EECS 16A Designing Information Devices and Systems I
Spring 2023

1 Introduction

Pre-Lab readings are short 1-2 page notes that we will have you read before your lab sections. They will contain a brief recap of previous lab material as well as a short overview of what to expect for the lab next week.

2 Logistics/Announcements

(a) Lab 1 (Last week) was Python Bootcamp. Checkoff for this lab was not graded so you do not need to worry about lab credit if you did not get checked off. We have already released solutions for this lab on the course website. Please feel free to refer to them if you were unable to finish the lab or if you want a review of the Python concepts covered.

(b) We will be starting the **Imaging Module** next week. Starting from next week's lab (Imaging 1), all labs will be **graded**.

(c) **Important:** We will be giving you your lab kits during your respective lab sections next week. Specific instructions on how to collect your lab kits will be given to you during your section.

3 Imaging 1 Overview

The goal of this module is to use linear algebra techniques to capture real world images with limited sensors. You will essentially be building a camera that captures one/multiple pixels at a time. While cameras in the real world are way more advanced than this, pixel imaging can be used in: X-ray imaging and 3D imaging. It will also prove to be a useful aid to allow you to reinforce the linear algebra concepts you learn in class.

Here are some key terms/definitions that will help your understanding in lab next week:

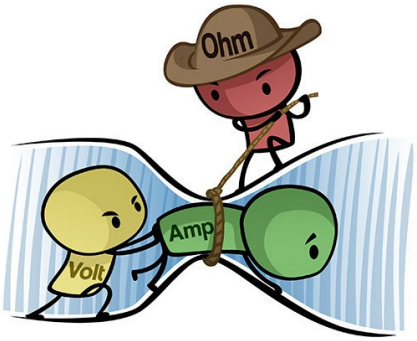
(a) If you try to walk across a carpet and then touch a metal doorknob, you might receive a small shock. This phenomenon of a "small shock" is commonly described as "static electricity". The shock is a result of **electric charge**. A basic property of matter, electric charge is a quantity of electricity that caused by the balance (or imbalance) of electrons and protons in an atom.
Charge (Q) is measured in terms of its standard unit - **coulomb (C)**.

(b) **Voltage (V) [volts (V)]** - Electric force that pushes charge through circuit

(c) **Current (I) [amperes (A)]** - Flow of charge through circuit
1 Amp = 1 charge per second = 1 coulomb per second

(d) **Resistor (R) [ohms (Ω)]** - Circuit component that resists the flow of charge through circuit. Resistance is a measure of how much resistance a resistor can provide (in Ohms).

The easiest way to understand Voltage, Current and Resistance is the following analogy: Think of water flowing through a pipe. The Voltage is the water force, the Current is the amount of water flowing through the pipe, and the resistance is the size of the pipe. More water will flow through the pipe (Current) the more pressure is applied (Voltage) and the bigger the pipe is (lower the resistance). Here's a helpful visual aid to better understand this relationship:



(e) Circuit Components:

i. **Resistors**

ii. **Capacitors** : Circuit component that stores your charge. They are called capacitors because they have a set capacity (in farads (F)). This set capacity, or, the value of a capacitor, is known as its **capacitance**. Capacitance is a measure of how much charge (energy) a capacitor can store.

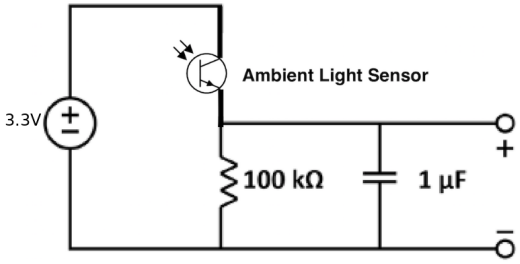
iii. **Voltage Source** : A device that can maintain a fixed voltage. Batteries are a simple example of a voltage source. Batteries are voltage sources that convert chemical energy into electrical energy to generate a voltage.

iv. **Wires / Jumpers** [pin-to-pin vs pin-to-socket]. A wire is a piece of metal that is used to carry electric current in a circuit. Jumper cables are simply wires that are covered in insulation (a material that does not conduct electricity).

v. **Light Emitting Diode (LED)**: A device that converts electric current directly into light.

vi. **Ambient Light Sensor**: A device that detects the amount of light in its vicinity.

You will be building the following circuit in lab:



$k\Omega$ = kiloohm = 1000Ω
μF = microfarad = $10^{-6}F$
NOTE: We don't expect you to understand anything about this circuit. This image is simply a preview of what you will be building in lab.

What does this circuit do? It is a circuit that reacts to light intensity. As you will see in lab, there is a clear, observable relationship between Voltage and Light Intensity, which you can use for your camera.

