# 18ECO109J-EMBEDDED SYSTEMS DESIGN USING RASPBERRY PI LABORATORY

**SEMESTER – V**

**2021 – 2022(ODD)**


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**Class : Mechatronics A**



**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(Under Section 3 of UGC Act, 1956)**

**S.R.M. NAGAR, KATTANKULATHUR – 603 203**

**CHENGALPATTU DISTRICT**

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**
**COLLEGE OF ENGINEERING & TECHNOLOGY**
**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

**(Under Section 3 of UGC Act, 1956)**
**S.R.M. NAGAR, KATTANKULATHUR**

# BONAFIDE CERTIFICATE

**Register No.: RA1911018010021**

Certified to be the bonafide record of work done by **Samarth Patel** of **Mechatronics Core B.Tech.** Degree course in the Practical **18ECO109J-EEMBEDDED SYSTEMS DESIGN USING RASPBERYY PI** in **SRM IST**, Kattankulathur during the academic year **2021**

**Staff In-Charge**

**Date:** **Head of the Department**

Submitted for University Examination held on 23.11.2021 at **SRM IST**, Kattankulathur.

**Date:** **Internal Examiner I** **Internal Examiner II**

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# Laboratory Report Cover Sheet

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

## 18ECO109J Embedded System Design using Raspberry Pi

**V Semester, 2021-2022 (Odd Semester)**

**Name: Samarth Patel**

**Register No. : RA1911018010021**

**Venue:**

**Title of Experiment:** Arithmetic and String Operation

**Date of Conduction: 26/07/2021**

**Date of Submission: 29/07/2021**

| Particulars | Max. Marks | Marks Obtained |
|---|---|---|
| Pre Lab | 05 | |
| program | 15 | |
| Post Lab | 5 | |
| Output verification &viva | 10 | |
| Lab Report | 05 | |
| **Total** | **40** | |

**REPORT VERIFICATION**

**Staff Name:** Suganthibrindha G

**Signature:**

# LAB 1: Arithmetic and String Operation

**Aim:**

To explore Arithmetic and string operations using python 3

**Task:**

1. Write a Python program to add two numbers
2. Write a Python Program for Program to find area of a circle
3. Write a Python code to remove 4 characters from start of given string “Raspberry Pi”
4. Write the Python code to find length of String “Computer Science”. Replace science with Electronics and display.

**Algorithm:**

1. Write a Python program to add two numbers

A. Get two inputs in two variables named NUM1 and NUM2
B. add the inputs we got from user and assign their value to a variable named SUM
C. Print SUM

2. Write a Python Program for Program to find area of a circle

A. Take input from user in a variable named radius
B. Use the formula of circle as (22/7)*(radius*radius) and store it in a variable named area
C. Round the float value stored in variable area two two decimal places
D. Print area

3. Write a Python code to remove 4 characters from start of given string “Raspberry Pi”

A. Create a variable named str1 and store “Raspberry Pi” in it
B. Use the function str1[4:] and store the result in a variable named strCut
C. Print StrCut

4. Write the Python code to find length of String “Computer Science”. Replace science with Electronics and display.

A. Create a variable named str2 and store “Computer Science” in it
B. Take a variable len and find the length of str2 using length function and store it in len
C. Use string replace command to replace string mentioned in question and store that result in replaceStr
D. Print the len variable contents
E. Print the replaceStr contents

**Programs:**

```
1. NUM1 = input("enter 1st number : ")
NUM2 = input("enter 2nd number : ")
SUM = float(NUM1) + float(NUM2)
print("the sum of {0} and {1} is {2}".format(NUM1, NUM2, SUM))

2. # area of circle
radius = int(input("Enter Side:"))
area = (22 / 7) * (radius * radius)
area = round(area, 2)
print("the area is :" + str(area))
```

```
3. # remove first 4 alphabets
str1 = "Rasoberry Pi"
strCut = str1[4:]
print("The new string is :" + strCut)
```

```
4. # replace and fin length
str2 = "Computer Science"
len = len(str2)
replaceStr = str2.replace("Science", "Electronics and display")
print(replaceStr)
print("The length of the string is:" + str(len))
```

**[**I have copied the above code from my VSCode and that is why it is showing like this this are not screenshot of the programs]**

**Pre Lab Questions:**

1. Which notation you will use to extract part of a string?

Ans. str[4:8]

2. Convert all the characters in the string "Raspberry" to upper case using python code.

Ans. "raspberry".upper()

**3.** List the comparison and arithmetic operators used in python.

Ans. Comparison Operator:- **< (less than), > (greater than), <= (less than equal to), >= (greater than equal to), == (exactly equal to), != (not equal to)**

**Arithmetic Operator:- + (add), - (subtract), / (divide), * (multiply), ** (power)**

**Post Lab Questions:**

1Write Python program to find simple interest.

Ans.

practical.py

python codes > practical.py > ...

```python

# find simple interest
p = float(input("Enter principal amount :"))
r = float(input("Enter the rate of interest :"))
t = float(input("Enter the amount of time :"))
si = (p * r * t) / 100
print("the simple interest is : {0}".format(si))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\practical.py"
Enter principal amount :10000
Enter the rate of interest :5
Enter the amount of time :10
the simple interest is : 5000.0
PS D:\Robocon\Codes>
```

2. >>> s = "abcdefghij"
   >>> s.find("def")
   What is the output?

Ans. 3

**Result:**

We successfully explored Arithmetic and string operations using python 3 and also successfully completed four programs using our knowledge to fin the required output.

practical.py

python codes > practical.py > ...

```python
NUM1 = input("enter 1st number : ")
NUM2 = input("enter 2nd number : ")
SUM = float(NUM1) + float(NUM2)
print("the sum of {0} and {1} is {2}".format(NUM1, NUM2, SUM))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\practical.py"
enter 1st number : 5
enter 2nd number : 5
the sum of 5 and 5 is 10.0
PS D:\Robocon\Codes>
```

practical.py

python codes > practical.py > ...

```python
# area of circle
radius = int(input("Enter Side:"))
area = (22 / 7) * (radius * radius)
area = round(area, 2)
print("the area is :" + str(area))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\practical.py"
Enter Side:2
the area is :12.57
PS D:\Robocon\Codes>
```

practical.py

python codes > practical.py > ...

```python

# remove first 4 alphabets
str1 = "Rasoberry Pi"
strCut = str1[4:]
print("The new string is :" + strCut)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\practical.py"
The new string is :berry Pi
PS D:\Robocon\Codes>
```

practical.py

python codes > practical.py > ...

```python
# replace and find length
str2 = "Computer Science"
len = len(str2)
replaceStr = str2.replace("Science", "Electronics and display")
print(replaceStr)
print("The length of the string is:" + str(len))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\practical.py"
Computer Electronics and display
The length of the string is:16
PS D:\Robocon\Codes>
```

# LAB-2 Loop Operations

## Aim:

To explore loop operations using python 3

## Task:

1. Write a function that returns the maximum of two numbers. **(Use if loop)**
2. Write a function called divisible that takes a number**. ( Use if loop)**

    - If the number is divisible by 3, it should return “Three”.
    - If it is divisible by 5, it should return “Five”.
    - If it is divisible by both 3 and 5, it should return “Three and Five”

Otherwise, it should return the same number.

3. Write a function for checking the speed of drivers. This function should have one parameter: speed.

    1. If speed is less than 70, it should print “Ok”.
    2. Otherwise, for every 5km above the speed limit (70), it should give the driver one demerit point and print the total number of demerit points. For example, if the speed is 80, it should print: “Points: 2”.
    3. If the driver gets more than 12 points, the function should print: “License suspended”

4. Write a function(Use for loop) called showNumbers that takes a parameter called limit. It should print all the numbers between 0 and limit with a label to identify the even and odd numbers. For example, if the limit is 3, it should print:

    - 0 EVEN
    - 1 ODD
    - 2 EVEN
    - 3 ODD

5. Write a program using while loop to check the number n is less than seven. If it is less than seven, print n is less than 7 and add 1 to n. If it is greater than 7, print n is not less than 7.

## Algorithm:

1.Write a function that returns the maximum of two numbers. (Use if loop)

A. num1 = 9 and num2 = 50

B. Use if num1>num2:

C. If true print num1 is bigger

D. If false print num2 is bigger

2.Write a function called divisible that takes a number. ( Use if loop)

A. Num = float(input(“enter”))

B. Def dividible(a)

C. Inside function use if a%3==0 and a%5==0

D. If true print three and five

E. Elif a%3==0

F. If true print three

G. Elif a%5==0

H. If true print five

I. Not call the function with the input number as parameter

3.Write a function for checking the speed of drivers.

A. take input in a variable named speed

B. def check_speed(s)

C. Inside function check if s<70:

D. If true print OK

E. If false s=s-70

F. S=s/5

G. Check if s greater than 12

H. If true print license suspended

I. If false print demerit point count

J. Check_speed(speed)

4.Write a function(Use for loop) called showNumbers that takes a parameter called limit. It should print all the numbers between 0 and limit with a label to identify the even and odd numbers.

A. Get the limit value in a variable named limitNum from the user

B. Def showNumbers(limit)

C. Use for i in range(limit + 1):

D. Check if i%2==0:

E. If true print i value and even

F. If false print i value and odd

G. showNumbers(limitNum)

5.Write a program using while loop to check the number n is less than seven. If it is less than seven, print n is less than 7 and add 1 to n. If it is greater than 7, print n is not less than 7.

A. Get the input from user in a variable n

B. Use wihle n<7:

C. Inside loop print n is less than 7

D. Inside loop n=n+1

E. Outside loop print n is not less than 7

## Programs:

## 1.

```
#Write a function that returns the maximum of two numbers.
 (Use if loop)
num1 = 9
num2 = 50
if num1 > num2:
    print("num1 is bigger")
else:
    print("num2 is bigger")
```

## 2.

```
#Write a function called divisible that takes a number. (
Use if loop)
num = float(input("Enter the number :"))
```

```python
def divisible(a):
    if a % 3 == 0 and a % 5 == 0:
        print("Three and Five")
    elif a % 3 == 0:
        print("Three")
    elif a % 5 == 0:
        print("Five")
```

```python
divisible(num)
```

**3.**

```python
#Write a function for checking the speed of drivers.
speed = float(input("Enter the driver's speed in km/hr :"))

def check_speed(s):
    if s < 70:
        print("OK")
    else:
        s = s - 70
        s = s / 5
        if s > 12:
            print("License Suspended")
        else:
            print("Demerit Points = {0}".format(s))
```

```python
check_speed(speed)
```

**4.**

```
#Write a function(Use for loop) called showNumbers that ta
kes a parameter called limit. It should print all the numb
ers between 0 and limit with a label to identify the even
and odd numbers.
limitNum = int(input("Enter the limit : "))


def showNumbers(limit):
    for i in range(limit + 1):
        if i % 2 == 0:
            print(str(i), " Even")
        else:
            print(str(i), " Odd")
```

```
showNumbers(limitNum)
```

**5.**

```
# Write a program using while loop to check the number n i
s less than seven. If it is less than seven, print n is le
ss than 7 and add 1 to n. If it is greater than 7,  print
n is not less than 7.
n = float(input("Enter number to be checked : "))


while n < 7:
    print("{0} is less than 7".format(n))
    n = n + 1
```

```
print("{0} is not less than 7".format(n))
```

## Pre Lab Questions:

1. What is the use of break statement?

Ans. To stop the execution of the current statement and execute the next statement following the statement containing the break function.

2.How do you repeat  some program code an exact number of times?’

Ans. Using loops and giving them appropriate conditions

3. List the logical operators used in python.

Ans. Logical Operators in python are :- AND, OR and NOT.

## Post Lab Questions:

1. Write a function that prints all the prime numbers between 0 and limit where limit is a parameter.

Ans.

Exp2.py

python codes > Exp2.py > ...

```python
# Write a function that prints all the prime numbers between 0 and limit where limit is a parameter.
limit = int(input("Enter the limit : "))
print("The prime numbers upto " + str(limit) + " are : \n2")
for i in range(2, limit):
    flag = False
    # print("i = " + str(i))
    for k in range(2, i):

        # print("k = " + str(k))
        if i % k == 0:
            break
        else:
            flag = True

    if flag == True:
        print(i)
```

TERMINAL  PROBLEMS 3  OUTPUT  DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter the limit : 25
The prime numbers upto 25 are :
2
3
5
7
9
11
13
15
17
19
21
23
PS D:\Robocon\Codes>
```

2  Write Python program for n-th fibonnaci number.

Ans.

Exp2.py

python codes > Exp2.py > ...

```python
# Write Python program for n-th fibonnaci number.
n = int(input("Enter the number to find in the series : "))
array = [0, 1]

for i in range(2, n):
    add = (array[i - 1]) + (array[i - 2])
    array.append(add)

print("The " + str(n) + "th number in the fibonnaci series is : " + str(array[n - 1]))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter the number to find in the series : 6
The 6th number in the fibonnaci series is : 5
```

## Result:

Exp2.py

python codes > Exp2.py > ...

```python
# Write a function that returns the maximum of two numbers. (Use if loop)
num1 = 9
num2 = 50
if num1 > num2:
    print("num1 is bigger")
else:
    print("num2 is bigger")
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
num2 is bigger
PS D:\Robocon\Codes>
```

Exp2.py

python codes > Exp2.py > ...

```python
# Write a function called divisible that takes a number. ( Use if loop)
num = float(input("Enter the number :"))


def divisible(a):
    if a % 3 == 0 and a % 5 == 0:
        print("Three and Five")
    elif a % 3 == 0:
        print("Three")
    elif a % 5 == 0:
        print("Five")


divisible(num)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter the number :15
Three and Five
PS D:\Robocon\Codes>
```

Exp2.py

python codes > Exp2.py > check_speed

```python

# Write a function for checking the speed of drivers.
speed = float(input("Enter the driver's speed in km/hr :"))


def check_speed(s):
    if s < 70:
        print("OK")
    else:
        s = s - 70
        s = s / 5
        if s > 12:
            print("License Suspended")
        else:
            print("Demerit Points = {0}".format(s))


check_speed(speed)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter the driver's speed in km/hr :120
Demerit Points = 10.0
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter the driver's speed in km/hr :200
License Suspended
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter the driver's speed in km/hr :50
OK
```

Exp2.py

python codes > Exp2.py > ...

```python
# Write a function(Use for loop) called showNumbers that takes a parameter called limit.
limitNum = int(input("Enter the limit : "))


def showNumbers(limit):
    for i in range(limit + 1):
        if i % 2 == 0:
            print(str(i), " Even")
        else:
            print(str(i), " Odd")


showNumbers(limitNum)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes>
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter the limit : 5
0  Even
1  Odd
2  Even
3  Odd
4  Even
5  Odd
```

Exp2.py

python codes > Exp2.py > ...

```python
# Write a program using while loop to check the number n is less than seven
n = float(input("Enter number to be checked : "))

while n < 7:
    print("{0} is less than 7".format(n))
    n = n + 1

print("{0} is not less than 7".format(n))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter number to be checked : 4
4.0 is less than 7
5.0 is less than 7
6.0 is less than 7
7.0 is not less than 7
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp2.py"
Enter number to be checked : 9
9.0 is not less than 7
```

# LAB-3 Programs on List Operations

| | | | | | |
|---|---|---|---|---|---|
| **Course Code** | : | 18ECO109J | **Course Title** | : | Embedded System Design Raspberry Pi |
| **Reg. No.** | : | | **Name** | : | |
| **Semester** | : | V Semester | **Year** | : | III Year |
| **Date of Expt.** | : | | **Date of Submission** | : | |
| **Name of Lab faculty member :** | | | | | |

## Aim:

To explore programs on list operations using python 3

## Task:

1. Write a python program to interchange first and last elements in a list.

2. [15, 14, 13, 12, 11, 10]
   (a) Reverse the contents of the list using slicing technique.
   (b) Same work do it using reverse() built in function.

3. Write the Python Program to merge two lists and sort it.

4. Write a python program to convert the list of string to list of list .

## Algorithms:

**Write for all the above 4 tasks**

1. Write a python program to interchange first and last elements in a list

**A. Define an array**
**B. Find length and store in length variable**
**C. Assign variable first and store the first element of array and assign variable second and store last element of array using pop() function.**
**D. Using insert add the last variable "first" at the end of the array and variable "second" at the starting of the array**
**E. Print the array**

2. [15, 14, 13, 12, 11, 10]
   (a) Reverse the contents of the list using slicing technique.
   (b) Same work do it using reverse() built in function.

**A. Assign an array named num**

B. Print("the reversed list using slicing is :- "+ str(num[::-1]))
C. num.reverse()
D. Print("the reversed list using reverse function is :-"+str(num))

3. Write the Python Program to merge two lists and sort it.

A. Assign two array with variable name one and two and give some elements in both of them
B. Use one.extend(two)
C. one.sort()
D. print(one)

4. Write a python program to convert the list of string to list of list .

A. Create an array of string with variable name as list
B. Create an empty list named final
C. Use for item in list:
D. Inside the loop use final.append([item])
E. After loop print the array named final

## Programs:

Copy and paste your code from the editor here

1.

```
# Write a python program to interchange first and last elemen
ts in a list.
l = ["first", "second", "last"]
length = len(l)
first = l.pop(0)
second = l.pop()

l.insert(0, second)
l.insert(length - 1, first)
print(l)
```

2.

```
# [15, 14, 13, 12, 11, 10]
# (a)Reverse the contents of the list using slicing technique.
# (b)Same work do it using reverse() built in function.
num = [15, 14, 13, 12, 11, 10]

print("The reversed list using slicing is          :-
" + str(num[::-1]))
num.reverse()
print("The reversed list using reverse function is :-
" + str(num))
```

3.

```
# Write the Python Program to merge two lists and sort it.
one = ["3", "2", "1"]
two = ["c", "a", "b"]
one.extend(two)
one.sort()
print(one)
```

4.

```
# Write a python program to convert the list of string to lis
t of list .
list = ["first", "second", "last"]
final = []
for item in list:
    final.append([item])
print(final)
```

## Pre Lab Questions:

1.
```
thislist =
["apple", "banana", "cherry", "orange", "kiwi", "melon", "mango"]
print(thislist[2:5])
```

What is the output?

Ans. ['cherry', 'orange', 'kiwi']

2. `thislist = ["apple", "banana", "cherry"]`
`thislist.append("orange")`
`print(thislist)`

What is the output?

Ans. `["apple", "banana", "cherry",”orange”]`

3. Print the last item of the list using negative indexing

`thislist = ["apple", "banana", "cherry"]`

Ans. `thislist[-1]`

## Post Lab Questions:

1. Write a Python Program to Calculate the Average of Numbers in the Given List.
   d = [100,200,300,400,500]

Ans.

Exp3.py

python codes > Exp3.py > ...

```python
# Write a Python Program to Calculate the Average of Numbers in the Given List.
d = [100, 200, 300, 400, 500]
lenD = len(d)
sum = 0
for i in range(lenD):
    sum = sum + d[i]

print("The average of numbers in the given list is : " + str(sum / lenD))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp3.py"
The average of numbers in the given list is : 300.0
```

2 Make a copy of the list with the `copy()` method:

`thislist = ["apple", "banana", "cherry"]`

Ans.

```python
# Make a copy of the list with the copy() method:
thislist = ["apple", "banana", "cherry"]

import copy

copyList = copy.copy(thislist)
print(copyList)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp3.py"
['apple', 'banana', 'cherry']
```

## Result:

Put screenshot which will show program and input and outputs of the program

```python
# Write a python program to interchange first and last elements in a list.
l = ["first", "second", "last"]
length = len(l)
first = l.pop(0)
second = l.pop()

l.insert(0, second)
l.insert(length - 1, first)
print(l)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp3.py"
['last', 'second', 'first']
```

```python
# Write the Python Program to merge two lists and sort it.
one = ["3", "2", "1"]
two = ["c", "a", "b"]
one.extend(two)
one.sort()
print(one)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp3.py"
['1', '2', '3', 'a', 'b', 'c']
```

Exp3.py

python codes > Exp3.py > ...

```python
# [15, 14, 13, 12, 11, 10]
# (a)Reverse the contents of the list using slicing technique.
# (b)Same work do it using reverse() built in function.
num = [15, 14, 13, 12, 11, 10]

print("The reversed list using slicing is          :-" + str(num[::-1]))
num.reverse()
print("The reversed list using reverse function is :-" + str(num))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp3.py"
The reversed list using slicing is          :-[10, 11, 12, 13, 14, 15]
The reversed list using reverse function is :-[10, 11, 12, 13, 14, 15]
PS D:\Robocon\Codes>
```

Exp3.py

python codes > Exp3.py > ...

```python

# Write a python program to convert the list of string to list of list .
list = ["first", "second", "last"]
final = []
for item in list:
    final.append([item])
print(final)

```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> & C:/Users/samar/AppData/Local/Microsoft/WindowsApps/python.exe "d:/Robocon/Codes/python codes/Exp3.py"
[['first'], ['second'], ['last']]
PS D:\Robocon\Codes>
```

# LAB-4 Programs on Dictionary Operations

## Aim:

To explore programs on dictionary operations using python 3

## Task:

1. Write a Python Program to generate a dictionary that contains a square of numbers (between 1 and n) in the form (x , x*x).x-is the number; x*x -is the square value.

2. Write a Python Program to generate a temperature profile dictionary (values in range:30 to 100)for ten days randomly (from august 1 to august 31) and check whether august 10 data exist in a dictionary or not. (Key=date,value=temperate value)

3. In program 2, find the count of temperature 30,40 in the dictionary.

4. Repeat the program 2 for July month and write a python program to concatenate the two dictionaries into one dictionary named July_aug_temp.

5. Write a Python Program to multiply all the items in the dictionary "July_aug_temp" which is generated in program 4 and find average temperate for the two months.

## Algorithms:

1. Write a Python Program to generate a dictionary that contains a square of numbers (between 1 and n) in the form (x , x*x).x-is the number; x*x -is the square value.

A. Create a variable n and take input in it from user

B. Create an empty dictionary dict

C. Use for i in range(n):

D. Inside the loop dict[i]=i*I

E. Print dict

2.Write a Python Program to generate a temperature profile dictionary (values in range:30 to 100)for ten days randomly (from august 1 to august 31) and check whether august 10 data exist in a dictionary or not. (Key=date,value=temperate value)

A. Import random

B. Create two functions for getting random date between 1 and 31 and temperature between 30 to 100

C. Create a dict with key as date and value as temp

D. Print that dict

E. Assign flag=true

F. Use for data in dict created:

G. Inside loop if date==10:

H. Inside if is true turn flag true and if false turn flag false

I. Outside if flag==true:

J. If true print aug 10 data is there

K. If false print aug 10 data is not there

3. In program 2, find the count of temperature 30,40 in the dictionary.

A. Assign c30 and c40 equal to zero
B. For item in dict:
C. If dict[item] == 30 add 1 to c30 using c30 = c30 + 1
D. If dict[item] == 40 add 1 to c40 using c40 = c40 + 1
E. Print the c30 and c40

4. Repeat the program 2 for July month and write a python program to concatenate the two dictionaries into one dictionary named July_aug_temp.

A. create another dict1 using random variables

B. Print dict1

C. Use dict.update(dict1)

D. Store dict in july_aug_temp

E. Print july_aug_temp

5. Write a Python Program to multiply all the items in the dictionary "July_aug_temp" which is generated in program 4 and find average temperate for the two months.

A. Assign multiply=1

B. Sum=0

C. For items in july_aug_temp:

D. Inside loop multiply = multiply * july_aug_temp[items] and sum = sum + uly_aug_temp[items]

E. Outside loop avg = sum/20

F. Print multiply and sum

## Programs:

**1.**

```
# Write a Python Program to generate a dictionary that contains a square of nu
mbers (between 1 and n) in the form (x , x*x).x-is the number; x*x -
is the square value.

n = 10

dict = {}

for i in range(n):
```

```
    dict[i] = i * i
print(dict)
```

**2.**

```
# Write a Python Program to generate a temperature profile dictionary (values in range:30 to 100)for ten days randomly (from august 1 to august 31)  and check whether august 10 data exist in a dictionary or not. (Key=date,value=temperate value)
import random


def rDate():
    d = random.randint(1, 31)
    return d
```

```
def rTemp():
    t = random.randint(30, 100)
    return t
```

```
dataAug = {rDate(): rTemp() for n in range(1, 11)}
print(dataAug)
```

```
flag = True
for date in dataAug:
    if date == 10:
        flag = True
    else:
        flag = False
```

```
if flag == True:
    print("August 10 data is there in the dictionary")
else:
    print("August 10 data is not there in the dictionary")
```

**3.**

```
# In above program, find the count of temperature 30,40 in the dictionary.
c30 = 0
c40 = 0

for item in dataAug:
    if dataAug[item] == 30:
        c30 = c30 + 1
    if dataAug[item] == 40:
        c40 = c40 + 1
```

```
print("count for '30' values : " + str(c30))
print("count for '40' values : " + str(c40))
```

**4.**

```
# Repeat the program 2 for July month and write a python program to concate
nate the two dictionaries into one dictionary named July_aug_temp
dataJuly = {rDate(): rTemp() for n in range(1, 11)}
print(dataJuly)

dataAug.update(dataJuly)
july_aug_temp = dataAug
print(july_aug_temp)
```

**5.**

```
# Write a Python Program to multiply all the items in the dictionary “July_aug_temp”  which is generated in program 4 and find average temperate for the two months.

multiply = 1

sum = 0

for items in july_aug_temp:

    multiply = multiply * july_aug_temp[items]

    sum = sum + july_aug_temp[items]


avg = sum / 20
```

```
print("The multilied number is : " + str(multiply))

print("The average of all the temperatures is : " + str(sum))
```

## Pre Lab Questions:

1. Write the function that removes the element with the specified key

Ans.

```python

# Write the function that removes the element with the specified key
def remove(key, dict):
    dict.pop(key)


dict = {1: 1, 2: 4, 3: 9, 4: 16, 5: 25}
key = 5

print("The original dictionary is : " + str(dict))
remove(key, dict)
print("The updated dictionary is : " + str(dict))


```

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
The original dictionary is : {1: 1, 2: 4, 3: 9, 4: 16, 5: 25}
The updated dictionary is : {1: 1, 2: 4, 3: 9, 4: 16}
PS D:\Robocon\Codes>
```

2. Write the function that returns the value of the specified key

Ans.

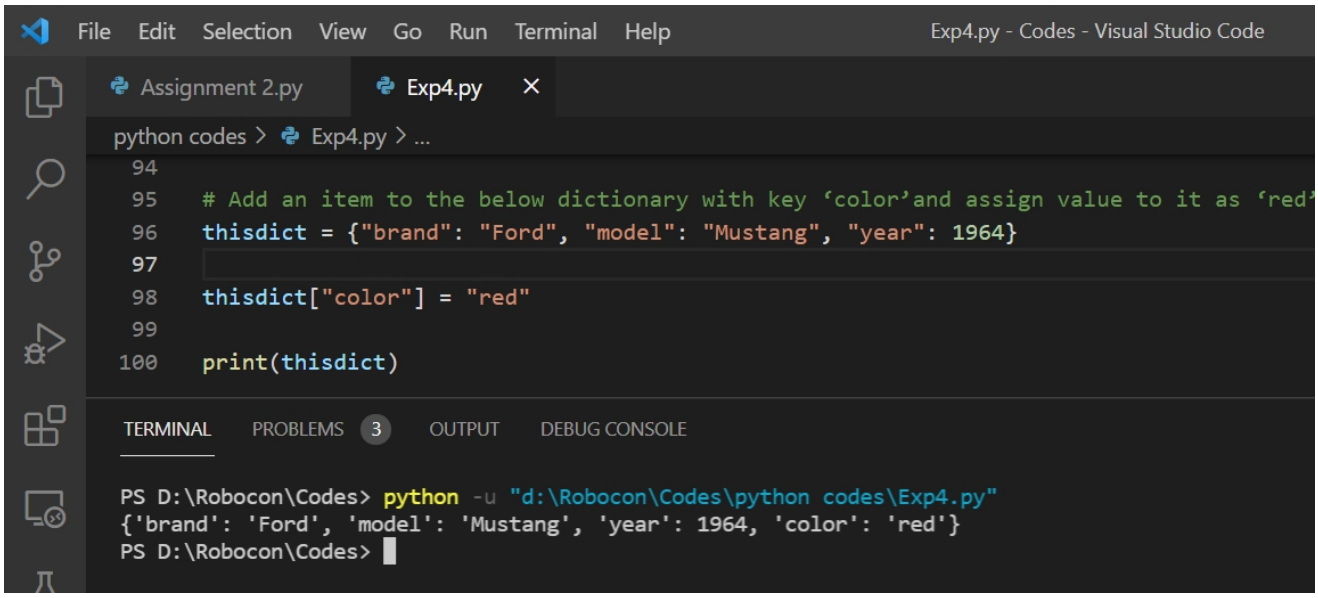
```python
# Write the function that returns the value of the specified key
def retVal(dict, key):
    return dict[key]


dict = {1: 1, 2: 4, 3: 9, 4: 16, 5: 25}
key = 4

val = retVal(dict, key)
print(val)
```

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
16
PS D:\Robocon\Codes>
```

3. Add an item to the below dictionary with key ‘color’and assign value to it as ‘red’:

```
thisdict = {
  "brand": "Ford",
  "model": "Mustang",
  "year": 1964
}
```

Ans.




## Post Lab Questions:

1. Make a copy of a dictionary with the `dict()` function:

```
Thisdict={
"brand":"Ford","model":"Mustang","year":1964
}
```

Ans.

File Edit Selection View Go Run Terminal Help Exp4.py - Code

Assignment 2.py | Exp4.py

python codes > Exp4.py > ...

```python
# Make a copy of a dictionary with the dict() function:
def dict(thisdict):
    return thisdict.copy()


thisdict = {"brand": "Ford", "model": "Mustang", "year": 1964}
dictCopy = dict(thisdict)
print(dictCopy)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
{'brand': 'Ford', 'model': 'Mustang', 'year': 1964}
PS D:\Robocon\Codes>
```

2 Create three dictionaries, then create one dictionary that will contain the other three dictionaries.

Ans.

File Edit Selection View Go Run Terminal Help Exp4.py -

Assignment 2.py | Exp4.py

python codes > Exp4.py > ...

```python

# Create three dictionaries, then create one dictionary that
dictA = {1: 1, 2: 4, 3: 9}
dictB = {4: 16, 5: 25, 6: 36}
dictC = {}

dictA.update(dictB)
dictC = dictA
print(dictC)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
{1: 1, 2: 4, 3: 9, 4: 16, 5: 25, 6: 36}
PS D:\Robocon\Codes>
```

**Result:**

File Edit Selection View Go Run Terminal Help Exp4.py - C

Assignment 2.py | Exp4.py

python codes > Exp4.py > ...

```python
# Write a Python Program to generate a dictionary that contains
n = 10
dict = {}
for i in range(n):
    dict[i] = i * i
print(dict)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
{0: 0, 1: 1, 2: 4, 3: 9, 4: 16, 5: 25, 6: 36, 7: 49, 8: 64, 9: 81}
PS D:\Robocon\Codes>
```

File Edit Selection View Go Run Terminal Help

Assignment 2.py | Exp4.py

python codes > Exp4.py > ...

```python
# Write a Python Program to generate a temperature profile di
import random


def rDate():
    d = random.randint(1, 31)
    return d


def rTemp():
    t = random.randint(30, 100)
    return t


dataAug = {rDate(): rTemp() for n in range(1, 11)}
print(dataAug)

flag = True
for date in dataAug:
    if date == 10:
        flag = True
    else:
        flag = False

if flag == True:
    print("August 10 data is there in the dictionary")
else:
    print("August 10 data is not there in the dictionary")
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
{13: 37, 9: 84, 5: 81, 26: 97, 18: 95, 10: 44, 7: 45, 3: 36}
August 10 data is not there in the dictionary
PS D:\Robocon\Codes>
```

File Edit Selection View Go Run Terminal Help Exp4.py - Codes -

Assignment 2.py | Exp4.py

python codes > Exp4.py > ...

```python
# # In above program, find the count of temperature 30,40 in the di
c30 = 0
c40 = 0

for item in dataAug:
    if dataAug[item] == 30:
        c30 = c30 + 1
    if dataAug[item] == 40:
        c40 = c40 + 1

print("count for '30' values : " + str(c30))
print("count for '40' values : " + str(c40))
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
{17: 97, 19: 35, 3: 71, 28: 85, 9: 99, 30: 64, 5: 91, 15: 83, 7: 30, 31: 58}
count for '30' values : 1
count for '40' values : 0
PS D:\Robocon\Codes>
```

File Edit Selection View Go Run Terminal Help Exp4.py - Codes - Visual Studio Code

Assignment 2.py | Exp4.py

python codes > Exp4.py > ...

```python
# Repeat the program 2 for July month and write a python program to concatenate the two dictionaries into
dataJuly = {rDate(): rTemp() for n in range(1, 11)}
print(dataJuly)

dataAug.update(dataJuly)
july_aug_temp = dataAug
print("The data of July and August is :")
print(july_aug_temp)
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
{14: 83, 16: 87, 18: 62, 13: 68, 17: 56, 29: 32, 11: 55, 22: 92}
{12: 54, 24: 30, 15: 92, 23: 56, 1: 36, 4: 56, 11: 59, 28: 84}
The data of July and August is :
{14: 83, 16: 87, 18: 62, 13: 68, 17: 56, 29: 32, 11: 59, 22: 92, 12: 54, 24: 30, 15: 92, 23: 56, 1: 36, 4: 56, 28: 84}
PS D:\Robocon\Codes>
```

File Edit Selection View Go Run Terminal Help Exp4.py - Codes - Visual Studio Code

Assignment 2.py | Exp4.py

python codes > Exp4.py > ...

```python
july_aug_temp = dataAug
print("The data of July and August is :")
print(july_aug_temp)

# # Write a Python Program to multiply all the items in the dictionary “July_aug_temp”  which is g
multiply = 1
sum = 0
for items in july_aug_temp:
    multiply = multiply * july_aug_temp[items]
    sum = sum + july_aug_temp[items]
```

TERMINAL PROBLEMS 3 OUTPUT DEBUG CONSOLE

```
PS D:\Robocon\Codes> python -u "d:\Robocon\Codes\python codes\Exp4.py"
The data of July and August is :
{15: 79, 25: 30, 4: 92, 20: 35, 11: 54, 21: 92, 9: 86, 30: 86, 8: 54, 16: 75, 26: 100, 22: 74, 28: 65, 24: 81}
The multilied number is : 44245369450499031360000000
The average of all the temperatures is : 1003
PS D:\Robocon\Codes>
```

# LAB-5- LED Blinking and Brightness Control

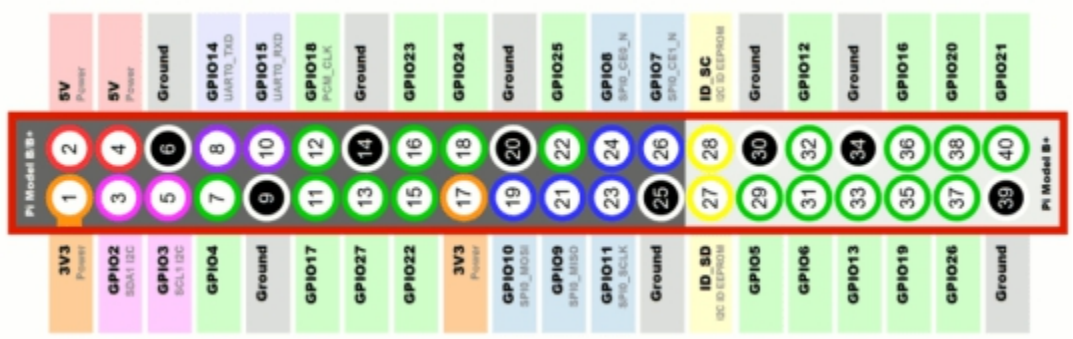
## Aim:

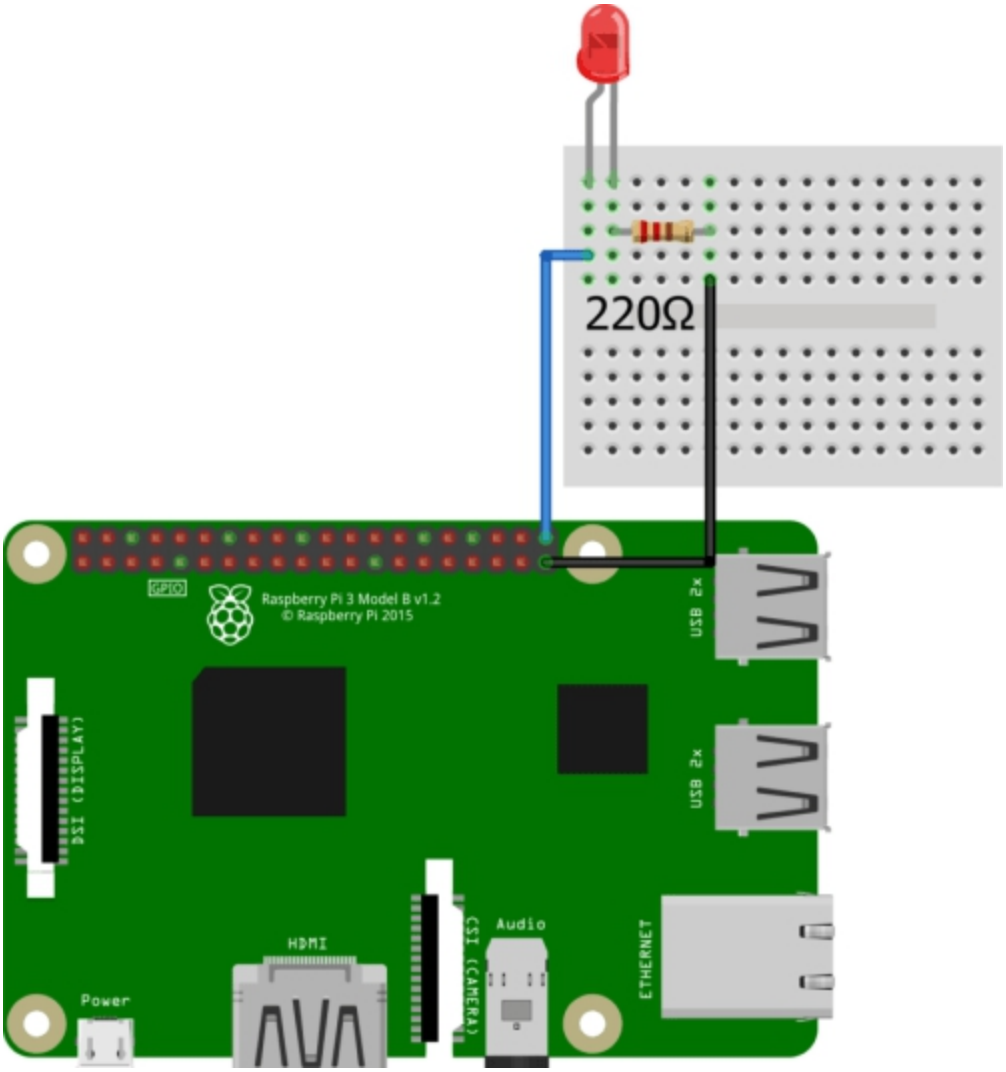
To write python code for LED blinking and brightness control using PWM in Raspberry Pi and test it

## Task:

1. Write a Python Program to generate LED Blinking and Brightness Control using PWM in Raspberry Pi and test it.

## Pin and Ciruit Diagaram :






# Algorithms:

1. Blinking LED

**A. Import RPi.GPIO as GPIO**

**B. Import time from sleep**

**C. setmode to GPIO.BOARD**

**D. Setup(8,GPIO.OUT)**

**E. while True:**

**F. Inside loop GPIO.OUPUT(8,GPIO.HIGH)**

**G. sleep(1)**

**H. GPIO.OUPUT(8,GPIO.LOW)**

**I. sleep(1)**

2. Brightness Control

**A.Import RPi.GPIO as GPIO**

**B.Import time from sleep**

**C.setmode to GPIO.BCM**

**D.Setup(8,GPIO.OUT)**

**E. Pwm =GPIO.PWM(18,500)**

**F. Pwm.start(100)**

**G. while True:**

**H. Take input between 0 to 100 from user**

**I. Convert the input in int and store in duty variable**

**J. Use Pwm.ChangeDutyCycle(duty)**

# Programs:

1. Blinking LED

```
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BOARD)
GPIO.setup(8, GPIO.OUT)

while True:
    GPIO.output(8, GPIO.HIGH)
    sleep(1)
    GPIO.output(8, GPIO.LOW)
    sleep(1)
```

2.Brightness Change

```
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BCM)
GPIO.setup(18,GPIO.OUT)

pwm = GPIO.PWM(18, 500)
pwm.start(100)

while True:
    duty_S = input("enter the brightness")
    duty = int(duty_S)
    pwm.ChangeDutyCycle(duty)
```

## Pre Lab Questions:

1. How can power control be done using PWM?

Ans. In PWM we vary the length of pulses while keeping the overall number of pulses per second constant to control the power.

2. Write the function related to PWM generation in Raspberry Pi

Ans. pwm.start(0)

## Post Lab Questions:

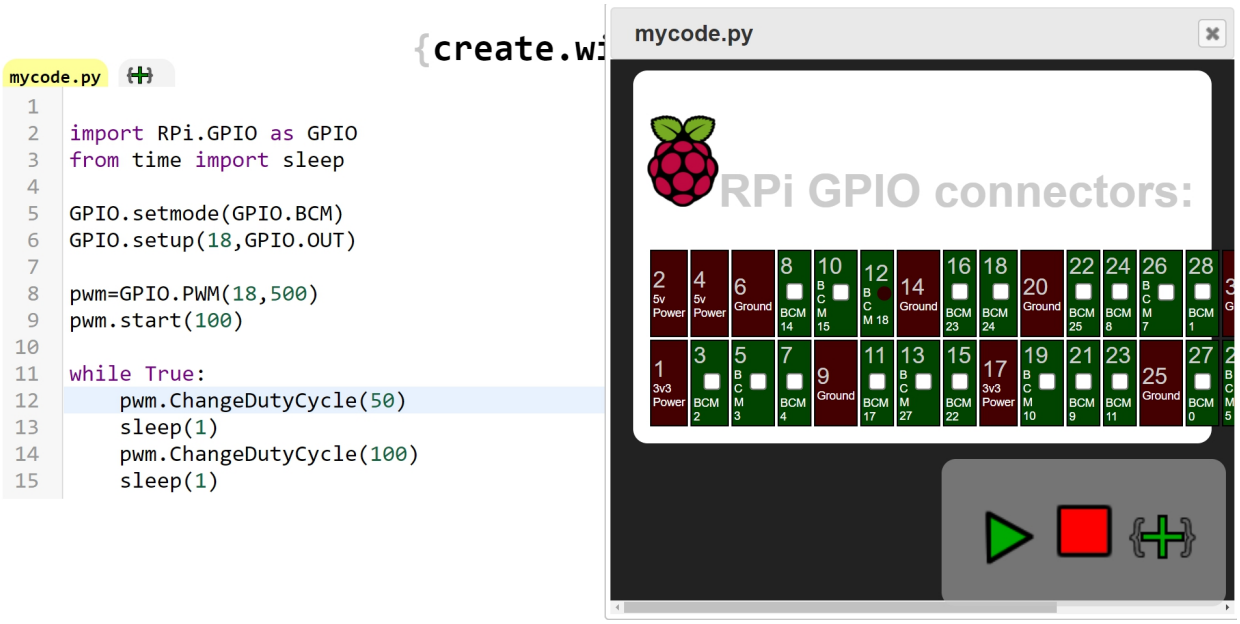
1. What is the impact of the change of frequency  PWM on the blinking effect of the LED?

Ans.The higher the frequency of high pulses, the higher the average voltage the higher the brightness intensity of the LED.

2. Write python code in which LED only make blinking with medium and highest brightness

Ans.

```
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BCM)
GPIO.setup(18,GPIO.OUT)

pwm=GPIO.PWM(18,500)
pwm.start(100)

while True:
    pwm.ChangeDutyCycle(50)
    sleep(1)
    pwm.ChangeDutyCycle(100)
    sleep(1)
```



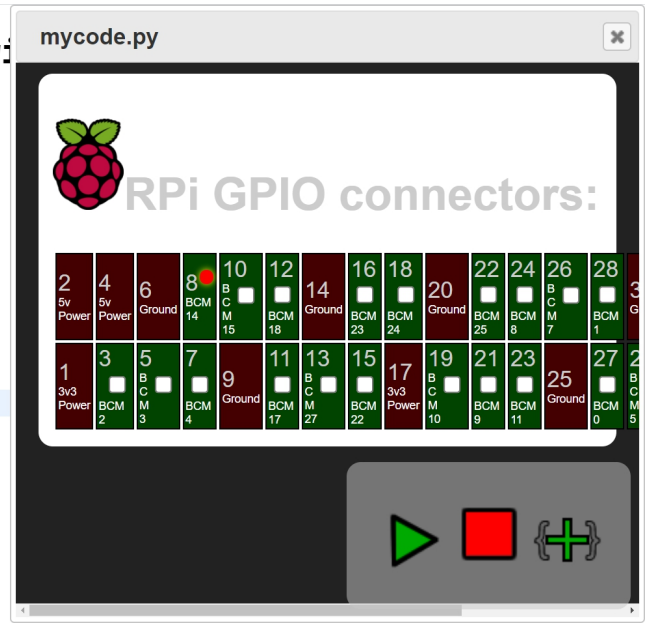

## Result:

1.Screenshot of the program window

# Blinking:-

mycode.py

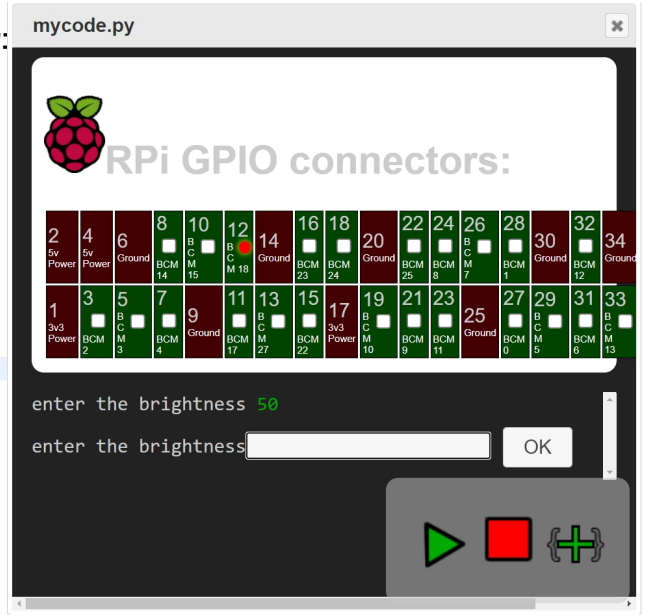
```python
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BOARD)
GPIO.setup(8, GPIO.OUT)

while True:
    GPIO.output(8, GPIO.HIGH)
    sleep(1)
    GPIO.output(8, GPIO.LOW)
    sleep(1)
```




# Brightness Control:-

mycode.py

```python
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BCM)
GPIO.setup(18, GPIO.OUT)

pwm = GPIO.PWM(18, 500)
pwm.start(100)

while True:
    duty_S = input("enter the brightness")
    duty = int(duty_S)
    pwm.ChangeDutyCycle(duty)
```



2.Video(concise) link of the demo

Blinking:-

https://drive.google.com/file/d/14WIzAthlEaGbck2DrG_m9JYNpsP43xP5/view?usp=sharing

Brightness Control:-

https://drive.google.com/file/d/1C7ugmoalo6MRuysSvOMLHrI2zQKRX_Mr/view?usp=sharing

# LAB – 6 Switching a High-Power DC Device

## Aim:

To write a program to switch a high-power DC device using relay or transistor.

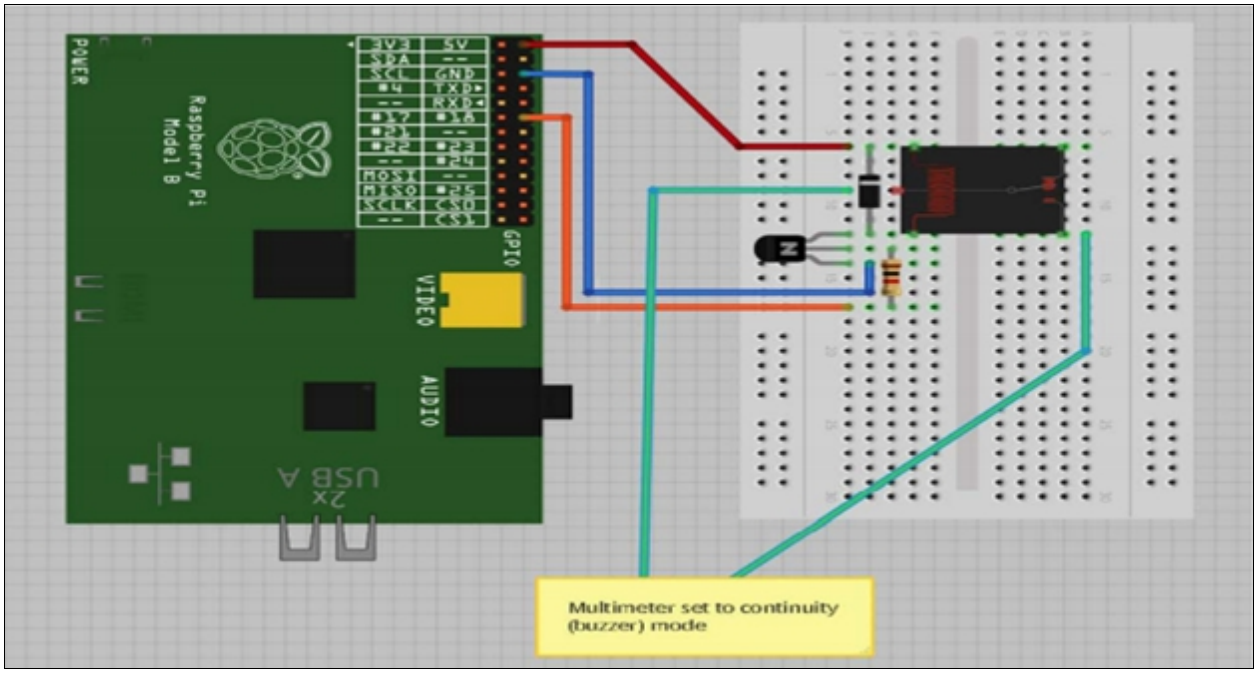
## Task:

1. Write a Python program to switch a high-power DC device using relay.

## Algorithm:

1. import RPi.GPIO and from timke import sleep
2. Set the board to GPIO.BOARD
3. Set pin 18 as GPIO.OUT
4. Inside while True: take an input from user and store in x
5. Check if x==”on” give gpio 18 as high and sleep(0.5)
6. Check if x==”off” give gpio 18 as low and sleep(0.5)
7. Check if x==’exit’ write break

## Pin & Circuit Diagram:




# Programs:

```
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BOARD)
GPIO.setup(18, GPIO.OUT)

while True:
    x = input("on/off/exit")
    if x == "on" or x == "ON":
        GPIO.output(18, GPIO.HIGH)
        sleep(0.5)
    if x == "off" or x == "OFF":
        GPIO.output(18, GPIO.LOW)
        sleep(0.5)
    if x == "exit" or x == "EXIT":
```

```
    break

GPIO.cleanup()
```

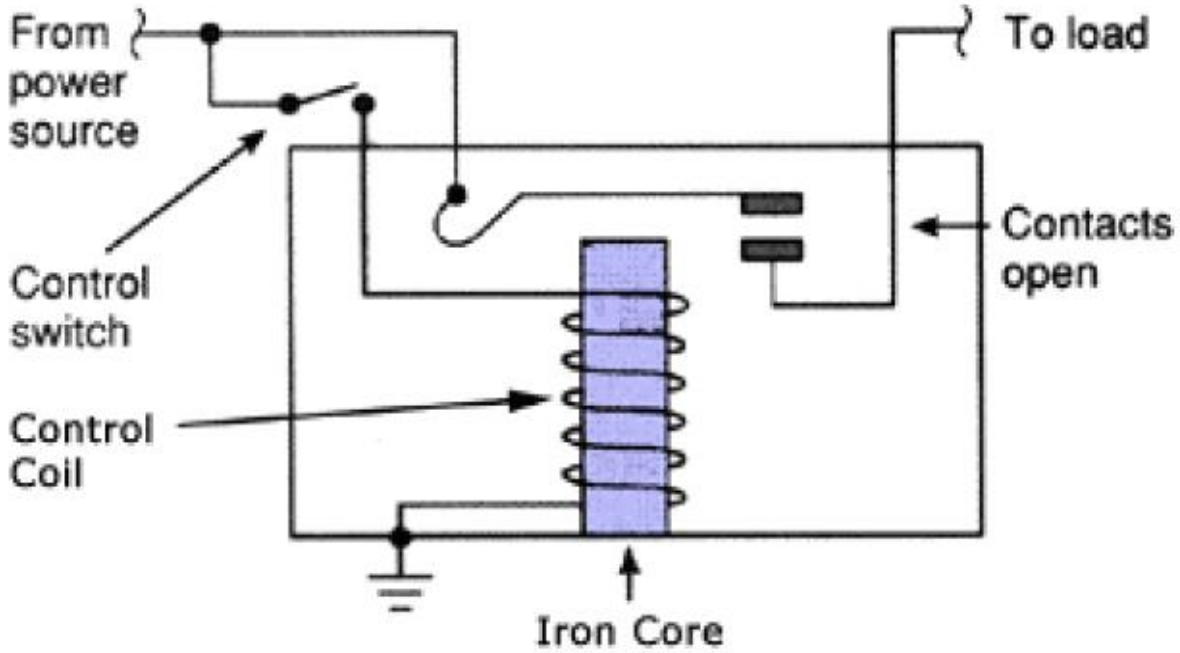
## Pre Lab Questions:

1. Can we switch a high-power device using conventional GPIO pin? Justify your answer.

Ans. We cannot switch a high-power device using conventional GPIO as it supplies only 3.3 V rather than the huge energy requirements of high power device which exceeds 3.3 V which in turn justifies why a conventional GPIO cannot switch hug power device.

2. With an aid of diagram, write the working of a relay.

Ans. A relay is an electromagnetic switch that is used to turn on and turn off a circuit by a low power signal, or where several circuits must be controlled by one signal.An iron core is surrounded by a control coil. As shown, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control coil, the electromagnet starts energizing and thus intensifies the magnetic field. Thus the upper contact arm starts to be attracted to the lower fixed arm and thus closes the contacts causing a short circuit for the power to the load. On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit.




3. Write the characteristics of high power MOSFET transistor.

Ans. High Power MOSFET characteristics are:-

- Low Cost
- Controls high power load upto 30 amps
- Helps in switching high power consuming devices.

## Post Lab Questions:

1. What are the limitations of relay?

Ans. Limitations are:-

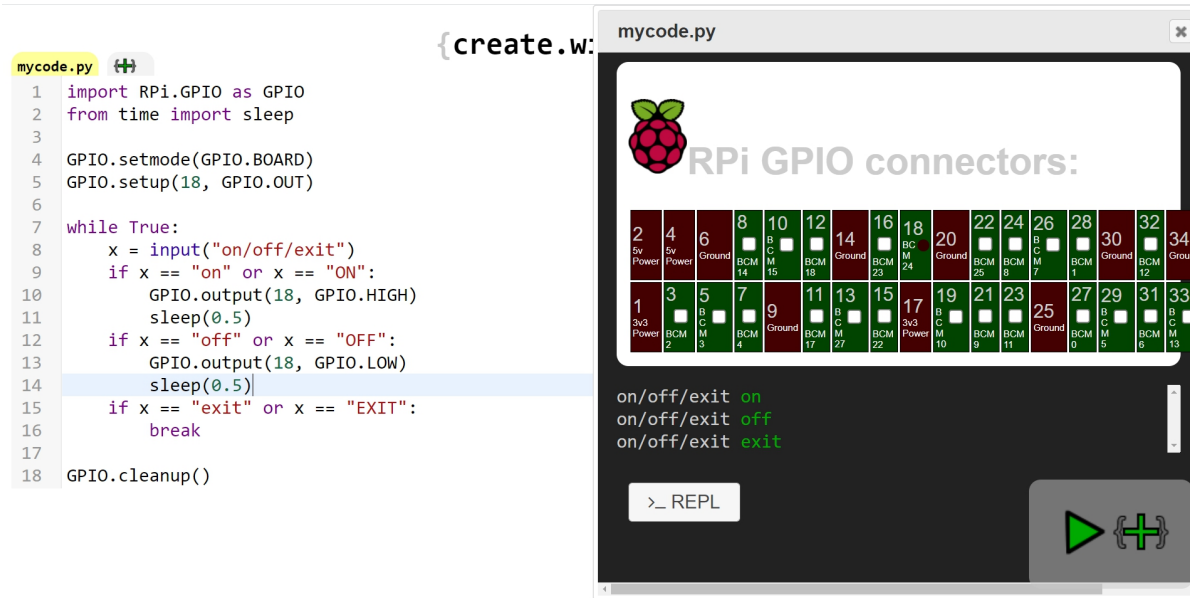
- There is a possibility of the relay becoming dangerously hot. When in doubt, overspecify the relay contacts.
- If the relay contacts are asked to exceed their specifications,then the relay's life will be shortened. There will be arcing, and the contacts may eventually fuse together.
- They are bulkier.
- They cannot switch rapidly.
- They use more power due to the power flowing through their coil.

2. Explain how to switch a 110 V or 240 V AC devices using Raspberry Pi.

Ans. Using a relay and a small transistor we can switch a 110 V or 240 V AC device using Raspberry Pi.

## Result:

### 1. Screenshot of the program window




### 2. Video(concise) link of the demo

**https://drive.google.com/file/d/1F2z8rO6vyCN4chblKuVPnehhP33oljS_/view?usp=sharing**

# LAB – 7 Programming on Interrupts

**Aim:**

To write a program to switch on LEDs for a while, as a reaction to interrupts.

# Task:

1. Configure two I/O pin for LOW to HIGH transition Interrupt source and HIGH to LOW transition Interrupt source
2. Write two Interrupt Service Routine(IRS) for LOW to HIGH transition Interrupt(ISRL2H) and HIGH to LOW transition Interrupt(ISRH2L), which will display( print)the occurrence of positive edge or negative edge Interrupt when it is called.
3. Make ON of LED1 **for a while**, if a positive edge interrupt signal occurs and call ISRL2H. Make ON of LED2 **for a while**, if the negative edge Interrupt signal occurs and call ISRH2L. Don't use inbuilt function GPIO.add_event_detect() to detect interrupt.

## Algorithm:

1. import Rpi.GPIO as GPIO and time

2. Assign required variables

3. Setmode to GPIO.BOARD

4. Set pins to input and output as per requirement

5. Declare variables

6. Give GPIO.output(led2, GPIO.HIGH)

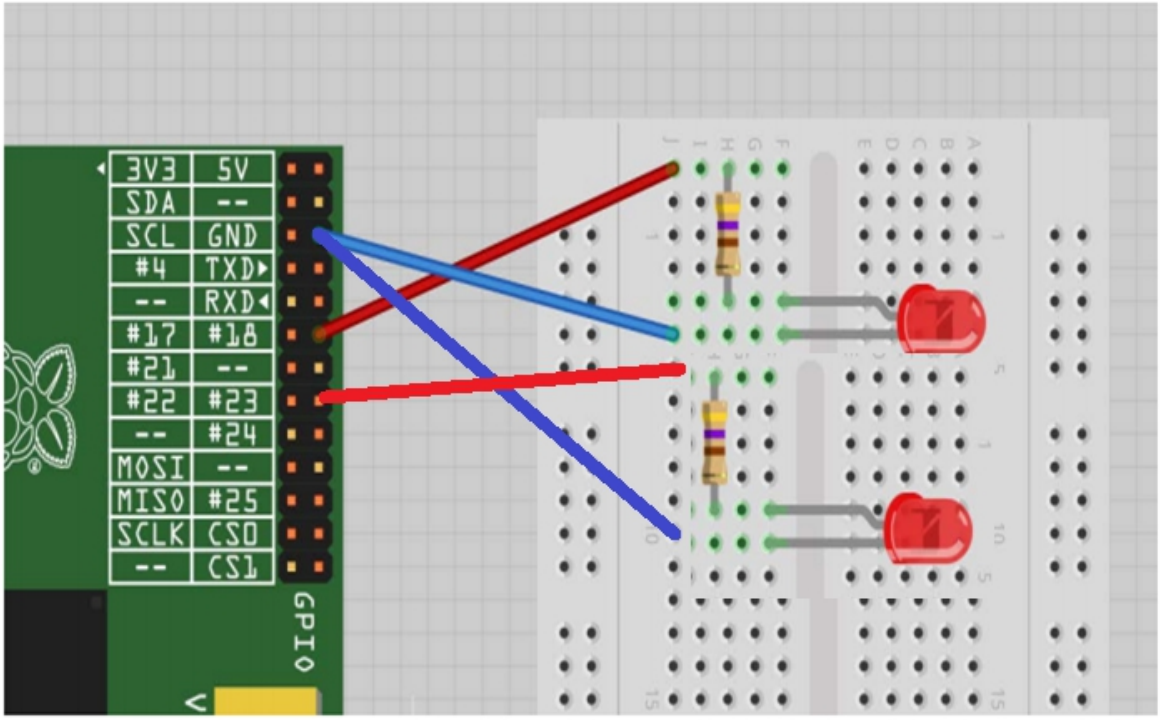
7. Create function INTL2H and inside it print Inside interrupt 1, declare global variable pos_edge, set led1 to high , add one to pos_edge, time.sleep(1),then turn led1 to low print number of positive edge , print existing interrupt 1 and then time.sleep(1)

8. Create function INTH2L and inside it print Inside interrupt 2, declare global variable neg_edge, set led2 to high , add one to

neg_edge, time.sleep(1),then turn led2 to low print number of negative edge , print existing interrupt 2 and then time.sleep(1)

9. Call a while True and inside loop give if condition where we receive Y as input interrupt 1 will be called then 2 and then use break to exit the program.

## Pin & Circuit Diagram:




Note: Interrupt sources are not shown in the figure.

**Programs:**

```
import RPi.GPIO as GPIO
import time
```

```
led1=27
led2=31
input1=29
input2=33

GPIO.setmode(GPIO.BOARD)
GPIO.setup(led1,GPIO.OUT)
GPIO.setup(led2,GPIO.OUT)
GPIO.setup(input1,GPIO.IN)
GPIO.setup(input2,GPIO.IN)

pos_edge=0
neg_edge=0

GPIO.output(led2,GPIO.HIGH)

def INTL2H():
  print("Inside Interrupt 1")
  global pos_edge
  GPIO.output(led1,GPIO.HIGH)
  pos_edge+=1
  time.sleep(1)
  GPIO.output(led1,GPIO.LOW)
  print("Number of positive edges",pos_edge)
  print("Existing interrupt 1....")
  time.sleep(1)

def INTH2L():
  print("Entering interrupt 2")
  global neg_edge
  GPIO.output(led2,GPIO.LOW)
  neg_edge=+1
  time.sleep(1)
```

```
  GPIO.output(led2,GPIO.HIGH)
  print("Number of negative edges",neg_edge)
  print("Existing interrupt 2....")
  time.sleep(1)

while True:
   if input("Press Y to enter interrupt 1")=="Y":
      INTL2H()
   if input("Press Y to enter interrupt 2")=="Y":
      INTH2L()
   if input("Press Y to exit")=="Y":
      break
```

**Pre-Lab Questions:**

1. What is polling? Write the merit and demerit of polling?

Ans. When the CPU continuously checks the status of the devices to find whether they require attention is called polling and it synchronous.
Merits :- simpler to implement, synchronous
Demerits :- Slows the speed of execution, only checks the condition when program is running.

2. Define interrupt? What do you understand by interrupt service routine?

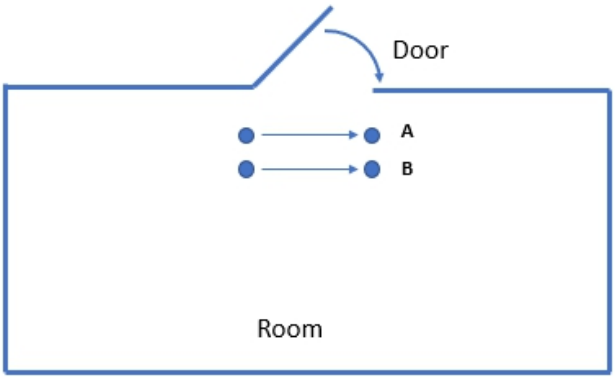
Ans. An interrupt is a signal that is sent to the processor which tells the processor that it is a high priority task and need immediate attention.
ISR defines when the interrupt should be triggered and it is a software that hardware invokes in response to an interrupt. Also it handles the triggered event of the interrupt and returns a logical interrupt value.

3. Explain the function ‘GPIO.add.event_detect( ).

Ans. It will monitor the any specified interrupt mentioned inside the function for any changes while executing the rest of the program and unlike polling it will still recognize the change even while executing other parts of the program.

**Post Lab Questions:**

1. In a room number of persons entering and leaving has to be recorded automatically. A system is installed for this. The hardware contains two Infra-Red (IR) source and detector like our TV remote and TV system. Whenever IR light is broken a movement is detected. Two sensors are spaced apart to find out whether the person is leaving or entering. Sensor A is placed first and Sensor B is placed second. So, if Sensor B is triggered then Sensor A is triggered then it is treated as leaving. If it is Sensor A and B then it is treated as entering. For clarity please refer below figure.




Write a suitable pseudo code or algorithm for above scenario. Explain the use of interrupts in this case.

Ans. Pseudo code for the above system is as follow:-

1. Import RPi.GPIO
2. From time import sleep
3. GPI.setmode(GPIO.BOARD)
4. Declare required variables
5. Setup pins as input pins
6. Inside loop while True:
7. First we create a string1 variable as empty variable
8. we check if A is low we add A to a string1 variable
9. B is triggered we add B to the string1 variable
10. The we will get AB for entering and BA for leaving in string1
11. Therefore with above conditions we create an if statement which will print entering for string1==”AB” and leaving for string1==”BA”

2)Compare edge triggering and level triggering. Out of the two which one you will prefer. Justify your answer.

Ans.

**Edge Triggering :-**

- Type of triggering that allows a circuit to become active at the positive edge or the negative edge of the clock signal.
- An event occurs at the rising edge or falling edge.
- Flip flops are edge triggered.

**Level Triggering :-**

- Type of triggering that allows a circuit to become active when the clock pulse is on a particular level.
- An event occurs during the time clock pulse is at a specific level.
- Latches are level triggered.

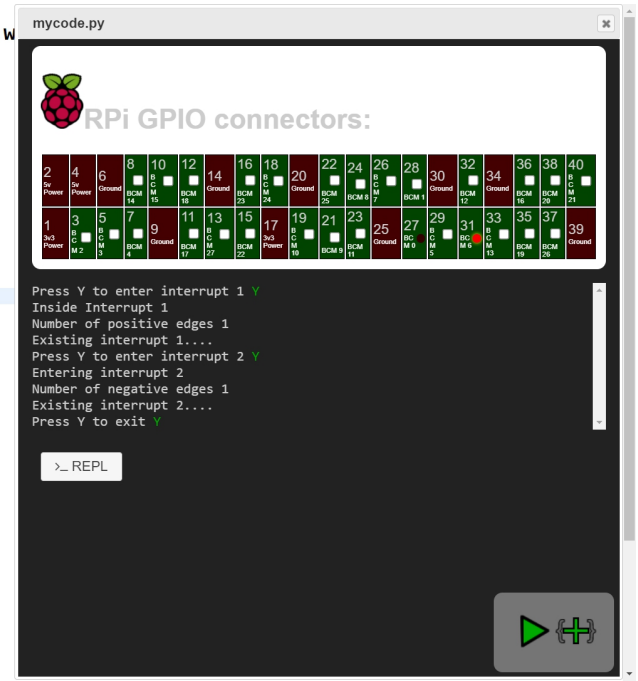
I will prefer edge triggering over level triggering as it allows device to create a very fine level trigger which is faster then all external feedback loops, allowing devices to accept inputs quickly, and then close off the entrance in time before their changing outputs will change the values of the input also it becomes to manage an event at rising edge and falling edge then maintaining a clock pulse at a high voltage or low voltage.

**Result:**

**1. Screenshot of the program window**

mycode.py

```python
import RPi.GPIO as GPIO
import time

led1=27
led2=31
input1=29
input2=33

GPIO.setmode(GPIO.BOARD)
GPIO.setup(led1,GPIO.OUT)
GPIO.setup(led2,GPIO.OUT)
GPIO.setup(input1,GPIO.IN)
GPIO.setup(input2,GPIO.IN)

pos_edge=0
neg_edge=0

GPIO.output(led2,GPIO.HIGH)

def INTL2H():
  print("Inside Interrupt 1")
  global pos_edge
  GPIO.output(led1,GPIO.HIGH)
  pos_edge+=1
  time.sleep(1)
  GPIO.output(led1,GPIO.LOW)
  print("Number of positive edges",pos_edge)
  print("Existing interrupt 1....")
  time.sleep(1)

def INTH2L():
  print("Entering interrupt 2")
  global neg_edge
  GPIO.output(led2,GPIO.LOW)
  neg_edge=+1
  time.sleep(1)
  GPIO.output(led2,GPIO.HIGH)
  print("Number of negative edges",neg_edge)
```




## 2. Video(concise) link of the demo

**https://drive.google.com/file/d/1kxdKv502GwcnnrKdwL4zPOgDzGTHhKWE/view?usp=sharing**

# LAB – 8 Programming on Stepper Motor

## Aim:

To write a program to run a stepper motor in Python.

## Task:

1. Write a Python program to run a stepper motor in Python with following conditions. Assume unipolar stepper motor. The step sequence should be '1010', '0110', '0101', '1001'. The term '1' represents excitation of stepper motor winding. The motor has to move 'forward' and 'reverse' based on user request. Assume number of steps as 2. Print the winding sequence as well as direction i.e. forward of reverse.

## Algorithm:

1. Set four pins in 'Board' mode as output pins
2. Create forward and reverse sequence.
3. Get the direction and number of steps.
4. If the direction is forward then use forward sequence to excite the winding by sending '1' in appropriate pins. If the direction is reverse then use reverse sequence to excite the winding.

## Pin & Circuit Diagram:

Figure 1. Pin Configuration of Board

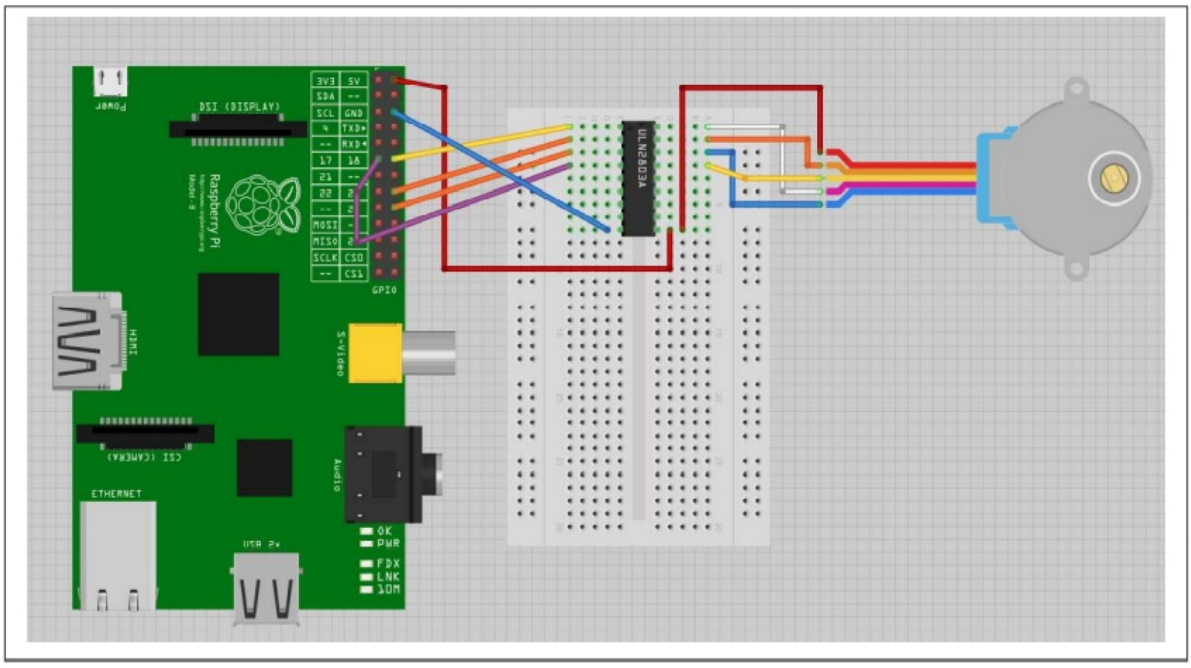



Figure 2. Raspberry Pi interfaced with unipolar stepper motor

# Programs:

```
import RPi.GPIO as GPIO
import time

GPIO.setmode(GPIO.BOARD)

coil_A1_pin = 22
coil_A2_pin = 24
coil_B1_pin = 26
coil_B2_pin = 28

GPIO.setup(coil_A1_pin, GPIO.OUT)
GPIO.setup(coil_A2_pin, GPIO.OUT)
GPIO.setup(coil_B1_pin, GPIO.OUT)
GPIO.setup(coil_B2_pin, GPIO.OUT)

forward = ['1010', '0110', '0101', '1001']
backward = ['1001', '0101', '0110', '1010']

def forw(delay, steps):
  for i in range(steps):
    for step in forward:
      print(step)
      set_step(step)
      time.sleep(delay)
```

```
def back(delay, steps):
  for i in range(steps):
    for step in backward:
      print(step)
      set_step(step)
      time.sleep(delay)

def set_step(step):
  GPIO.output(coil_A1_pin, step[0] == '1')
  GPIO.output(coil_A2_pin, step[1] == '1')
  GPIO.output(coil_B1_pin, step[2] == '1')
  GPIO.output(coil_B2_pin, step[3] == '1')

while(True):
  choice = input("Enter your choice - Forward [F/f] -Backward [B/b] - Stop [S/s]: ")

  if(choice == 'F' or choice == 'f'):
    print("Forward Motion")
    set_step('0000')
    forw(1,2)
    set_step('0000')
    time.sleep(2)

  if(choice == 'B' or choice == 'b'):
    print("Backward Motion")
    set_step('0000')
    back(1,2)
    set_step('0000')
    time.sleep(2)

  if(choice == 'S' or choice == 's'):
    print("STOP!!!")
    break
```

## Pre-Lab Questions:

1. Compare Stepper Motor, DC Motor and servo motors.

Ans.

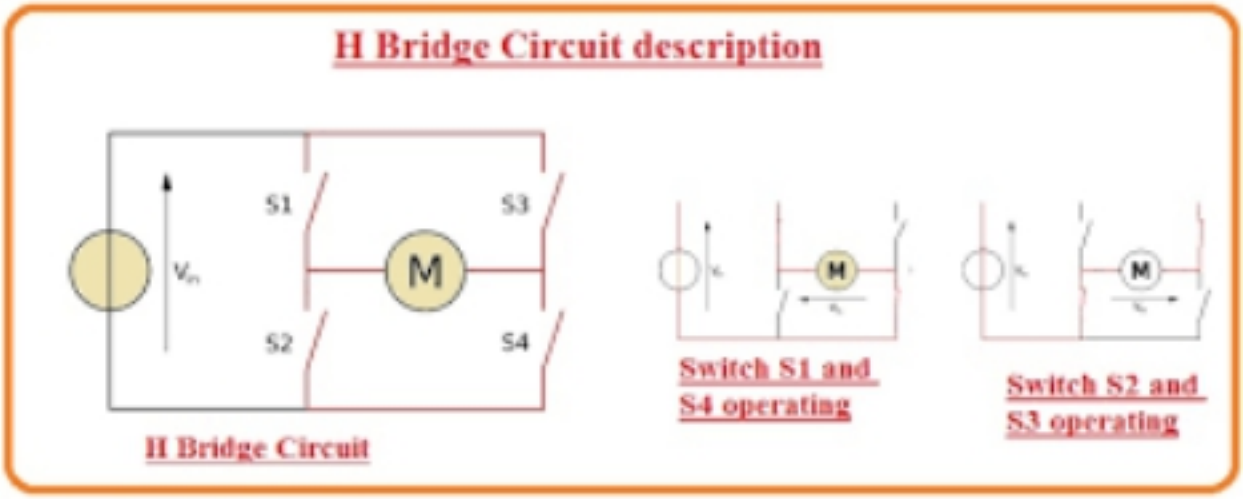
DC Motor:-
Continuous rotation motors, which start spinning as and when power is applied and stops when remove. Speed of DC motors is controlled by PWM.

Servo Motor:-
Do not rotate freely like DC motors and angle of rotation is restricted to 180 degrees.Servo motors receive a control signal that represents an output position and

applies power to the DC motor until the shaft turns to the correct position, determined by the position sensor.
Stepper Motor:-
They are different from servo and DC motor in the way that it moves in steps and to move it to a precise location we need to calculate its step angle and give the appropriate current to move it to a desired location we want.

2. Write about H-bridge. Use a figure if necessary.

Ans.An H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. There are two configurations in which the current flows in different directions at the motors terminals which help in changing the direction in which the motor is running by changing the direction of the current supplied.



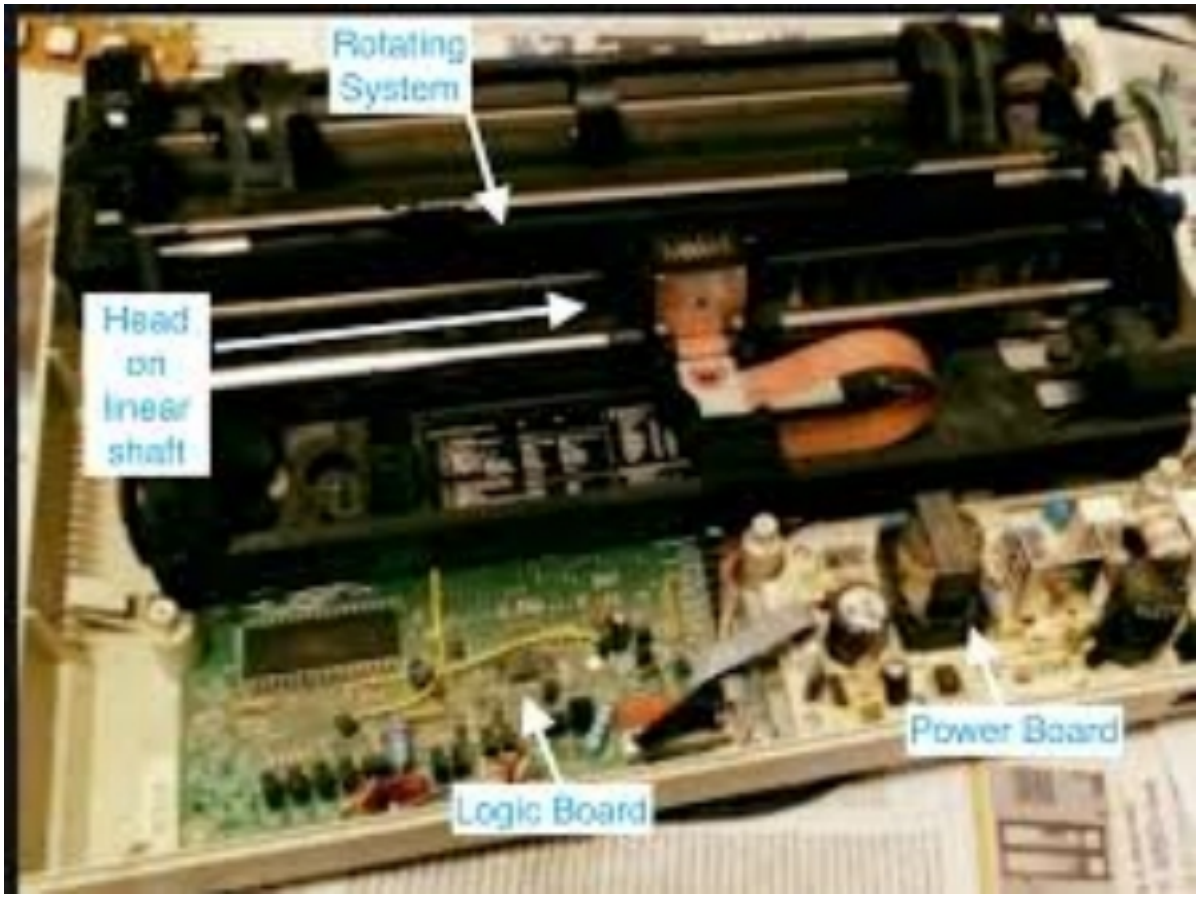

3. In this experiment the stepper motor windings were energized in sequence. Write the name of the sequence along with merits? Write the other types of sequences.

Ans. The name of the sequence is full step sequence. It's hardware and software is easy to design and because of that cost can be controlled easily. The other two types of sequence are Half and Micro step.

## Post Lab Questions:

1. Explain how stepper motor is used in printers. Use a figure if required.

Ans. It is very helpful in printers because it moves in steps of precise measurements .Stepper motor is used to move the cartridge in a to and fro motion using its step movement.That is how ink application becomes possible because of stepper motor and that is how stepper motor is used in printers.




**2.** Bring out an expression that connects Step Angle of steppe motor and number of rotor teeth.

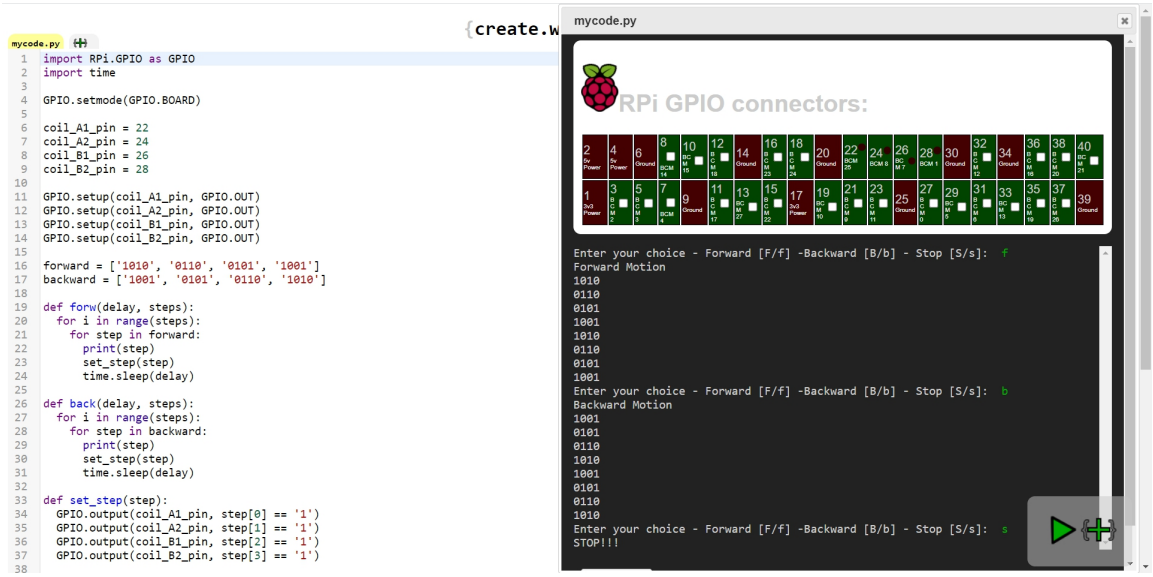
**Ans.**

**Step angle = 360 / (2* stator phaess* number of rotor teeths)**

## Result:

A Python program to run a stepper motor in Python with given conditions has been written and implemented to get the desired output.

### 1.Screenshot of the program window




## 2.Video(concise) link of the demo

https://drive.google.com/file/d/1oUWb9sf5fd4TUh0VhwLxMB30lRfmNVxa/view?usp=sharing

# LAB – 9 Programming on Switch

| | | | | | |
|---|---|---|---|---|---|
| **Course Code** | : | 18ECO109J | **Course Title** | : | Embedded System Design Raspberry Pi |
| **Reg. No.** | : | RA1911018010021 | **Name** | : | Samarth Patel |
| **Semester** | : | V Semester | **Year** | : | III Year |
| **Date of Expt.** | : | 22-09-2021 | **Date of Submission** | : | 01-10-2021 |
| **Name of Lab faculty member :** | | | | | |

## Aim:

To write a program to utilize a push switch to control an LED.

## Task:

1. To turn an LED on and off with a push switch so that it toggles between on and off each time switch is pressed.

## Algorithm:

1. Set one pin as input and another pin as output in 'Board' mode.
2. Initialize the state of LED as False and state of input state as True.
3. Read the input pin and store the Boolean value in a variable (say new_input_state)
4. Check whether new_input_state is False and the old input state is True. If yes then change the state of the LED.
5. Wait for a while.
6. Repeat the steps 4 and 5 continuously.

## Pin & Circuit Diagram:

Figure 1. Pin Configuration of Board

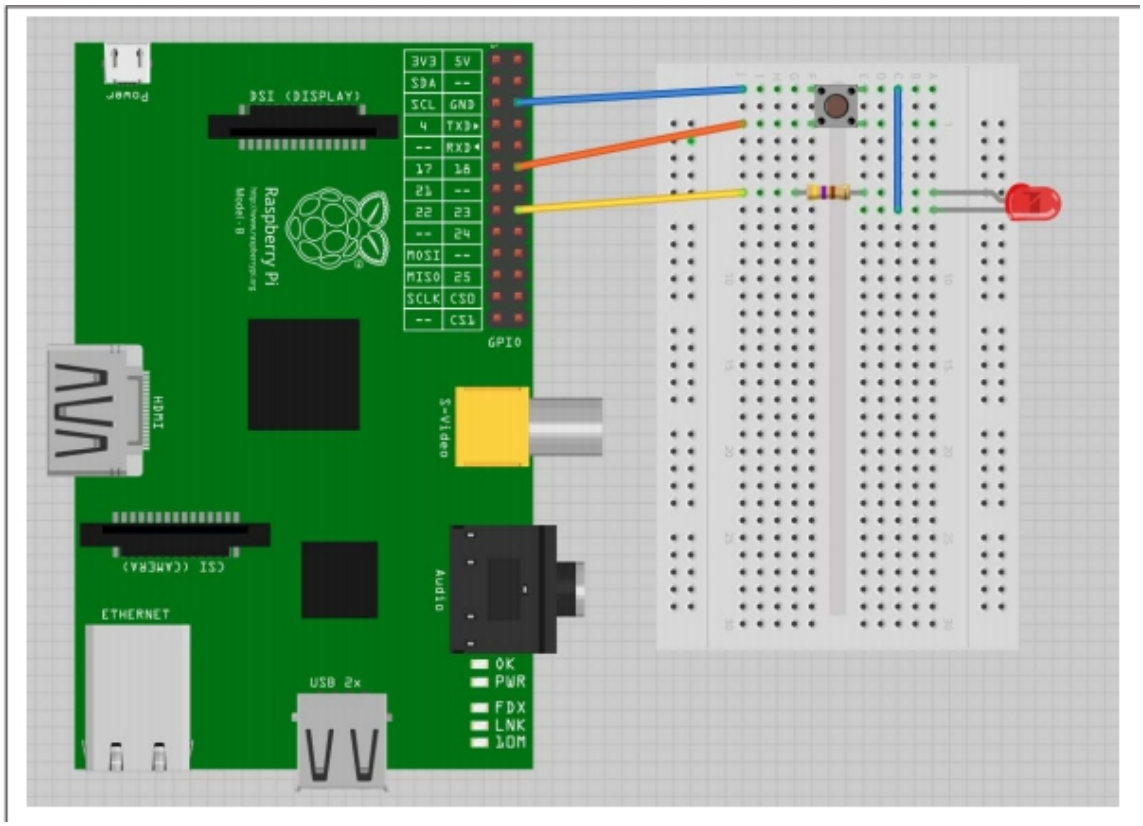



Figure 2. Raspberry Pi interfaced with a Switch and LED

# Program:

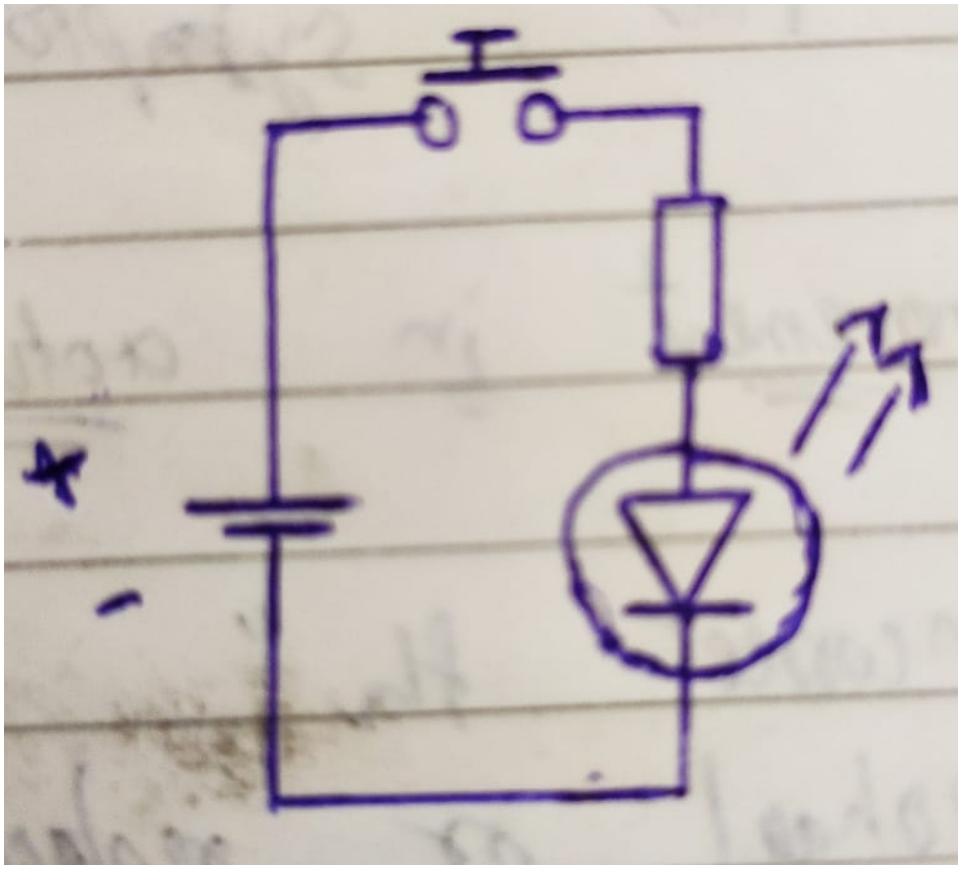
```
from gpiozero import LED,Button
led1=LED(17)
led2=LED(18)
button=Button(2)
led2.on()
while(True):
  button.wait_for_press()
  print("BUTTON PRESSED!!")
  led1.on()
```

```
led2.off()

button.wait_for_release()
print("BUTTON RELEASED!!")
led1.off()
led2.on()
```

## Pre-Lab Questions:

1. Draw a schematic of a push switch.

Ans.




2. What is meant by switch bouncing? How to overcome this problem?

Ans. It is the non-ideal behavior of any switch which generates multiple transitions of a single input and it is a major problem when dealing with a logic circuits.

We can overcome switch bouncing by using the following methods:-

- Hardware debouncing
- RC debouncing
- Switch debouncing IC

3. What is polling? Why it is not preferred?

Ans. When the CPU continuously checks the status of the devices to find whether they require attention is called polling and it synchronous.

It is not preferred because if you use polling for checking the change the program will be stuck and won't perform other tasks whereas in interrupts other tasks will also be performed and change would also be detected.

## Post Lab Questions:

1. How to build a rotary encoder using simple switches.

Ans.An encoder is a sensing device that provides feedback. Rotary Encoders are sensors that detect position and speed by converting rotational mechanical displacements into electrical signals and processing those signals. There are two main types of rotary encoder: absolute and incremental. The sequence the encoder outputs while spinning clockwise is 00, 01, 11, 10 repeat. So if you have a reading of 01, the next reading can either be 00 or 11 depending on the direction the knob is turned. To build a rotary encoder using simple switches: The switches cannot be rotated as the knob of the rotary encoder but they can be used to do function that rotary encoder with push button can do. i. In interrupts, processor is simply disturbed once any device interrupts it. But in polling, the processor waste countless processor cycles by checking the command ready line bit of each device. ii. It is not preferred because if you use polling for checking the change the program will be stuck and won't perform other tasks whereas in interrupts other tasks will also be performed and change would also be detected The push button can be used for example to navigate the cycling machine parameters. The library which is helpful for this is "ClickEncoder.h".We have to use it as switch so it can be done as click to move forward, double click to move backward digit and hold to display that the cycles are being reset and released the reset is executed.

2. Write the functions of a keyboard interface available in a computer keyboard controller. What is ghost key problem? How it is minimized? (Hint: https://cdn.thomasnet.com/ccp/10110462/133780.pdf)

Ans. The SK5100/SK5101 scans a keyboard organized by a 8x20 matrix for a maximum of 160 keys. The IC provides internal pull-ups for the row input pins. When active, the encoder selects each column line and it reads the row data lines which helps in detecting which key is pressed and when key is pressed it is debounced for 28 ms. Once key is verified it is loaded into transmit buffer.

**Ghost key problem:-** In any scanned contact switch matrix, whenever three keys defining a rectangle on the switch matrix are pressed at the same time, a fourth key positioned on the fourth corner of the rectangle is sensed as being pressed.

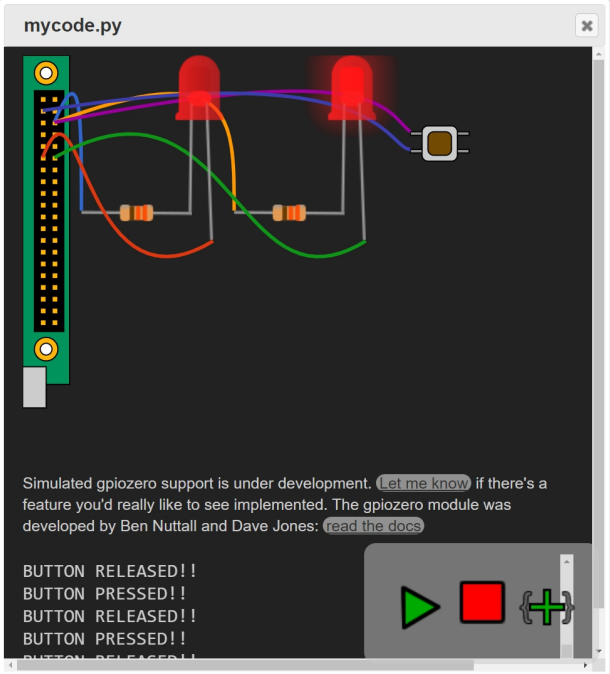
**Solution :-** Keys that are intended to be used in combinations should be placed in the same row or column of the matrix, whenever possible. Shift keys (Shift, Alt, Ctrl, Window) should not reside in the same row (or column) as any other keys. The SK5100/SK5101 has built-in mechanisms to detect and reject "ghost" keys.

## Result:

### 1. Screenshot of the program window

mycode.py

```python
from gpiozero import LED,Button
led1=LED(17)
led2=LED(18)
button=Button(2)
led2.on()
while(True):
  button.wait_for_press()
  print("BUTTON PRESSED!!")
  led1.on()
  led2.off()

  button.wait_for_release()
  print("BUTTON RELEASED!!")
  led1.off()
  led2.on()
```




## 2. Video(concise) link of the demo

**https://drive.google.com/file/d/1Z8e-BpFg_tZh_wdHH9FImks0RyPPHv_j/view?usp=sharing**

# LAB – 10 Programming on LED Matrix Display

| | | | | | |
|---|---|---|---|---|---|
| **Course Code** | : | 18ECO109J | **Course Title** | : | Embedded System Design Raspberry Pi |
| **Reg. No.** | : | RA1911018010021 | **Name** | : | Samarth Patel |
| **Semester** | : | V Semester | **Year** | : | III Year |
| **Date of Expt.** | : | 28-09-2021 | **Date of Submission** | : | 29-09-2021 |
| **Name of Lab faculty member** | : | | Suganthibrindha G | | |

## Aim:

To write a python program to display a given symbol pattern and text on the LED Matrix Display on Sense HAT platform

## Task:

1. To write a python program to display(scrolling) "SRM IST " in sensehat LED matrix display and execute it in the Sense HAT simulator
2. To write a python program to display "give way" traffic symbol and diode symbol and execute it in the Sense HAT simulator

## Algorithm:

[**algorithm is same for both the programs]

A. from sense_hat import SenseHat

B. Import time

C. s= SenseHat()

D. s.low_light = True

E. Specify array with values ranging from 0 to 255 and name them as colour created

F. Def function for printing specific output in the display

G. Create an array where the functions to be printed will be given in line

H. Count=0

I. while True:

J. s.set_pixels(images[count % len(images)]())

K. time.sleep(.75)

L. count += 1

# Pin & Circuit Diagram:

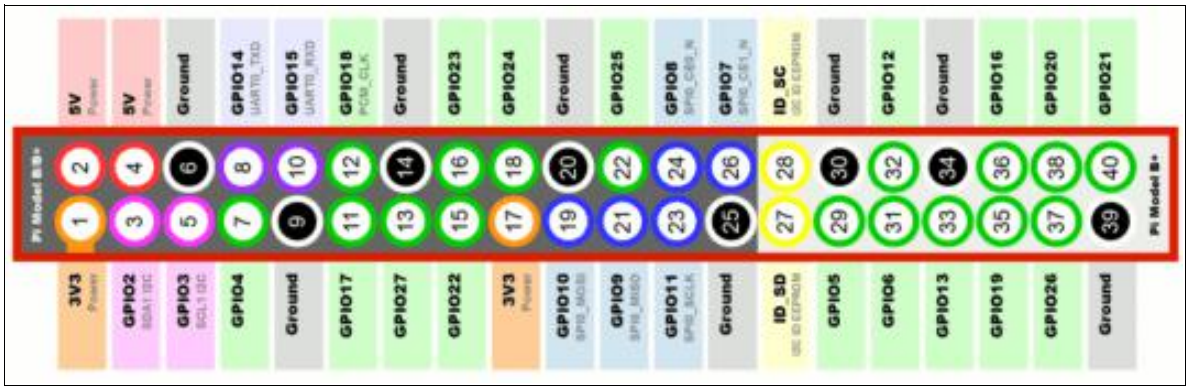



Figure 1. Pin Configuration of Board

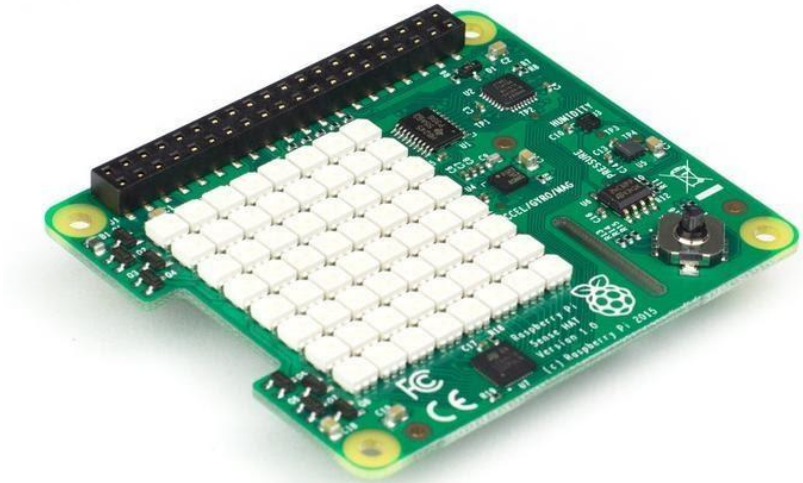


Figure 2. Raspberry Pi SenseHat board with 8x8 matrix LED display

# Program:

# 1.

exp10 1.

```
from sense_hat import SenseHat
import time

s = SenseHat()
s.low_light = True

green = (0, 255, 0)
yellow = (255, 255, 0)
blue = (0, 0, 255)
red = (255, 0, 0)
white = (255,255,255)
nothing = (0,0,0)
pink = (255,105, 180)

def s_alpha():
    P = pink
    O = nothing
    logo = [
    O, P, P, P, P, P, P, O,
    O, P, O, O, O, O, O, O,
    O, P, O, O, O, O, O, O,
    O, P, O, O, O, O, O, O,
    O, P, P, P, P, P, P, O,
    O, O, O, O, O, O, P, O,
    O, O, O, O, O, O, P, O,
    O, P, P, P, P, P, P, O,
    ]
    return logo

def r():
    P = pink
    O = nothing
    logo = [
    O, P, P, P, P, P, O, O,
    O, P, O, O, O, P, O, O,
    O, P, O, O, O, P, O, O,
    O, P, O, O, O, P, O, O,
    O, P, P, P, P, P, O, O,
    O, P, O, P, O, O, O, O,
    O, P, O, O, P, O, O, O,
    O, P, O, O, O, P, O, O,
    ]
    return logo
```

```
def m():
    P = pink
    O = nothing
    logo = [
    P, O, O, O, O, O, P, O,
    P, P, O, O, O, P, P, O,
    P, O, P, O, P, O, P, O,
    P, O, O, P, O, O, P, O,
    P, O, O, O, P, O, P, O,
    P, O, O, O, O, O, P, O,
    P, O, O, O, O, O, P, O,
    P, O, O, O, O, O, P, O,
    ]
    return logo

def i():
    P = pink
    O = nothing
    logo = [
    P, P, P, P, P, P, P, P,
    P, P, P, P, P, P, P, P,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    P, P, P, P, P, P, P, P,
    P, P, P, P, P, P, P, P,
    ]
    return logo

def t():
    P = pink
    O = nothing
    logo = [
    P, P, P, P, P, P, P, P,
    P, P, P, P, P, P, P, P,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    ]
    return logo

def space():
    P = pink
    O = nothing
    logo = [
    O, O, O, O, O, O, O, O,
```

```
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    ]
    return logo
images = [s_alpha, r, m, space, i, s_alpha, t]
count = 0

while True:
    s.set_pixels(images[count % len(images)]())
    time.sleep(.75)
    count += 1
```

# 2.

```
from sense_hat import SenseHat
import time

s = SenseHat()
s.low_light = True

green = (0, 255, 0)
yellow = (255, 255, 0)
blue = (0, 0, 255)
red = (255, 0, 0)
white = (255,255,255)
nothing = (0,0,0)
pink = (255,105, 180)

def space():
    P = pink
    O = nothing
    logo = [
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    ]
    return logo


def diode():
```

```
    P = pink
    O = nothing
    logo = [
    O, O, O, P, P, O, O, O,
    P, P, P, P, P, P, P, P,
    O, O, O, P, P, O, O, O,
    O, O, P, O, O, P, O, O,
    O, P, O, O, O, O, P, O,
    P, P, P, P, P, P, P, P,
    O, O, O, P, P, O, O, O,
    O, O, O, P, P, O, O, O,
    ]
    return logo


def giveway():
    P = pink
    O = nothing
    logo = [
    P, P, P, O, O, O, O, O,
    P, P, P, P, O, O, O, O,
    P, P, O, P, P, O, O, O,
    P, P, O, O, P, P, O, O,
    P, P, O, O, P, P, P, O,
    P, P, O, P, P, P, O, O,
    P, P, P, P, O, O, O, O,
    P, P, P, O, O, O, O, O,
    ]
    return logo

images = [diode, space, giveway, space]
count = 0

while True:
    s.set_pixels(images[count % len(images)]())
    time.sleep(.75)
    count += 1
```

## Pre-Lab Questions:

1. What is the Sense HAT board?

Ans. It is an add-on board for Raspberry Pi, made for AstroPi mission. It is an 8x8 RGB LED matrix, a five button joystick.

2. What are sensors available in Sense HAT?

Ans. Sensors available in Sense HAT are:-

- Gyroscope

- Accelerometer
- Magnetometer
- Temperature
- Barometric pressure
- Humidity

## Post Lab Questions:

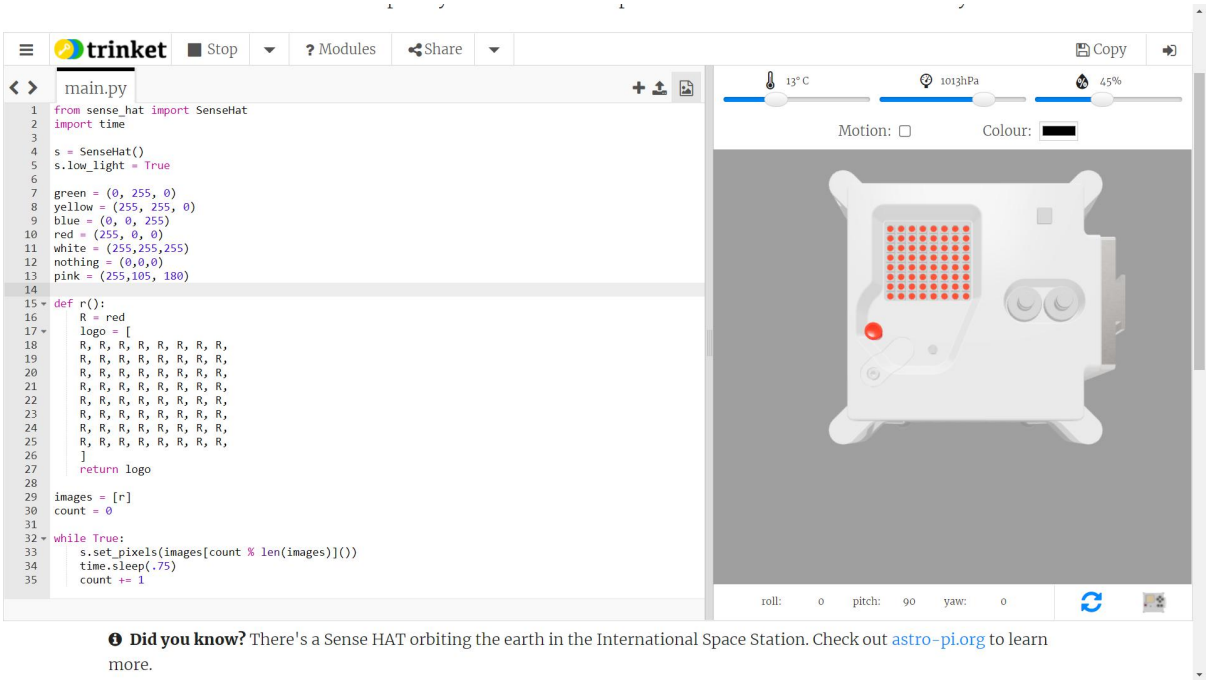
1. Write the statements to display in red clour and orange clour in Sense HAT matrix display

Ans.

**For presenting in red:-**

```
from sense_hat import SenseHat
import time

s = SenseHat()
s.low_light = True

green = (0, 255, 0)
yellow = (255, 255, 0)
blue = (0, 0, 255)
red = (255, 0, 0)
white = (255,255,255)
nothing = (0,0,0)
pink = (255,105, 180)

def r():
    R = red
    logo = [
    R, R, R, R, R, R, R, R,
    R, R, R, R, R, R, R, R,
    R, R, R, R, R, R, R, R,
    R, R, R, R, R, R, R, R,
    R, R, R, R, R, R, R, R,
    R, R, R, R, R, R, R, R,
    R, R, R, R, R, R, R, R,
    R, R, R, R, R, R, R, R,
    ]
    return logo

images = [r]
count = 0

while True:
    s.set_pixels(images[count % len(images)]())
```

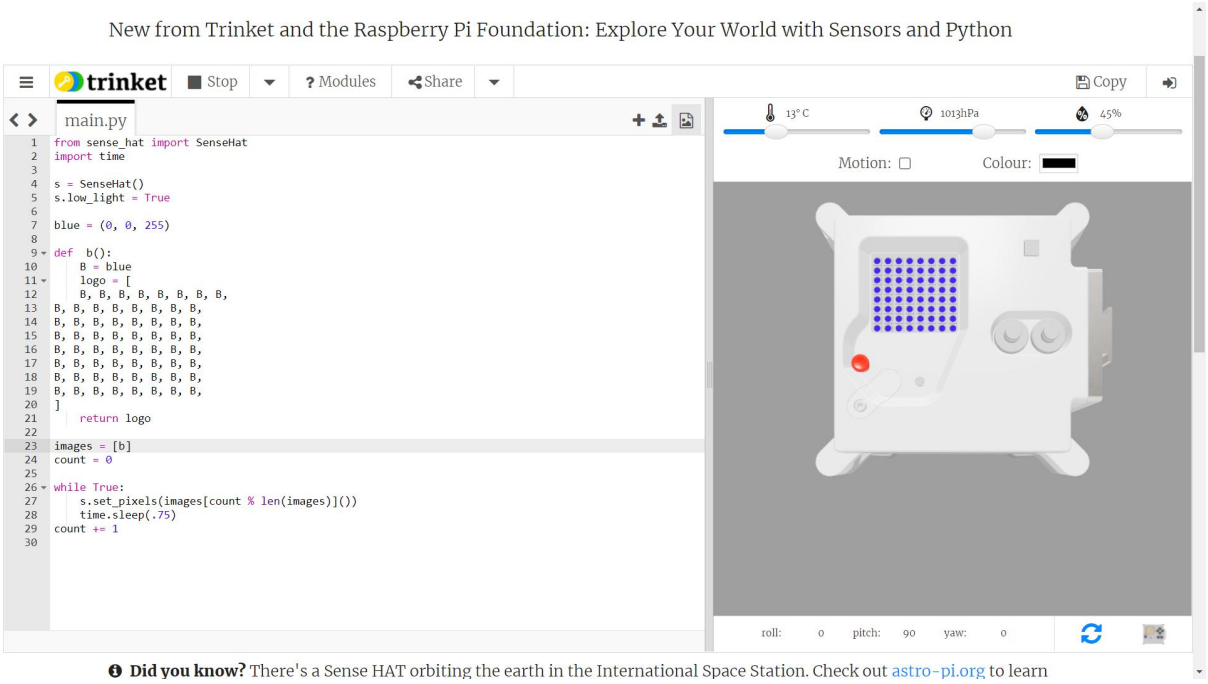
```
    time.sleep(.75)
    count += 1
```




**For presenting in blue:-**

```
from sense_hat import SenseHat
import time

s = SenseHat()
s.low_light = True

blue = (0, 0, 255)

def  b():
    B = blue
    logo = [
    B, B, B, B, B, B, B, B,
    B, B, B, B, B, B, B, B,
    B, B, B, B, B, B, B, B,
    B, B, B, B, B, B, B, B,
    B, B, B, B, B, B, B, B,
    B, B, B, B, B, B, B, B,
    B, B, B, B, B, B, B, B,
    B, B, B, B, B, B, B, B,
    ]
    return logo

images = [b]
count = 0

while True:
```

```
s.set_pixels(images[count % len(images)]())
time.sleep(.75)
count += 1
```

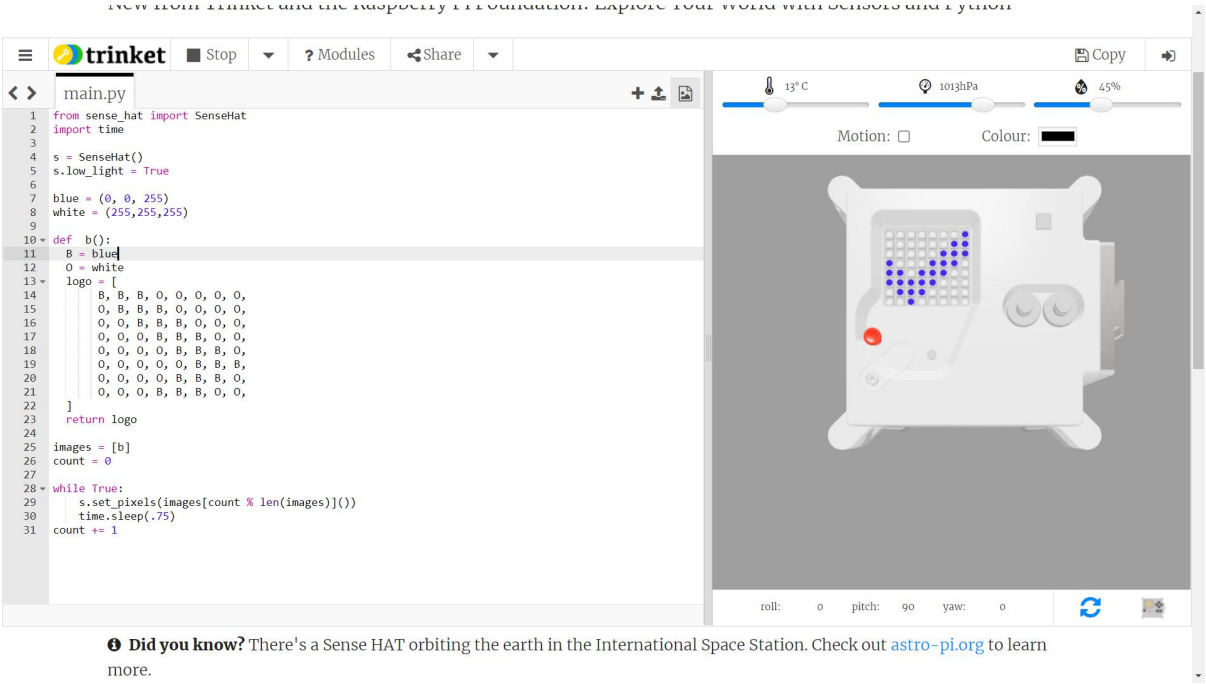



2. Give the python code to display Nike symbol in blue color

Ans.

```
from sense_hat import SenseHat
import time

s = SenseHat()
s.low_light = True

blue = (0, 0, 255)
white = (255,255,255)

def  b():
  B = blue
  O = white
  logo = [
      B, B, B, O, O, O, O, O,
      O, B, B, B, O, O, O, O,
      O, O, B, B, B, O, O, O,
      O, O, O, B, B, B, O, O,
      O, O, O, O, B, B, B, O,
      O, O, O, O, O, B, B, B,
      O, O, O, O, B, B, B, O,
      O, O, O, B, B, B, O, O,
  ]
```

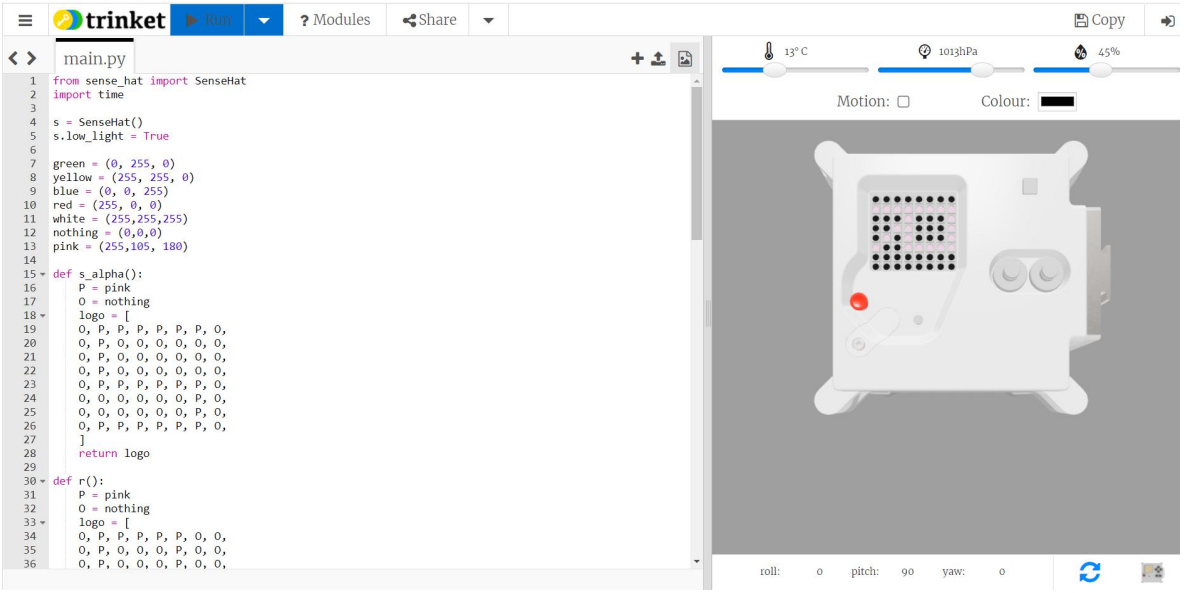
```
  return logo

images = [b]
count = 0

while True:
    s.set_pixels(images[count % len(images)]())
    time.sleep(.75)
count += 1
```



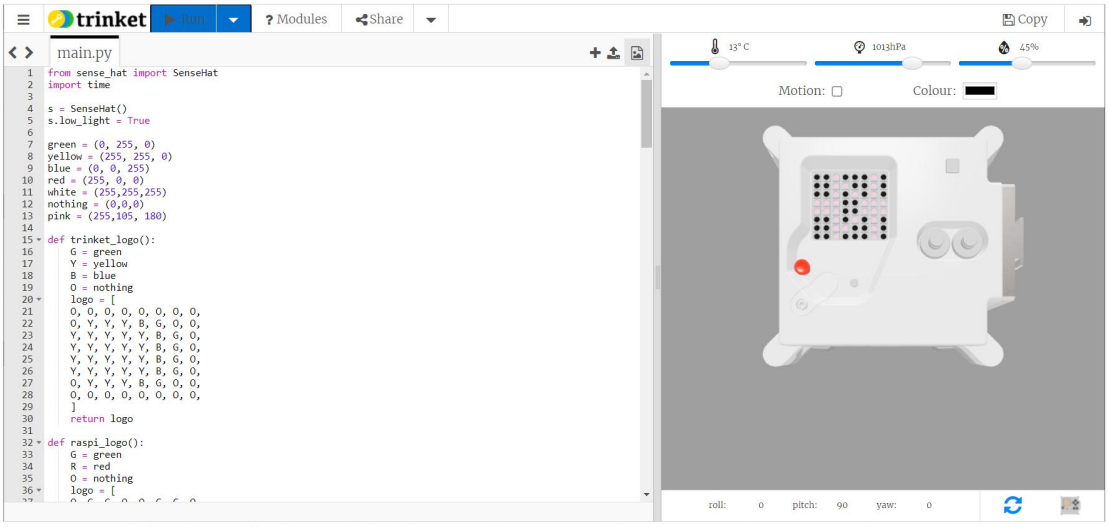

# Result:

## 1. Screenshot of the program window

## Task 1:-



## Task 2:-



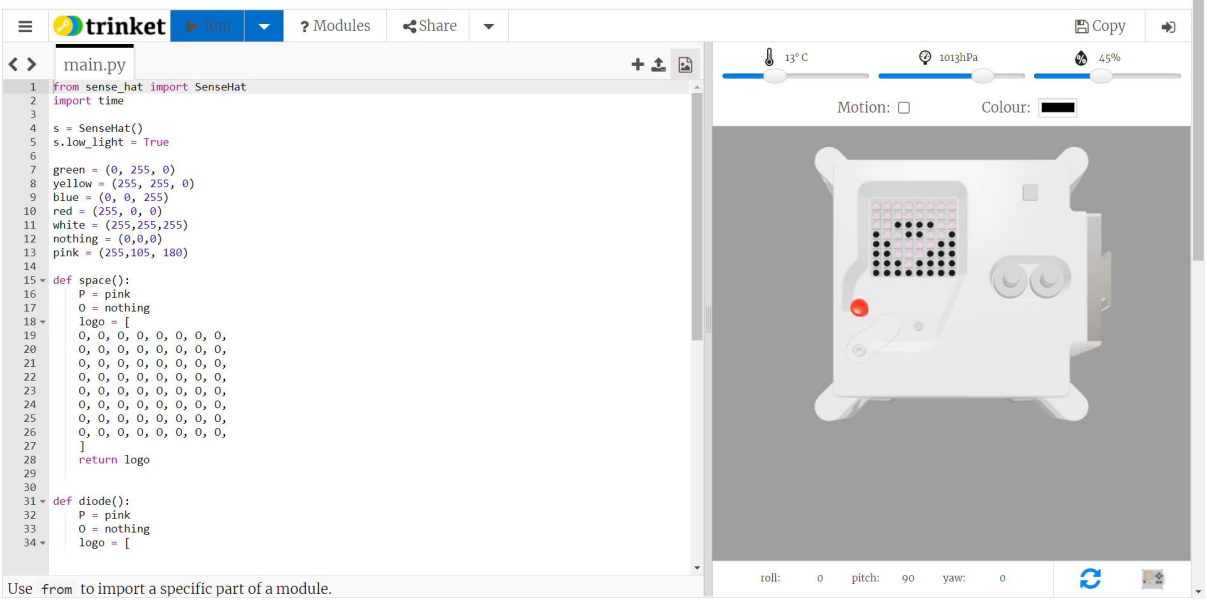

```
from sense_hat import SenseHat
import time

s = SenseHat()
s.low_light = True

green = (0, 255, 0)
yellow = (255, 255, 0)
blue = (0, 0, 255)
red = (255, 0, 0)
white = (255,255,255)
nothing = (0,0,0)
pink = (255,105, 180)

def trinket_logo():
    G = green
    Y = yellow
    B = blue
    O = nothing
    logo = [
    O, O, O, O, O, O, O, O,
    O, Y, Y, Y, B, G, O, O,
    Y, Y, Y, Y, Y, B, G, O,
    Y, Y, Y, Y, Y, B, G, O,
    Y, Y, Y, Y, Y, B, G, O,
    Y, Y, Y, Y, Y, B, G, O,
    O, Y, Y, Y, B, G, O, O,
    O, O, O, O, O, O, O, O,
    ]
    return logo

def raspi_logo():
    G = green
    R = red
    O = nothing
    logo = [
```

**Did you know?** There's a Sense HAT orbiting the earth in the International Space Station. Check out astro-pi.org to learn more.

Try out some of the example Python programs below to see what the Sense HAT can do. You can use the Sense HAT features from your own Python trinkets by typing `import sense_hat` at the top!

### Code the Sense HAT in Your Browser!

New from Trinket and the Raspberry Pi Foundation: Explore Your World with Sensors and Python




```
from sense_hat import SenseHat
import time

s = SenseHat()
s.low_light = True

green = (0, 255, 0)
yellow = (255, 255, 0)
blue = (0, 0, 255)
red = (255, 0, 0)
white = (255,255,255)
nothing = (0,0,0)
pink = (255,105, 180)

def space():
    P = pink
    O = nothing
    logo = [
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    O, O, O, O, O, O, O, O,
    ]
    return logo


def diode():
    P = pink
    O = nothing
    logo = [
```

## 2. Video(concise) link of the demo

**Task 1:-**

**https://drive.google.com/file/d/1p-zYSHG92nwJCe-RjUHxs3tQxghJ_U1n/view?usp=sharing**

**Task 2:-**

**https://drive.google.com/file/d/1rZfjCRuNRidnm0rQ0ZQsyU5P0CUVAoBu/view?usp=sharing**

# LAB – 11 Programming on WebServer

| | | | | | |
|---|---|---|---|---|---|
| **Course Code** | : | 18ECO109J | **Course Title** | : | Embedded System Design Raspberry Pi |
| **Reg. No.** | : | RA1911018010021 | **Name** | : | Samarth Patel |
| **Semester** | : | V Semester | **Year** | : | III Year |
| **Date of Expt.** | : | 20.10.2021 | **Date of Submission** | : | 15.11.2021 |
| **Name of Lab faculty member :** | | | | | |

## Aim:

To write a python program to display sensor data value on a web page(localhost) using the bottle library on any python IDE.

## Task:

1. To write a python program to display temperature, humidity, wind speed data and rain sensor data (rainy or not) in a webpage(localhost) using JSON format using bottle library (get sensor data from user and which is coming from a sensor )

## Algorithm:

1. import route and run request from bottle
2. Get temperature, humidity, windspeed and rainy or not from the user
3. Define the getsens
4. sensor_log=[{'sensor':'Temperature','value':tempr},

{'sensor':'humidity','value':hum},

{'sensor':'wind speed','value':ws},

{'sensor':'rain','value':rain}]

5. return dict(sensor_log)
6. Give hostname, port and debug as true to execute the program

## Program:

```
 from bottle import route,run,request
tempr=input("enter the temperature value:")
hum=input("enter the humidity:")
ws=input("enter the windspeed:")
rain=input("enter rainy or not:")
@route('/')
def getsens():
sensor_log=[{'sensor':'Temperature','value':tempr},
{'sensor':'humidity','value':hum},
{'sensor':'wind speed','value':ws},
{'sensor':'rain','value':rain}]
return dict(data=sensor_log)
run(host='localhost',port=7000,debug=True)
```

## Pre-Lab Questions:

1. What is the JSON format?

Ans. It stand for JavaScript Object Notation. JSON is a lightweight data-interchange format. JSON is plain text written in JavaScript object notation. It is used to send data between computers.

2. Why is the JSON format used on the webpage?

Ans.One of the main functions of JSON is to transmit data between web application and server. The standard is clean and clear which makes it more productive and more useful.

## Post Lab Questions:

1. Write the statements to run the webserver in localhost at port 8080 in bottle library

Ans.
```
@route('/message')
def hello():
return "Today is a beautiful day"
run(host='localhost', port=8080, debug=True)
```

2. How is HTTP request methods handled in the bottle? give an example code

Ans. The HTTP protocol defines several request method (sometimes referred to as “verbs”) for different tasks. GET is the default for all routes with no other method specified. These routes will

match GET requests only.To handle other methods such as POST, PUT, DELETE or PATCH, add a method keyword argument to the route() decorator or use one of the five alternative decorators: get(), post(), put(), delete() or patch().

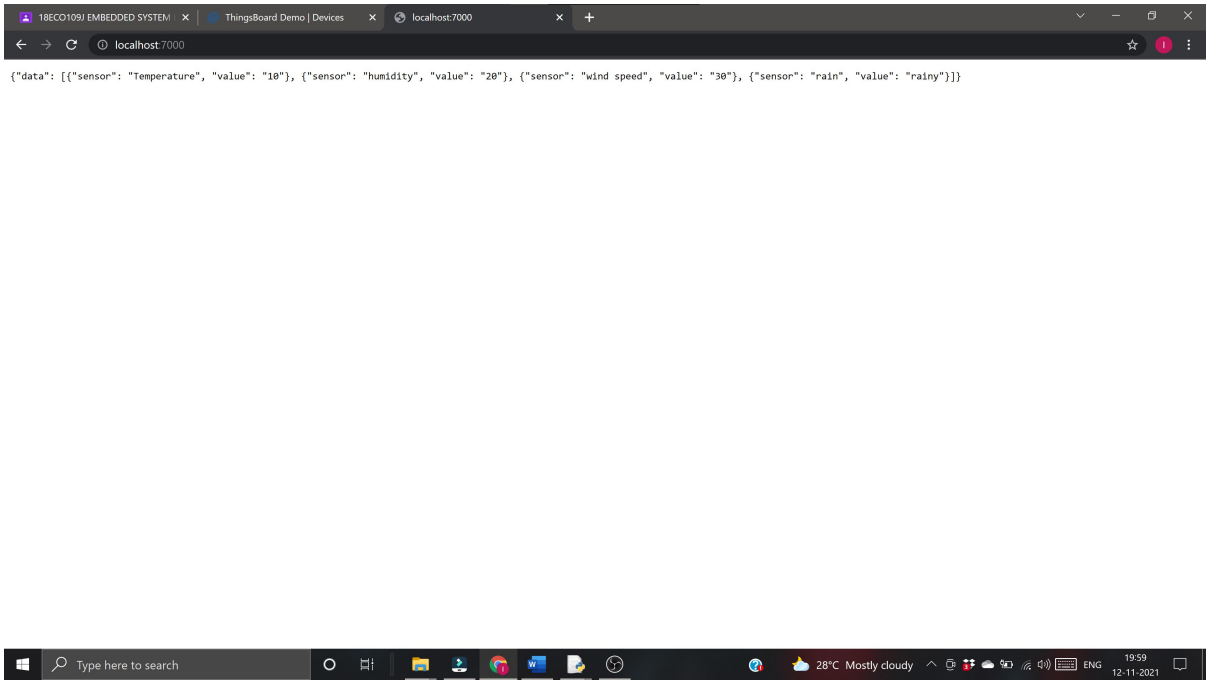
Example code:

```
from bottle import get, post, request

@get('/login'

def login():

    return

def do_login:

    username = request.forms.get('username')

    password = request.forms.get('password')

if check_login(username, password):

    return

else

    return
```

## Result:

### 1. Screenshot of the program window

```
enter the temperature value10
enter the humidity20
enter the windspeed30
enter rainy or notrainy
Bottle v0.12.19 server starting up (using WSGIRefServer())...
Listening on http://localhost:7000/
Hit Ctrl-C to quit.

127.0.0.1 - - [12/Nov/2021 19:59:09] "GET / HTTP/1.1" 200 170
```




## 2. Video(concise) link of the demo

https://drive.google.com/file/d/1W0dS9F7Zh6gRoqmz42paG1TuE5bD7n1k/view?usp=sharing

# LAB – 12 -Pushing Data to Thingsboard Open-source IoT Platform Using MQTT Protocol

| | | | | | |
|---|---|---|---|---|---|
| **Course Code** | : | 18ECO109J | **Course Title** | : | Embedded System Design Raspberry Pi |
| **Reg. No.** | : | RA1911018010021 | **Name** | : | Samarth Patel |
| **Semester** | : | Semester | **Year** | : | III Year |
| **Date of Expt.** | : | 08.11.2021 | **Date of Submission** | : | 20.11.2021 |
| **Name of Lab faculty member :** | | | Suganthi Brindha G | | |

## Aim:

To write a python program to push and display sensor data value on thingsboard web page using the MQTT Protocol using any python IDE.

## Task:

1. Install pho-mqtt in any python IDE (follow the procedure given in theory class)
2. Create a account in www.thingsboard.io and create a device (follow the procedure given in theory class)
3. Create ACCESS TOKEN for the device and use it in the python MQTT Protocol client program (follow the procedure given in theory class)
4. Write python MQTT Protocol client program to push and display temperature, humidity, wind speed data and rain sensor data (rainy or not) in a webpage of www.thingsboard.io using JSON format using pho-mqtt library (get sensor data from user and assume that which is coming from a sensor )
5. Diplay the pushed sensor data by the task 4 code in www.thingsboard.io by Creating a dashboard with Analogue gauges WIDGET(follow the procedure given in theory class)

## Algorithm:

1. Import paho.mqtt.client as mqttt

2. Import .json
3. Assign host = ‘demo.thingsboard.io’
4. Copy and paste the access token from the thingsboard dashboard
5. Assign the sensor datas which we want in sensor_data
6. Assign client
7. In while True: loop give the sensor data values
8. Repeat the same procedure for humidity, windspeed, rain sensor and give the obtained values for the sensors
9. Make the client connection
10. Publish the client connection
11. Disconnect the client

## Program:

```
  from time import  sleep
import paho.mqtt.client as mqtt
import json



host='demo.thingsboard.io'
access_token='A9APvLsF7ri4GS8eodOU'

sensor_data={'temperature':0,'humidity':0,'windspeed':0,'rain sensor':'not rainy'}
client=mqtt.Client()

client.username_pw_set(access_token)



while True:
   sensor_data['temperature']=70

   sensor_data['humidity']=40
   sensor_data['windspeed']=50
   sensor_data['rain sensor']='not rainy'
   client.connect(host, 1883,20)

   client.publish('v/devices/me/telemetry', json.dumps(sensor_data),1)
   client.disconnect()

   sleep(10)
```

## Pre-Lab Questions:

1. What is the MQTT protocol? Why is it used in the IoT system?

Ans.

- MQTT is the standard protocol for messaging and data exchange forthe Internet of Things. The protocol uses a publish/subscribe architecture. The technology provides a scalable and cost-effective way to connect devices over the Internet.
- MQTT is a lightweight publish/subscribe messaging protocol designed for low-bandwidth, high latency, unreliable networks. MQTT's featuresmake it an excellent option for sending high volumes of sensor messages to analytics platforms and cloud solutions

2. What is the ThingsBoard platform? List the cabality/support provided by ThingsBoard ?

Ans.

- ThingsBoard is an open-source IoT platform that enables rapid development, management, and scaling of IoT projects. Our goal is to provide theout-of-the-box IoT cloud or on-premises solution that will enable server-side infrastructure for your IoT applications.
- Support provided by thingsboard consists of smart metering, smart energy, smart farming and fleet tracking.

## Post Lab Questions:

1. Write the statements to connect MQTT client to ThingsBoard keepalive time of 5 seconds and explain

Ans.**client.connect(host, 1883, 5)**

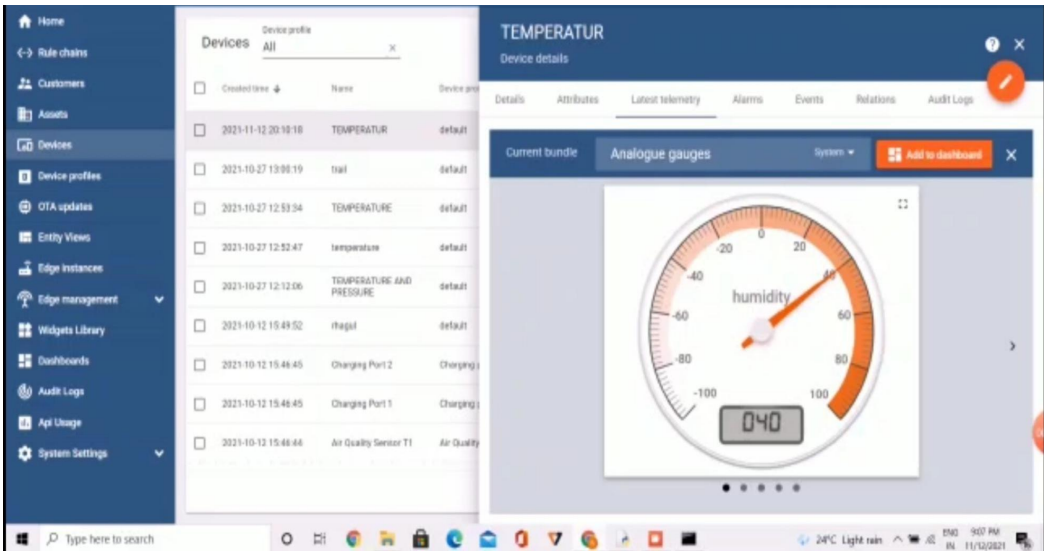
In this statement the **client.connect( )** function has three important functions. The first one is for calling the host. The second one is the default MQTT port (1883) and the final one is the keepalive time of wanted seconds.

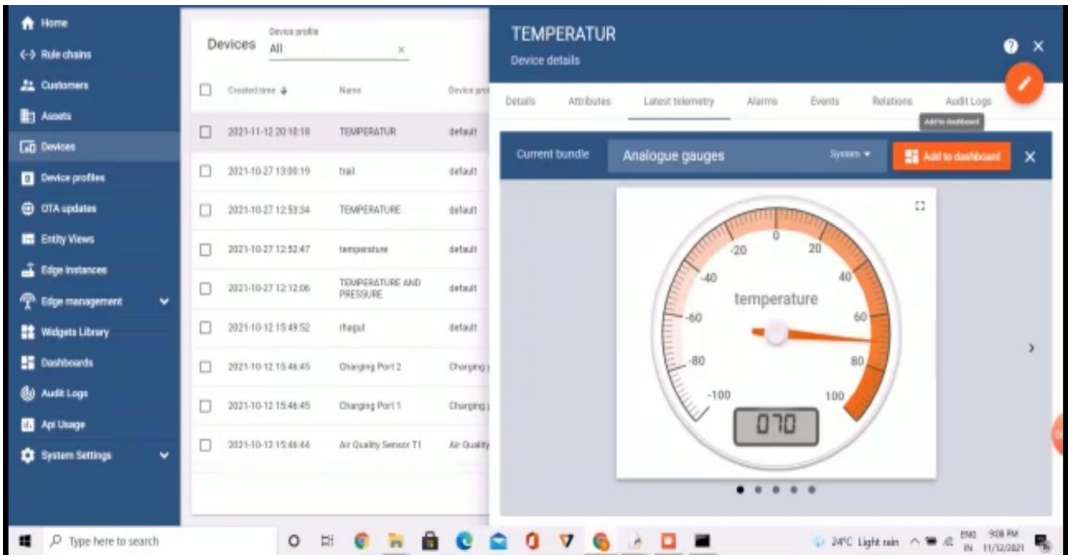
2. Write the statements to publish data from MQTT client using JSON format to ThingsBoard and explain

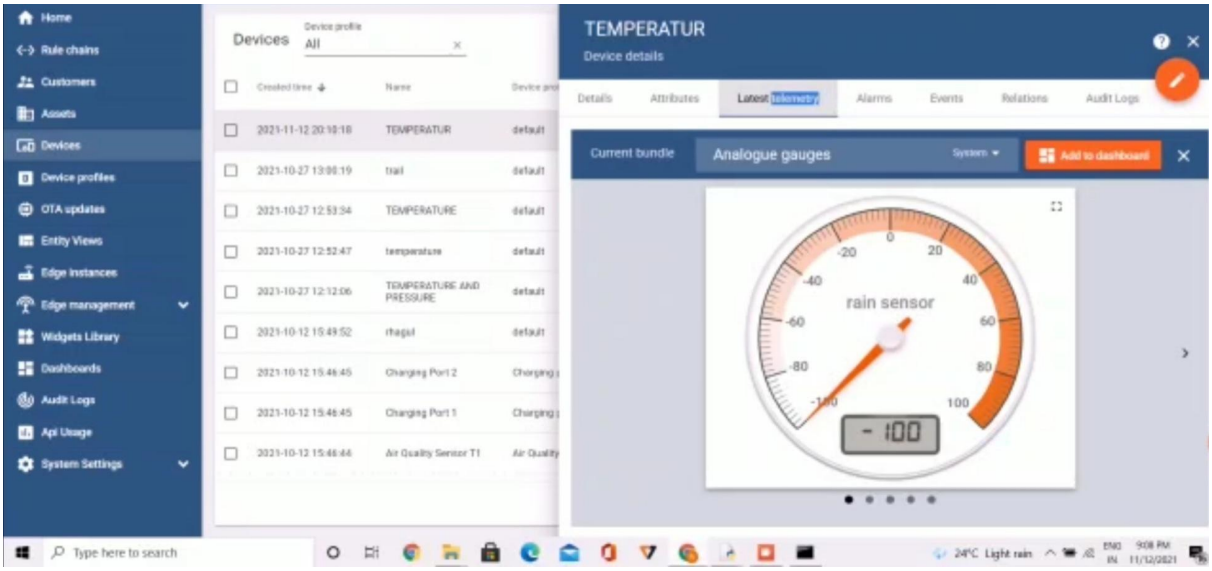
**Ans. client.publish('V/devices/me/telemetry',json.dumps(sensor_data),1)**

## Result:

### 1. Screenshot of the program window


Home
Rule chains
Customers
Assets
Devices
Device profiles
OTA updates
Entity Views
Edge instances
Edge management
Widgets Library
Dashboards
Audit Logs
Api Usage
System Settings
Devices
Device profile
All
TEMPERATUR
Device details
Details
Attributes
Latest telemetry
Alarms
Events
Relations
Audit Logs
Current bundle
Analogue gauges
Add to dashboard
humidity
040
Type here to search


Home
Rule chains
Customers
Assets
Devices
Device profiles
OTA updates
Entity Views
Edge instances
Edge management
Widgets Library
Dashboards
Audit Logs
Api Usage
System Settings
Devices
Device profile
All
TEMPERATUR
Device details
Details
Attributes
Latest telemetry
Alarms
Events
Relations
Audit Logs
Current bundle
Analogue gauges
Add to dashboard
temperature
070
Type here to search




## 2. Video(concise) link of the demo

**https://drive.google.com/file/d/1Dq1nIUW87D2J6WK9MkJe9jwBq2SU5_w2/view?usp=sharing**

SRM Institute of Science and Technology

College of Engineering and Technology

Department of Electronics and Communication Engineering

**18ECO109J-Embedded System Design Using Raspberry Pi**
**2021-22 (Odd Semester)**

# Mini Project Report

**Name** : **Samarth Patel**

**Register No.** : **RA1911018010021**

**Day / Session** : 03-11-2021

**Venue** : Raspberry Pi Lab

**Project Title** : Smart Traffic Management System

**Lab Supervisor** : Ms. G. Suganthi Brindha

**Team Members** : Parth Panchal (RA1911018010073)

Pranshu Sharma (RA1911018010078)

| **Particulars** | **Max. Marks** | **Marks Obtained** |
|---|---|---|
| Objective & Description | 05 | |
| Algorithm,Flowchart,Program | 10 | |
| Presentation | 10 | |
| Results | 10 | |
| Viva | 10 | |
| Report | 05 | |
| **Total** | **50** | |

**REPORT VERIFICATION**

**Date** : 03-11-2021

**Staff Name** : Ms. G. Suganthi Brindha

# Title

## Objectives:

The objective of this project is to develop a smart traffic management system by using sensors, raspberry pi and python programming to manage traffic situations on road efficiently and also decrease carbon emissions.

## Abstract:

In today's world as the number of vehicles owned by a single family increasing as well as the standard living, resulting in more number of vehicles bought every year which are out on our streets resulting in traffic jams on roads. We have the current system of traffic signals where there is only a fixed timer for every lane regardless of the amount of vehicles on the lane. So we have developed a smart system where we will use ultrasonic sensor to detect which lane has more traffic and change the timer accordingly to ease traffic on that lane and the same for all the lanes at the intersection which will help in easing traffic based on the traffic on individual lanes. Also it will help in decreasing pollution as a vehicle is more polluting the environment when it has to stop and start and then run again once then to just keep driving it which will be facilitated by the increased timer resulting in less number of vehicles stopping at the traffic resulting in less pollution when seen at every intersection as there will be a huge number of vehicles which won't be stopping and then running which will help in lesser pollution too. This is how our smart traffic management system is useful as it eases traffic and also helps in reducing pollution.

## Hardware/Software Requirements:

Hardware Requirement:

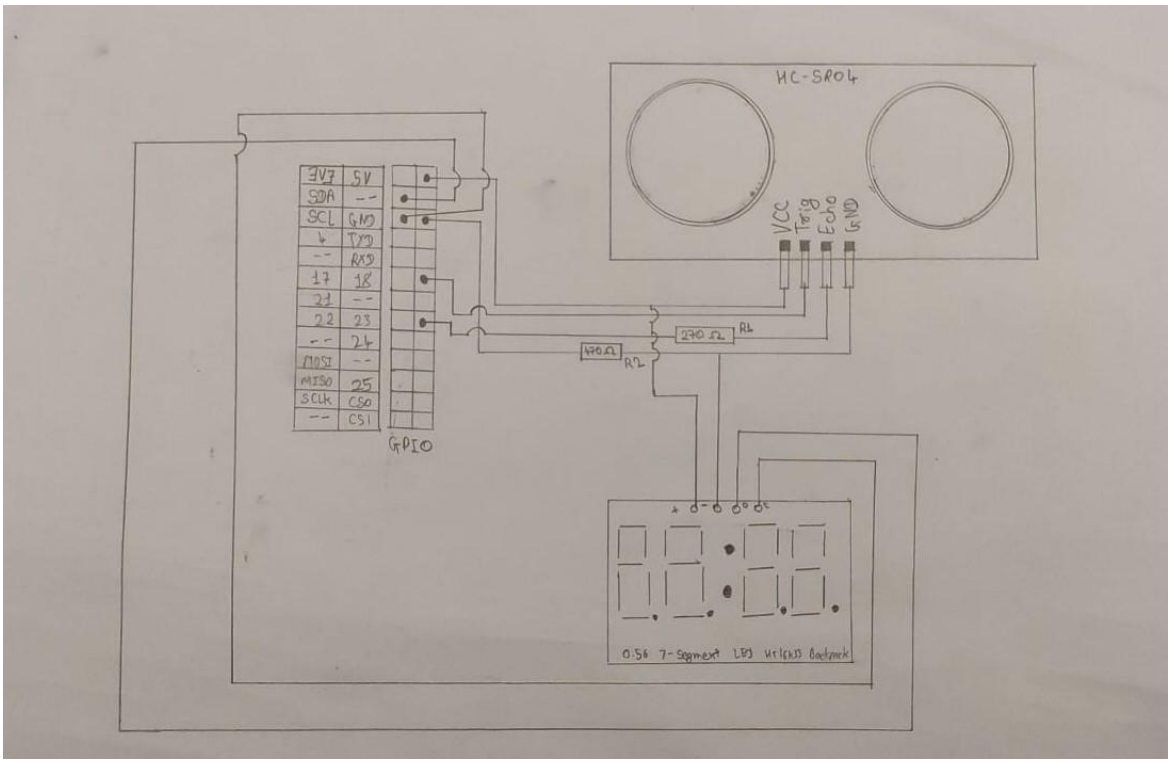
- Raspberry Pi Board
- Ultrasonic Sensor (HC-SR04)
- 0.56'' 7-segment LED HT16K33 Backpack
- Resistors (270 Ω, 470 Ω)

- Wires

Software Requirement:

- https://create.withcode.uk/ (for simulation purpose)
- https://app.diagrams.net/ (for making flowchart)

## Block Diagram/Connection Diagram:



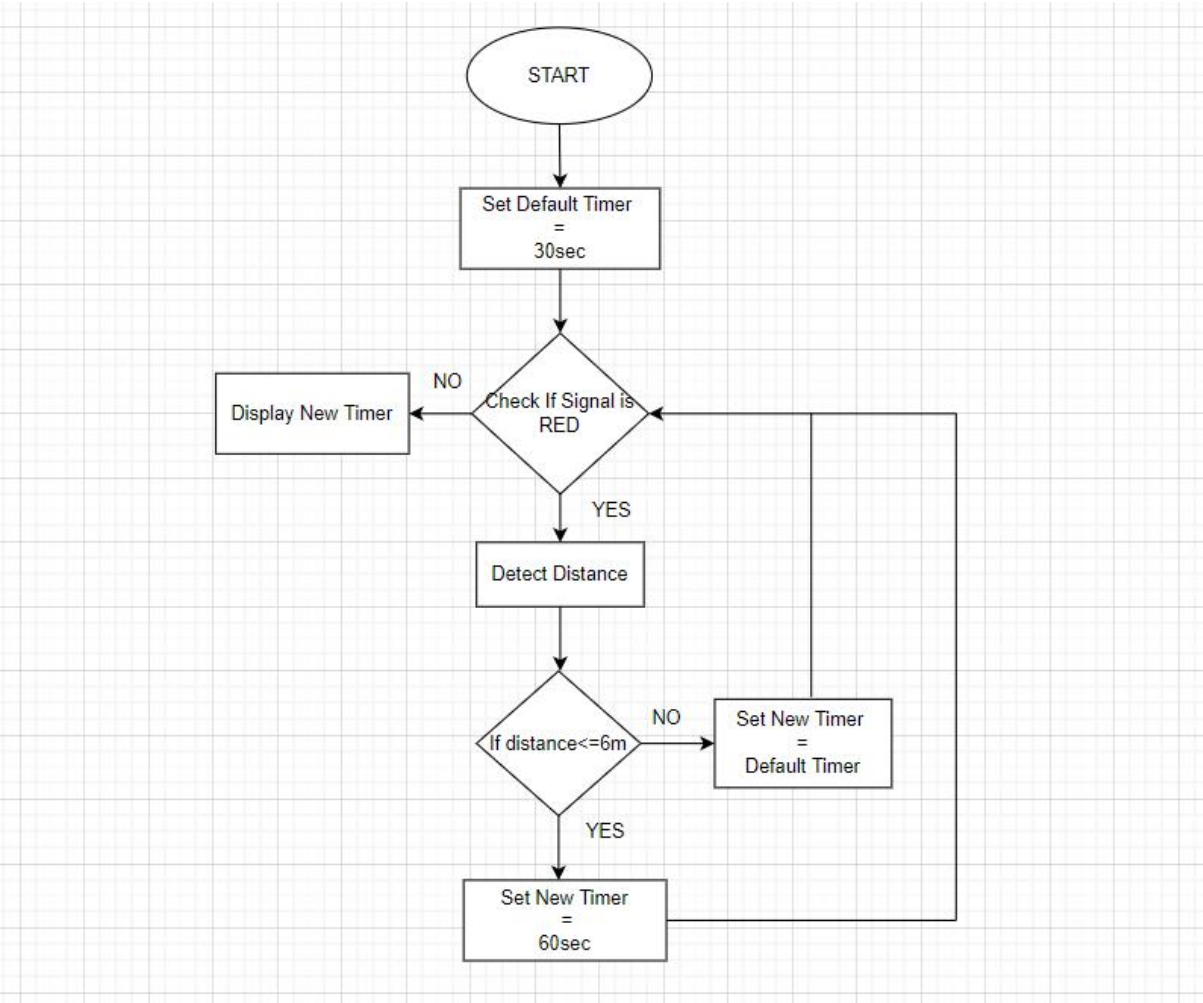

- The ultrasonic Sensor has four pins named Vcc, Trig, Echo and GND.
- The Vcc pin is connected to 5V GPIO of raspberry board so through this it will receive its input voltage .
- The Trig pin being connected to 18 GPIO pin and Echo pin is connected in series with 270Ω resistor and 23 GPIO pin of board.
- The GND pin of sensor is connected in series with 470Ω resistor and GND pin of board.

- The 7 segment LED display has four pins as positive terminal, negative terminal, D and C pin. The positive terminal of LED is connected in parallel with 5V GPIO pin of raspberry board.
- The negative terminal is connected in parallel with GND pin of board.
- The D pin is connected to SDA pin and C pin is connected to SCL pin od board respectively.

**Algorithm:**

1. First we will start the system and import the required modules.
2. We will set GPIO mode to GPIO.BOARD.
3. Set pin 12 as output pin.
4. Create a function checkDist() and return int input from user.
5. newTimer=0
6. Create another function named printTimer() with argument as newTimer.
7. Inside the function run a for loop with range 0 to neewTimer.
8. Inside the loop print(newTimer) and decrement it by 1 and sleep(0.1)
9. Now the functions are completed and declare the main loop as while(1).
10. Set defaultTimer=30.
11. Create if(input("Enter the Red signal is ON or Off:")=="on"):
12. For if true condition store distance from the checkDist() function in distance variable.
13. Then set pin 12 as HIGH.
14. Check if distance is less than or equal to 6m.
15. If yes then set newTimer=60 else store defaultTimer into newTimer.
16. For else condition set 12 pin as LOW and call printTimer(newTimer) function.
17. At last GPIO.cleanup()

**Flow Chart:**




- First the system will start and we will specify defaultTimer as 30 seconds.
- Then we check if signal is red or not.
- If yes then we find the distance measured by ultrasonic sensor.
- Then we check if distance is less than or equal to 6 metres.
- If yes we set newTimer equal to 60 seconds.
- If no we set newTimer equal to defaultTimer.

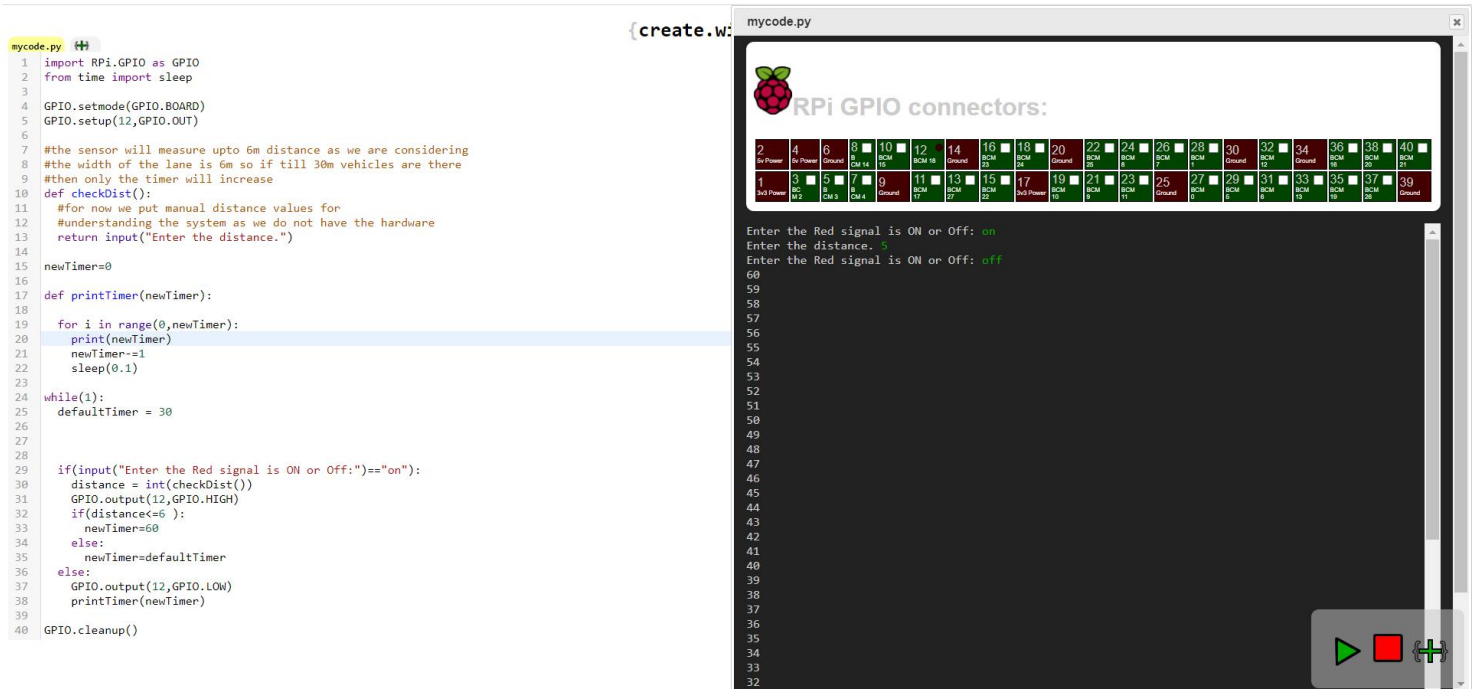
- After checking for both case we go to the first if and check if, signal is red or not, and if it is off then it will start displaying timer as per the newTimer value and during that time other components will be turned off.

**Program:**

```
import RPi.GPIO as GPIO
from time import sleep

GPIO.setmode(GPIO.BOARD)
GPIO.setup(12,GPIO.OUT)

#the sensor will measure upto 6m distance as we are considering
#the width of the lane is 6m so if till 30m vehicles are there
#then only the timer will increase
def checkDist():
  #for now we put manual distance values for
  #understanding the system as we do not have the hardware
  return input("Enter the distance.")

newTimer=0

def printTimer(newTimer):

  for i in range(0,newTimer):
    print(newTimer)
    newTimer-=1
    sleep(0.1)

while(1):
  defaultTimer = 30



  if(input("Enter the Red signal is ON or Off:")=="on"):
    distance = int(checkDist())
    GPIO.output(12,GPIO.HIGH)
```

```
    if(distance<=6 ):
      newTimer=60
    else:
      newTimer=defaultTimer
  else:
    GPIO.output(12,GPIO.LOW)
    printTimer(newTimer)

GPIO.cleanup()
```

**Output:**




**Simulation Video Link:**

- https://drive.google.com/file/d/12hDK15wLMiU3ISgit105WMOA9cHrikrE/view?usp=sharing

**Real Time Constraints:**

- We have assumed that we will place the ultrasonic sensor at 30m from the traffic signal to detect the presence of vehicle up to that point from traffic signal.
- We are assuming that the lane is 6m in width therefore we are using the condition if distance<=6m.
- Since it is a simulation so we are taking the distance and traffic signal state,i.e, if red light is on or not.
- We are assuming that by adding 30sec we will be able to successfully ease traffic by giving more time and decreasing the number of vehicles in lane efficiently.

**Conclusion:**

- We have successfully designed and implemented smart traffic management system with the help of raspberry pi and ultrasonic sensor.
- We believe that by implementing this system in real world, we can ease traffic issues.
- Also the vehicles will be used efficiently which will eventually lead to less carbon emissions and protecting the mother nature.