**Aim:**

**Optimizing MicroPython for different Display Control: Interfacing different display unit with Raspberry Pi Pico W.**

**Objectives:**

1) Introduction to **Different display unit such as OLED Screen, Liquid Crystal display, Seven Segment Display, RGB Led Strip** etc. and its behavior and applications.

2) Implementation of **Programming an OLED Screen to display text** on Micro-python with

Raspberry Pi Pico W.

3) Implementation of Programming a **Liquid Crystal Display (LCD) Screen to display text**

**on** Micro-python with Raspberry Pi Pico W.

4) Implementation of **Room Temperature Meter with a Liquid Crystal Display (LCD)** using Raspberry Pi Pico W.

5) Implementation of Programming a **Common Cathode (CC) based Seven Segment Display Screen to display numeric** on Micro-python with Raspberry Pi Pico W.

6) Implementation of **Displays number 0-9 with or without the decimal point using Common Cathode (CC) based Seven Segment Display** and Raspberry Pi Pico W.

7) Implementation of **favorite colors and displays them on the RGB LED Strip** using Raspberry Pi Pico W.

8) Implementation of a **Randomly generated colourful flowing light using RGB LED Strip module** and Raspberry Pi Pico W.

**Summary of Experiment - 5 Goals and Outcomes**

By the end of this experiment, students will gain a solid understanding of different display devices and their interfacing to Raspberry Pi Pico W using MicroPython programming, and practical experience in building and controlling IoT-related hardware. These skills will serve as a strong foundation for more complex IoT projects in the future.

**Pre-Lab Questionnaire:**

1) What type of interface is typically used to connect an SSD1306 OLED display to a Raspberry Pi Pico?

2) What is the I2C address of the SSD1306 OLED display?

3) What are the pinout connections between SSD1306 OLED display and Raspberry pi pico?

4) How to import the SSD1306 OLED library in MicroPython for Raspberry Pi Pico?

5) How to initialize the OLED display object with specific I2C address and screen resolution in MicroPython for Raspberry Pi Pico?

6) How to clear the OLED display in MicroPython for Raspberry Pi Pico?

7) How to change the contrast of the OLED display in MicroPython for Raspberry Pi Pico?

8) How to invert the colors on OLED display in MicroPython for Raspberry Pi Pico?

9) How to set the OLED display to sleep mode and wake up the OLED display from sleep mode in MicroPython for Raspberry Pi Pico?

10) How many data lines are required to interface an LCD with a Raspberry Pi Pico using MicroPython?

11) What is the function of the RS pin in an LCD interface with a Raspberry Pi Pico?

12) What library do we use to interface an LCD with a Raspberry Pi Pico using MicroPython?

13) How does one Clear the screen of the LCD using MicroPython?

14) How does one control the cursor position of the LCD using MicroPython?

15) How many digital pins are required to interface a 7-segment display with a Raspberry Pi Pico using MicroPython?

16) What is the function of the common pin in a 7-segment display interface with a Raspberry Pi Pico?

17) How can you display the number "5" on a common cathode 7-segment display connected to a Raspberry Pi Pico using MicroPython?

**Answers to Pre-Lab Questions**

**Components/Equipment Required:**

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| --- | --- | --- | --- |
| **Sl. No.** | **Name of the**  **Component / Equipment** | **Specification** | **Quantity** |
|  | Raspberry Pi Pico | RP2040 microcontroller chip, 125MHz | 1 |
|  | Raspberry Pi Pico cable | USB Type A to Micro-B | 1 |
|  | Resistors (carbon type) | ¼ watt (10 KΩ) | 1 |
|  | Resistors (carbon type) | ¼ watt (1 KΩ) | 1 |
|  | Trimmer Pot | 10 K | 1 |
|  | OLED Module | SSD1360, 0.96 inch | 1 |
|  | Thermister | 103 | 1 |
|  | LCD module | 16 x 02 | 1 |
|  | Seven Segment Display | Common Cathode | 1 |
|  | RGB LED Strip | WS 2812 | 1 |
|  | Breadboard | 840 Tie points | 1 |
|  | Jumper Wire | ----------------------- | As per requirement |

**Objective 1**

Introduction to **Different display unit such as OLED Screen, Liquid Crystal display, Seven Segment Display, RGB Led Strip** etc. and its behavior and applications.

**Objective 2**

Implementation of **Programming an OLED Screen to display text** on Micro-python with Raspberry Pi Pico W.

**Code**

**Observation**

**Figure 1: (**Simulation-based setup of an OLED Screen to display text on Micropython using Raspberry Pi Pico**.)**

**Figure 2: (**Hardware-based setup of an OLED Screen to display text on Micropython using Raspberry Pi Pico**.)**

**Objective 3**

Implementation of **Programming a Liquid Crystal Display (LCD) Screen to display text** on Micro-python with Raspberry Pi Pico W.

**Code**

**Observation**

**Figure 3: (**Simulation-based setup of a Liquid Crystal Display (LCD) Screen to display text on Micropython using Raspberry Pi Pico**.)**

**Figure 4: (**Hardware-based setup of a Liquid Crystal Display (LCD) Screen to display text on Micropython using Raspberry Pi Pico**.)**

**Objective 4**

Implementation of **Room Temperature Meter with a Liquid Crystal Display (LCD)** using with Raspberry Pi Pico W.

**Code**

**Observation**

**Figure 5: (**Simulation-based setup of **Room Temperature Meter with a OLED / LCD** to display text on Micropython using Raspberry Pi Pico**.)**

**Figure 6: (**Hardware-based setup of **Room Temperature Meter with a OLED / LCD** to display text on Micropython using Raspberry Pi Pico**.)**

**Objective 5**

Implementation of Programming a Common Cathode (CC) based Seven Segment Display Screen to display numeric on Micro-python with Raspberry Pi Pico W.

**Code**

**Observation**

**Figure 7: (**Simulation-based setup of Common Cathode (CC) based Seven Segment Display Screen to display numeric on Micropython using Raspberry Pi Pico**.)**

**Figure 8: (**Hardware-based setup of Common Cathode (CC) based Seven Segment Display Screen to display numeric on Micropython using Raspberry Pi Pico**.)**

**Objective 6**

Implementation of Displays number 0-9 with or without the decimal point using Common Cathode (CC) based Seven Segment Display with Raspberry Pi Pico W.

**Code**

**Observation**

**Figure 9: (**Simulation-based Displays number 0-9 with or without the decimal point using Common Cathode (CC) based Seven Segment on Micropython using Raspberry Pi Pico**.)**

**Figure 10: (** Hardware-based Displays number 0-9 with or without the decimal point using Common Cathode (CC) based Seven Segment on Micropython using Raspberry Pi Pico**.)**

**Objective 7**

Implementation of your favorite colors and display them on the RGB LED Strip Raspberry Pi Pico W .

**Code**

**Observation**

**Figure 11: (**Simulation-based set-up for displaying favorite colors and display them on the RGB LED Strip on Micropython using Raspberry Pi Pico W**.)**

**Figure 12: (**Hardware-based set-up for displaying favorite colors and display them on the RGB LED Strip on Micropython using Raspberry Pi Pico W**.)**

**Objective 8**

Implementation of a randomly generated colorful flowing light using RGB LED Strip module and Raspberry Pi Pico W .

**Code**

**Observation**

**Figure 13: (**Simulation-based set-up for randomly generated colorful flowing light using RGB LED Strip module on Micropython using Raspberry Pi Pico W**.)**

**Figure 14: (**Hardware-based set-up for randomly generated colorful flowing light using RGB LED Strip module on Micropython using Raspberry Pi Pico W**.)**

**Conclusion:**

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**Precautions:**

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**Post Experiment Questionnaire:**

1) How to write a text to OLED display on a specific x and y coordinate in MicroPython for Raspberry Pi Pico?

2) How to display an image on OLED display in MicroPython for Raspberry Pi Pico?

3) How to draw a line on OLED display in MicroPython for Raspberry Pi Pico?

4) Write a MicroPython code to:

a) Display "Hello World!" on the OLED Display

b) Display an Image on the OLED Display

c) Draw a rectangle on the OLED Display

d) Scroll text on OLED Display

5) A 16x2 LCD is connected to a Raspberry Pi Pico using MicroPython. The LCD's data pins are connected to the Raspberry Pi Pico's GP26 to GP33. The LCD's RS pin is connected to GP25 and the LCD's E pin is connected to GP24. Write the MicroPython code to initialize the LCD and write "Hello World!" on the first line of the LCD.

6) A common cathode 7-segment display is connected to a Raspberry Pi Pico using MicroPython. The display's segments A, B, C, D, E, F, G, and DP are connected to the Raspberry Pi Pico's GP26, GP27, GP28, GP29, GP30, GP31, GP32, and GP33 respectively. Write the MicroPython code to initialize the display pins and display the number "5" on the 7-segment display. like "WOKWI" for IoT experiments in terms of realism, cost, and learning experience.

**Answers to Post-Lab Questions**

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| --- | --- | --- | --- |
| **(Signature of the Faculty)** | |  | **(Signature of the Student)** |
|  | | **Name:** |  |
| **Date:** |  | **Registration No.:** |  |
|  |  | **Branch:** |  |
|  | | **Section** |  |