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Digital Art - Drawing Using Rapberry Pi

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ABSTRACT: Gesture recognition is the process of recognizing and interpreting a stream of continuous sequential gesture from the given set of input data. Gestures are non-verbal information which is used for the better understanding of computer language.. Human gestures are perceived through vision and computer vision used to analyze different sets of gestures using. The approach proposed here is cost effective and to implement this we need less hardware and sensors are not required. The system is developed to interpret set of gestures into mouse control instructions. A vision system keeps record on the monitors the hand and tracks the colored object placed in the fingertips of each finger and the screen cursor is moved using different gestures. Raspberry Pi uses Python as the main programming language and is it linux based platfiorm and software development on Linux is easy as it is an open source code development environment. The system consist of a Raspbian camera which continuously monitors and tracks the gestures.

KEYWORDS: Raspberry Pi, Open CV, Linux, Gesture recognition.

I. INTRODUCTION

The system consists of ARM11 Raspberry Pi device, camera and Projector. There are color markers placed at the tip of users fingers. Marking the user's fingers with red, yellow, green and blue colored tape helps the camera to recognize the hand gestures. Captured gesture image is transferred to the ARM11 Raspberry Pi device for further processing. Projector receives the information from the ARM11 Raspberry Pi device & projects on to any particular surface or screen.

II. PROPOSED METHODOLOGY

Digital artconsists of either 2D visual information displayed on an electronic visual display or information mathematicallywhich is translated into 3D information, viewed through perspective projection on an electronic visual display.With using pencil and a piece of paper we can reflect computer graphics in 2D which is simplest. In this case, however, the image is on the computer screen and the instrument you draw with might be a fingertips and it appears on tablet. What is generated on your screen might appear to be drawn with a pencil, pen or marker. The second kind is 3D computer graphics, where the screen becomes a window which forms a virtual envirnoment where you arrange objects to be displayed by the computer. Typically a 2D computer graphics use raster graphics as their primary means of source data representations, whereas vector graphics are used by 3D in the creation of virtual reality installations. The third paradigm is to generate art in 2D or 3D entirely through the execution of algorithms which are coded into computer programs and could be considered the native art form of the computer. It cannot be produced by computer. The examples are Fractal art, Datamoshing algorithm art and real-time generative art.

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III. BLOCK DIAGRAM

This is the block diagram of Digital Art. We have used Raspberry Pi 3 Model B .It has 1.2GHz 64-bit quad-core ARMv8 CPU, 802.11n Wireless LAN, Bluetooth 4.1, Bluetooth Low Energy (BLE).After that we need to connect camera so that it can capture the image .After the image is been captured we can display it on projector or any monitor screen.

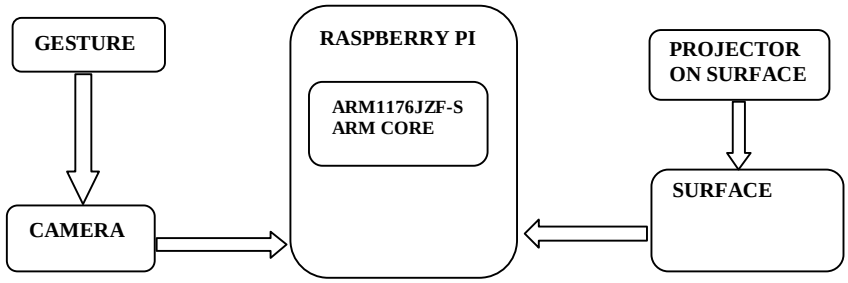

Figure 1: Block Diagram

IV. WORKING PRINCIPLE

For handwriting and gesture recognitionDynamic time warping (DTW)-based recognition algorithm is used. Users hold the inertial pen to write numbers and symbols or English lowercase letters and make hand gestures with their preferred style and speed. Hand motions are been generated by inertial signals wirelessly transmitted to a computer for online recognition. The proposed DTW-based inertial signal acquisition are included in acquisition recognition , signal pre-processing, motion detection, template selection, and recognition. We integrate signals collected from an accelerometer, a a magnetometer , and a gyroscope into a quaternion-based complementary filter for reducing the integral errors caused by the signal drift or intrinsic noise of the gyroscope, reduces the accuracy of the orientation estimation. Furthermore, we have developed minimal intra-class to maximal inter-class based template selection method for a DTW recognizer to obtain a superior class separation for improved recognition. The system consists of ARM11 Raspberry Pi device, camera and Projector. There are color markers placed at the tip of users fingers. Marking the user's fingers with red, yellow, green and blue colored tape helps the camera to recognize the hand gestures. Captured gesture image is transferred to the ARM11 Raspberry Pi device for further processing. Projector receives the information from the ARM11 Raspberry Pi device & projects on to any particular surface or screen.

V. HARDWARE IMPLEMENTAION

The system consists of ARM11 Raspberry Pi device, camera and Projector. User's finger are used to placed the color marker.There are color markers placed at the tip of users fingers. Which marks the user's fingers with red, yellow, green and blue colored tape helps the camera to recognize the hand gestures. Captured gesture image is transferred to the ARM11 Raspberry Pi device for further processing. Projector receives the information from the ARM11 Raspberry Pi device & projects on to any particular surface or screen.

VI. SOFTWARE IMPLEMENTAION

ere before detecting the image we first need to convert RGB to HSV. After that image will be captured in 8 bits. Then we have to decide the particular range for particular color.Hue values of basic colors:
Orange has 0-22
Yellow has 22- 38
Green has 38-75

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Blue has 75-130
Violet has 130-160
Red has 160-179
These are approximate values. You have to find the exact range of HUE values according to the color of the object. The range of 170-179 is perfect for the hue values of my object. The SATURATION and VALUE is depend on the lighting condition of the environment as well as the surface of the object.Then after that we need to assign the upper and lower value of the particular color. And hence our object would be detected after performing morphological operations.

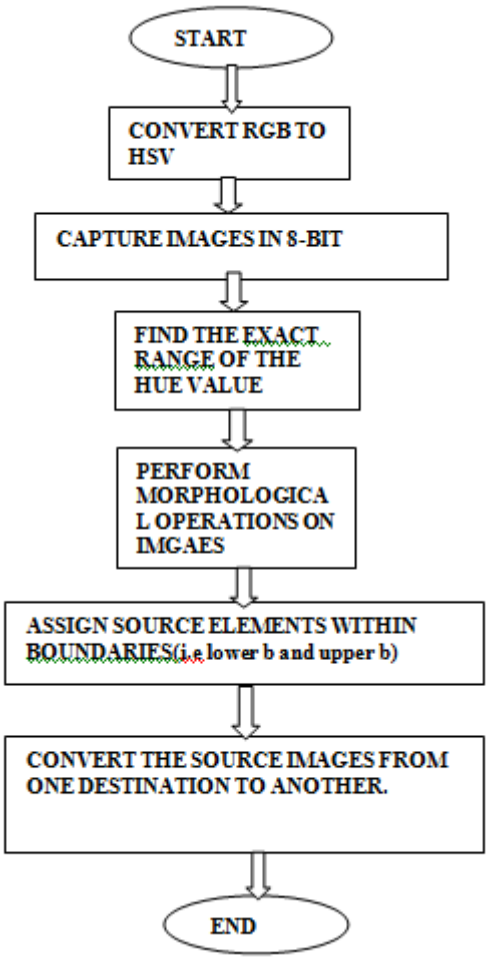

Figure 2: Flowchart

VII. DESIGN ALGORITHM

Images are been captured by OpenCV and videos in 8-bit, unsigned integer, BGR format. In other words, captured images can be considered as 3 matrices; BLUE, GREEN and RED (hence the name BGR) which has integer values from 0 to 255.
The following image shows how a color image is represented using 3 matrices.

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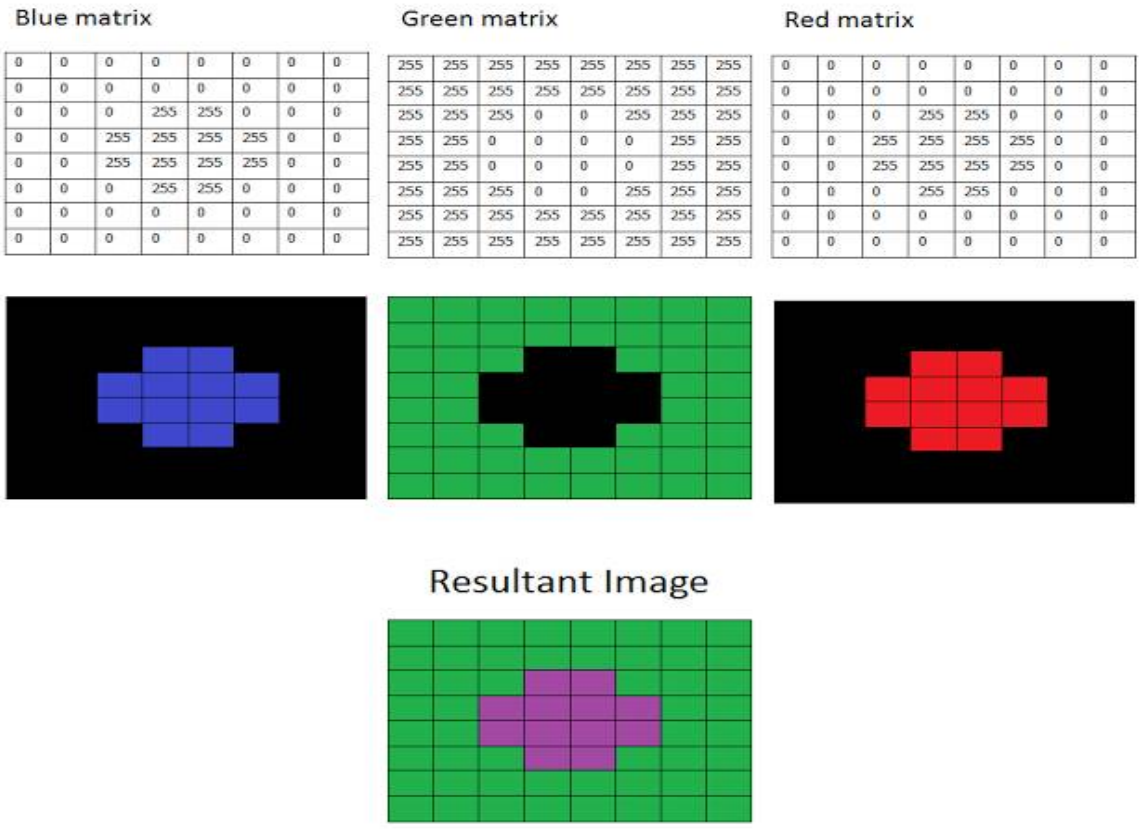

Figure 3: Color Matrix

In the above image, a pixel is represented by each small boxes2222 of the image. The pixels are so small in real images, these pixels are so small that it cannot be differentiated.Usually, one can think that BGR color space is more suitable for color based segmentation. For image segmentation HSV color space is the most suitable. So, in the above application, I have converted the color space of original image of the video from BGR to SV image.
HSV color space is also consists of 3 matrices, HUE , SATURATION and VALUE.
In OpenCV, value range HUE,SATURATION and value are
respectively 0-179, 0-255 and 0-255. Color is been represents the HUE , the amount to which that respective color is mixed with white is represented by SATURATION and the amount to which that respective color is mixed with black is represented by VALUE.
I have considered HUE as the red object, SATURATION, and VALUE in between 170-180, 160-255, 60-255 respectively. Here the HUE is unique for that specific color distribution of that object.
By considering lighting condition of that environment SATURATION and VALUE varies.

Hue values of basic colors:
Orange has 0-22
Yellow has 22- 38
Green has 38-75
Blue has 75-130
Violet has 130-160
Red has 160-179

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These are approximate values. You have to find the exact range of HUE values according to the color of the object.The range of 170-179 is perfect for the hue values of my object. The SATURATION and VALUE is depend on the lighting condition of the environment as well as the surface of the object.

After thresholding the image, you'll see small white isolated objects here and there. It may be because of noises in the image or the actual small objects which have the same color as our main object. By applying morphological opening these unnecessary white patches can be eliminated..
Morphological opening can be achieved by a erosion, followed by the dilation..
White holes are included in Thresholded image. It may be because of noises in the image. These unnecessary small holes in the main object can be eliminated by applying morphological closing. By using the dilation process morphological closing can be achieved, followed by the erosion with the same structuring element.

VIII. EXPERIMENTAL RESULTS

Here we have shown exact output of Digital Art. First we need to contour the image(fig 4,5,6.) .In contouring all the points of our object are been located. Once we have contoured the object we can find mid-point of an object as we have all the point of the object. In this way our object is been detected and hence we can move the object with hand gestures and get the final output.

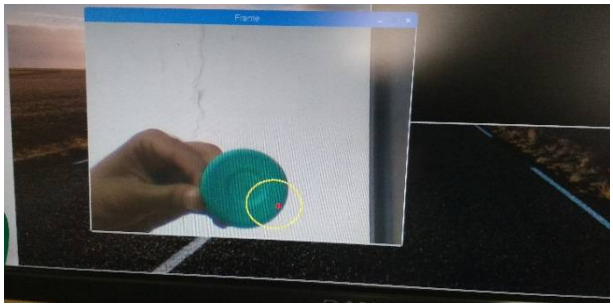

Figure 4:- Coutouring the Image(a)

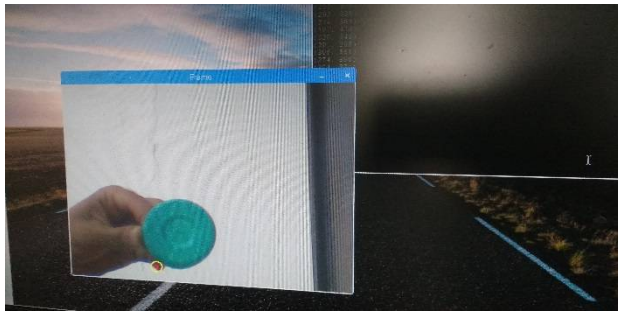

Figure 5:- Coutouring the Image(b)

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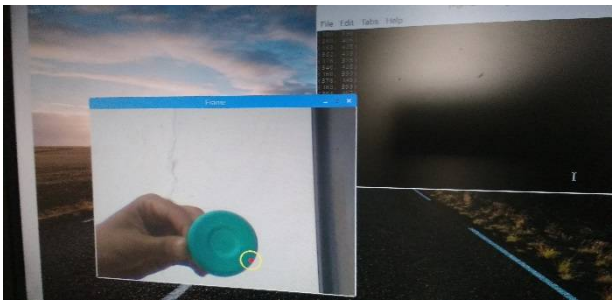

Figure 6:- Coutouring the Image(c)

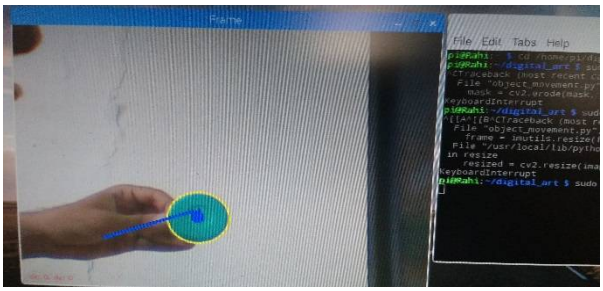

Figure 7:- Detecting the midpoint of object.

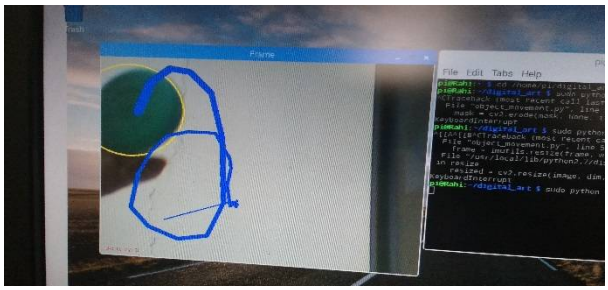

Figure 8:- Final Output

IX. CONCLUSION

This paper has presented one of the application of raspberry Pi. Here by using our hand gestures how we can implemented our desired image. With the help of mathematical algorithms we can identify human gestures. Gesture recognition first recognizes the object and then tracks it and also provides the information about object. This is the easiest way to track an object. Another application would be tracking a ball in cricket matches.

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