

## Object Detection And Tracking Using Image Processing

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### ABSTRACT

The aim of this project is to explore different methods for helping computers interpret the real world visually, investigate solutions to those methods offered by the open-sourced computer vision library viz. OpenCV, and implement some of these in a Raspberry Pi based application for detecting and keeping track of objects. The project focuses on two major categories, the object detection and the object tracking. The result of this project is a Windows based Python application that is able to detect and keep track of objects by reading the Hue, Saturation and Intensity (HSV) values of frames captured by the Raspberry Pi camera module. The major application of our project is fruit sorting and for this application we have selected the fruit banana to be our test subject. Through this project we are sorting the bananas into three different categories namely ripe (in perfect edible condition), unripe and overripe.

**Keywords:** OpenCV, Python, HSV

### I. INTRODUCTION

Computer vision and visual detection of features and colors have always been a large field of interest. However, this is possible only with the help of a lot of hardware which can also increase the expenses and the complexity of the project.

The Raspberry Pi is a pocket size microcomputer which makes it relatively simple to build projects with the advantage of requiring less hardware and in turn making it more cost efficient.

There are respectively two environments. The first being the object detection and second being the object tracking.

In the first scenario we place an object in front of the camera module which extracts the HSV values from the object using OpenCV software and a Python code, hence detecting the object.

In the second scenario we feed a set of HSV values into the bot which in turn follows the object having that set of HSV value.

HSV is the abbreviation of Hue-Saturation-Value. As the name suggests it has three major components:

- Hue: - Hue is the color proportion of the object of interest expressed in degrees from 0 to 360.
- Saturation: - Saturation is the amount of gray in the color, from 0 to 100 percent. It can also be viewed on a range from just zero to 1
- Value (Brightness): - It describes the brightness or intensity of the color

HSV relates to how people relate to color more than the RGB values and hence it is more efficient.

Computer Vision – OpenCV is the library of programming functions mainly aimed at achieving

real time computer vision. It is completely free and an open source platform supporting programming languages C++ and Python.

### II. HARDWARE SPECS

#### 1. RASPBERRY PI

Raspberry Pi is a pocket-sized microcomputer. Pi model 3b. These are its specs: -SoC: Broadcom BCM2837 (roughly 50% faster than the Pi 2). The key feature of this model is that it has an inbuilt wireless module which reduces hardware

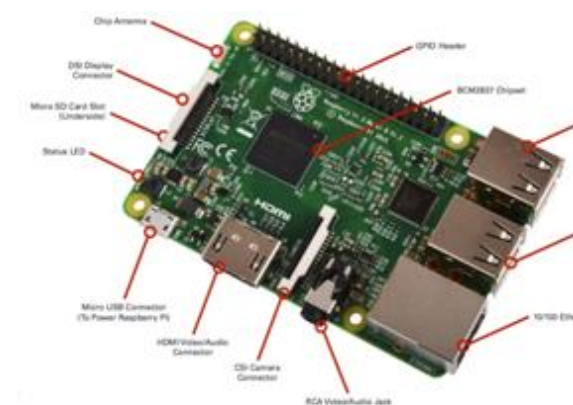


Fig 1: Raspberry Pi Model 3B

#### 2. RASPBIAN OS

Raspbian OS is specially available for Raspberry Pi. Raspbian comes out on top as being the most user-friendly, best-looking, has the best range of default software and optimized for the Raspberry Pi

hardware. Raspbian is a free operating system based on Debian (LINUX).

### 3. PYTHON

Created in late 1980's, python is a high level, multipurpose, programmer - friendly language. It has a huge compendious standardlibrary. Its ease of use helps to integrate systems effectively.

### 4. NUMPY

It is a library for Python used to handle large multidimensional arrays and matrices. It is open source with an active community.

### 5. OPENCV

OpenCV is an image processing library written in optimized C/C++.It uses multi core processing. It supports various platforms like Windows, Linux, Mac Os.It paves way for using different languages like Java, Python, C++,C.[7]

### 6. WEBCAM

A webcam is video camera that feeds or streams its image in the real time to our computer through a computer network. When captured by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet. [6]



Fig 2: Frontal Opal Camera

### ALGORITHM

- Step1:** Capture live video.
- Step 2:**Processing the frames. This step includes converting the individual frame captured in the video feed from BGR to HSV
- Step 3:** The HSV image is split into its respective components into Hue, Saturation, Intensity(Value)
- Step4:** Setting the HSV range using trackbar to set the region of interest in the frame
- Step5:** Image Segmentation is based on the ranges of Hue, Saturation,Intensity and then the operation of thresholding is performed to get the final detected image using bitwise 'AND'

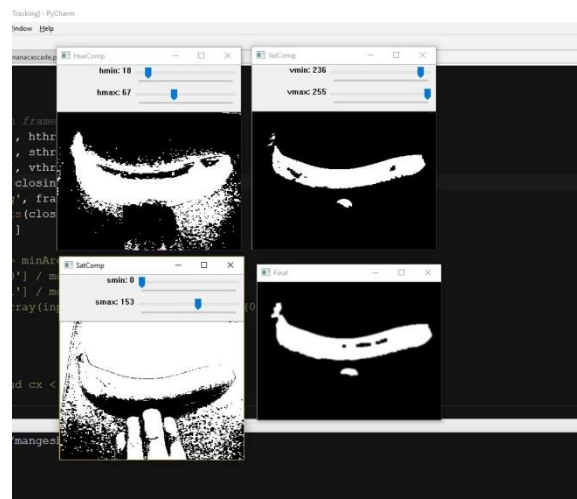


Fig 3: HSV values of a given object

**Step6:** Using Morphological transformation we can remove noise and isolate the region of interest (ROI).

**Step 7:** Object is tracked by calculating its centroid of the final detected object . Centroid is found using moments which is used to detect the actual position of the object.

### III. RESULT

The project is able to categorize bananas into different categories by analysing different variations in the state of appearance based on HSV values of bananas skin for future enhancement

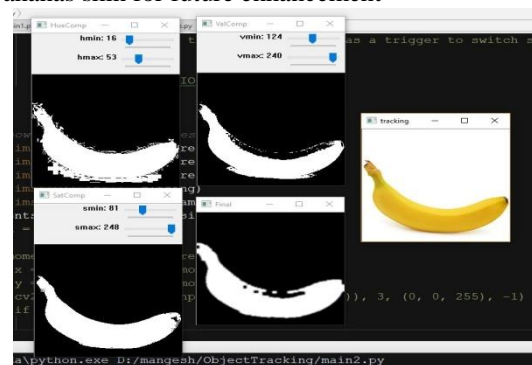


Fig 4: Perfectly Ripe

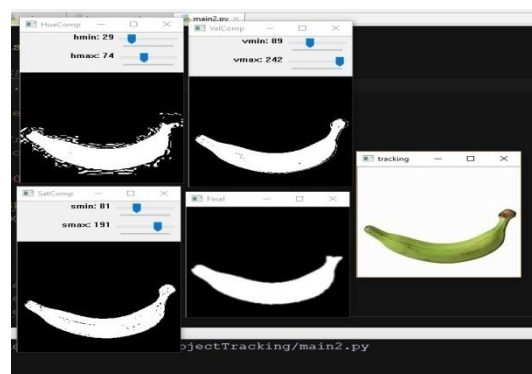


Fig 5: Not Adequately Ripe

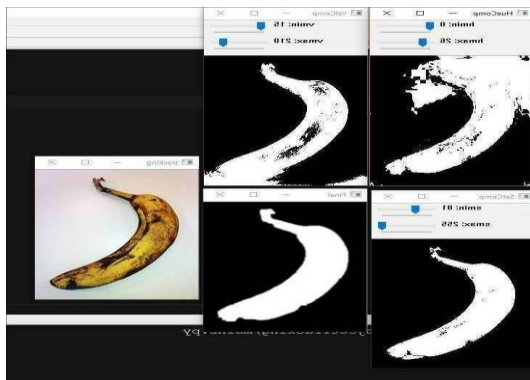


Fig 6: Overripe

Category	Hue Ranges (Hmax-Hmin)	Saturation Ranges (Smax-Smin)	Intensities Ranges (Vmax-Vmin)
Unripe	74-29	191-81	242-89
Ripe	53-16	248-81	240-124
Overripe	26-0	255-81	210-15

Table 1: Table for the HSV values for different conditions of the bananas

#### IV. FUTURE SCOPE

- With the inclusion of hardware such as arm an autonomous bot can be developed which could assist in sorting and tracking
- The program can be enhanced by the use of machine learning to increase the efficiency of the object tracking and detection.
- Inclusion of conveyer belts and some other hardware could help in large scale industries.

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