Inspiring Excellence

Lab report 2 of CSE461

Submitted By:

Group 4

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1. Name of the Experiment: Measuring distance using ultrasonic sensor.

2. Objective: The objective of this report is to present the findings and methodology for measuring distance using an ultrasonic sensor. The report aims to provide a comprehensive understanding of the principles behind ultrasonic distance measurement, the experimental setup and procedure, the data collection and analysis process, and the overall accuracy and limitations of the measurement technique. The report also aims to offer recommendations for improving the accuracy and reliability of distance measurement using ultrasonic sensors.

3. Equipment:

- Raspberry Pi
- Ultrasonic Sensor (HC-SR04)
- Breadboard
- Jumper Wires
- 5 resistors of 220 ohm
- MicroSD Card
- USB Cable
- Monitor, Keyboard, and Mouse (Optional)

4. Experimental Setup: To do this task firstly, we connected the positive side of the breadboard with the 5V port of the Raspberry-pi and then connected the negative side of the breadboard with the GND port of Raspberry-pi. That is how we give power to the breadboard. Now we insert the pins of the ultrasonic sensor to the Raspberry-pi and by the help of jumper wire, we connect the Vcc side of the breadboard to the Vcc port of the ultrasonic sensor and also by the help of another jumper wire we connect negative side of the breadboard to the ground port of the ultrasonic sensor. In ultrasonic sensors there is also TRIG and ECHO. TRIG basically gives output to the ultrasonic sensor and then the sensor

sends that to the Raspberry-pi. That is how the ultrasonic sensor measures the distance. But before connecting the TRIG and ECHO we need to know that the Raspberry-pi can handle 3-3.3V to generate the best output. So, due to the 5V input we need to reduce it to at least 3.3 V, that is why here we use five 220 ohm resistors to reduce the voltage. Therefore, with GPIO 21 we connect the TRIG and with GPIO 20 we connect the resistors and resistors are connected with ECHO. After running the code we can see the distance.

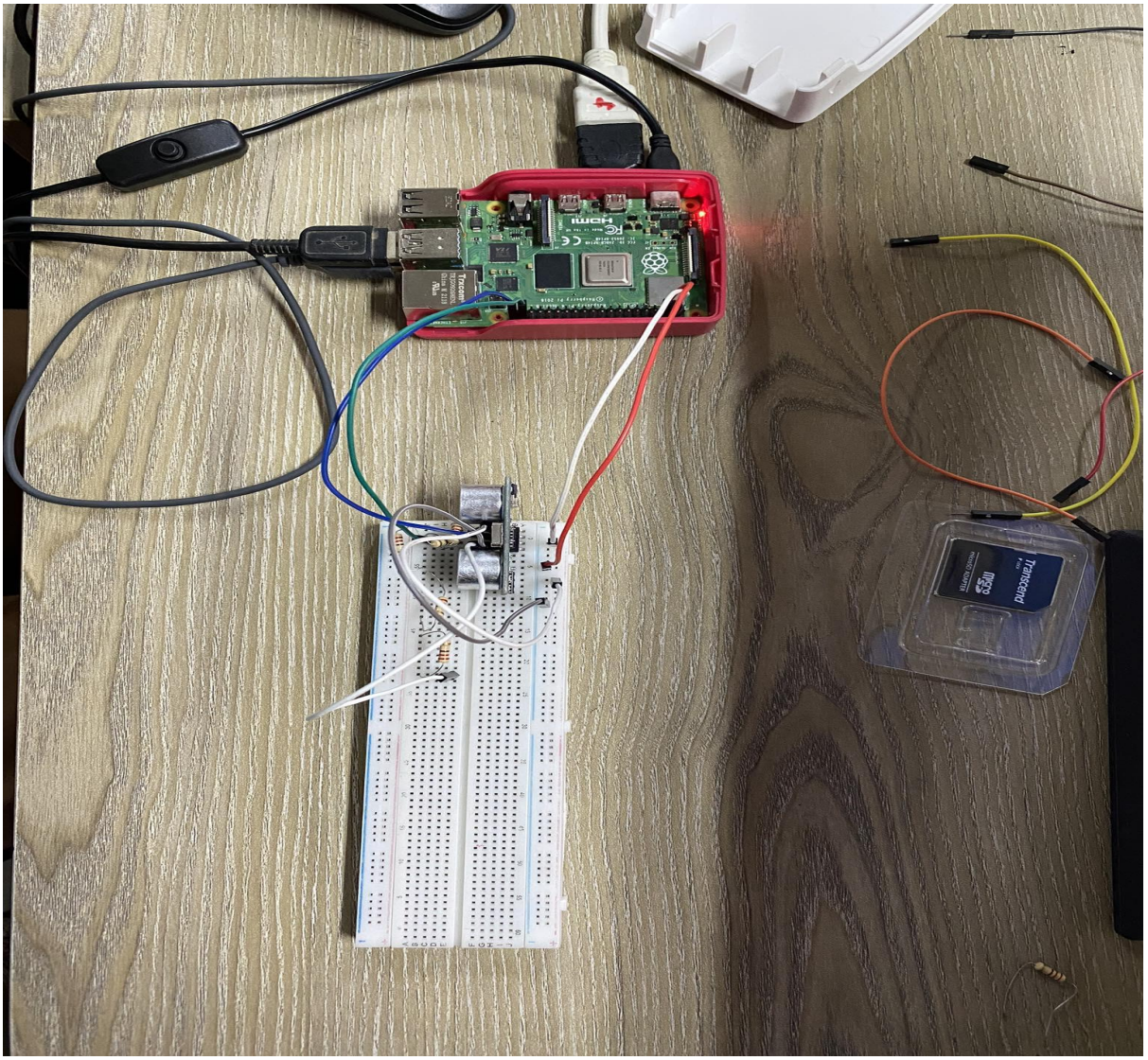

Fig 1: Circuit Setup

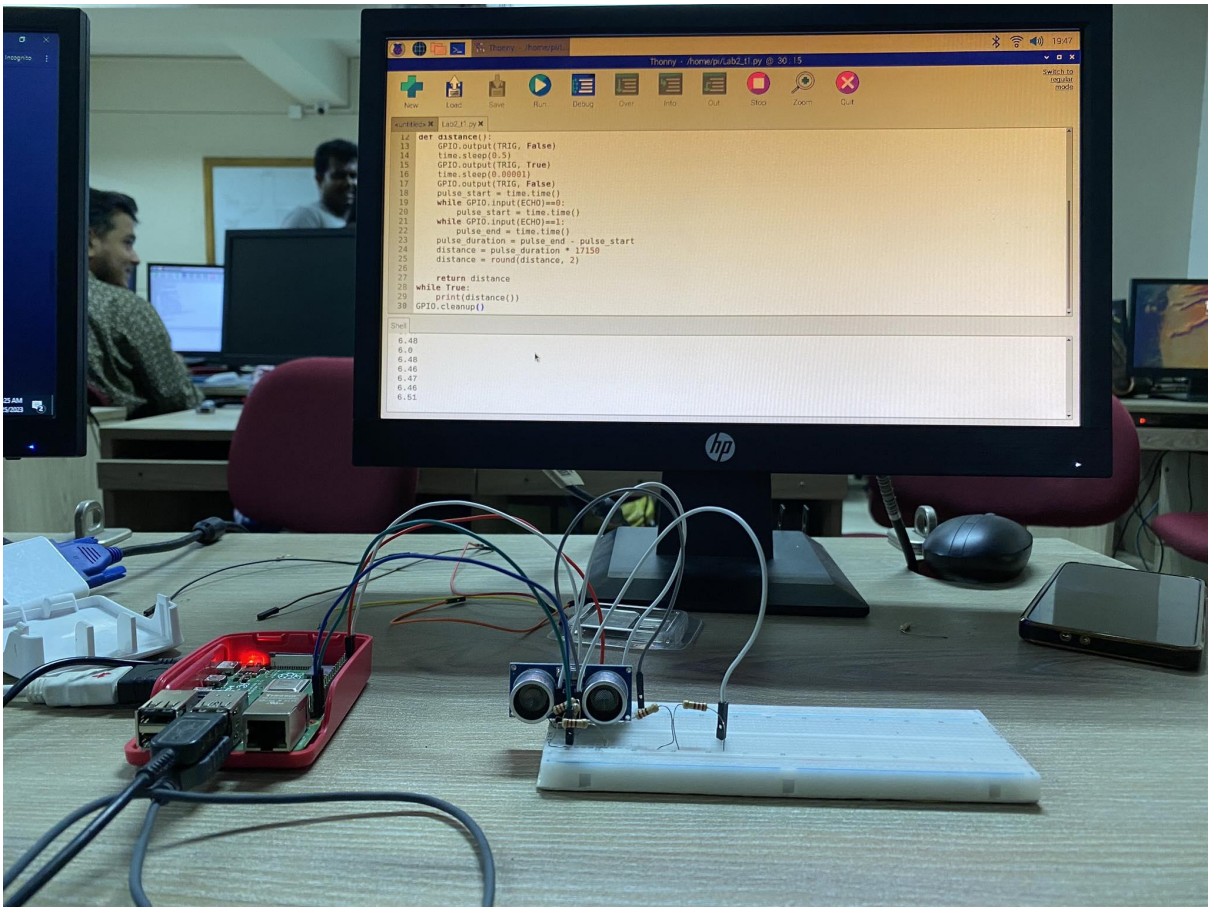

Fig 2: Circuit Setup with Results

Result: The distance measurement System was successfully implemented utilizing the Raspberry Pi and the ultrasonic sensor(HC-SR04). In accordance with the instructions, the circuit was built by tying the resistors, ultrasonic sensor, and Raspberry Pi's GPIO pins. The sensor was thereafter utilized to run the code to measure the distance. The tool being tested accurately measured the distance between the ultrasonic sensor and the object in front of it during testing. The measurements were shown on the console output and it was in real time. The system illustrated an outstanding amount of precision and stability, with repeatable and accurate distance readings.

5. 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
while True:
        print(distance())
GPIO.cleanup()
```

Discussion :

The raspberry pie can only withstand a maximum voltage of 3.3V where from the breadboard we are getting 5V. To drop the voltage from 5V to 3.3V we have added resistors for keeping the raspberry-pi safe. To have a clear signal, the connection of ground is needed. Basically, an ultrasonic sensor calculates distance by using sound waves and by using the sending and receiving time. During the experiment we also use our fingers to test the experiment and our ultrasonic sensor also detects our distance. Each time with different distances of fingers, raspberry-pi showed us different particular measurements of distances.