RESEARCH ARTICLE

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Color Objects Detection in Real-time with Raspberry Pi and Image Processing

K. V. Kalyan Chakravarthy[1*], M. Vamshi Krishna[2]

[1]Assistant Professor, Department of CSE, Centurion University of Technology and Management, Gidijala, Andhra Pradesh, India

[2]Professor, Department of ECE, Dhanekula Institute of Engineering and Technology, Ganguru, Vijayawada, Andhra Pradesh, India

Abstract

Color has been broadly utilized continuously in many applications. It offers a few massive focal points over geometric prompts, for example, computational straightforwardness, heartiness under partial impediment, pivot, scale, and goal changes. Even though color techniques end up being proficient in an assortment of computer vision applications, there are a few issues related to these strategies for which color tracking is one of the most significant. Color has been generally utilized in machine-based vision frameworks for assignments, for example, picture division, object tracking, and detection. The objective of this task is the proficient following of tracking color objects from a grouping of live pictures for use continuously applications including observation and robot route. This paper addresses building a real-time tracking framework comprising standard equipment and fit for tracking various objects from an edge arrangement progressively.

Keywords: Real-time color tracking, Thresholding, RGB color space

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Introduction

Tracking various objects in video surveillance systems turns into a significant assignment for applications where quick image processing calculations are needed at the hour. Different algorithms are there to track the moving article where classified image processing uses Kalman filter. While using image processing and computer vision method, the computerized camera appears to have a progressively adaptable capacity to track color objects. Kalman filter is used to track the round object in a given area when the object is in motion. If the object is not in motion, i.e., nonlinear and non-Gaussian, Kalman filter finds it challenging to track the object. So a methodology is adopted to track by using Hue-saturation-value (HSV), luma and chrominance components (YUV), red-green-blue (RGB) color-based tracking. The Otsu method is used to classify images into two classes, foreground and background. It gives a single intensity threshold value. A new algorithm (spectral sharpening algorithm) is demonstrated to enhance the performance of color for identification, which enhances colored object detection and tracking.

Methodology

The RGB color model is mainly used in Computer Vision. The input taken by the camera is in the RGB color model. It should be converted to the Hue, Saturation, and Value (HSV) color model to match the threshold value. HSV color conversion is similar to human color perceiving; hence it is used. SIFT algorithm is used to detect features of the image like color. Each pixel value of the images is matched with each color's threshold values by using inRange function, and these pixels are filtered. All these pixels filtered together form the required color object. Thus the threshold value of each pixel is found, and the colored objects are detected.

Step 1: The real-time data was collected using a webcam using the command video capture.

Step 2: The collected real-time data was converted into HSV color model from RGB color model. For this, color conversion command cv2.cvtColor() can be used.

Step 3: SIFT algorithm is used for finding the features of the image, like color. In this inRange command is used to

Corresponding Author: K. V. Kalyan Chakravarthy, Assistant Professor, Department of CSE, Centurion University of Technology and Management, Gidijala, Andhra Pradesh, India, e-mail: tokalyankv@gmail.com

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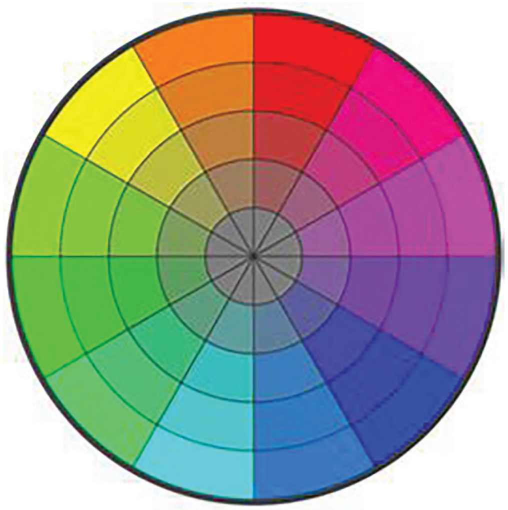

Figure 1: RGB color model

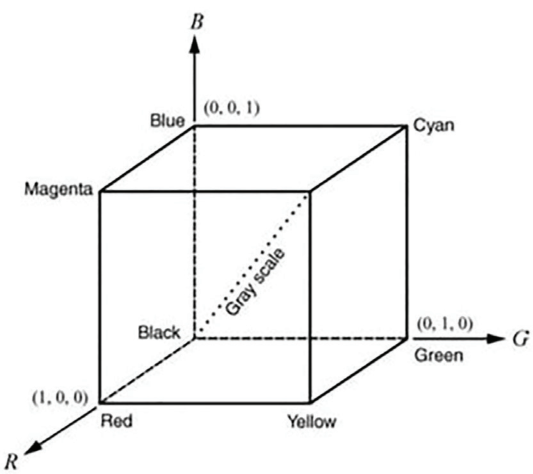

Figure 2: Cartesian system

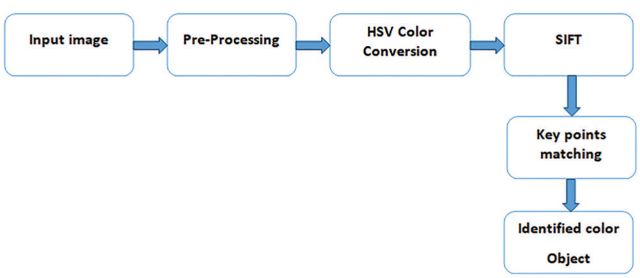

Figure 3: Flow chart

set a threshold value of the required color. For example, red color needs to be detected, the upper and lower threshold values of red must be mentioned in the inRange command.

Step 4: This inRange command filters the pixels with a pixel value in the range of red or some other required color mentioned in the inRange command previously. The function inRange is assigned to the mask function, which masks the part of the image that does not match the pixel values mentioned in the inRange command.

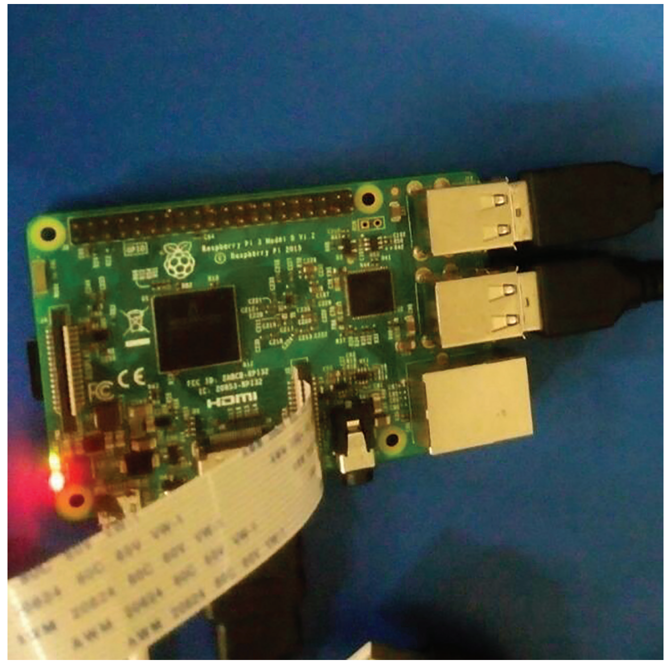

Figure 4: Set up of the project

Figure 5: Set up with web cam

Step 5: All these pixels in the required color range were filtered, and the color object was detected. The remaining pixels are covered by a black mask, like in figure 6 and figure 7.

Requirements

1. **Raspberry Pi 3 -** The Raspberry Pi is a progression of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation.
2. **Pi Camera -** The Pi camera module is a compact light weight camera that bolsters Raspberry Pi. It imparts with Pi using the MIPI camera serial interface convention. It is typically utilized in image processing, AI, or reconnaissance ventures

Figure 6: Single Color Green Is Detected

Figure 7: Both Green and Blue Colors Are Detected

3. HDMI

4. SD Card - To load open CV and the project and required libraries.

5. Python -Python is an interpreted, elevated level, broadly helpful programming language.

6. Open CV – Open CV is a library of programming functions mainly used at real-time computer vision applications

7. Raspbianbuster - The Raspbian Buster released as the replacement of Raspbian Stretch, which was the default Raspberry Pi working system, is good with all the models of Raspberry Pi. Buster is dependent on the most recent adaptation of Debian Linux 10

Results

By consolidating the camera input and the item facilitate, we can make the Raspberry Pi track the object any place it goes. On the off chance that we distinguish that the object has moved to the other side of the camera outline, we can utilize the Raspberry Pi equipment control to re-focus the item inside the camera outline (either by controlling the robot or inclining and panning the camera).

Conclusion

A novel methodology is applied to identify the colored object in real-time when the object is in motion. To get the accurate result HSV, RGB, YUV filters can be used instead of Kalman filter. Red, Blue, Green colors can be detected by using this methodology. This project can be implemented in various fields of our daily life like Video surveillance, sports, medical applications, and robotics. Based on the results produced, the system has been tested to be effective at detecting color.

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