LAB –12 Programming on Ultrasonic Sensors

Aim:

To measure distance using an ultrasonic rangefinder using Raspberry Pi using python.

Task:

To construct a Raspberry Pi based embedded system to measure distance using an ultrasonic rangefinder HC SR-04 using Python.

Pin & Circuit Diagram:

Figure 1: Pin diagram of Raspberry Pi

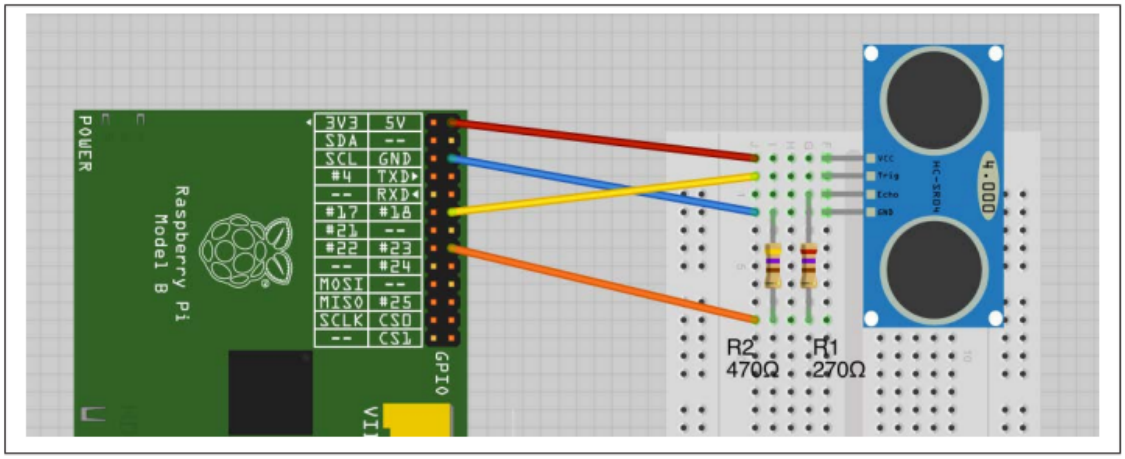


Figure 2: Connecting a SR-04 rangefinder to a Raspberry Pi

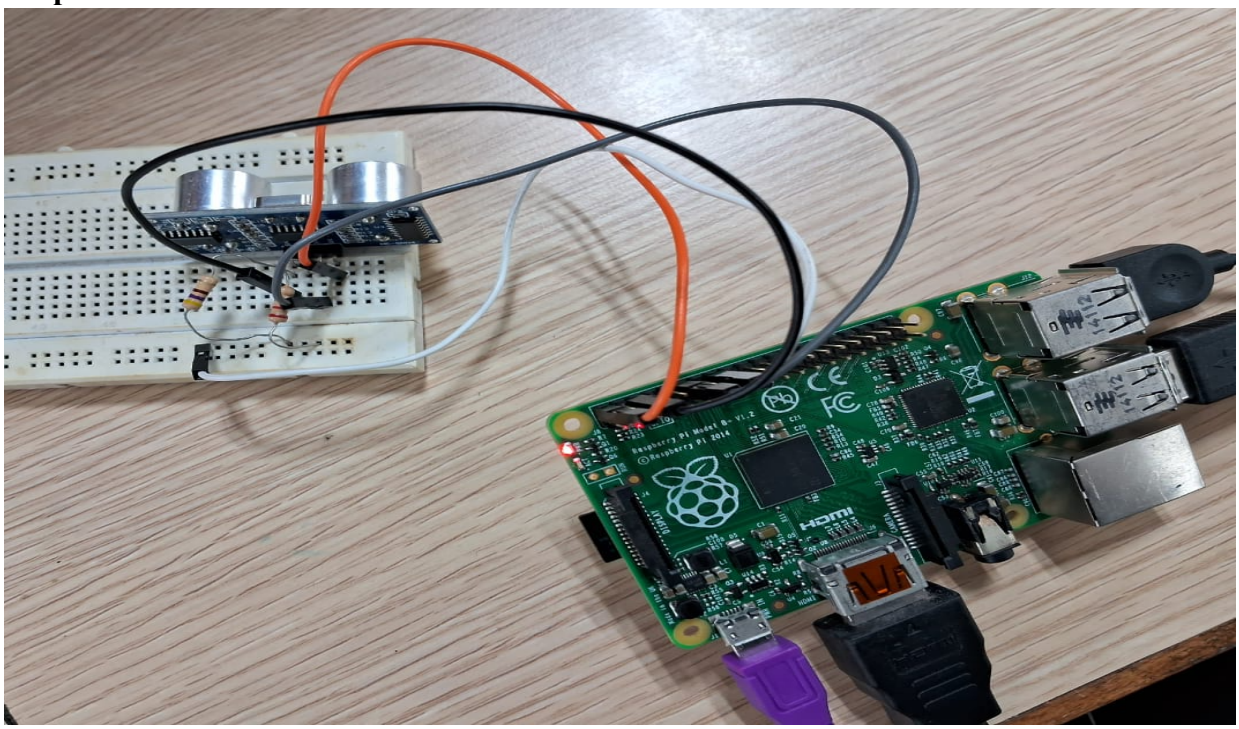
Algorithm:

1.Import the **RPi.GPIO** library for GPIO control.
2. Set the GPIO mode to BCM.Assign the trigger GPIO pin to **TRIG** (pin 18) and the echo GPIO pin to **ECHO** (pin 23).
3. Define a function called **distance**:
 i)Set the **TRIG** pin to high for a short duration (10 microseconds) and then set it back to low.
 ii)Use a while loop to measure the time it takes for the **ECHO** pin to go from low to high.
 iii)Calculate the duration of the pulse.
 iv)Calculate the distance in centimeters using the speed of sound (17150 cm/s).
 v)Return the calculated distance.
4.Print the distance in centimeters.

Program:

```
import RPi.GPIO as GPIO
import time
GPIO.setmode(GPIO.BCM)
TRIG = 18
ECHO = 23
GPIO.setup(TRIG,GPIO.OUT)
GPIO.setup(ECHO,GPIO.IN)

def distance():
  GPIO.output(TRIG,True)
  time.sleep(0.00001)
  GPIO.output(TRIG,False)

  while GPIO.input(ECHO)==0:
    pulse_start=time.time()

  while GPIO.input(ECHO)==1:
    pulse_end=time.time()
    pulse_duration=pulse_end-pulse_start
  distance=pulse_duration*17150
  distance=round(distance,2)

  return distance

while True:
  dist=distance()
  print("Distance:{} cm".format(dist))
  time.sleep(0.2)
```

Output:



Pre Lab Questions:

1. Explain the principle of ultrasonic range finder HC SR04 sensor.
2. What is the maximum distance range of HC-SR04 ultrasonic distance sensors ?

Post Lab Questions:

1. Draw the Pin diagram of HC SR-04 rangefinder.

2. How do you measure distance using an ultrasonic sensor ?

Result:

Thus,the Python program interfaces with the ultrasonic sensor via the Raspberry Pi's GPIO pins, accurately measuring and reporting the distance to objects in centimeters.