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Sign Language Recognition Using Image Processing For Mute People

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***Abstract*: Computer recognition of sign language is an important research problem for enabling communication with mute people. This project introduces an efficient and fast algorithm for identification of the number of fingers opened in a gesture representing an alphabet of the Binary Sign Language.**

The system does not require the hand to be perfectly aligned to the camera. The project uses image processing system to identify, especially English alphabetic sign language used by the mute people to communicate. The basic objective of this project is to develop a computer based intelligent system that will enable mute 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, machine learning and artificial intelligence concepts to take visual inputs of sign language's hand gestures and generate easily recognizable form of outputs.

Hence the objective of this project is to develop an intelligent system which can act as a translator between the sign language and the spoken language dynamically and can make the communication between people with mute and normal people both effective and efficient. The system is we are implementing for Binary sign language but it can detect any sign language with prior image processing.

***Keywords:* Computer recognition, Sign Language, mute people significantly.**

I. INTRODUCTION

Mute people can't speak and normal people don't know the sign language which is used for inter communication between mute people. This system will be useful to solve this problem.

With the help of Image processing MATLAB will identify the sign language performed by the mute person and send the corresponding character to the micro controller. Micro controller will announce the received character. This way the sign language will be converted in to voice language.

II. SYSTEM ARCITECTUR

The system consists of 4 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.

Dimensions of captured image is calculated with respect to X and Y coordinates taking integration of them. The calculated dimensions are then stored into the database in the form of template. The templates of newly created dimensions are compared with the existing one. If comparison leads to success 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.

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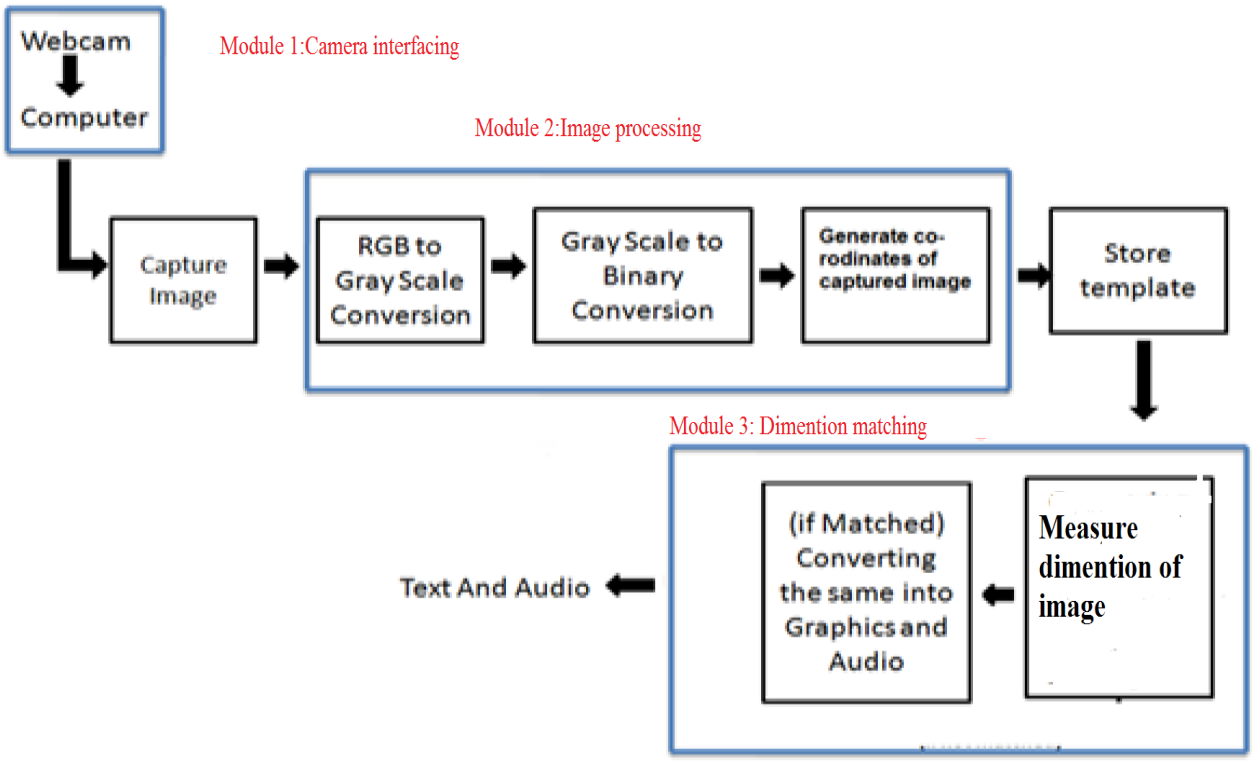

III. HOW IT WORK

Image Processing:

An image may be defined as a two-dimensional function, f(x, y), where x and y are spatial coordinates, and the amplitude off at any pair of coordinates (x, y) is called the intensity or grey level of the image at that point. When x, y, and the amplitude values of f are all finite, discrete quantities, we call the image a digital image. The field of digital image processing refers to processing digital images by means of a digital computer. Note that a digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are referred to as picture elements, image elements, pels, and pixels. Pixel is the term used most widely to denote the elements of a digital image.

RGB Color Recognition:

Basically, any color image is a combination of red, green, blue colors. An important trade-off when implementing a computer vision system is to select whether to differentiate objects using color or black and white and, if color, to decide what color space to use (red, green, blue or hue, saturation, luminosity)[1]. For the purposes of this project, the detection of skin and marker pixels is required, so the color space chosen should best facilitate this. The camera available permitted the detection of color information. Although using intensity alone (black and white) reduces the amount of data to analyze and therefore decreases processor load it also makes differentiating skin and markers from the background much harder (since black and white data exhibits less variation than color data).

Therefore it was decided to use color differentiation. Further maximum and minimum HSL pixel color values of a small test area of skin were manually calculated. These HSL ranges were then used to detect skin pixels in a subsequent frame (detection was indicated by a change of pixel color to white). But Hue, when compared with saturation and luminosity, is surprisingly bad at skin differentiation (with the chosen background) and thus HSL shows no significant advantage over RGB. Moreover, since conversion of the color data from RGB to HSL took considerable processor time it was decided to use RGB. [3]

We will take the color image. Then make required portion of image as white by using Thresholding technique (as explained below) and garbage part that is background as black. Then we get black and white image and it is compared with the stored template.

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Color image to Binary image conversion:

To convert any color to a grayscale representation of its luminance, first one must obtain the values of its red, green, and blue (RGB) primaries. Grayscale or grayscale digital image is an image in which the value of each pixel is a single sample, that is, it carries only intensity information. Images of this sort, also known as black and white, are composed exclusively of shades of gray, varying from black at the weakest intensity to white at the strongest. A binary image is a digital image that has only two possible values for each pixel. Typically the two colors used for a binary image are black and white though any two colors can be used. The color used for the object in the image is the foreground color while the rest of the image is the background color. Until now a simple RGB bounding box has been used in the classification of the skin and marker pixels.[4]

Thresholding:

Thresholding is the simple method of image segmentation [1]. In this method we convert the RGB image to Binary image. Figure 2-5 shows the details of image processing. Binary image is digital image and has only two values (0 or 1). For each pixel typically two colors are used black and white though any two colors can be used. Here, the background pixels are converted into black color pixels and pixels containing our area of interest are converted into white color pixels. It is nothing but the preprocessing.

Coordinate Mapping:

In the previous step only the area containing marker color bands are preserved for further processing and rest of the portion of image are converted into black color pixels this is shown in figure 6. This task of converting color band pixels into the white color pixels is accomplished by setting the values of RGB color in filter. After getting the marker pixels that are now highlighted as a white color pixels, coordinates of that area for each color is generated. The newly generated coordinates are the compared with the stored coordinates in the database for the purpose of output generation using pattern matching technique explained in the next section.

Pattern Matching Algorithm:

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), Yellow_new (Yx, Yy).Pixel values comprise of the minimum and maximum values of each color pixel or can be called as coordinates. The generated values of these co-ordinates will be then compared with the values stored in the templates stored in the database. 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.

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

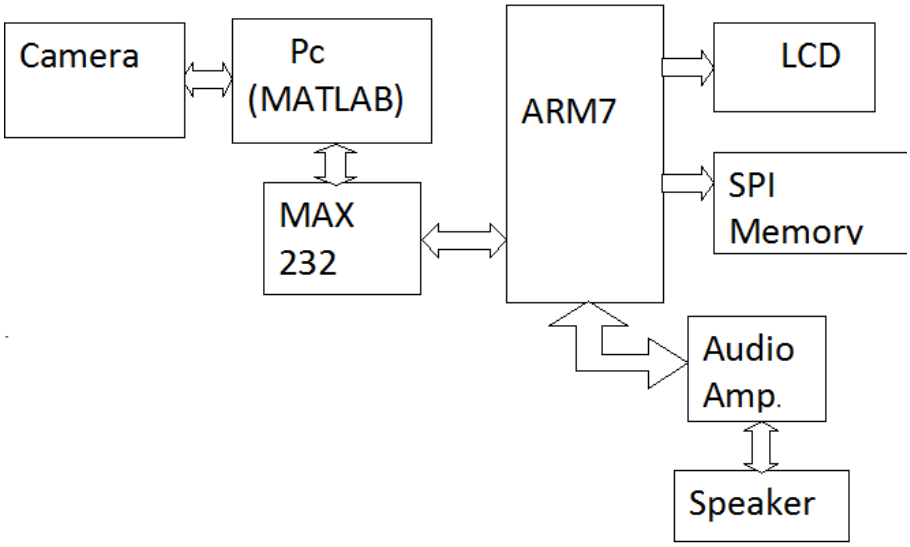
$$Y = \frac{\text{Moment in Y direction}}{\text{Area}}$$

Each newly generated pixel value then gets compared with the previously stored template value in the database. Algorithm proceeds until the comparison leads to success or failure. If algorithm returns positive result then the sign will be converted into corresponding text and audio if comparison results into failure then the proper error message will be displayed on the screen.

Text to speech conversion:

This part comes under Artificial Intelligence [4] where once the template matching operation becomes successful the matched image is then translated into text and audio format. For this purpose, predefined methods are used for conversion.

IV. BLOCK DIAGRAM



In block diagram as shown above there is one webcam which connected to pc, the captured image can be stored in pc, this image can be given in mat lab an image processing done on that after transfer to max 232 to convert signal into simple digital ttl logic. Using arm7, audio amp. & speaker the text can be converted into speech. Alphanumeric display used show text.

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