How to Make a Thermal Fishing Bob

Ingredients

1 computer AND:
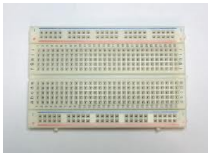
1 breadboard	**1 Arduino UNO**	**1 three-color (LED) Light Emitting Diode**	**1 10K Thermistor**

1 10k Resistor	**1 180 Ohm Resistor**	**2 100 Ohm resistors**	**9 wires**
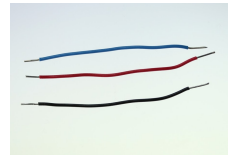
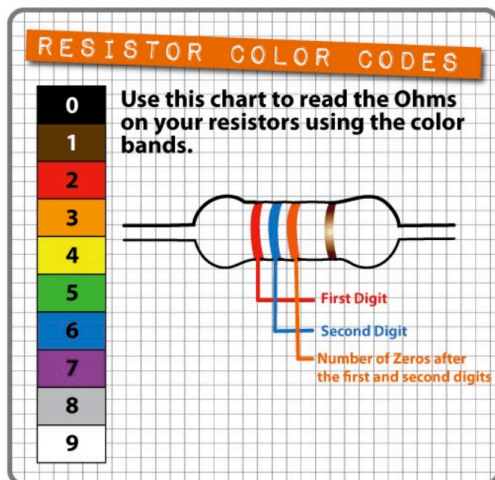|			
1 battery attachment	**1 9-volt battery**	**Container**	**Floatie Materials**

Other materials: scissors, hot glue gun and glue, tape, arduino-to-computer connecting cord
INDEX OF TERMS:

What is an 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
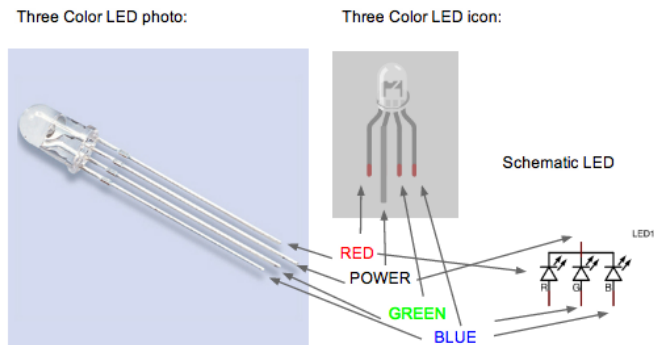
What are Resistors? Resistors change the amount of electricity traveling in a circuit by conducting electricity to different degrees
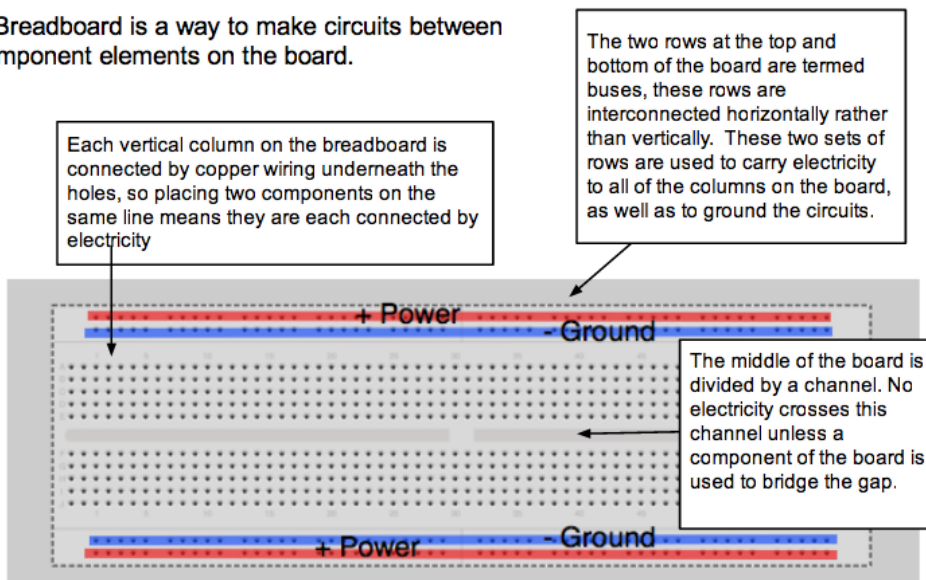
one 180Ω resistor

RESISTOR COLOR CODES

0	Use this chart to read the Ohms on your resistors using the color bands.
1	
2	
3	
4	
5	First Digit
6	Second Digit
7	Number of Zeros after the first and second digits
8	
9	

two 100Ω resistors

one 10kΩ Resistor

What is a Breadboard?:

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

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

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.

+ 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.

What is an

+ Power
- Ground

Arduino: Arduino is an open-source hardware and software prototyping platform. It allows us to control the flow of electricity and lets us measure electricity through CODE.
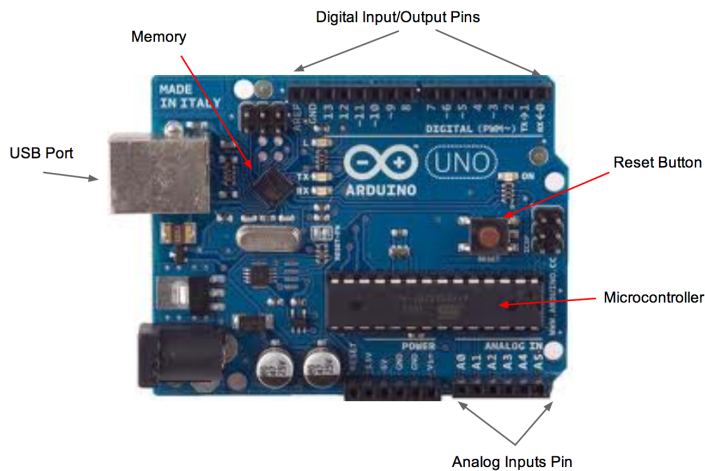
What is a Thermistor: A Thermistor is a kind of thermometer. It is basically the a resistor whose ability to conduct electricity changes depending on the temperature. Based on how much electricity the thermistor is conducting you can calculate what the temperature must be. Our Thermistor is coated in plastic so that it is waterproof. It comes with a 10K resistor that the program uses as a reference for how much electricity is moving through the circuit. The program measures the difference in the current traveling through the thermistor (whose resistance changes as the temperature changes) and the 10K resistor (whose resistance stays the same with temperature).

The Thermal Fishing Bob works by the arduino calculating the temperature detected by the Thermistor and mapping that temperature to a color of light.
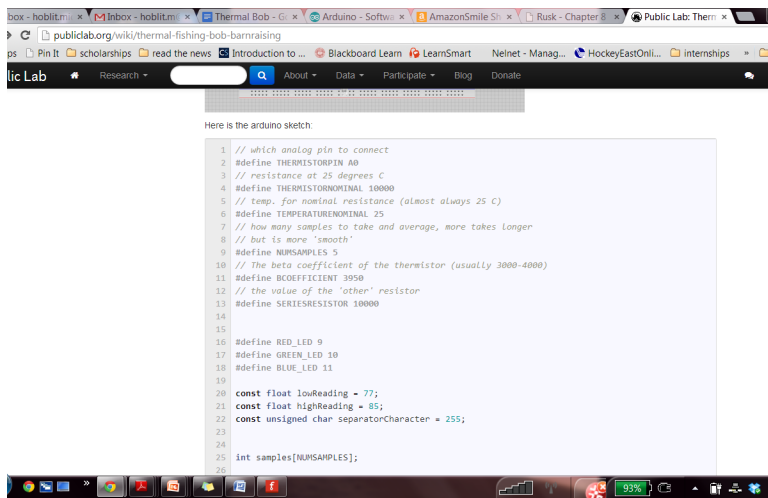
INSTRUCTIONS

1) Assign each group member to a role. One member (with the computer) is the computer person, two members will be building the housing to hold the breadboard, and two will be assembling the breadboard.

**COMPUTER:** (supplies needed for this person: Arduino, computer, cord)
1. Download arduino software from http://arduino.cc/en/main/software. You will want Arduino 1.0.5
2. Open the program.
3. Set the "board" under "tools" to arduino UNO
4. Select the Serial Port.
3. Copy the arduino sketch from http://publiclab.org/wiki/thermal-fishing-bob-barnraising and into the arduino program screen.

4. Paste the sketch into the open Arduino program on your computer. SAVE THE SKETCH.

This button allows you to check to make sure your code is working

This button allows you to send your code to the arduino

this button allows you to see what your sensor is sensing.

(Click the check button below "file" to ensure correct copying.)

5. Acquire the connector to link the arduino to the computer.
6. Once the arduino is identified by the computer, click the arrow button (pointing left under the "edit" tab") to put the code onto the Arduino.
7. Done! Disconnect the arduino from the computer and give it to the group members working on assembling the board.
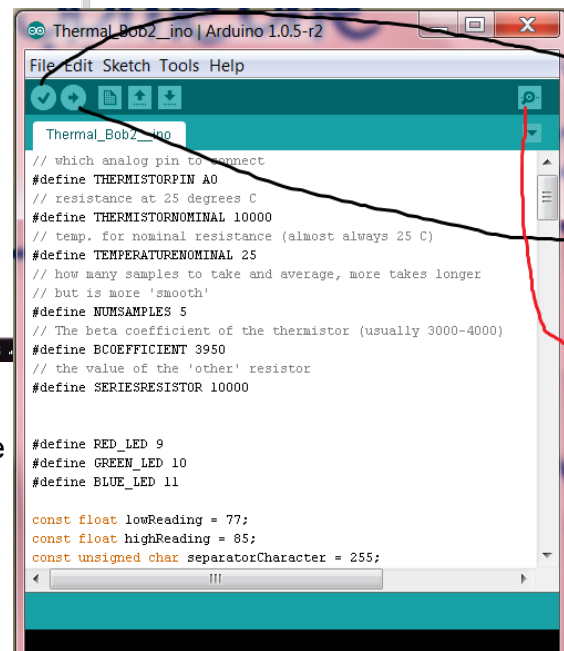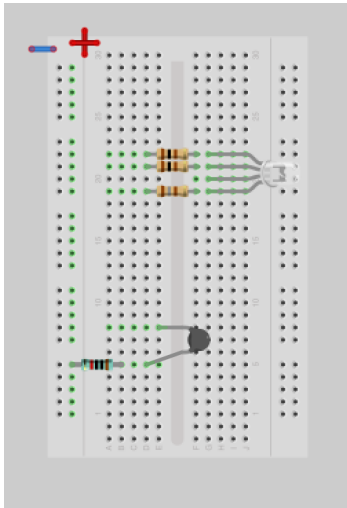
Circuit Assembly:
supplies: LED, Thermistor, resistors, wires, breadboard, arduino (pick this up when the first group has programed it).

1. Insert 180 Ohm and two 100 Ohm resistors and LED into the breadboard as shown below The long leg of the LED should be in the second position.

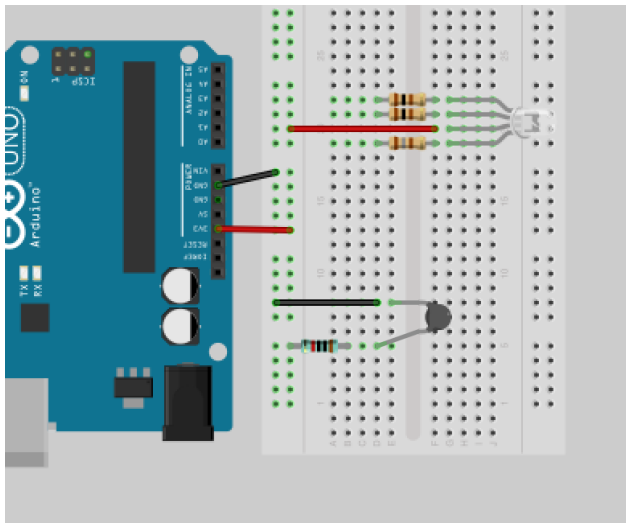**AND Add the Thermistor and the 10 K resistor to the board as shown below**

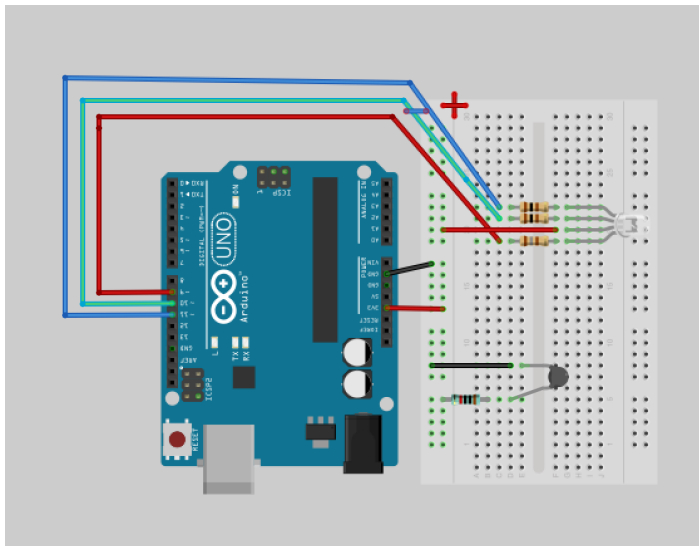**2. Insert two of your wires as shown. These will originate and terminate on the breadboard.**
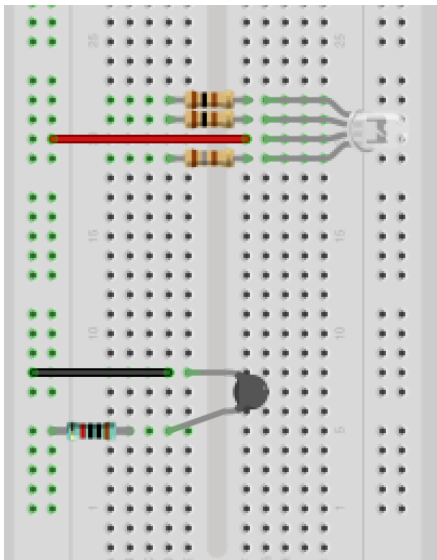
4. Now, you will start connecting the breadboard to the Arduino. First connect up the
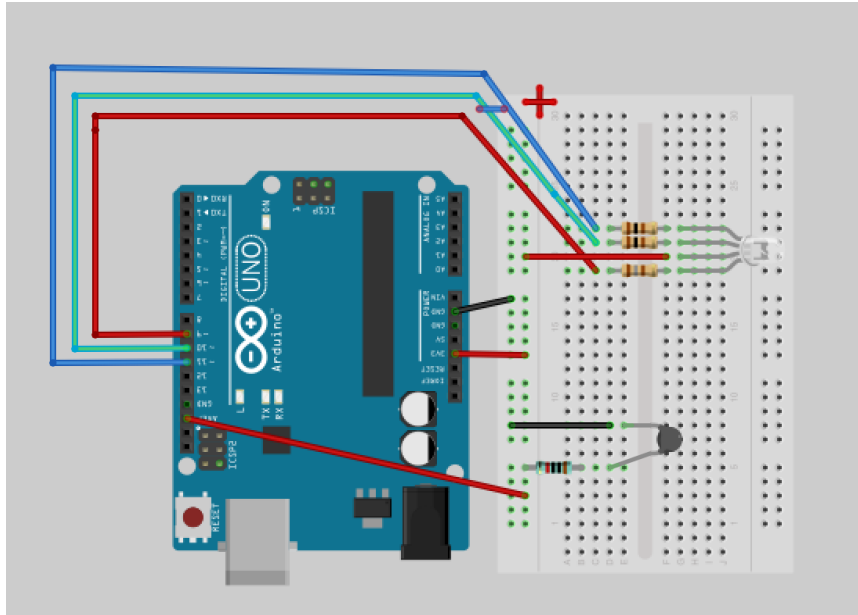
**power to (3.3 Volts) and the Ground (GRN).**

4. Next wire up the LED Insert wires as shown. The red wire will go into the hole on the Arduino labelled ~9, green is ~10 and blue is ~11.

5. Now, add a wire from the power bus on the bread board to Aref input. This double checks the voltage of our circuit. Why is it important to be sure the voltage going round the circuit is constant?

7. Connect the wire that measure the current from the Thermistor to A0. Analog O on the arduino.
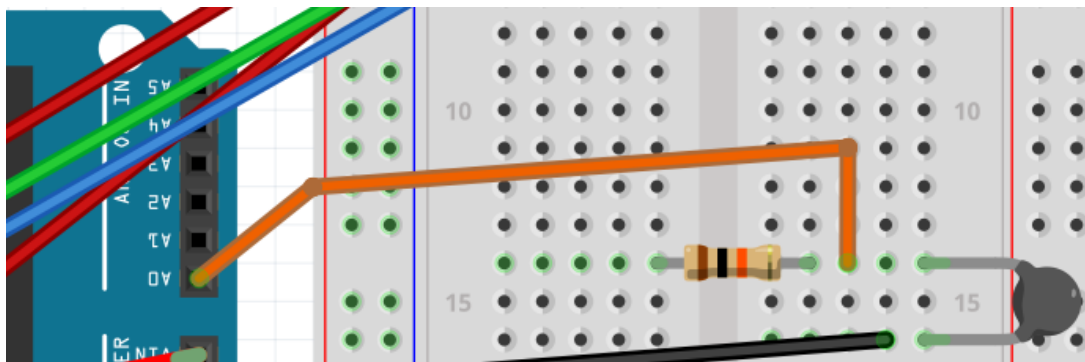
I almost forgot this important orange wire, that needs to be connected into a hole between the Thermistor 10K and the 10K ohm resistor. The second end of the wire is inserted into A0 on the Arduino

6.

7. You're almost done! Last step is to connect the battery. Snap the battery holder onto the battery. Then, take the red end and insert it into the Arduino in the slot labelled "VIN" and the black end into "GND".
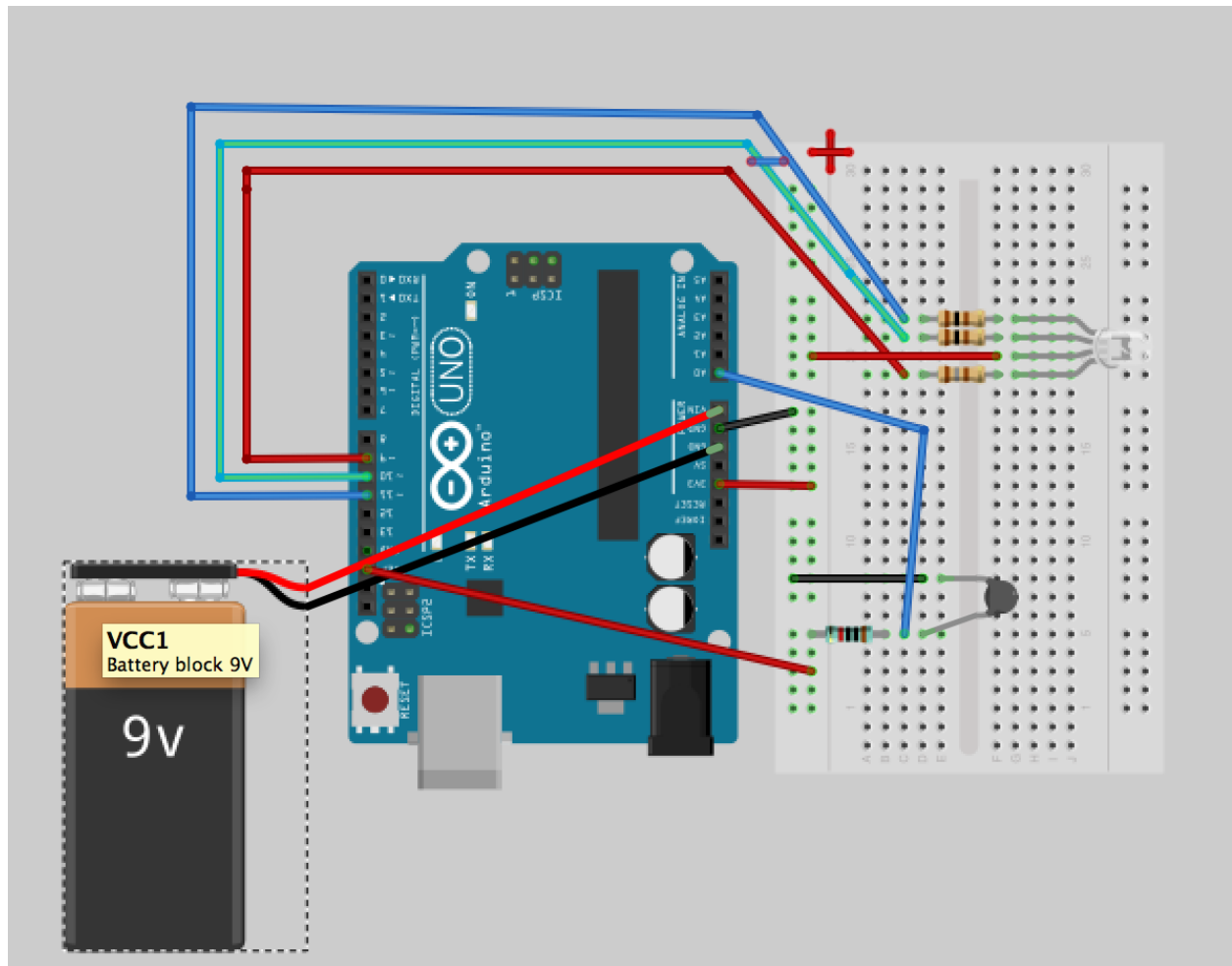
8. One last step!! Black out the lights on the ARDUINO. There are a couple of lights on the ardunio, use black duct tape to cover them.

HOUSING:
supplies: container, scissors, hot glue, hot glue gun, thermistor, velcro, tape, foam tubing.

1. Take the label from the drink container, make sure the container is dry.

2. Remove the container's cap. You are going to widen the container's openning so you can get the bread board and arduino in and out. Use the scissors to widen the openning. Don't cut away so much that you can't twist the cap back on.

3. Take the container cap. You are going to putting a small hole through the center of

the cap that thermistor will thread through. Use the scissors or screwdriver to "drill" the small hole. Don't cut yourself!

4. Make your floatie! Measure a length of pipe insulation that fits around your container. Cut the pipe insulation. Make the pipe insulation into a doughnut. Seal the doughnut with duct tape.

PUTTING IT ALL TOGETHER

1. Check your circuit works! When you warm up the thermistor, the light should change to red. When you cool it down it should go blue-green.
2. Thread the thermistor through the whole in the cap.
3. Use hot glue to make seal around the hole.
4. Secure your arduino, breadboard and battery together with tape. Try to make the package as compact as possible.
5. Place a piece of velcro in the bottom of your container, and one on the electronics.
6. Place the electronics into the container.
7. Try screwing on the cap!