ELEC 291 – Project Module #2
Summer 2022

Temperature Sensing

Note: Your work in this module builds on your design from module #1. This means that your final work should include all the circuits from module 1 and module 2.

PART A

1. In the previous module, you turned on a fan for temperatures above 45^{o}C. If the temperature is in the 35^{o}C - 45^{o}C range, turn on the same fan but at half speed of what you have for 45^{o}C, using PWM.

2. Turn off the fan after 30 seconds (only for the 35-40^{o}C range).

   Note: This means that in your final demo, you have a fan with two speeds: One for temperatures above 45^{o}C and one for the 35^{o}C - 45^{o}C range.

   Note: This part of the circuit is not connected to the microcontroller and should be controlled separately.

PART B

1. Save your temperature reading in a micro SD card at a speed of 10 data per second. Your card should have enough memory for storing 24 hours worth of data.

2. Transfer the data to your computer and plot a graph of Temperature vs. Time.

3. Control the start and end of data logging with a push button.

   Note: Other features of the project should be functional during the data logging process.

Simulations

- Simulate your circuit in part (A) in MultisimLive.

Do we need to include the last report?

Reflection of each or the whole team?

Final Report

Your report should include the following sections:

- **Design and calculations:** Your design for each part of the project (Module #1 and Module #2) with schematics. For each circuit, explain clearly how you have chosen the components and their values and justify your decisions with calculations, etc.

- **Design Decision Making**

  - **Improvement to Module #1:** Show any improvement you made to your design (circuit or code) for each part of Module #1 (data reading from NTC, motor control 1, circuit protection, etc.). Compare the new design with the previous one (for each part) and discuss the improvement in terms of performance/accuracy, power consumption, or economic aspects.

  - **Module #2 Design Alternatives:** Compare your design (circuit or code) for each part of Module #2 (motor control 2, data logging, logic gates, etc.) with an alternative design in terms of performance/accuracy, power consumption, and economic aspects, and justify your final choice.

- **Maximum Range:** What is the maximum range of temperature that can be measured with a 0.1^{o}C precision in your design? Did this range improve compared to module #1? Explain and show your calculations.

- **Challenges and Mitigations:** What were the challenges faced in designing your device and how did you mitigate them?

- **Theory vs. Practice:** Discuss three significant discrepancies that you noticed between theory/simulations and practice. Explain the reason behind each discrepancy.

- **Reflection:** What is your main takeaway from this project? What would you do differently if you were to do this project again?

- **Applications:** Think of an application, other than the obvious ones, that your design can be used for. What modifications would you make to your design to make it suitable for such application? (If you are in CPEN or BMEG, consider applications or modifications that are closely related to your field.)

- **Citations:** Proper citation of any resources used (IEEE style).

- **Appendices:** Any other information or data related to your design (optional).

Deliverables

Deliverables	Due Date	Percentage
Simulations + Code	Tuesday June 21, 11:59 PM	5%
Live Demo	Wednesday June 22	15%
Report	Sunday June 26, 11:59 PM	15%
Short Video	Sunday June 26, 11:59 PM	5%
Total		40%