ECE 303-Serial Communications Project

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Contents

"Light" Reading—hahaha–get it?

- Adafruit website on LEDs: `https://learn.adafruit.com/all-about-leds`
- Adafruit website on photocells: `https://learn.adafruit.com/photocells`

Motivation

Photoresistors are very simple yet useful pieces of electronic circuits. They are used in several equipment, such as cameras and slow RPM counters.

In this project, you will be analyzing a photoresistor, and controlling and receiving data to/from the Arduino via your computer. As the PWM signal increases the duty cycle, the LED should get brighter, up until a point. Additionally, the photocell should decrease in resistance as more light is incident on it.

Baseline Experiment

The baseline experiment is shown in the lecture notes and video. The LED is a white LED in series with a $1\,\text{k}\Omega$ resistor(either one can be connected to ground). On a different circuit, the photocell will be connected to the 5V pin, and in series with a $10\,\text{k}\Omega$ resistor(resistor to ground). The computer is connected to the Arduino via the USB port. You can choose to either use MATLAB or Python on this project.

Required for Each Experiment

For each experiment below, you are to provide the following:

- A properly labeled graph of resistor voltage and photocell voltage versus duty cycle
- A properly labeled graph of photocell resistance and current versus duty cycle. Note that the graph should have the photocell resistance on the left vertical axis and the photocell current on the right vertical axis.

Other common notes across all experiments:

- Conduct all experiments in a space that is as dark as possible, whether all lights in the room are out, or the system is contained in something where light can minimally penetrate.
- Save your data. It might make it easier for you to compare and contrast in your explanations.
- Power your Arduino using a wall socket to ensure your reference voltage for the ADC is 5V.

- Sweep the duty cycle from 0 to 100% by using the analogWrite command, and increment the argument in the analogWrite command from 0 to 255 in increments of 1.

Experiment 1-Base Experiment

Perform the base experiment discussed previously.

Experiment 2-Change the LED color

Return to the base experiment. Replace the white LED with a red LED. After that experiment, replace the red LED with the green LED. Repeat the experiment.

Experiment 3-Change the photocell resistor

Return to the base experiment configuration. Replace the resistor in the photocell line with a $5\,\mathrm{k}\Omega$ resistor. Perform the analysis.

Experiment 4-Averaging

Return to the base experiment configuration. Instead of taking one data point per increment, conduct a 5 point averaging.

Questions to Ponder

1. Is it better to take voltage readings across the photocell or resistor?
2. Is it better to have the experiment be conducted in a totally dark room or in a container that light can't penetrate?
3. Should the photocell get the same voltage readings from different color LEDs? Why or why not?
4. Is it better to conduct averaging on the Arduino, or post-process it on a computer?
5. Is it better to save the data in memory and then transfer the data to the computer, or send the data every sample?
6. Would it be better or worse if each iteration is conducted faster?