Image Processing based Language Converter for Deaf and Dumb

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Abstract – **This application helps the deaf and dumb person to communicate with the rest of the world using sign language. Suitable existing methods are integrated in this application. Computer recognition of sign language is an important research problem for enabling communication with hearing impaired people. The Computer based intelligent system will enable deaf & dumb people significantly to communicate with all other people using their natural hand gestures.**

Keywords- **sign language, hand gestures, RGB, Binary conversion, opencv**

I. INTRODUCTION

Deaf and Dumb people are usually deprived of normal communication with other people in the society. It has been observed that they find it really difficult at times to interact with normal people with their gestures, as only a very few of those are recognized by most people. Since people with hearing impairment or deaf people cannot talk like normal people so they have to depend on some sort of visual communication in most of the time. Sign Language is the primary means of communication in the deaf and dumb community. As like any other language it has also got grammar and vocabulary but uses visual modality for exchanging information. The problem arises when dumb or deaf people try to express themselves to other people with the help of these sign language grammars. This is because normal people are usually unaware of these grammars. As a result it has been seen that communication of a dumb person are only limited within his/her family or the deaf community. The importance of sign language is emphasized by the growing public approval and funds for international project. At this age of Technology the demand for a computer based system is highly demanding for the dumb community. However, researchers have been attacking the problem for quite some time now and the results are showing some promise. Interesting technologies are being developed for speech recognition but no real commercial product for sign recognition is actually there in the current market. So, to take this field of research to another higher level this project was studied and carried out. The basic objective of this research was to develop a computer based intelligent system that will enable dumb people significantly to communicate with all other people using their natural hand gestures. The idea consisted of designing and building up an intelligent system using image processing, data mining and artificial intelligence concepts to take visual inputs of sign language's hand gestures and generate easily recognizable form of outputs in the form of text & Voice.

II. RELATED WORK

The literature survey is carried out as a part of the project work. It has provided review of the past research about image processing based language converter and other researchers. The past research effort will properly guide to justify the scope and direction of the present effort.

Soumya Dutta and Bidyut B. Chaudhuri propose Color-based target recognition which is inherently difficult, due to variation in the apparent color of targets under varying image in conditions. A number of factors might lead to the problem, namely, the color of incident daylight, surface reflectance properties of the target, illumination geometry, and viewing geometry. A color image edge detection algorithm is proposed in this paper. [1]. Christopher Lee and Yangsheng Xu developed a glove-based gesture recognition system that was able to recognize 14 of the letters from the hand alphabet, learn new gestures and able to update the model of each gesture in the system in online mode, with a rate of 10Hz. They developed a gesture recognition system, based on Hidden Markov Models, which can interactively recognize gestures and perform online learning of new gestures [2]. Etsuko Ueda, Yoshio Matsumoto, Masakazu Imai, and Tsukasa Ogasawara propose a novel method for a hand-poseestimation that can be used for vision-based human interfaces. "Voxel model" is used in this system for integrating multiview point. At present, there are two major problems, accuracy and speed [3].P. Subha Rajama, G. Balakrishnan proposes a method that provides the conversion of a set of 32 combination of the binary number 25 which represents the _UP'and _DOWN'positions of five fingers into decimal numbers. They used Palm Extraction method, Feature point extraction method, training phase [4]. T. Starner, J. Weaver, and A. Pentland proposed that combine Dynamic time wrapping or Hidden Markov Models (HMMs) with discrimination classifier for recognizing speech, handwriting or Sign Language. This system involved in two proposed methods by using 40 signs. The first method obtained 92% accuracy and second method obtained 98% accuracy. [5]. Fu-hua Chou, Yung-Chun Su, presents novel processing algorithms for the gesture images detection and recognition. In this method the static hand gesture of sign language is constructed by the Gaussian mixture model, and the unknown gesture image is identified by Gaussian model match. Based on presented static sign language detection and recognition algorithms, the correct recognition rate is about 94% in average [6]. Shreyashi Narayan Sawant presents design and implementation of real time Sign Language Recognition system base on vision to recognize 26 gestures from the Indian Sign Language using MATLAB. Principle Component

Analysis (PCA) algorithm is used for comparing obtained features. After comparing features minimum Euclidean distance is calculated for sign recognition. This system provides an opportunity for a deaf-dumb people to communicate with non-signing people without the need of an interpreter [7].

Mostafa Karabasi, Zeeshan Bhatti, Asadullah Shah, design a model for recognizing Malaysian Sign Language through image processing techniques. In order to implement a real time hand gesture recognition system, video footage will be obtained from digital camera. In the final step the normal person will type the text and its equivalent animation of hand gestures will be presented. This system, gives more accurate results least possible time. [8] D. Kumarage, S. Fernando, P. Fernando, D. Madushanka & R. Samarasinghe presents a less costly approach to develop computer vision. They explore new concepts of breaking down motion gestures to sub components for parallel processing and mapping motion data into static data representations. This concept can be used to identify sign language gestures, without performing computational intensive tasks of each and every frame captured [9]. Meenakshi Panwar aims to present a real time system for hand gesture recognition on the basis of detection of some meaningful shape based features like orientation, centre of mass (centroid), status of fingers. The approach introduced in this method is totally depending on the shape parameters of the hand gesture. Used K-means clustering for segmenting the hand object, so that only segmented significant cluster or hand object is to be processed in order to calculate shape based features. It gives approximate recognition rate of 94% [10].

III. System Development

The goal of proposed method is to convert RGB to text massage. Fig.1 shows the overall idea of proposed system. The system consists of 2 modules. Image is captured through the webcam. The camera is mounted on top of system facing towards the wall with neutral background. Firstly, the captured Colored image is converted into the gray scale image which intern converted into the binary form. Coordinates of captured image is calculated with respect to X and Y coordinates.Recognice the colors which color is present, then convert it to particular binary code. Then the same will be converted into audio and textual form. The system works in two different mode i.e. training mode and operational mode. Training mode is part of machine learning where we are training our system to accomplish the task for which it is implemented i.e. Alphabet Recognition.

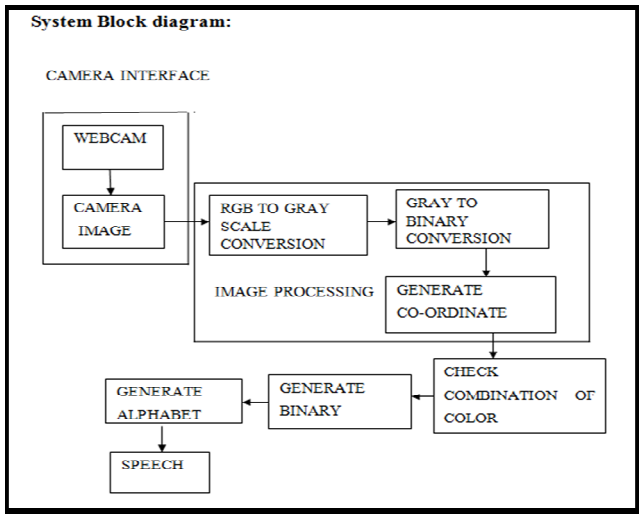

Fig.1 System Block Diagram

IV. Experimental Results

The experimental results of this system are as shown below,
The algorithm is implemented using C# & .net using various real time and standard images. The real time images are captured from web camera. The experimental results show the robustness of algorithm in both real time and standard images. The main motive of this work is to Convert RGB to binary in form of audio & text.

A. RGB Color Recognition

The above Fig.2 indicates the red image captured using web camera & is the target image for binary conversion.

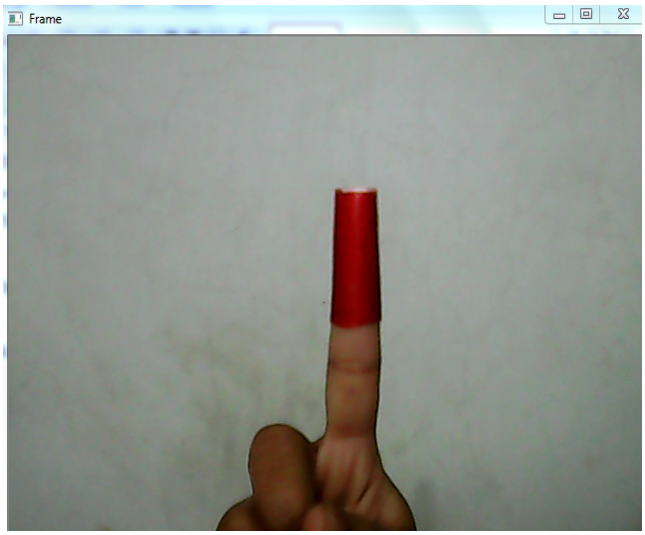

Fig 2: Captured Red Image using web camera

B. Color calibration RGB Adjust software

After capturing images using webcam, different pixel values calculated as shown in below image.

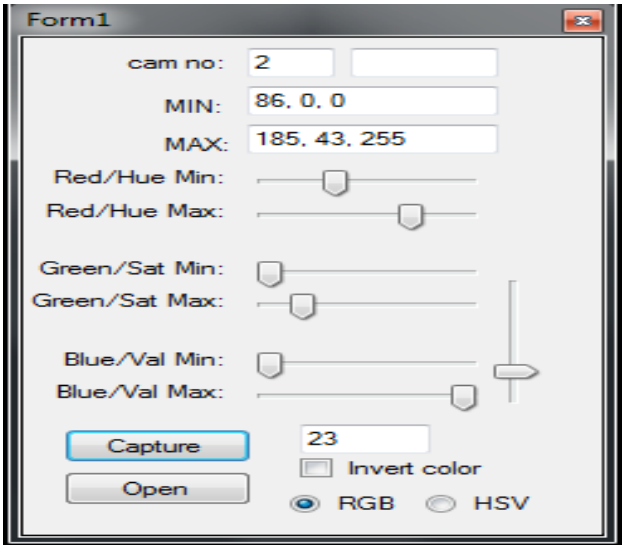

Fig 3: Captured Pixel Values for Red Image using web camera

C. Color image to Binary image conversion

For above Pixel values below are the binary image for red color.

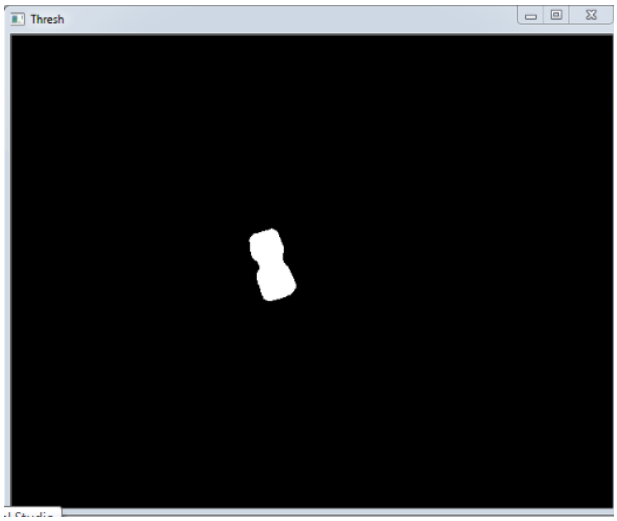

Fig 4: Captured Binary Image for Red Image using web camera

D. COORDINATE FINDING

After getting the marker pixels that are now highlighted as a white color pixels. Coordinates of that area for each color is generated.

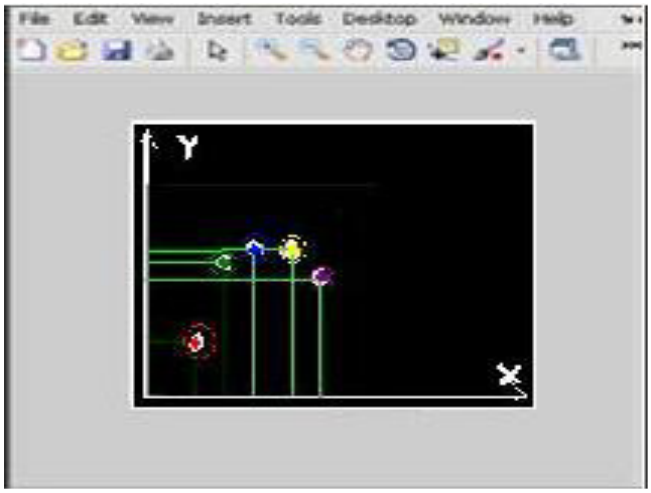

Fig 5: Co-ordinate Mapping

In this method, the input image after processing is set to the pixel values (3) of each color to be used such as Red_new (Rx, Ry), Green_new (Gx, Gy), Blue_new (Bx, By), Purple_new (Px, Py), Parrot Green _new (PGx, PGy). Pixel values comprise of the minimum and maximum values of each color pixel or can be called as co-ordinates. To obtain these values the general idea is firstly to find the area of each color pixel and the coordinates (Yx, Yy) by using the equation: Area= count number of white pixels obtained by Thresholding.

$$X=\frac{\text{Moment in X direction}}{\text{Area}} \qquad Y=\frac{\text{Moment in Y direction}}{\text{Area}}$$

E. ALPHABET RECOGNITION

Following table 1 shows the values assigned to each finger. Binary Alphabet calculation: It is possible to display total (25−1) i.e.31 gestures using the fingers of a single hand.

Table.1 Values assigned to each Color

	Purple	Parrot green	Blue	Dark Green	Red
Power of two	2^4	2^3	2^2	2^1	2^0
Value	16	8	4	2	1

Table 2. Alphabets code

SR NO	Purple	Parrot gre	Blue	Dark Gree	Red	Text
1	0	0	0	0	1	A
2	0	0	0	1	0	B
3	0	0	0	1	1	C
4	0	0	1	0	0	D
5	0	0	1	0	1	E
6	0	0	1	1	0	F
7	0	0	1	1	1	G
8	0	1	0	0	0	H
9	0	1	0	0	1	I
10	0	1	0	1	0	J
11	0	1	0	1	1	K
12	0	1	1	0	0	L
13	0	1	1	0	1	M
14	0	1	1	1	0	N
15	0	1	1	1	1	O
16	1	0	0	0	0	P
17	1	0	0	0	1	Q
18	1	0	0	1	0	R
19	1	0	0	1	1	S
20	1	0	1	0	0	T
21	1	0	1	0	1	U
22	1	0	1	1	0	V
23	1	0	1	1	1	W
24	1	1	0	0	0	X
25	1	1	0	0	1	Y
26	1	1	0	1	0	Z
27	1	1	0	1	1	Space

F. RGB TO TEXT CONVERSION

Putting pixel values for different colors giving text massages as per above alphabate codes. Below images are the example shown for Red color. While showing Red input as shown in below input infront of webcam text form shows 'a' alphabate as shown in below output image. In the similar way deaf & dump can talk with other person using different colors. Below output image is the example of one of the statement.

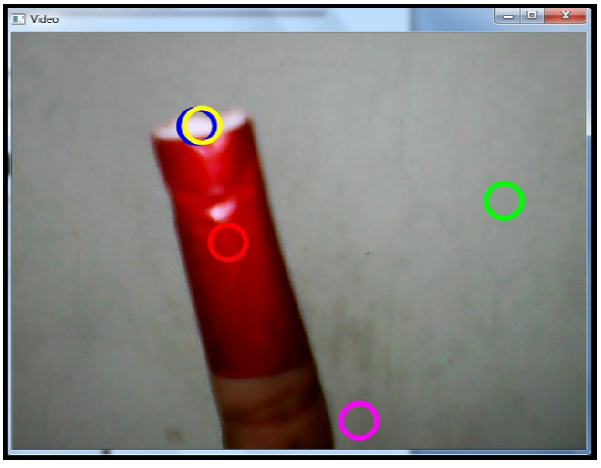

Fig6. Input image for 'a' alphabet

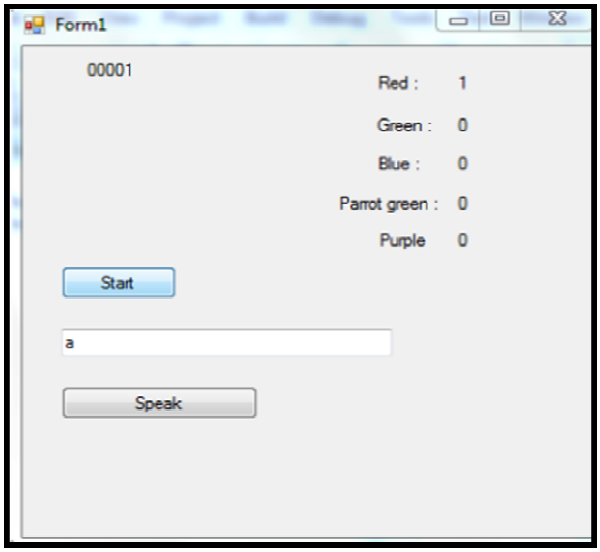

Fig7.Output image for 'a' alphabet

V. CONCLUSION

- Sign Language is captured by introducing inexpensive computer which is user friendly for everyone, to translate it into text to solve communication problem of deaf & dumb people. It is such design that the message display in front of the user i.e. on monitor screen, so deaf & dumb people can communicate easily with normal people. In this system text converter into voice by using speech synthesizer, so blind people can also commutates easily.

- In world applications, this system is helpful for deaf and dumb of us those cannot communicate with ancient person. The foremost characteristic of this project is that the gesture recognizer may be a standalone system, that's applied in common-place of living. It's in addition useful for speech impaired and para-lysed patient means those do not speak properly and in addition used for Intelligent Home Applications and industrial applications.

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