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Touchless Fingerprint Capture Project Report

Extraction of Fingertips from the hand.

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***Abstract*— The purpose of this project is to implement a segmented image and extracting fingertips out of it which is obtained after capturing an original frame then converting into a respective color space and then bringing it to a binary from where the further process of contouring and drawing rectangle on the fingertips takes place in order to get the desired result.**

Keywords- Image processing, Binary Image, HSV Image, Contouring

1. INTRODUCTION

Image processing is defined as a method to perform some operations on the image in order to enhance or to extract useful information. Currently image processing is among the rapidly growing technologies which forms a core research area for engineering and computer science applications. There are various touchless or contactless technologies that includes gesture recognition, touchless sensing, voice recognition, face recognition etc.Touch-less technology has a faster speed with respect to authentication or verification, which in turn saves time and hence gives more priority to hygiene as well as proves a better option over conventional biometric devices.

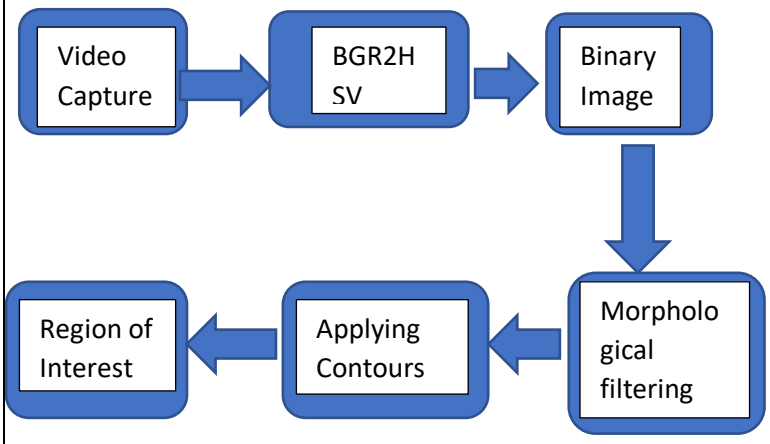
In this project, the requirement is to have a high computational speed with respect to detection of fingers in order to draw a rectangle over the fingertips and separate it from the rest of the hand which is the desired output. This systems have a better approach with respect to touchless technology which gives a good accuracy and higher speed at a less implementation cost.

2. SYSTEM DESCRIPTION

In this paper the approach towards the project is implemented. It gives a description about the beginning to the end process of the project. The platform for building this project was openCV and C++ as a coding language. The project implementation starts with a built-in camera which is used for capturing a live video or continuous frames. From these captured frames the operations of converting an image from one color space to another color space takes place i.e. from BGR to HSV and then thresholding is carried out on the HSV image where inrange function is applied inorder to get the binary image which is the first desired output i.e the hand segemntation.

After retrieving the binary image, contouring is performed on the image inorder to get the continuous points which is then mapped or drawn on the original image where it is required to have a ROI with respect to fingertips. Then the ROI is taken into consideration for drawing a rectangle and then reduced to just fingertips and thus the final desired result is obtained.

3. METHODS OF IMPLEMENTATION FOR PROJECT



3.1 VIDEOCAPTURE:

The function VideoCapture is used for cameras for reading video files or image sequences. Hence this becomes first step for the project as many functions are needed to be performed on the original frame.

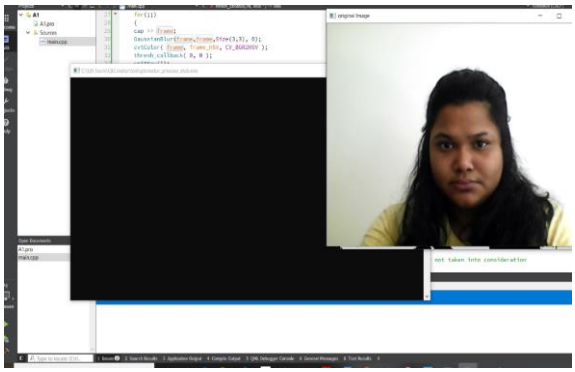


Fig 3.1: Video Capture for an original frame.

3.2 BGR2HSV

RGB means Red, Green, Blue which are primary colors, while the camera uses the concept of BGR that is Blue, Green, Red. Most often, an RGB color is stored in a structure or unsigned integer with Blue occupying the least significant "area" (a byte in 32-bit and 24-bit formats), Green the second least, and Red the third least. BGR is the same, except the order of areas is reversed. Red occupies the least significant area, Green the second (still), and Blue the third.HSV is defined as Hue, Saturation, and Value which is a cylindrical color model that remaps the RGB primary colors into dimensions that are easier for humans to understand. With the use of BGR2HSV function of open cv, the following frame gets converted into HSV which is then becomes a necessary step to convert this image into binary form.

3.3 BINARY IMAGE:

A binary image is an image that consists of pixels that can have one of exactly two colors values that is black(0) and white(255). In Binary images each pixel value is stored as a single bit—i.e. 0 or 1. After performing Cvtcolor on the HSV image, then comes Inrange() function where these values from HSV are taken into consideration where it performs thresholding operations and the retrieved output that we get is a black and white image.

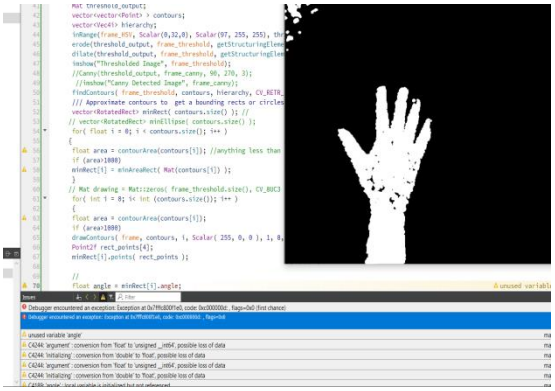


Fig 3.3: Binary image after performing the operations on the original frame.

3.4 MORPHOLOGICAL FILTERING:

Morphological filtering is performed on a binary image using two functions erosion and dilation. By using the erosion function we are basically shrinking an image region by removing border pixels. Whereas with dilation function we are region growing by adding pixels to the image region borders.

3.5 APPLYING CONTOURS:

Contours are basically a function that is used to initiate a curve which joins all the continuous points along the boundary with respect to same color or intensity. findContours is a function that is used for retrieving all the contours(or basically the continuous points along the hand) from the binary image. This technique is proved to be efficient for shape analysis, object identification and recognition etc. drawContours is a function that is used for drawing all the contours on the original frame with the help of all the mapped contours from the above function

3.6 REGION OF INTEREST (ROI):

- The region of interest is the important part of implementation in the project. Here the contour area is calculated for the whole finger with minarearect() function which in return gives the value with respect to 2-D plane i.e. height, width and angle.

- The contours within the mentioned area are kept and others are discarded. Then a mathematical operation is performed in order to reduce the rectangle from full finger to just the fingertips. After reducing it we finally get the desired output.

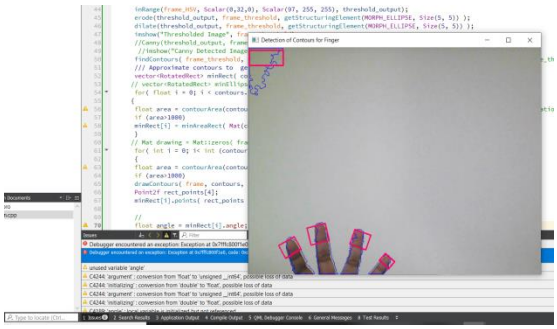


Fig 3.6: ROI performed on the finger to obtain the desired output.

4. APPLICATIONS

- The web camera can be used for contactless technologies such as face recognition, gesture recognition etc.
- This method could be used for real time moving objects.
- It has a Low cost of implementation.
- Can be used as a method over conventional biometric devices.

5. RESULTS AND DISCUSSION

- The web camera needs to be placed at a specific angle from the input that is our hand in order to get proper output with respect to hand segmentation as well as for ROI.
- Detection of one finger has a better approach but as we increase the number of fingers the ROI becomes unstable which becomes difficult to maintain.

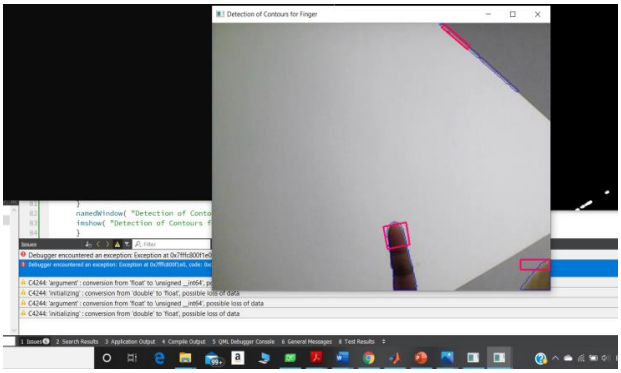


Fig 5.1: Inclination of camera for the output.

Fig 5.1: Instability due to increase in number of fingers.

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6. CHALLENGES AND PROBLEMS

- It was difficult to detect hand in the presence of low light which led to varying of inputs in order to get the desired output.
- Use of some open cv functions.
- Drawing perfect rectangles on fingertips and maintaining stability.

7. REFERENCES

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