ECE 1001--1002 Introduction to Robotics
Lab #11: Temp-n-Light

Objectives

Write programs with more complicated decision making

Introduction

You will need an Arduino with the LCD display, photoresistor (light sensor), temperature sensor, switch, and several LED's.

You will need the map function to re-scale numbers
https://www.arduino.cc/reference/en/language/functions/math/map/
You might need to use a do…while loop, which always executes at least once:
https://www.arduino.cc/reference/en/language/structure/control-structure/dowhile/

Requirements

1) Build a system with the LCD display (and a potentiometer to control the contrast) and a temperature sensor;

You may need several variables, although this task can be done using arrays, there is no need to, and unless you are feel sufficiently experienced, stick with single variables. Note, these measurements need floating point numbers, so you should declare these variables as “float” not “int” for example:
float tempNow = 20.0;

This task should operate continuously. You don’t need a while loop for this, but if…else if…else would be a good way to do this.

Temperature will be in degrees Celsius and should be measured every 0.75 seconds (750 ms). The most recent measurement should be in the top row at the left, the measurement before that in the middle of the top row, and the measurement before that at the right in the top row, one digit will not display, arrange them as best you can with space between.

Calculate the average of these three measurements, and if the average is 0.15 degrees (or more) higher than the previous average, "rising" should be displayed at the right of the display, lower row. If the average is 0.15 degrees (or more) less than the previous average, "falling" should be displayed at the left of the lower row. And if the average is not more than 0.15 degrees from the previous average, the word "stable" should be displayed in the middle of the lower row.

Adjust the threshold and measurement time and understand how it works.

Demonstrate your system.

2) Build a system with the LCD display (and a potentiometer to control the contrast), a photoresistor, a manual button.

You may not need float variables for this task. Since you need to combine the hardware and software I/O from several labs, you may want to devise some simple programs that prove your hardware and I/O are setup correctly before you get too deep in building the program.

While the temperature sensor can easily be made to output calibrated units we are accustomed to, such as degrees F or degrees C, the light sensor's output doesn't have a similar familiar scale. We can output the raw 0—1023 analog output, or convert that output to volts, but neither tell us much about how light it is. What's even worse, some locations may be very bright, others very dim. One way to make the light more useful to us is to convert the light output to a percentage (between 0 and 100) of some maximum and minimum light readings. In some cases, it's desirable to calibrate the light sensor readings to the location it is used. Use one of the Arduino buttons to enter and save the darkest Light sensors value and the lightest sensor value. The map() function can re-scale numbers for you. This lab requires output between 0 and 100, the map function may allow outputs less than 0, replace any negative value with zero.

Write the sensor calibration code for the Light sensor, which only runs once. The calibration code will provide the darkest value the sensor reads and the lightest value it reads. Make a system which you first calibrate to the darkest and lightest sensor values the sensor will experience. It should not reset the calibration values unless the Arduino is reset. Use a switch as a way for the user to communicate when it is “darkest” and when it is “lightest.” The Arduino must wait until the user says it is “dark” or “light” by pushing the button, in response to prompts on the display. After pushing the button, you should assume that a “debounce” is required; for now, just delay 100ms before accepting the value of your switch.

With these two calibration values, the Light sensor should continuously displays a light value between 0 and 100 for how bright the ambient light is. Display this value on the LCD (update every 750 ms). Map the Light sensor value to 0 – 100 using the map function.

Demonstrate your system.

3) Combine 1 and 2 into a big program, which alternates between telling you how light it is for 10 seconds, and then if it getting warmer or colder for 10 seconds. The program should find the light/dark thresholds only once at the start.

Demonstrate your system.