Experiment- 5

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Subject Code: 20CSP-358
Subject Name: Internet of Things
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Aim: To measure the distance of an object using an ultrasonic sensor.

Objective:

- Learn about interfacing.
- Learn about IoT programming

Components Required:

1. Arduino Uno R3 board
2. Ultrasonic sensor (HC-SR04)
3. 16×2 LCD I2C Display
4. Jumper Wires

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.
As 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 used:
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)

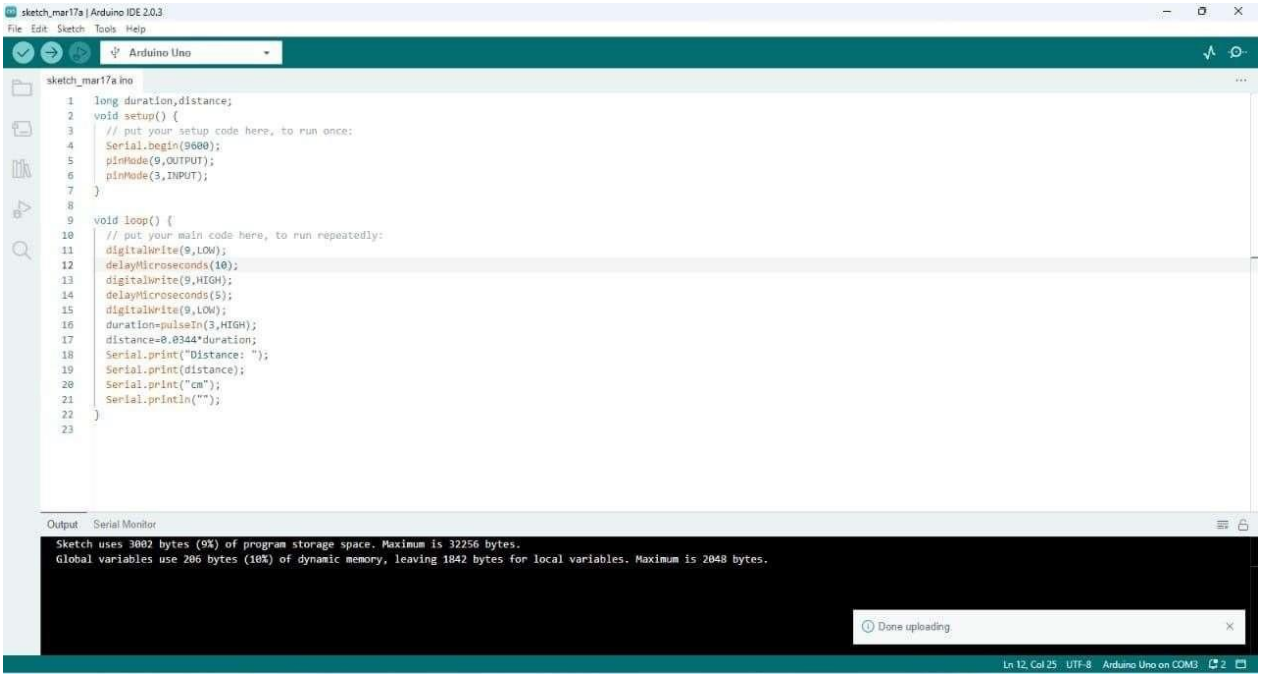
Procedure:

Step 1: Connect the Echo pin of the ultrasonic sensor to the pin 3 of the Arduino using blue colored jumper wire.
Step 2: Connect the Trigger pin of the ultrasonic sensor to the pin 9 of the Arduino using yellow colored jumper wire.
Step 3: Connect the one end of the ultrasonic sensor to ground using green colored jumper wire and vcc to pin 5 of the Arduino using orange colored jumper wire.
Step 4: Now write a code in your Arduino IDE.
Step 5: Now connect your Arduino board to your laptop via USB jack and in your Arduino IDE, select your board and click on upload.
Step 6: Observe the output in the Serial monitor in Arduino IDE.

Code:

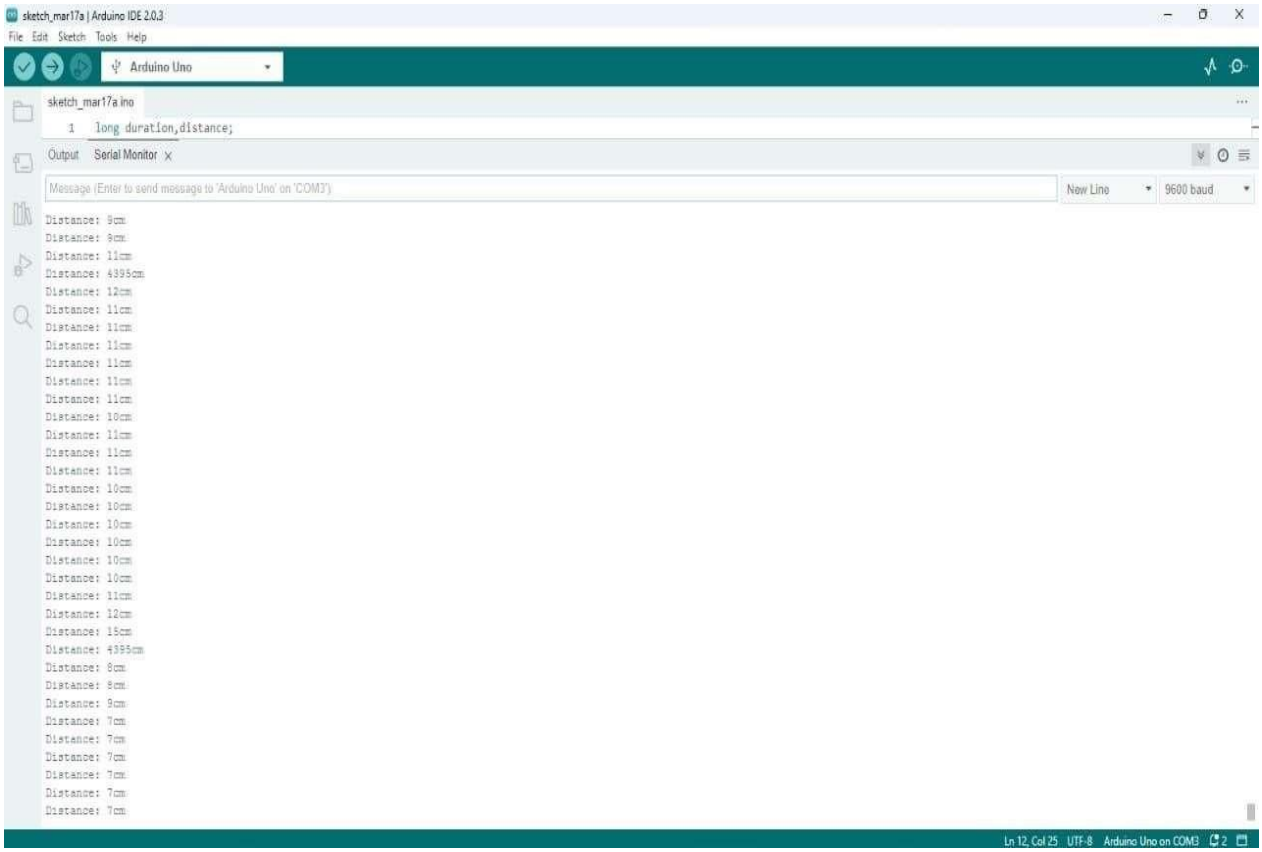
```
long
duration,distance;
void setup() {
  // put your setup code here, to run
  once:              Serial.begin(9600);
  pinMode(9,OUTPUT);
  pinMode(3,INPUT);
}

void loop() {
  // put your main code here, to run
  repeatedly:
  digitalWrite(9,LOW);
  delayMicroseconds(10);
  digitalWrite(9,HIGH);
  delayMicroseconds(5);
  digitalWrite(9,LOW);
```

```
  duration=pulseIn(3,HIGH);
  distance=0.0344*duration;
  Serial.print("Distance: ");
  Serial.print(distance);
  Serial.print("cm");
  Serial.println("");
}
```



Result:

Serial monitor:


sketch_mar17a | Arduino IDE 2.0.3
File Edit Sketch Tools Help
Arduino Uno
sketch_mar17a.ino
1 long duration,distance;
Output Serial Monitor
Message (Enter to send message to 'Arduino Uno' on 'COM3')
New Line
9600 baud
Distance: 9cm
Distance: 9cm
Distance: 11cm
Distance: 4395cm
Distance: 12cm
Distance: 11cm
Distance: 11cm
Distance: 11cm
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Ln 12, Col 25 UTF-8 Arduino Uno on COM3

Circuit:

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COMPUTER SCIENCE & ENGINEERING