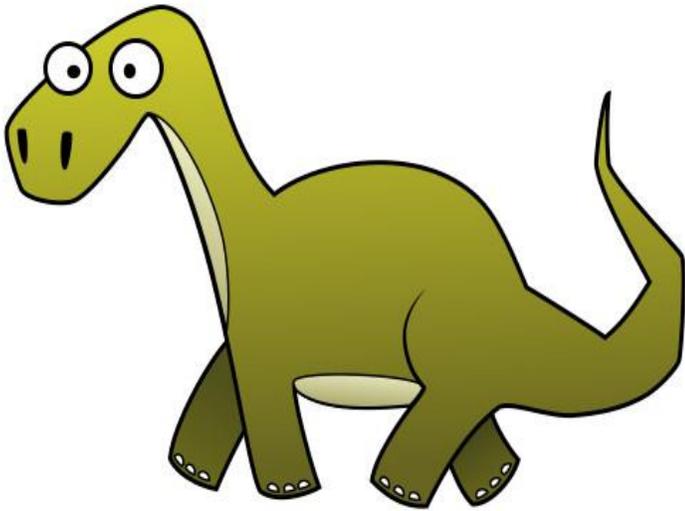# Carnegie Mellon ROBOTICS CLUB

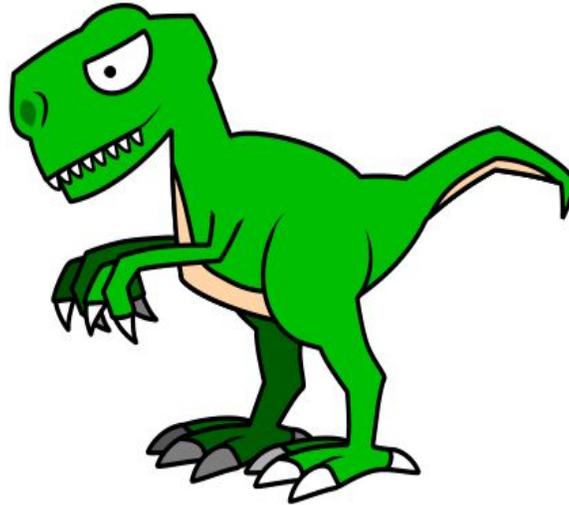# Photovore

Spring 2026

Overview

- Photovore Lab
- What is Electricity
  - Voltage
  - Current
- Basic Components
  - Wires
  - Resistors
- Photovore Circuit
  - Voltage Divider
  - Breadboards

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The Lab
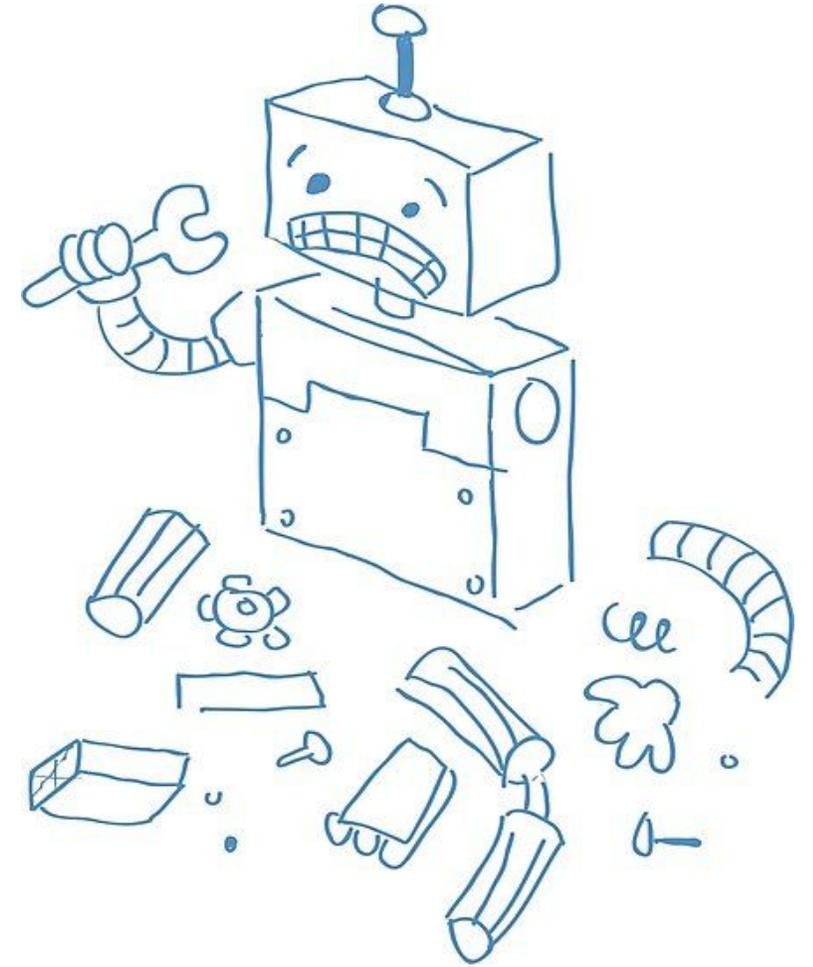
- Herbivore
- Carnivore
- Photovore?

Lab Objectives

- Learn about sensors!

- Make a circuit with sensors!

- Make your robot sense light!

- Make your robot drive to the light!

- Make your robot eat the light!
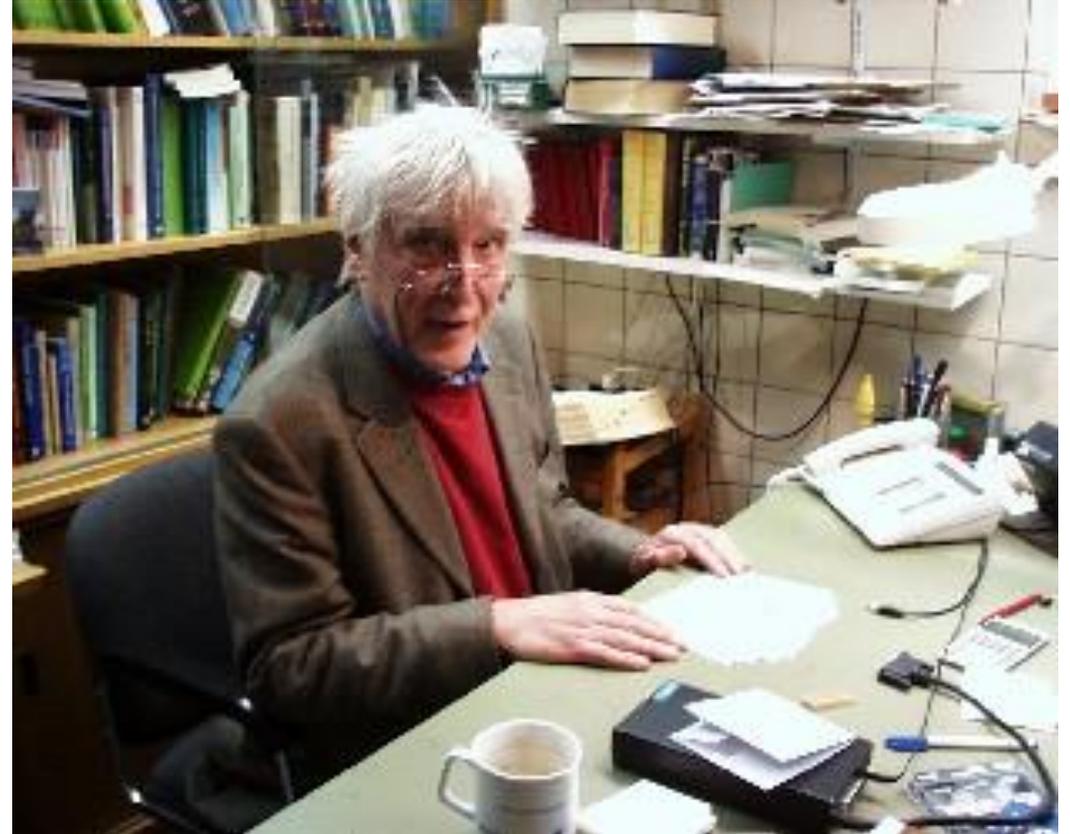 - but be careful...

History

- A photovore is a robot that is attracted to light.

- Grey Walter created the "turtle" robots in 1948 – they were among the first photovores.

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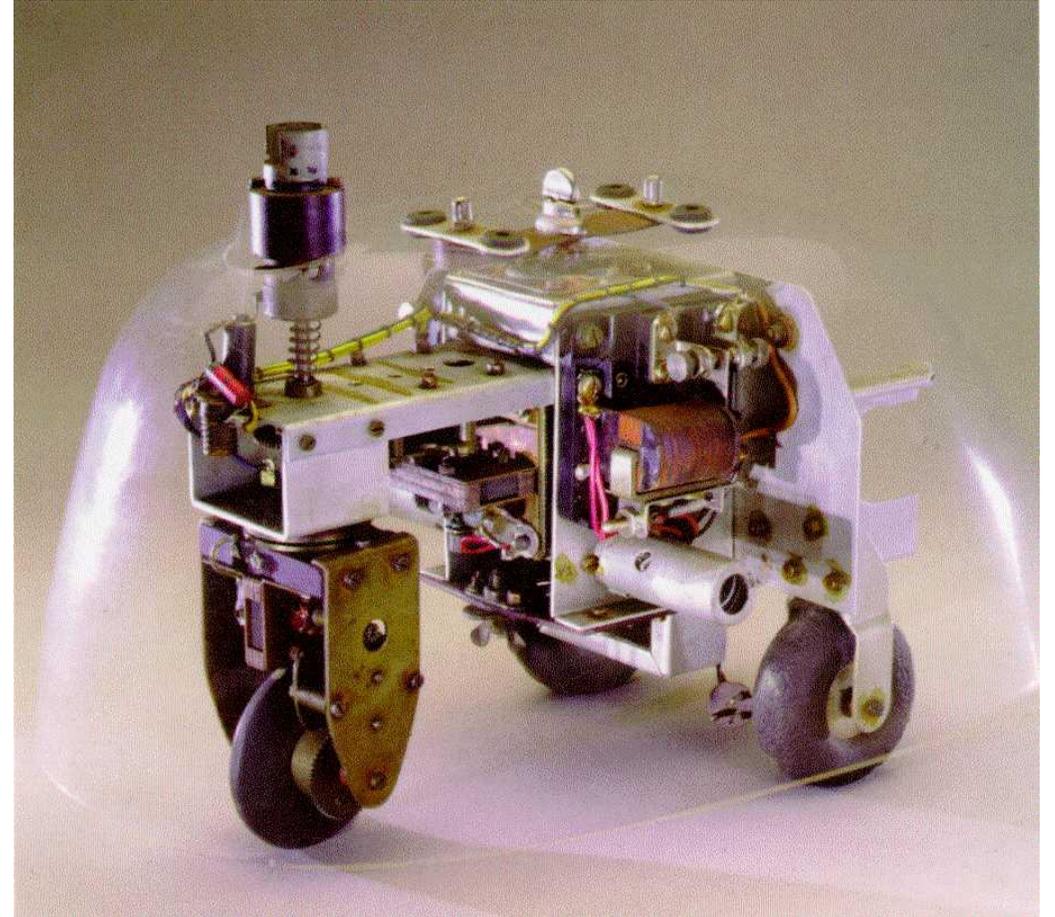
History

Braitenberg published a paper (1984) on a simple method of controlling a photovore.
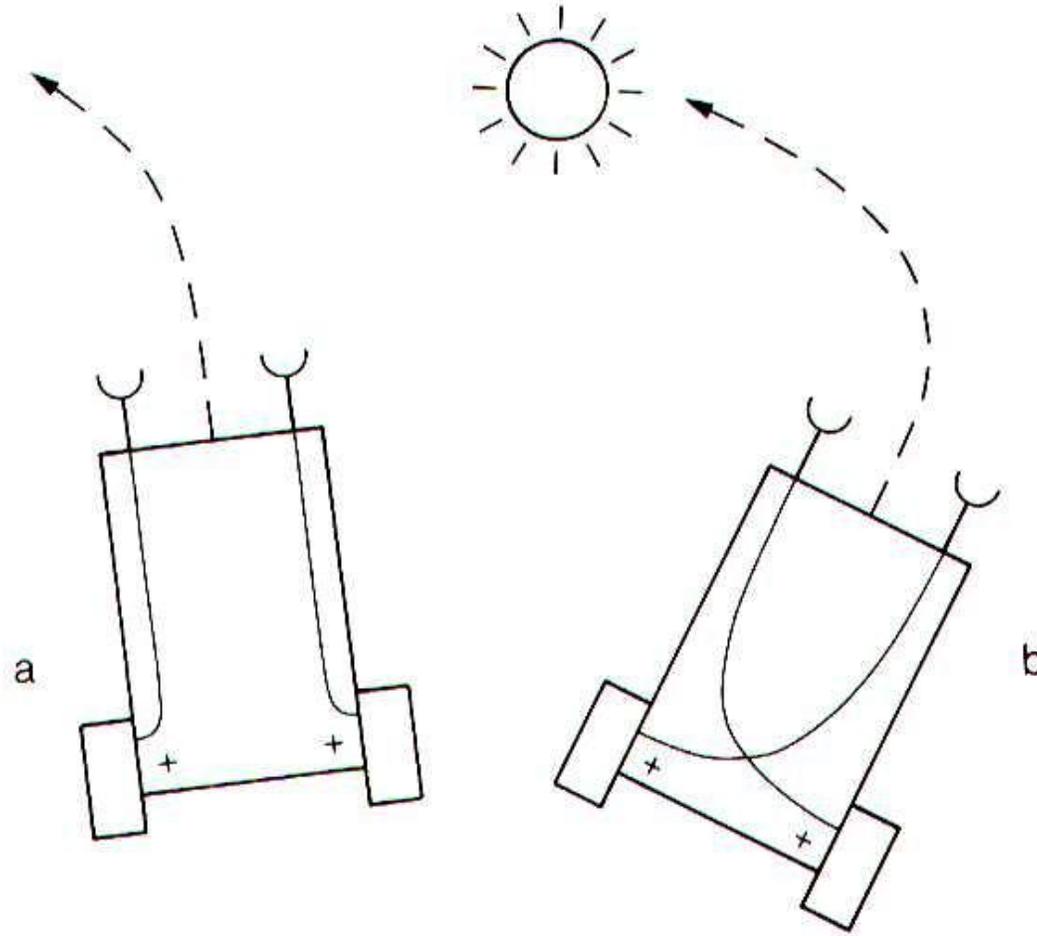
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Figure 3

Vehicles 2a and 2b in the vicinity of a source (circle with rays emanating from it). Vehicle 2b orients toward the source, 2a away from it.

The Challenge

- Your task – to create a photovore.
- Your robot should be able to find the light as long as your robot is within 10(ish) feet of the light.
- After that, your sensors just can't tell the light from room light.
  - Or can they…
- Once you've found it, drive towards it!
- "Completeness" is being able to drive from any starting position to the light.
- You don't have to gracefully stop, try to though.
- You can't just wander around until you find it.

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Circuits

Why Circuits

- The Romi's main chip can't measure light on its own
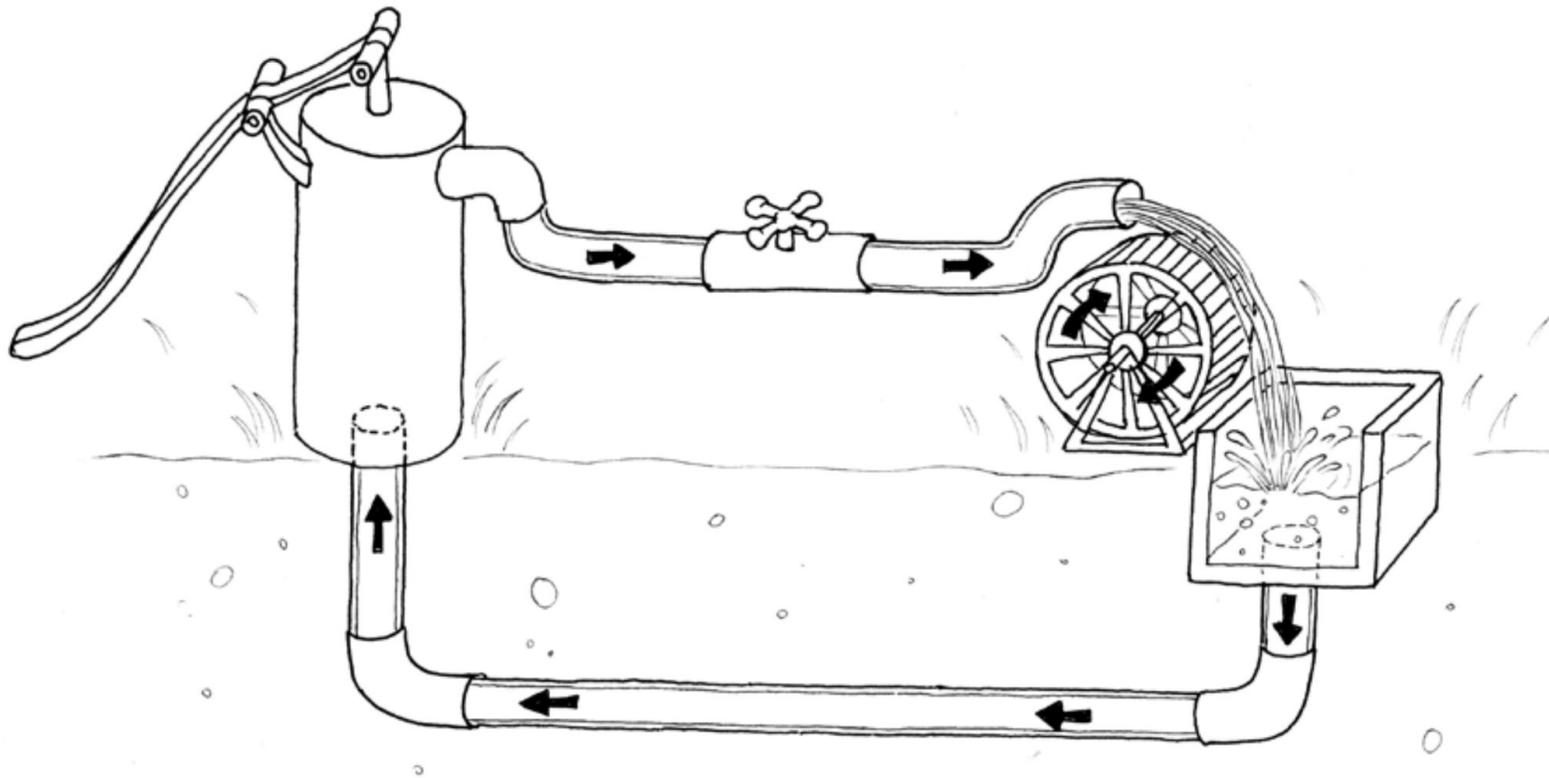- We need to use circuits to convert light into something it can understand.
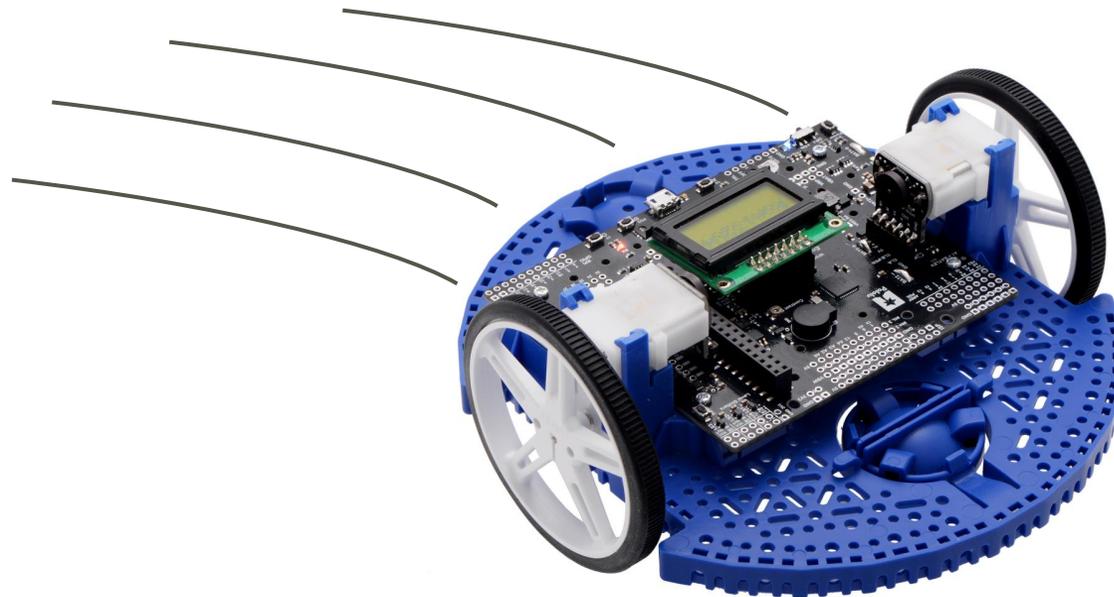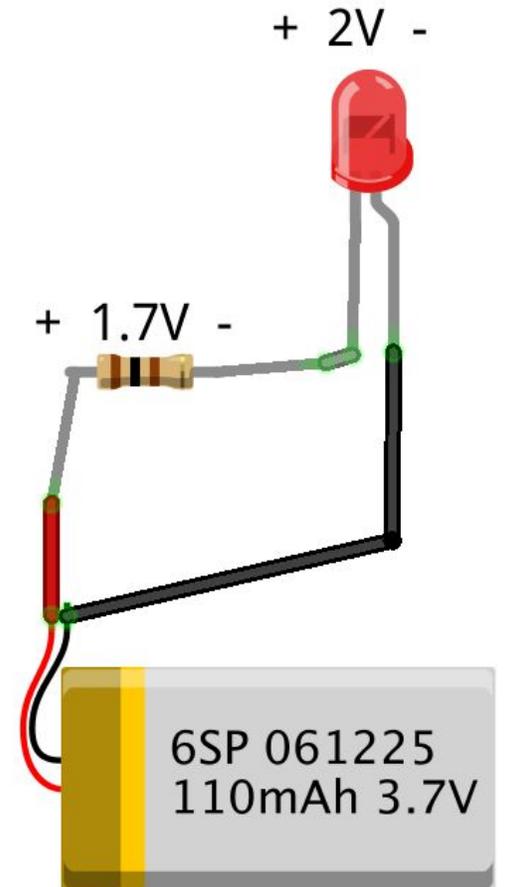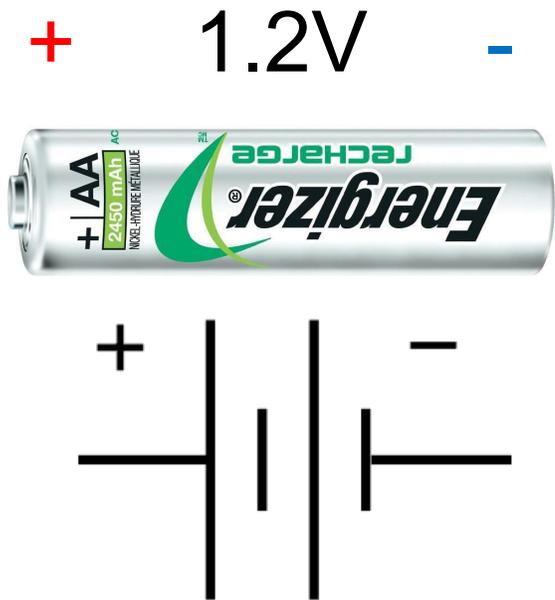
WRONG WAY

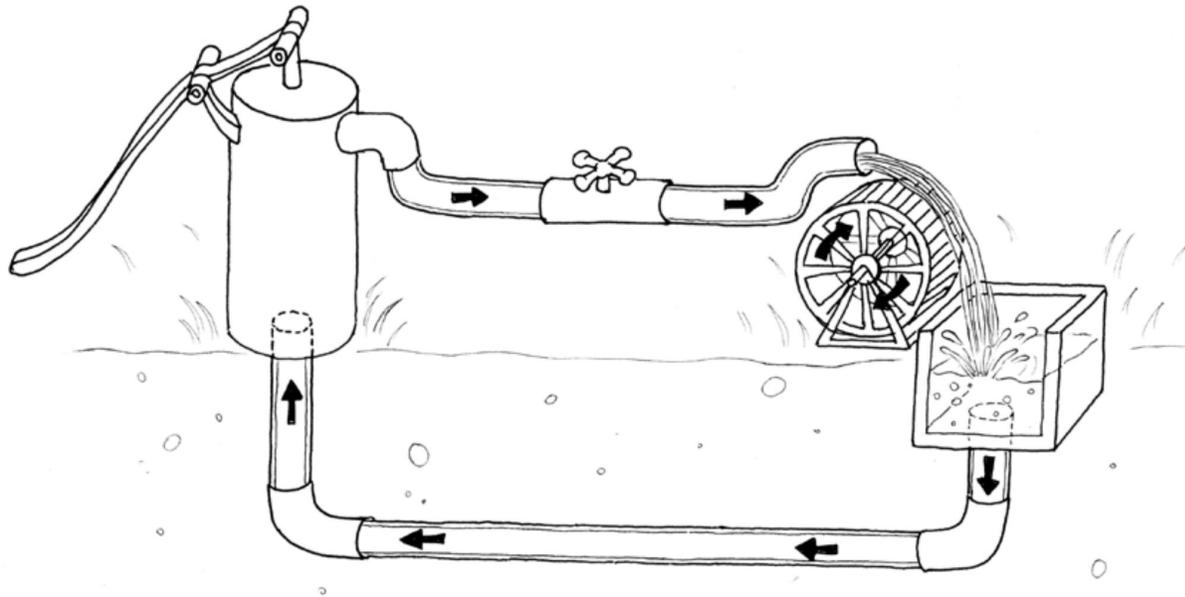Image Credit: "Getting Started with Arduino" by Massimo Banzi

Voltage

- Voltage: Difference in electrical potential energy
  - Units: Volts

Candy Question!

- What is voltage in the water analogy?
- What are the units of voltage?
  - Bonus if you can break it down into basic SI units!

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Answer:

- In the water analogy, the difference of potential energy of the water is the voltage.
  - For example, the decrease of energy as the water falls down from the tower, across the waterwheel, to a lower altitude would be like a decrease in voltage.
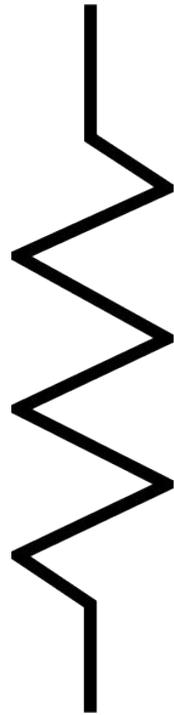- Units: kg * meter^2 / (s^3 A)

Current

- Current: rate of flow of electrical charge
  - Units: Amps (Coulomb/second) (1000 mA = 1 A)

20 mA -->

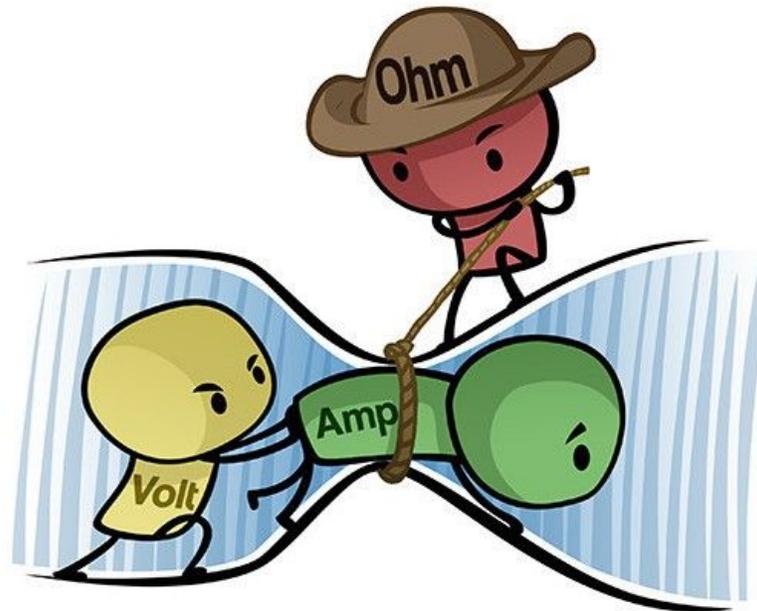6SP 061225
110mAh 3.7V

~300 mA -->

9V
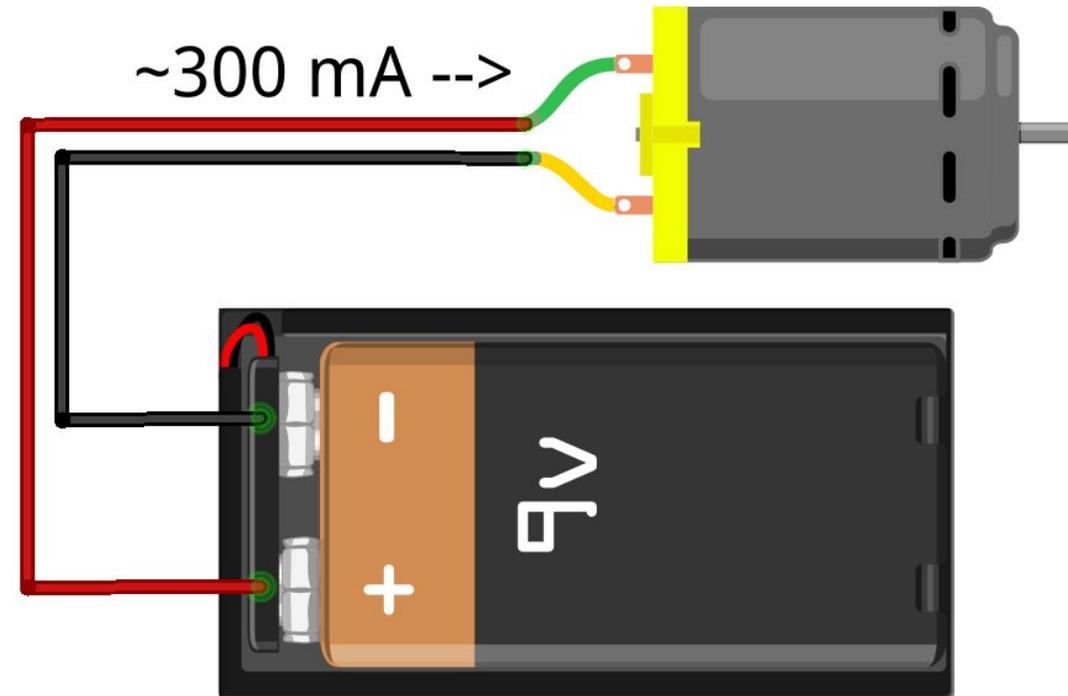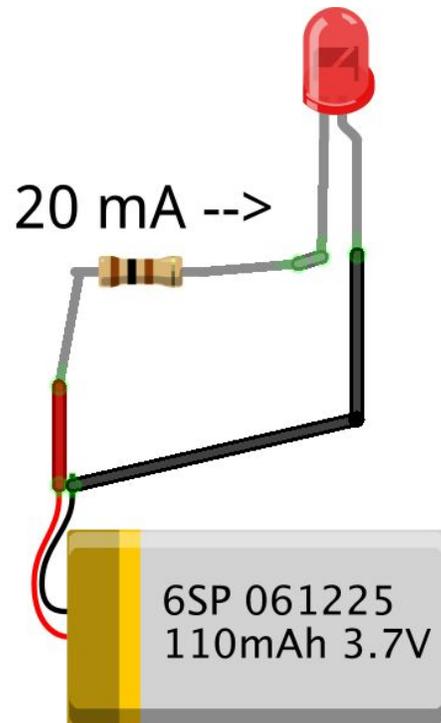
Resistors

- Resist flow of electricity
- Colored bands describe the resistor's value
- Large values = Closer to an open circuit (air)
- Small values = Closer to a short circuit (wire)
- Units: Ohms

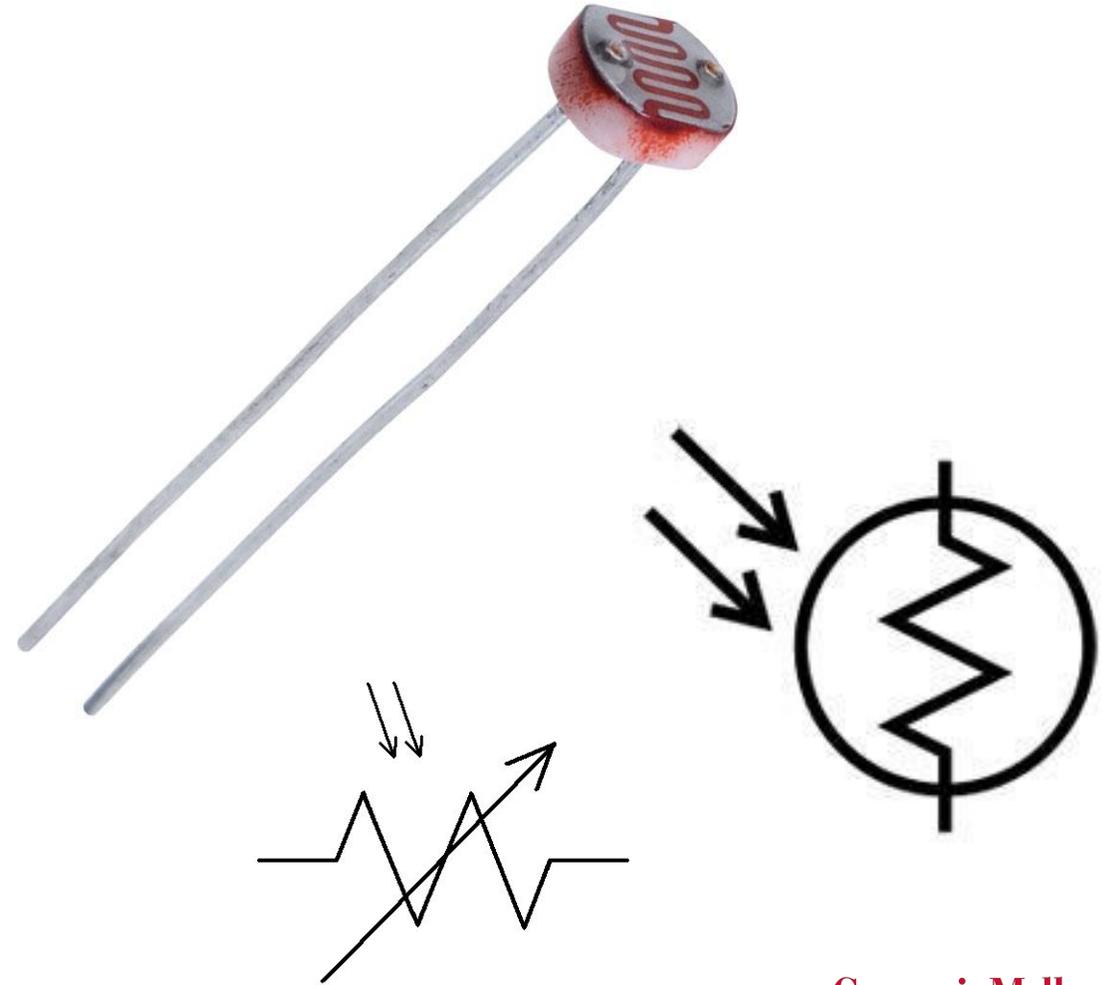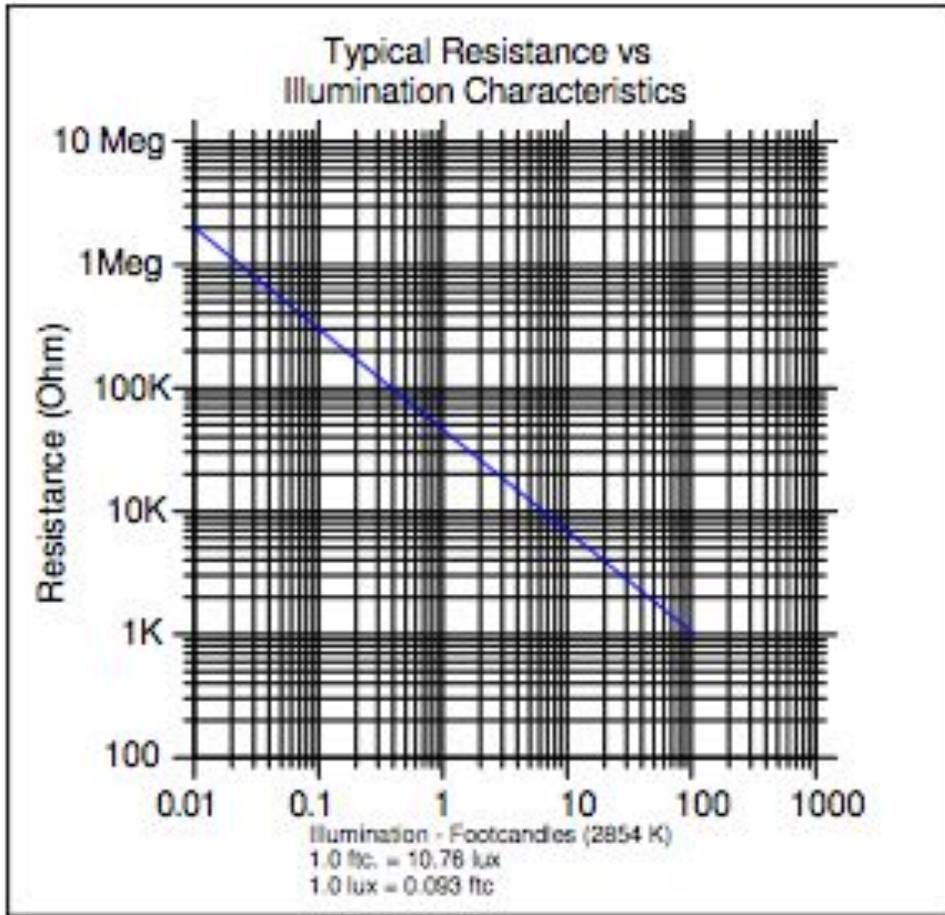Carnegie Mellon
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Why does this cartoon make any sense at all?

IE, how does this relate to voltage, current, and resistance?

Photoresistor

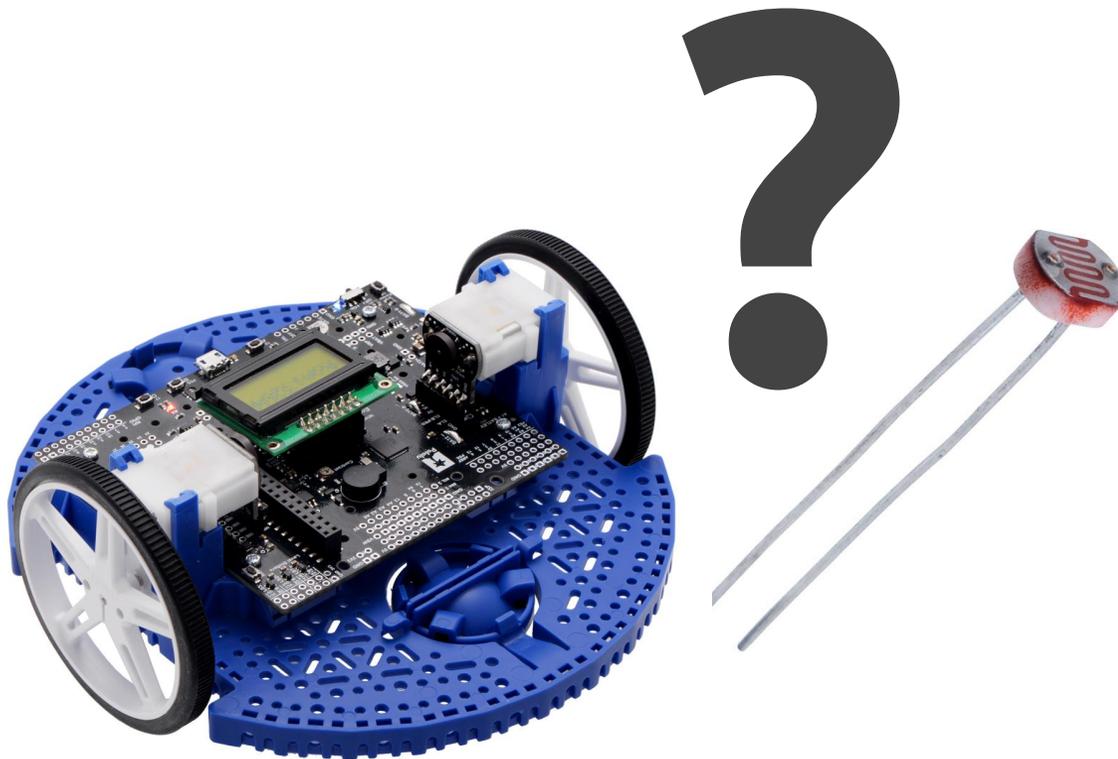But none of this helps us measure light…

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Photoresistor

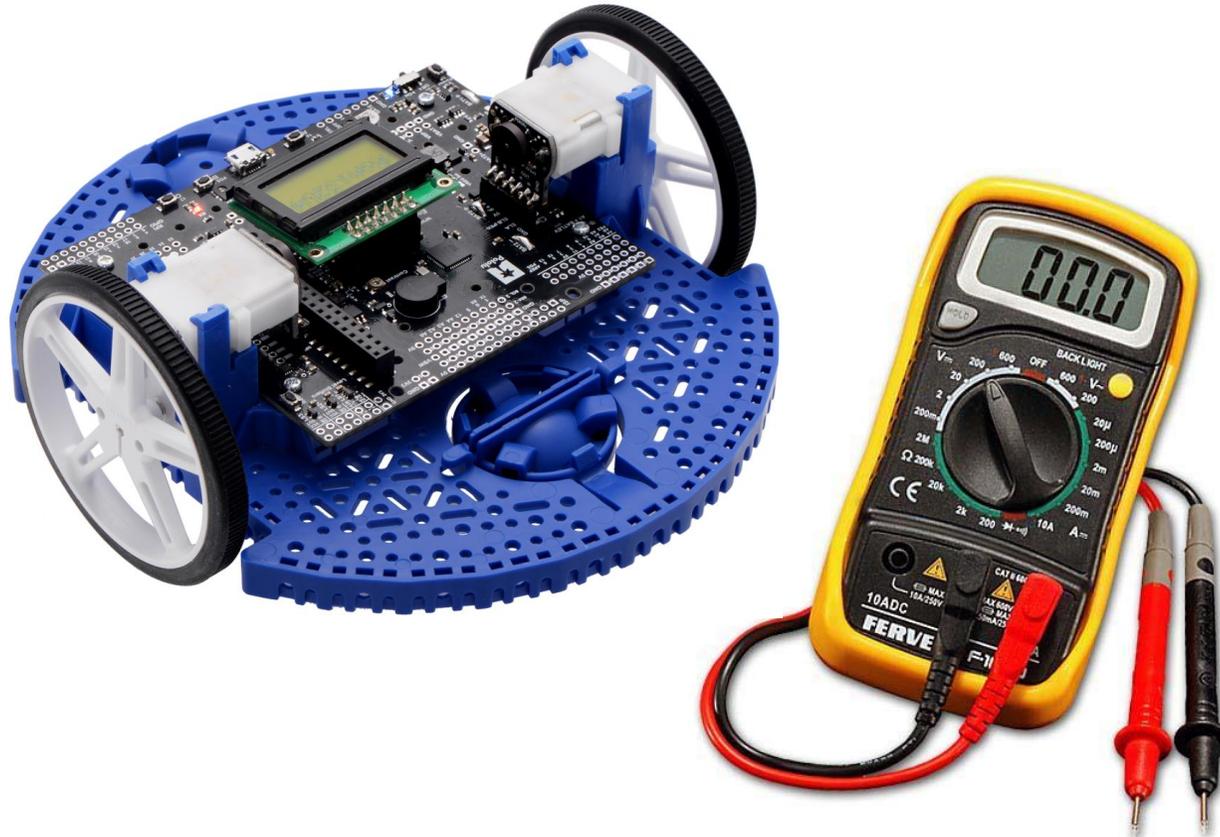Typical Resistance vs Illumination Characteristics

Photoresistor

- Great! a part that changes its resistance based on light!
- **BUT** the romi can't measure resistance directly
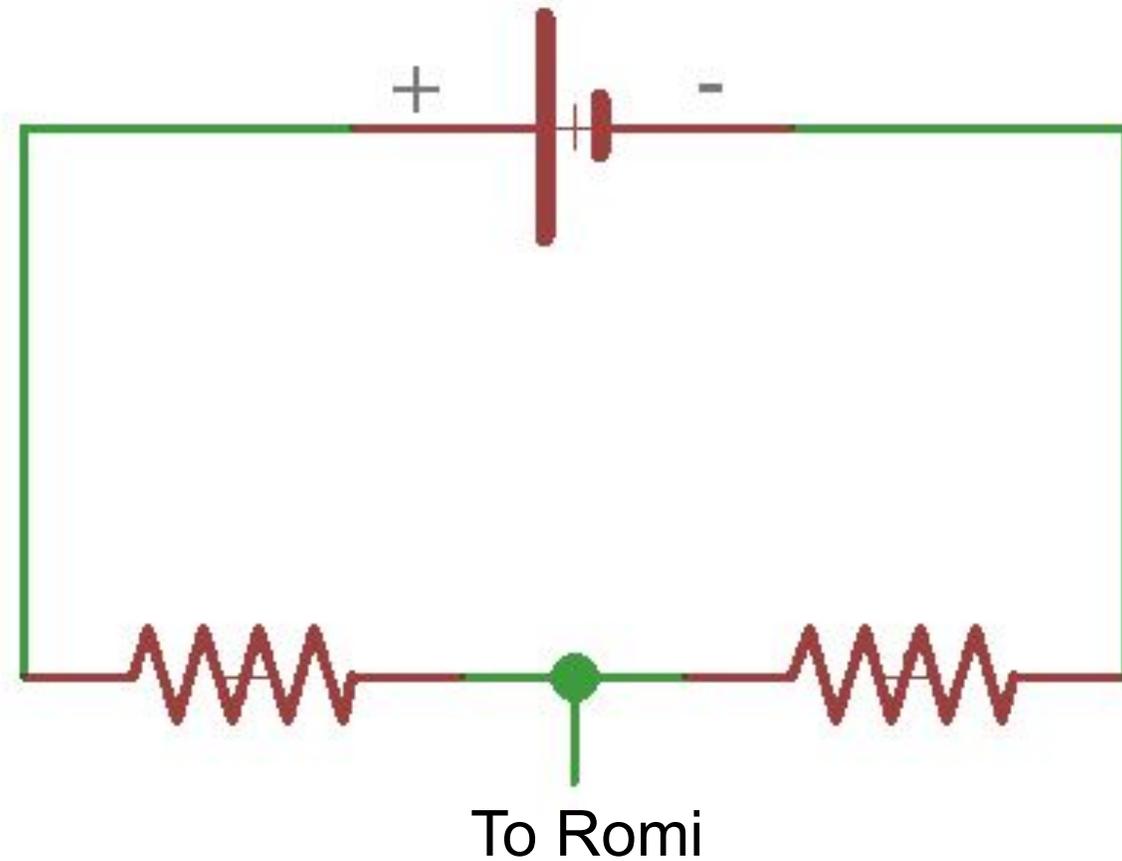
Voltage Measurement

- So what can the Romi Measure?... VOLTAGE!
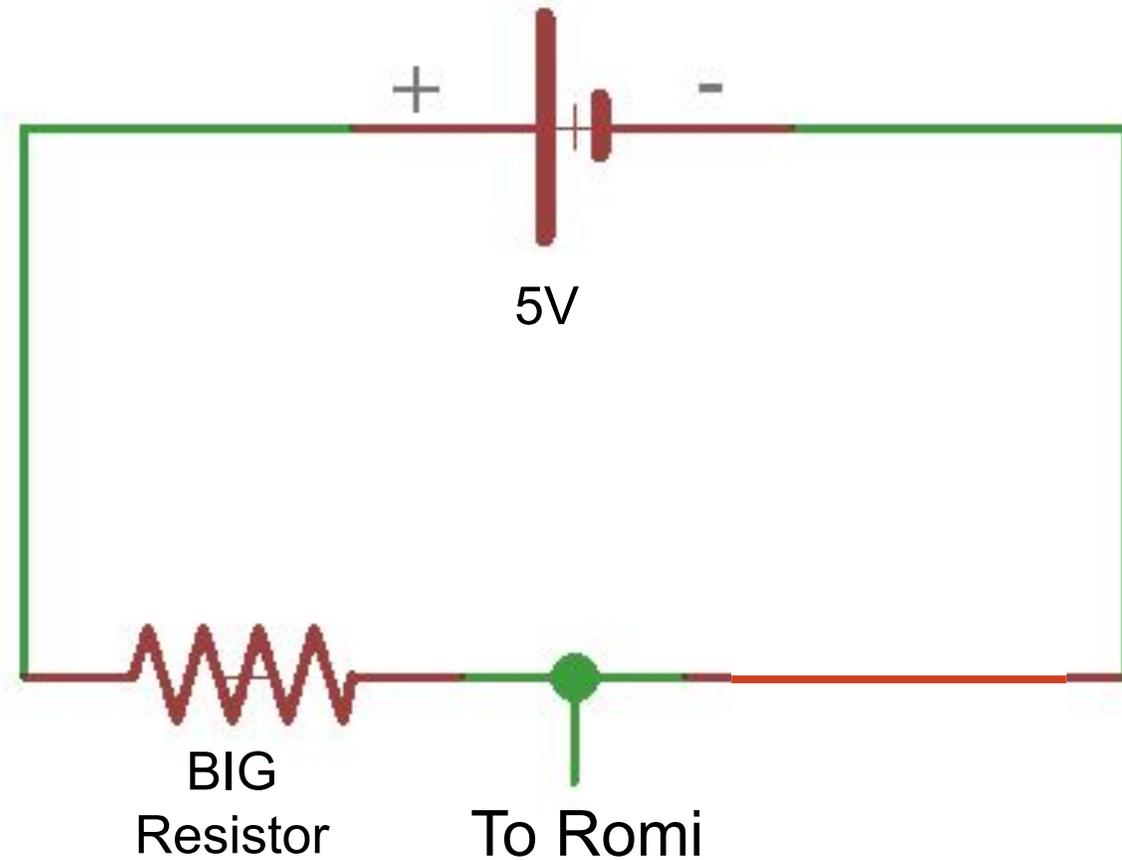 - Well, mostly… can only measure voltage from 0V-5V

Voltage Divider

- We can use a voltage divider circuit to convert resistance changes into voltage changes that the Romi can read
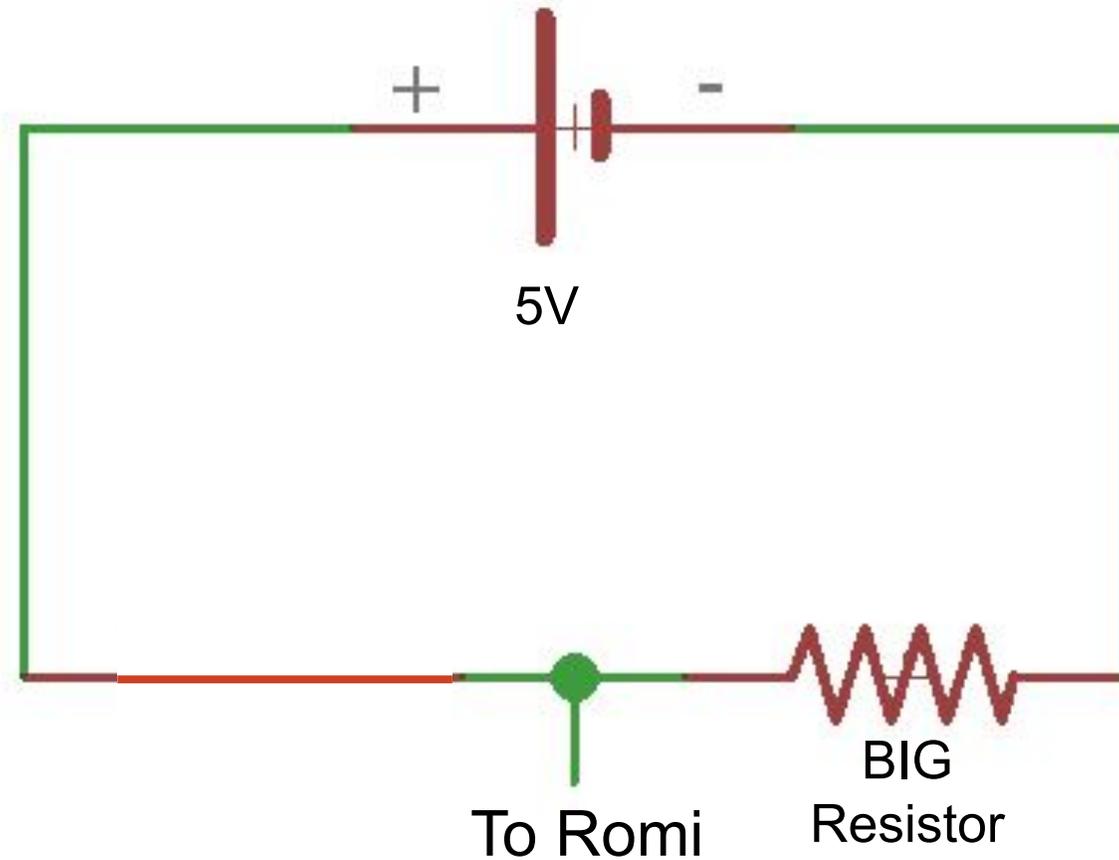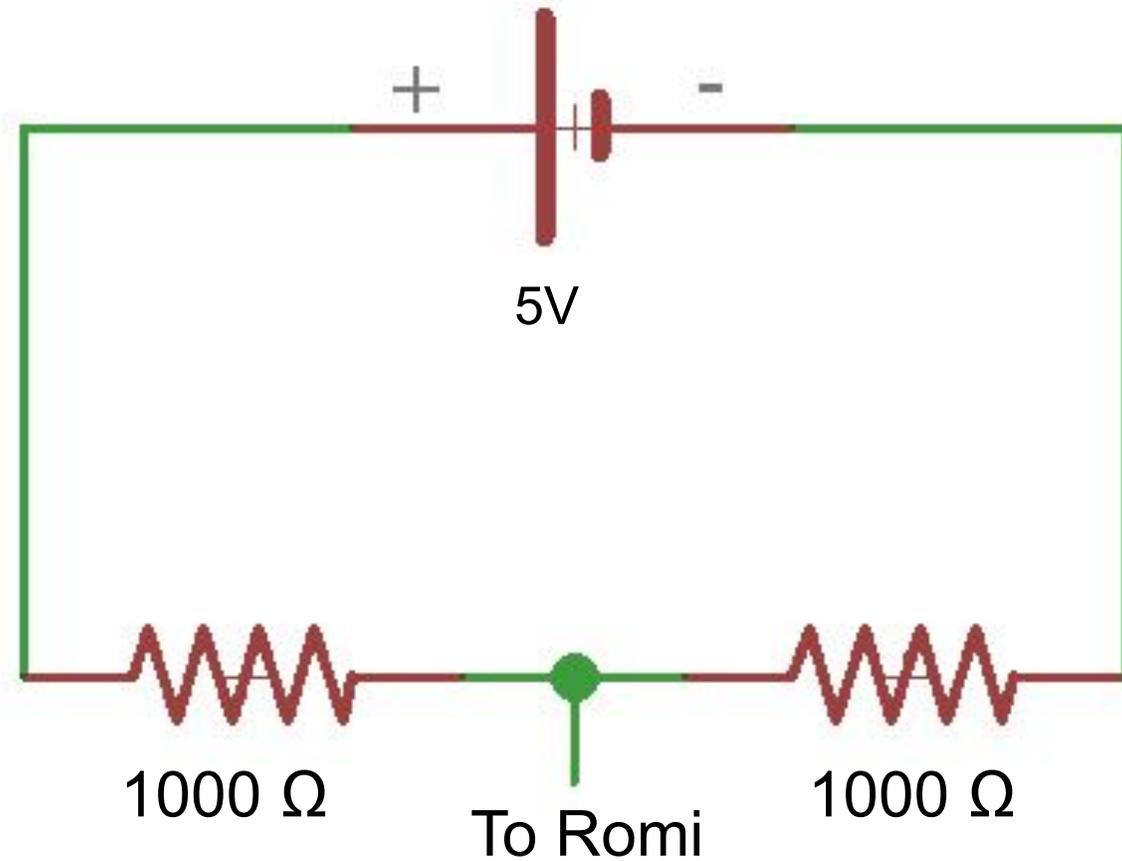
Voltage Divider

To Romi

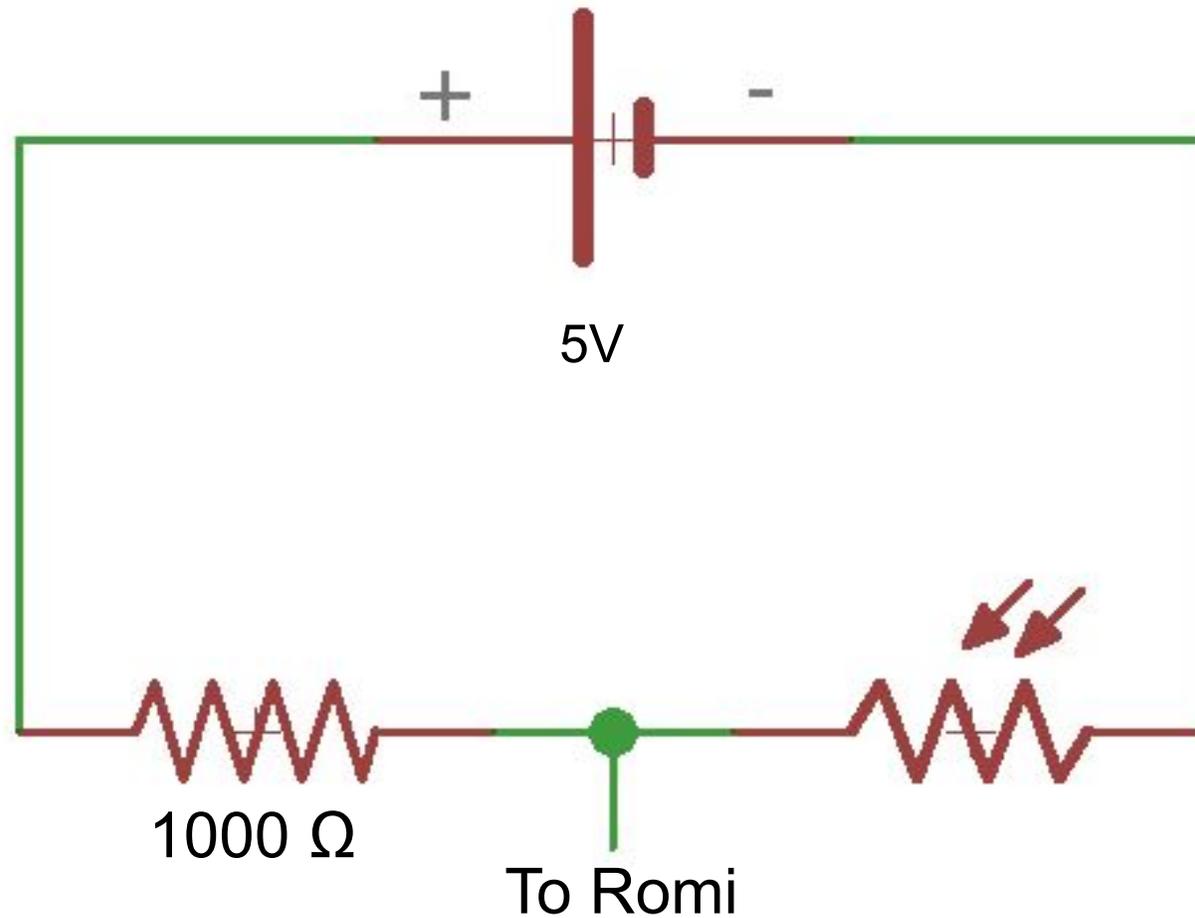# Voltage Divider

5V

BIG
Resistor

To Romi

Voltage Divider

5V

To Romi

BIG
Resistor

Voltage Divider

5V

1000 Ω

To Romi

1000 Ω

Voltage Divider

5V

1000 Ω

To Romi

Full Romi Circuit

5V

1000 Ω

Romi
Connection 1
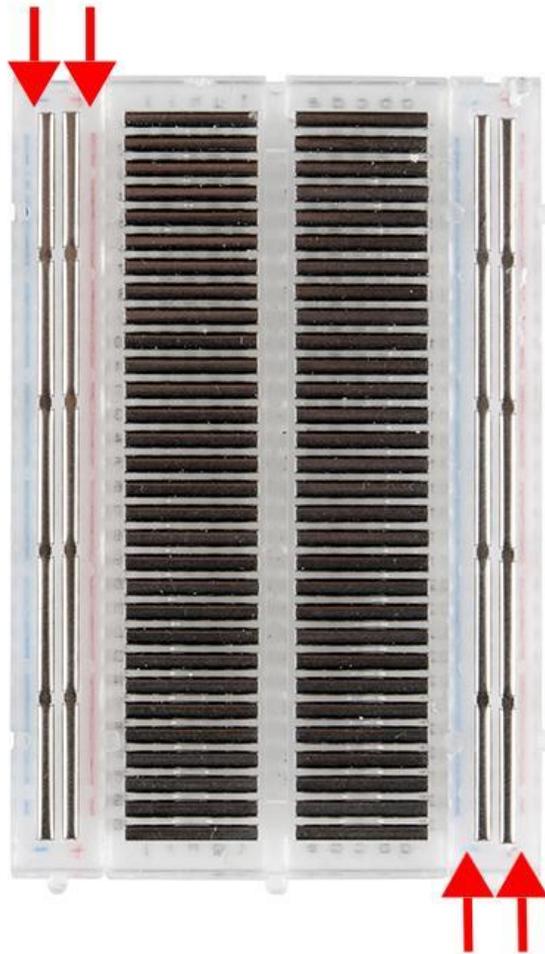
Left Sensor

1000 Ω

Romi
Connection 2

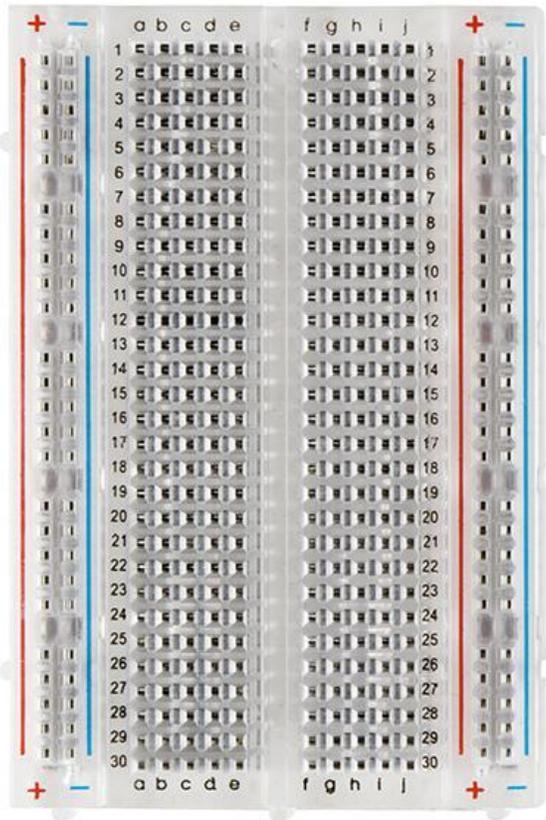Right Sensor
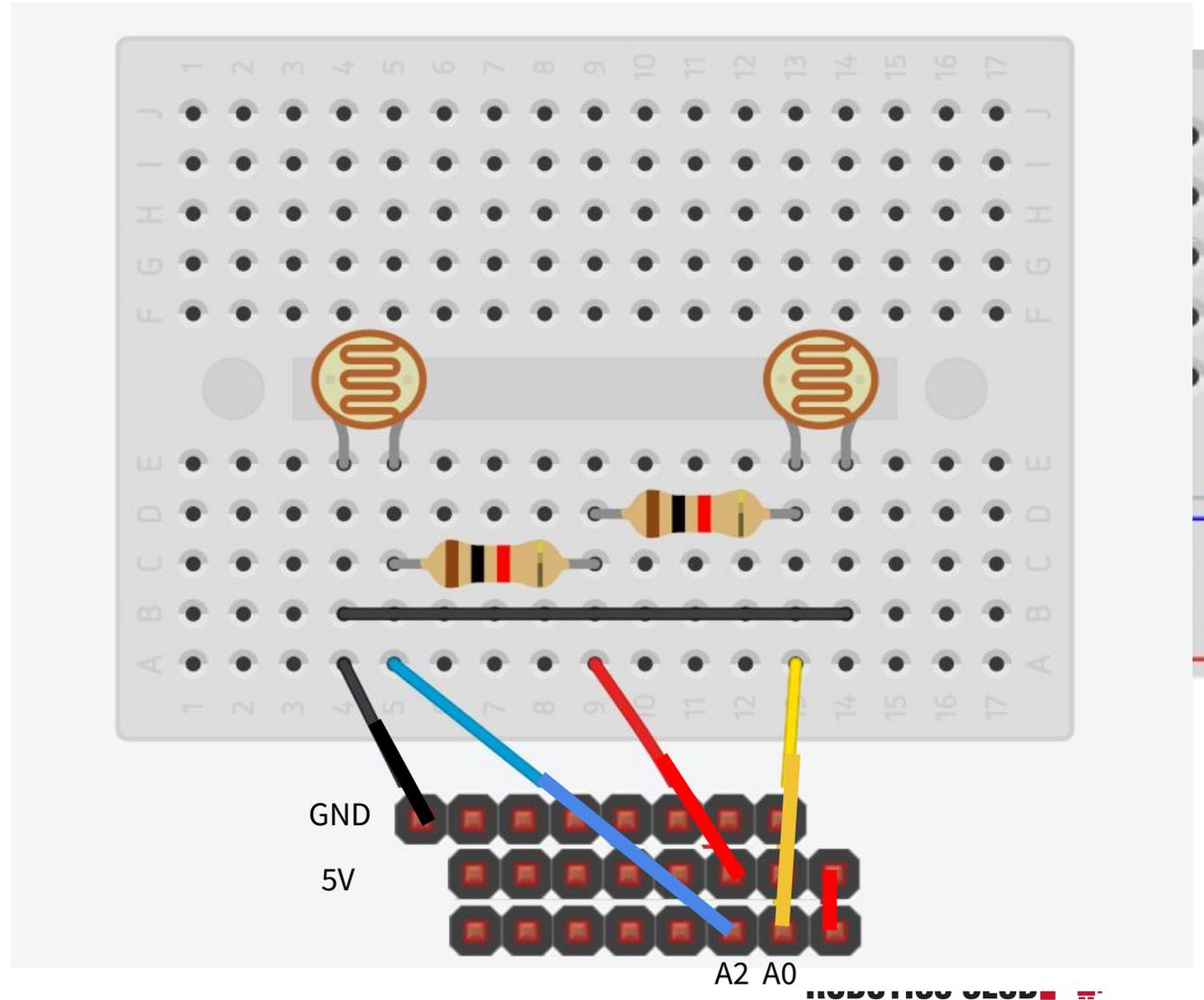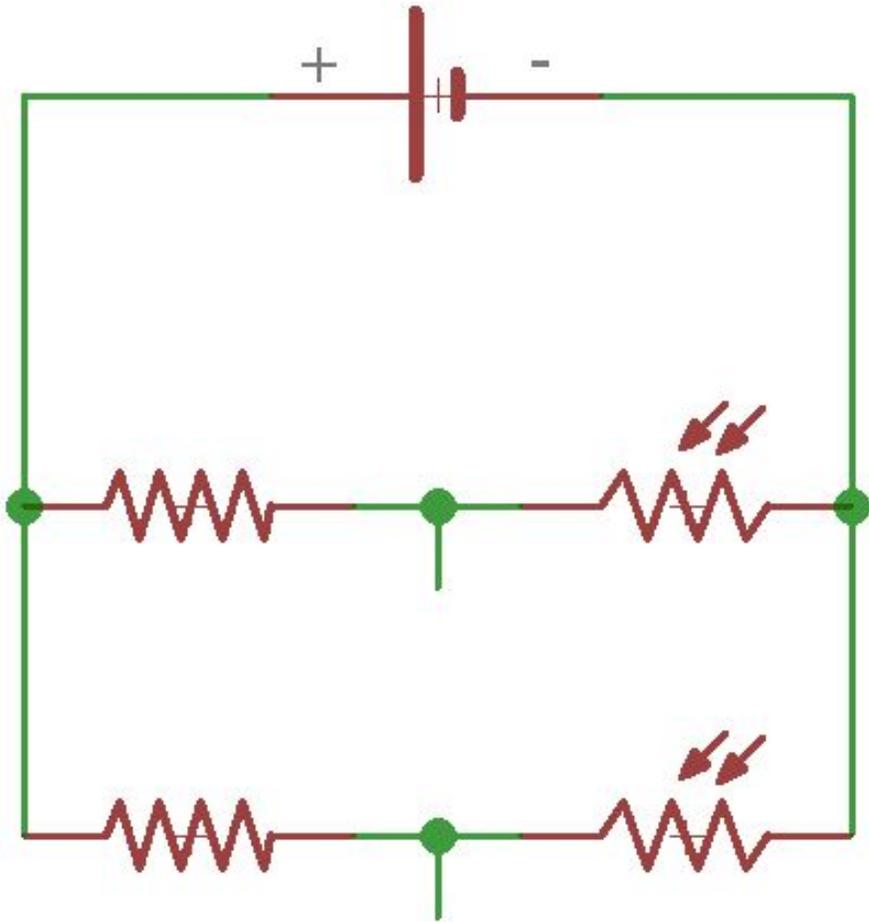
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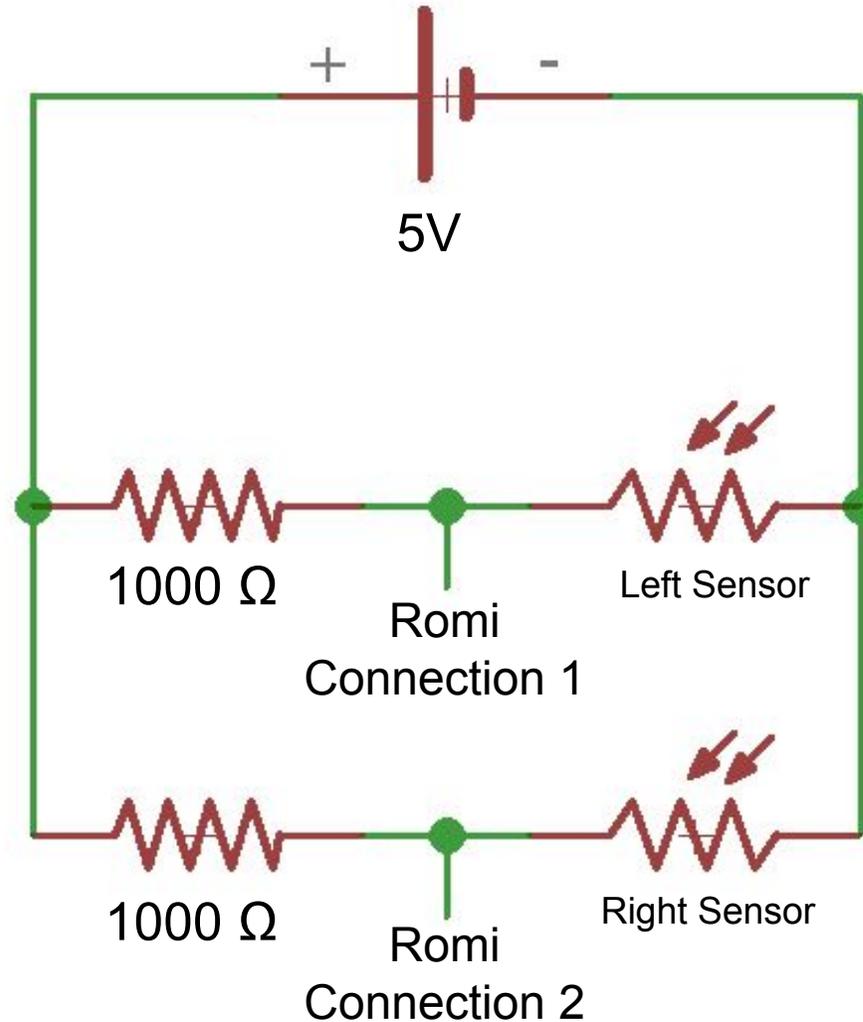
Circuit

Great! We have our circuit to measure light. But how do we build it?
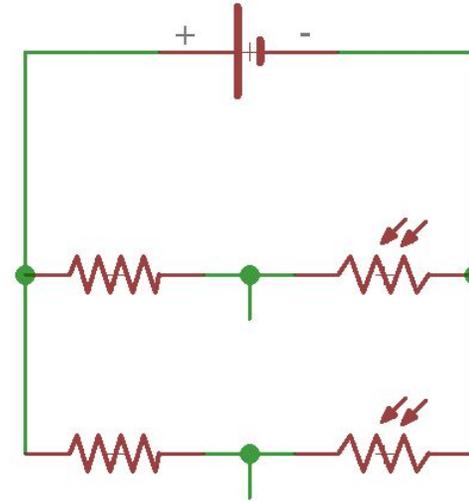
Breadboards

Build it!

GND

5V

A2 A0
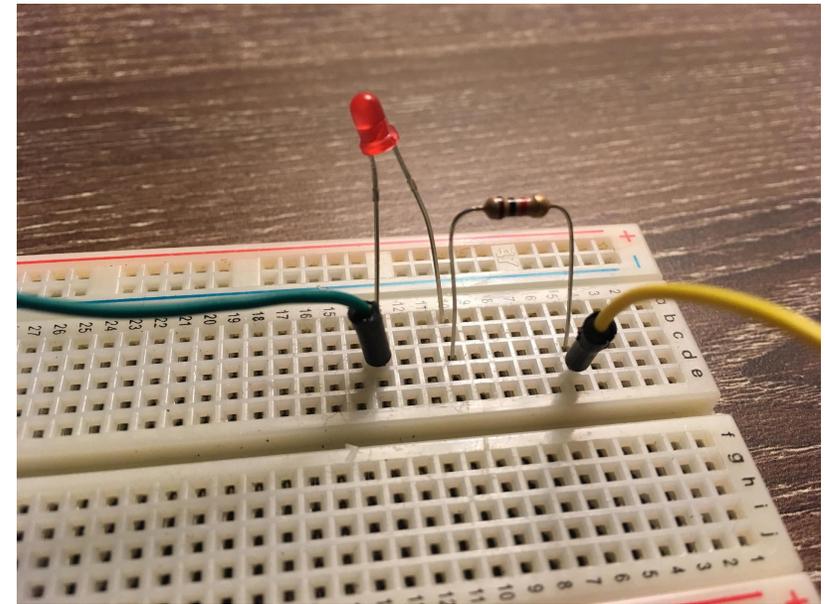
Code

```
#define LEFT_SENSOR A0
#define RIGHT_SENSOR A2

void setup() {
}

void loop() {
  // Sensor readings will be between 0 and 1023
  // 0 = 0V; 1023 = 5V at center of voltage divider
  int left_light = analogRead(LEFT_SENSOR);
  int right_light = analogRead(RIGHT_SENSOR);
}
```

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