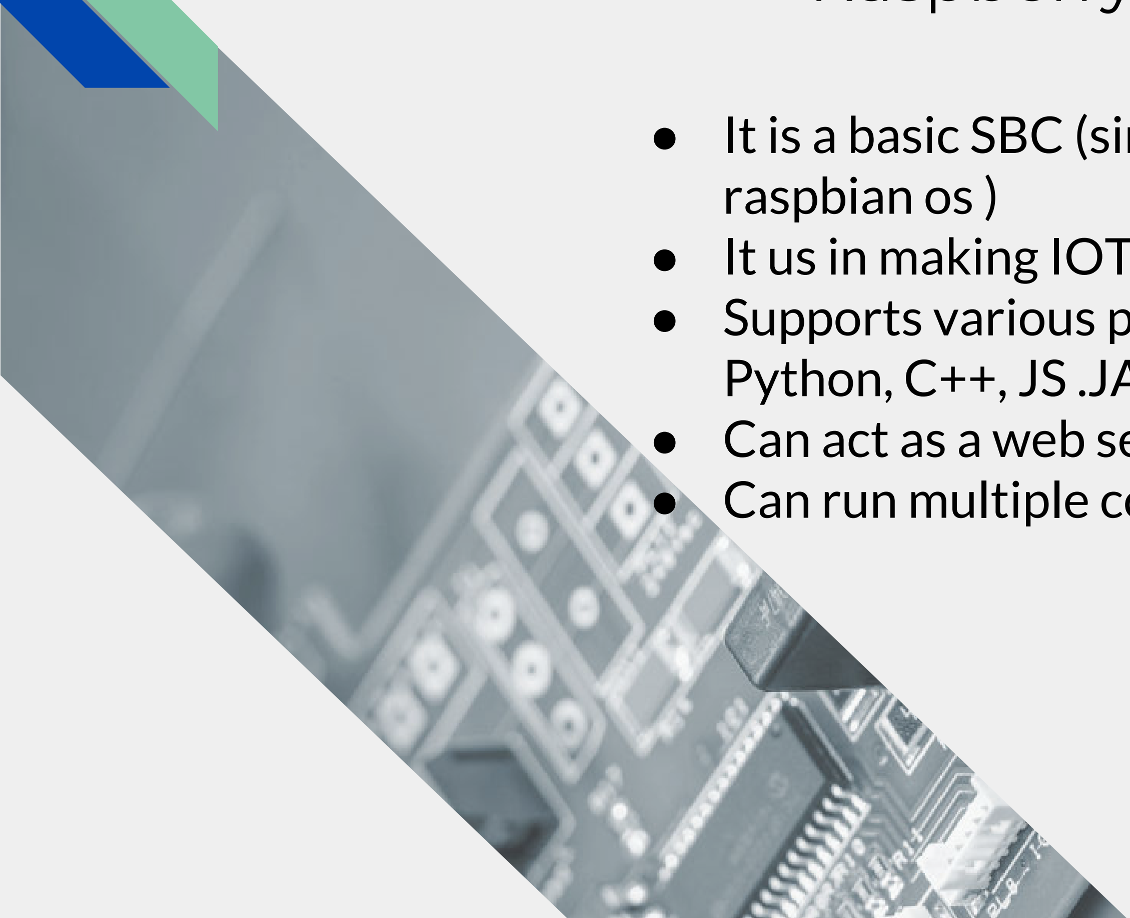
Exploring Computer vision capability on Raspberry pi 4

Raspberry Pi

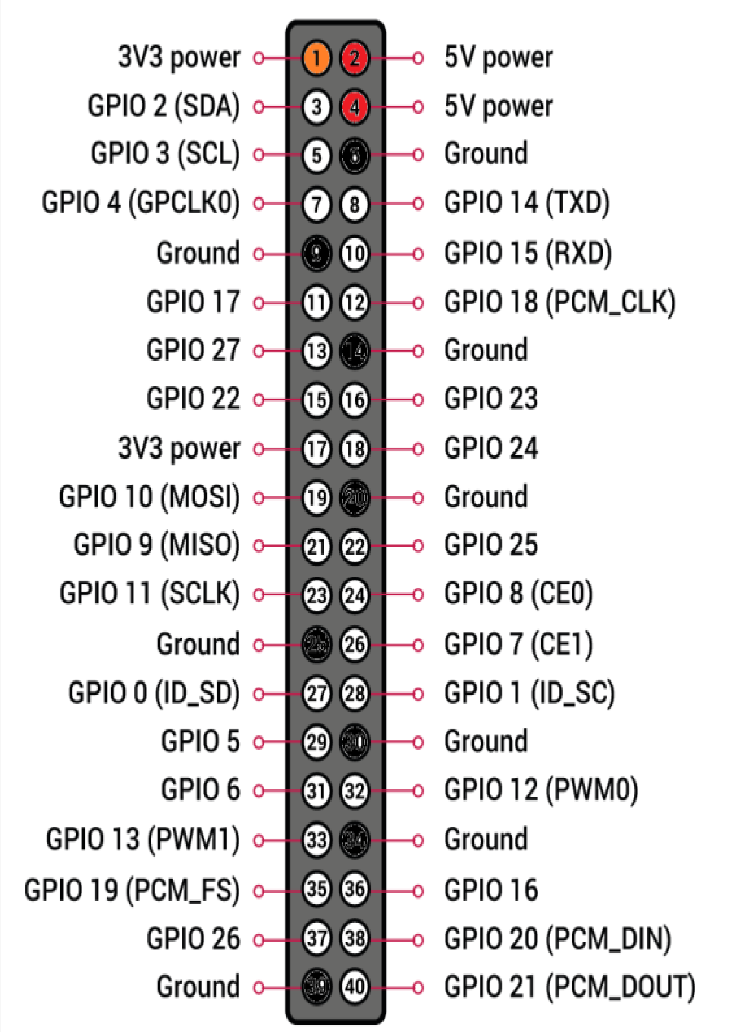
- It is a basic SBC (single board computer that support raspbian os)
- It us in making IOT, Robotic and Automation projects
- Supports various programming language like C, Python, C++, JS .JAVA
- Can act as a web server , a stand alone computer
- Can run multiple codes and task at a single time



Raspberry Pi 4 GPIO

(It also has DPI display parallel interface) takes 28 pins

- 40 GPIO
- I2C
- UART
- JTAG
- SPI



3V3 power	1	2	5V power
GPIO 2 (SDA)	3	4	5V power
GPIO 3 (SCL)	5	6	Ground
GPIO 4 (GPCLK0)	7	8	GPIO 14 (TXD)
Ground	9	10	GPIO 15 (RXD)
GPIO 17	11	12	GPIO 18 (PCM_CLK)
GPIO 27	13	14	Ground
GPIO 22	15	16	GPIO 23
3V3 power	17	18	GPIO 24
GPIO 10 (MOSI)	19	20	Ground
GPIO 9 (MISO)	21	22	GPIO 25
GPIO 11 (SCLK)	23	24	GPIO 8 (CE0)
Ground	25	26	GPIO 7 (CE1)
GPIO 0 (ID_SD)	27	28	GPIO 1 (ID_SC)
GPIO 5	29	30	Ground
GPIO 6	31	32	GPIO 12 (PWM0)
GPIO 13 (PWM1)	33	34	Ground
GPIO 19 (PCM_FS)	35	36	GPIO 16
GPIO 26	37	38	GPIO 20 (PCM_DIN)
Ground	39	40	GPIO 21 (PCM_DOUT)

Cv (Computer vision)

- It gives capability to analyse image
- Detect objects
- Recognise face
- Find pattern in image and video
- Can help in OCR(Optical char recog)
- Helps in making decision based on image processing

Why we need CV (Computer vision)

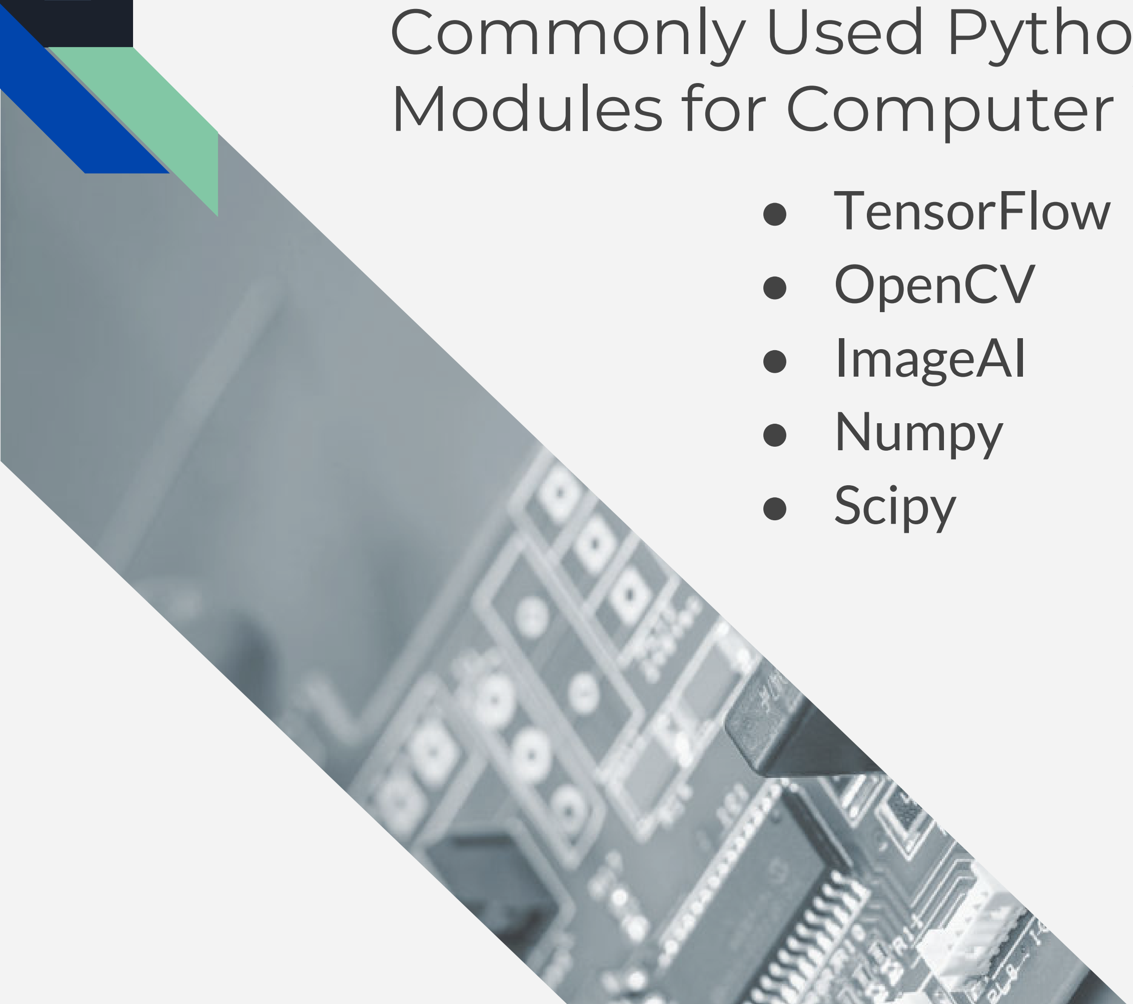
- In robotics to recognise objects and analyse environment
- In Autonomous vehicles
- In security camera
- In analysing image and to study the pattern in image

Programming language good for this in Raspberry pi

Python
C

Commonly Used Python Libraries and Modules for Computer Vision

- TensorFlow
- OpenCV
- ImageAI
- Numpy
- Scipy



Most Common Python Libraries For Robotics

Controlling Robot

- Gpiozero (Control GPIO of RPI)

Making Robot Talk

- Espeak
- GTTS

Making Gui for Robot

- Guizero
- pygame

Understanding the basics of python

- We can use pip for installing and uninstalling the libraries to python environment
- Python is a scripting language the run line by line so here we do not need the opening and braces for starting of function.
- We need not to declare the data type of variables in python it automatically detects that .
- We need to take care of **indentation** in python
- We need to take care of version of python

Suppose if you want to print output in python 2 you can directly use print result to print
But in python3 you need to use brackets.

Designing A Object Detection Robot and Testing TensorFlow Module On Raspberry Pi 4

Choosing Right Board for Project ?

- First decide purpose and features that your robot need
- Then go to specification of board that meet that feature

Features :-
Robot should take Image and video
Robot can process Image and detect object
Robot tell about detected object in form of audio and video output

Here we need to do Image processing for our project that requires a lot of RAM and Processing power.
So selecting RPI 4 with RAM 2 GB or grater

Designing a Object detection Robot Using Raspberry Pi TensorFlow

Selecting Libraries That Fulfill Our Requirement

For detecting Object and Processing object we use Open CV and TensorFlow .
For moving camera module we need to drive servo so we can use gpio zero
For audio output of detected object we can use Espeak
Libraries needed are :-
Opnecv
TensorFlow
Espeak
Gpiozero

Learn to use libraries to make robot

Controlling GPIO of raspberry pi using gpiozero

```
from gpiozero import LED
from time import sleep
led = LED(17)
while True:
    led.on()# for off led.off()
```

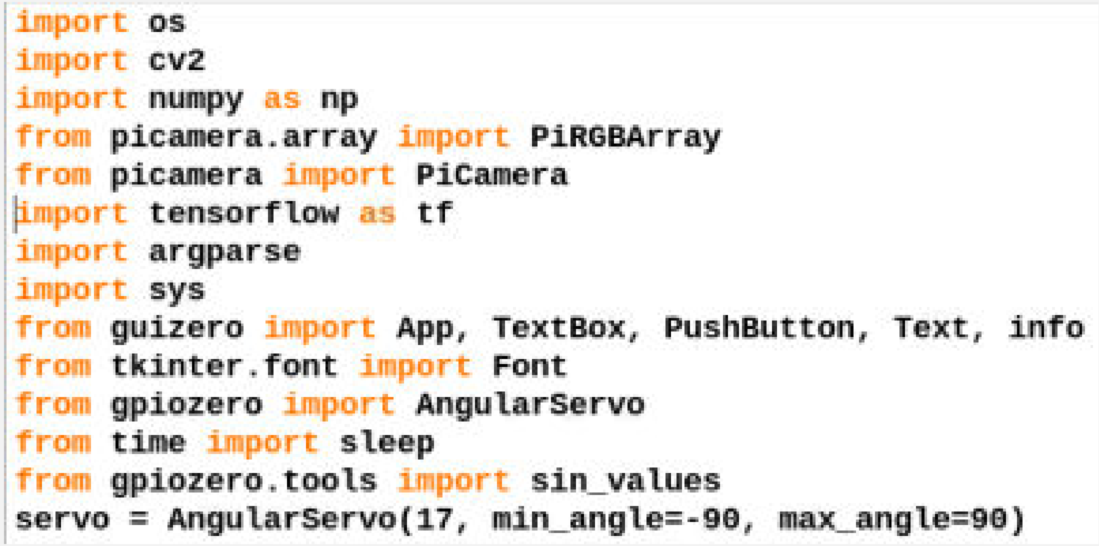
Controlling servo

```
from gpiozero import AngularServo
from time import sleep
servo = AngularServo(17, min_angle=-90, max_angle=90)
while True:

     servo.angle = -90
```

How to make my Pi talk?

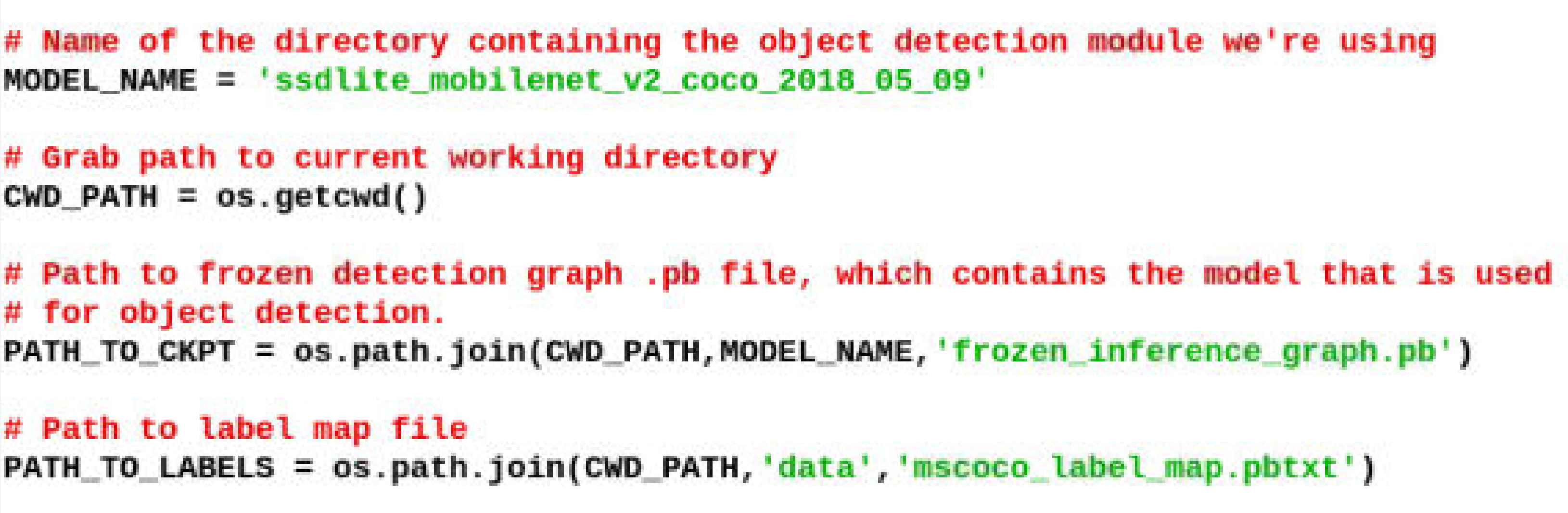
```
Import espeak

While True:
        espeak.set_voice("En")///set the voice language
        espeak.set_voice("whisper")///// setting the type like loud
        espeak.synth("Hey hello ")//////voice to
```

Designing a Object detection Robot Using Raspberry Pi TensorFlow



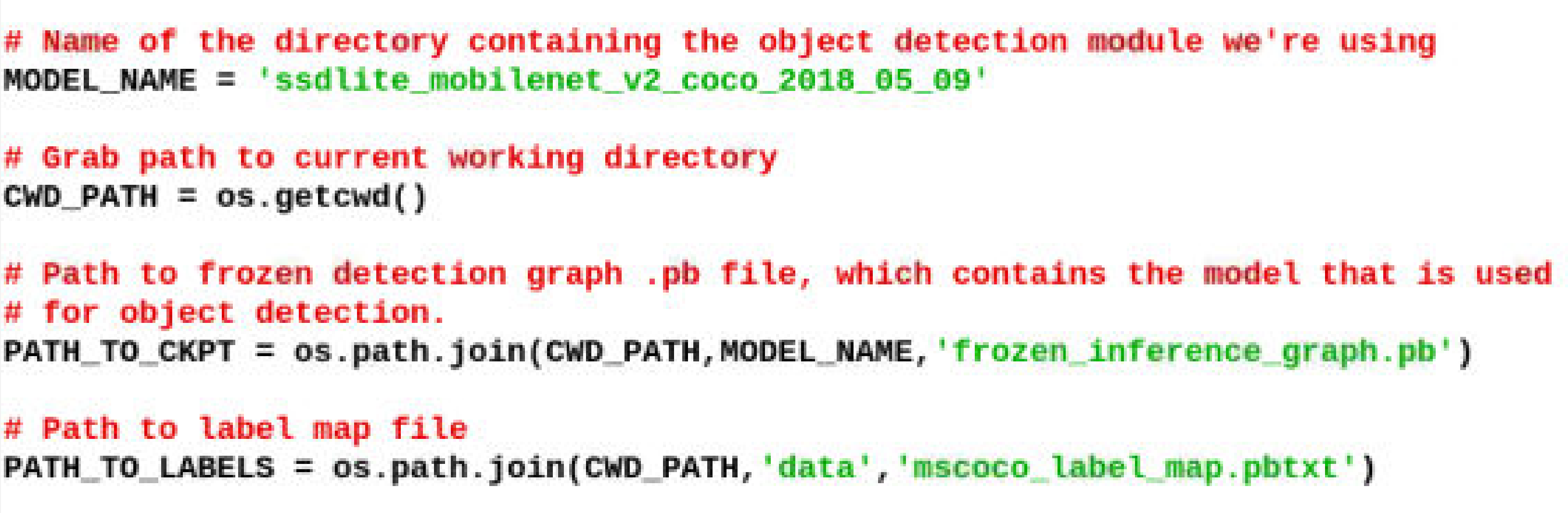
```
import os
import cv2
import numpy as np
from picamera.array import PiRGBArray
from picamera import PiCamera
import tensorflow as tf
import argparse
import sys
from guizero import App, TextBox, PushButton, Text, info
from tkinter.font import Font
from gpiozero import AngularServo
from time import sleep
from gpiozero.tools import sin_values
servo = AngularServo(17, min_angle=-90, max_angle=90)
```

Designing a Object detection Robot Using Raspberry Pi TensorFlow



```
# Name of the directory containing the object detection module we're using
MODEL_NAME = 'ssdlite_mobilenet_v2_coco_2018_05_09'

# Grab path to current working directory
CWD_PATH = os.getcwd()

# Path to frozen detection graph .pb file, which contains the model that is used
# for object detection.
PATH_TO_CKPT = os.path.join(CWD_PATH,MODEL_NAME,'frozen_inference_graph.pb')

# Path to label map file
PATH_TO_LABELS = os.path.join(CWD_PATH,'data','mscoco_label_map.pbtxt')
```

Designing a Object detection Robot Using Raspberry Pi TensorFlow



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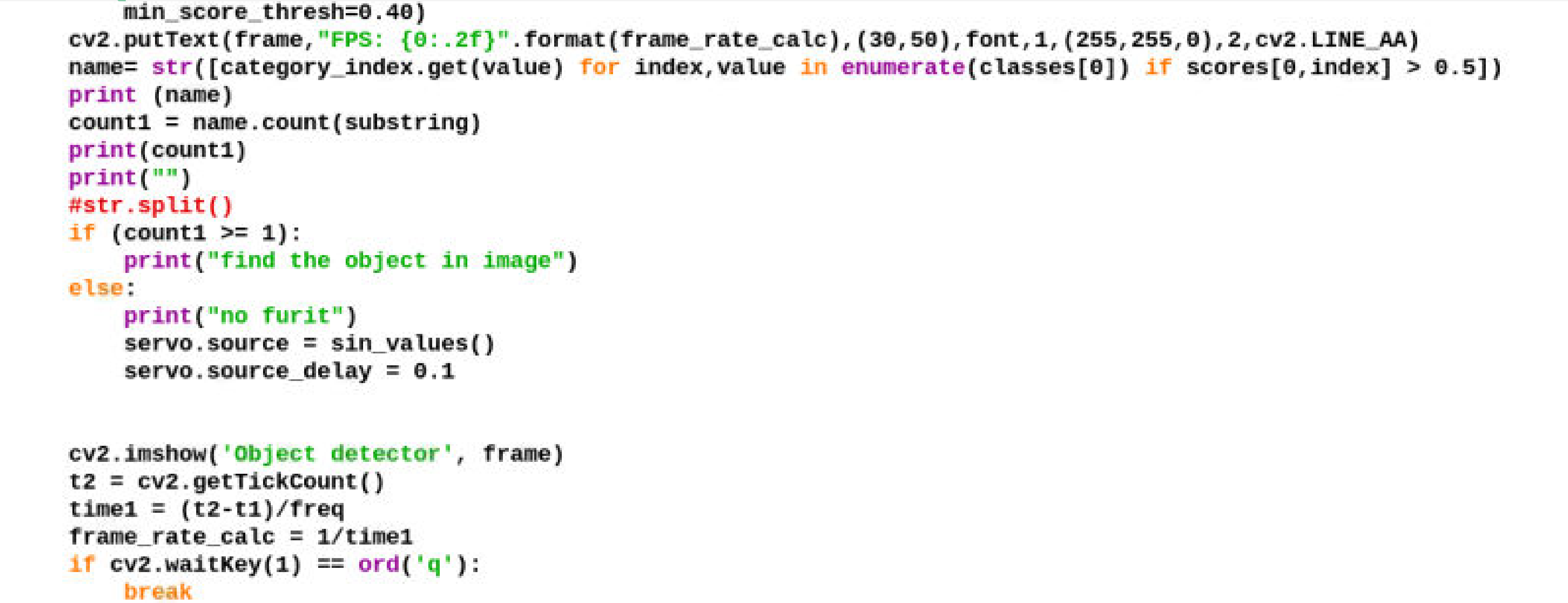
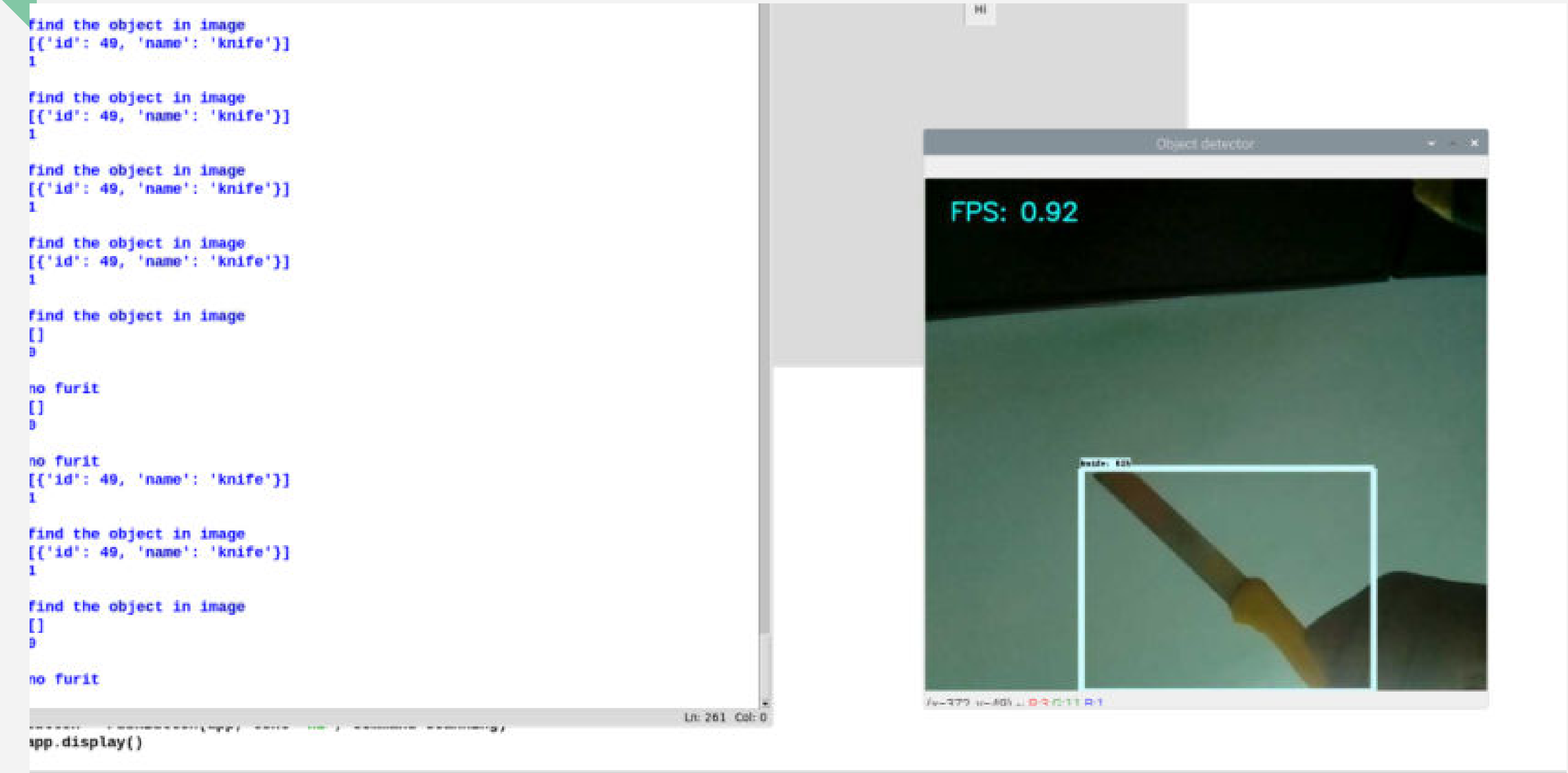


```
    min_score_thresh=0.40)
cv2.putText(frame,"FPS: {0:.2f}".format(frame_rate_calc),(30,50),font,1,(255,255,0),2,cv2.LINE_AA)
name= str([category_index.get(value) for index,value in enumerate(classes[0]) if scores[0,index] > 0.5])
print (name)
count1 = name.count(substring)
print(count1)
print("")
#str.split()
if (count1 >= 1):
    print("find the object in image")
else:
    print("no furit")
    servo.source = sin_values()
    servo.source_delay = 0.1


cv2.imshow('Object detector', frame)
t2 = cv2.getTickCount()
time1 = (t2-t1)/freq
frame_rate_calc = 1/time1
if cv2.waitKey(1) == ord('q'):
    break
```

Designing a Object detection Robot Using Raspberry Pi TensorFlow



```
find the object in image
[{'id': 49, 'name': 'knife'}]
1

find the object in image
[{'id': 49, 'name': 'knife'}]
1

find the object in image
[{'id': 49, 'name': 'knife'}]
1

find the object in image
[{'id': 49, 'name': 'knife'}]
1

find the object in image
[]
0

no furit
[]
0

no furit
[{'id': 49, 'name': 'knife'}]
1

find the object in image
[{'id': 49, 'name': 'knife'}]
1

find the object in image
[]
0

no furit
```

Ln: 261 Col: 0

```
app.display()
```

THANK YOU