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Hand Gesture Recognition

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Abstract:

In this paper, an application for live gesture recognition is developed using webcam input in python. It is a combination of live detection and gesture identification. The software uses the webcam to detect hand gestures made by the user and provides the output accordingly. The user has to perform a particular hand gesture. The webcam captures the input video and performs operations on the gesture values, recognizes it and performs the action corresponding to it. The code continuously captures video from the webcam and takes the frames of the video at every instant. Firstly, the noises that are present in frames collected from the webcam are minimized. Then the frame which is captured in RGB format is converted to Grayscale and then Hue-Saturation-Value format. Hand in frame collected is recognized by threshold value to black and white. By using a few functions, we can detect hand static gestures made by the user. By considering the edge of hand detected, it finds the best circumscribing contour.

Keywords **—Hue-Saturation-value, Grayscale.**

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I. INTRODUCTION

The process of gesture recognition revolves around taking input from the webcam and processing the input and converting it into a form that can be understood easily. Interpreting the hand gesture from the video input of the webcam according to the methodgives corresponding commands for the operations.

It uses the OpenCV 4.2.0 library for handling the operations on the input from the webcam. Python v-3.7.4 is used as the base language. Also, it includes further modifications to eliminate noise. The interpreted gesture is scanned against a set of known gesture values to find which gesture matches the best. Various features of the code of the paper are, can detect any kind of gesture which is provided in the set of values. Eliminates the background noises by blurring so the operations can be operated in a place where there is no much movement in the background. The code is optimized so as to reduce noise due to poor lighting. The movements of the hand while performing the gesture are only taken in the area of interest. This also adjusts to the lighting conditions in the area of interest.

II. EXISTINGSYSTEM

Current trends of Computer vision techniques the user had to wear gloves, helmet & other heavy apparatus. For detecting hand gesture presently, some optical or mechanical sensors, actuator & accelerometer are used with the glove.

That equipment converts finger flexion into electrical signals for determining the hand posture. In this method, the user have to carry cables which are difficult to manage in real-time. This approach needs more maintenance due to the complex wired mechanism.

III. PROPOSED SYSTEM

The proposed system presented in this paper performs real-time hand gesture recognition which is done using various image processing techniques.The overall system architecture of the hand gesture recognition system as follows.

A. System architecture

The basic flow diagram of the system is Capture the image of the gesture frame by frame through webcam Input image is processed and gesture is recognized using image processing Command signal is generated and transmitted to the device. The device performs actions according to the command received.

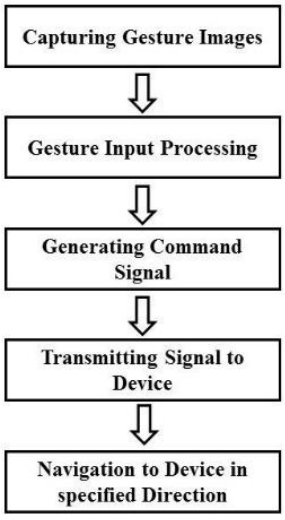

Fig 1. Architecture of Proposed System

B. Hand gesture recognition

The proposed system presented in this paper performs real-time hand gesture recognition which is done using various image processing techniques. The overall system architecture of the hand gesture recognition system.

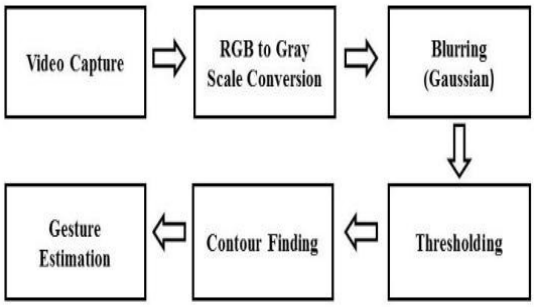

Fig. 2. Architecture of an (HGRS) Hand Gesture Recognition System

C. Modules

The steps involved in the process of hand gesture recognition are,

i. Video Acquisition

The first step in the hand gesturerecognition process is to capture the hand gestures of the user. The video of the user is captured through webcam. This process involves converting the video to static frames that can be used for image processing. These frames are obtained through the function of OpenCV library and are further processed for greyscale conversion.

Input:video of the user providing hand gestures through webcam.

Fig. 3 Sample Image

Output: static frames of hand

Fig. 4 Sample display of static frames

ii. RGB to Grayscale Conversion

The second step isGrayscale Conversion of the image. The frames represent complete information regarding a particular gesture. The function in the OpenCV library is used to convert the image to Grayscale. Grayscale images have fewer number of bits as they have only a single channel of colour which can be represented using 8 bits and thus is easy for calculations in image processing. So, we convert our RGB image to Grayscale.

Input: RGB image frames

Fig. 5 Sample RGB image

Output: Grey Scale images

Fig.6 Sample display of greyscale images

iii. Blurring

The technique used to perform blurring isGaussian Blur. Gaussian smoothing is performed to reduce noise in the image. To blur the images Gaussian smoothening operator is used. This operator helps in reducing the noise present in the image in the form of intensity variation. The kernel used in this process is different and it acts like a mean filter.

Input: The Grayscale image frame

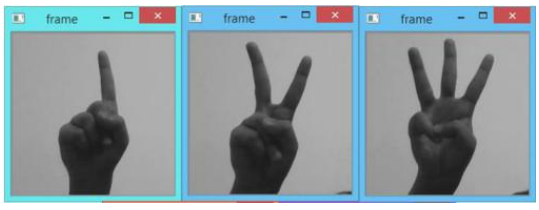

Fig. 7 Sample display of grey scale images

Output: Blurred image frames

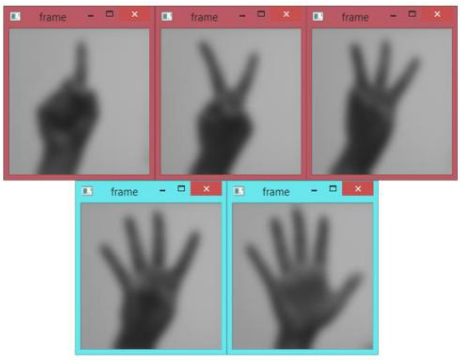

Fig. 8 Sample display of blurred frames

iv. Thresholding

Thresholding is the method in which thevalues which are present in the region of interest are brightened and the remaining areas are darkened. Thresholding is a simple technique for the segmentation of the image. Binary images which consist of only two colours thatare black and white are formed using this method. It is the process of extracting features in which the required features are converted to white andthe remaining region is converted to black and vice- verse.

Input: Blurred image frames

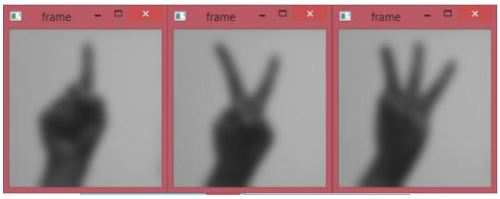

Fig. 9 Sample Blurred frames

Output: Thresholded images

Fig. 10 Thresholding of images

v. Contour Finding

Contour is the boundary of a region ofinterest in an image with only one channel. The unnecessary contours formed by the other objects are removed. The contours of small areas are normally formed by the noise present in the image so we remove the areas of small contours.

Input: Thresholded image frames

Fig. 11 Threshold of images

Output: Contour of Hand in the Sample image

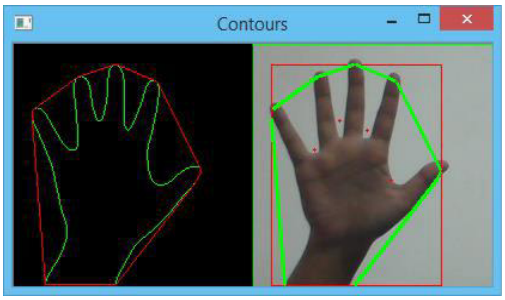

Fig. 12 Contour Detection

vi. Gesture Estimation

Then we find the convex hull of thehand portion. The smallest polygon which is created by the points so that all the points either lie inside the polygon or on the boundary of the polygon is called Convex Hull. Each fingertip of the hand is connected to form the convex hull. After this, we estimated convexity defects. The convex hull, which is smeared on the outline of the hand, causes defects around the hand. The region which is surrounded by the fingers and the convex hull is the defect caused. The function in OpenCV to find Convexity defects provides 3 parameters

Starting point of the defect

Endpoint of defect

Depth of the defect Device performs

The number of fingers represented by the user is calculated using the following formula:

Number of Fingers=Number of Defects + 1

vii. Output Feed

The respective output text of the recognized gesture is displayed on the screen.

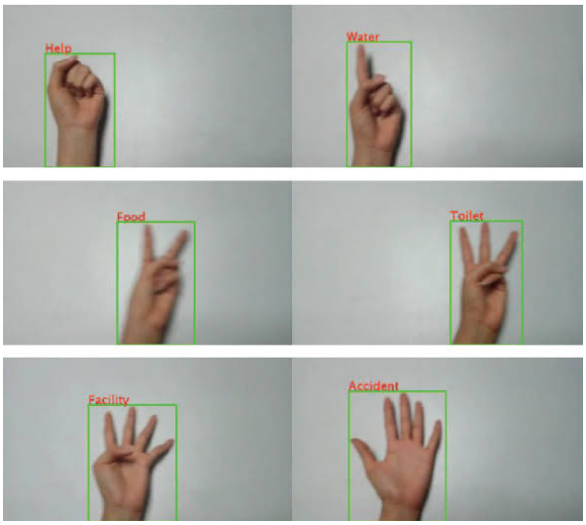

Fig. 13: Output figure with text.

IV.CONCLUSION

Our algorithm is simple and optimized for hand gesture recognition and can be easily implemented in real-time applications. The system receives the gestures of the user through the webcam and output text is displayed. The proposed algorithm can be used in various fields like medical, industry and entertainment. The algorithm is useful in worse light conditions but can be improved further for better results. The performance analysis of the algorithm has been done by taking images of gestures at different conditions like non-uniform background, poor light conditions. The main advantage of the system is that it does not require any physical contact with humans and provides a natural way of communicating with the computer. The algorithm implementation does not require any additional hardware.

V.ACKNOWLEDGMENT

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