How to Make a Thermal Flashlight:

1. Purchase the component parts:

Parts list
For a Thermal Flashlight with 5 V Melexis Sensor and Common Cathode LED.

- 1 Melexis MLX90614 non-contact IR thermometer (5v).
- Data sheet: http://www1.futureelectronics.com/doc/MELEXIS/MLX90614ESF-AAA.pdf
- 1 common-anode RGB LED
- 2 4.7k Ohm resistors
- 2 100 Ohm resistors
- 1 180 Ohm resistor
- 1 0.1 μF capacitor
- wire
- a breadboard or circuit board & soldering eqmt.
- Arduino
- 9v battery and holder
- Wire
- Wire Cutters

2. Build the Circuit Board
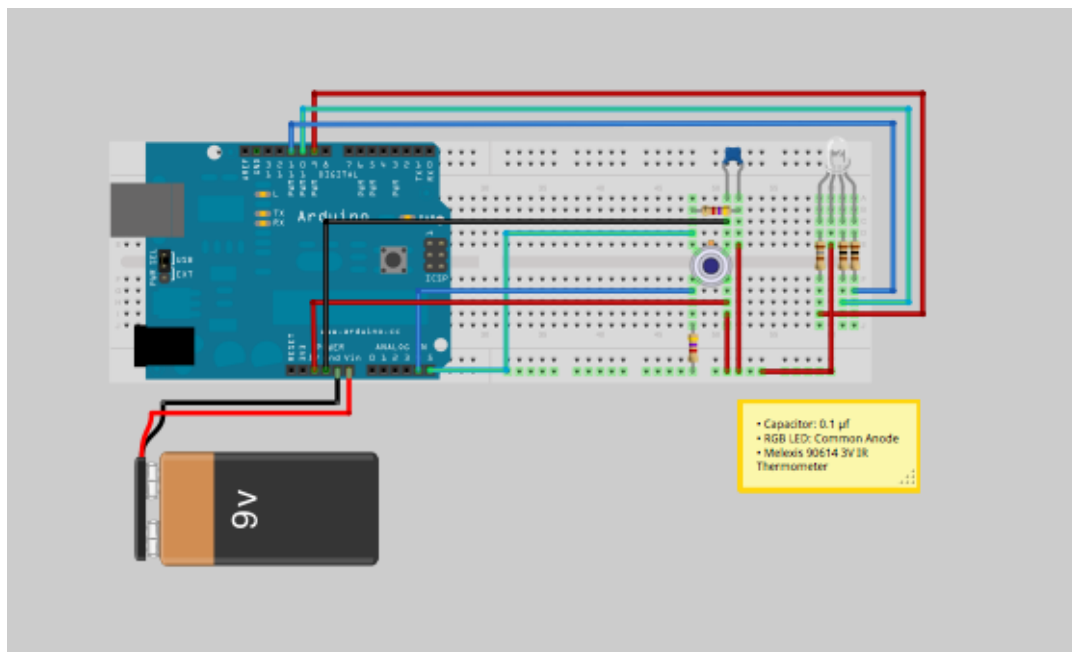
2.1 Place the Major components on the breadboard:

The circuit you are building connects temperature readings from the thermometer to different colors of light emitted by the LED through a Breadboard. You will learn later how to set both the range of the temperature and the colors of light emitted by the LED.

What are the Major Components?:

Three color LED (light emitting diode) the three colors made by the LED red, blue and green will be blended to match different temperatures.

Three Color LED photo:

Three Color LED icon:

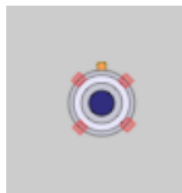Schematic LED

RED
POWER
GREEN
BLUE

LED1

R G B
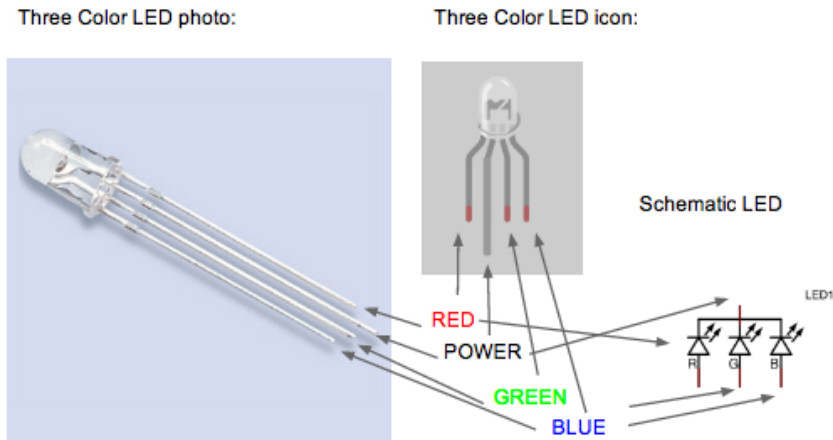
The Melexis non-contact thermometer. This thermometer senses the temperature of objects it is pointed at. The orientation of the thermometer is determined by the tab which should be pointed toward 12 o'clock.
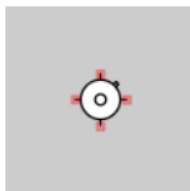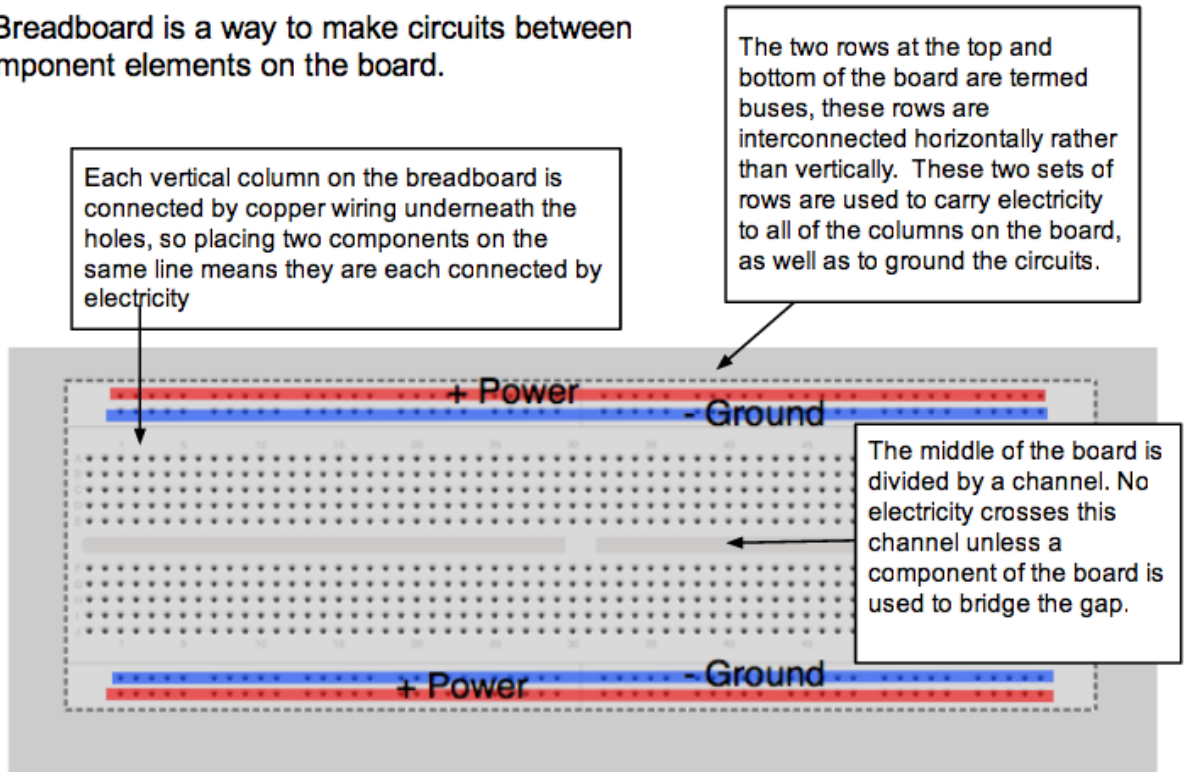
Melexis 5V sensor

Icon

Photograph

Schematic

What is a Breadboard?:

A Breadboard is a way to make circuits between component elements on the board.

The two rows at the top and bottom of the board are termed buses, these rows are interconnected horizontally rather than vertically. These two sets of rows are used to carry electricity to all of the columns on the board, as well as to ground the circuits.

Each vertical column on the breadboard is connected by copper wiring underneath the holes, so placing two components on the same line means they are each connected by electricity

+ Power
- Ground

The middle of the board is divided by a channel. No electricity crosses this channel unless a component of the board is used to bridge the gap.

+ Power
- Ground

Where should I place them on the Breadboard?

Close together! The flashlight should change color based on what the temperature of the object the sensor points at. So that the light shines on the object whose temperature you are interested in sensing, you should place the LED and Sensor close to each other on the breadboard.
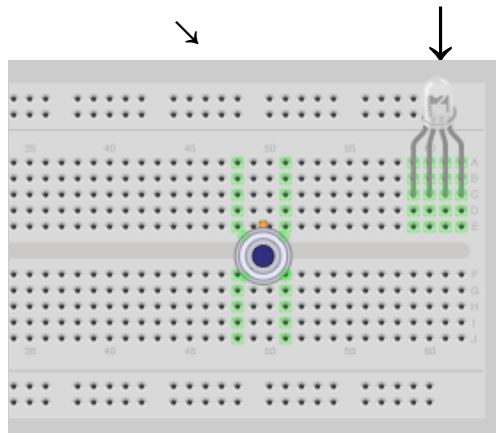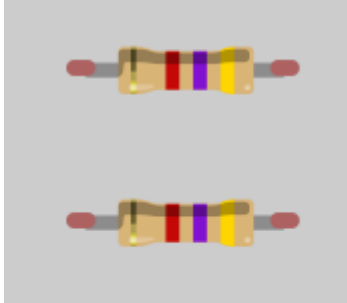
1. Each "leg" of the LED and the sensor should go in one hole of the breadboard.
2. Orient the LED so the long leg (power) is in the second position from Left to Right
3. The Nub on the sensor should face to 12 o'clock, this sets the directionality of the legs.

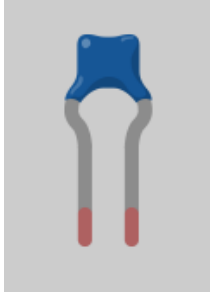**2.2 Create a Circuit between the Components:**

The next step is to create a circuit between the LED and Sensor using common electronic components: Resistor and Capacitors. The LED and the Sensor require different quantities and electricity, the amount of electricity to each component is managed using resistors and capacitors.

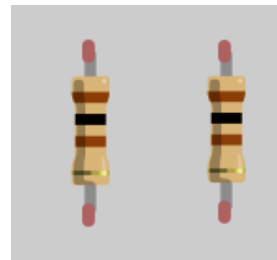2.3 Select your resistors and capacitor.

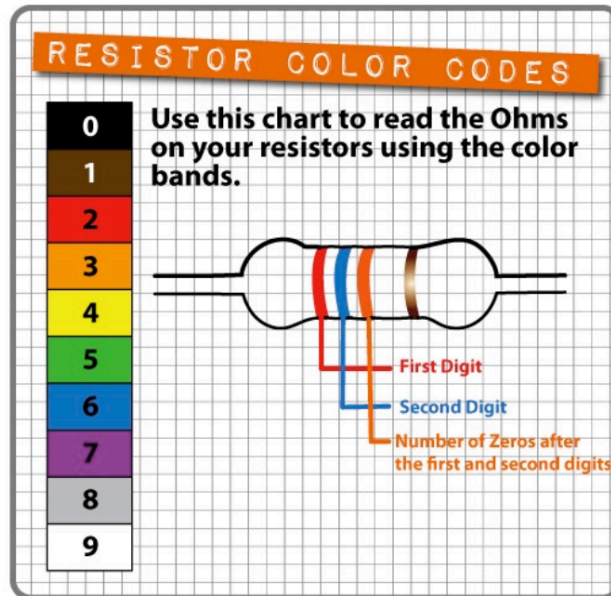Sensor Resistors: two 4.7 kΩ

Sensor Capacitor: one 0.1µF capacitor

LED Resistors: one 180Ω resistor

and two 100Ω resistors

RESISTOR COLOR CODES

0	
1	
2	
3	
4	
5	
6	
7	
8	
9	

Use this chart to read the Ohms on your resistors using the color bands.

First Digit
Second Digit
Number of Zeros after the first and second digits
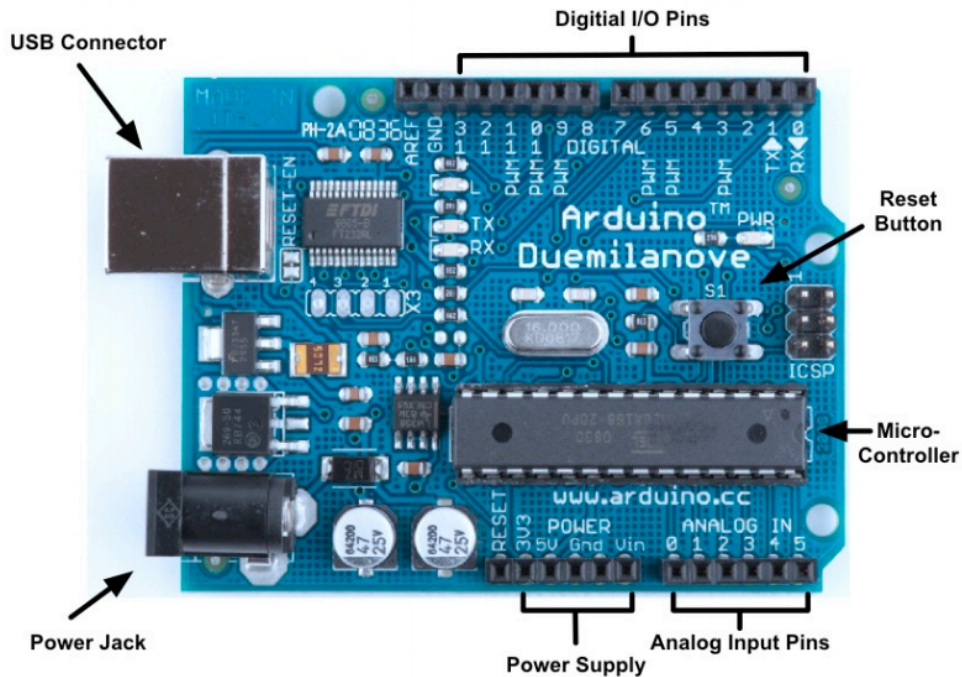
2.4 Put your resistors and capacitor into the breadboard

Trim the legs of the resistors with wire cutters and place them in the breadboard according to this diagram:
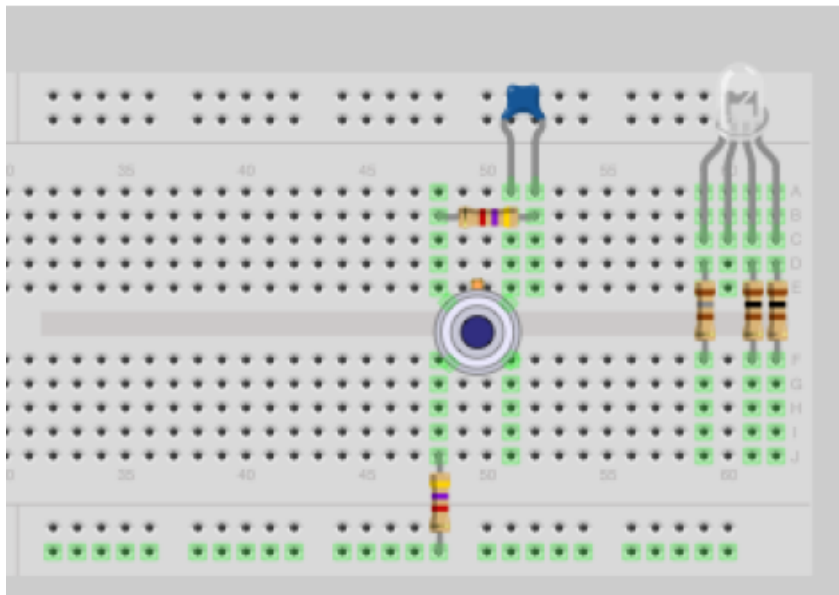
2.5 Grab your Arduino!

What is an Arduino?

* A Microcontroller you can program
* Inputs and outputs
* Memory

- **open-source hardware and software** prototyping platform

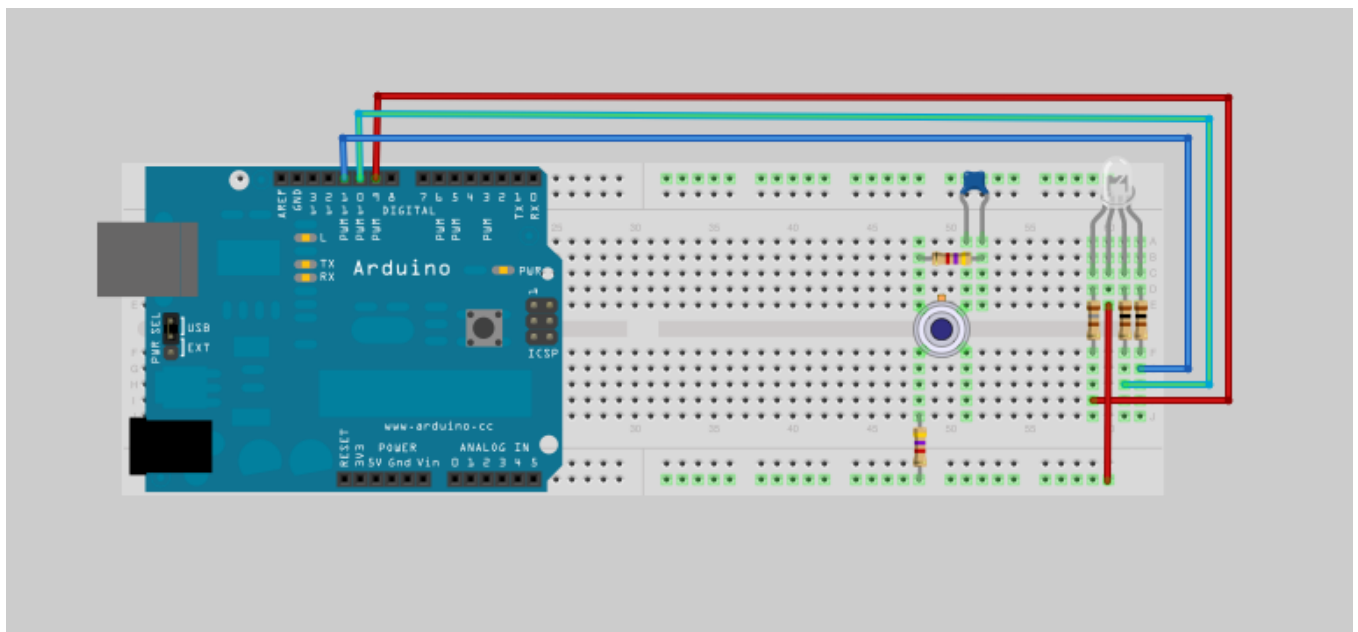- will allow us to **control** the flow of electricity **and** let us **measure** electricity through **CODE**

2.6 Wiring LED to Arduino

Step 1: Take power to the LED.
Which leg should it go to?
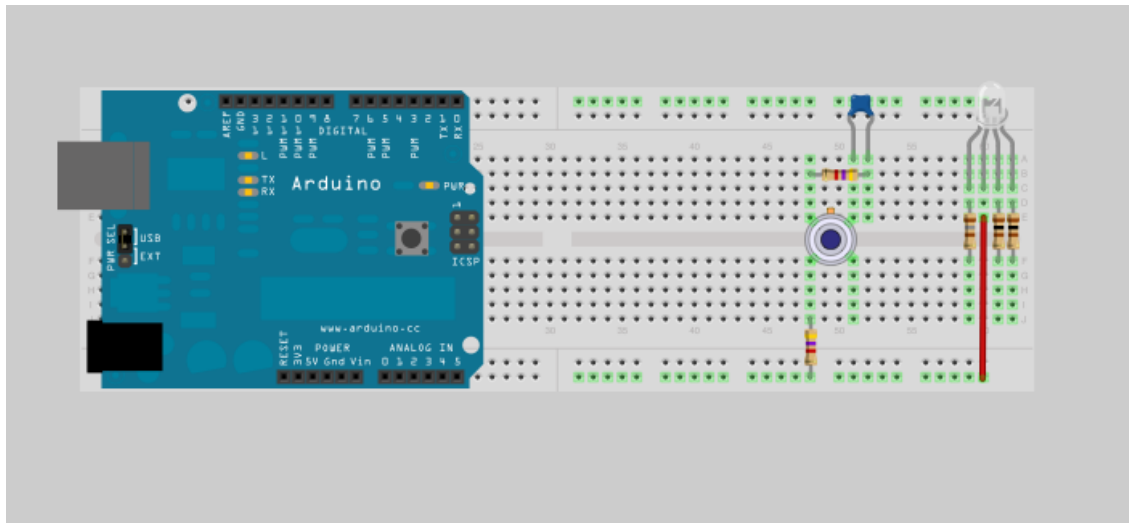
Step 2: Connect up the RED, GREEN and BLUE legs of the LED to Digital pins 9, 10 and 11

DONE!

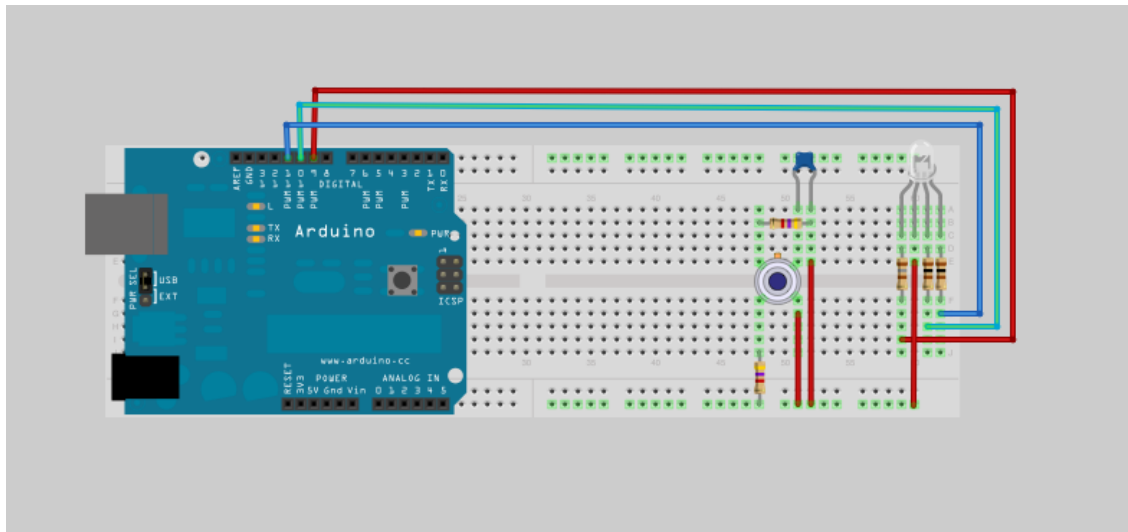## 2.7 Wiring the Sensor to the Arduino

Step 1:
Bring Power to the Sensor!
The sensor has a little computer inside it so it needs power to two points.
       Connect one wire to the capacitor. Make sure to jump the gap!
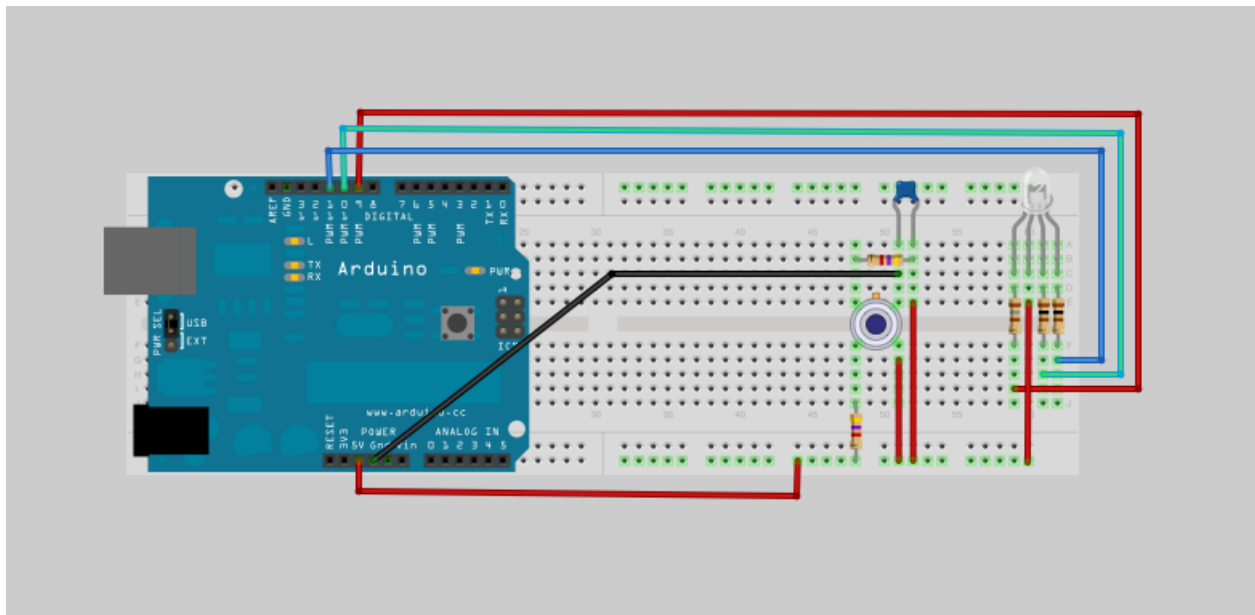   Connect one wire to the bottom right leg of the sensor.

Step 2:
Bring Power to the Board!
      Connect the 5V pin on the Arduino to the Power bus on the board
      And connect the top right leg of the capacitor to the Ground (GND) pin.

Step 3: Bring Data to and from the Sensor
      Connect one wire from the top left leg of the sensor to ANALOG pin 5.
      Connect one wire from the bottom left leg of the sensor to ANALOG pin 4
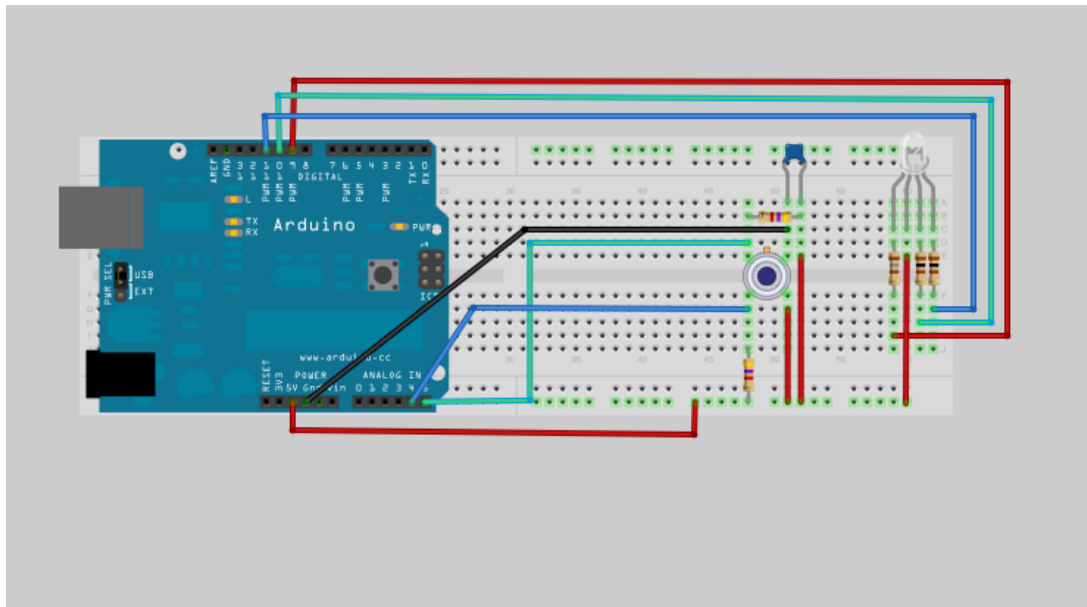
2.8 FINAL STEP!

Plug in the board--Use either a battery, or plug into a computer

Connect Black wire to Ground (GRN)

Connect Red wire to Voltage in (VIN)

The LED should light up