EECS16A Imaging 1

TA, ASE, ASE, ASE

Please sit in front of a lab station with a partner! You need to use the towers!
IMPORTANT: ROOM CAPACITY

- We can’t have more than 49 people in this room
- If lab is full, we will first kick out all waitlisted folks
- If you lie about being enrolled, you will be REMOVED from the course
  ○ Please be ready to show either CalCentral enrollment or an email confirming a switch.
Semester Outline

- Imaging Module
- Touchscreen Module
- Locationing 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

- Distribute materials (TI MSP430F5529)
  - Bring your kit **every week**
    - Yes, even if your partner brings theirs
- Circuits + Breadboarding 101
- Build circuit that reacts to light intensity
  - Use Oscilloscope and Launchpad to see how the circuit behaves
- Graded checkoff starts 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 on your circuit? : Resistors
## 4 Band Resistor Color Coding

<table>
<thead>
<tr>
<th>COLOR</th>
<th>1ST BAND</th>
<th>2ND BAND</th>
<th>MULTIPLIER</th>
<th>TOLERANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLACK</td>
<td>0</td>
<td>0</td>
<td>x1Ω</td>
<td>±1%</td>
</tr>
<tr>
<td>BROWN</td>
<td>1</td>
<td>1</td>
<td>x10Ω</td>
<td>±1%</td>
</tr>
<tr>
<td>RED</td>
<td>2</td>
<td>2</td>
<td>x100Ω</td>
<td>±2%</td>
</tr>
<tr>
<td>ORANGE</td>
<td>3</td>
<td>3</td>
<td>x1000Ω</td>
<td>±1%</td>
</tr>
<tr>
<td>YELLOW</td>
<td>4</td>
<td>4</td>
<td>x10000Ω</td>
<td>±0.5%</td>
</tr>
<tr>
<td>GREEN</td>
<td>5</td>
<td>5</td>
<td>x100000Ω</td>
<td>±0.25%</td>
</tr>
<tr>
<td>BLUE</td>
<td>6</td>
<td>6</td>
<td>x1000000Ω</td>
<td>±0.10%</td>
</tr>
<tr>
<td>VIOLET</td>
<td>7</td>
<td>7</td>
<td>x10000000Ω</td>
<td>±0.05%</td>
</tr>
<tr>
<td>GREY</td>
<td>8</td>
<td>8</td>
<td></td>
<td>±5%</td>
</tr>
<tr>
<td>WHITE</td>
<td>9</td>
<td>9</td>
<td></td>
<td>±10%</td>
</tr>
<tr>
<td>GOLD</td>
<td>9</td>
<td>9</td>
<td>0.1</td>
<td>±5%</td>
</tr>
<tr>
<td>SILVER</td>
<td></td>
<td></td>
<td>0.01</td>
<td>±10%</td>
</tr>
</tbody>
</table>
Ambient Light Sensor

It’s a type of resistor whose value can change depending how much light there is around it!
Equipment for Today: Capacitors

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

IMPORTANT:
Always keep current limited @ 0.1 A limit
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 )
- 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? Same
How many nodes? 3
Where are these nodes?
Breadboard

Horizontal holes are linked together

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

How do we make this circuit?
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

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

3.3V

Ambient Light Sensor

100 kΩ

1 μF
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”
FAQ

- UNZIP the downloaded file before doing anything - ask us if you have questions
- SHIFT+RIGHT CLICK on a folder window to open in CMD
  - Select ‘open powershell window here’
  - ‘ipython notebook’ to open notebook inside prompt
  - Let us know IMMEDIATELY if you’re having trouble with this
- Keep output of the voltage source off while you are building things
- Probes are in the back
- Make sure you are using the right resistor (Brown Black Gold) - get at TA desk
- Make sure your ambient light sensor is in the right direction
- DO NOT PIP INSTALL ANYTHING, keep the install as is
- Complete the lab in PAIRS, do ONE setup per group