Testing performance of computer vision on different computer hardware

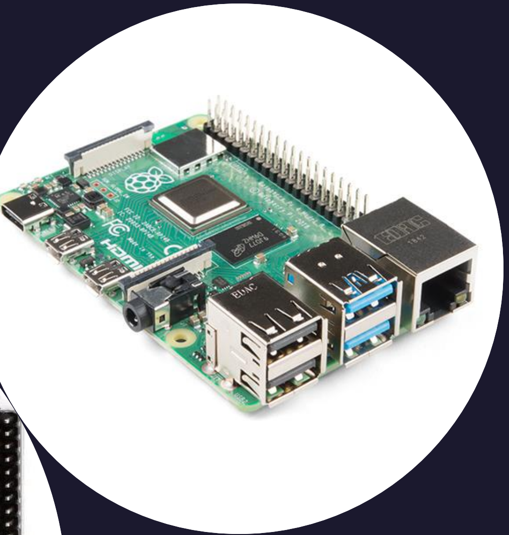
By Elena Montalvo, Dennis Lee, Rafael Hernandez, Carlos Zarco

Project Description

We will be testing several different devices' processor capabilities in recognizing color through visuals and analyzing their performance through software related means.

Hardware

LIBRE
COMPUTER BOARD
AML-S905X-CC
Open Computing Realized
Libre Computer Project
www.libre.computer



ORACLE
VirtualBox

	Le Potato	RaspberryPi 4	Virtual Box
Price	$35	~$45	~Free
Available	Yes	No	Yes
Processor	4 Core ARMv8 Cortex-A53 1.512GHz	4 Core ARMv8 Cortex-A72 1.8GHz	4
GPU	5 Core 3D		~
RAM	2GB DDR3	1/2/4/8 GB	2GB
Video	H.264/H.265	H.264/H.265	~
Video Out	HDMI 2.0 4K HDR	micro-HDMI x2 4k	~
USB	USB2.0 x 4	USB2.0 x 2, USB3.0 x 2	~
Ethernet	100 Mb	1Gb	~
Wireless	X	2.4GHz + 5GHz	~
Bluetooth	X	5.0 and BLE	~
Power-in	MicroUSB	Micro SD	~
Load OS	Micro SD	Micro SD	~
Tinker!	40 Pin GPIO Header	40 Pin GPIO Header	~

Software

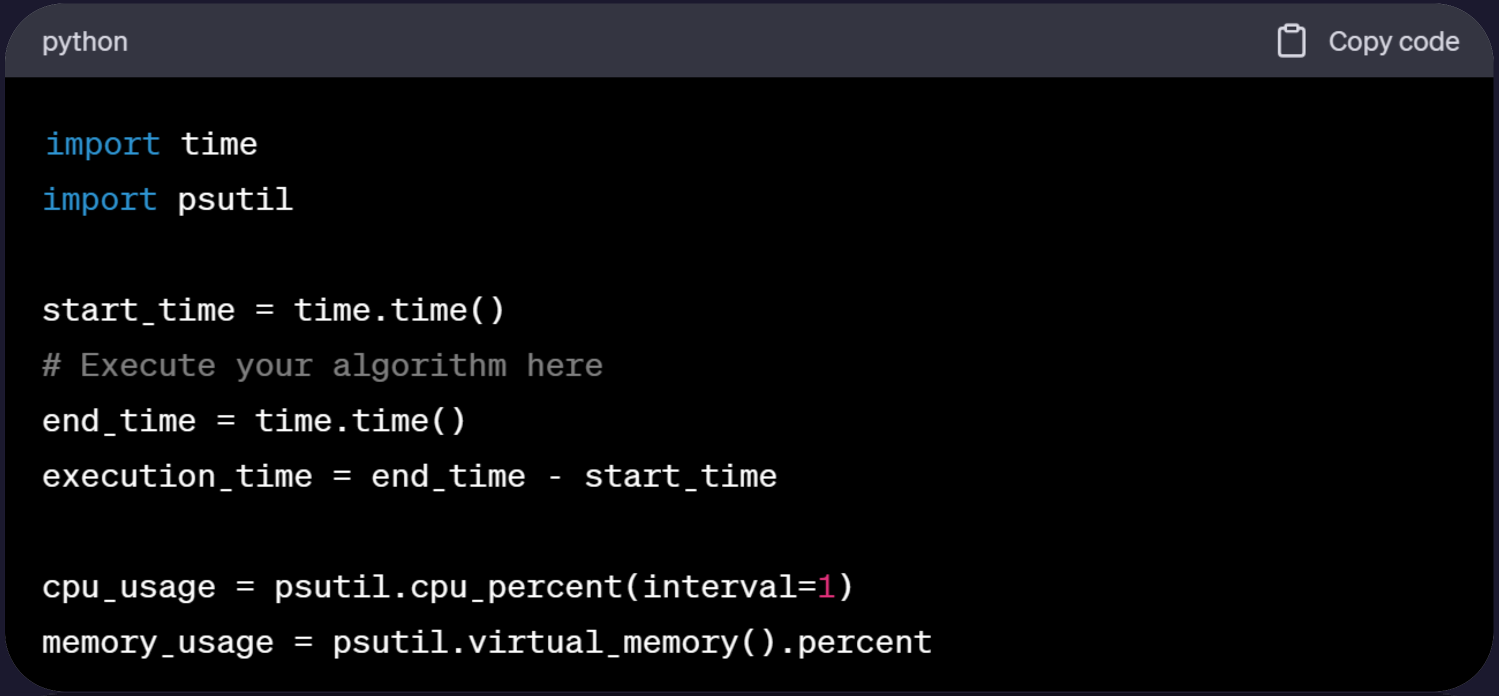
- Operating System: Linux (Ubuntu)
- OpenCV: Open Source Computer Vision Library
  - Python bindings
- Color recognition (K-means clustering algorithm)

Performance Metrics

- CPU Execution Time
- Cost/Performance: Which choice is more economical for the price you pay
- CPU Usage: Monitor the Percent of the CPU used
- Memory Usage: Track RAM Consumption while the algorithm runs
- I/O Operations: Elapsed time for file I/0 operations like read/write.

How will we measure the Performance

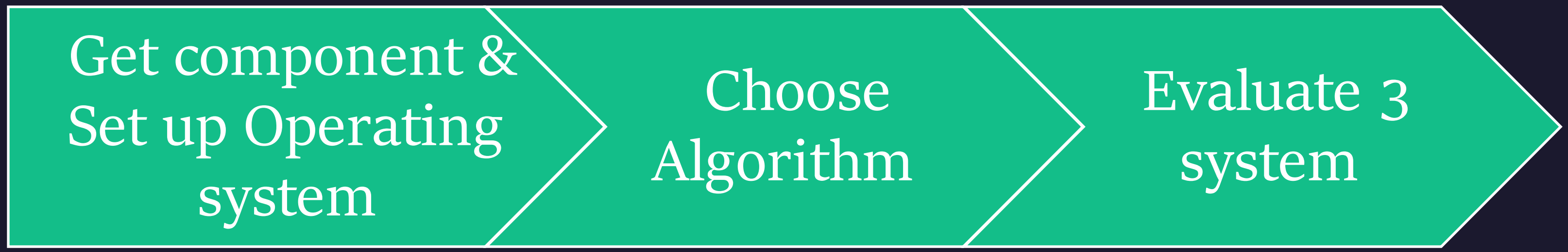
- Python has in-built utilities that can be added to your code to check to see how performant your algorithm is
- For example, the following is for measuring the **CPU** and **Memory Usage**



```python
import time
import psutil

start_time = time.time()
# Execute your algorithm here
end_time = time.time()
execution_time = end_time - start_time

cpu_usage = psutil.cpu_percent(interval=1)
memory_usage = psutil.virtual_memory().percent
```

Our progress and in progress

- We have the Le Potato and we are waiting for the Wi-Fi adapter to arrive
- Waiting on the Raspberry Pi 4
- We set up virtual box
- Evaluating our software potential



Get component & Set up Operating system

Choose Algorithm

Evaluate 3 system

Update

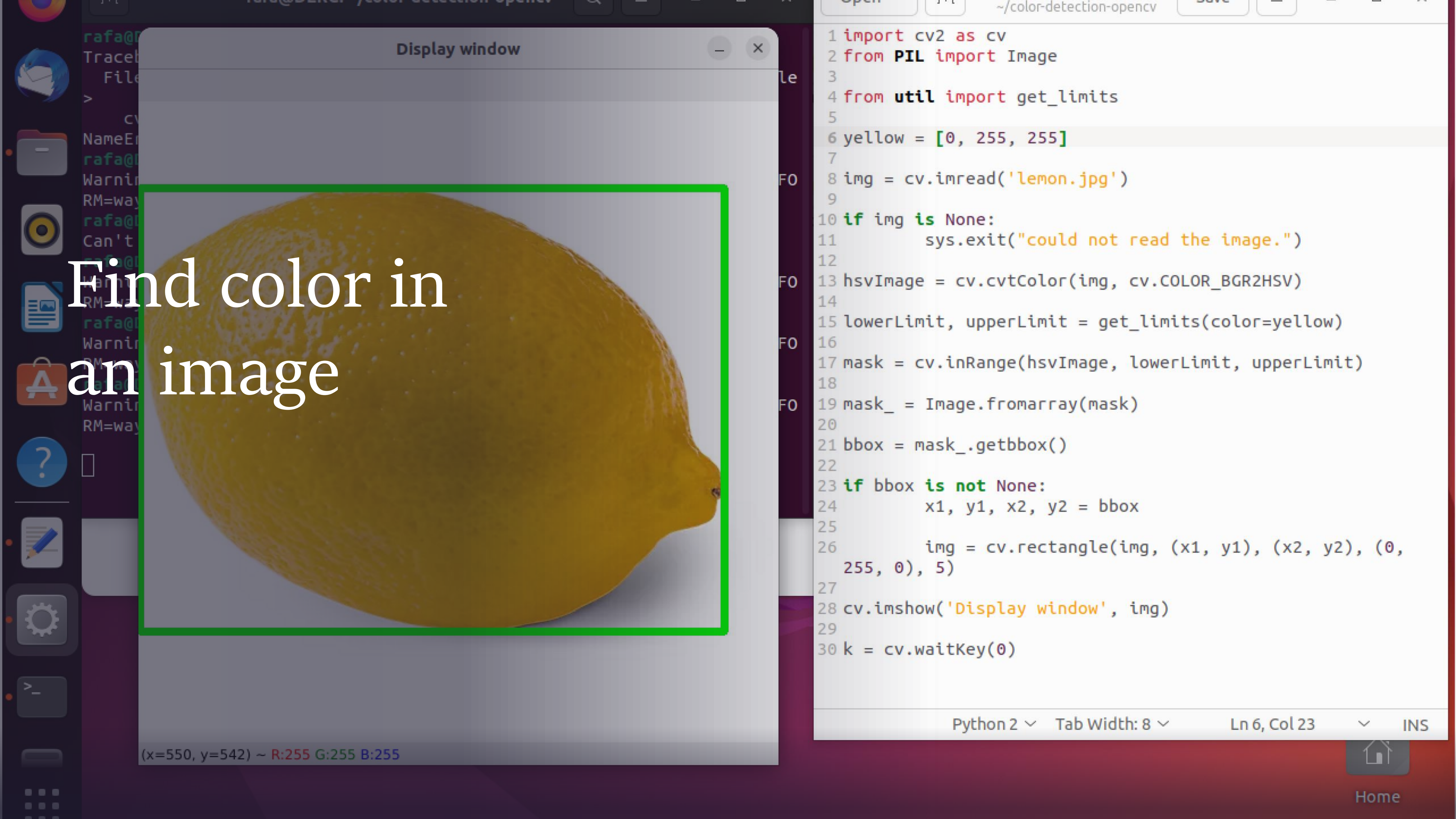
We focus setting up Virtual Box, in each team member computers. Tested Python3-OpenCV algorithms, on a live camera, image and video to detect a specific color.

Will be implementing all the multiple test for the 3 phases for each hardware test for CPU Usage, Memory Usage, Execution time.

- Find a color in a live video ✓
- Find color in a image ✓
- Find color in a Video ✓
- Test performance using python library. ✓
- Implement in raspberry pi and le potato. ⌛
- Testing using in in each processor ⌛

Find a color on a live video

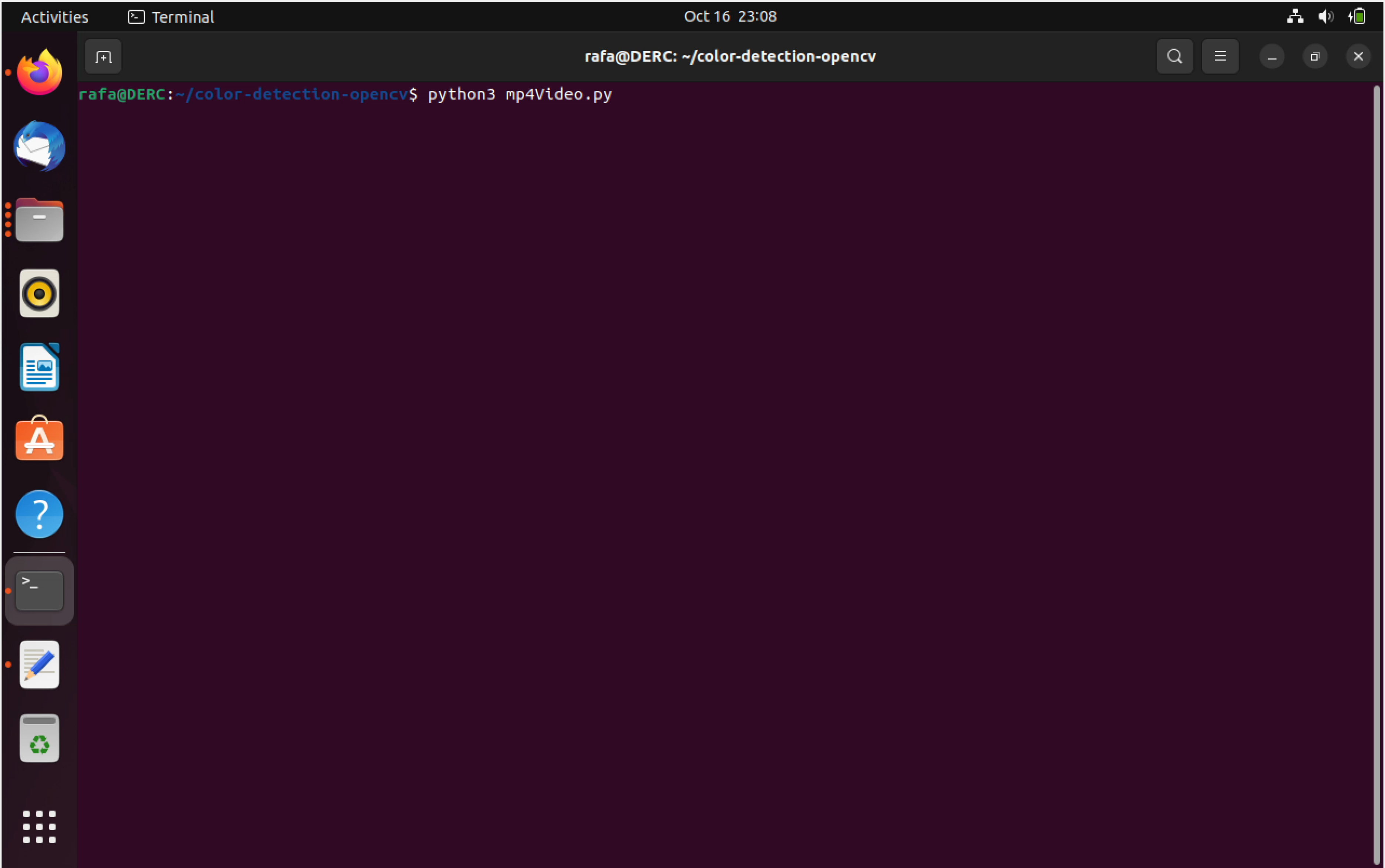
Find color in an image



```
import cv2 as cv
from PIL import Image

from util import get_limits

yellow = [0, 255, 255]

img = cv.imread('lemon.jpg')

if img is None:
        sys.exit("could not read the image.")

hsvImage = cv.cvtColor(img, cv.COLOR_BGR2HSV)

lowerLimit, upperLimit = get_limits(color=yellow)

mask = cv.inRange(hsvImage, lowerLimit, upperLimit)

mask_ = Image.fromarray(mask)

bbox = mask_.getbbox()

if bbox is not None:
        x1, y1, x2, y2 = bbox

        img = cv.rectangle(img, (x1, y1), (x2, y2), (0, 255, 0), 5)

cv.imshow('Display window', img)

k = cv.waitKey(0)
```

```
(x=550, y=542) ~ R:255 G:255 B:255
```

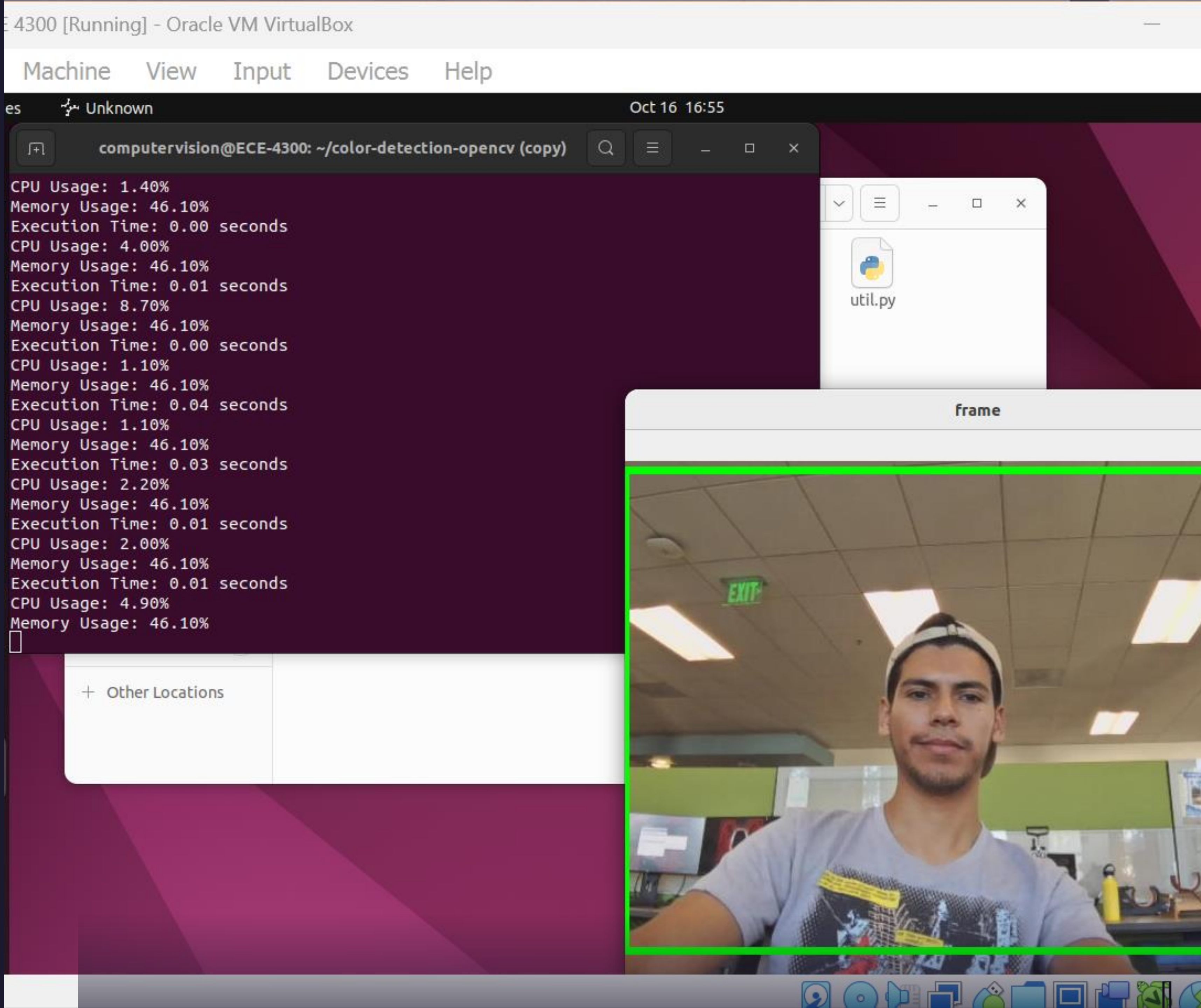
Find Color in a Video



```
rafa@DERC:~/color-detection-opencv$ python3 mp4Video.py
```

Test performance of the video

- CPU Usage
- Memory Usage
- Execution time



4300 [Running] - Oracle VM VirtualBox
Machine
View
Input
Devices
Help
es
Unknown
Oct 16 16:55
computervision@ECE-4300: ~/color-detection-opencv (copy)
util.py
Other Locations
frame

```
CPU Usage: 1.40%
Memory Usage: 46.10%
Execution Time: 0.00 seconds
CPU Usage: 4.00%
Memory Usage: 46.10%
Execution Time: 0.01 seconds
CPU Usage: 8.70%
Memory Usage: 46.10%
Execution Time: 0.00 seconds
CPU Usage: 1.10%
Memory Usage: 46.10%
Execution Time: 0.04 seconds
CPU Usage: 1.10%
Memory Usage: 46.10%
Execution Time: 0.03 seconds
CPU Usage: 2.20%
Memory Usage: 46.10%
Execution Time: 0.01 seconds
CPU Usage: 2.00%
Memory Usage: 46.10%
Execution Time: 0.01 seconds
CPU Usage: 4.90%
Memory Usage: 46.10%
```

Progress

	HARDWARE	SET UP		TEST		
		UBUNTU	LIBRARIES	LIVE CAMERA	FIND COLOR IN IMAGE	VIDEO
VITUAL BOX	13th Gen Intel(R) Core(TM) i7-13700H 2.90 GHz	🟩	🟩	🟩		
	11th Gen Intel(R) Core(TM) i7-1165G7 @ 2.80GHz	🟩	🟩	🟨		
	11th Gen Intel(R) Core(TM) i7-11800H @ 2.30GHz	🟩	🟩	🟩	🟩	🟩
	Intel(R) Core(TM) i5-7300U CPU @ 2.60GHz	🟩	🟩	🟨		
MICRO COMPUTER	Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.8GHz					
	Quad core ARM Cortex-A53 64-bit SoC @ 1.512GHz	🟩	🟨			