Course Name: Internet Of Things Lab **Course code:** 21CSP-344

Date of Performance 24/08/2023

Experiment 2.1

Aim: Formulate distance of an object using an ultrasonic sensor.

Objectives:

1.Learn about interfacing.
2. Learn about IoT programming.

Components Used:

- Arduino Uno R3 board
- Ultrasonic sensor (HC-SR04)
- 16×2 LCD I2C Display
- Jumper Wires

Description:

Arduino:

It is an open-source electronics platform. It consists ATmega328 8-bit Micro controller. It can be able to read inputs from different sensors & we can send instructions to the micro controller in the Arduino. It provides Arduino IDE to write code & connect the hardware devices like Arduino boards & sensors.

Ultrasonic Sensor:

An ultrasonic Sensor is a device used to measure the distance between the sensor and an object without physical contact. This device works based on time-to-distance conversion.

Working Principle of Ultrasonic Sensor:

Ultrasonic sensors measure distance by sending and receiving the ultrasonic wave. The ultrasonic sensor has a sender to emit the ultrasonic waves and a receiver to receive the ultrasonic waves. The transmitted ultrasonic wave travels through the air and is reflected by hitting the Object. Arduino calculates the time taken by the ultrasonic pulse wave to reach the receiver from the sender.

We know that the speed of sound in air is nearly 344 m/s,

So, the known parameters are time and speed (constant). Using these parameters, we can calculate the distance traveled by the sound wave.

*Formula: Distance = Speed * Time*

In the code, the "duration" variable stores the time taken by the sound wave traveling from the emitter to the receiver. That is double the time to reach the object, whereas the sensor returns the total time including sender to object and object to receiver. Then, the time taken to reach the object is half of the time taken to reach the receiver.

so we can write the expression as,

*Distance = Speed of Sound in Air * (Time Taken / 2)*

Note: Speed of sound in air = 344 m/s.

CODE:

```
#define echoPin 8 // attach pin D2 Arduino to pin Echo of HC-SR04
#define trigPin 9 // attach pin D3 Arduino to pin Trig of HC-SR04
long duration; // Variable to store time taken to the pulse to reach receiver
int distance; // Variable to store distance
void setup()
{
pinMode(trigPin, OUTPUT); // Sets the trigPin as an OUTPUT
pinMode(echoPin, INPUT); // Sets the echoPin as an INPUT
Serial.begin(9600);// The text to be printed in serial monitor
Serial.println("Distance measurement using Arduino Uno.");
delay(500);
}
void loop()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2); // wait for 2 ms to avoid collision in serial monitor
digitalWrite(trigPin,HIGH); // turn on the Trigger to generate pulse
delayMicroseconds(10); // keep the trigger "ON" for 10 ms to generate pulse for 10 ms.
digitalWrite(trigPin,LOW);
duration = pulseIn(echoPin, HIGH); //returns the time taken by the pulse to reach the receiver
distance = duration * 0.0344 / 2; // Expression to calculate distance using time
Serial.print("Distance: ");
Serial.print(distance); // Print the output in serial monitor
Serial.println(" cm");
delay(100);
}
```

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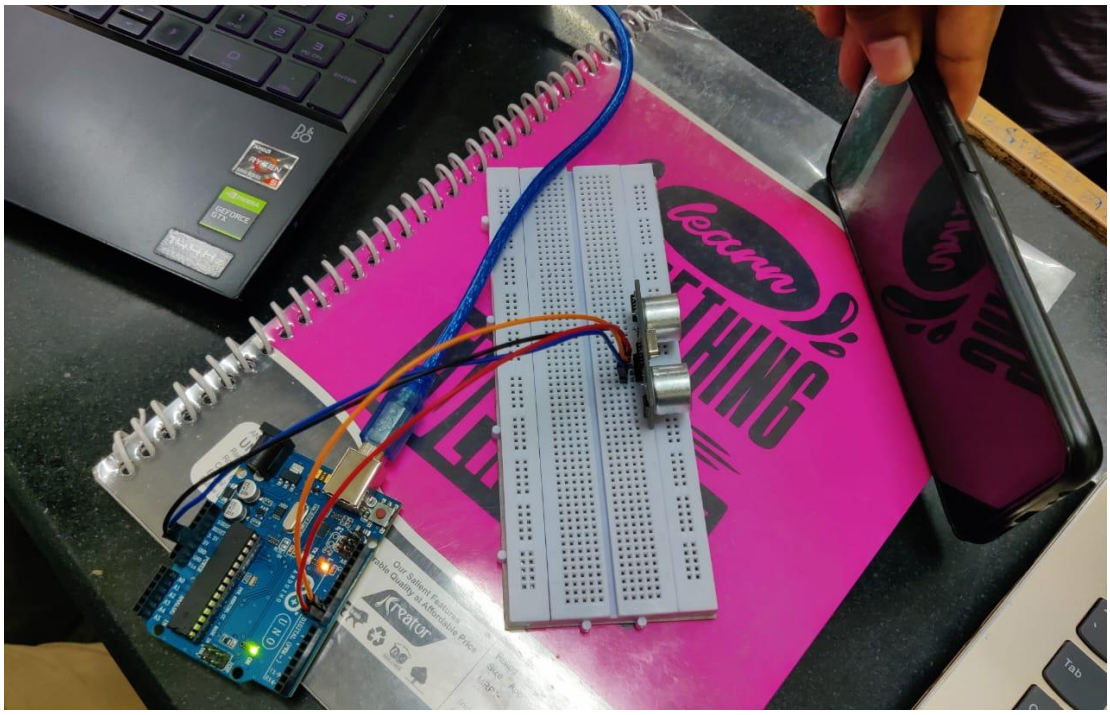
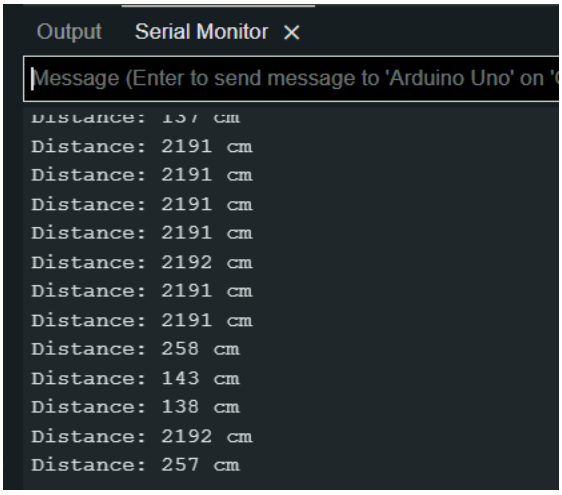
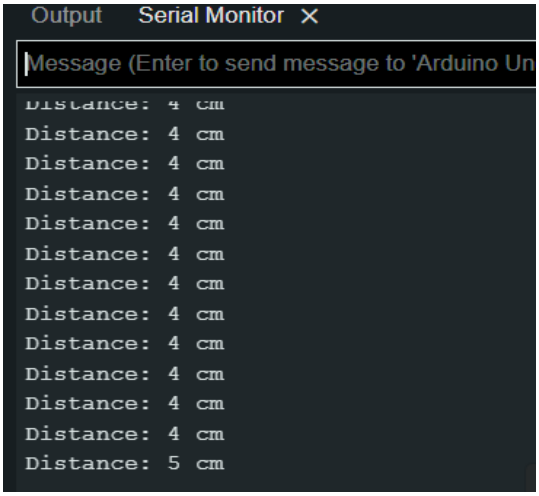
Output and Simulation :







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Learning Outcomes :

- Understanding Ultrasonic Technology
- Principles of Distance Measurement
- Calculating Distance