

# INSPIRE 1A03

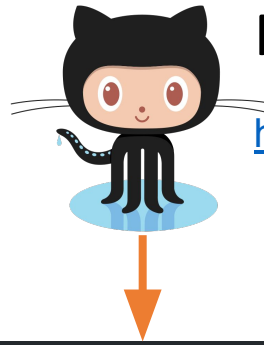
## Electronics for the Rest of Us!

Day 1 recap

Day 2 outline

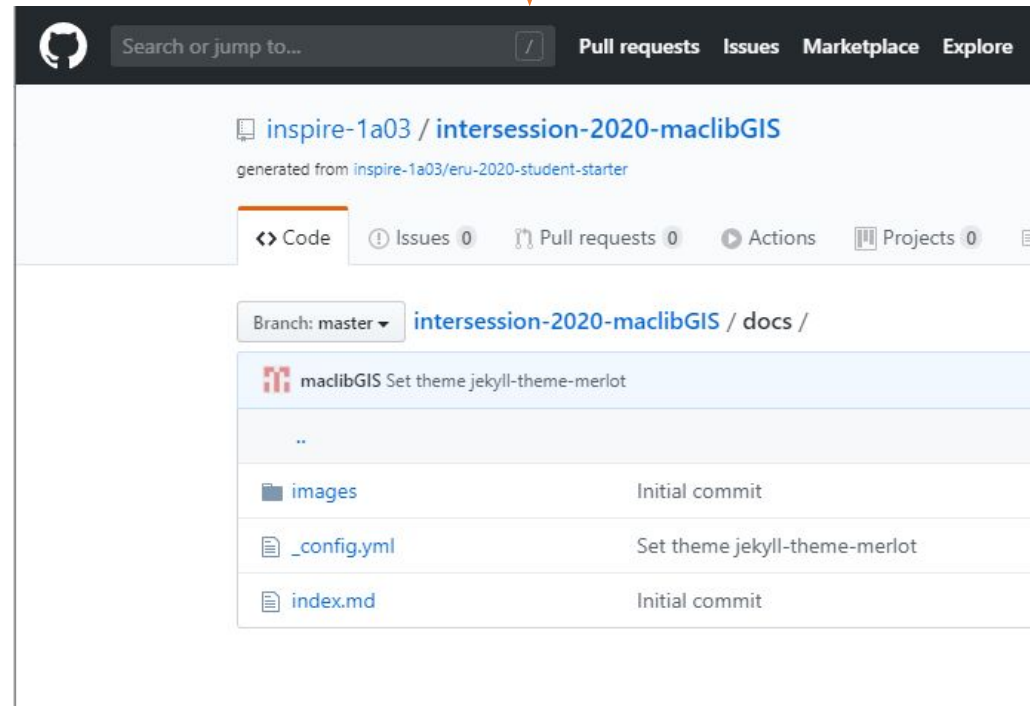
# Day 1 recap

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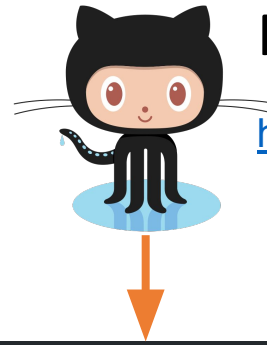
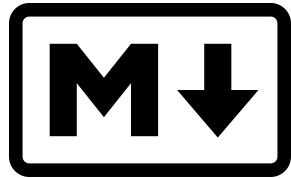


Project GitHub repository

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

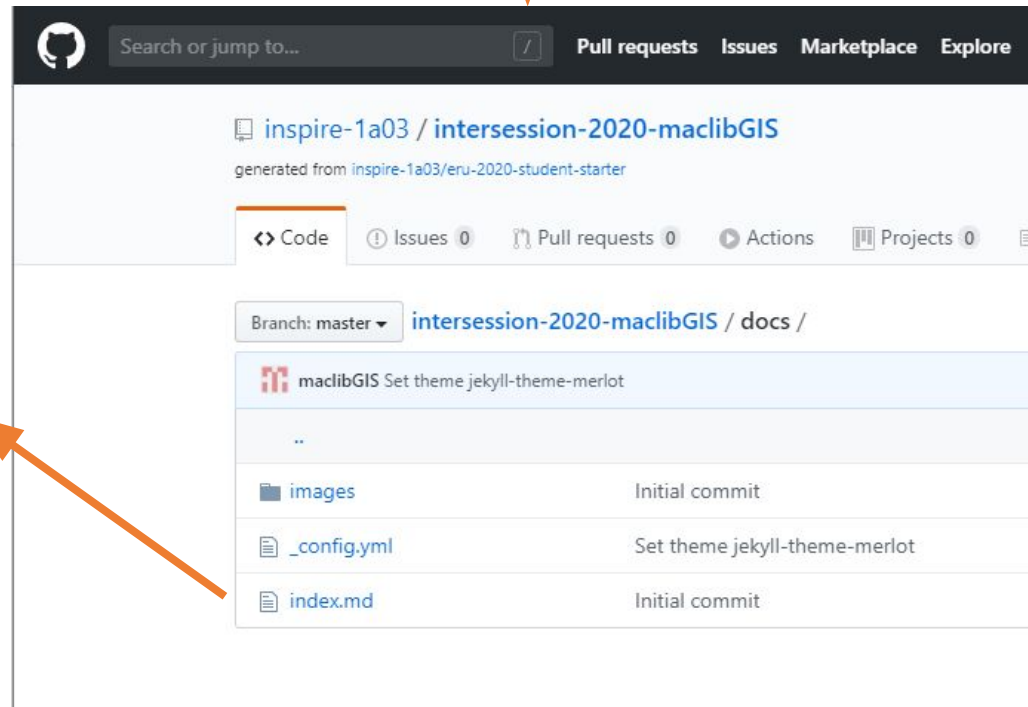


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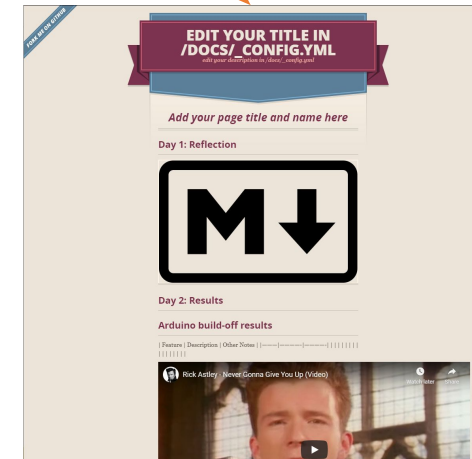


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**GitHub Pages**



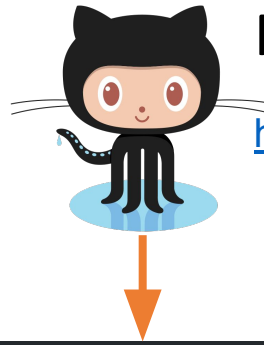
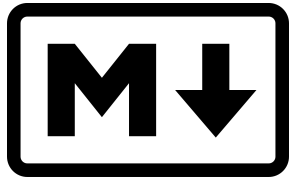
Project webpage

index.md

Markdown + text

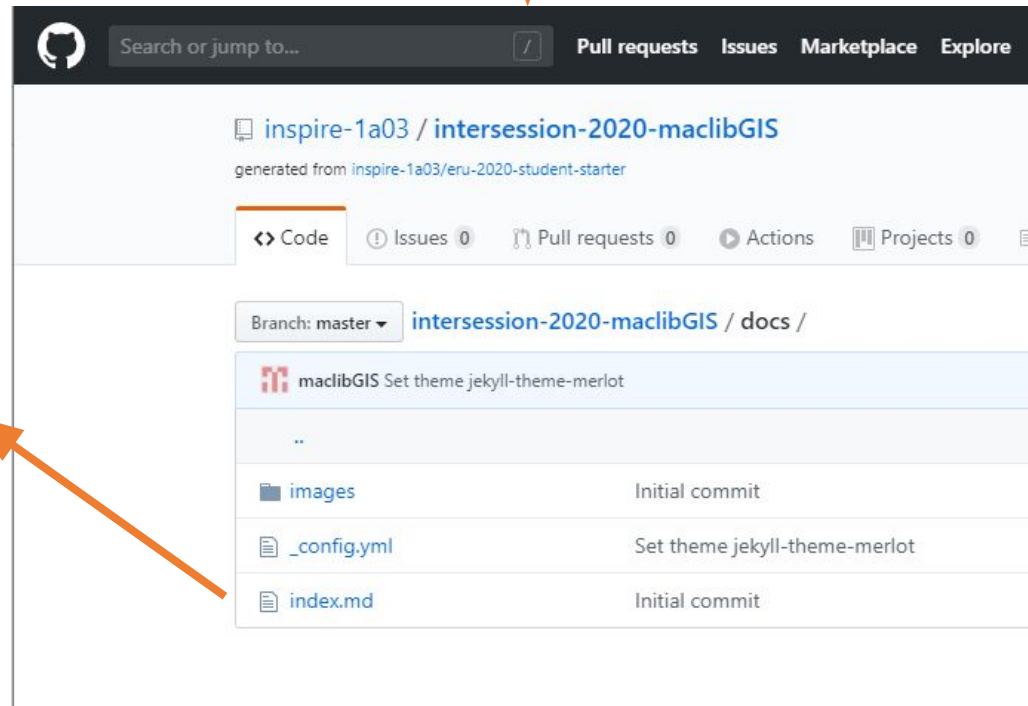
<https://inspire-1a03.github.io/intersession-2020-<username>/>

# Day 1 recap



Project GitHub repository

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



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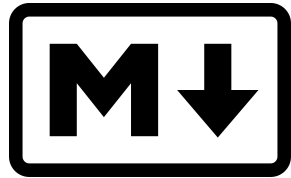
👁 Preview changes

```
1  # Add your page title and name here
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3  Welcome to your project page for Electronics for the Re
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12 what you hope to take away from it.
13
14 You're also asked to insert a photo that represents you
15 - Take a photo of you working or one of your circuits a
16 - Then, insert your photo into your document by modifyi
17 -->
```

index.md

Markdown + text

# Day 1 recap

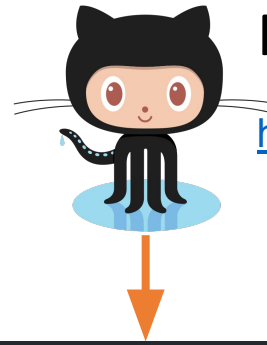


```
<> Edit file    Preview changes

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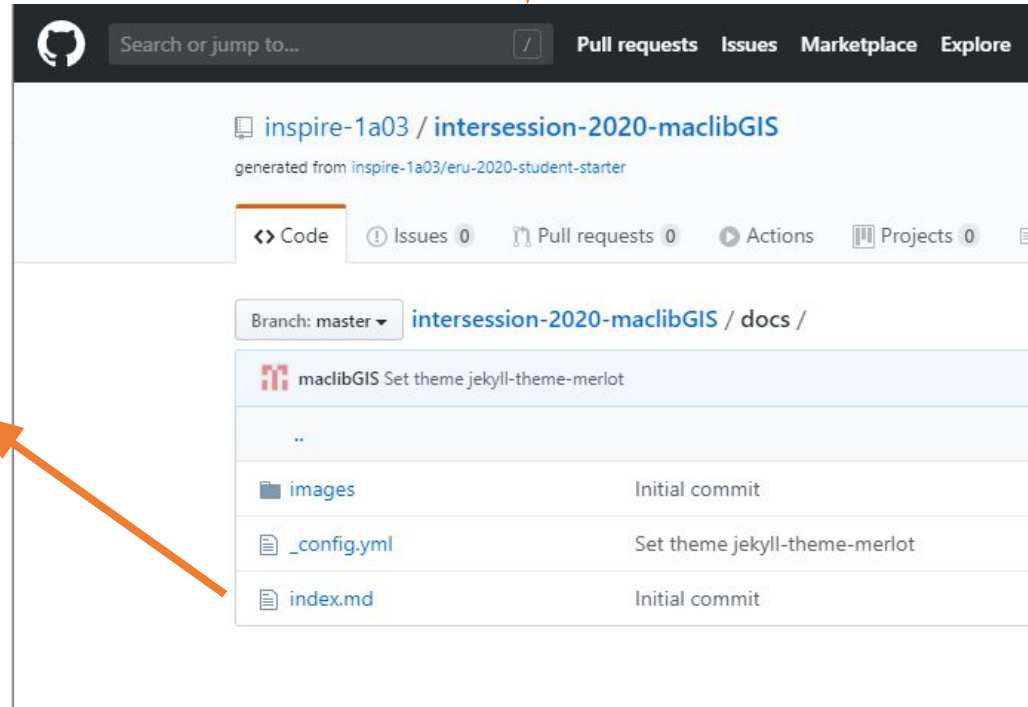
index.md

Markdown + text

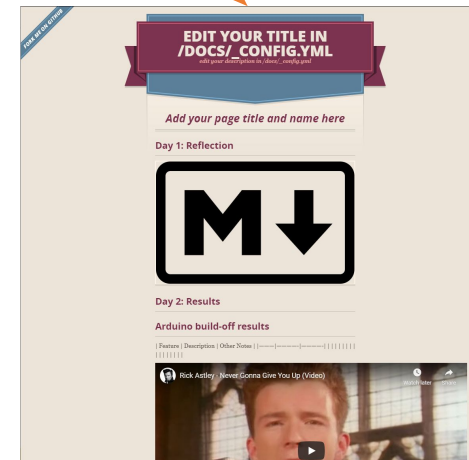


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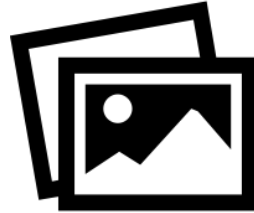
GitHub Pages



Project webpage

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

photos

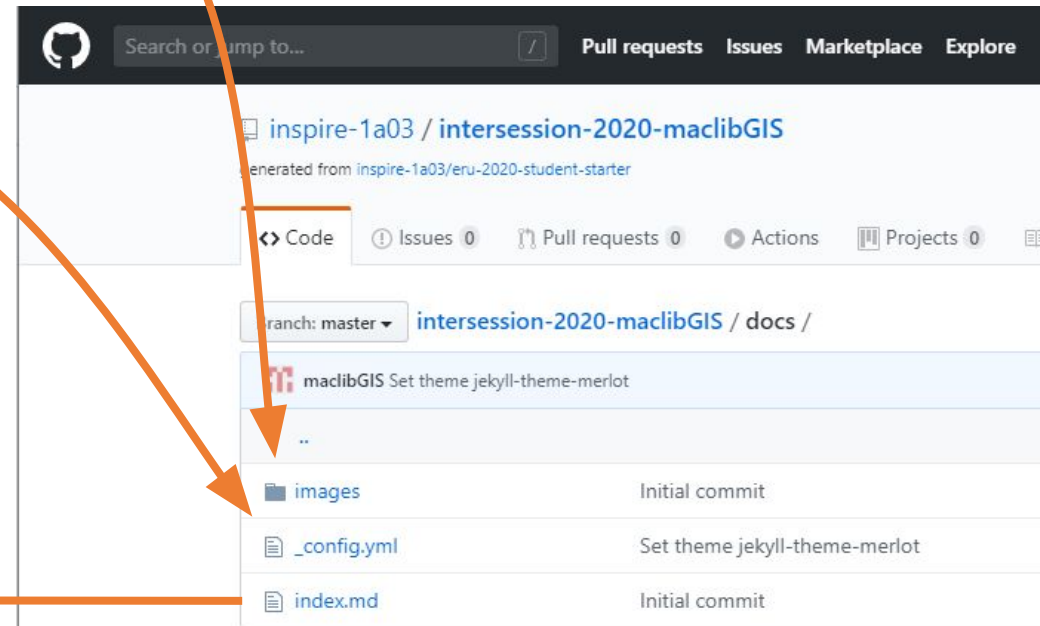


code

```
Arduino IDE 1.8.12
File Edit Sketch Tools Help
Thermistor
* I have used this successfully with some CB Pipe Sensors (https://www.atcommunity.co.uk)
* which he obtained from https://www.rapidonline.co.uk.
*/
#include <math.h>
#define ThermistorPIN 0 // Analog Pin 0
float Vcc = 4.91; // only used for display purposes, if used
// set to the measured Vcc.
float pad = 9850; // balance/pad resistor value, set this to
// the measured resistance of your pad resistor
float thesrm = 10000; // thermistor nominal resistance
float Thermistor(int RawADC) {
  long Resistance;
  float Temp; // Dual-Purpose variable to save space.
  Resistance=pad*(1024.0 / RawADC) - 1);
  Temp = log(Resistance); // Converting the Log(resistance) so not to calculate it 4 times
  Temp = 1 / (0.001129148 + (0.000234125 * Temp) + (0.0000000876741 * Temp * Temp * Temp
  Temp = Temp - 273.15; // Convert Kelvin to Celsius
  // BEGIN- Remove these lines for the function not to display anything
  //Serial.print("ADC: ");
  //Serial.print(RawADC);
}
```

## Project GitHub repository

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



index.md



- deliverable 1
- deliverable 2
- deliverable 3
- deliverable 4

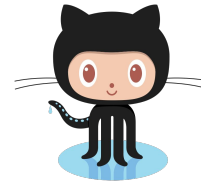
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photos



## Project GitHub repository

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code

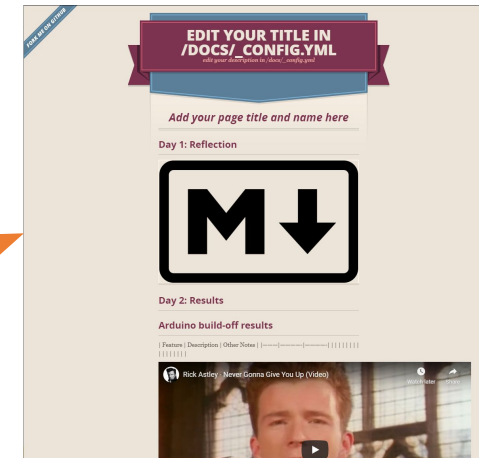
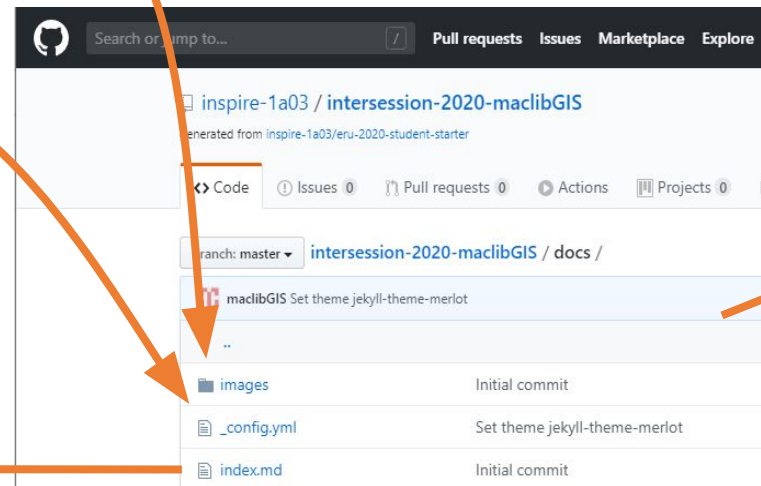
```
Arduino IDE 1.8.10
File Edit Tools Help
Sketch
1 // I have used this successfully with some of the boards: https://www.arduino.cc/en/Reference/USB
2 // which is obtained from https://www.arduino.cc/en/Reference/USB
3
4 #include <math.h>
5
6 #define ThermistorPin 0 // Analog Pin 0
7
8 float vcc = 4.752 // only used for display purposes, if used
9 // not to the measured Vcc.
10 float pad = 9000 // balance/pad resistor value, set this to
11 // the measured resistance of your pad resistor
12 float theore = 10000 // theore's nominal resistance
13
14 float ThermistorPin Read0001
15 // Read Resistance
16 float Temp // Dual-Purpose variable to save space.
17
18 Resistance-pad(1024,0 // Read0001 = 10r
19 Temp = logResistance // Having the logResistance in not to calculate it 4 times
20 Temp = 1 / (R-0.012544 + (R-0.0025412) * Temp + 0.00000074) * Temp * Temp * Temp
21 Temp = Temp - 273.15 // Convert Kelvin to Celsius
22
23 // B001B- Remove these lines for the function not to display anything
24 //Serial.println(Temp);
25 //Serial.print(Read0001);
```



index.md

Markdown + text

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Project webpage

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

# Day 2 Outline (slightly revised)

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## **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

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## 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

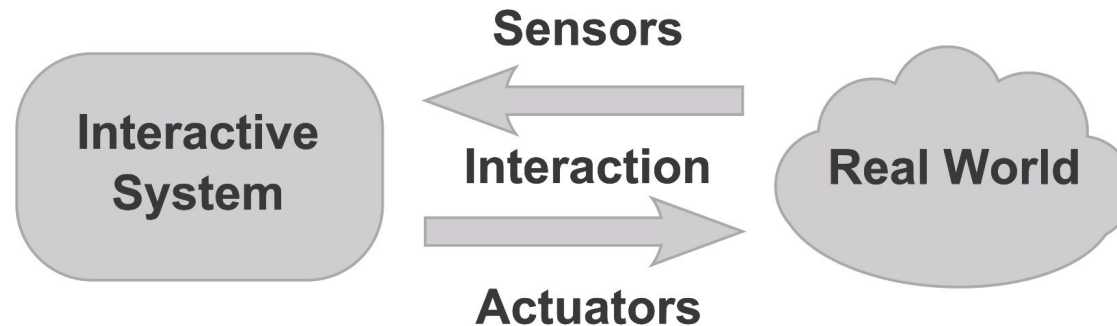
## Devices, Sensors, & Actuators

# Devices: Interacting with the “real world”

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**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

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

**Sensors**



**Actuators**

# Sensors and actuators in everyday life

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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...

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- 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!

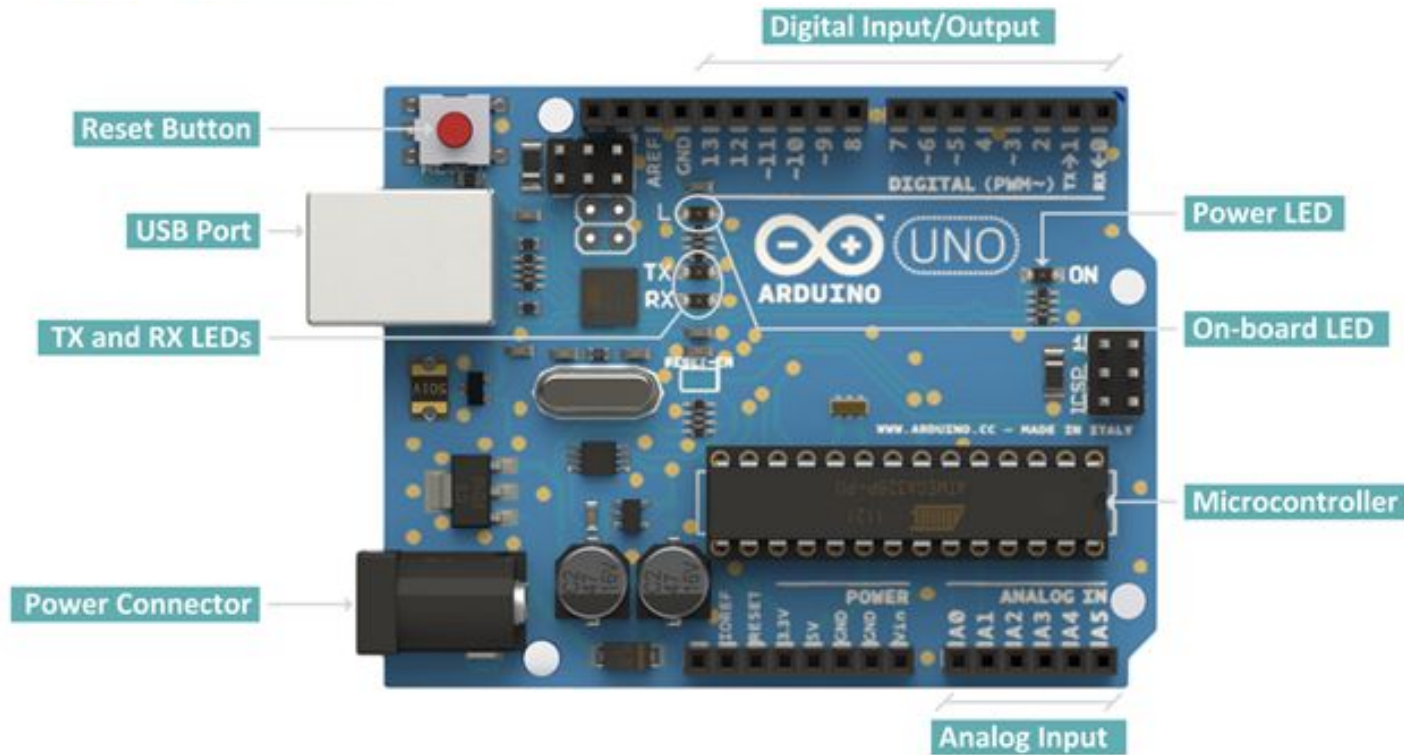
[https://en.wikipedia.org/wiki/Physical\\_computing](https://en.wikipedia.org/wiki/Physical_computing)

# 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.

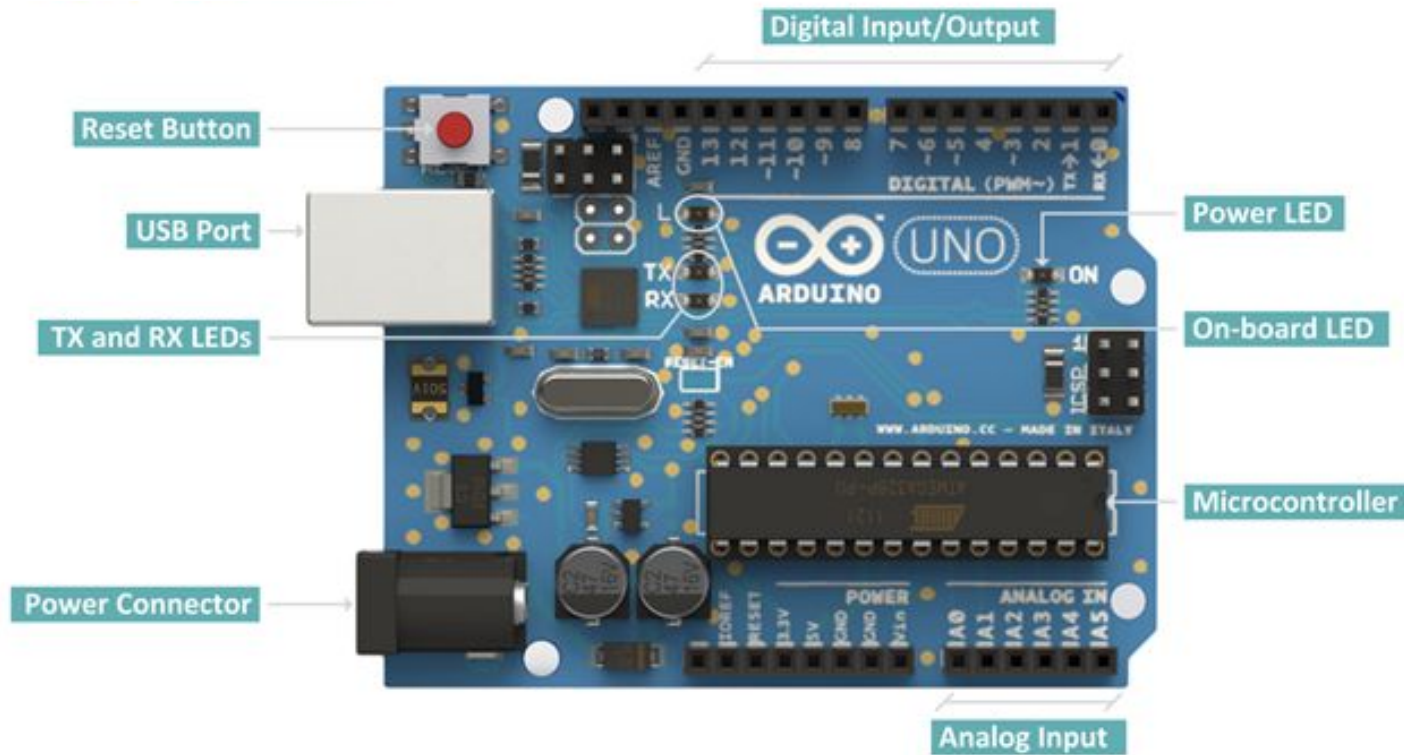
# In your kit: Arduino Microcontroller



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.

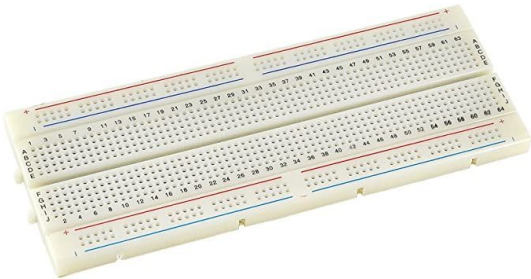
On-board LEDs communicate the board's power, transmitting (TX) and receiving (RX) statuses.

# 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

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## **Resistors**

Current resisting conductors

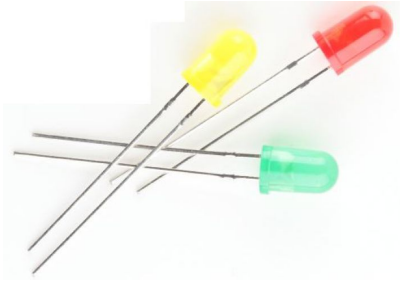


## **Pushbutton**

Push-sensitive circuit connection controller

# In your kit: Actuators

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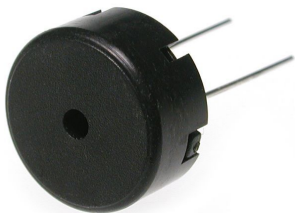


## Light Emitting Diodes (LEDs)



## RGB LED

Integrated red, green, and blue LEDs



## Buzzer

# In your kit: Sensors

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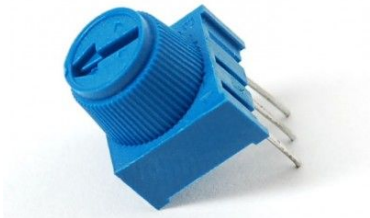
## Photocell

Light-sensitive variable resistor



## Thermistor

Temperature-sensitive variable resistor



## Potentiometer

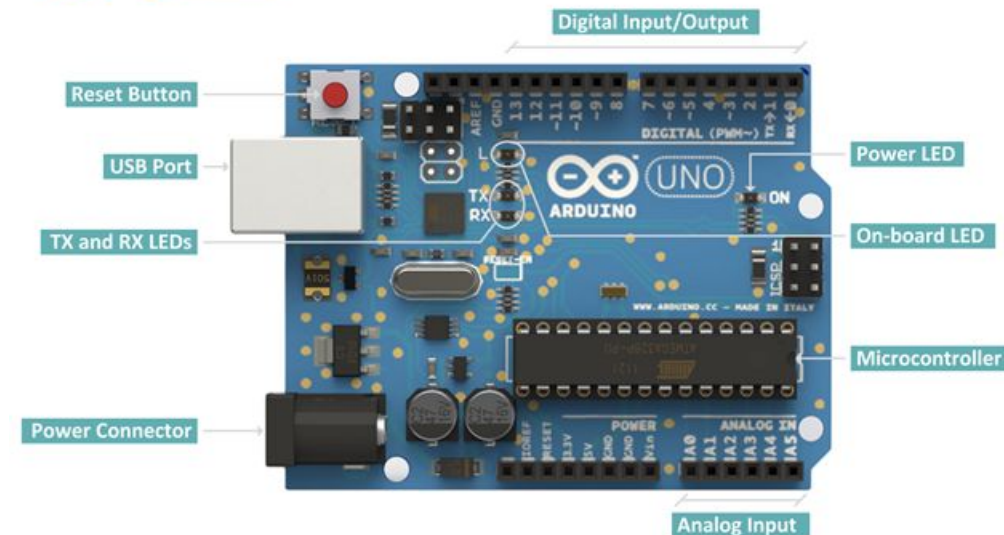
Position-sensitive variable resistor

# Arduino is...

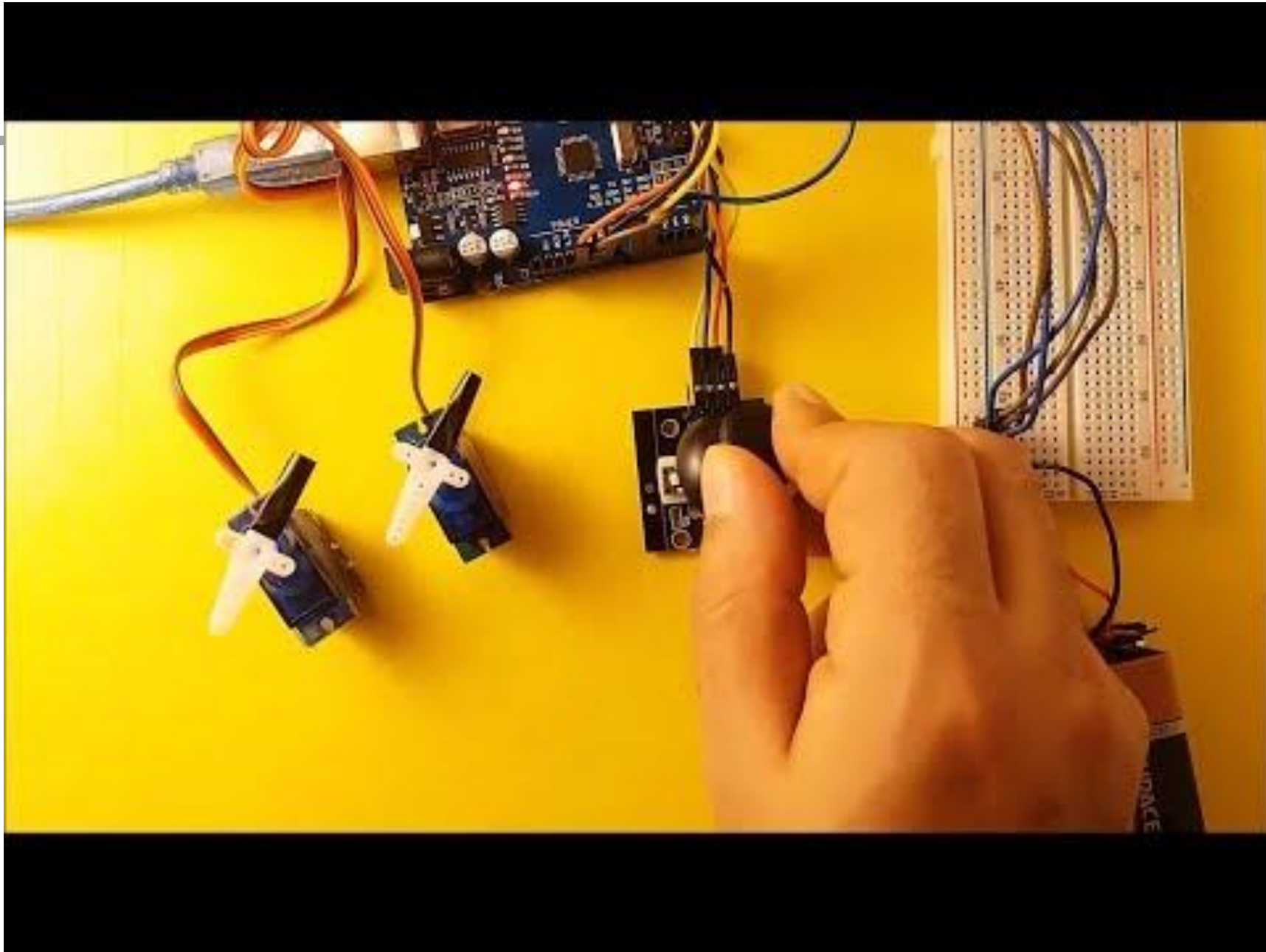
an “open-source electronics prototyping platform...intended for artists, designers, hobbyists, and anyone interested in creating interactive objects of environments”

- arduino.cc

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



# Some Arduino project examples - Beginner to Intermediate





# Some Arduino project examples - A little more advanced





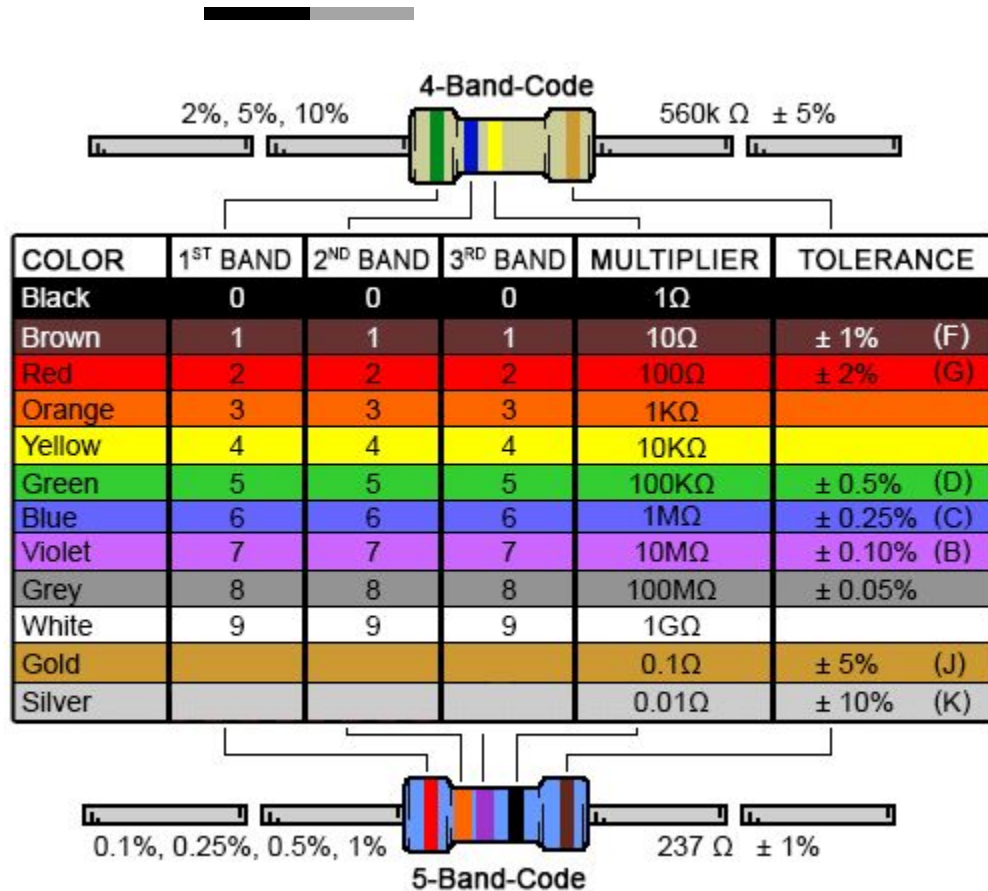
# Let's get started!

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

Other important information

# Resistor Colour Codes



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

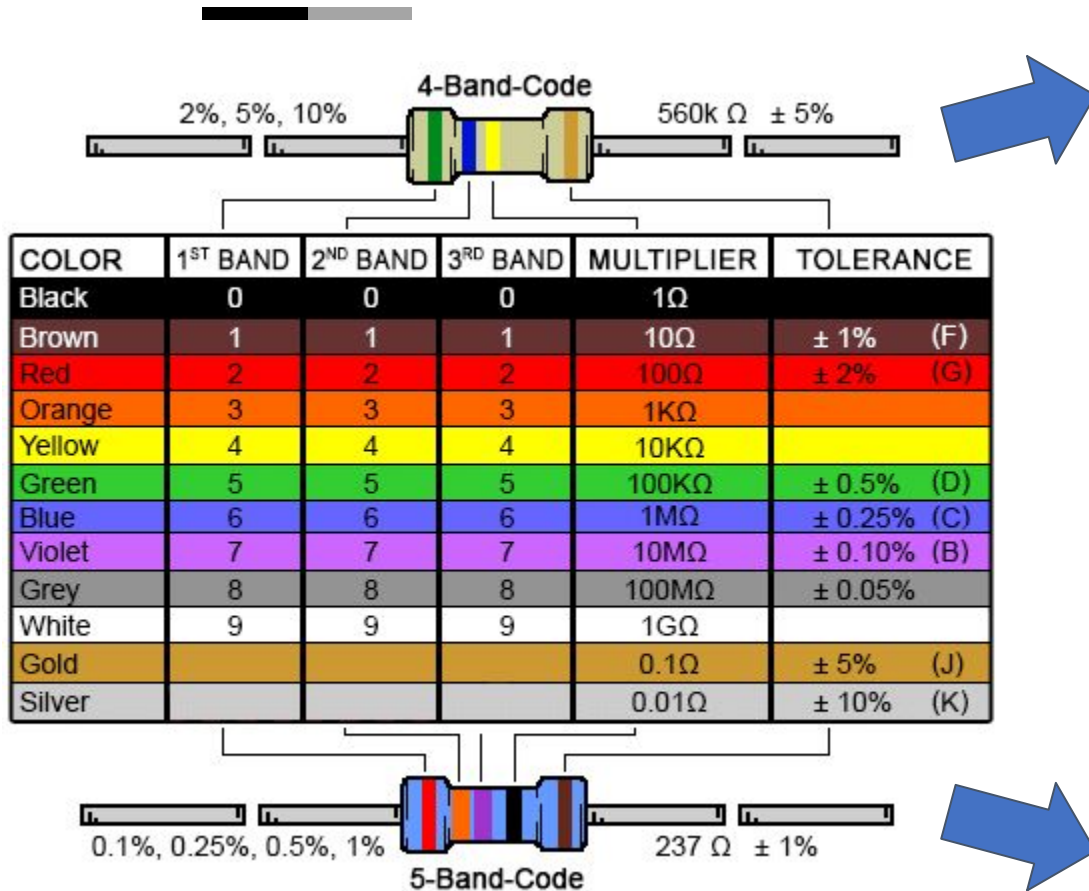
May use 4-, 5-, or 6-band systems

## Useful resources

[resisto.rs/](https://resisto.rs/) - find colour code for a given resistance

[bit.ly/resistor-calculator](https://bit.ly/resistor-calculator) - calculate resistance given a colour code

# Resistor Colour Codes



## 4-band example

1st band = green = 5

2nd band = blue = 6

multiplier = yellow = 10000 ohm (=10 Kohm)

$56 \times 10,000 = 560,000 = \mathbf{560 \text{ Kohm}}$

## 5-band example

1st band = red = 2

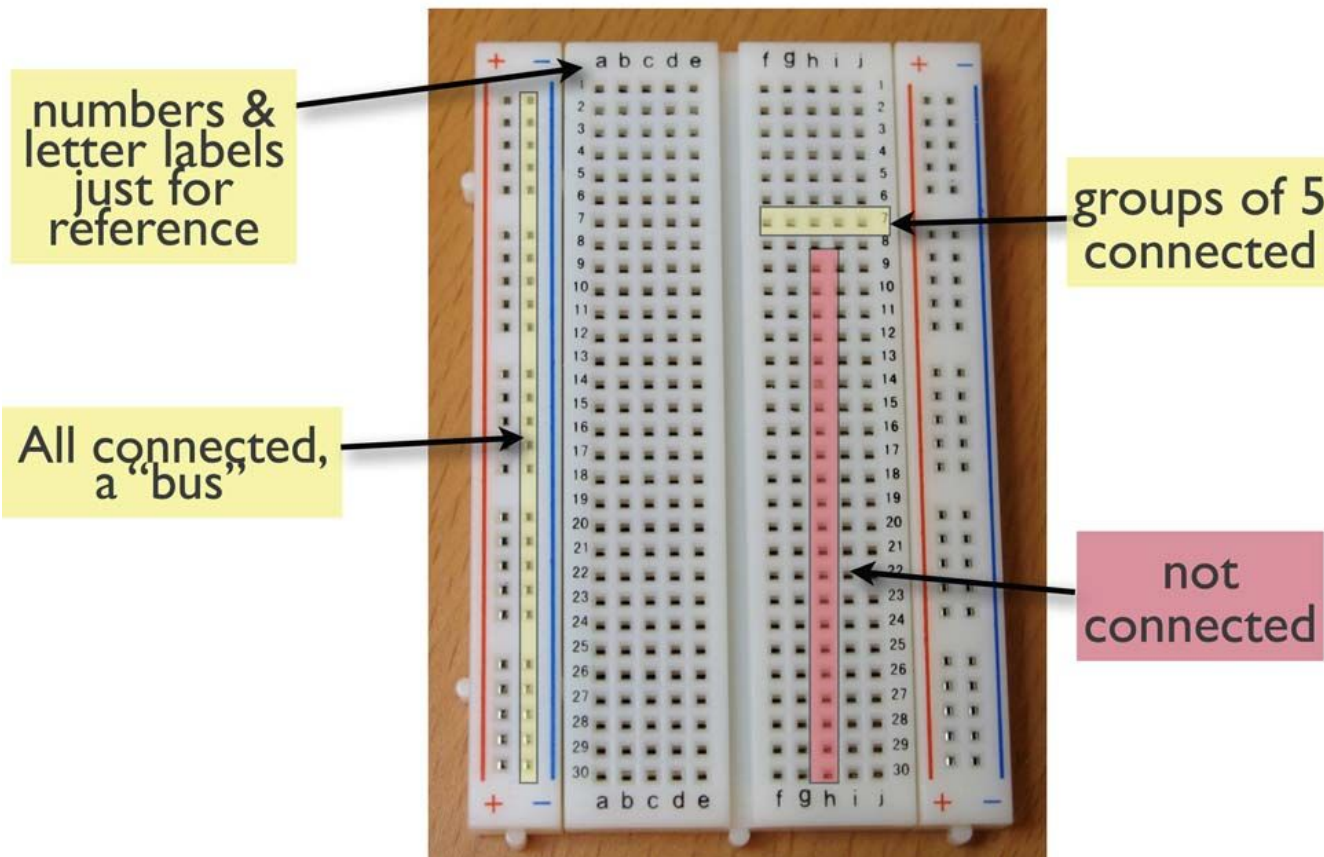
2nd band = orange = 6

3rd band = violet = 7

multiplier = black = 1 ohm

$267 \times 1 = \mathbf{267 \text{ ohm}}$

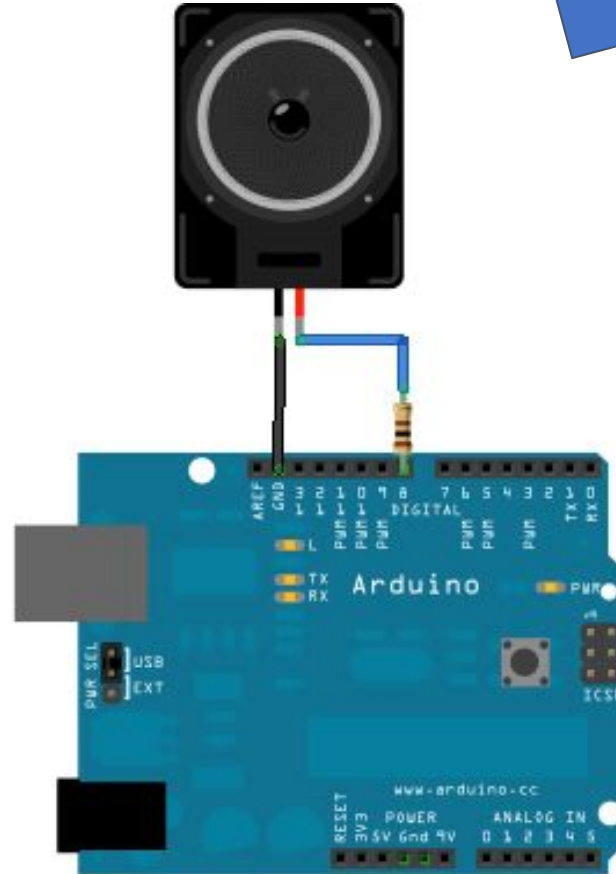
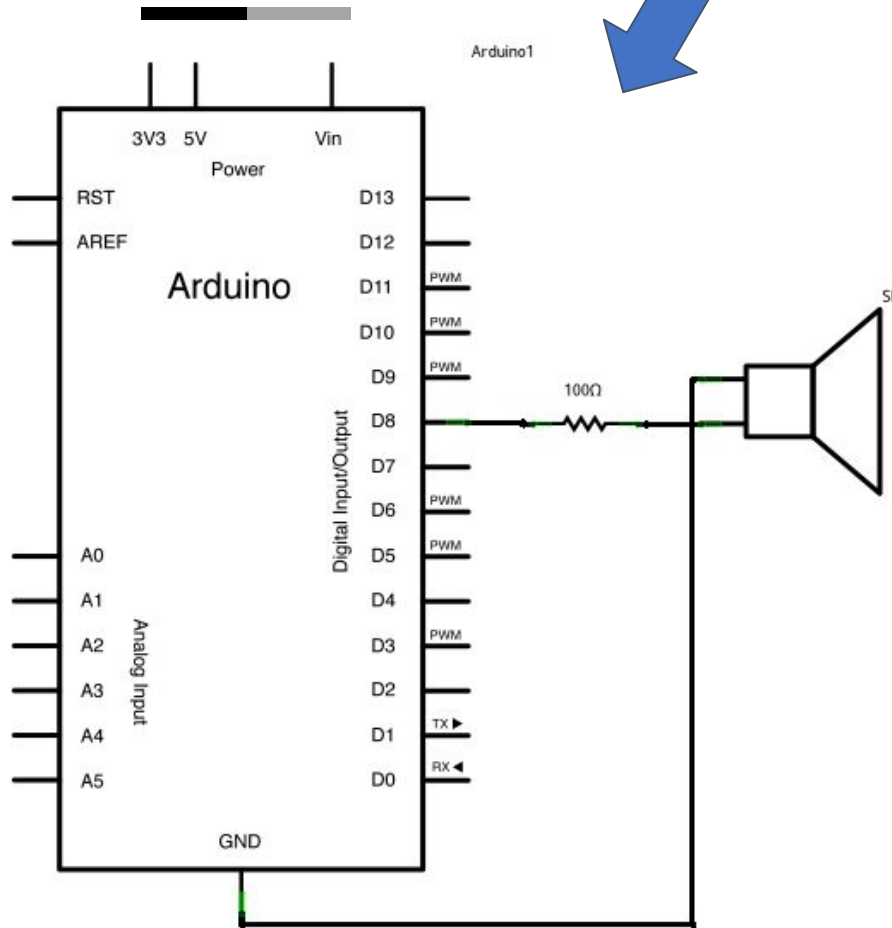
# Solderless breadboard



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

