EXPERIMENT NO :- 06

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AIM : Interfacing of Components in Distance Measurement Using Laser Sensor.

Theory :

Unit Testing of VL53L0X with Arduino

Before integrating the VL53L0X with an LCD, test it separately using the **Serial Monitor**.

Connections:

VL53L0X Pin	Arduino Pin
VCC	5V
GND	GND
SDA	A4
SCL	A5

Code for Testing VL53L0X:

```
#include <Wire.h>
#include <Adafruit_VL53L0X.h>

Adafruit_VL53L0X lox;

void setup() {
  Serial.begin(115200);
  Serial.println("VL53L0X Unit Test");

  // Initialize I2C and sensor
  if (!lox.begin()) {
```

```
    Serial.println("Error: Failed to detect VL53L0X sensor!");
    while (1); // Halt execution
  }
  Serial.println("VL53L0X sensor detected!");
}

void loop() {
  VL53L0X_RangingMeasurementData_t measure;

  lox.rangingTest(&measure, false);

  if (measure.RangeStatus != 4) { // 4 means out of range
    Serial.print("Distance: ");
    Serial.print(measure.RangeMilliMeter);
    Serial.println(" mm");
  } else {
    Serial.println("Error: Out of range");
  }

  delay(500); // Read every 500ms
}
```

Unit Testing of LCD with Arduino

Before integrating with **VL53L0X**, test if the **LCD (16x2 with I2C module)** is functioning properly.

Connections for I2C LCD:

LCD Pin	Arduino Pin
VCC	5V
GND	GND
SDA	A4
SCL	A5

Code for Testing LCD:

```
#include <Wire.h>
```

```
#include <LiquidCrystal_I2C.h>

LiquidCrystal_I2C lcd(0x27, 16, 2);

void setup() {
   lcd.begin();
   lcd.backlight();
   lcd.setCursor(0, 0);
   lcd.print("LCD Test OK!");
}

void loop() {
}
```

Final Integration:

Now, combine **VL53L0X and LCD** to display real-time distance.

Final Circuit Connections

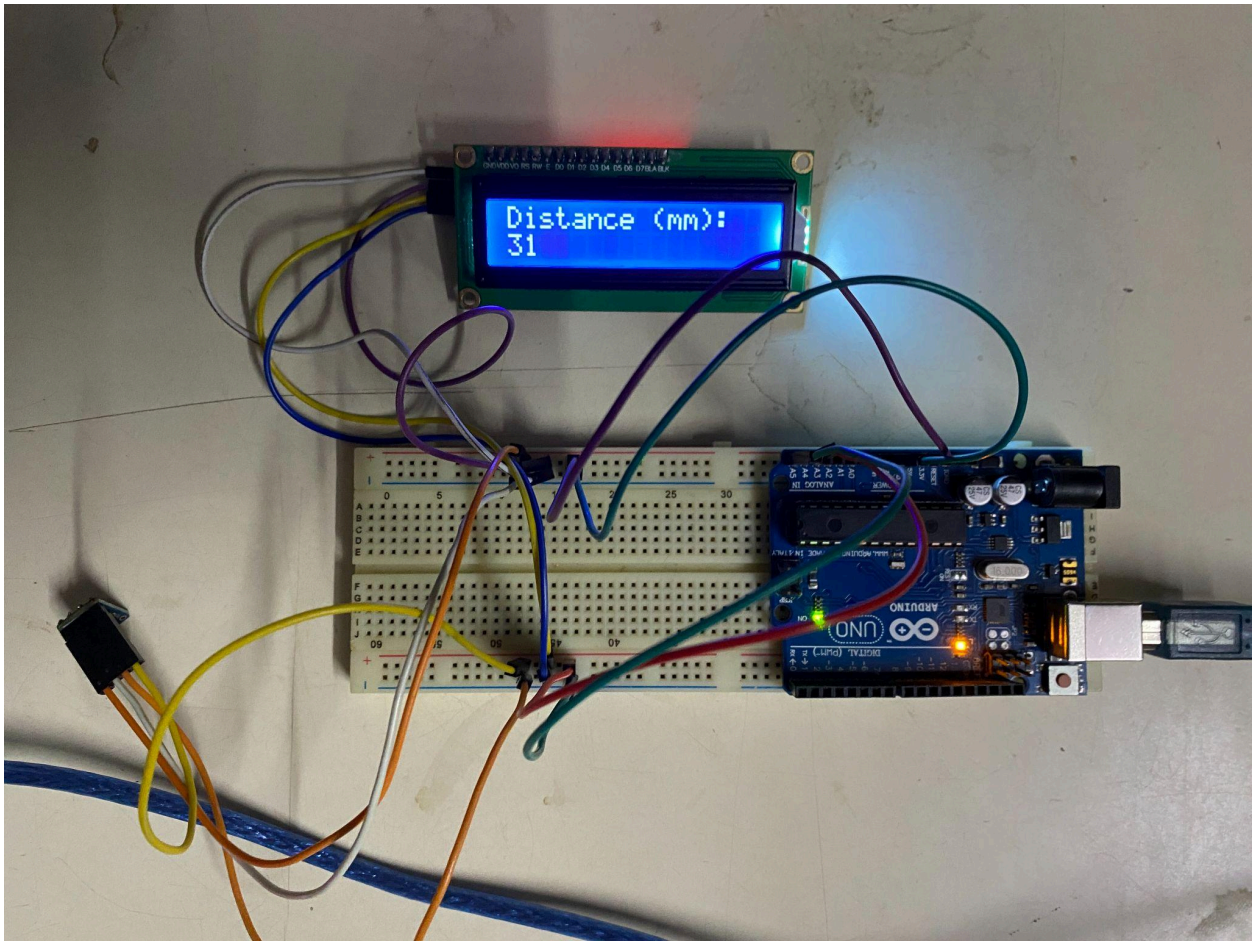
- **VL53L0X**
  - **VCC → 5V on Arduino**
  - **GND → GND on Arduino**
  - **SDA → A4 on Arduino**
  - **SCL → A5 on Arduino**
- **LCD (I2C)**
  - **VCC → 5V on Arduino**
  - **GND → GND on Arduino**
  - **SDA → A4 on Arduino**
  - **SCL → A5 on Arduino**

Final Code:

```
#include <Wire.h>
#include <Adafruit_VL53L0X.h>
#include <LiquidCrystal_I2C.h>
```

```
LiquidCrystal_I2C lcd(0x27, 16, 2); // Use 0x3F if your LCD address is different
Adafruit_VL53L0X sensor = Adafruit_VL53L0X();

void setup() {
  Serial.begin(9600);

  // Initialize LCD
  lcd.init();
  lcd.backlight();
  lcd.print("Initializing...");

  // Initialize VL53L0X sensor
  if (!sensor.begin()) {
    lcd.clear();
    lcd.print("Sensor Error!");
    while (1);
  }

  lcd.clear();
  lcd.print("Distance (mm):");
  delay(1000);
}

void loop() {
  VL53L0X_RangingMeasurementData_t measure;

  sensor.rangingTest(&measure, false); // Get distance in mm

  if (measure.RangeStatus != 4) { // Check if measurement is valid
    lcd.setCursor(0, 1);
    lcd.print("                "); // Clear previous value
    lcd.setCursor(0, 1);
    lcd.print(measure.RangeMilliMeter);
  } else {
    lcd.setCursor(0, 1);
    lcd.print("Out of Range");
  }

  delay(500); // Update every 0.5 seconds
```

```
}
```



Distance measurement is a crucial aspect of robotics, automation, and IoT applications. In this experiment, we interface a **VL53L0X laser distance sensor** with an **Arduino Uno** and a **16×2 LCD display** to measure and display distance in real-time. The **VL53L0X sensor** uses **Time of Flight (ToF) technology** to calculate the distance between the sensor and an object.

Working of the System

1. VL53L0X sensor emits an infrared laser pulse.
2. The pulse reflects off an object and returns to the sensor.
3. The sensor calculates the Time of Flight (ToF) of the pulse.
4. Distance = (Speed of Light × Time) / 2
5. The calculated distance is sent to Arduino via I2C.
6. Arduino processes the data and formats it for display.
7. The 16×2 LCD displays the real-time distance measurement.

Conclusion:

In this experiment, we successfully interfaced the VL53L0X laser distance sensor with an Arduino Uno and a 16×2 LCD display to measure and display real-time distance. The VL53L0X sensor, based on Time of Flight (ToF) technology, accurately calculated the distance between the sensor and an object by measuring the time taken for an emitted infrared pulse to return.

By first performing unit testing on both the VL53L0X sensor and the LCD separately, we ensured proper functionality before integrating them into a single system. The final implementation displayed real-time distance measurements on the LCD, demonstrating the feasibility of using ToF-based sensors for distance measurement in robotics, automation, and IoT applications. This experiment highlights the importance of precise distance measurement in various real-world applications, including object detection, obstacle avoidance, and industrial automation.