Course Title: Introduction to Robotics
Course Code: CSE461
Lab Report - 02
GROUP- 04

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Name of the Experiment: Measuring distance using ultrasonic sensor.

Objective:

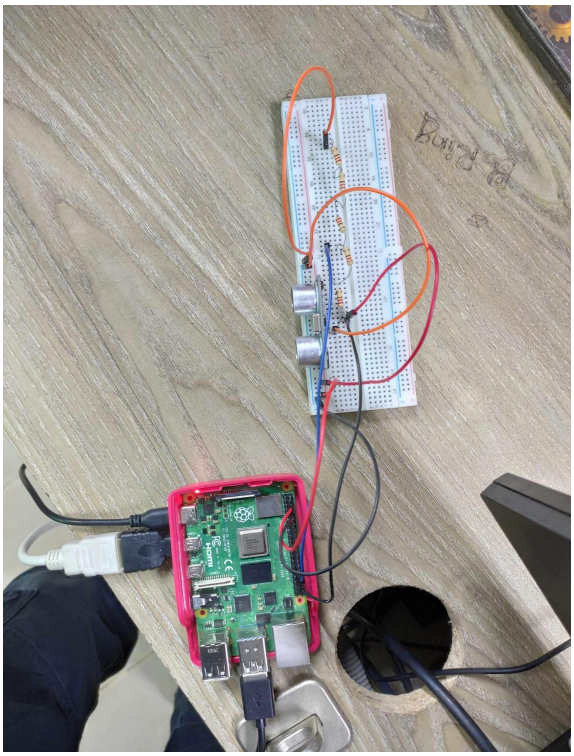
The goal is a set of procedures for learning about ultrasonic sensors and how to utilize them, especially with a Raspberry Pi, to measure distance. The procedures entail learning the fundamentals of ultrasonic sensors, becoming acquainted with the Raspberry Pi and its parts, setting up Python libraries and writing programs, obtaining practical coding experience through its terminal, comprehending the value of precision in distance measuring while developing problem-solving abilities. However, the objective is to be able to use the ultrasonic sensor to measure distance and resolve any problems that may occur during setup and testing.

Components required for the setup:

For controlling the LED with a push button on the Raspberry Pi 4, we need the following electronic components:

- Raspberry Pi
- Ultrasonic Sensor (HC-SR04)
- Breadboard
- Jumper Wires
- 1k and 1.5k resistor
- MicroSD Card
- USB Cable
- Monitor, Keyboard, and Mouse (Optional

Experimental Setup:



The Ultrasonic Sensor (HC-SR04) and resistors were initially mounted on the breadboard. One side of the two resistors linked in series is connected to the Ultrasonic Sensor's Echo pin. Additionally, the resistors' opposite sides are linked to the remaining three resistors are also linked in series with the GPIO 20 pin. The GND pin of the Ultrasonic Sensor is linked to the opposite side of these three resistors, and a male-to-female wire also connects the GND pin to the Raspberry Pi 4's 06 no. Pin, which is designated with Ground.

The Vcc pin of the Ultrasonic Sensor is linked to the 04 no. Pin, designated as 5V DC Power, of the GPIO, and the Trigger pin of the Ultrasonic Sensor is attached to the GPIO 21 pin.

Code:

```
import RPi.GPIO as GPIO
import time
GPIO.setmode(GPIO.BCM)
TRIG = 21
ECHO = 20
GPIO.setup(TRIG, GPIO.OUT)
GPIO.setup(ECHO, GPIO.IN)
def distance():
GPIO.output(TRIG, False)
time.sleep(0.5)
GPIO.output(TRIG, True)
time.sleep(0.00001)
GPIO.output(TRIG, False)
pulse_start = time.time()
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
print(distance())
GPIO.cleanup()
```

Results:

According to our setup, the possible result for measuring distance using an ultrasonic sensor is displayed in the python terminal in raspberry pi 4. When an object was in a constant place, we got the constant distance value after pressing the run button of the python terminal. Again, when we increased the object's distance

from the ultrasonic sensor, we got a higher distance value than the previous one. Furthermore, when we decreased the object's distance from the sensor, we got a lower distance value from the previous.

Question answer:

We are aware that the Raspberry Pi's Ground (GND) pins are not intended to accept high voltage. The GND pins are designed to give all of the circuits and components attached to the Raspberry Pi a standard electrical ground reference. If a GND pin were to receive electricity, the Raspberry Pi or any attached components may be harmed. To convert the high input voltage (5V) into the necessary low-level voltage, resistors are utilized here.

Resistors are not directly used in measuring distance using an ultrasonic sensor. The primary component used for distance measurement with an ultrasonic sensor is the sensor itself, which typically consists of a transducer that emits ultrasonic waves and a receiver that detects the reflected waves.However, resistors can be present in the circuitry connected to the ultrasonic sensor for various purposes, such as voltage level shifting, current limiting, or impedance matching. These resistors are used to ensure proper signal conditioning and compatibility between different components within the circuit.For example, a voltage divider circuit may be used with resistors to scale down the output voltage of the ultrasonic sensor to match the input voltage range of a microcontroller or other electronic device. This allows the distance measurement to be accurately processed and interpreted by the connected system.In summary, while resistors themselves are not directly involved in the distance measurement process of an ultrasonic sensor, they can be used in the supporting circuitry to ensure proper signal conditioning and compatibility with other components.

Discussions:

This was a straightforward experiment where the object's distance was determined using an ultrasonic sensor. Through this job, we learned how to operate a raspberry pi, an ultrasonic sensor, a breadboard, and the capabilities of various raspberry pi. and pins for ultrasonic sensors. Additionally, we get to become acquainted with the GPIO and time libraries. Fortunately, we were able to seamlessly integrate each component of the assignment and achieve the required outcome.