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

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 – 29th May 2024
Hardware demonstration Viva – 5th June 2024
Report Submission – 7th June 2024