EECS 16A Imaging 1

**Insert your names here**
IMPORTANT: LAB CAPACITY

- Only students enrolled in this lab section should be present here

- If you lie about being enrolled in this section, you will be REMOVED from the course
  - Please be ready to show either CalCentral enrollment or an email confirming a switch.
IMPORTANT: COVID Protocols

- Masks are always required
- We will be checking green badges as students enter the lab
- Masks + Wipes + Sanitizers should be available at the TA desk
- Students will be required to wipe down their station before the start of every section
- Food and Drink are never allowed in the lab. This is especially true this semester. Students and staff should go outside (either Cory courtyard or out of the building) for food or water.
- Please DO NOT COME TO LAB if you’re UNWELL!
Action Item: Instructional Accounts

● To use the computers at the lab stations, you will need to login using your instructional account.

● Create an EE16A account by logging into acropolis with your CalNet ID.

● Click “Create an Account” for EE16A and wait for the page to create an account.

● You will be presented with an ee16a account and a password and prompted with an option to send the account information to an email. Please email this account information to yourself.
Action Item: Instructional Accounts

- On a Windows computer, you can change your password by hitting Control + Alt + Delete and selecting “Change Password”. Follow the prompt to permanently change your password.
- If you ever forget the password that you set, you can reset it by going to acropolis and resetting the password associated with that account.
Semester Outline

- Imaging Module
- Touchscreen Module
- Acoustic Positioning Module
Why Imaging?

- Use linear algebra techniques to capture real world images with limited sensors
- Today:
  - Finding a link between physical quantities and voltage
  - If you can digitize it, you can do anything (IOT devices, internet, code, processing)
Today’s Lab: Imaging Part 1

● You should have received lab materials (TI MSP430F5529 + lab kit)
● Circuits + Breadboarding 101
● Build circuit that reacts to light intensity
  ○ Use Launchpad (+ Oscilloscope) to see how the circuit behaves
● Graded checkoff starts today!
Today’s Lab: Imaging Part 1

● In-Person lab
  ○ Uses PSU, Oscilloscope and Launchpad

● Remote lab
  ○ Uses Virtual Oscilloscope and Launchpad
Note for Remote Students

- Do not worry if you don’t get the Launchpad/Energia setup working today
  - Attend buffer section to get help with Energia issues
  - Can still get checked off for Imaging 1 today
Our circuit

3.3V

Ambient Light Sensor

100 kΩ

1 μF
A Little Physics: Voltage, Current, and Resistors

- **Voltage [Volts]** - pushes charge through circuit
- **Current [Amps]** - flow of charge through circuit
  - 1 Amp = 1 charge per second
- **Resistor [Ohms]** - circuit component that resists the flow of charge through circuit
Simple Circuit: The Tools™

- Components
  - Resistors
  - Capacitors
  - Voltage Source
- Wires / Jumpers [male-to-male vs male-to-female]
What’s in your circuit? : Resistors
What’s on your circuit? : Resistors

<table>
<thead>
<tr>
<th>COLOR</th>
<th>1ST BAND</th>
<th>2ND BAND</th>
<th>MULTIPLIER</th>
<th>TOLERANCE</th>
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<tbody>
<tr>
<td>BLACK</td>
<td>0</td>
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Poll Time! What color is a 100 ohm resistor?

1. black-brown-red
2. brown-black-black-brown
3. brown-black-red
4. brown-black-black-black

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Poll Time! What color is a 100K resistor? (100 kilo-ohms, so 100,000 ohms)

1. brown-black-red
2. brown-black-brown
3. brown-black-yellow
4. brown-black-white
Poll Time! What color is a 100K resistor? (100 kilo-ohms, so 100,000 ohms)

1. brown-black-red
2. brown-black-black-brown
3. brown-black-yellow
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Ambient Light Sensor

It behaves like a resistor and the current passing through it depends on how much light there is around it!

Direction matters!
Equipment for Today: Capacitors

They store your charge! Called capacitors because they have a set capacity (in Farads)
Equipment for Today: Wires/Jumpers

Male End

Female End
Equipment for Today: Voltage Source

IMPORTANT: Always keep current limited @ 0.1 A limit

PSU cables are hanging on back wall
We will be using the LaunchPad instead of the PSU as our voltage source. The 3V3 and GND pins on the LaunchPad are the + and - terminals of the voltage source respectively.
Simple Circuit: The Theory

- Components
- Nodes
  - Point in circuit where circuit elements meet
  - Wire between components are considered part of one node
- We know you don’t know much about circuits yet; we’ve given you very detailed instructions on how to build the circuit in the lab
Simple Circuit: The Theory™

- Components (Resistors, LEDs, Capacitors)
- Nodes
  - Point in circuit where circuit elements meet
  - Wire between components are considered part of one node

What components?
How many nodes?
Where are these nodes?
Simple Circuit: The Theory™

- Components (Resistors, LEDs, Capacitors)
- Nodes
  - Point in circuit where circuit elements meet
  - Wire between components are considered part of one node

What components? **Voltage source, resistor**

How many nodes? 2

Where are these nodes?
Simple Circuit: The Theory™

- Components (Resistors, LEDs, Capacitors)
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What components?
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Simple Circuit: The Theory™

- Components (Resistors, LEDs, Capacitors)
- Nodes
  - Point in circuit where circuit elements meet
  - Wire between components are considered part of one node

What components? **Same**
How many nodes? **3**
Where are these nodes?
Horizontal holes are linked together.

But not across the middle divider.
Breadboard
Breadboard Do’s and Don’t’s

How do we make this circuit? →

5V PWR
Breadboard Do’s and Don’t’s

✓ Do plug component’s ends into two different rows - separate nodes
Breadboard Do’s and Don’t’s

✓ Do plug components across the gap in your breadboard - A-E and F-J are separate
Breadboard Do’s and Don’t’s

Is this okay? If there is an error, where?

5V PWR
Breadboard Do’s and Don’t’s

✘ **Do not** plug both ends of component into the same row! This creates a short
Breadboarding Color Convention
Light-detecting Circuit

![Circuit Diagram]

- 3.3V power supply
- Ambient Light Sensor
- 100 kΩ resistor
- 1 μF capacitor
How to get your lab kit (1 per student)

- After finishing ~20% of the lab you will reach the end of the “Obtaining a Lab Kit” section
- Call over a lab staff member and: (also described in lab notebook)
  - Show answers to PSU, Oscilloscope, and lab kit questions
  - Demonstrate how to use the equipment
  - Be able to name components in the lab kit
- Everything in kit (bag+Launchpad) is yours to keep but EACH STUDENT HAS TO BRING THEM BACK TO EVERY LAB
How to start

- Please use the station desktops for this lab
- If you need an instructional account, let us know
- Work in pairs
- This week’s lab is listed as “Imaging Lab 1”
- Make sure website says Spring 2020
FAQ

- **Remote:** Complete the lab in **GROUPS OF 4** in your assigned breakout room
  - You must each build your own setup and answer all questions in your own notebook
- **In-Person:** Complete the lab in **PAIRS**, do ONE setup and notebook per group
- Speak to the TA if you do not have a partner and would like one
- Use the help queue and google checkoff form (linked in the lab)
  - [Lab.eecs16a.org](Lab.eecs16a.org)
- **DON’T LEAVE/PACK UP YOUR CIRCUIT WITHOUT BEING CHECKED OFF FIRST**
FAQ

● Make sure current limit of power supply is set to 0.1A
● Turn PSU output off while building your circuit
● Keep voltage source leads from LaunchPad to breadboard disconnected while building your circuit
  ○ Female ends can stay connected to the LaunchPad
● Probes are on the back wall
● **Make sure you are using the correct resistors (Brown Black Yellow Gold for light sensor)**
● **Make sure your ambient light sensor is in the right direction**
● Before leaving, please return the wires, power off your machines, and sign out of the computers
● Check following slide for common Energia Install errors and possible fixes
Common Energia Install Errors

- **Error**: The system cannot find the file specified
  - Fix: Manually update your board from version 1.0.6 to 1.0.7 (Tools --> Board --> Boards Manager --> Energia MSP430 Boards --> Update)

- **Error**: Serial monitor not displaying anything
  - Fix: select correct Baud rate in the serial monitor window (refer to lab notebook); press RST (reset) button on LaunchPad

- **Error**: Serial monitor displaying strange symbols
  - Fix: close serial monitor; reupload the code to the other COM port and open serial monitor again.

- **Error**: not detecting the launchpad as a launchpad (something like COM3 and COM4 show up)
  - Fix: if on Windows, make sure to install drivers [https://energia.nu/guide/install/windows/](https://energia.nu/guide/install/windows/)

- **Error**: If you have a space in your Windows username and you encounter an error when running the program, follow these instructions (courtesy of a 16B student’s Piazza post)
  - Energia stores some important stuff in this directory: C:\Users\First Last\AppData\Local\Energia15
    - note: username has a space
  - Create the following directory structure: C:\Users\First\AppData\Local
  - Now copy the Energia15 folder from your actual home directory into the local folder in your firstname only user home directory.