# University of Mumbai

PRACTICAL JOURNAL – PAPER II

PSIT4P2c

# Advanced IOT

SUBMITTED BY

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SEAT NO 40426

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR QUALIFYING
M.Sc. (I.T.) PART-II (SEMESTER – IV) EXAMINATION

2022-2023

Department of Information Technology

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SANTACRUZ (E), MUMBAI – 400098.

# University of Mumbai

## Department of Information Technology

### CERTIFICATE

This is to certify that **Mr. Sandeep Jairam Sharma Seat No. 40426** studying in **Master of Science** in **Information Technology Part II Semester IV** has satisfactorily completed the Practical of **PSIT4P2c Advanced IOT** as prescribed by University of Mumbai, during the academic year **2022-23**.

| | | |
|---|---|---|
| Signature | Signature | Signature |
| Guide | External Examiner<br>Examined by | Head of the Department<br>Certified by |

College Seal

Date:

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# Practical No 1

**Aim**: Installing Raspbian on Raspberry Pi and executing applications on it using Python and node.js

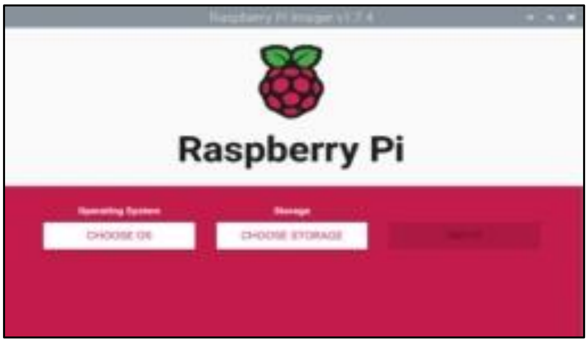
**Hardware**: Raspberry Pi Kit

**Software**: Raspberry Pi OS, Python, Nodejs

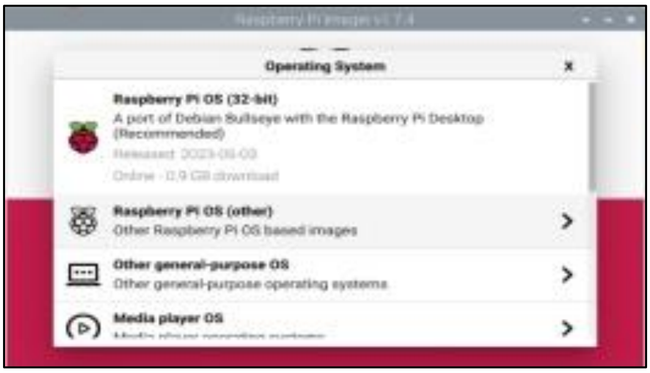
## Steps to be followed:

### Step 1: Installing Raspberry Pi

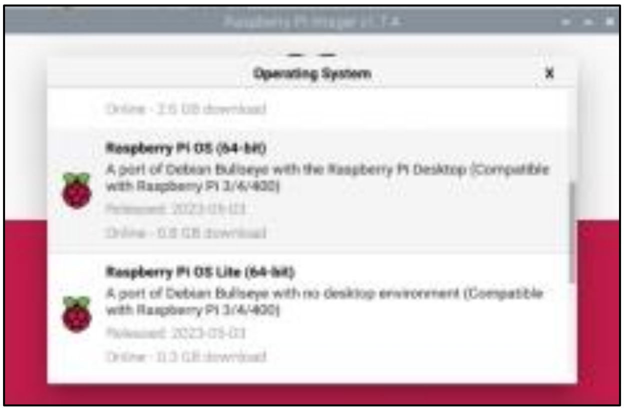
- To Install Raspberry Pi OS in SD Card, use **Raspberry Pi Imager**



- Select **‘Choose OS’**


Raspberry Pi Imager v1.7.4
Operating System
Raspberry Pi OS (32-bit)
A port of Debian Bullseye with the Raspberry Pi Desktop (Recommended)
Released: 2023-05-03
Online - 0.9 GB download
Raspberry Pi OS (other)
Other Raspberry Pi OS based images
Other general-purpose OS
Other general-purpose operating systems
Media player OS

- Now we are only installing Raspberry PI OS only select **Raspberry PI OS (OTHER)**



Raspberry Pi Imager v1.7.4

Operating System ×

Online - 2.6 GB download

Raspberry Pi OS (64-bit)
A port of Debian Bullseye with the Raspberry Pi Desktop (Compatible with Raspberry Pi 3/4/400)
Released: 2023-05-03
Online - 0.8 GB download

Raspberry Pi OS Lite (64-bit)
A port of Debian Bullseye with no desktop environment (Compatible with Raspberry Pi 3/4/400)
Released: 2023-05-03
Online - 0.3 GB download

- Choose This Version **64bit**(don’t select the LITE VERSION)
- After Connecting all the required connection to the Raspberry Pi now boot it up.

**Step 2: Intsall Python and Node.js**

- To install Python, open terminal and give the below command:

```
sudo apt update
sudo apt install python3 idle3
```

Then set the variable path:

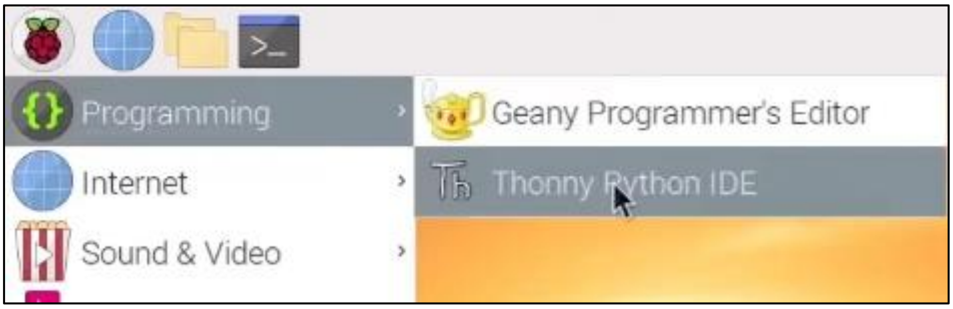
```
Echo ‘export PATH=”$PATH:/home/admin/.local/bin”’>> ~/bashrc
```

- To install Node.js give the below command in the terminal:

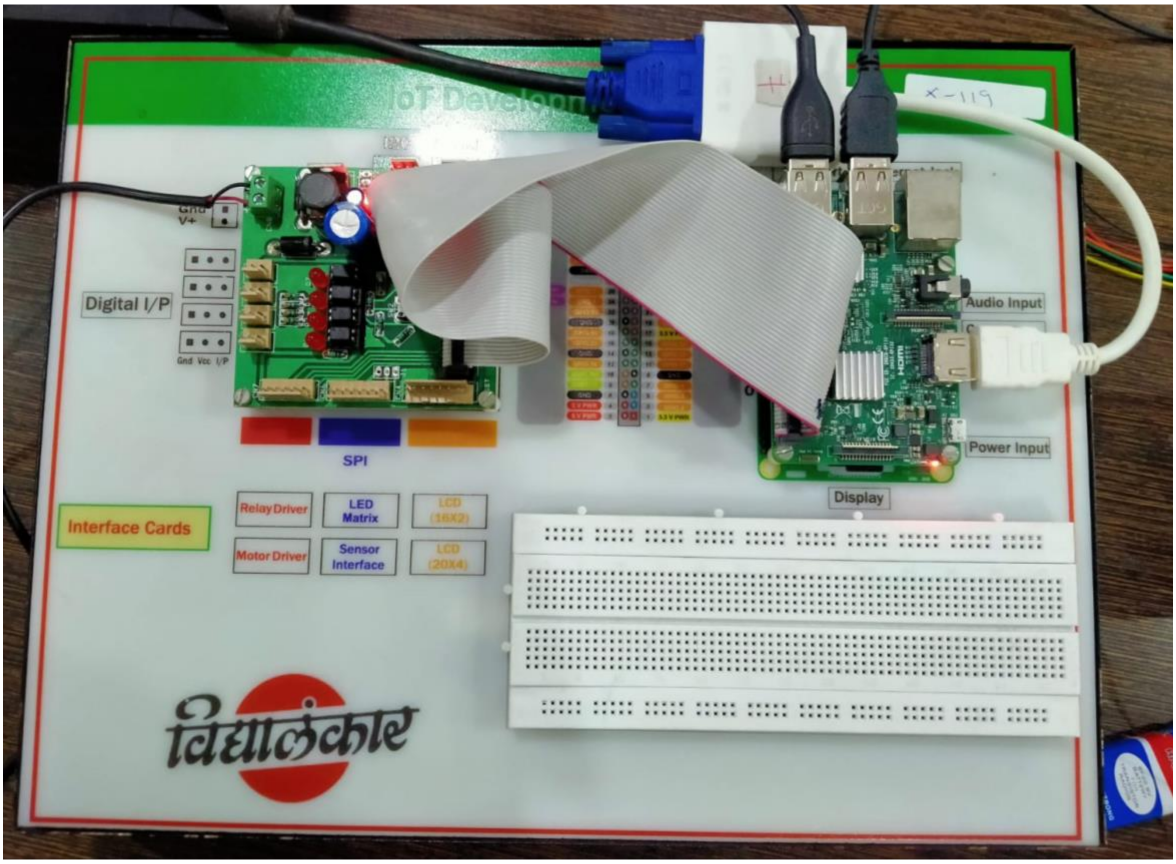
```
sudo apt-get install nodejs
```

**Step 3: Running python code and nodejs code in raspberry pi**

- Open Any Programming Editor and write the code



## Raspberry Pi Circuit:



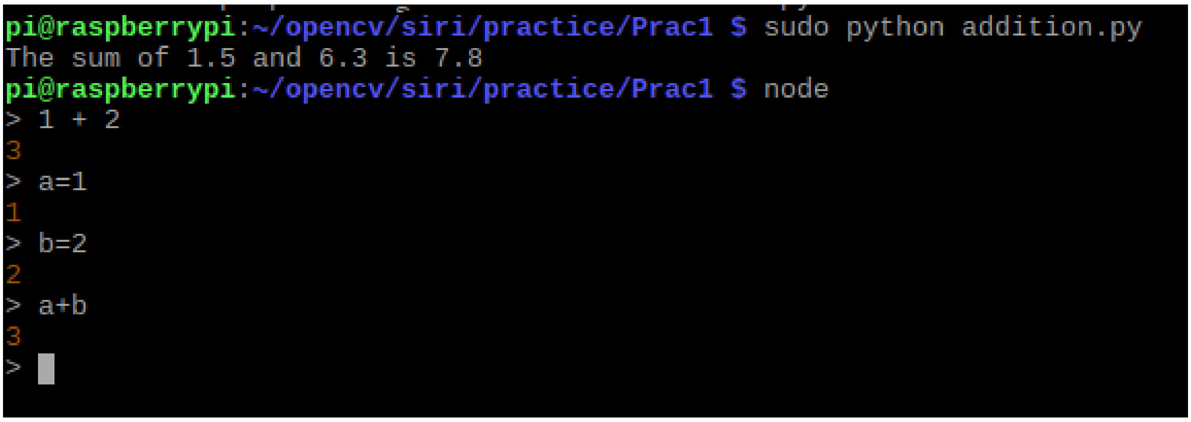
## Source Code:

Python Code:

```
num1 = 1.5
num2 = 6.3

# Add two numbers
sum = num1 + num2

# Display the sum
print('The sum of {0} and {1} is {2}'.format(num1, num2, sum))
```

For nodejs to execute type `node` on terminal.

## Output:



```
pi@raspberrypi:~/opencv/siri/practice/Prac1 $ sudo python addition.py
The sum of 1.5 and 6.3 is 7.8
pi@raspberrypi:~/opencv/siri/practice/Prac1 $ node
> 1 + 2
3
> a=1
1
> b=2
2
> a+b
3
>
```

# Practical No 2

**Aim**: Create a home automation system and control the devices remotely.

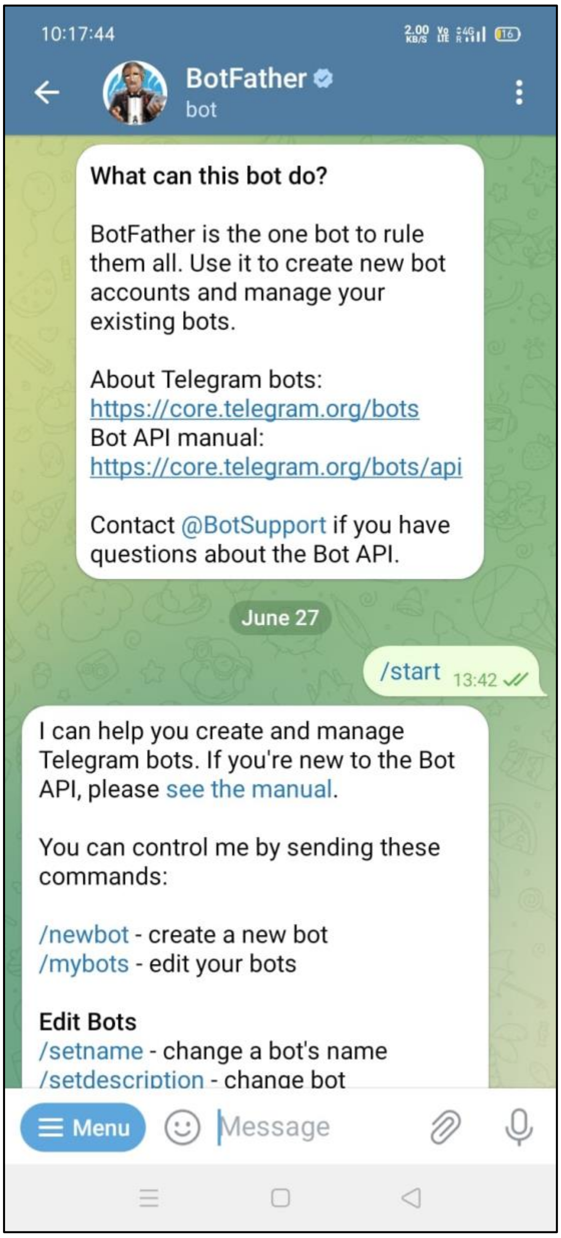
**Hardware**: Raspberry pi kit, relay, battery, bulb, fan, cables

**Software**: Raspberry Pi OS, Python, Telegram, Telepot

## Steps to be followed:

### Setting up BotFather in Telegram

- In Telegram App, search for BotFather.
- Send `/start` message



What can this bot do?

BotFather is the one bot to rule them all. Use it to create new bot accounts and manage your existing bots.

About Telegram bots:
https://core.telegram.org/bots
Bot API manual:
https://core.telegram.org/bots/api

Contact @BotSupport if you have questions about the Bot API.

June 27

/start 13:42

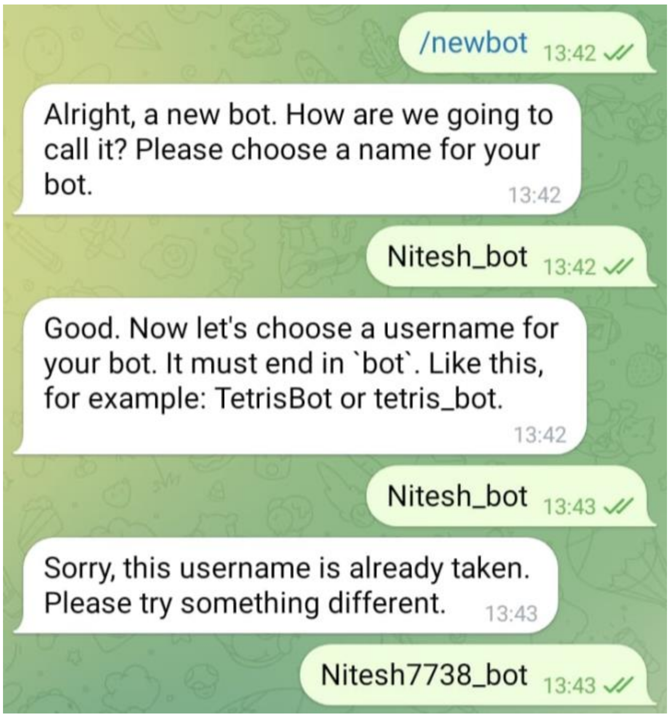
I can help you create and manage Telegram bots. If you're new to the Bot API, please see the manual.

You can control me by sending these commands:

/newbot - create a new bot
/mybots - edit your bots

Edit Bots
/setname - change a bot's name
/setdescription - change bot

- To create a new bot, send `/newbot` message. (Refer to the image below)
- It will ask the bot name, give suitable name to your bot. If the name is available, bot will be created and token will be given to access the API, else will ask you to give the other name.



/newbot 13:42

Alright, a new bot. How are we going to call it? Please choose a name for your bot. 13:42

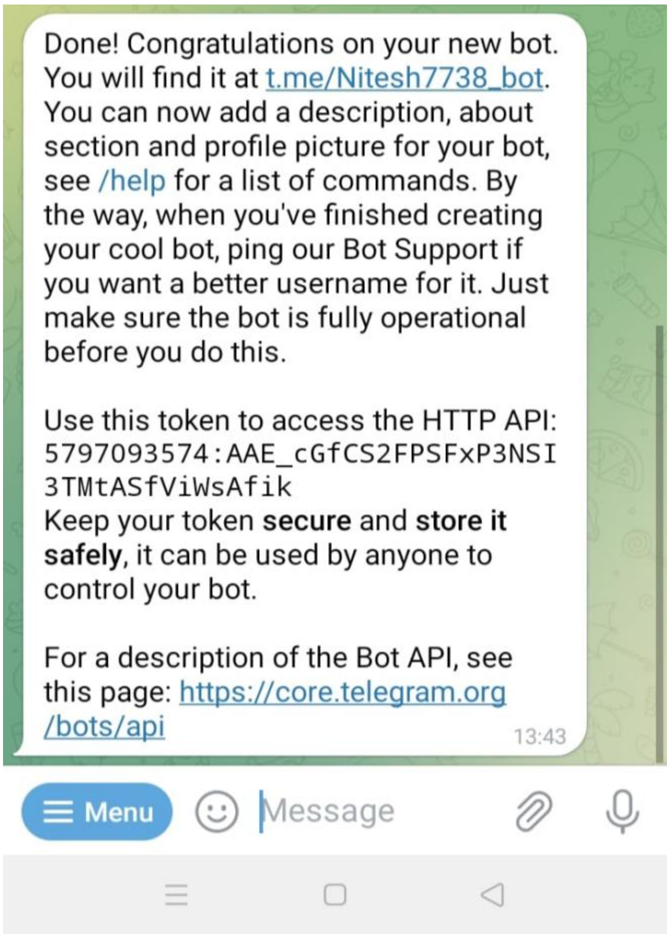
Nitesh_bot 13:42

Good. Now let's choose a username for your bot. It must end in `bot`. Like this, for example: TetrisBot or tetris_bot. 13:42

Nitesh_bot 13:43

Sorry, this username is already taken. Please try something different. 13:43

Nitesh7738_bot 13:43



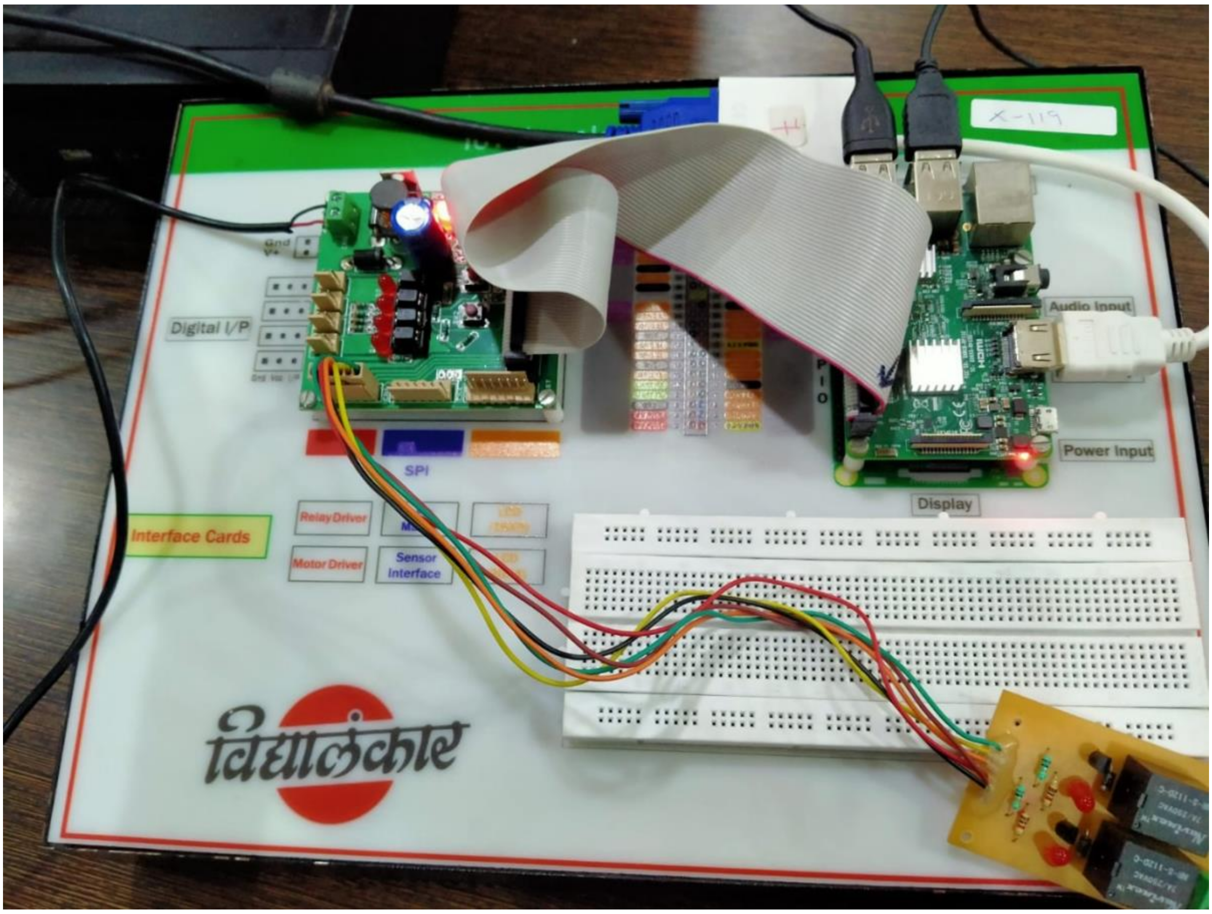
Done! Congratulations on your new bot. You will find it at t.me/Nitesh7738_bot. You can now add a description, about section and profile picture for your bot, see /help for a list of commands. By the way, when you've finished creating your cool bot, ping our Bot Support if you want a better username for it. Just make sure the bot is fully operational before you do this.

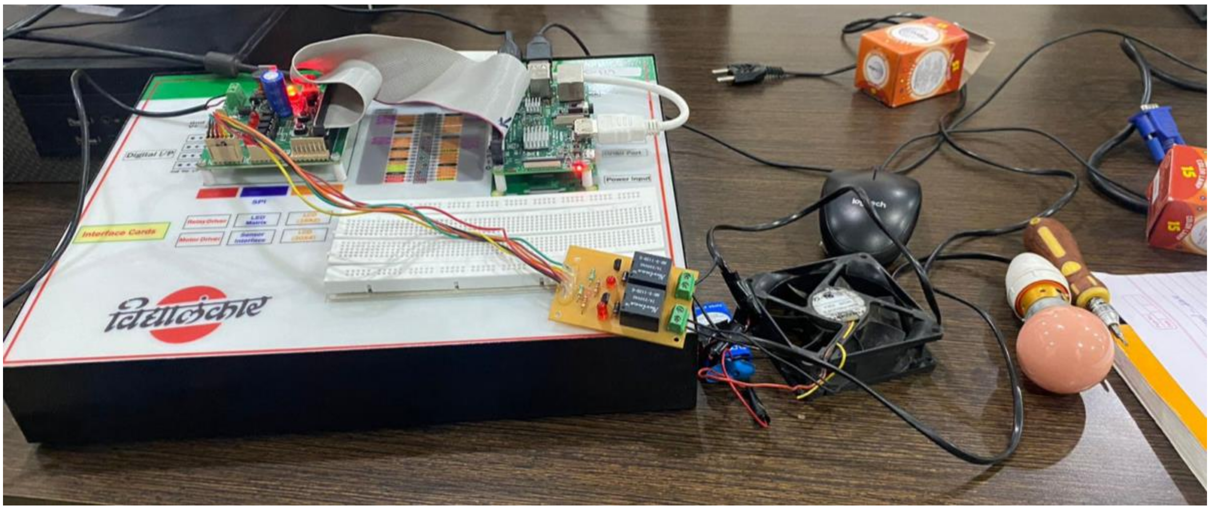
Use this token to access the HTTP API:
5797093574:AAE_cGfCS2FPSFxP3NSI
3TMtASfViWsAfik
Keep your token **secure** and **store it safely**, it can be used by anyone to control your bot.

For a description of the Bot API, see this page: https://core.telegram.org/bots/api 13:43

## Raspberry Pi Circuit:

- Connect the relay, fan and bulb with cables. The other end of the relay connector connect it with relay driver slot on the raspberry pi kit. Refer to the below image for the circuit.

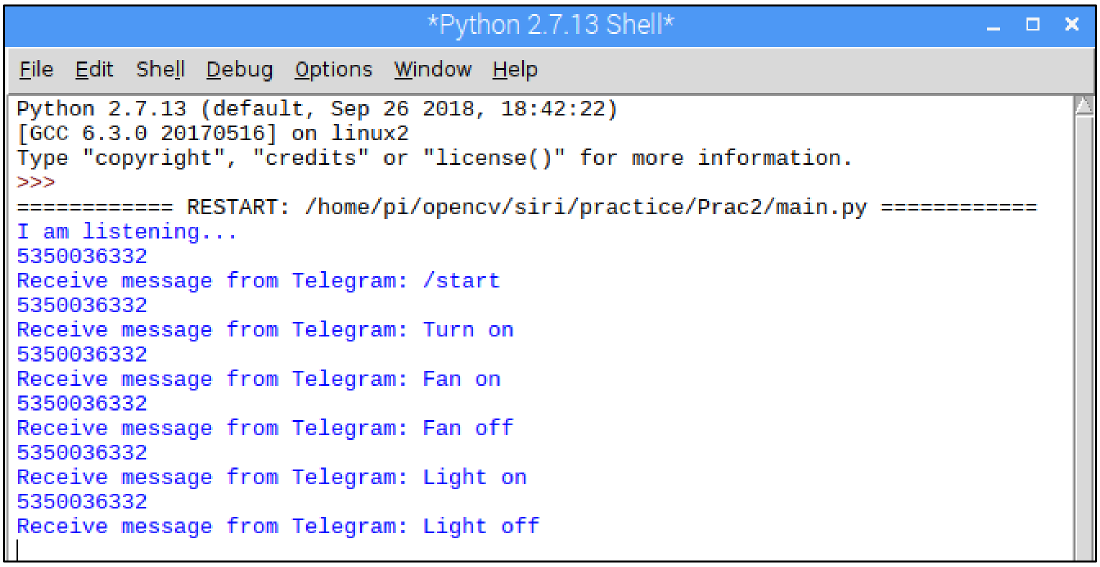




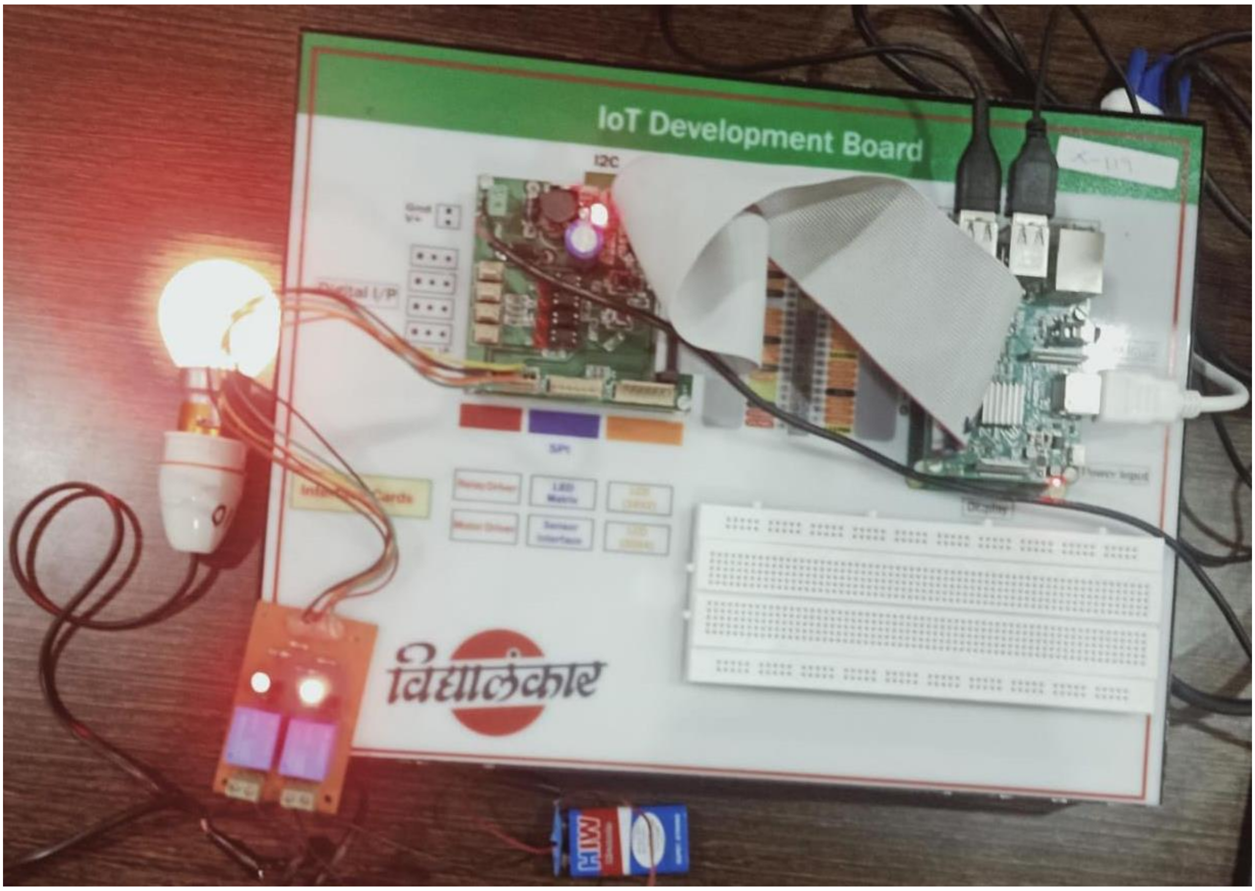
## Source Code:

```
import sys
import time
import random
import datetime
import telepot
import RPi.GPIO as GPIO

RELAY1 = 20
RELAY2 = 16

FAN   = RELAY1
LIGHT = RELAY2

GPIO.setwarnings(False)
# to use Raspberry Pi board pin numbers
GPIO.setmode(GPIO.BCM)
GPIO.cleanup()
# set up GPIO output channel
GPIO.setup(RELAY1, GPIO.OUT)
GPIO.setup(RELAY2, GPIO.OUT)

#Your Telegram token key variable.
telegramBotToken = '6212499066:AAEjXEFaH_LQV8OQ6SFn_ZYpa0RbhDQyHe8'


#function to on and off devices
def on(pin):
        GPIO.output(pin,GPIO.HIGH)
        return "on"

def off(pin):
        GPIO.output(pin,GPIO.LOW)
        return "off"

def handle(msg):
    chat_id = msg['chat']['id']
    print str(chat_id)
    command = str(msg['text'])

    print 'Receive message from Telegram: %s' % command

    if 'Fan' in command or 'fan' in command:
            if 'on' in command:
                    bot.sendMessage(chat_id, str( "Fan " + on(FAN) ))
            elif 'off' in command:
                    bot.sendMessage(chat_id, str( "Fan " + off(FAN) ))

    elif 'Light' in command or 'light' in command:
            if 'on' in command:
                    bot.sendMessage(chat_id, str( "Light " + on(LIGHT) ))
            elif 'off' in command:
                    bot.sendMessage(chat_id, str("Light " + off(LIGHT) ))

bot = telepot.Bot(telegramBotToken)
bot.message_loop(handle)
print 'I am listening...'

while 1:
    time.sleep(10)
```

## Output:



```
Python 2.7.13 (default, Sep 26 2018, 18:42:22)
[GCC 6.3.0 20170516] on linux2
Type "copyright", "credits" or "license()" for more information.
>>>
============ RESTART: /home/pi/opencv/siri/practice/Prac2/main.py ============
I am listening...
5350036332
Receive message from Telegram: /start
5350036332
Receive message from Telegram: Turn on
5350036332
Receive message from Telegram: Fan on
5350036332
Receive message from Telegram: Fan off
5350036332
Receive message from Telegram: Light on
5350036332
Receive message from Telegram: Light off
```



# Practical No 3

**Aim**: Implement Microservices on IoT device

**Hardware**: Raspberry pi kit

**Software**: Raspberry Pi OS, Python

## Source Code:

### Install Flask package with the below command in the terminal:

```
sudo pip install Flask
```

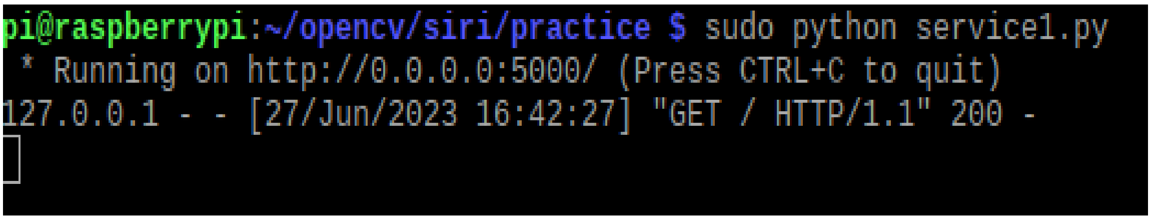
### service1.py

```
from flask import Flask
app=Flask(__name__)
@app.route('/')
def hello():
    return "hello from microservices1"
if __name__ =='__main__':
    app.run(host='0.0.0.0', port=5000)
```

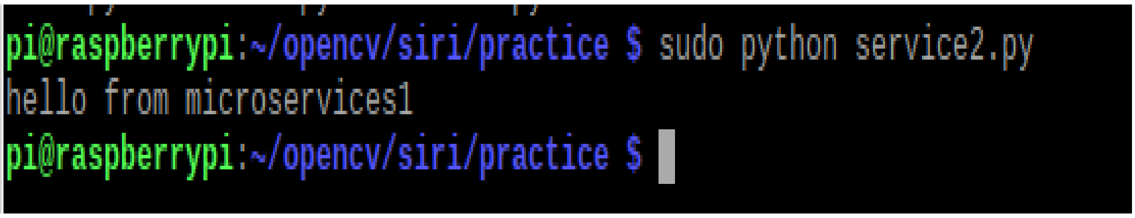
### service2.py

```
import requests
//replace the url in below statement with the url that you get
// after running the service1.py
response=requests.get("http://0.0.0.0:5000")
print (response.text)
```

## Output:



```
pi@raspberrypi:~/opencv/siri/practice $ sudo python service1.py
 * Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [27/Jun/2023 16:42:27] "GET / HTTP/1.1" 200 -
```



```
pi@raspberrypi:~/opencv/siri/practice $ sudo python service2.py
hello from microservices1
pi@raspberrypi:~/opencv/siri/practice $
```

# Practical No 4

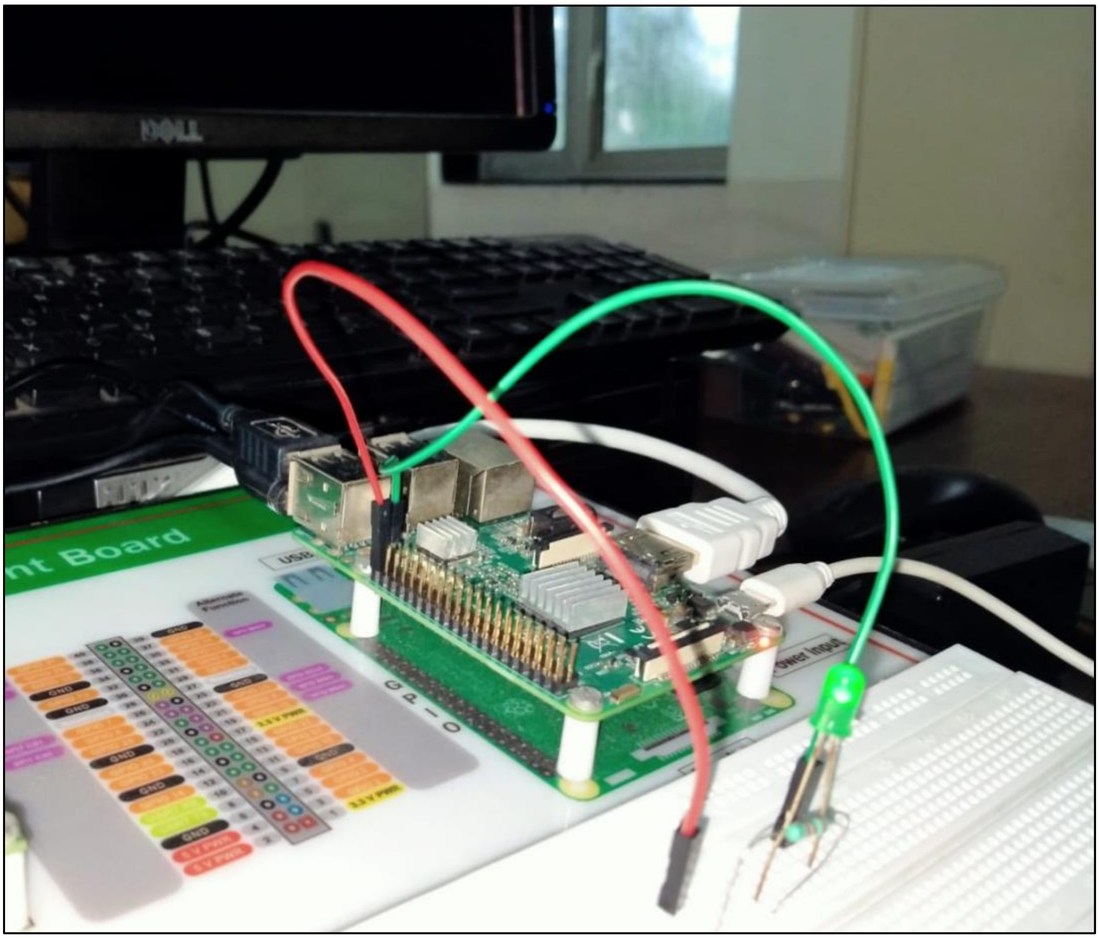
**Aim**: Build your own IoT platform

**Hardware**: Raspberry pi kit, LED, breadboard, cables, resistor, USB adapter 2.1 Amp

**Software**: Raspberry Pi OS, Python

**Rasberry Pi circuit**:

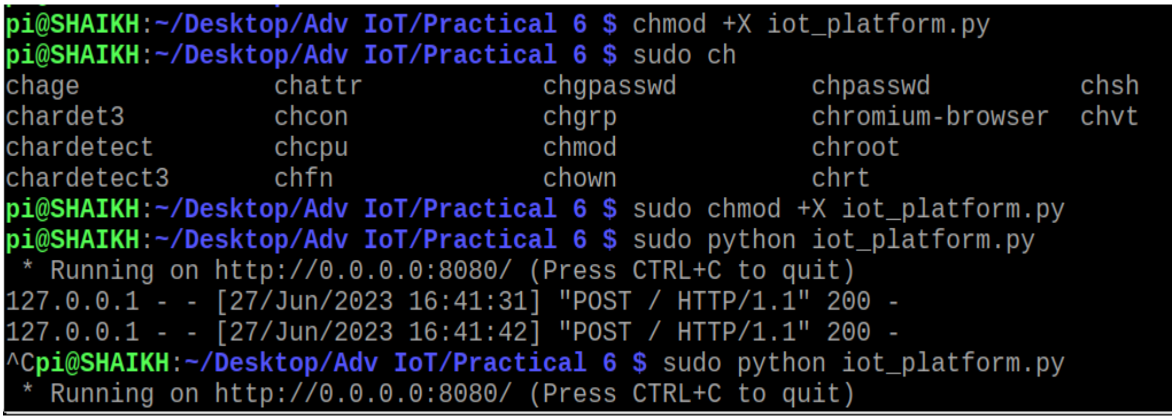
- Connect LED, resistor and cables on breadboard with raspberry pi as shown in the below image:



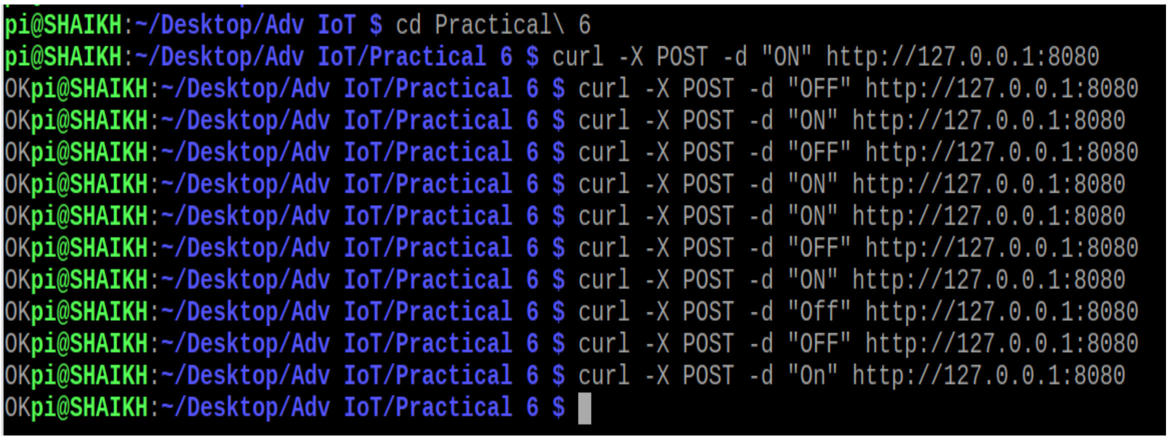
## Source Code:

```
import RPi.GPIO as GPIO
from flask import Flask, request

#Define GPIO pin
led_pin = 21

#set GPIO mode
GPIO.setwarnings(False)
GPIO.setmode(GPIO.BCM)
GPIO.setup(led_pin, GPIO.OUT)

#Create Flask app
app = Flask(__name__)

#Define route to handle HTTP POST request
@app.route('/',methods=['POST'])
def handle_post():
      message = request.get_data(as_text=True)
      if message == "ON":
            GPIO.output(led_pin, GPIO.HIGH)
      elif message == "OFF":
            GPIO.output(led_pin, GPIO.LOW)
        return 'OK'

if __name__ =='__main__':
      app.run(host='0.0.0.0', port=8080)
```

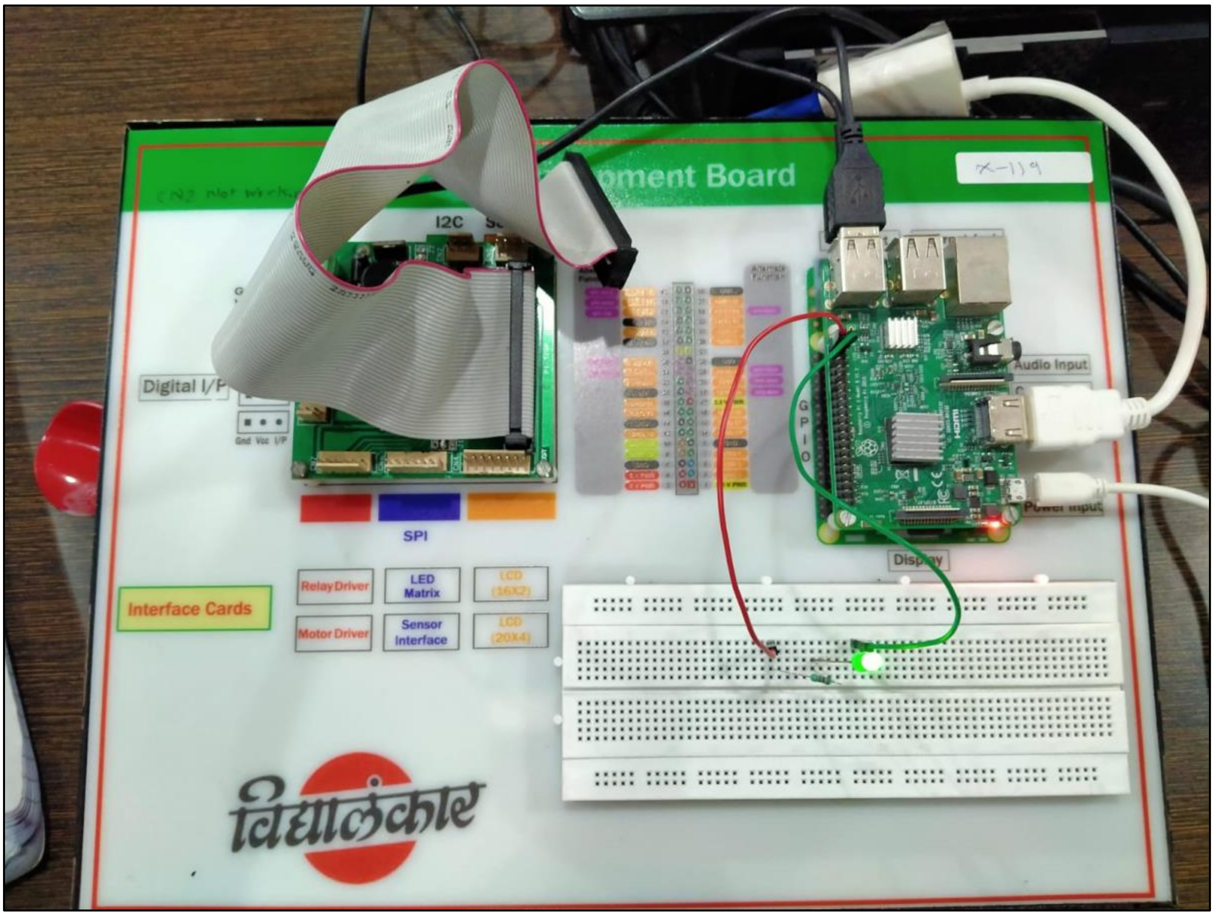
## Output:



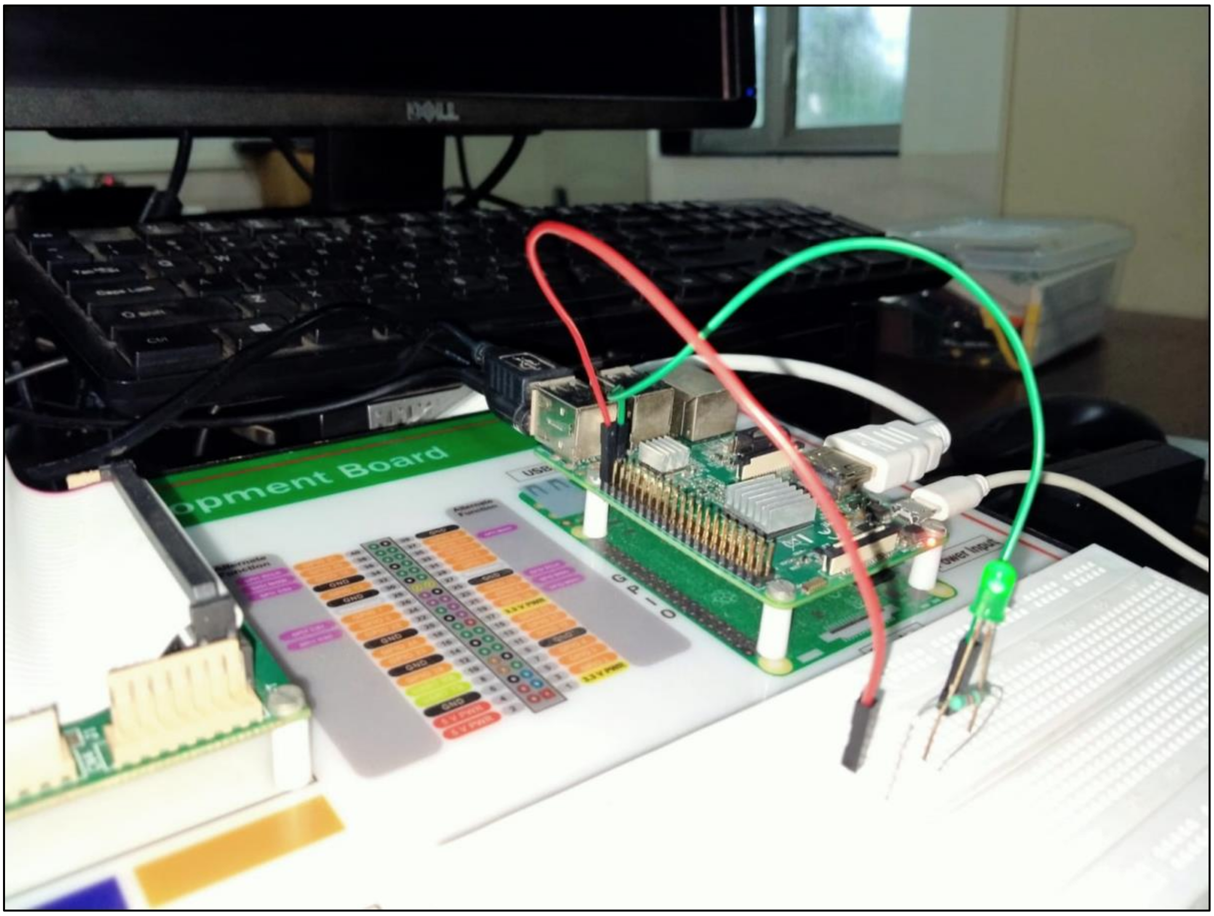
```
pi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ chmod +X iot_platform.py
pi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ sudo ch
chage              chattr             chgpasswd          chpasswd           chsh
chardet3           chcon              chgrp              chromium-browser   chvt
chardetect         chcpu              chmod              chroot
chardetect3        chfn               chown              chrt
pi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ sudo chmod +X iot_platform.py
pi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ sudo python iot_platform.py
 * Running on http://0.0.0.0:8080/ (Press CTRL+C to quit)
127.0.0.1 - - [27/Jun/2023 16:41:31] "POST / HTTP/1.1" 200 -
127.0.0.1 - - [27/Jun/2023 16:41:42] "POST / HTTP/1.1" 200 -
^Cpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ sudo python iot_platform.py
 * Running on http://0.0.0.0:8080/ (Press CTRL+C to quit)
```



```
pi@SHAIKH:~/Desktop/Adv IoT $ cd Practical\ 6
pi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "ON" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "OFF" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "ON" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "OFF" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "ON" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "ON" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "OFF" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "ON" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "Off" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "OFF" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ curl -X POST -d "On" http://127.0.0.1:8080
OKpi@SHAIKH:~/Desktop/Adv IoT/Practical 6 $ 
```



oment Board
I2C
Digital I/P
SPI
Interface Cards
Relay Driver
LED Matrix
LCD (16X2)
Motor Driver
Sensor Interface
LCD (20X4)
Audio Input
Power Input
Display
GPIO
विद्यालंकार



# Practical No 5

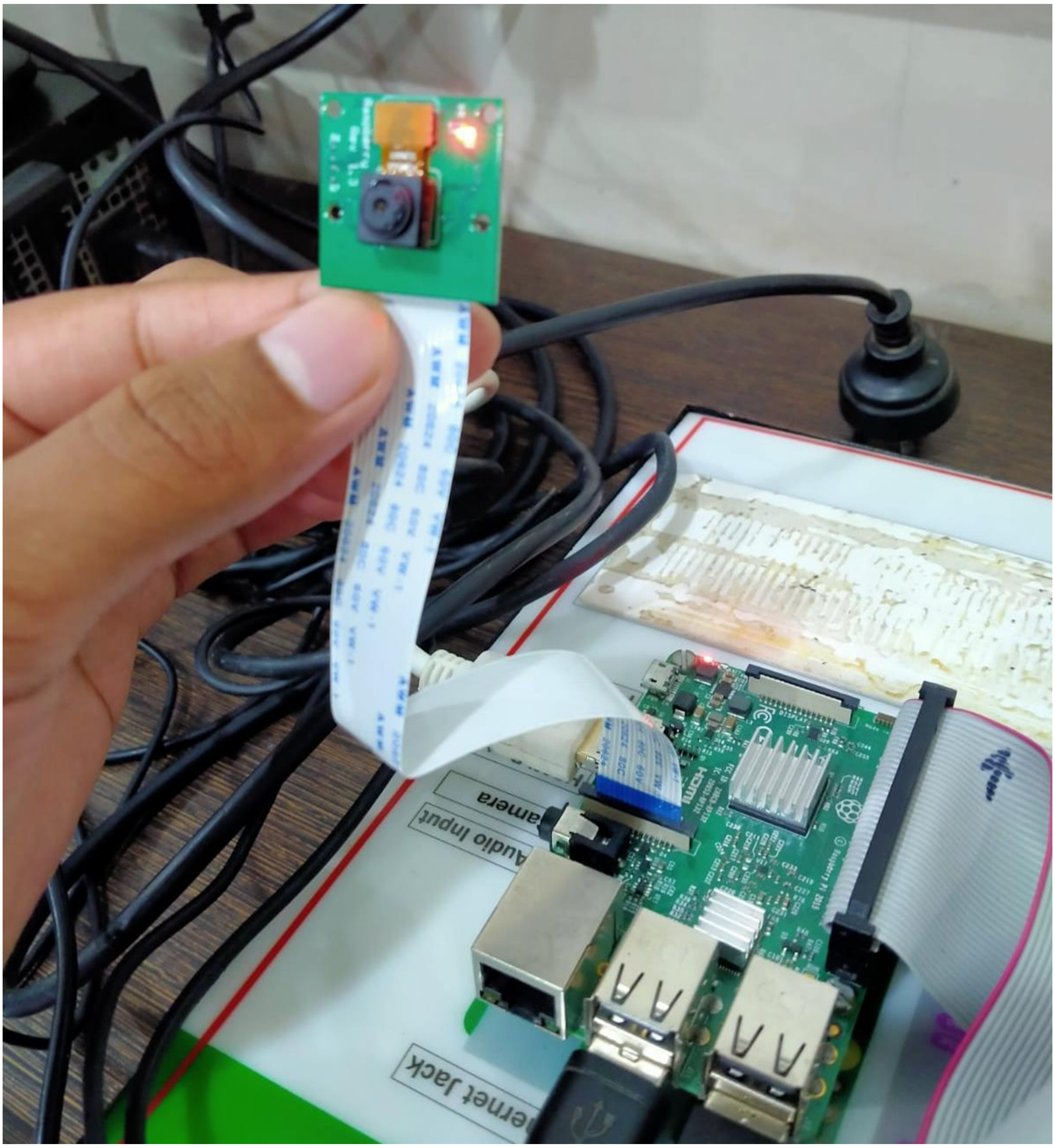
**Aim**: Face Detection using IoT Device

**Hardware**: Raspberry pi kit, Pi Camera

**Software**: Raspberry Pi OS, Python

**Rasberry Pi circuit**:

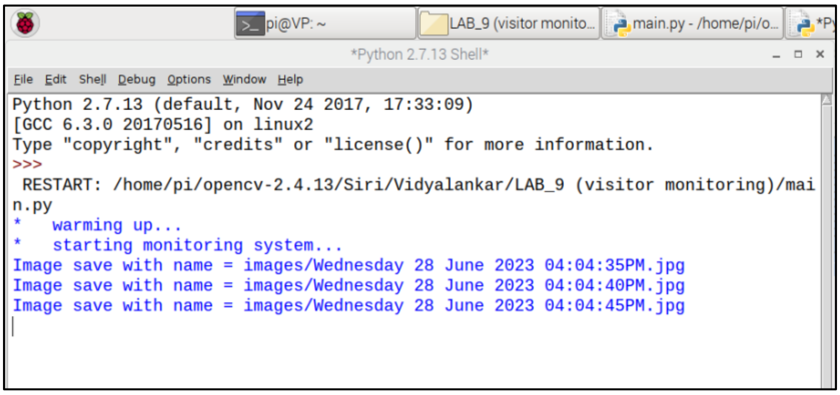
- Connect pi camera on the Raspberry Pi kit as shown below:


Camera
Audio Input
Ethernet Jack

## Source Code:

```
import cv2
import numpy as np
import datetime
import time

# Initialize the camera capture object
cap = cv2.VideoCapture(0) # 0 represents the default camera

# Load the pre-trained face detection model
face_cascade = cv2.CascadeClassifier('haarcascade_frontalface_default.xml')

# Start the main loop to capture frames from the camera
while True:
    ret, frame = cap.read() # Read a frame from the camera

# Convert the frame to grayscale for face detection
    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)

# Perform face detection
    faces = face_cascade.detectMultiScale(gray, scaleFactor=1.3,
minNeighbors=5)

# Draw rectangles around the detected faces
    for (x, y, w, h) in faces:
        cv2.rectangle(frame, (x, y), (x + w, y + h), (0, 255, 0), 2)
        timestamp = datetime.datetime.now()
        ts = timestamp.strftime("%A %d %B %Y %I:%M:%S%p")
        cv2.imwrite("images/" + str(ts) + ".jpg", frame)
        print "Image save with name = " + "images/" + str(ts) + ".jpg"

# Display the frame with detected faces
    cv2.imshow('Face Detection', frame)

# Break the loop if 'q' is pressed
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break

# Release the camera and close the windows
cap.release()
cv2.destroyAllWindows()
```

## Output:



```
Python 2.7.13 (default, Nov 24 2017, 17:33:09)
[GCC 6.3.0 20170516] on linux2
Type "copyright", "credits" or "license()" for more information.
>>>
 RESTART: /home/pi/opencv-2.4.13/Siri/Vidyalankar/LAB_9 (visitor monitoring)/mai
n.py
*   warming up...
*   starting monitoring system...
Image save with name = images/Wednesday 28 June 2023 04:04:35PM.jpg
Image save with name = images/Wednesday 28 June 2023 04:04:40PM.jpg
Image save with name = images/Wednesday 28 June 2023 04:04:45PM.jpg
```