

EE4930 Advanced Embedded Systems  
Section 011, Winter 2022/23

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## Laboratory 4: "Finite State Machine"

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Pre-lab Submittal:	None.
Demonstration and Submittal:	Due at the end of the day of the Week 6 lab session. Late submittals will be penalized per the course syllabus.

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### Objectives

- Write code to implement a Finite State Machine (FSM) using the Look Up Table (LUT) with function pointers mechanism.

This is an individual lab. Each student must independently complete this assignment. While discussing ideas and potential solutions with your classmates is permitted, sharing code is prohibited.

**All software must be written in C using the CCS IDE.**

For this laboratory, you will use an FSM to implement the control for a dehumidifier. Use the Look Up Table (LUT) method of implementing an FSM. A dehumidifier removes moisture from the air to control the humidity in an enclosed space (frequently used in basements). A compressor cools a coil and a fan blows air from the space across the coil. Moisture in the air condenses onto the coil and runs down to a drain.

### Specifications:

- Inputs:
  - Room temperature – potentiometer (40 – 90 deg. F)
  - Humidity – potentiometer (0 – 100% RH)
  - Humidity setpoint – two push button switches (up, down)
  - Ice sensor – yes/no (switch or jumper)
- Outputs:
  - Fan control – ON/OFF
  - Compressor – ON/OFF
  - LCD
    - Temperature
    - Setpoint
    - Humidity
    - Defrost indication
- The setpoint adjustment should be in increments of 5% relative humidity
- If the humidity sensor reading is greater than the setpoint by at least 5, and if the ice sensor does not sense ice, then turn on the fan and compressor. Leave them on until the humidity reading drops below the setpoint by at least 5.
- If the humidity reading is at least 5 less than the setpoint, and if the ice sensor does not sense ice, turn off the compressor and the fan. Leave them off until the humidity reading goes above the setpoint by at least 5.
- If the humidity sensor reading is within 5 of the setpoint, then there should be no change in the outputs, i.e., if the reading came into this setpoint band from below, the outputs should remain off, if it came into it from above, the outputs should remain on. (hysteresis)

- **EE4930:** Any time there is ice sensed, then turn on the fan (but not the compressor) (Defrost mode). When the ice is gone, return to normal operation, but only start dehumidification if the humidity sensor reading is at least 5 above the setpoint.
- **EE5981:** If there is ice, then turn on the fan (but not the compressor) (Defrost mode). When the ice is gone, return to normal operation, remembering where the system was before defrost. This will only make a difference if the humidity reading when the ice sensor turns off is within 5% of the setpoint.
- Always display the current temperature, humidity and setpoint values. If the unit is running in defrost mode, also display the word 'DEFROST' to indicate to the user that it is in this mode.
- Choose an appropriate update rate for this state machine based on the task requirements.

## Demo

Demonstrate correct operation of your dehumidifier control to the instructor.

## Submittal

In your lab report, include:

- Printed copies of your source code
- Circuit diagram
- State diagram of your FSM