**FORMAN CHRISTIAN COLLEGE**

**(A CHARTERED UNIVERSITY)**

**A blue and white logo

Description automatically generated**

**CSCS 306 A**

**FA24**

**Lab 7 Report**

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**Introduction**

This lab aimed to simulate a control system for monitoring the gas volume in a cylinder using an Arduino-based system. The project involved utilizing a potentiometer to simulate volume levels, an LCD to display these values, and LEDs for real-time visual feedback. Task 1 focused on volume display using an LCD, while Task 2 extended this functionality to include a 4-LED setup to indicate volume percentages.

These tasks introduced essential embedded system concepts, including sensor data mapping, LED control, and serial communication for debugging purposes.

**Functions**

**Task 1: LCD-Based Volume Display**

The code for Task 1 was designed to:

* Read analog values from a potentiometer.
* Map these values to gas volume (0 to 100 cubic feet).
* Display the mapped volume on a 16x2 LCD in real time.

**Task 2: LED-Based Volume Display**

Task 2 added 4 LEDs to represent volume percentages:

* 1-25%: Turn ON the 1st LED.
* 26-50%: Turn ON the 1st and 2nd LEDs.
* 51-75%: Turn ON the 1st, 2nd, and 3rd LEDs.
* 76-100%: Turn ON all LEDs.

Each task integrated serial communication to display debugging information, including potentiometer readings and mapped percentages.

**Algorithms and Logic**

**Task 1: LCD Volume Display**

**Setup Phase**:

* **LCD Initialization**: Pins for the LCD were specified, and the display was initialized using lcd.begin(16, 2).
* **Potentiometer Connection**: The analog value from the potentiometer was read using analogRead(A0) and mapped to gas volume using the map() function.

**Loop Phase**:

1. Read the potentiometer value.
2. Map the value to gas volume (0 to 100 cubic feet).
3. Display the mapped value on the LCD.
4. Print the raw potentiometer value and the mapped volume to the Serial Monitor.

**Task 2: LED Volume Display**

**Setup Phase**:

* LEDs were configured as outputs using pinMode().

**Loop Phase**:

1. Read the potentiometer value and map it to a percentage.
2. Control LED states based on the mapped percentage:
   * Turn ON LEDs progressively as volume increases.
   * Turn OFF LEDs when the volume decreases.
3. Display real-time readings on the Serial Monitor for debugging.

**Code Breakdown**

**Task 1: LCD-Based Volume Display**

#include <LiquidCrystal.h>

// Initialize the LCD (RS, E, D4-D7 pins)

LiquidCrystal lcd(12, 11, 2, 3, 4, 5);

void setup() {

lcd.begin(16, 2); // Initialize the LCD

lcd.setCursor(0, 0);

lcd.print("Gas Volume:"); // Print a test message on the first row

Serial.begin(9600); // Initialize Serial Monitor

}

void loop() {

int potValue = analogRead(A0); // Read potentiometer value

int gasVolume = map(potValue, 0, 1023, 0, 100); // Map to 0-100 cubic feet

lcd.setCursor(0, 1);

lcd.print("Volume: ");

lcd.print(gasVolume);

lcd.print(" c-ft "); // Add unit

// Print debugging information

Serial.print("Potentiometer Value: ");

Serial.print(potValue);

Serial.print(" | Gas Volume: ");

Serial.println(gasVolume);

delay(500); // Delay for stability

}

**Task 2: LED-Based Volume Display**

// Define LED pins

const int led1 = 2; // 1st LED (1-25% volume)

const int led2 = 3; // 2nd LED (26-50% volume)

const int led3 = 4; // 3rd LED (51-75% volume)

const int led4 = 5; // 4th LED (76-100% volume)

void setup() {

pinMode(led1, OUTPUT);

pinMode(led2, OUTPUT);

pinMode(led3, OUTPUT);

pinMode(led4, OUTPUT);

Serial.begin(9600); // Initialize Serial Monitor

Serial.println("System Initialized");

}

void loop() {

int potValue = analogRead(A0); // Read potentiometer value

int gasPercentage = map(potValue, 0, 1023, 0, 100); // Map to 0-100%

// Control LEDs based on volume percentage

if (gasPercentage > 0 && gasPercentage <= 25) {

digitalWrite(led1, HIGH);

digitalWrite(led2, LOW);

digitalWrite(led3, LOW);

digitalWrite(led4, LOW);

} else if (gasPercentage <= 50) {

digitalWrite(led1, HIGH);

digitalWrite(led2, HIGH);

digitalWrite(led3, LOW);

digitalWrite(led4, LOW);

} else if (gasPercentage <= 75) {

digitalWrite(led1, HIGH);

digitalWrite(led2, HIGH);

digitalWrite(led3, HIGH);

digitalWrite(led4, LOW);

} else {

digitalWrite(led1, HIGH);

digitalWrite(led2, HIGH);

digitalWrite(led3, HIGH);

digitalWrite(led4, HIGH);

}

// Debugging output

Serial.print("Potentiometer Value: ");

Serial.print(potValue);

Serial.print(" | Gas Percentage: ");

Serial.println(gasPercentage);

delay(500); // Small delay for stability

}

**Output**

**Task 1**

A circuit board with wires

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**Task 2**

**Serial Monitor Output**

Potentiometer Value: 512 | Gas Percentage: 50%

Potentiometer Value: 768 | Gas Percentage: 75%

Potentiometer Value: 1023 | Gas Percentage: 100%

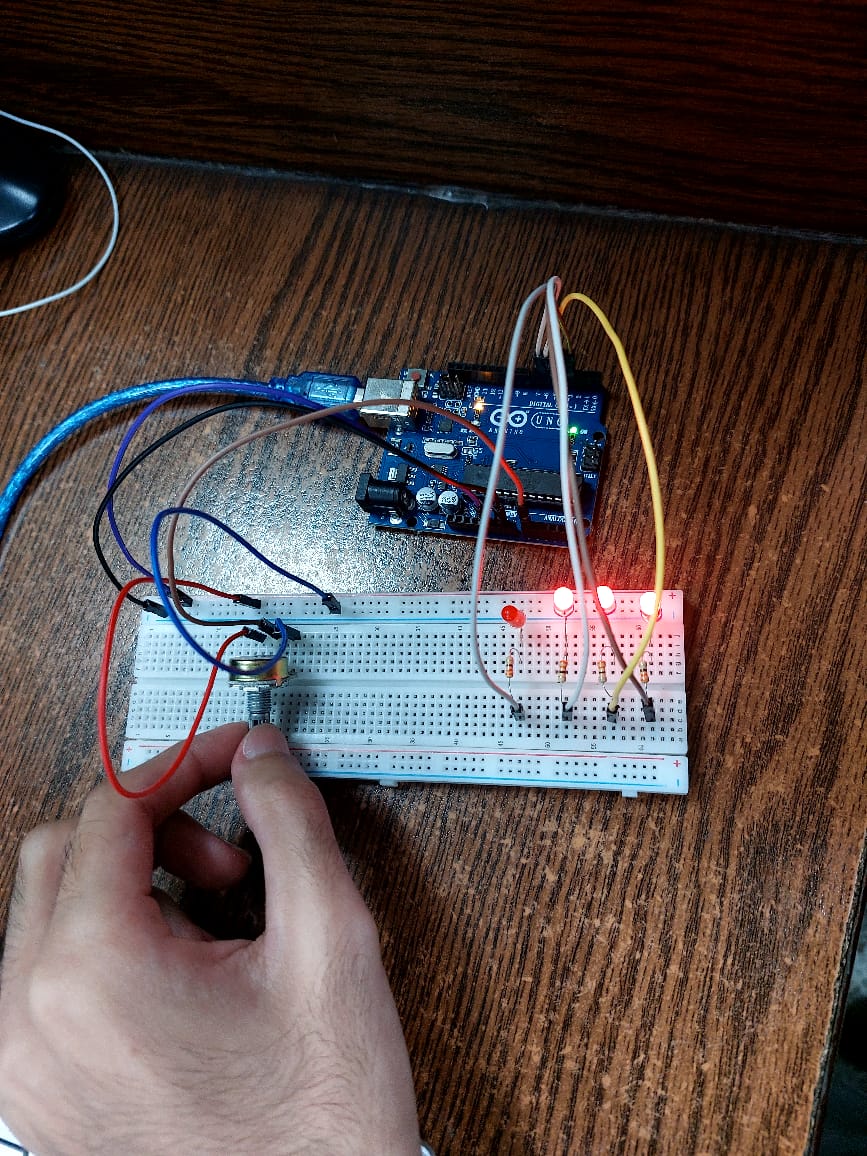
**Images**

A hand holding wires connected to a circuit board

Description automatically generatedA hand holding a circuit board

Description automatically generated

A hand holding a circuit board with wires

Description automatically generated

A hand holding a piece of electronic equipment

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