normal world, since it facilitates two way communications. The projected methodology interprets language into speech. The system overcomes the necessary time difficulties of dumb people and improves their manner. This system converts the language in associate passing voice that's well explicable by deaf people. With this project the deaf-mute people can use the gloves to perform sign language and it will be converted into speech; and the speech of normal person is converted into text and corresponding hand gesture, so the communication between them can take place easily.

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