INSPIRE 1A03

Electronics for the Rest of Us!

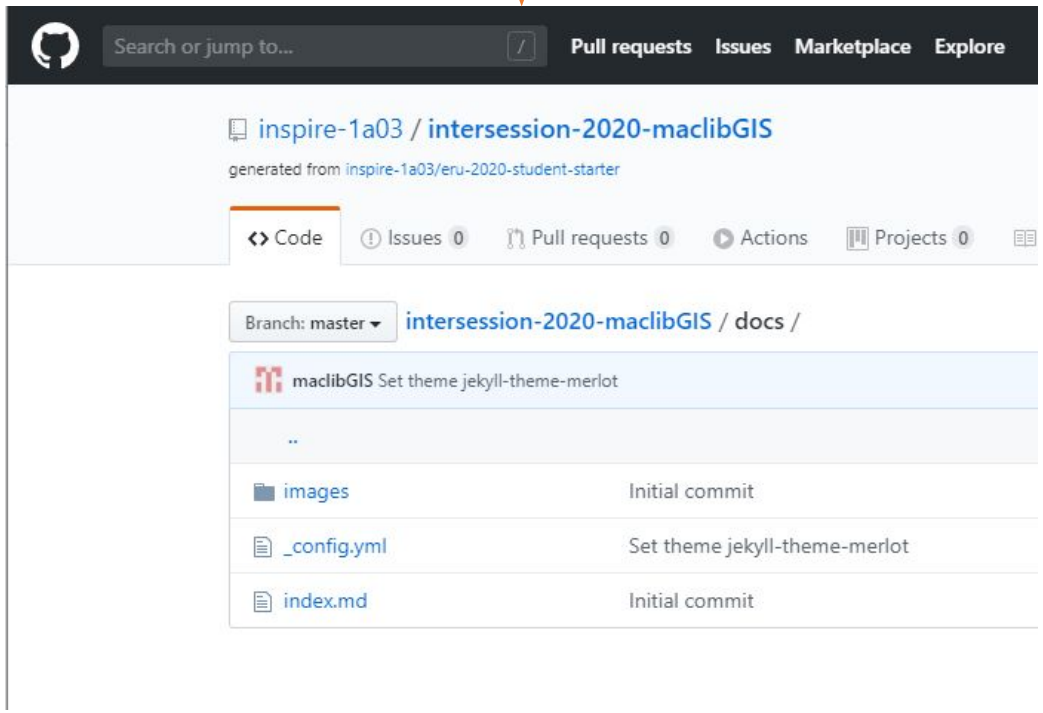
Day 1 recap

Day 2 outline

Day 1 recap

Project GitHub repository

https://github.com/inspire-1a03/intersession-2020-<username>



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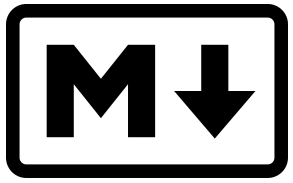
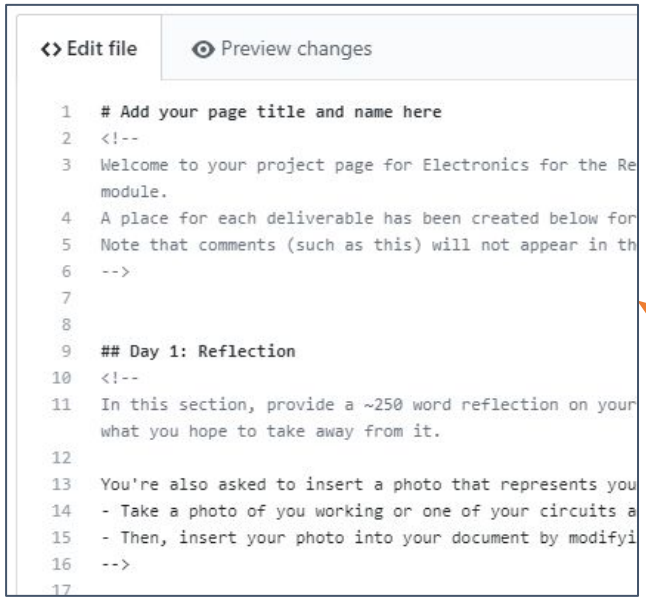
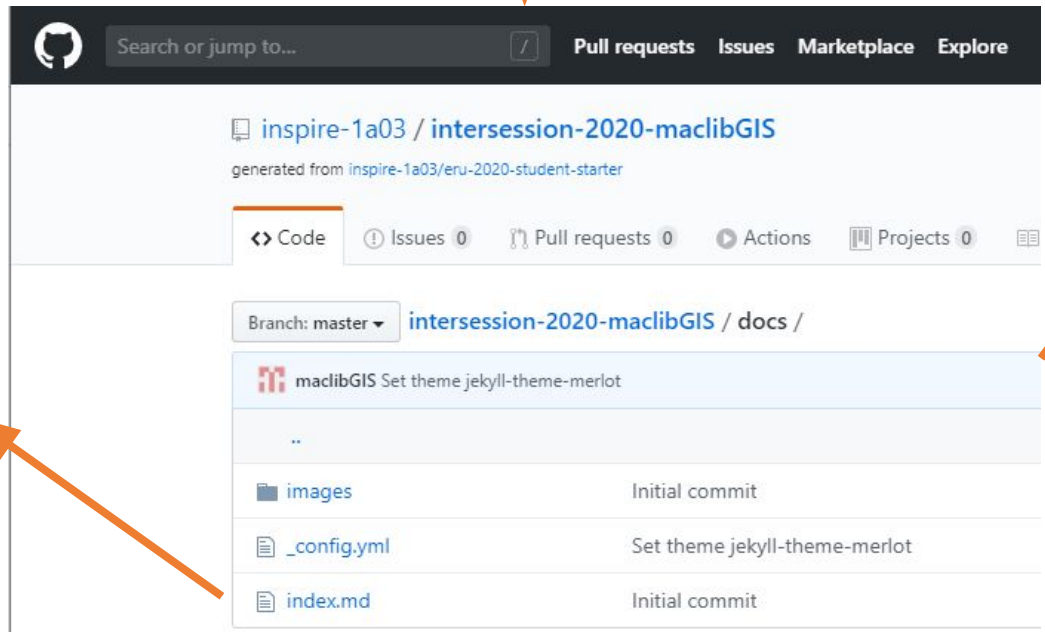
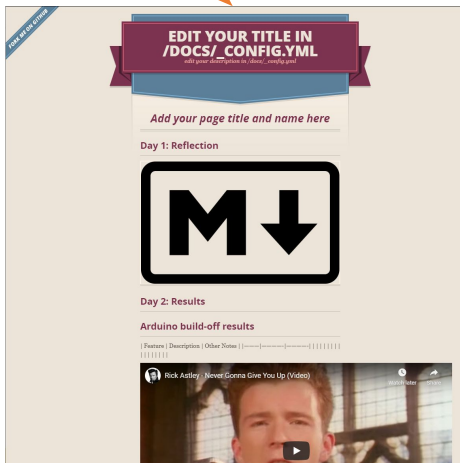




index.md

Markdown + text





Project webpage

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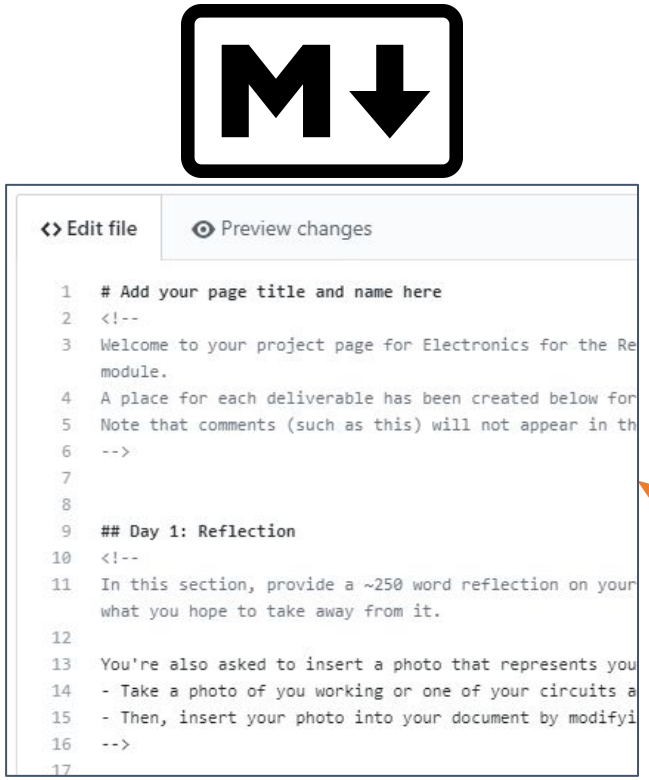

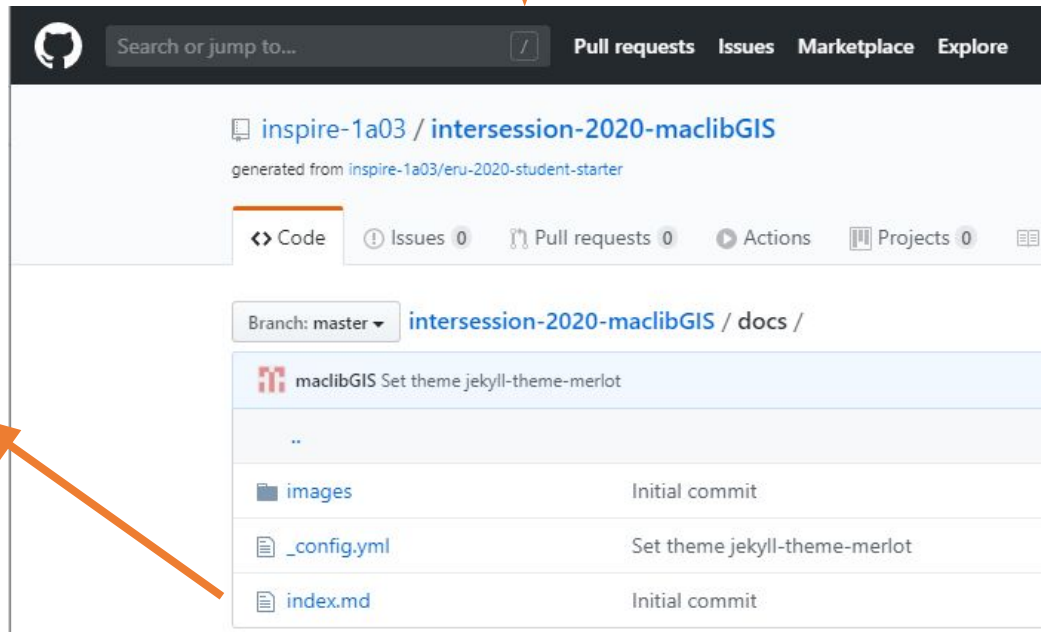

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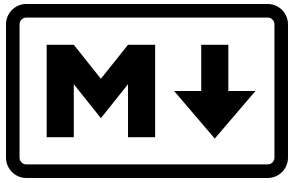

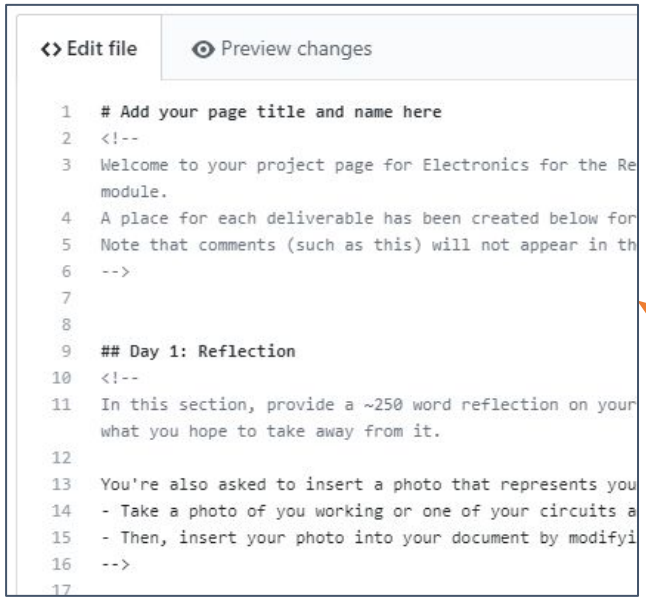

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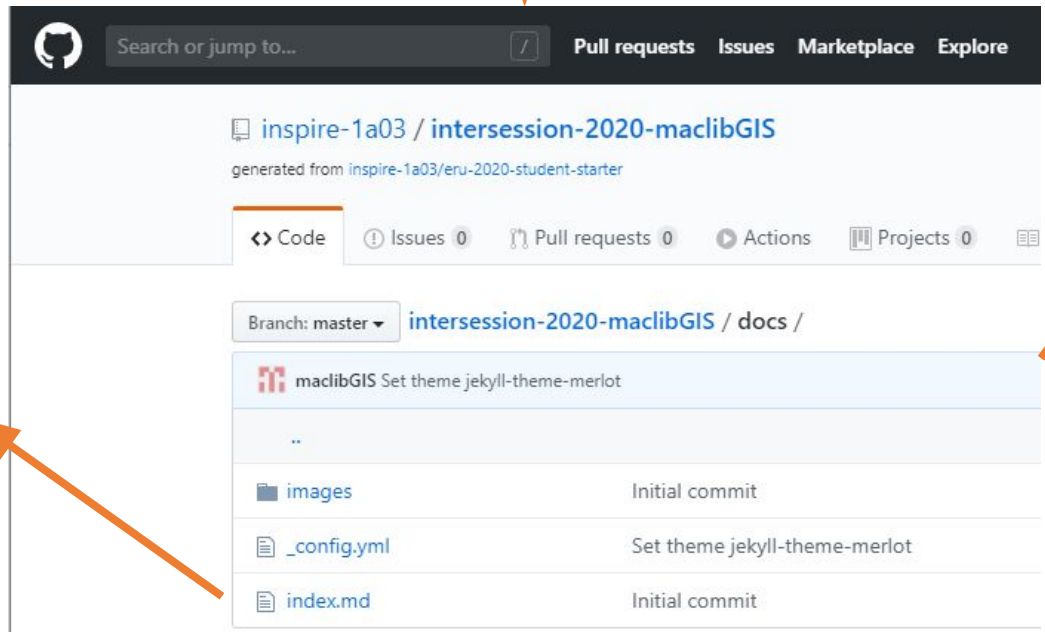

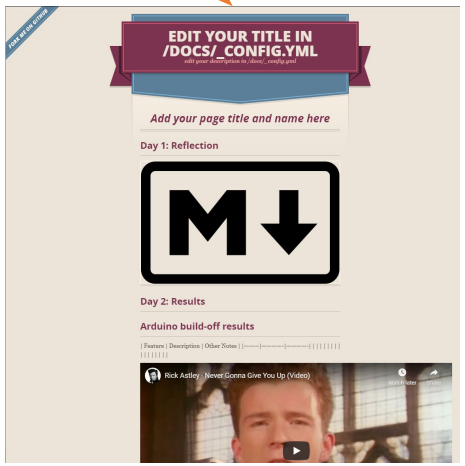

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photos

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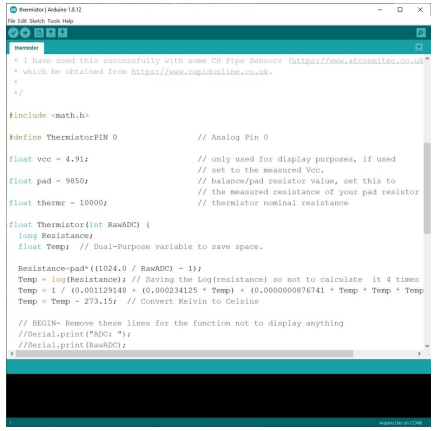
code



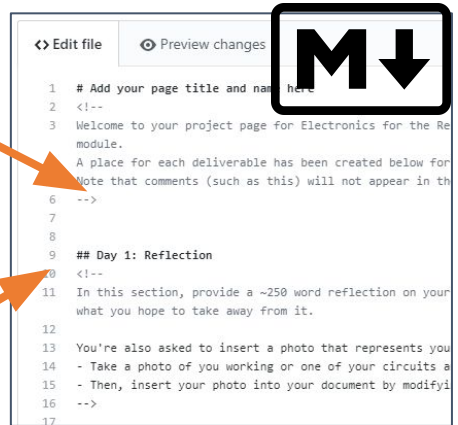
index.md

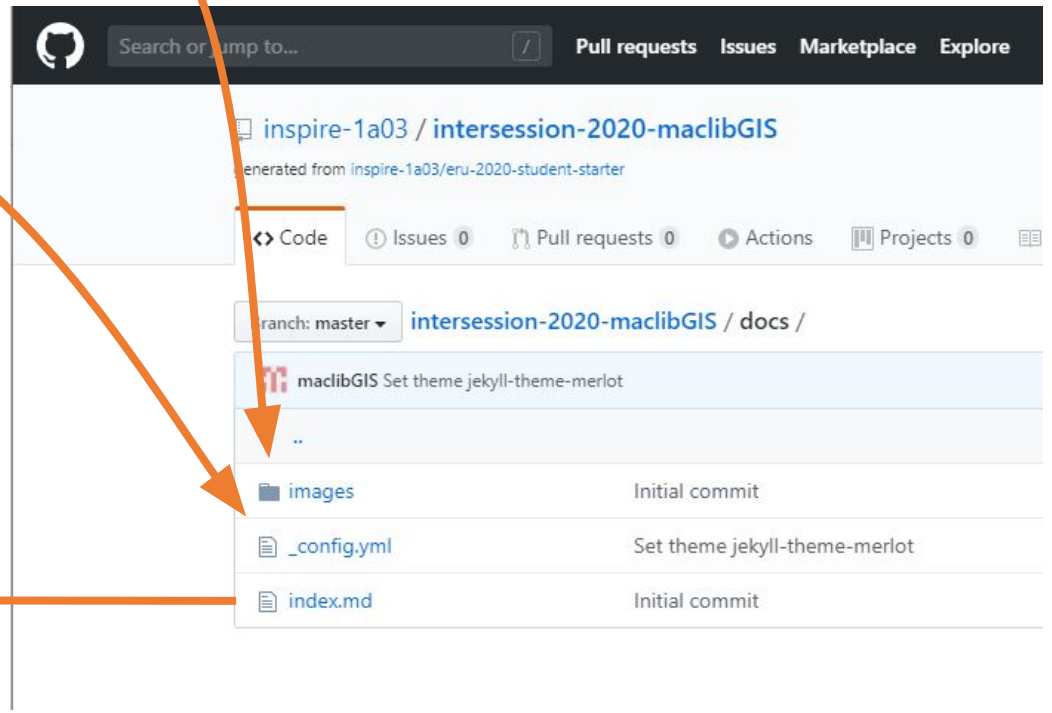
deliverable 1

deliverable 2

deliverable 3

deliverable 4





photos

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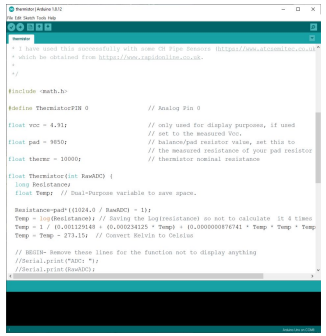

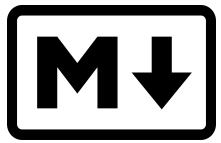

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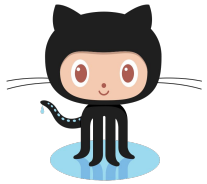
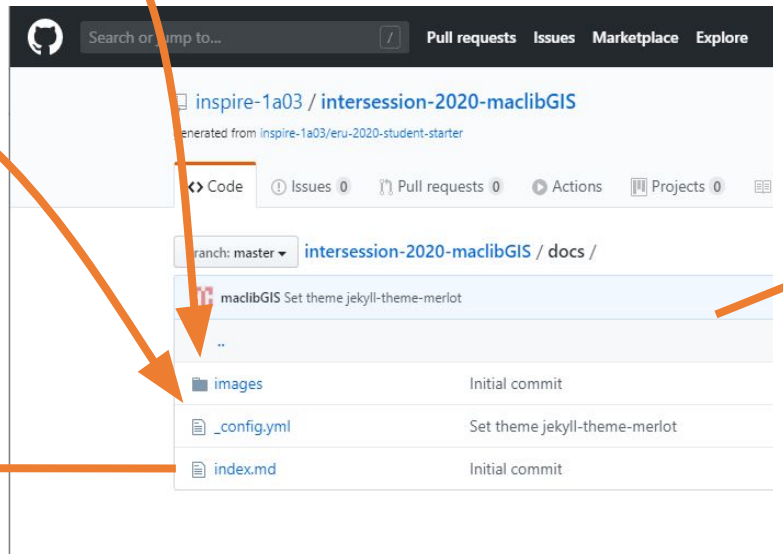
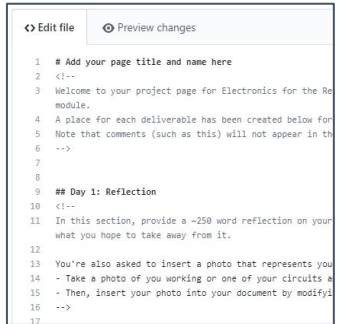
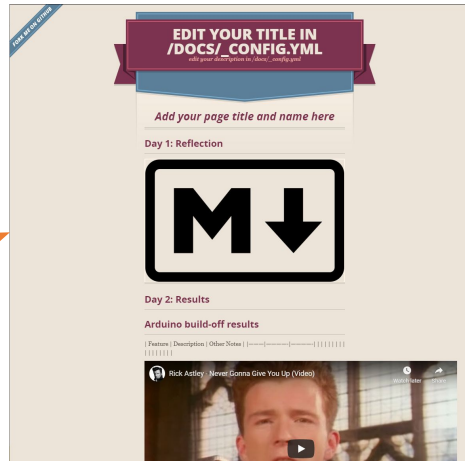








Project webpage

https://inspire-1a03.github.io/intersession-2020-<username>/

Day 2 Outline (slightly revised)

4:10 - 4:30

- Introduction to Devices, Actuators, Sensors (together)

4:30 - 5:15

- Working together — Building basic circuits; running basic programs (together)

5:15 - 6:00

- Working within your breakout group (with support from Jay in the General channel)

7:00 - 8:00

- Open support time (non-mandatory, but Jay is available to answer questions)

Day 1 & 2 Deliverables

Day 1 reflection + photo

- Finish reflection from yesterday
- Take a photo of a device as you're working on it today.
  - Upload to your repo & link to it in your reflection

Day 2 reflection + photo

- Upload your fully-commented Arduino sketch from your final Day 2 build task–a thermometer connected to an RDB LED–into your GitHub repository.
- Provide a short (~150 words) summary of your work on this circuit
- link to your code (in your GitHub repository) in the text of your response.

See full deliverable instruction on outline page of module webpage

https://inspire-1a03.github.io/eru-2020/eru-outline.html

Electronics for the Rest of Us!

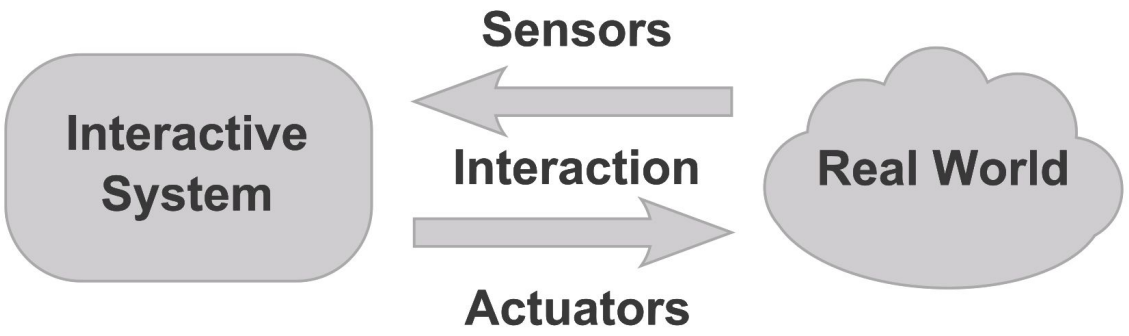
INSPIRE 1A03 | Spring 2020 | Jay Brodeur

Devices, Sensors, & Actuators

Devices: Interacting with the “real world”

Sensors are acted upon by conditions in the “real world”

- Communicate information about the “real world” to the system



Actuators affect changes in the “real world”

- Instructions provided by the system (often in response to sensor input)

Sensors and actuators in everyday life

Consider your phone. What are some of its sensors and actuators?

Sensors

Actuators

Sensors and actuators in everyday life

Consider your phone. What are some of its sensors and actuators?

Sensors

- Light sensor (optical)
- Microphone (sonic)
- Touchscreen (capacitance)
- Camera (optical)
- Thumbprint scanner (capacitance or sonic)
- Buttons (tactile)

Actuators

- Screen (optical / LEDs)
- Flashlight (optical / LEDs)
- Vibration (motor)
- Speaker (sonic)

Physical Computing is...

- building interactive physical systems by the use of software and hardware that can sense and respond to the analog world
- a creative framework for understanding human beings' relationship to the digital world
- most often describes handmade art, design or DIY hobby projects that use sensors and microcontrollers

Thanks, Wikipedia!

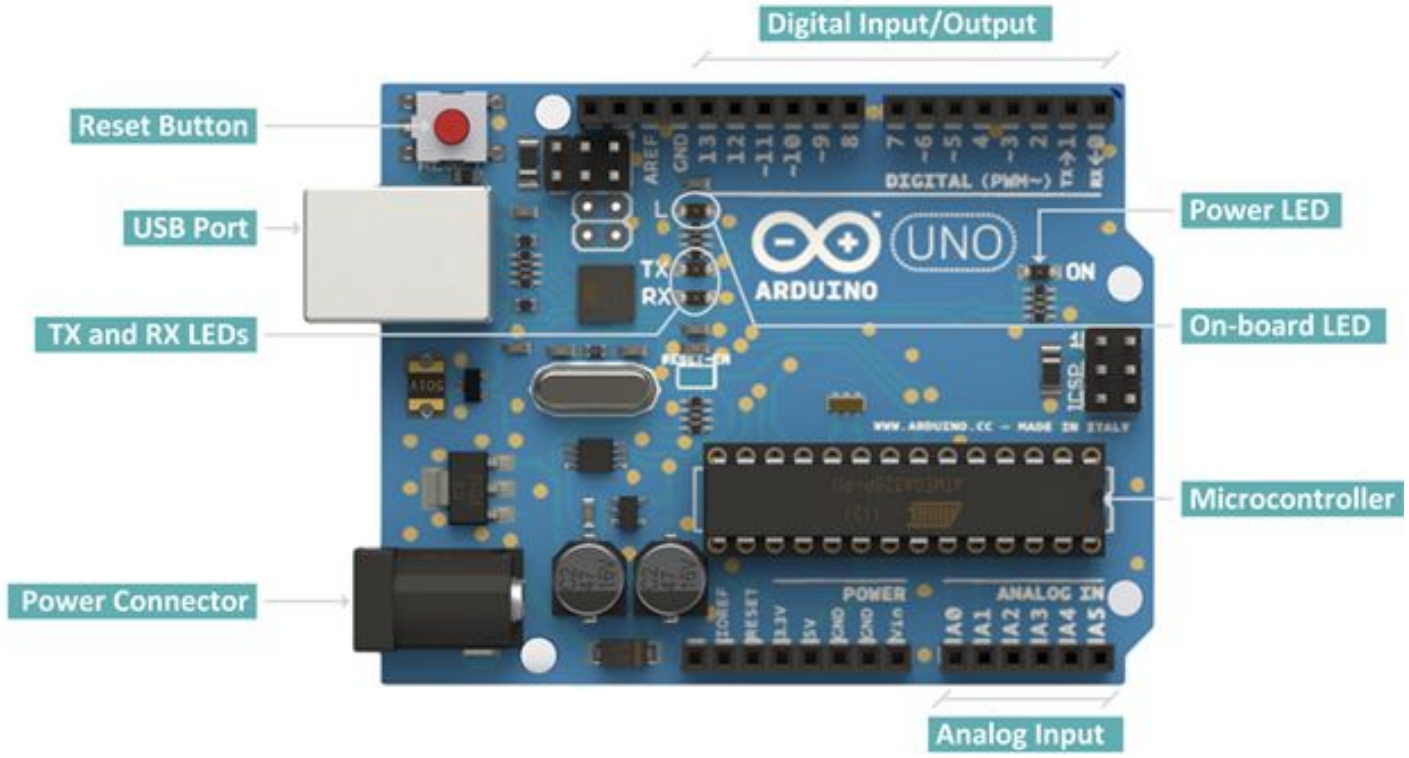
https://en.wikipedia.org/wiki/Physical_computing

Inside your kit.

At this point, feel free to open up your Arduino kit and explore the components that have been given to you.

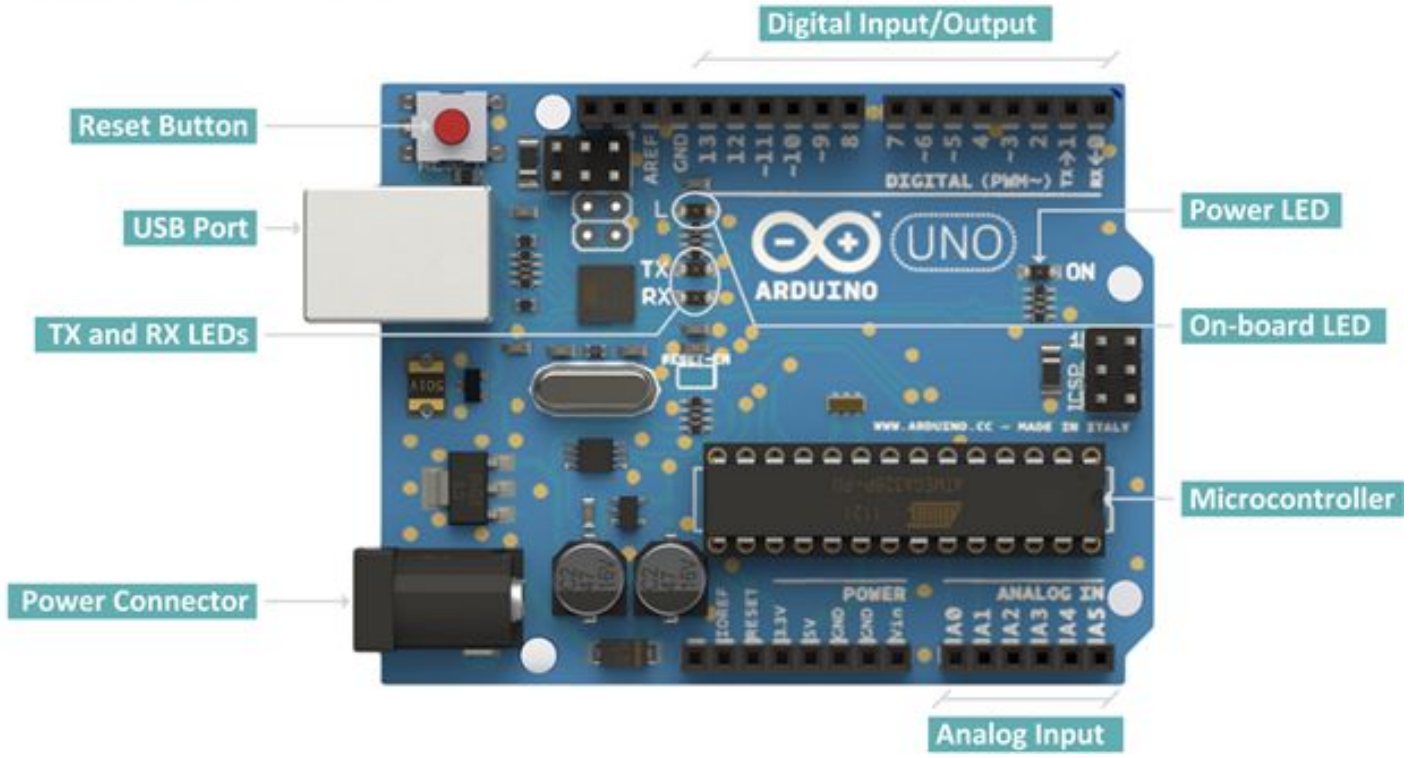
The following slides provide information on these items.

In your kit: Arduino Microcontroller



In your kit, you have been provided with an Arduino UNO R3. The UNO is the most common of the Arduino microcontroller boards, though there are many others that suit a wide variety of purposes! Note that many vendors sell boards similar to Arduinos--many of them are completely compatible with all things Arduino (though it's not guaranteed).

In your kit: Arduino Microcontroller



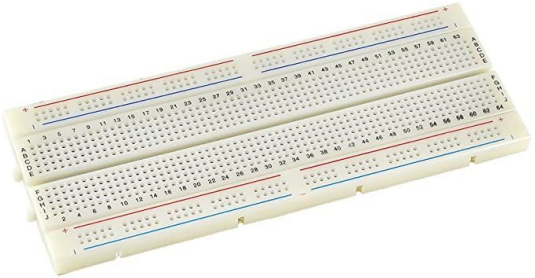
The microcontroller board consists of the microcontroller chip, along with a variety of integrated components that connect it to power sources, computers, and other sensors, actuators, and devices.

On-board LEDs communicate the board's power, transmitting (TX) and receiving (RX) statuses.

In your kit: Connectors

USB Type-B cable

Connects an Arduino board to a computer



Solderless Breadboard

Used to create circuits without soldering

Jumper wires

Used to connect the Arduino, the breadboard, and other components

In your kit: Other circuit components

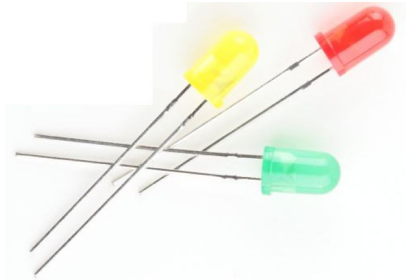
Resistors

Current resisting conductors

Pushbutton

Push-sensitive circuit connection controller

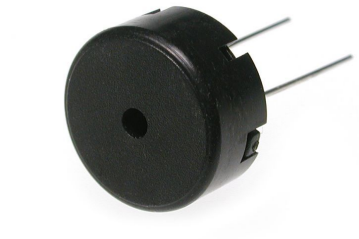
In your kit: Actuators



Light Emitting Diodes (LEDs)

RGB LED

Integrated red, green, and blue LEDs



Buzzer

In your kit: Sensors

Photocell

Light-sensitive variable resistor

Thermistor

Temperature-sensitive variable resistor

Potentiometer

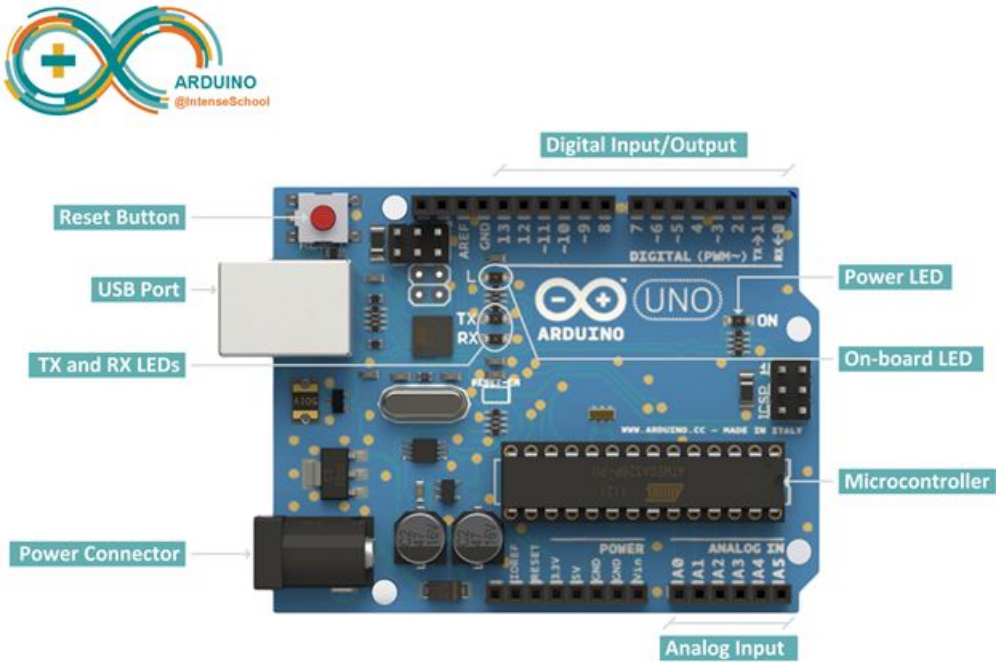
Position-sensitive variable resistor

Arduino is...

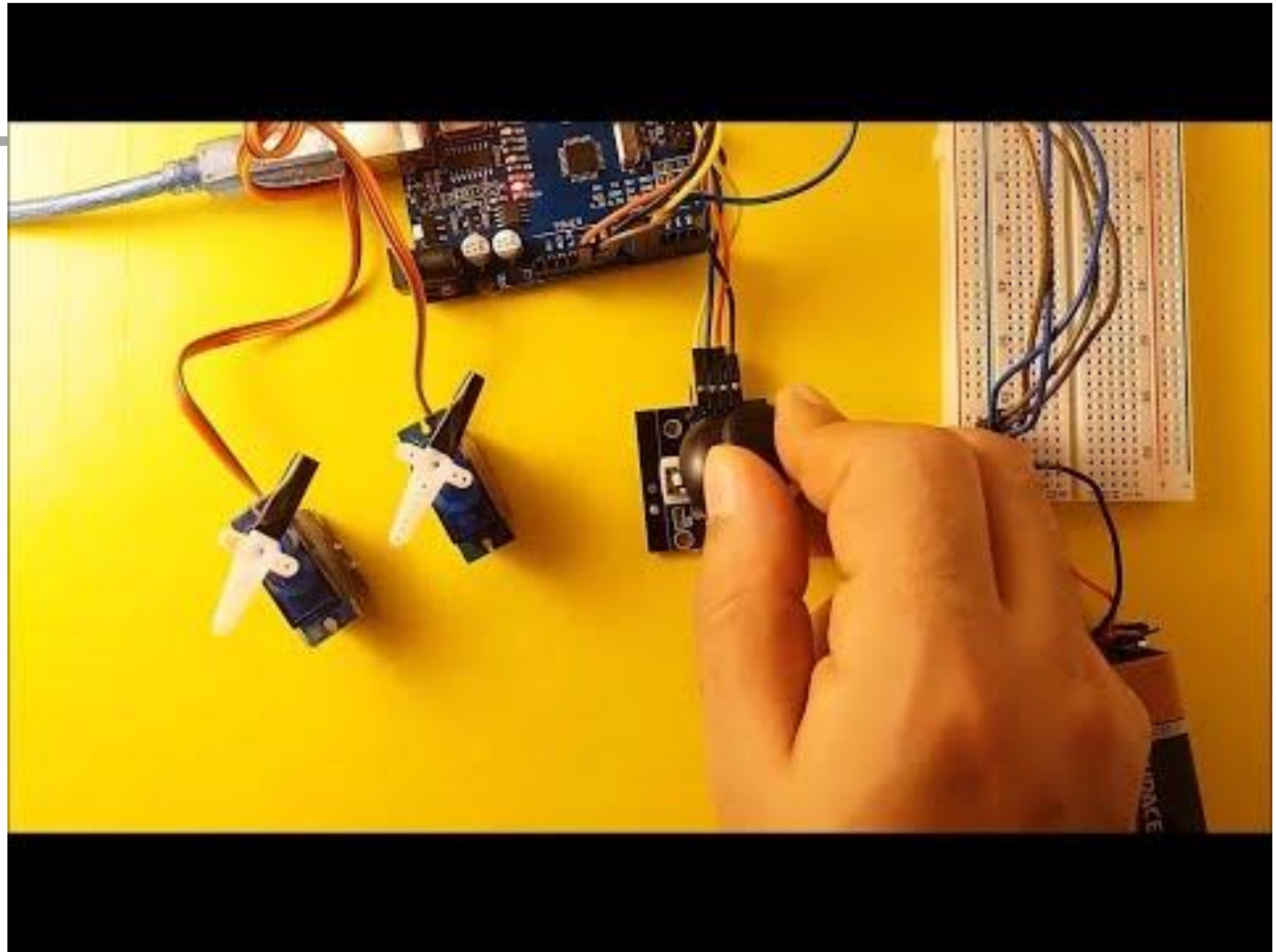
an “open-source electronics prototyping platform...intended for artists, designers, hobbyists, and anyone interested in creating interactive objects of environments”

- arduino.cc

- A single-board microcontroller
- Integrated Development Environment (IDE) software
- A programming language
- A community: arduino.cc/



Some Arduino project examples - Beginner to Intermediate



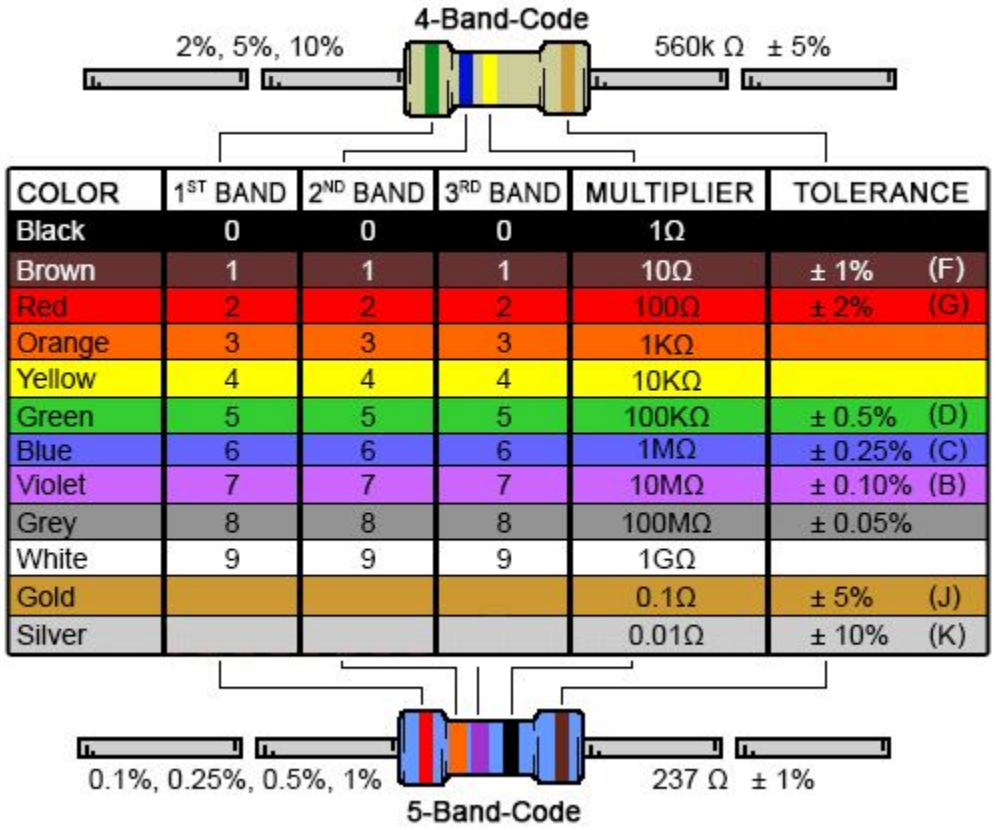
Some Arduino project examples - A little more advanced

Let’s get started!

Go to inspire-1a03.github.io/eru-2020 (u.mcmaster.ca/eru-home)
and navigate to Part 2 in the Day 1 & 2 worksheet

Other important information

Resistor Colour Codes



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8	100MΩ	± 0.05%
White	9	9	9	1GΩ	
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

Resistor colour codes communicate its resistance (i.e. ability to resist current)

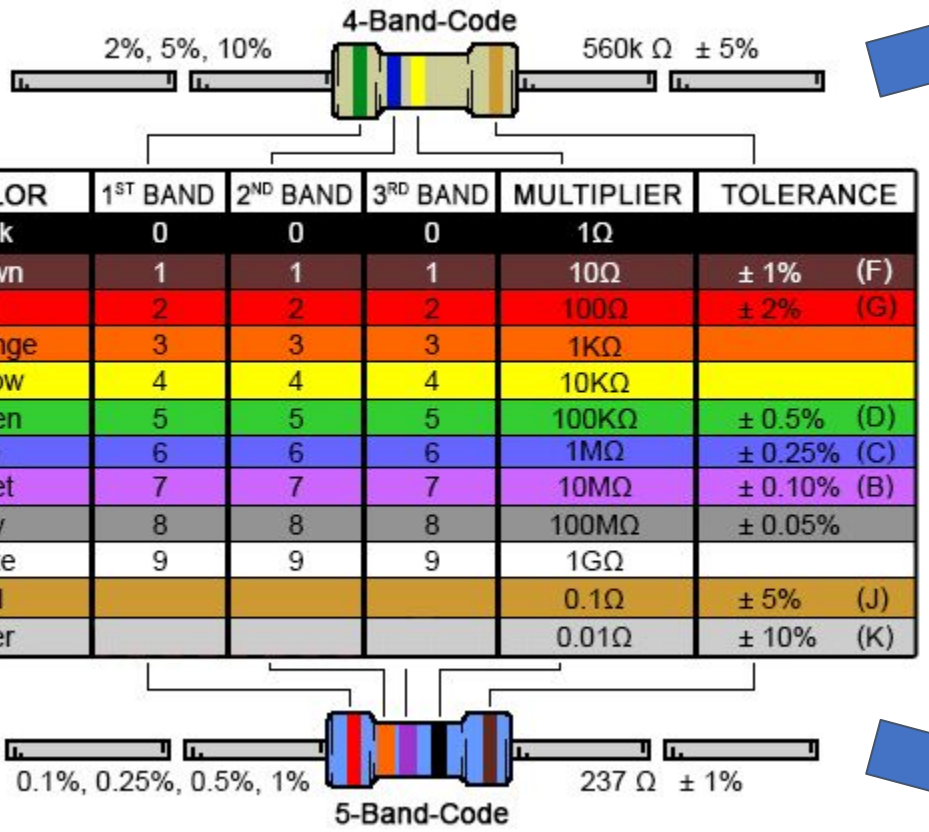
May use 4-, 5-, or 6-band systems

Useful resources

resisto.rs/ - find colour code for a given resistance

bit.ly/resistor-calculator - calculate resistance given a colour code

Resistor Colour Codes



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Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8	100MΩ	± 0.05%
White	9	9	9	1GΩ	
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

4-band example

1st band = green = 5

2nd band = blue = 6

multiplier = yellow = 10000 ohm (=10 Kohm)

56 x 10,000 = 560,000 = **560 Kohm**

5-band example

1st band = red = 2

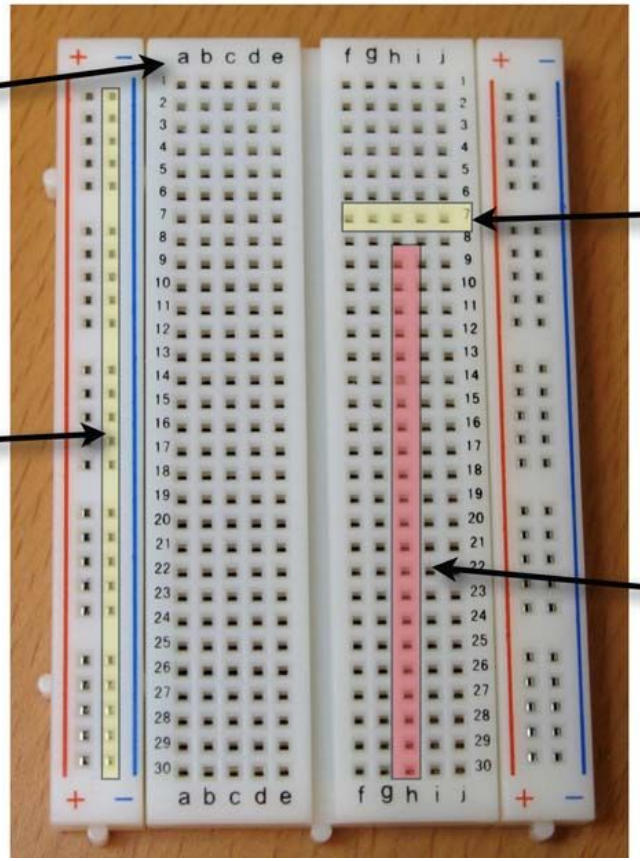
2nd band = orange = 6

3rd band = violet = 7

multiplier = black = 1 ohm

267 x 1 = **267 ohm**

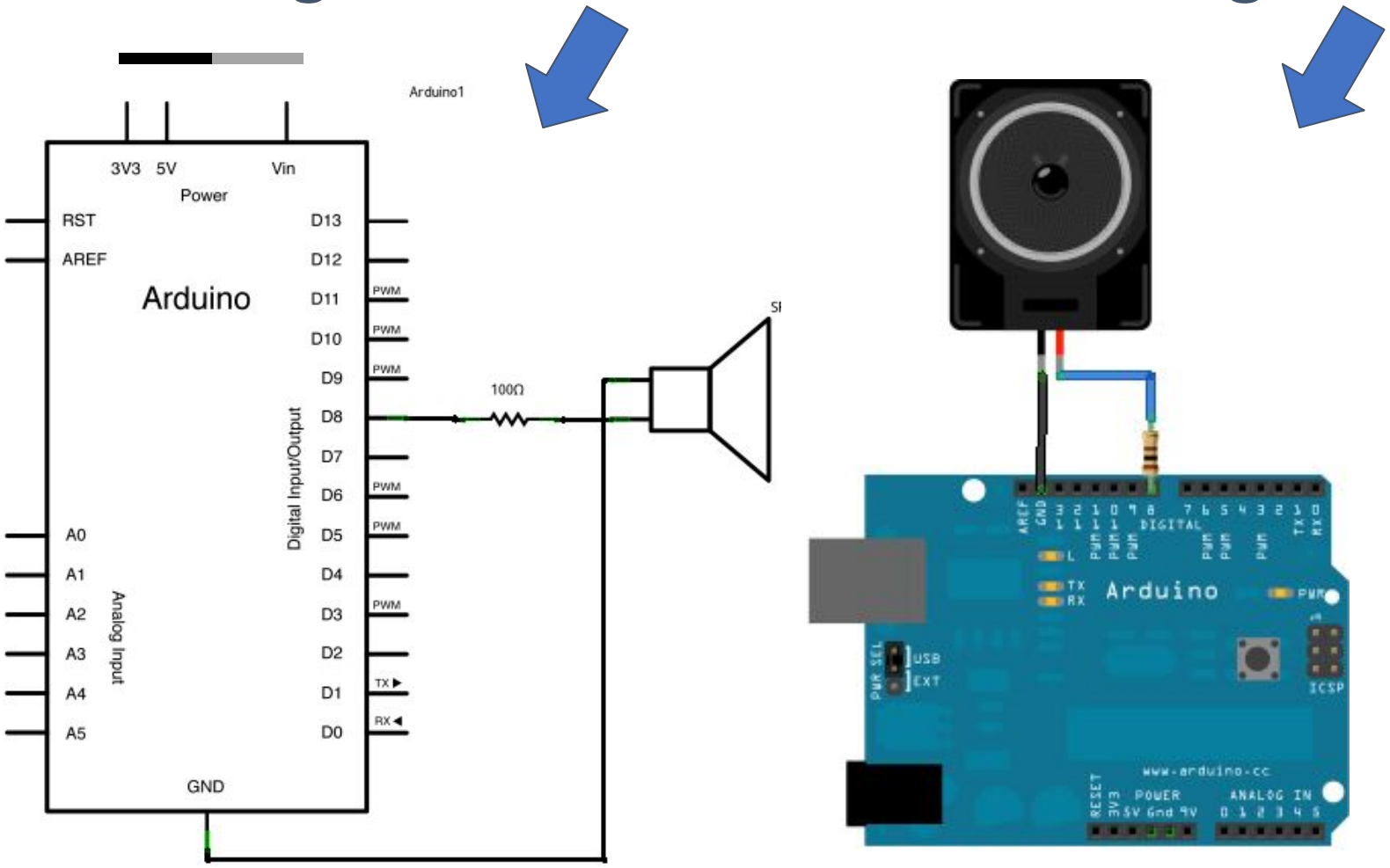
Solderless breadboard



Useful for rapidly creating and prototyping circuits (no need to solder pieces together)

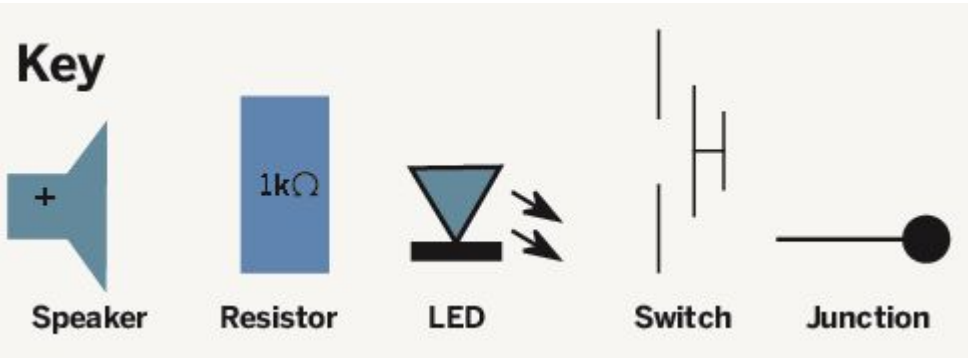
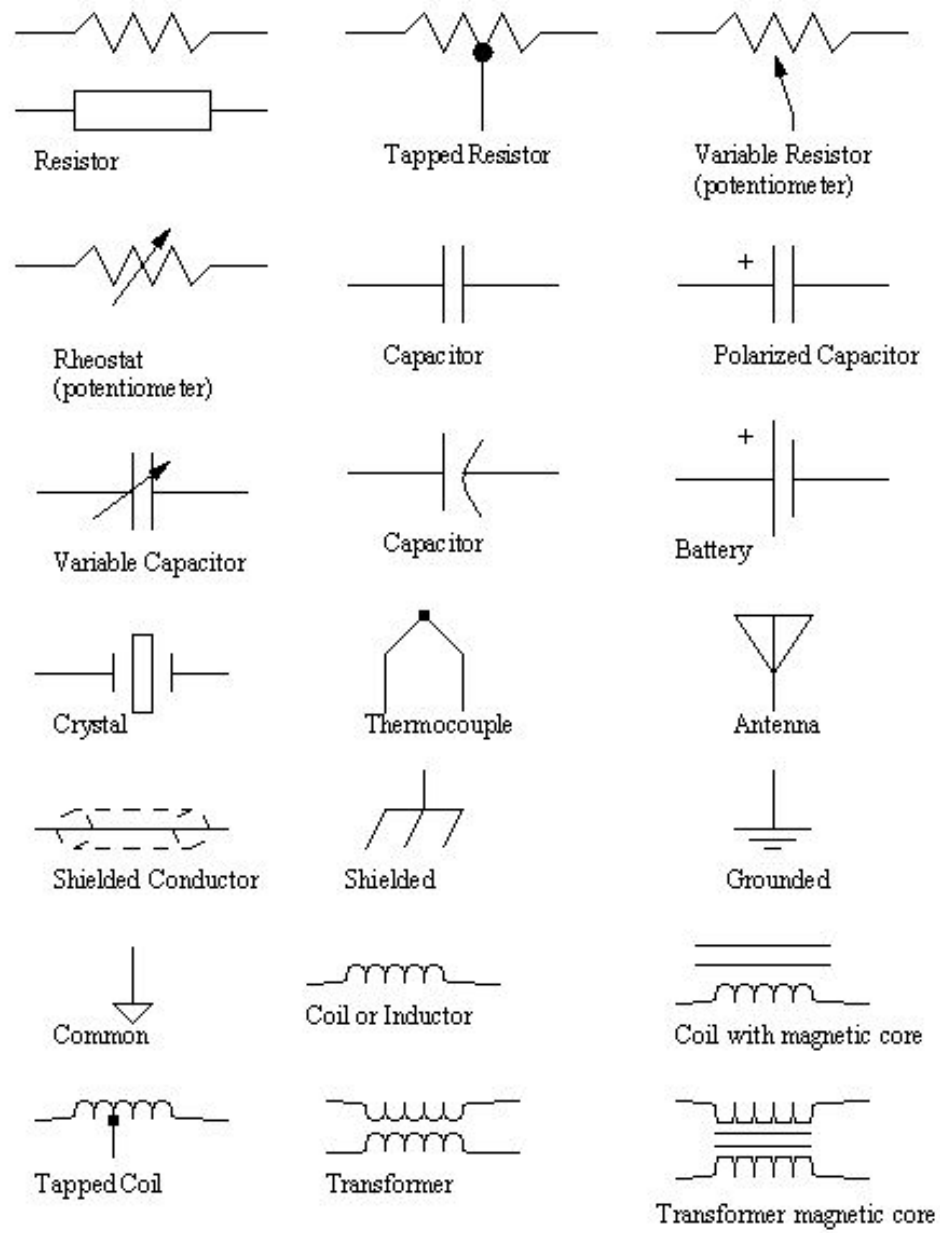
Inserting wires/leads into a connected row is equivalent to touching them all together

Wiring Schematics and Circuit Diagrams



Useful for representing the components and configuration of a circuit

Important for recreating a circuit

Fritzing (http://fritzing.org/home/) is open source software to design virtual circuits and create schematics and diagrams (download page).

Common schematic symbols