EXPERIMENT NO :- 05

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AIM: Simulation of Distance Measurement Using Laser Sensor in TinkerCad

Theory:

Tinkercad is an **online simulation tool** that allows users to design, simulate, and test electronic circuits. It provides a virtual environment where components like **Arduino, sensors, LCDs, LEDs, motors, and more** can be connected and programmed without needing physical hardware.

Tinkercad is widely used for:

- Learning and testing **Arduino projects**.
- Simulating **sensor-based applications**.
- Debugging circuits before implementing them in real life.

Since Tinkercad does not have a built-in laser distance sensor model like VL53L0X or LIDAR, we simulate it using an ultrasonic sensor (HC-SR04) as an alternative for distance measurement.

Distance measurement is essential in automation, robotics, and industrial applications. Laser distance sensors work based on the **Time of Flight (ToF) principle**, where a laser pulse is emitted, and the time taken for its return determines the distance.

Formula Used:

$$\text{Distance} = \frac{\text{Speed of Light} \times \text{Time Taken}}{2}$$

where:

Speed of light (c) = 3×10^8 m/s

Time Taken is the round-trip time of the laser beam.

Objectives of Simulation

- To simulate the working of a distance sensor using Tinkercad.
- To verify distance measurement through Arduino and serial monitor output.
- To debug and test code before real-world implementation.

Steps: -

- **Step 1: Open Tinkercad and Create a New Circuit**

    1. Go to Tinkercad (https://www.tinkercad.com/).
    2. Click on "Circuits" from the left panel.
    3. Click "Create New Circuit".

- **Step 2: Add Components**

    Search and drag the following components onto the workspace:

    1. Arduino Uno
    2. 16x2 LCD Display (without I2C)
    3. HC-SR04 Ultrasonic Sensor
    4. 10KΩ Potentiometer (for LCD contrast)
    5. Resistors (220Ω or 1KΩ for LCD backlight)
    6. Jumper Wires

- **Step 3: Wire the Components**
    - **Wiring the LCD to Arduino**

LCD Pin	Connect To
GND	Arduino GND
VCC	Arduino 5V
V0 (Contrast)	Middle Pin of Potentiometer
RS	Arduino Pin 7
RW	Arduino GND

E	Arduino Pin 8
D4	Arduino Pin 6
D5	Arduino Pin 5
D6	Arduino Pin 4
D7	Arduino Pin 3
A (Backlight +)	5V (via 220Ω resistor)
K (Backlight -)	GND

- **Wiring the Ultrasonic Sensor**

HC-SR04 Pin	Connect To
VCC	Arduino 5V
GND	Arduino GND
Trig	Arduino Pin 9
Echo	Arduino Pin 10

- **Wiring the Potentiometer (For LCD Contrast)**

Potentiometer Pin	Connect To
Left Pin	Arduino 5V
Middle Pin	LCD V0
Right Pin	Arduino GND

- **Step 4: Write the Arduino Code**

1. Click on "Code" and select "Text" mode.

2. Paste this code in the Arduino editor:

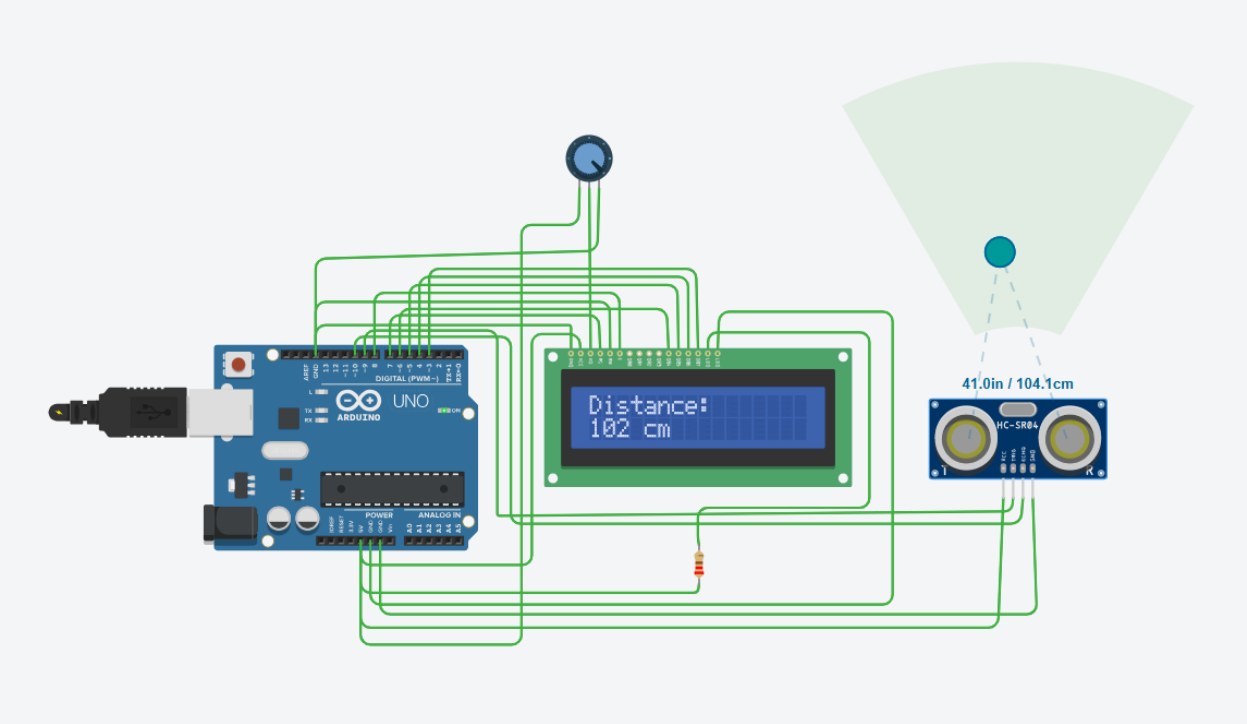
Code : -

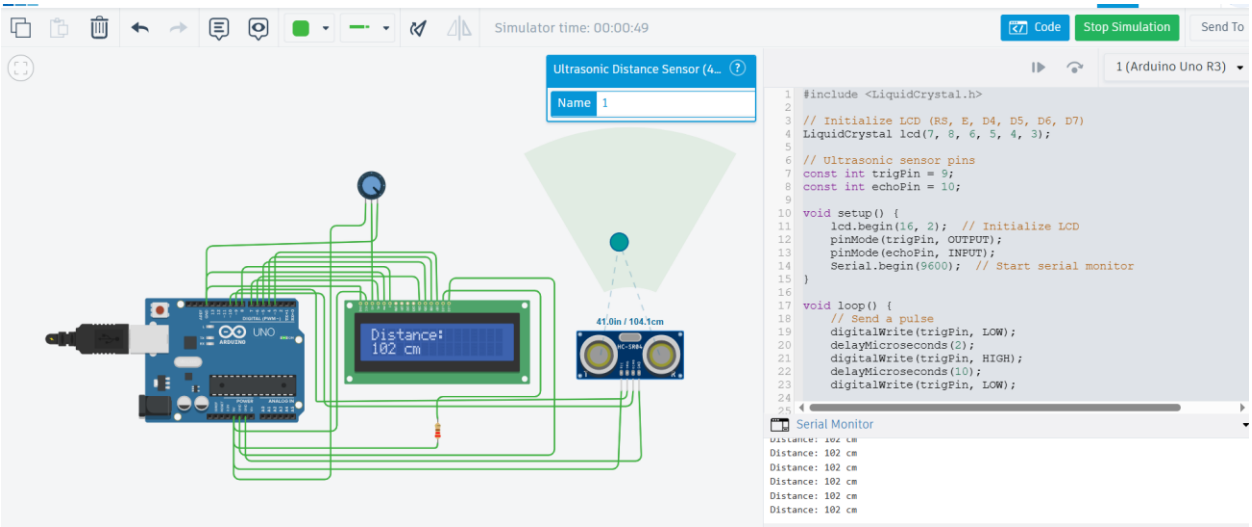
```
#include <LiquidCrystal.h>

// Initialize LCD (RS, E, D4, D5, D6, D7)
LiquidCrystal lcd(7, 8, 6, 5, 4, 3);

// Ultrasonic sensor pins
const int trigPin = 9;
const int echoPin = 10;

void setup() {
  lcd.begin(16, 2);  // Initialize LCD
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);
  Serial.begin(9600);  // Start serial monitor
}

void loop() {
  // Send a pulse
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

  // Read the echo
  long duration = pulseIn(echoPin, HIGH);
  int distance = duration * 0.034 / 2;  // Convert time to distance (cm)

  // Display on LCD
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Distance:");
  lcd.setCursor(0, 1);
  lcd.print(distance);
  lcd.print(" cm");
```

```
    Serial.print("Distance: ");
    Serial.print(distance);
    Serial.println(" cm");

    delay(500);
}
```

- **Step 5: Start the Simulation**

1. Click the "Start Simulation" button.
2. Observe the LCD displaying the measured distance in centimeters.
3. If the LCD is blank, adjust the potentiometer to change the contrast.
4. Open Serial Monitor (Click on "Code" → "Monitor") to check values.





Conclusion:

The simulation successfully demonstrated distance measurement using an ultrasonic sensor in Tinkercad. The measured distance was accurately displayed on a 16x2 LCD screen, showing how ultrasonic sensors can be used for automation, robotics, and obstacle detection applications.

This experiment helped in understanding:
- How to interface an ultrasonic sensor with Arduino.
- How to display sensor data on an LCD.
- How to simulate and test circuits in Tinkercad before real-world implementation