**Assignment 1**

**Assignment Title: Temperature Monitoring System Design and Implementation**

**Application required:** Embedded Software and Hardware

**Microcontroller:** Any Raspberry pi

**Steps:**

**1. Objective:** Design and implement a temperature monitoring system using a thermistor NTC100. The system should be capable of reading temperature data from the sensor using ADC ADS1219, displaying it on an output interface like an LCD, and triggering an alarm when the temperature exceeds a predefined threshold.

**2. Circuit design:**

* Design a circuit incorporating the ADC ADS1219, NTC100 thermistor, Raspberry Pi 4B, LCD display, and necessary components for interfacing and signal conditioning.
* Select appropriate passive components (resistors, capacitors) for the thermistor circuit and ensure compatibility with the Raspberry Pi GPIO pins.
* Design the alarm circuitry to trigger when the temperature exceeds the predefined threshold.

**3. Circuit simulation:**

* Utilize simulation software (e.g. Proteus, KiCad or Altium Designer) to simulate the designed circuit and verify its functionality.
* Validate temperature sensing, signal conditioning, and alarm triggering aspects of the circuit through simulation.

**4. Schematic/PCB design:**

* Create a schematic diagram of the circuit using a design tool such as Proteus, KiCad or Altium Designer.
* Lay out the PCB considering factors like component placement, signal routing, and power distribution.
* Design a 2-layer PCB layout adhering to design rules and best practices for signal integrity and manufacturability.

**5. Usage of breadboard:**

* Prototype the circuit on a breadboard to verify functionality and test individual components.
* Use the breadboard setup for initial testing and debugging before finalizing the PCB design.

**6. Write SW:**

* Develop Python code to interface with the Raspberry Pi GPIO pins and read temperature data from the NTC100 thermistor using ADC ADS1219.
* Implement logic to process temperature readings, display them on the LCD interface, and trigger the alarm when necessary.
* Ensure error handling and robustness in the software code to handle unexpected scenarios.

**7. Write testcases:**

* Define test cases covering various aspects of the system functionality, including temperature sensing, display accuracy, alarm triggering, and error handling.
* Develop automated test scripts to execute the test cases and validate the system behaviour under different conditions.

**8. Demonstrate functionality:**

* Assemble the PCB based on the schematic/PCB design and populate it with the required components.
* Install the software on the Raspberry Pi and connect it to the PCB.
* Demonstrate the functionality of the temperature monitoring system, showcasing temperature readings, LCD display output, and alarm triggering based on predefined thresholds.
* Perform comprehensive testing to ensure the system meets the specified requirements and performs reliably under normal operating conditions.

80% outside the company  
20% inside the company

**Note:**

1. **Circuit Diagram, Schematic should be submitted (. sch, JPG/PNG file) and PCB file(.pcb).**
2. **Create a full working project in video format with proper explanation and send google drive link.**
3. **Upload the full project on GitHub and share the link.**
4. **Add footprint locations in explanation.**

1. **Datasheet:**
2. **Thermistor: https://datasheetspdf.com/mobile/944190/Danfoss/NTC100K/1**

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