

Lab Tasks

Task 1 : Arduino Code for LCD Operations

- Setting Cursor on LCD
- Scrolling Text on LCD
- Displaying Custom Characters on LCD

0.1 Task 1 (a) : " Setting Cursor on LCD "

```
// Include LCD library
#include <LiquidCrystal.h>

// Initialize the library with the numbers of the interface pins
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {
  // Set up the LCD's number of columns and rows:
  lcd.begin(16, 2);

  // Print the message "Setting Cursor on LCD" on the first line
  lcd.print("Set Cursor");
}

void loop() {
  // Set the cursor to column 0, line 1 (the second row)
  lcd.setCursor(0, 1);

  // Print "LCD" on the second line of the LCD
  lcd.print("LCD");
}
```

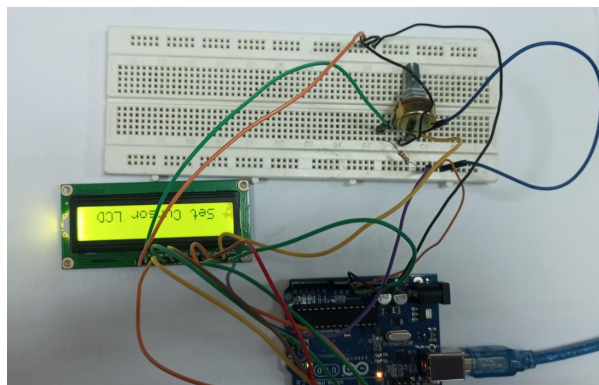


Figure 1: Cursor set on the LCD - text

0.2 Task 1 (b) : " Scrolling Text on LCD "

```
// Include LCD library
#include <LiquidCrystal.h>

// Initialize the library with the numbers of the interface pins
LiquidCrystal lcd(12, 11, 5, 4, 3, 2);

void setup() {
  // Start the serial communication (optional)
  Serial.begin(9600);

  // Set up the LCD's number of columns and rows
  lcd.begin(16, 2);

  // Display the initial text
  lcd.print("world this is a");
}

void loop() {
  // Scroll the text left to right
  lcd.setCursor(0, 1); // Move to the second row

  // Define the scrolling text
  String scrollText = "scrolling text ";

  // Scroll text across the LCD screen
  for (int position = 0; position < scrollText.length(); position++) {
    lcd.clear(); // Clear the display
    lcd.setCursor(0, 1); // Set cursor at the beginning of the second row
    lcd.print(scrollText.substring(position)); // Print the substring starting from
    delay(300); // Delay for smooth scrolling
  }
}
```

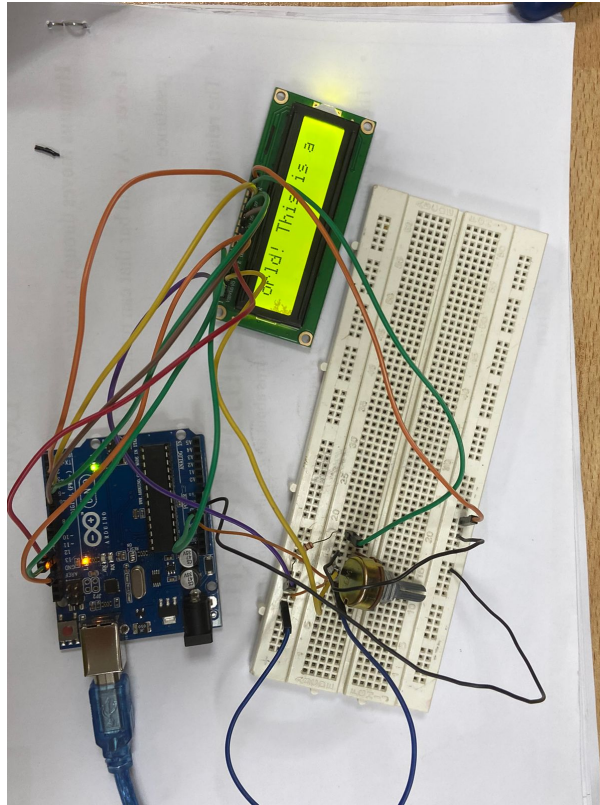


Figure 2: Scrolling Text on LCD

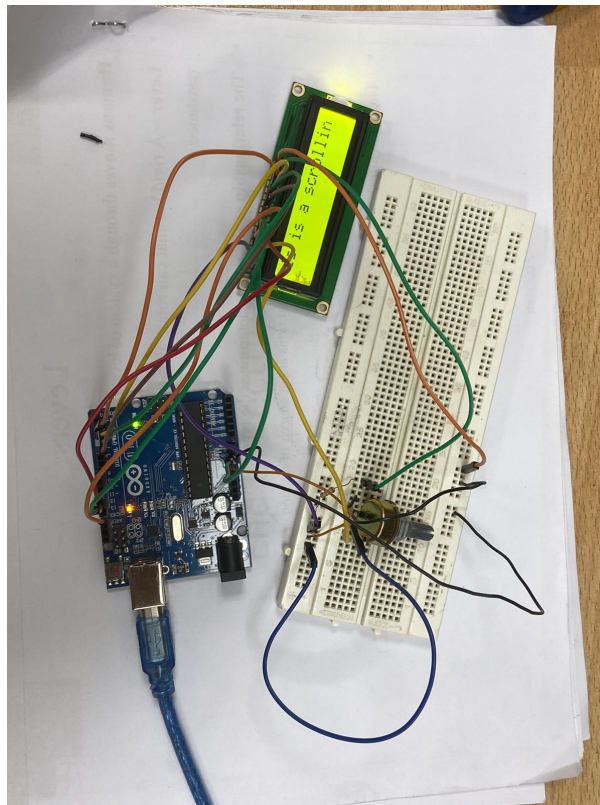


Figure 3: Scrolling Text on LCD

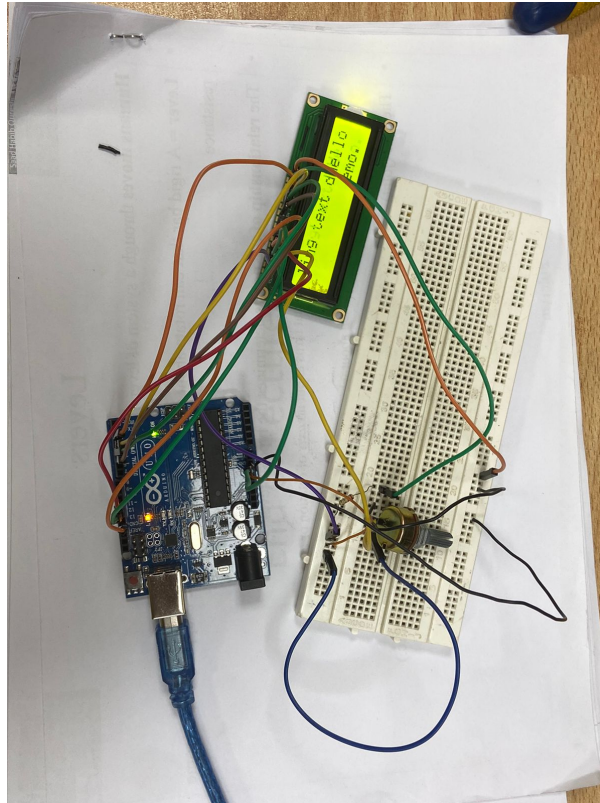


Figure 4: Scrolling Text on LCD

0.3 Task 1 (c) : ” Displaying Custom Characters on LCD ”

```
#include <LiquidCrystal.h>

// Define LCD pins
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;

// Create LCD object
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

// Scrolling text message
String message = "Hello, World!";

// Custom smiley face character (:) - 5x8 pixel character pattern
byte smiley[8] = {
  B00000,
  B10001,
  B00000,
  B00000,
  B10001,
  B01110,
  B00000,
};
```

```
// Setup function
void setup() {
  lcd.begin(16, 2); // Initialize LCD
  lcd.createChar(0, smiley); // Store the custom smiley face in position 0
  lcd.setCursor(0, 0);      // Set cursor to the top-left corner
  lcd.print("Hello, World!"); // Print initial message
  delay(2000); // Wait to display message before starting scroll
}

// Loop function for scrolling text and smiley
void loop() {
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("Look! :)"); // Print message with custom character
  lcd.setCursor(7, 0);   // Position smiley next to message
  lcd.write(byte(0));    // Display the smiley face

  delay(1000); // Delay to show the smiley

  // Scroll the message
  for (int i = 0; i < message.length(); i++) {
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print(message.substring(i)); // Scroll substring of message
    lcd.setCursor(15, 1); // Position for scrolling
    lcd.write(byte(0));   // Display smiley in second row, last column
    delay(400);           // Adjust scrolling speed
  }
  delay(1000); // Pause between scrolls
}
:
```

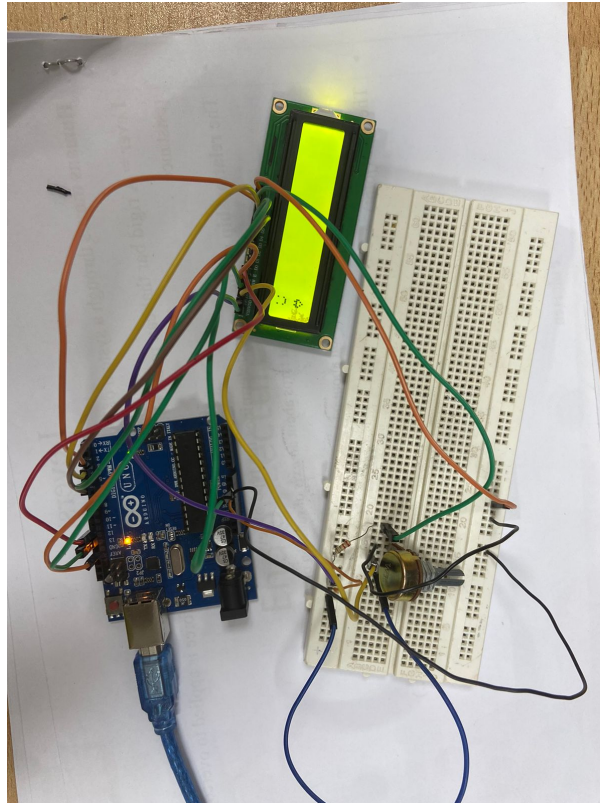


Figure 5: Displaying Custom Characters on LCD

0.4 Question :

Write an Arduino code that accepts serial input from a host computer and displays it on the LCD. Explain each line of the code and include the code and its output with the manual.

0.5 Answer :

```
#include <LiquidCrystal.h>

// Define LCD pins
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;

// Create LCD object
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);

void setup() {
  // Initialize serial communication at 9600 baud
  Serial.begin(9600);

  // Initialize LCD
  lcd.begin(16, 2);
  lcd.setCursor(0, 0);
  lcd.print("Waiting for input...");
}
```

```
void loop() {  
  // Check for serial input  
  if (Serial.available() > 0) {  
    // Clear LCD  
    lcd.clear();  
  
    // Read serial input  
    String input = Serial.readStringUntil('\n');  
  
    // Display input on LCD  
    lcd.setCursor(0, 0);  
    lcd.print(input);  
  
    // Wait for 10 second before clearing LCD  
    delay(10000);  
    lcd.clear();  
  }  
}
```

Output :

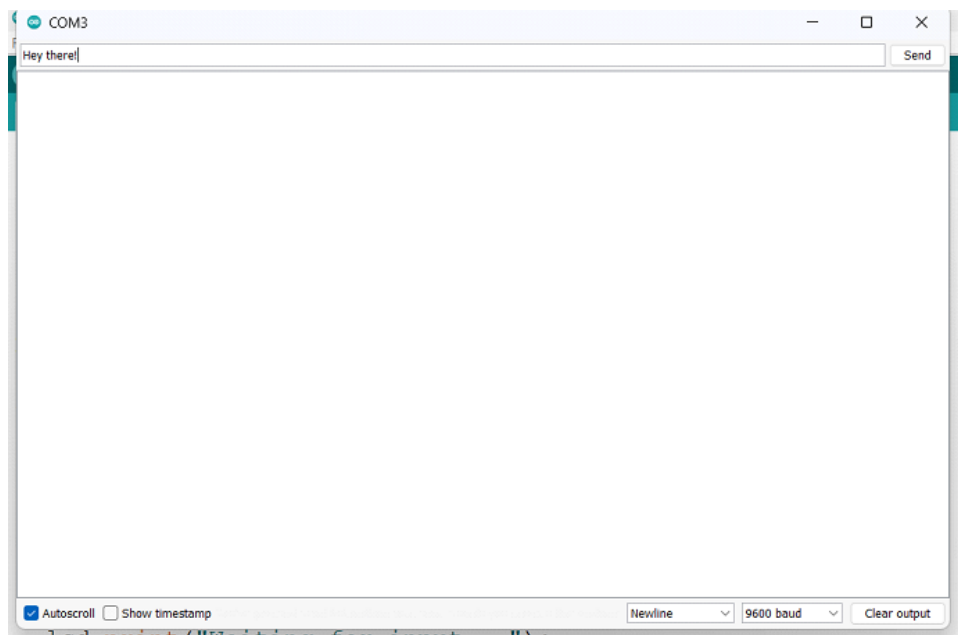


Figure 6: Output for it.

Task 2: Number Systems Conversion

Perform one example of each:

- **Binary to Decimal and vice versa**

- Hexadecimal to Binary and vice versa
- Hexadecimal to Decimal and vice versa

Answer : Binary to Decimal and Decimal to Binary

Example 1: Binary to Decimal

- Binary: 101101

- Calculation:

$$\begin{aligned}(101101)_2 &= (1 \times 2^5) + (0 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0) \\ &= 32 + 0 + 8 + 4 + 0 + 1 = 45\end{aligned}$$

- Result: $(101101)_2 = (45)_{10}$

Example 2: Decimal to Binary

- Decimal: 45

- Calculation:

– Divide by 2, recording the remainder each time:

$$45 \div 2 = 22 \quad \text{remainder } 1$$

$$22 \div 2 = 11 \quad \text{remainder } 0$$

$$11 \div 2 = 5 \quad \text{remainder } 1$$

$$5 \div 2 = 2 \quad \text{remainder } 1$$

$$2 \div 2 = 1 \quad \text{remainder } 0$$

$$1 \div 2 = 0 \quad \text{remainder } 1$$

– Read remainders from bottom to top: 101101

- Result: $(45)_{10} = (101101)_2$

2. Hexadecimal to Binary and Binary to Hexadecimal

Example 1: Hexadecimal to Binary

- Hexadecimal: 2F

- Calculation:

– Each hex digit converts to 4 binary digits:

$$2_{16} = 0010_2 \quad \text{and} \quad F_{16} = 1111_2$$

– Combine: 0010 1111

- Result: $(2F)_{16} = (00101111)_2$

Example 2: Binary to Hexadecimal

- **Binary:** 11011110

- **Calculation:**

- Group into 4 bits each:

$$1101 = D \quad \text{and} \quad 1110 = E$$

- Combine: DE

- **Result:** $(11011110)_2 = (DE)_{16}$

3. Hexadecimal to Decimal and Decimal to Hexadecimal

Example 1: Hexadecimal to Decimal

- **Hexadecimal:** 1A3

- **Calculation:**

$$\begin{aligned} (1A3)_{16} &= (1 \times 16^2) + (10 \times 16^1) + (3 \times 16^0) \\ &= 256 + 160 + 3 = 419 \end{aligned}$$

- **Result:** $(1A3)_{16} = (419)_{10}$

Example 2: Decimal to Hexadecimal

- **Decimal:** 419

- **Calculation:**

- Divide by 16, recording the remainder each time:

$$419 \div 16 = 26 \quad \text{remainder } 3$$

$$26 \div 16 = 1 \quad \text{remainder } 10 \text{ (A in hex)}$$

$$1 \div 16 = 0 \quad \text{remainder } 1$$

- Read remainders from bottom to top: 1A3

- **Result:** $(419)_{10} = (1A3)_{16}$