LCD: Text Animation

INTERNET OF THINGS

Time: 60 mins

Introduction

In this class, the student/s will learn to display static and scrolling text on the LCD using ESP32 board.

New Commands Introduced

- #include <LiquidCrystal_I2C.h> — Includes the LCD_I2C library
- lcd.init() — Initializes the LCD
- lcd.backlight() — Starts the backlight of the LCD
- lcd.setCursor() — Sets the cursor to a particular row and column on the LCD
- lcd.print() — Prints the message passed at the current cursor
- lcd.scrollDisplayLeft() — Scrolls the text one column to the left
- lcd.scrollDisplayRight() — Scrolls the text one column to the right

Vocabulary

- **LCD**(Liquid Crystal Display): is an electronic component that is used to get visual feedback. It uses liquid crystals to control passage of light through the display panel in order to show characters on screen.
- **I2C**(Inter-Integrated Circuit): is a protocol used to establish communication between two or more **ICs**(Integrated Circuits).
- **SCL**(Serial CLock line): is a I2C Clock line. It is used to synchronize all data transfers over the I2C bus.
- **SDA**(Serial DAta line): is a I2C Data line.It is used to transfer data between ICs.

Learning Objectives

Student/s should be able to:

- ***Describe*** LCD and its uses.
- ***Explain*** how LCD works and can be used for visual interaction between ESP32 and humans.
- ***Demonstrate*** how to connect an I2C LCD with ESP32 and display scrolling text on it.

Activities

1. **Class Narrative:** *(3 mins)*

    - Brief the student/s that after unlocking the first door, friends enter a room with another door and a LCD attached to it. They must display the welcome message on the LCD to unlock it.

2. **Concept Introduction Activity:** *(4 mins)*

    - Let the student/s undertake the explore-activity to observe the working of the LCD.
    - Brief the student/s about the types of LCD and how they work.
    - Explain the rows and columns of the LCD student/s will use in the class.
    - Using the slides, explain that the student/s will learn:
        - to connect the LCD.
        - to display a static text on the LCD.
        - to display a scrolling text on the LCD.

3. **Activity 1: Connect the LCD** *(12 mins)*

    Teacher Activity: *(6 mins)*

    - Brief the students about the difference between a LCD and an I2C integrated LCD.
    - Inform the student/s of the I2C pins on the ESP32 board and I2C LCD. Clock pin is used to send a pulse to the board. Data pin is used to send and receive data between devices.
    - Demonstrate how to connect the I2C LCD with the ESP32 board.

    Student Activity: *(6 mins)*

    - Guide the student/s to connect the LCD to the ESP32 board.

4. **Activity 2: Display the Greeting** *(12 mins)*

    Teacher Activity: *(5 mins)*

    - Explain how to install the library and setup the LCD for programming.
    - Demonstrate how to print the message at different positions on the LCD.

    Student Activity: *(7 mins)*

    - Guide the student/s to include the LCD library, setup the LCD, setup the cursor, and print the greeting message on the LCD.

5. **Activity 3: Create a Scrolling Text (***14 mins)*

Teacher Activity: *(8 mins)*

- Brief the students how to scroll the text left or right on the LCD screen.
- Demonstrate how to scroll the text on the LCD screen by writing a for loop and scrolling the text left in that loop.

Student Activity: *(8 mins)*

- Guide the students to create a scrolling text from right to left in a loop and then restarting it from the right like a never ending message.

6. **Introduce the Post class project:** *(2 min)*
    - Create a stopwatch on the LCD.
7. **Test and Summarize the class learnings:** *(5 mins)*
    - Check for understanding through quizzes and summarize learning after respective activities.
    - Summarize the overall class learning towards the end of the class.
8. **Additional activities:**
    - Encourage the student/s to scroll the welcome message from left to right.
    - Encourage the student/s to display the T-rex running from left to right.
9. **State the Next Class Objective:** *(1 min)*
    - In the next class, student/s will create an Electronic Voting Machine using push buttons and a LCD.

U.S. Standards:

CSTA: 2-AP-11, 2-AP-12, 2-AP-13, 2-AP-14, 2-AP-19

Links Table		
Activity	**Activity Name**	**Link**
Class Presentation	LCD: Text Animation	https://s3-whjr-curriculum-uploads.whjr.online/d4a0c592-ac87-49ab-80eb-eb6c4c5893e8.html
Explore Activity	LCD: Text Animation	https://wokwi.com/projects/385338482911751169
Teacher Activity 1	Connect the LCD	https://wokwi.com/projects/3853382522

		16622081
Teacher Reference: Teacher Activity 1 Solution	Connect the LCD	https://wokwi.com/projects/385338204817836033
Student Activity 1	Connect the LCD	https://wokwi.com/projects/384158027599730689
Teacher Reference: Student Activity 1 Solution	Connect the LCD	https://wokwi.com/projects/384157930045455361
Teacher Activity 2	Display the Greeting	https://wokwi.com/projects/385338173821926401
Teacher Reference: Teacher Activity 2 Solution	Display the Greeting	https://wokwi.com/projects/385338125601057793
Student Activity 2	Display the Greeting	https://wokwi.com/projects/384158699649959937
Teacher Reference: Student Activity 2 Solution	Display the Greeting	https://wokwi.com/projects/384158113402613761
Teacher Activity 3	Display a Scrolling Text	https://wokwi.com/projects/385338931817667585
Teacher Reference: Teacher Activity 3 Solution	Display a Scrolling Text	https://wokwi.com/projects/385338891086779393
Student Activity 3	Display a Scrolling Text	https://wokwi.com/projects/385338711824300033
Teacher Reference: Student Activity 3 Solution	Display a Scrolling Text	https://wokwi.com/projects/385338482911751169
Student's Additional Activity 1	Scroll Text to the Right	https://wokwi.com/projects/385339523521824769
Teacher Reference: Student's Additional Activity 1 Solution	Scroll Text to the Right	https://wokwi.com/projects/385339394297405441
Student's Additional Activity 2	Add a T-rex Runner	https://wokwi.com/projects/385361164135636993
Teacher Reference: Student's Additional Activity 2 Solution	Add a T-rex Runner	https://wokwi.com/projects/385360947645573121
Post Class Project	Add a Stopwatch on LCD	https://wokwi.com/projects/384529402565960705
Teacher Reference: Post Class Project Solution	Add a Stopwatch on LCD	https://wokwi.com/projects/384529064581558273