EE2509 Lab5: Prologue

Control Using User Variable Passive Components

Key Principles:

- Resistors, capacitors, and inductors can be made in user variable forms
  - Resistors are called potentiometers (3 terminal) or rheostats (2 terminal)
  - Capacitors are often called trim capacitors
  - Inductors are called variable inductors

Simplified Process:

- Variable resistors can be used as voltage dividers to control an output voltage, as current limiting resistors to control the current (brightness) of an LED, …
- Variable capacitors and inductors are used to limit frequency content (radio station tuning, low pass filter corner, …)

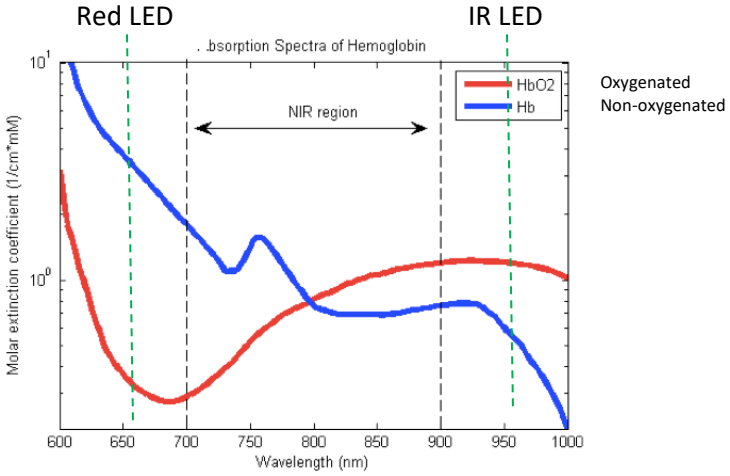
Potentiometer  Trim Capacitor  Trim Inductor 

Pulse Oximetry

Key Principles:

- Oxygenated blood absorbs Red Light and Infrared Light at different rates

Absorption



Oxygenated
Non-oxygenated

Simplified Process:

- Place the Photocell in a resister divider configuration

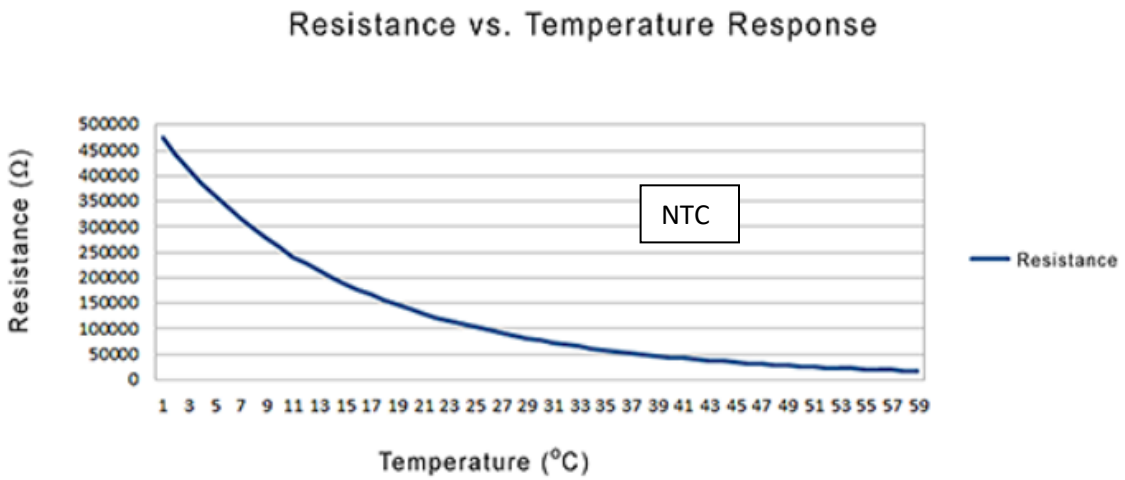
- Shine a Red LED and an IR LED through the skin onto a detector (photocell) on the other side.
- Compare the relative levels of light received to estimate the level (ratio) of oxygenated cells vs non-oxygenated cells

Photcell 

Temperature Measurement

Key Principles:

- The resistance of some materials changes with temperature
- 2 types of Thermistors
  - PTC – positive temperature coefficient: T↑ - R↑
  - NTC – negative temperature coefficient: T↑ - R↓



Simplified Process:

- Place the Thermistor in a resistor divider configuration
- Measure the resistance and use a function to determine the corresponding temperature

Thermistor 

EE2905 Lab 5: Analog Inputs

Objectives

- Interface to Potentiometer (Rheostat)
- Interface to Photocell
- Interface to LED Bar
- Manipulate a Binary Word
- Use the BusOut class

Prelab — **student check off**

- Review the Potentiometer Basics slides ☐
- Review the LED Bar spec ☐
- Review the BusOut Class slides ☐
- Review the Photocell spec ☐

Assignment

Part 1: Create a program that reads the value of the 10KΩ potentiometer in rheostat mode with a 10KΩ load resistor..

Print the results out to the console (in ohms). Only print the value and the word Ohms to speed up the display.

Display the relative resistance in 10-bit binary on the LED Bar.

0Ω	00 0000 0000
…	
5KΩ	10 0000 0000
…	
10KΩ	11 1111 1111

Think carefully about which version of ".read_xxx" will make your work easiest

You can only read the ADC once per loop

Main should only control flow – each major process should be in its own function ☐

Part 2: Create a program that reads the output from the Photocell. Print the relative light intensity (% of max) to the console. Note: you must first characterize the range of light available to properly calculate the %.

Display the relative light intensity on the LED Bar in a thermometer code.

0 – 10%	00 0000 0001
…	
40% - 50%	00 0001 1111
…	
90% - 100%	11 1111 1111

This conversion can be done with if-else or a case statement

Challenge → It can also be done with a 3 line **for** loop

You can only read the ADC once per loop

Main should only control flow – each major process should be in its own function ☐

Check Off

- Demo and document your Potentiometer program 50%
- Demo and document your Photocell program 50%

Checkoff due beginning of Lab 6 (in-person or via Teams chat)

Informal Lab Report: flow diagram(2), code(2), schematic(2), intensity characterization - due beginning of Lab 6.