A Gesture-Driven Speaking System for Mute Individuals Using Image Processing Techniques

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ABSTRACT

This paper presents a sign to speech converter for dumb people.**[1]** In the present world it is very difficult for the dumb people to talk with the ordinary people. So it becomes impossible for them to communicate with the ordinary people unless and until ordinary people like us learn the sign language for the purpose of communication. The sign language of dumb is quite difficult to learn and it is not possible for everybody to learn that language. So every person cannot come and share their thoughts with these physically impaired people. So here is a system which would enable the dumb people to communicate with each and every one.**[2]** In this system a webcam is placed in front of the physically impaired person. The physically impaired person would put his finger in front of the web camera and the webcam will capture the hand gesture and perform image processing using principle component analysis algorithm (PCA).**[3]** The co-ordinates captured will be mapped with the one previously stored and accordingly exact picture from the database will be identified. Continuing in this way physically impaired person will be able to go through the entire sentence that he wants to communicate. Later on this sentence will be translated into speech so that it would be audible to everyone..

Keywords: Webcam, Physically Impaired, Gesture, PCA, Image Processing.

I.   INTRODUCTION

Overview

 The need of this system is to give output in day to day life for "Image Processing Based Sign to Speech Converter for Dumb People" using PCA algorithm. It will explain the aim and whole declaration for the evaluation of system. It will also explain system constraints, interface and interactions with other external applications. An attempt has also been made to explore about the need and motivation for interpreting ISL, which will provide opportunities for hearing impaired people in industry.**[4]** The aim of the proposed project is to overcome the challenge of skin color detection for natural interface between user and machine. This project is developed for the physically impaired people and would be beneficial as they can communicate with everyone. In our system a webcam is placed in front of the physically impaired person.**[5]** The physically impaired person will place a finger with particular action in front of the camera .When he makes the gestures, the webcam will capture the exact positions of the fingers and perform image processing using principle component analysis algorithm. The co-ordinates captured will be mapped with the one previously stored and accordingly exact image from the database will be identified. **[6]**Continuing in this way physically impaired person will be able to go through the entire sentence that he wants to communicate. Later on this sentence will be translated into speech so that it would be audible to everyone. **[7]**By using this system the physically impaired people would be benefited as they can communicate with everyone freely which indeed would be great achievement for the mankind.

Objective

The great challenge lies in developing an economically feasible and hardware independent system so that physically impaired people can communicate easily.

- Datasheet of all the hand gestures will be made beforehand.
- Then, using matlab programing the real time picture of sign will be captured and will be compared with the datasheet. (photo captured will be converted into binary image)
- Then Matlab will give the output to the Arduino and that output will be in accordance with the matched picture.
- Then from the arduino, this output will be given to the APR circuit which have 5 inputs.
- All the 5 inputs will be having a different message stored.
- Then in accordance with the output received by the arduino, respective message will be played.
- At the end there is an amplifier that is being used to amplify the message
- There is a speaker through which message can be easily heard

Advantages
- Low cost
- Compact systems
- Flexible to users
- It takes less power to operate system

Applications
- Gesture recognition and conversion.
- As a translating device for Mute people.
- It can be used for Mobiles for SMS sending.
- Translation of sign language in many regional languages.

II.   EARLIER WORKS

Ibrahim Patel And Dr. Y. Srinivas Rao proposes an Automated speech synthesizer and converter in cue symbol generation for hearing impairs. For the interaction of normally speaking personals with hearing impairs the communication gap leads to a non-interactive medium for the two communicators. To develop a communication approach in this paper we propose a medium for the conversion of speech signal to visual cue symbols by automatically synthesizing the given speech signal and mapping to cue symbols for visual representation. In this system is focused with the objective of reducing the communication gap between normal people and vocally disabled.

Anbarasi Rajamohan, Hemavathy R. Dhanalakshmi proposes a Deaf-Mute Communication converter. Deaf-mute person has always found it difficult to communicate with normal people. The project aims to facilitate people by means of a glove based deaf-mute communication interpreter system. For each specific gesture, the flex sensor produces a proportional change in resistance and accelerometer measures the movement of hand. The glove includes two modes of operation – training mode to benefit every user and an operational mode.

III.   MATERIALS AND METHODS

Arduino IDE: The open-source **Arduino** Software (**IDE**) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.[8]

Arduino Uno: The **Arduino Uno** is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.[9]

In some textile-based projects, this is the most practical tool to maintain the hang of the fabric. Educationally, it's a very safe and unintimidating way to learn how to use embedded electronics.[10]

Digital Voice Processor Using Apr 9600.
Digital voice recording chips with different features and coding technology for speech compression and processing are available on the market from a number of semiconductor manufacture.[11] APR 9600 single chip voice recorder and playback device from A plus integrated circuits makes use of a proprietary analogue storage technique implemented using flash non-volatile memory process in which each cell is capable of storing up to 256 voltage levels.

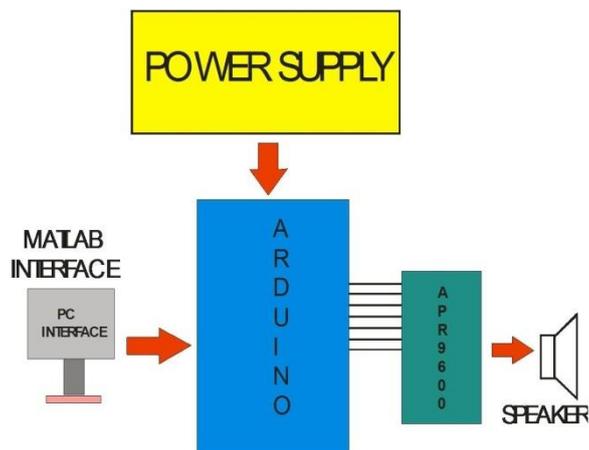 **Speaker:** For audio amplification and audio output

Fig.1. Block diagram of system

Firstly database will be created beforehand and then real time image will be captured and will be matched from the database and then using matlab programming, output will be given to arduino which processes the information for every explicit gesture created.**[12]** The controller has 2 modes of operation – coaching mode and operational mode. In coaching mode the gesture is formed by the user and also the voltage levels area units keep in EEPROM.**[13]** In operational mode the information is being compared with predefined values and also the matched gestures area unit sent with text to speech conversion module i.e APR circuit where all the messages will be pre-stored and corresponding output will be played and can be easily heard in the speaker.

IV.   PROPOSED METHODOLOGY

For implementation of this system we require different hand gestures and web camera is required for capturing the gestures. The person would be placing different gestures in front of the camera. When the user makes the gesture of a symbol while implementing system there are different modules involve in the system are as follows:
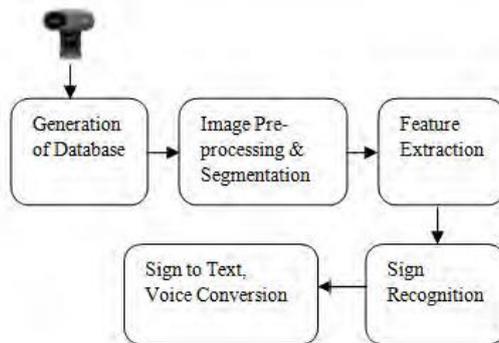

Fig.2. Proposed System of Sign Recognition

1.   **Generation of Database** : First of all while processing the images, it is necessary to prepare a proper database of 5 images of each symbol total of 40 images are captured in order to increase the accuracy for identification of images.
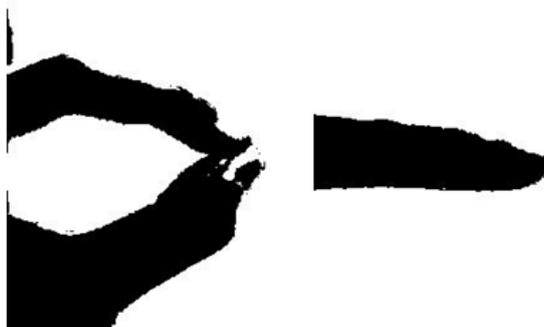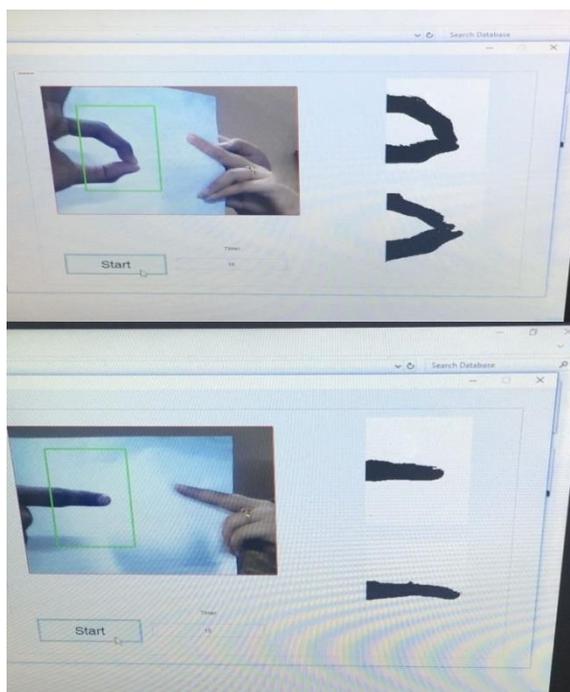
Fig 3- Input Database

2. **Image pre-processing and segmentation:** Preprocessing consists of image acquisition, segmentation and morphological filtering methods. Then the Segmentation of hands is carried out to separate object and the background. PCA algorithm is used for segmentation purpose. The segmented hand image is represented certain features. These features are further used for gesture recognition Morphological filtering techniques are used to remove noises from images so that we can get a smooth contour.
3. **Feature extraction :**It is a method of reducing data dimensionality by encoding related information in a compressed representation. The selection of which features to deal with are centroid, skin colour and principle component analysis as the main features.
4. **Sign Recognition:** It uses principle component algorithm analysis to identify the image from the database.

The PCA algorithm involves 2 phases:

*   Training phase
*   Recognition phase

In training mode, each gesture is represented as a column vector. Then PCA finds the eigen vectors of the covariance matrix of gestures and then they are multiplied by each of their gesture vectors to obtain their gesture space projections.

In the recognition phase, a subjected gesture is projected onto gesture space and the euclidean distance is computed between this projection and all known projections.
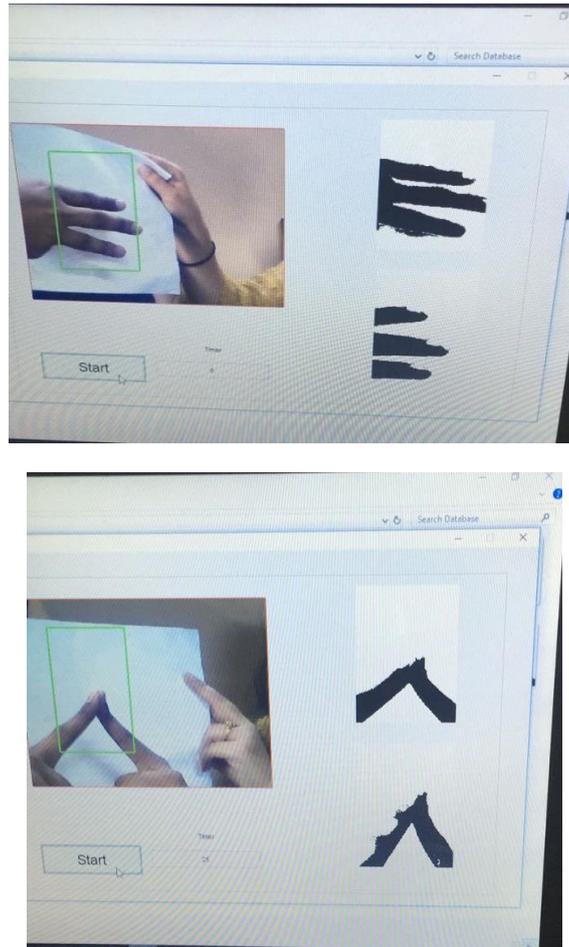
Fig 4- Output Matching w.r.t. Input Database

5. **Sign to voice conversion-** The identified image is converted into voice or speech signal using APR 9600 and speaker.

V. RESULTS AND CONCLUSION

This paper proposes an electronic design that can be used for communication between deaf, mute people and normal people.

The following remarks could be the summary of the findings from this work.
- The design is more compatible and faster responsive when compared to existing design using PCA algorithm
- A responsive time of 2 to 3 seconds.
- More Compact and portable.
- Efficient communication between differently abled (deaf in this context) and normal people.
- Assign language involves different gestures and hand movement, improves small motor skills of differently abled people.
- A mobile application can be built for the efficient use of the design and to make it user-friendly.
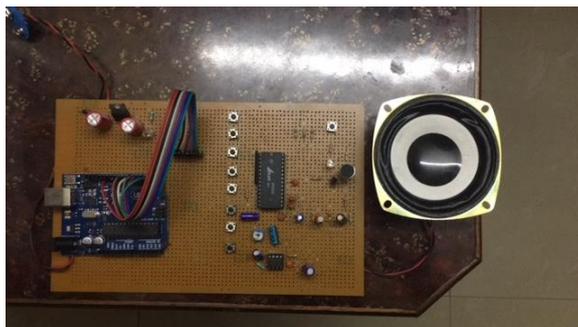
Fig 5: Proposed hardware

VI. CONCLUSION

The proposed method is tested on different gestures. It produce fairly stable and good results Every person cannot come and share their thoughts with these physically impaired people. So we have come up with a system which would enable the dumb to communicate with each and every one by using the image processing based language converter and sign language recognition system proposed for human computer interaction using Image Processing Technique

VII. REFERENCES

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