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Electronic Device Control Using Hand Gesture Recognition for Differently Abled

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Abstract: Handgesturerecognitionsysteminwhichitdetectshandgestureinmidairandcontrols the device according to the given input gesture.Thisprojectputforwarda technique to control the appliances for hearing impaired or people in general so that they can operate the gadgets.This System is a prototype system that helps to recognize hand gesture to normal people in order to communicate more effectively with the special people. This focuses on the problem of gesture recognition in real time that sign language used by the community of deaf people. The problem addressed using Skin Detection, Image Segmentation, Image Filtering, and Template Matching techniques. This system recognizes gestures of ASL (American Sign Language) including the alphabet.

Key words: Image Filtering,ASL(American Sign Language),SkinDetection,TemplateMatching,Correlation-Coefficient,Image Acquisition etc

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1. INTRODUCTION

Communication means to share thoughts, messages, knowledge or any information. Since ages communication is thetool of exchange of information through oral,writing, visuals signs or behavior. The communication cycle considers to be completed once the message is received by a receiver and recognizes the message of the sender. Ordinary people communicate their thoughts through speech to others. whereas the hearing-impaired community the means of communication is the use of sign language and ASL is 3rd most used sign Language.

2. LITERATURE SURVEY

Many novel methods have been developed in past few years, to facilitate communicationbetweenthesignlanguageusersandthosewhocan'tspeaksignlanguage.Mrs.NeelaHarish,Dr.S. Poonguzhali,proposed a system which depends on flex sensors, accelerometersoutputvaluessuchas,coordinatesgivenbyaccelerometerandthebending values given by the flex sensors, for the interpretation ofsigns.In past works, distinctive algorithms have been utilized for hand gesture recognition system. "Hong Cheng, Lu Yang and Zicheng Liu have surveyed 3D hand gesture recognition in which they have overviewed shading hand gesture recognition utilizing shading gesture division and utilizing gloves. This method is long and the real test is the online recognition of 3D hand gestures".

There are already a lot of methodologies available for gesture recognition. In [5], author makes use of glove method in which the input is provided to computer through inertial tracking devices with high accuracy. But this technique is again in conflict with our idea of communication being natural and intuitive. Other techniques such as in marker method require the user to mark blackcircles on fingers. After processing the skin is represented with white pixels and black circles marked are counted. It is inconvenient and time consuming for the user to mark black circles and this method is also rotation variant.[6]Another method is use of depth aware cameras such as structured light beam cameras which provide information about the distance of points on hands to computer. Based on this a 3-d representation is generated and the gesture is identified [7].

Another method employs use of convex hulls for calculating the number of fingers, although in some cases if plane of all the fingers is not same this method fails to generate correct result.

The above mentioned are effective methods with high accuracy. However,the motive of this paper is to compete with above techniques

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without any special equipment or marking. This paper tries to develop and modify simple algorithms employing the introductory knowledge of image processing.

3.PROPOSEDMETHODOLOGY

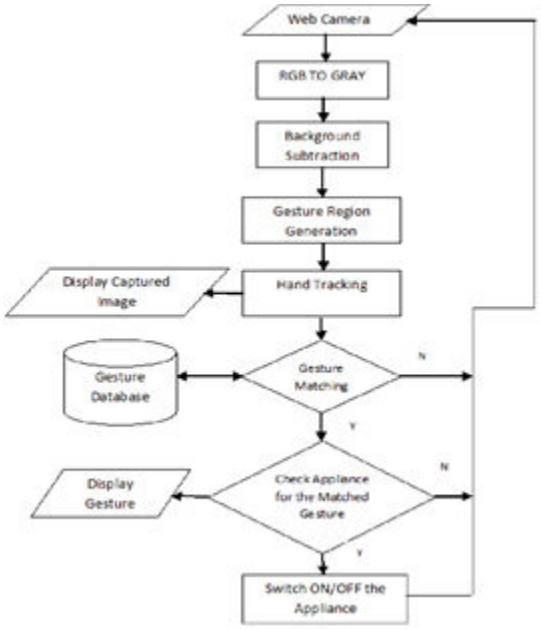

Fig.1Proposed BlockDiagram

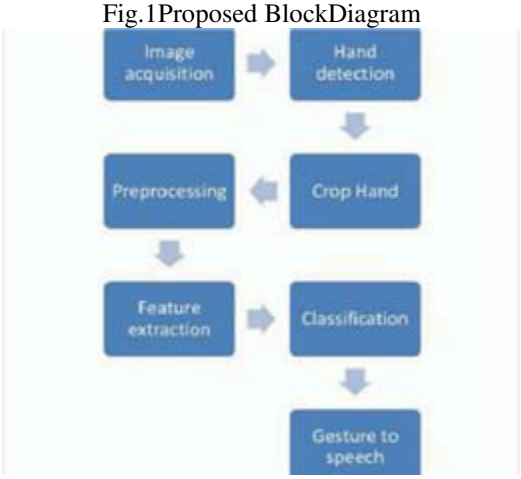

Fig.2 Block Diagram

WorkingPrinciple

The proposed system comprises of four modules which are defined as vision baseddata acquisition, pre-processing, feature extraction and gesturerecognition.Fig.1 and Fig.2 show the schematic block diagram and flow diagram of the proposed system. Adatabase is made which consists of the gesture's images that are to be matched with. The current gesture image is input to the web camera of the computer.The current image is the colored image. The camera clicks the real time image for feature extraction.

Theimageisthenprocessedusingthepreprocessingstepstoenhancethequalityofthe image.Thesizeoftheimageisvariedtochangeitsresolution.Randomnoisesareremoved byfilteringtheimage.Thecurrentgestureimageisthenconvertedfromcoloredtoblack and white. The edges of the gesture are detected. The preprocessing steps are useful for attaining the accuracy of theprogram.Theimageismatchedwiththeexistingtraindatabaseandtheoutputisgiveninthe form audio. The output tells theappliance that is switched ON/OFF after completing the steps.

4. EXPERIMENTAL RESULTS

4.1 Skin Detection

There are several techniques used for color space transformation for skin detection. Some potential color spaces that are considerable for skin detection process are:a)CIEXYZ b)YcbCr c)YIQ d)YUV

And YCbCr metric is used for Skin Detection algorithm. Skin Detection process involves classification of each pixel of the image to identify as part of human skin or not by applying Gray-world Algorithm for illumination compensation and the pixels are categorized based on an explicit relationship between the color components YCbCr.In YCbCr colorspace, the single component “Y” represents luminance information, and Cb and Cr represent color information to store two color-difference components, Component Cb is the difference between the blue component and a reference value, whereas component Cr is the difference between the red component and a reference value.

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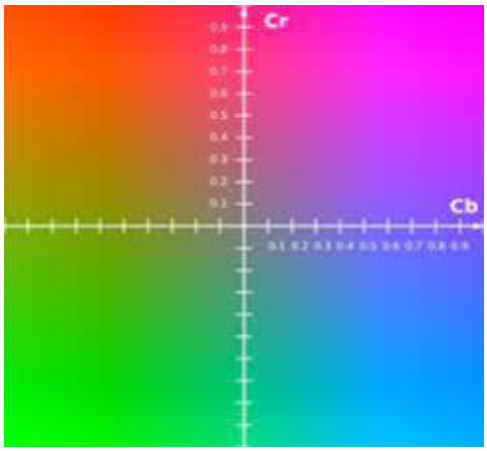

Fig.3 Cb and Cr color composition

4.2 Gray world algorithm

Gray world algorithm is used for the input picture taken from video for illuminance compensation. The gray world normalization makes the assumption that changes in the lighting spectrum can be modelled by three constant factors applied to the red, green and blue channels of color.By this we can achieve image normalization in the input picture Which helps us to simplify and increase the ability of separation between skin and non-skin, and also decrease the ability of separation among skin tone.

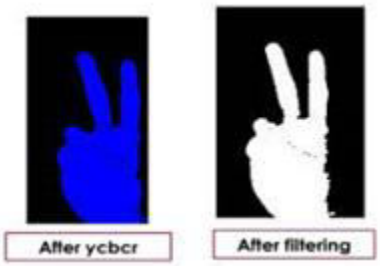

Fig.4 Skin pixel Detection

Thus, a pixel is considered a human skin, if a set of pixel is falling into that particular category with a certain value of Cr and Cb having certain threshold.

Thus,Condition for a skin pixel is Skin: 1 if (cb ≥ 77 and cb ≤ 127 and cr ≥ 133 and cr ≤ 173) *or* 0 *otherwise*. And the detected skin pixels are marked as blue for easy detection. After the skin detection, image marked with blue color converted into the binary with skin pixels as '1' and rest are "0". So that, the correlation of the image can be matched with the Template.

4.3 Image Filtering

Image Filtering is applied for the image to remove noise in the gesture.And median Filter is applied to filter the image.After applying median filter each output pixel contains the median value in a 3-by-3 neighborhood around the corresponding pixel in the input image.

Fig.5After applying median filter

Median filter pads the image with 0s on the edges, so

the median values for points within one half the width of the neighborhood ([m n]/2) of the edges might appear distorted.

4.4 Template Matching

Template matching is done by using correlation. It involves determining correlation coefficient between two image one is template image and another is search image. Template matching involves a predefined gesture database which is used to match with the input gesture. The input gesture is matched with every predefined image gesture in database and its corresponding correlation coefficient is determined and the image with highest correlation coefficient is determined as matched gesture and it's corresponding alphabet is determined. And the determined alphabet is concatenated to a string and this string is used for speech conversion.Correlation coefficient is a statistical measure of the degree to which changes to the value of one variable predict change to the value of another.Correlation

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coefficients are expressed as values between +1 and -1.A coefficient of +1 indicates a perfect positive correlation, A change in the value of one variable will predict a change in the same direction in the second variable. A coefficient of -1 indicates a perfect negative correlation, A change in the value of one variable predicts a change in the opposite direction in the second variable.Lesser degrees of correlation are expressed as non-zero decimals. A coefficient of zero indicates there is no discernable relationship between fluctuations of the variables.

Fig.6 Template Matching

The matched image is then used to determine the corresponding alphabet in ASL Language.

Fig.7 American Sign Language(ASL)

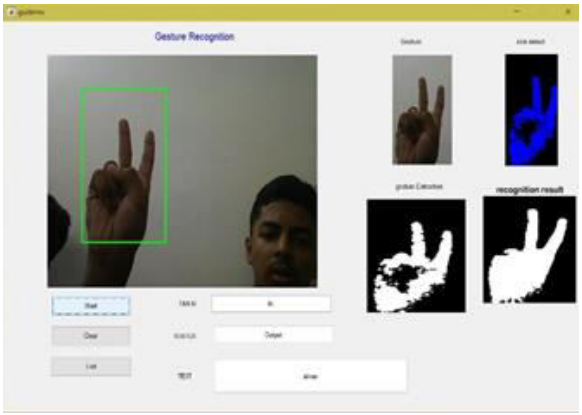

Fig.8 GUI Output for Hand Gesture Recognition

4.5. String Conversion and Speech Conversion

The determined alphabet from ASL for the corresponding gesture is concatenated to a string so that it can used for the speech conversion for which this stiring serves as an input .And the string is used to speak out the word using speech function.

This system can recognize a set of 24 letters from the ASL alphabets: A, B, C, D, E, F, G, H, I, K, L, M, N, O, P, Q, R, S, T, U, V, W .

5. CONCLUSION

This system can be used in mobile devices for the ease of use and the accuracy of the gesture matching can be increased by training the dataset than template matching using correlation. Overall, the system works perfectly for some gestures and does 't need any other requirements to attain accuracy. The image acquisition and skin detection work with high accuracy. The results obtained are applicable, and can be implemented in a mobile device smart phone having frontal camera.

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