



CSE461

Introduction to Robotics Lab

Lab No. : 02

Group : 03

Section : 08

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Group members :

MD.Sohanur Rahman Shimul	22299079
Fayez Ahmad Protik	23101474
Mahibi Islam	22201828
Tithi Halder	22101406
Sharmin Jahan Ananna	22101850

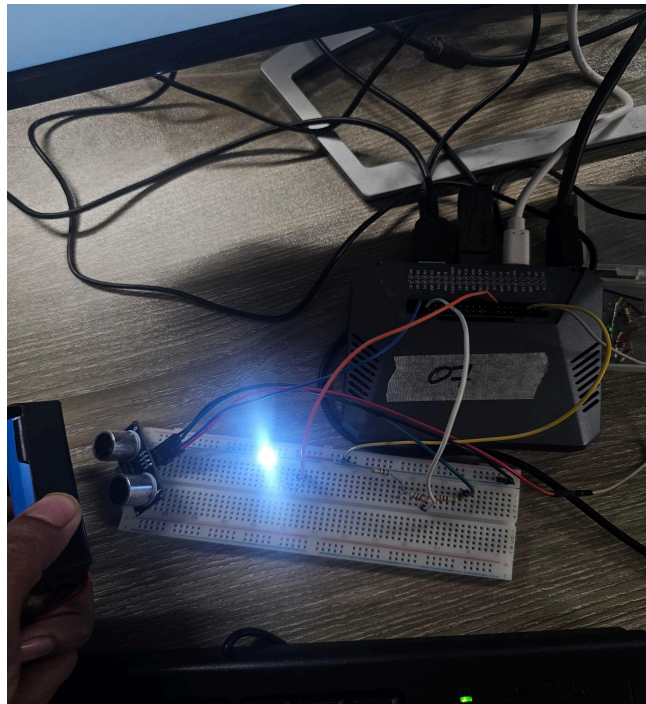
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Submitted to -

Utsha Kumar Roy & Sadman Sharif

1. **Objectives:** Introduction to Raspberry PI microcontroller and control an LED with an ultrasonic sensor using the board.
2. **Equipments:** Raspberry PI development board, LED (Light Emitting Diode), Ultrasonic Sensor(HC-SR04), Resistor (appropriate value for current limiting, typically around 220 ohms), Jumper wires, Breadboard, USB pen drive containing OS
3. **Experimental Setup:**
(Picture + Explanation)

Picture



Explanation:

- Connected the VCC pin of the ultrasonic sensor to the 5V pin of the board.
- Then the GND pin with the ground pin of the board.
- Connected the TRIG (trigger pin) and the ECHO pin with GPIO pin 21 and 20.

- The ECHO pin outputs 5V which will damage the GPIO pin of the Raspberry PI as it can only take 3.3V at maximum. So in order to convert it to a safer level we used resistors using the voltage divider rule shown in the figure below. The 5V from the Echo pin will first need to be converted to 3.3V and then connect it to the GPIO pin. Then the voltage needs to be dropped to the ground. The ratio of the voltage division has to be 1:2 where we will be using one 220 ohm resistor connected to 5V and two 220 ohm resistors to GND.
- Connect one end of a 220 ohm resistor to a GPIO pin of your Raspberry PI and connect the other end to the anode of the LED.
- Connect the cathode of the LED to a ground pin of the board.

4. Code: (If Applicable)

```
# Enter Code Here

1. from gpiozero import LED
2. import RPi.GPIO as GPIO
3. import time
4. GPIO.setmode(GPIO.BCM)
5. TRIG = 21 #GPIO21
6. ECHO = 20 #GPIO20
7. led=LED(22)
8.
9. GPIO.setup(TRIG,GPIO.OUT)
10. GPIO.setup(ECHO,GPIO.IN)
11.
12. def distance():
13.     GPIO.output(TRIG, False)
14.     time.sleep(0.5)
15.     GPIO.output(TRIG, True)
16.     time.sleep(0.00001)
17.     GPIO.output(TRIG, False)
18.     pulse_start = time.time()
19.     while GPIO.input(ECHO)==0:
20.         pulse_start = time.time()
21.     while GPIO.input(ECHO)==1:
22.         pulse_end = time.time()
23.     pulse_duration = pulse_end - pulse_start
24.     distance = pulse_duration * 17150
25.     distance = round(distance, 2)
26.
27.     return distance
28.
29. while True:
30.     print(distance())
31.     if distance() <= 5:
32.         led.on()
33.     else:
34.         led.off()
35. GPIO.cleanup()
```

5. Results (Output of the experiment):

The sensor will measure the surrounding object's distance and if it is 5 cm in range then the LED will turn on.

6. Discussions/Answers:

In this lab we got to know how to use any kind of sensor. Especially in this case the ultrasonic sensor by which we can measure the surrounding object's distance. We also learned to do experiments based on the sensor's readings.