D2L Assignment Folder: Final Exam Part I

- By submitting this work, you guarantee that you have upheld the Code of Academic Integrity.
  - All parties involved will be charged, so please safeguard your work.

Rules:

- You may not use any other human being for questions or help in any way.
- You must do your own work (all programs will be checked for plagiarism).
- You may use books and online references, but you may not ask for help online (e.g., forums).
- We have full faith in your ability to write a great program on your own, but if you have any trouble, please send your Course Instructor an email immediately and we will attempt to help you.

1. System Description

You will use Tinkercad to create an Arduino controlled software and hardware component based system for the HVAC 370 Automated Environmental Control System. This system manages and automates heating and cooling.

The temperature is checked periodically (details below) and displayed. If the temperature is within a moderate range, then the system remains in an 'off' state. If the temperature falls below the range, then the heating system is turned on and the fan motor is activated. If the temperature rises above the range, then the cooling system is turned on and the fan motor is activated. The fan motor is controlled by a potentiometer and the contrast for the LCD on the HVAC is also controlled by a potentiometer.

You will prototype this system using two breadboards, one for the Heating / Cooling / Display mechanisms (shown below on the left) and one for the Fan Assembly (shown below on the right).

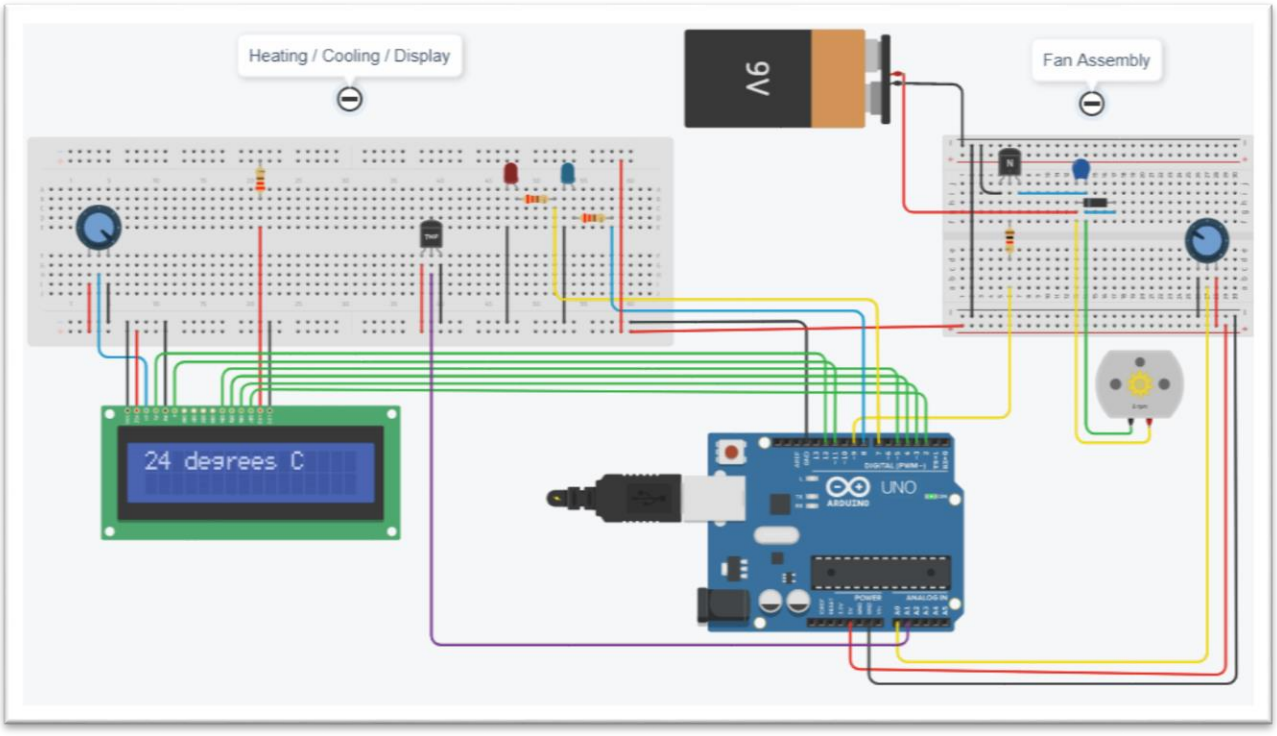

Figure 1 HVAC 370 Automated Environmental Control Circuit

2. References

The following link contains information on how to read the input of the temperature sensor:

Adafruit Learning: How to Read the TMP36 Temperature Sensor

The datasheet for the temperature sensor is in the D2L folder for those of you interested in the full documentation.

Datasheet for TMP35_36_37.pdf

3. Requirements

3.1. Functional Requirements

2.1.1. Environmental Control

2.1.1.1. The system shall check the current temperature every 1 second.

2.1.1.2. The system shall display the current temperature on the LCD screen in degrees Celsius.

2.1.1.2.1. Example (also shown in circuit image below in Figure 1):

24 degrees C

2.1.1.3. The system shall turn on the heating system when the temperature is below 20° C. Turning on the heating system changes the following status:

- Red LED On
- Blue LED Off
- Fan motor On

2.1.1.4. The system shall turn on the cooling system (turn on the blue LED, turn off the red LED) when the temperature is above 28 ° C. Turning on the cooling system changes the following status:

- Red LED Off
- Blue LED On
- Fan motor On

2.1.1.5. The system shall turn off all heating and cooling conditioning systems (both LEDs turned off) when the temperature is between 20 ° C and 28 ° C, inclusive. Turning of the heating system and cooling system changes the following status:

- Red LED Off
- Blue LED Off
- Fan motor Off

2.2. Hardware Requirements

2.2.1. The following hardware configuration shall be used:

Heating / Cooling / Display	
LCD	LCD(Pins 12, 11, 5, 4, 3, 2)
TMP36	5V, Pin A1, GND
Red LED (Heat)	Pin 7
Blue LED (Cool)	Pin 8
Potentiometer	LCD Contrast
220 Ω Resistor	LCD / LED / Power
Fan Assembly	
9V Battery	Quantity: 1
0.1 µF Ceramic Capacitor	Quantity: 1
NPN Transistor (BJT)	Pin 9
1K Ω Resistor	NPN Transistor
Potentiometer	Pin A0
DC Motor	Capacitor / Diode

2.3. Non-Functional Requirements

2.3.1. Prototype Platform

2.3.1.1. This prototype shall be implemented using the virtual Tinkercad platform.

2.3.2. Fan Assembly

2.3.2.1. The prototype Fan Assembly shall be implemented using the same configuration used in Lesson 33 for adjusting the DC Motor speed using a Potentiometer.

2.3.2.2. The prototype Fan Assembly shall be implemented using the same controlling software used in Lesson 33 for adjusting the DC Motor speed using a Potentiometer.

3. Delivery Instructions

3.1. Submit the following assets to the Assignment Folder: Final Exam Part I

3.1.1.Image(s) of your circuit shall show

3.1.1.1. Your name in the Circuit Title box in the upper left corner of Tinkercad

3.1.1.2. The Arduino and the pins used

3.1.1.3. Wiring of the hardware on the breadboard

3.1.2. Plain ASCII Text file containing a copy of your software

3.1.2.1. Name it SIE370Final_LNameF.txt, where LNameF is LastNameFirstInitial

Example: SIE370Final_KeatonS.txt