

**IA 2209 – Microcontroller Laboratory**  
**Department of Instrumentation and Automation Technology**  
Faculty of Technology, University of Colombo

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**Design Project - 2024**  
**Basic Temperature Monitor with Alarm and Display Modes**

**Q.** Create a microcontroller-based temperature monitoring system that can:

**Task 1: Temperature Display on 7-Segment Display**

- Use two push buttons to increment and decrement of temperature level instead of a temperature sensor.
- Display the current temperature on the 7-segment display, with appropriate mapping for Celsius and Fahrenheit. (should display both Celsius and Fahrenheit in same display, but in different times)

**Task 2: Temperature Alarm**

- Define a threshold temperature (40 Celsius) beyond which an alarm is triggered.
- Use an LED to signal the alarm when the temperature exceeds this threshold. (Blink a separate LED)
- Provide a push button to reset or acknowledge the alarm.
- Alarm should work in both Mode 1 and Mode 2.

**Task 3: Temperature Range Indication with LEDs**

- Use a set of LEDs to indicate different temperature ranges:
  - LED 1 for cold (e.g., below 15°C).
  - LED 2 for normal (e.g., 15°C to 25°C).
  - LED 3 for warmth (e.g., 26°C to 35°C).
  - LED 4 for hot (e.g., above 35°C).
- Update the LEDs as the temperature changes, ensuring they represent the correct range.
- Also change the brightness of the relevant LED within the range.
  - Increase brightness of the LED 1 in 0 – 15 Celsius range.
  - Increase brightness of the LED 2 in 16 – 25 Celsius range.
  - Increase brightness of the LED 1 in 26 – 35 Celsius range.
  - Increase brightness of the LED 1 in 35 - 40 Celsius range.
  - Blink the Alarm LED when the temperature is above 40 Celsius.

**Task 4: Toggle Between Celsius and Fahrenheit**

- Implement a push button to switch between Celsius and Fahrenheit on the SSD.
- Include conversion logic to ensure correct temperature calculation in both units.

### Task 5: Mode Switching

- Add a push button to toggle between different display modes:
  - Mode 1: Display the current temperature on the 7-segment display.
  - Mode 2: Show the temperature range indication using the LEDs.
- Each press of the button should switch to the next mode.

#### Main Components:

1. ATmega328P Microcontroller
2. 28 pin IC base for Atmega328P
3. Tactile push buttons (6\*6\*4 mm)
4. SSD Displays – cathode type – 3 digits for temperature display.
5. LEDs (4 from one color & 1 from another)
6. 16MHz Crystal Oscillator (if needed)
7. Resistors, Capacitors and other supporting components.

#### Note:

- Choose either the dot board or PCB to solder the circuit components.
- Required resistors and capacitors should be decided by the students.
- Implement debouncing for push buttons to prevent erratic behavior.
- Use interrupts for responsive push button handling.
- 10% marks will be allocated to the finished look of the final product.

### End of the practical,

1. The tasks should be simulated through SimulIDE or Proteous software and demonstrate the simulations.
2. The circuit should be developed on a dot board or on a PCB and demonstrate the functions.
3. A report should be developed about the project. (Report format will be shared).

#### **Deadlines.**

**Simulation Viva – 29<sup>th</sup> May 2024**

**Hardware demonstration Viva – 5<sup>th</sup> June 2024**

**Report Submission – 7<sup>th</sup> June 2024**