

PHYSICAL COMPUTING

FOR

WEB DEVELOPERS



Workshop with Jean-Philippe Côté & Mark Rigley

Tangible JS

Pre-Installed Software

- **Arduino IDE 1.6.x** <https://www.arduino.cc>
- **CH34x Driver** <http://tinyurl.com/jbnmhz7>
- **NW.js (SDK Flavor), LTS 0.14.x** <http://nwjs.io>
- **Node.js 6.x** <https://nodejs.org>

* If you have not yet installed the software as per the pre-workshop instructions, please request one of the USB keys with all necessary installers.

PHYSICAL COMPUTING

Physical computing,
in the broadest sense,
means...

... building interactive
physical systems by
the use of **software**
and **hardware** that can
sense and **respond** to
the **analog world**.

1 NW.js



Chromium

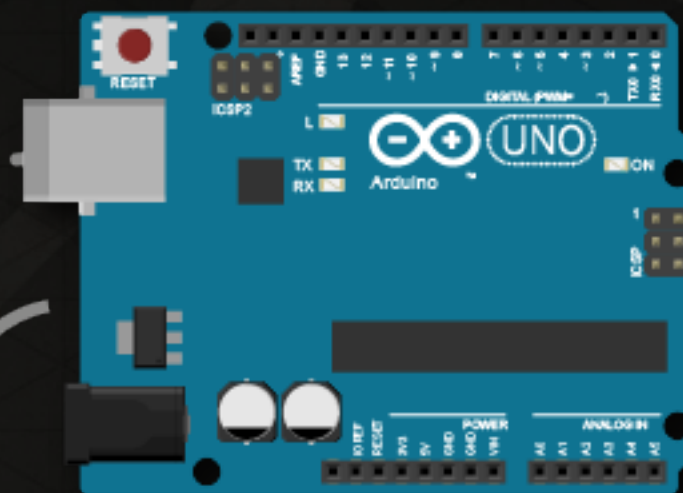


Node.js

2 Johnny-Five



3 Arduino



Actuators



Sensors

Firmata

1 NW.js

2 Johnny-Five

3 Arduino



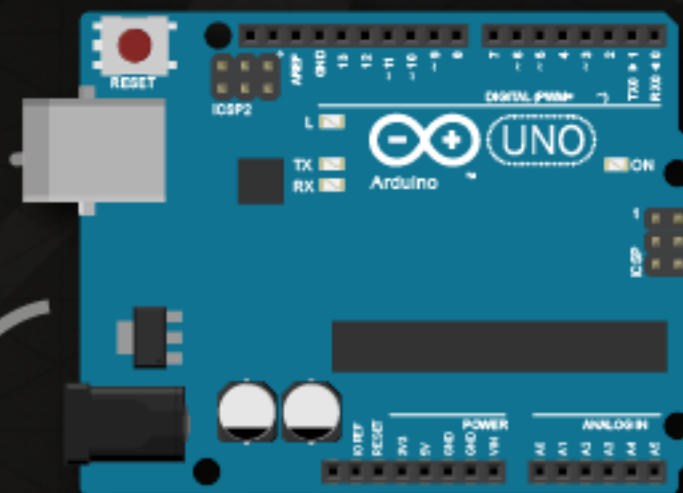
Chromium



Node.js



Firmata



Actuators



Sensors

Libraries to download

1. Go to: <http://tangiblejs.com/camp2016>
2. Download: [camp2016-workshop-lib.zip](#)

* The libraries are: [jQuery](#), [QuickSettings.js](#), [Tone.js](#) and a super simple particle library I put together for this workshop ([particle.js](#)).

01

Our 1st NW.js Desktop Application

Running the app

macOS

- Put **nwjs.app** inside the project folder and double-click it.

Windows

- Copy all the files from the decompressed NW.js zip archive into the project folder and double-click on **nw.exe**.

or

- Drag and drop the project folder onto **nw.exe** or onto a **shortcut** to nw.exe.

Available APIs

- **NW.js APIs**

- <http://docs.nwjs.io/en/latest/>
- Available in **nw.***

- **Native Node.js APIs**

- <https://nodejs.org/dist/latest-v6.x/docs/api/>
- Accessible by using **nw.require("module")**

- **Node.js 3rd-Party Modules**

- <https://www.npmjs.com/>
- Accessible by using **nw.require("module")**

- **Front-End Libraries**

- Accessible by linking them with **<script> tags** in the usual fashion.

- **Chrome Platform APIs**

- https://developer.chrome.com/apps/api_index
- Available in **chrome.***

Running the app from the command line

Step1.

macOS

- Add `export PATH=$PATH:/Applications/nwjs.app/Contents/MacOS/` to your `~/.bash_profile`

GNU/Linux (depends on distro)

- Add `export PATH=$PATH:/path/to/nw` to your `~/.profile`

Windows

- Add the path to `nw.exe` to your `Path` system variable

Step 2.

From the project folder, simply issue:

`nwjs .`

`nw .`

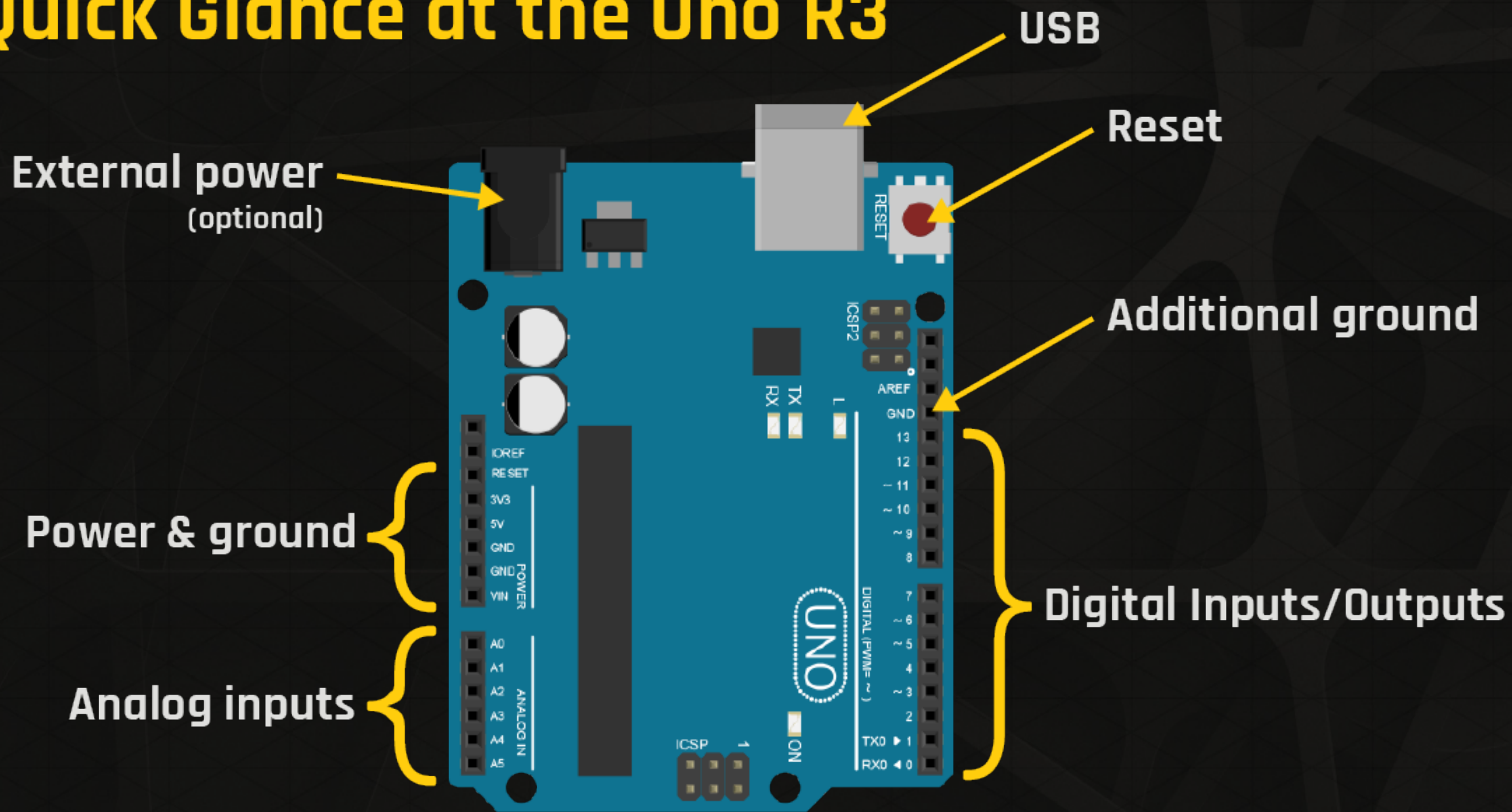
`nw.exe .`

macOS

Linux

Windows

A Quick Glance at the Uno R3

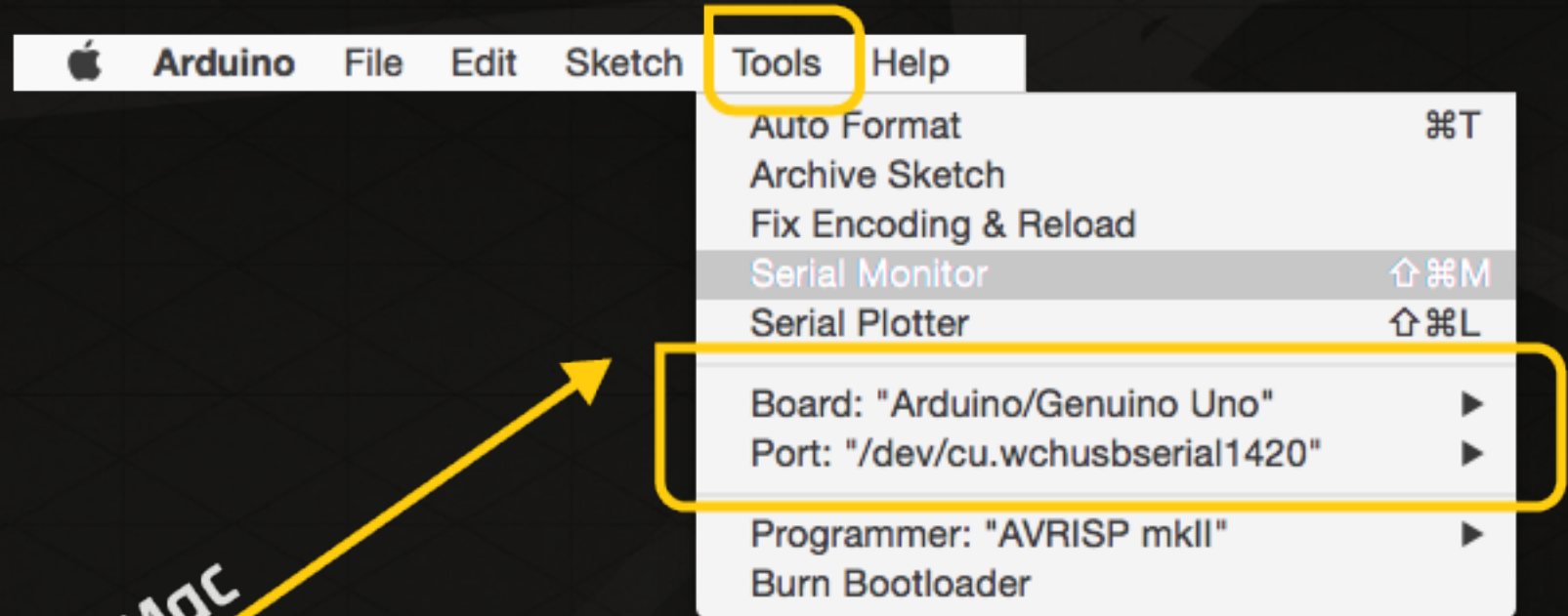


Firmata Setup

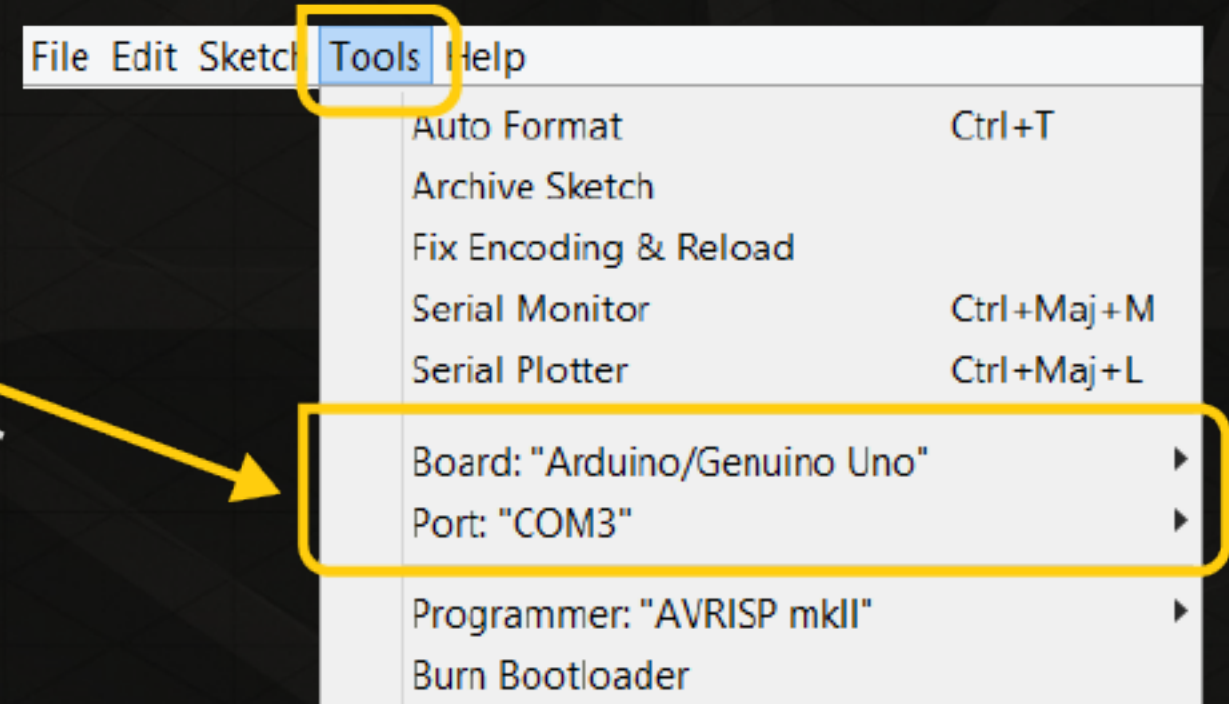
1 Plug in the board to your laptop's USB port

2 Start the Arduino application

3 Make sure the board type and port are selected



Mac

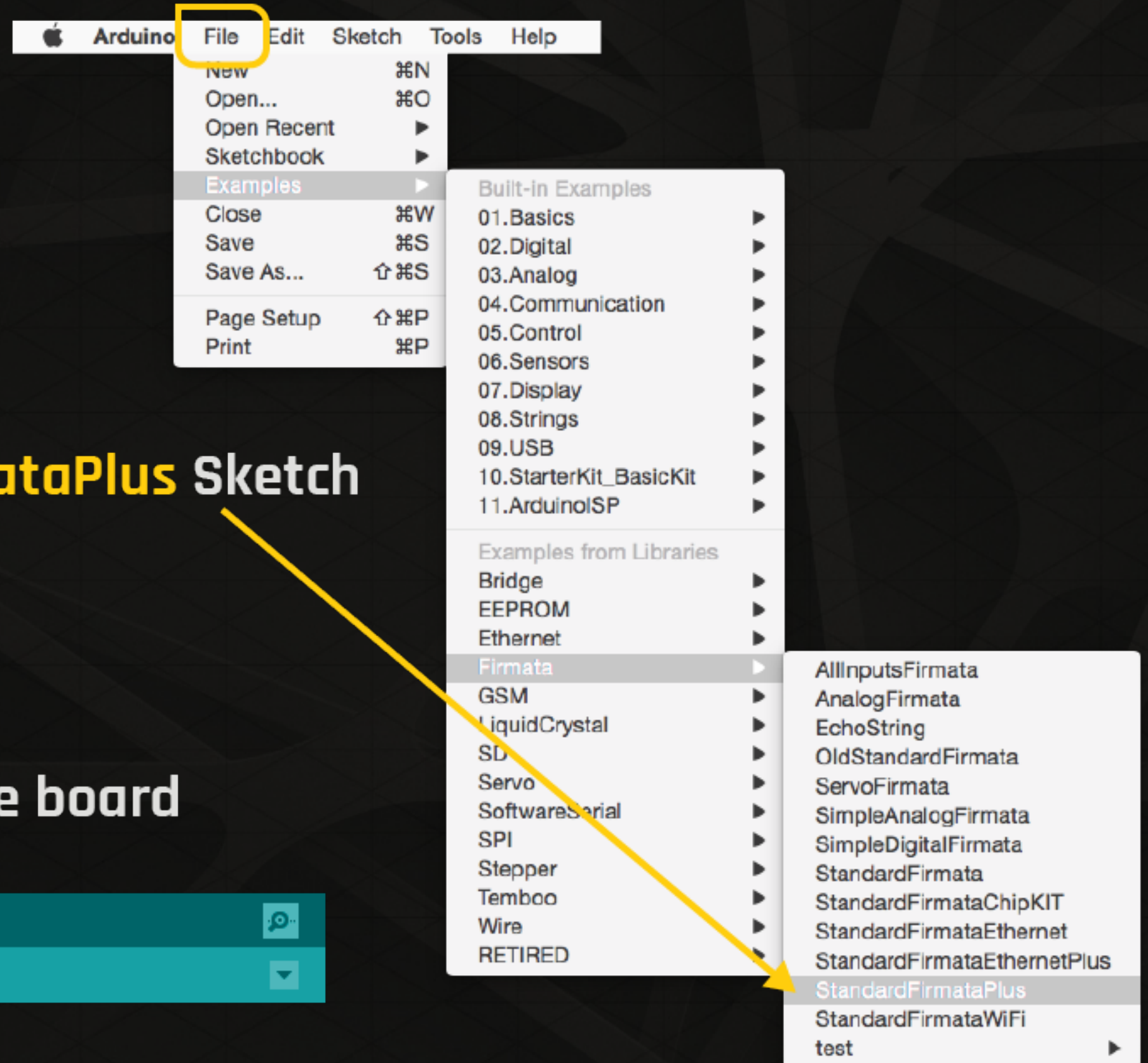


Windows

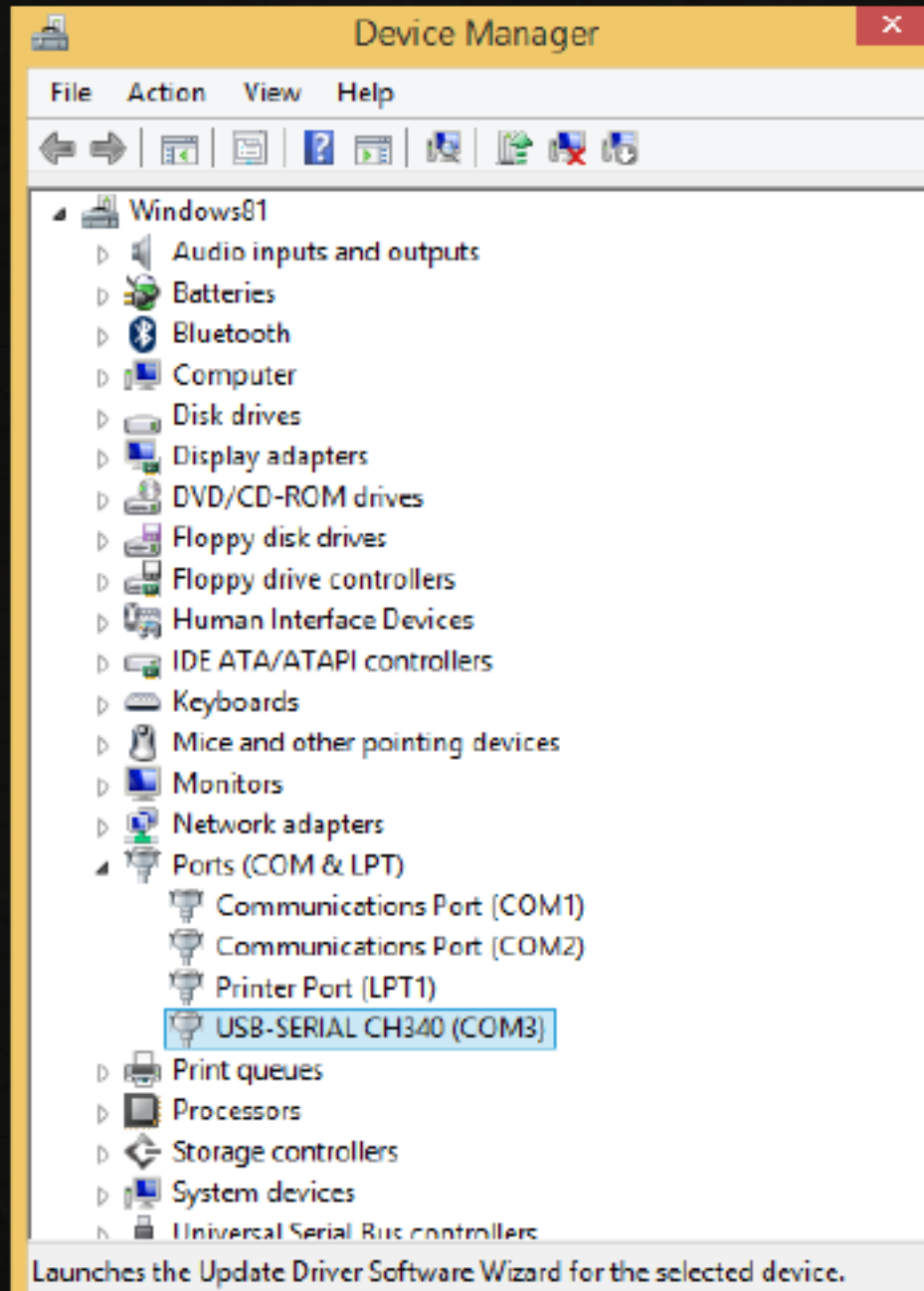
Firmata Setup

4 Load the **StandardFirmataPlus** Sketch

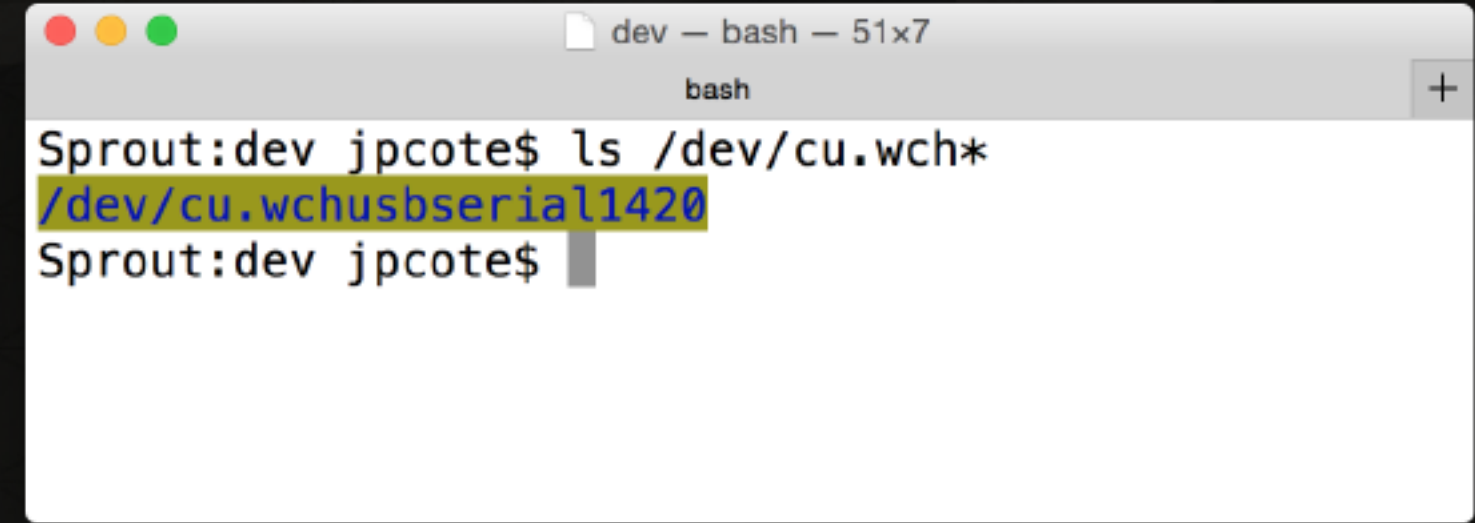
5 Upload the sketch to the board



System-Level Device Detection



Windows



macOS

* Obviously, for the device to show up, it must be plugged in!

Installing Johnny-Five & nwjs-j5-fix

Johnny-Five

- Using the Terminal/PowerShell go to project directory and issue:

```
npm install johnny-five --save
```

- To confirm the installation, you can use:

```
npm -v johnny-five
```

nwjs-j5-fix

- Using the Terminal/PowerShell go to project directory and issue:

```
npm install nwjs-j5-fix --save
```

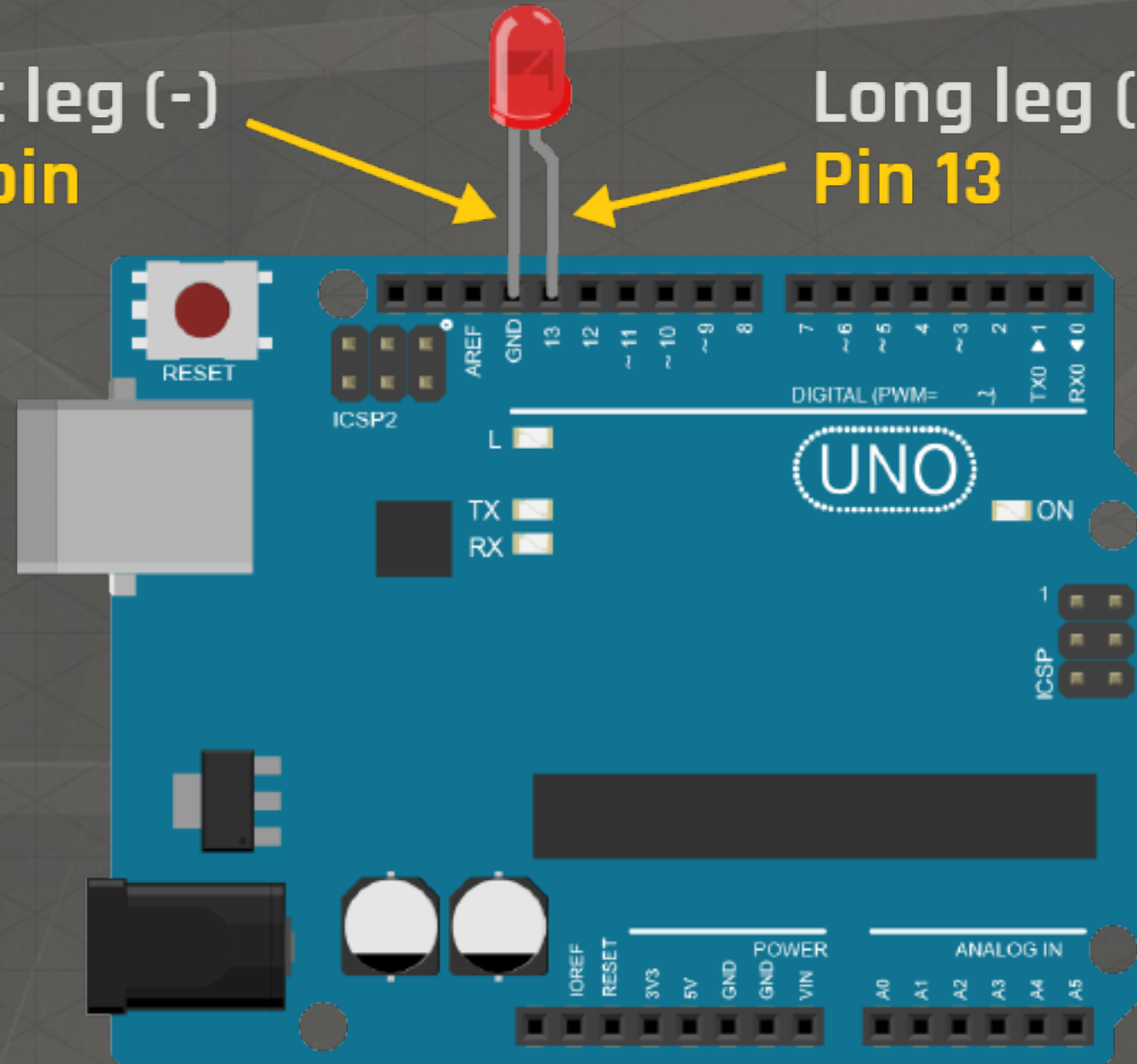
02

The Hello, world! **of Physical Computing**

02. Blinking an LED

Short leg (-)
GND pin

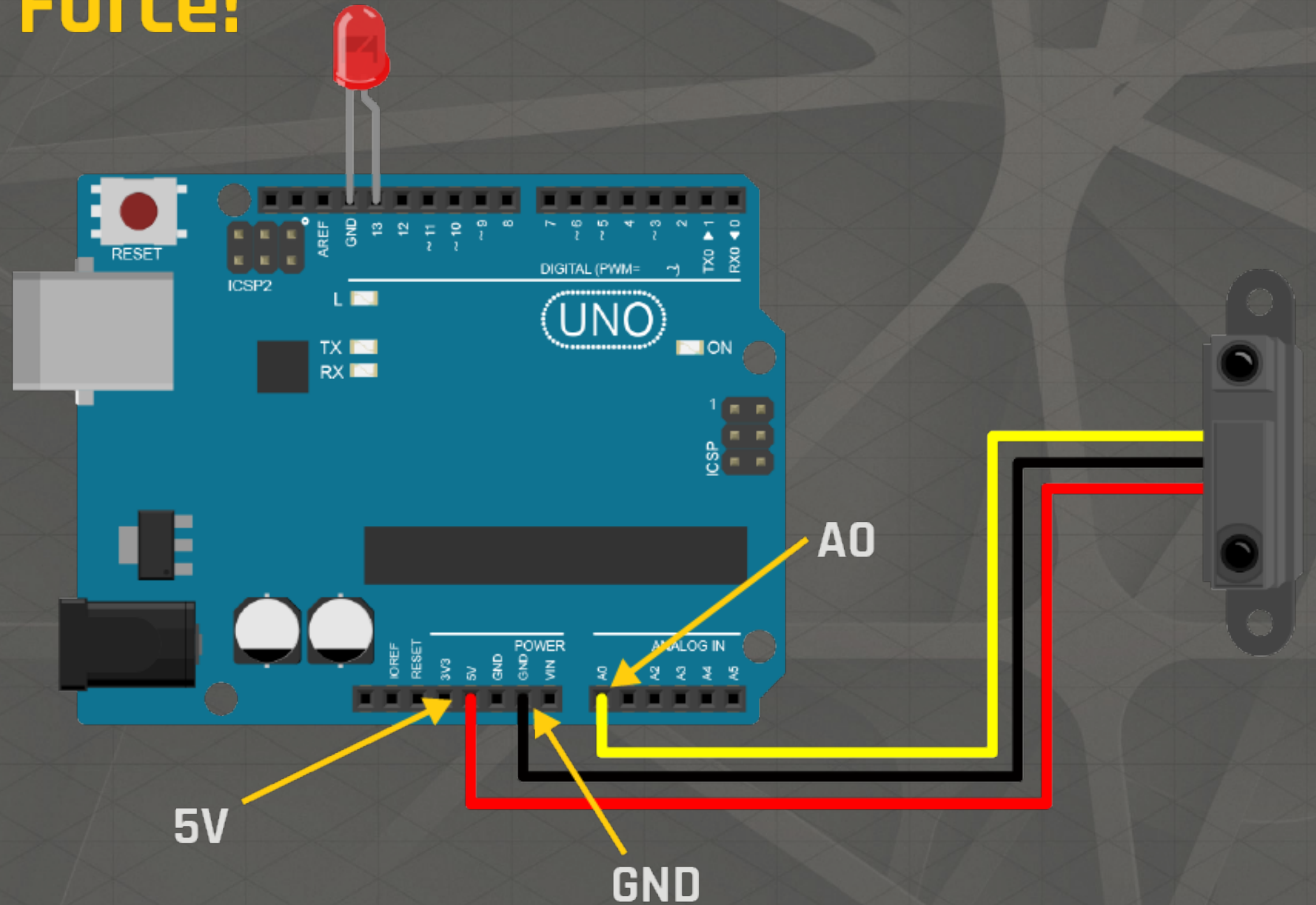
Long leg (+)
Pin 13

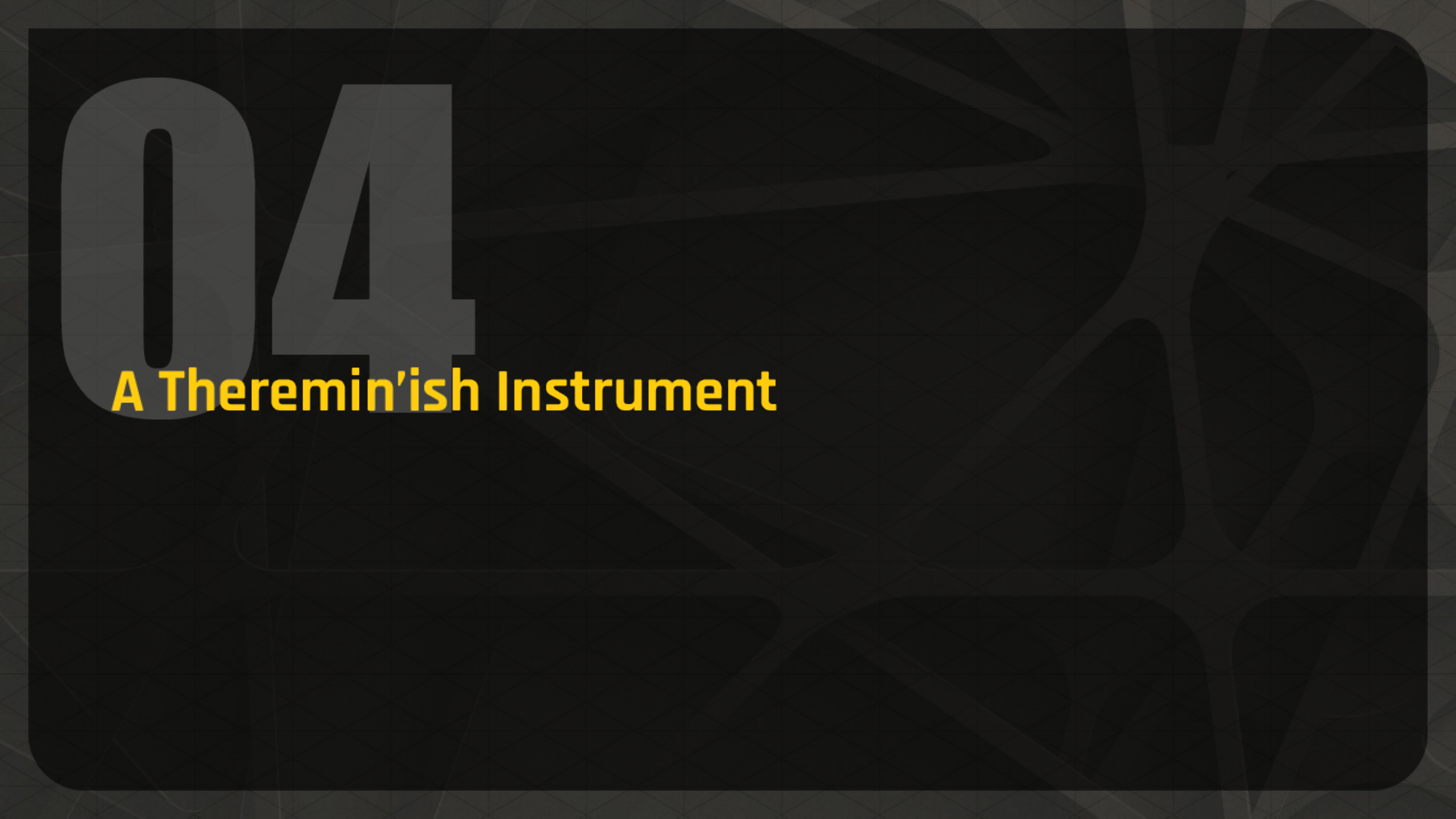


03

Using The Force **to Control Light Particles**

03. Use The Force!

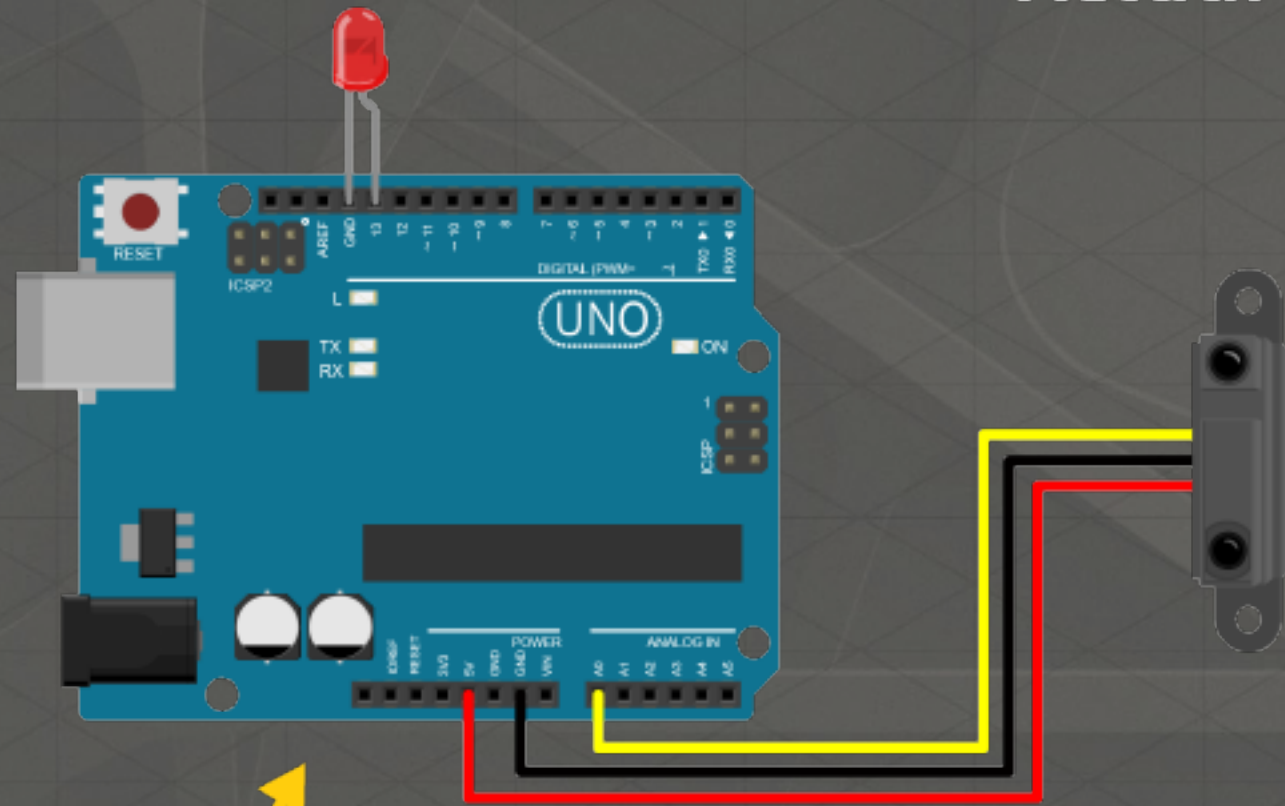




04

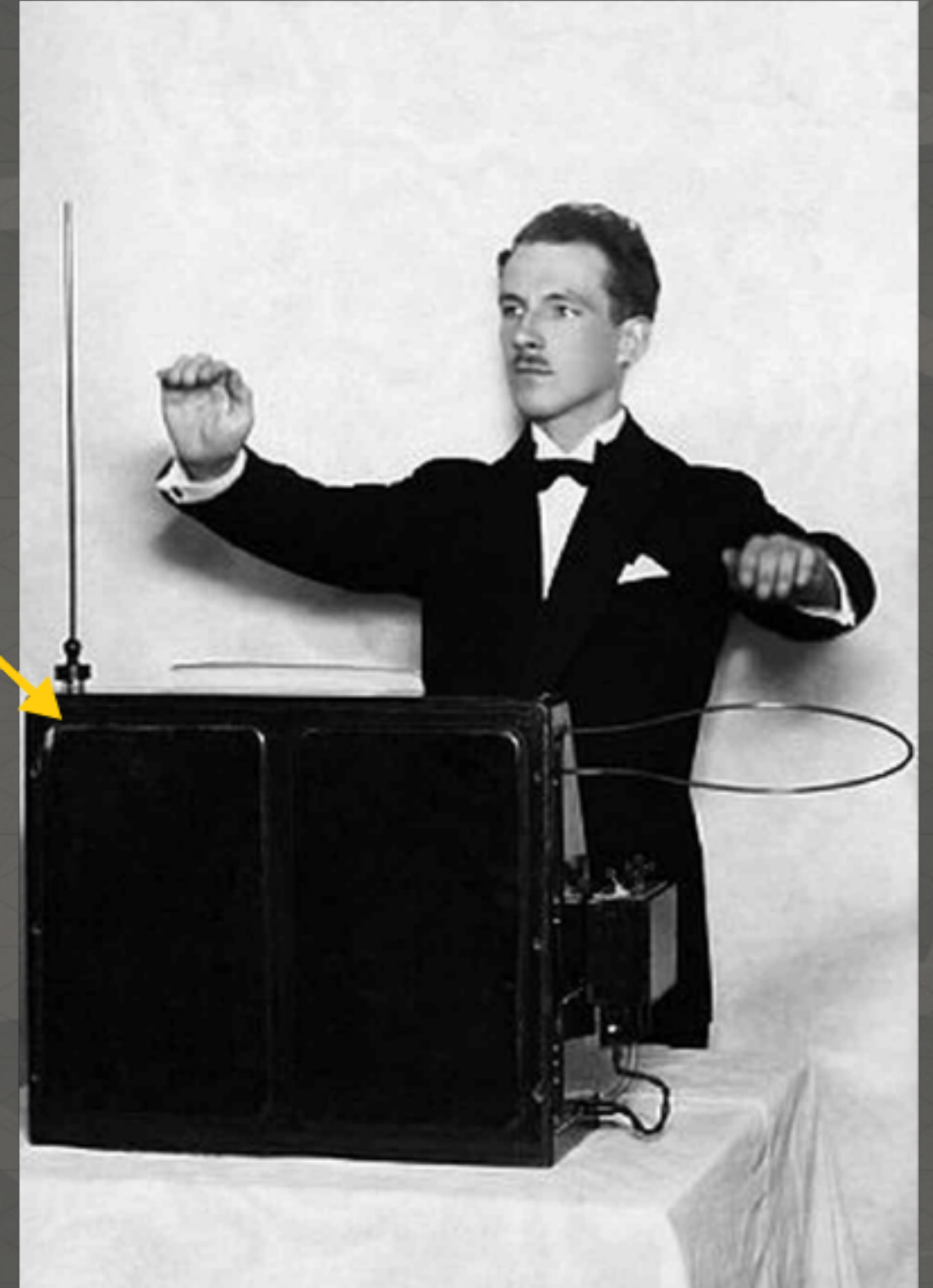
A Theremin'ish Instrument

04. Theremin



Same wiring as before

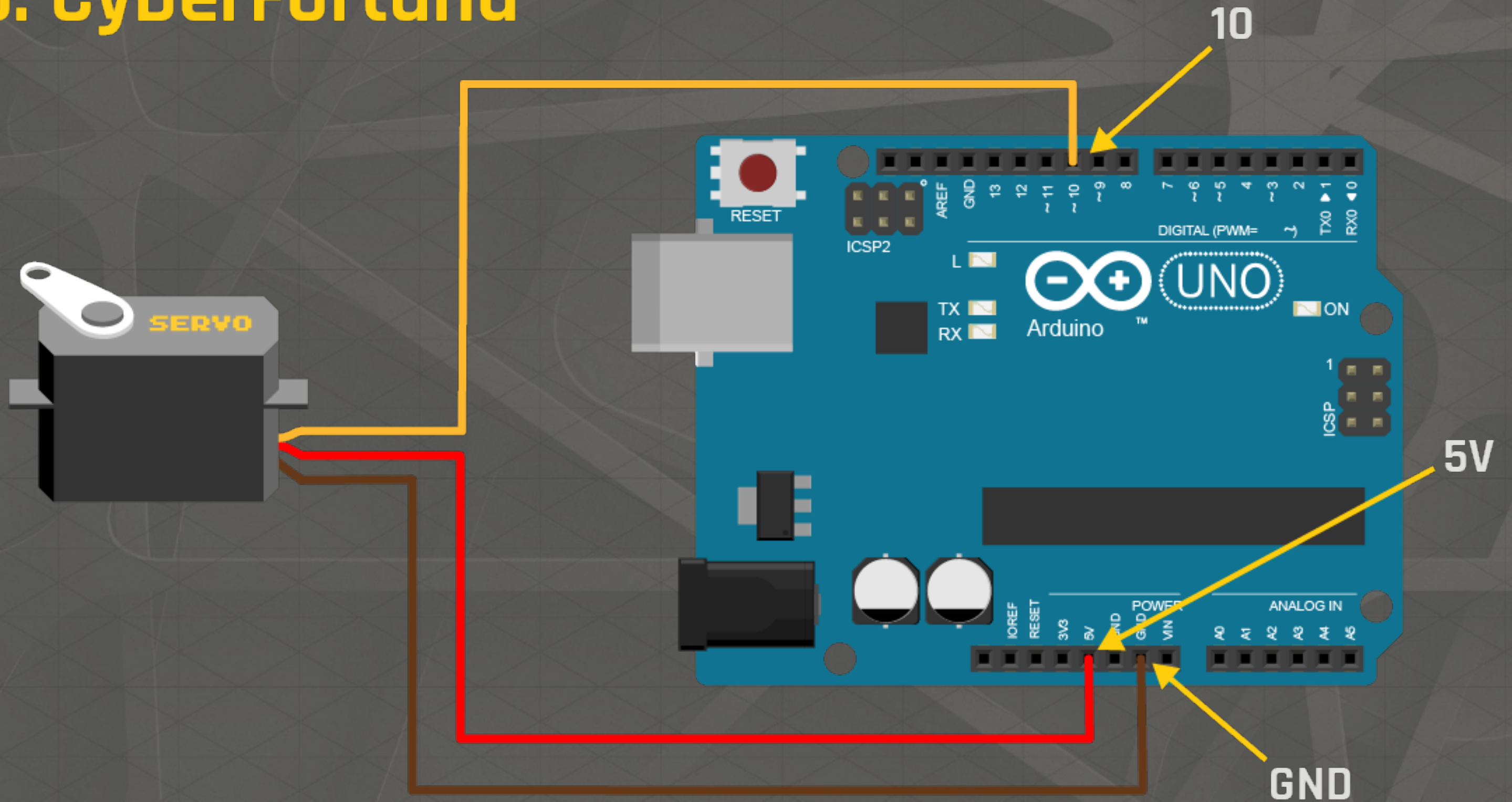
Actual Theremin



05

A 21st Century Fortune Teller

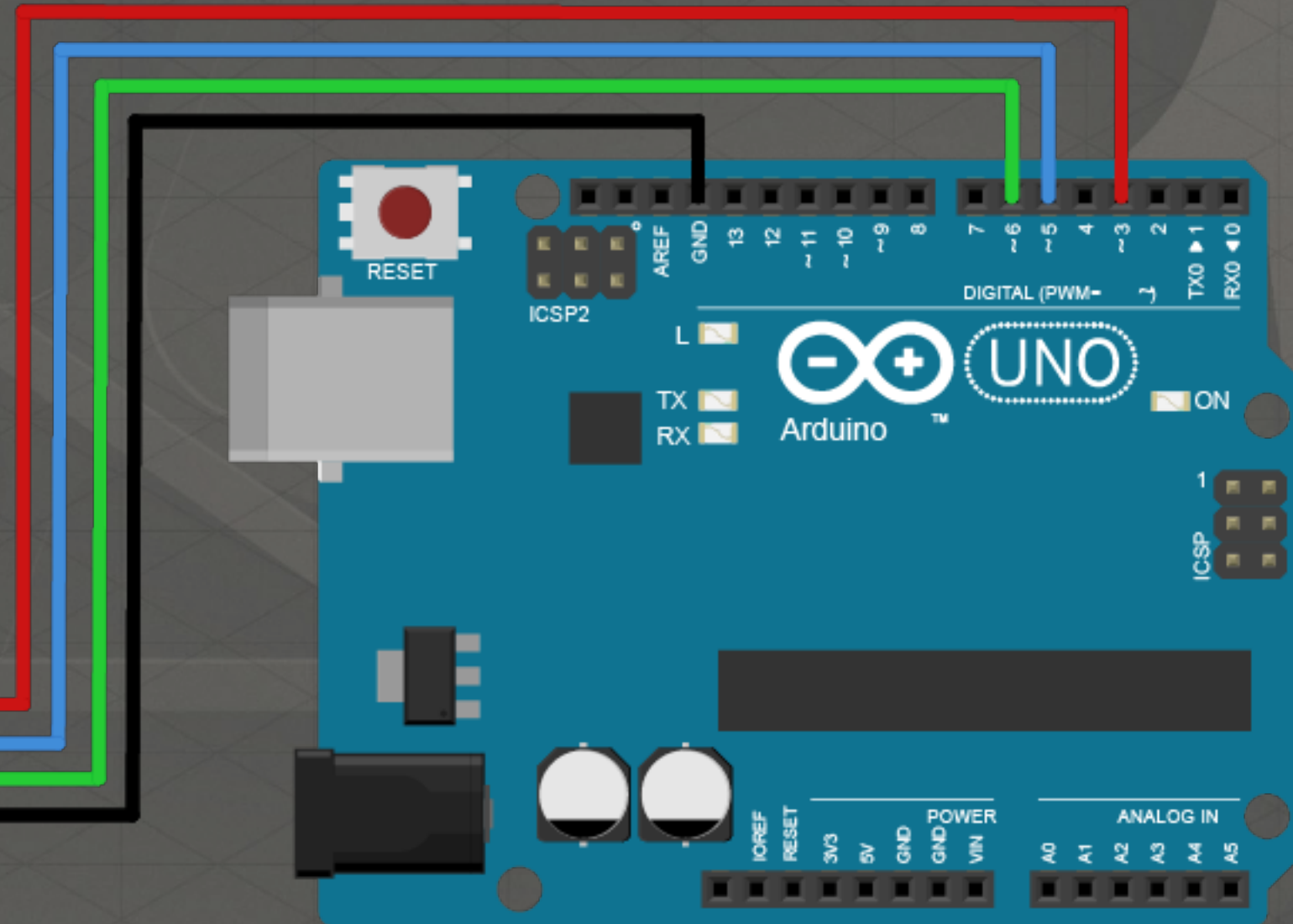
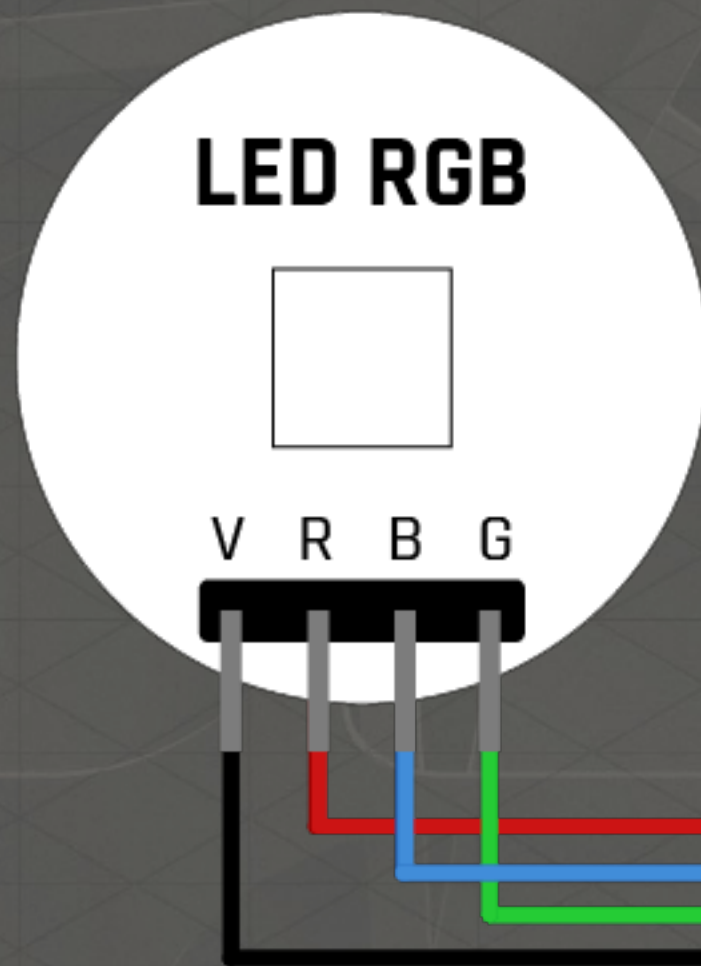
05. CyberFortuna



006

All the Colors in the World...

06. RGB LED



3	→	R
5	→	B
6	→	G
GND	→	V

The Road Ahead...

Software



johnny-five.io/api



docs.nwjs.io



tangiblejs.com/code

Hardware

Boards

A wide range of microcontrollers and single board computers are supported by the Johnny-Five library.

Sensors

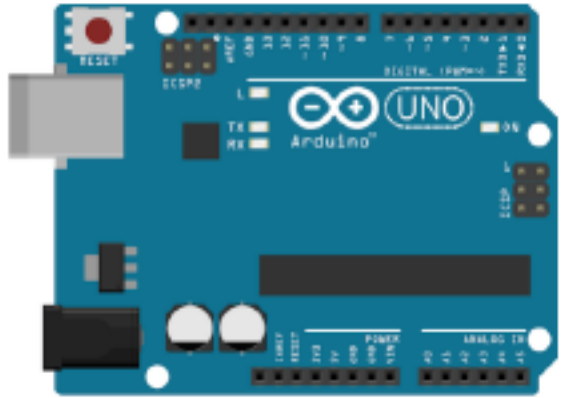
A sensor is an object whose purpose is to detect events or changes in its environment.

Actuators

An actuator is the mechanism by which a control system acts upon an environment.

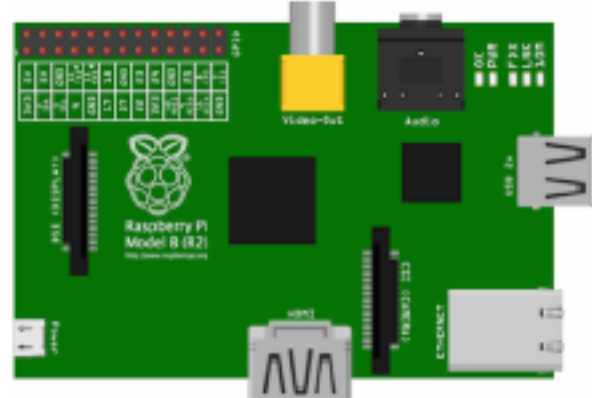
Boards

Arduino



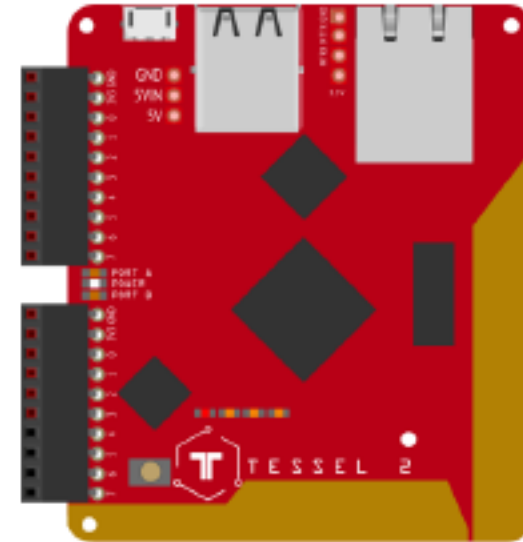
Most popular

Raspberry Pi



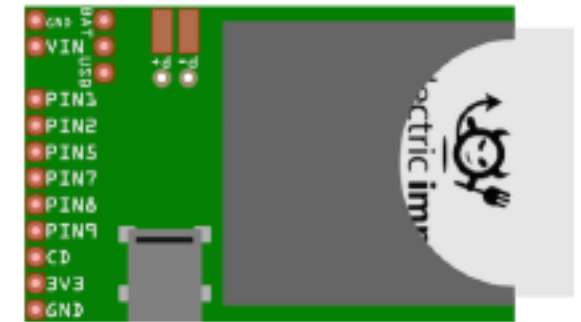
More powerful

Tessel



Native JavaScript

Electric Imp

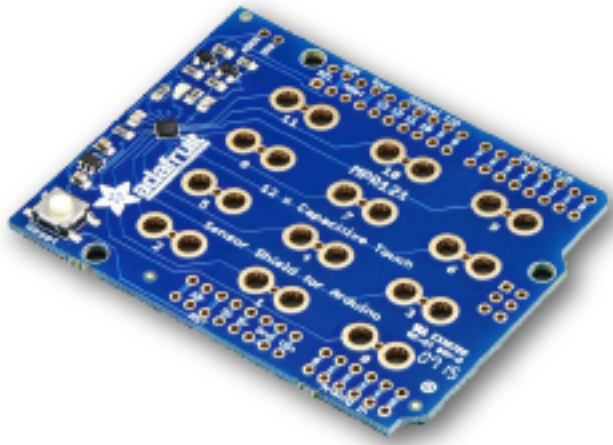


Tiny (24mm x 32mm)

<http://johnny-five.io/platform-support/>

Sensors

Touch Sensors



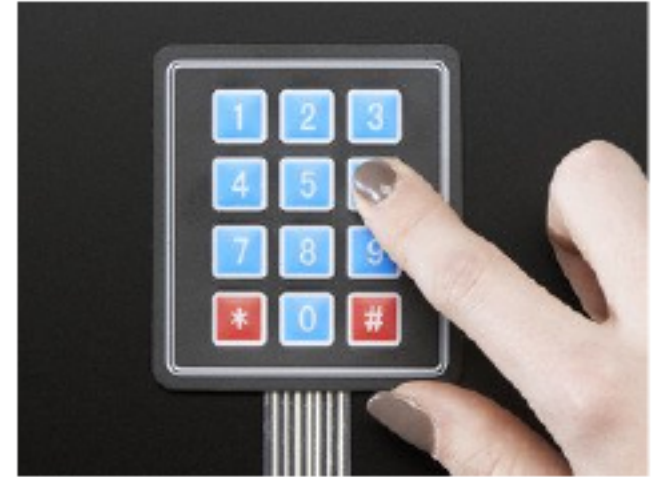
Touch Breakout



Ribbon Switch



Keypads



Distance Sensors



Infrared

2-10cm

20-150cm

100-500cm

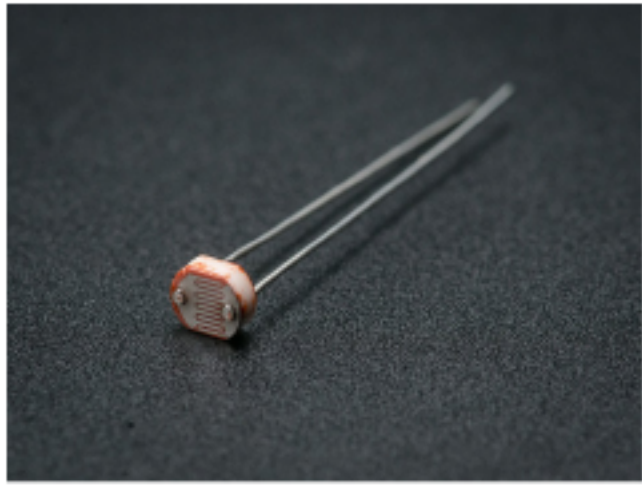
10-80cm

0-645cm

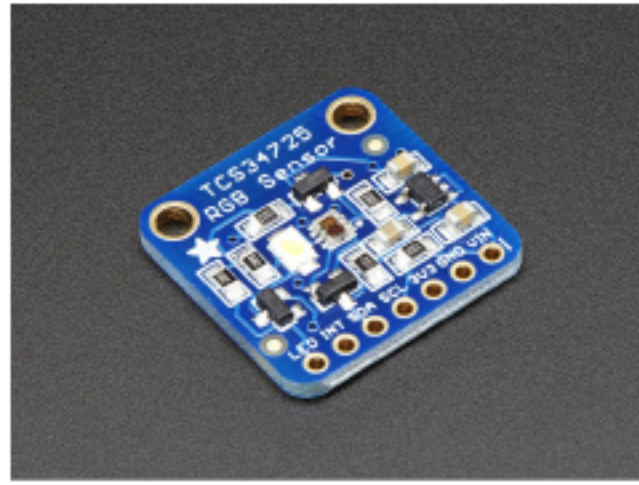


Ultrasonic

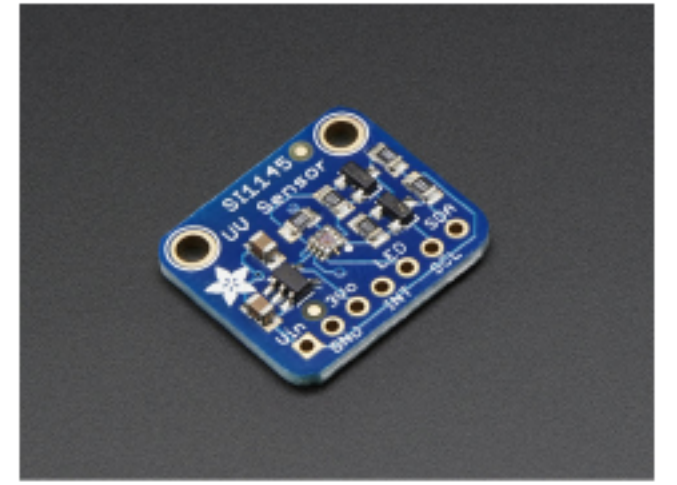
Light & Color Sensors



Photoresistor

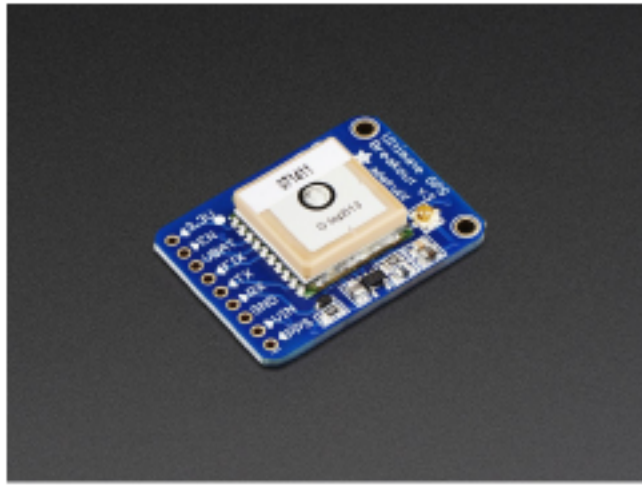


RGB Color

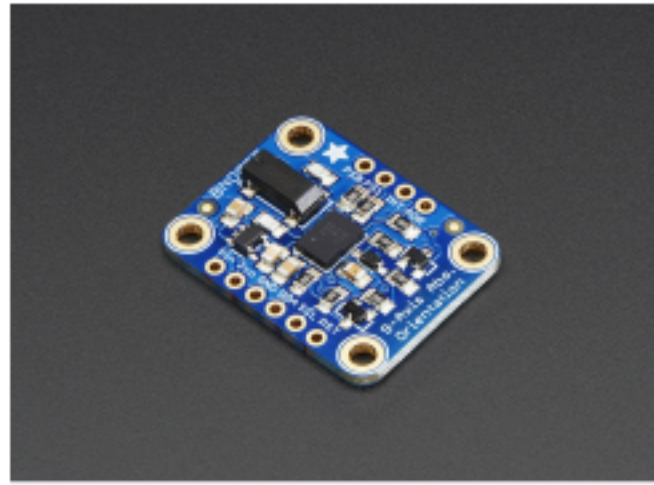


UR/IR/Visible

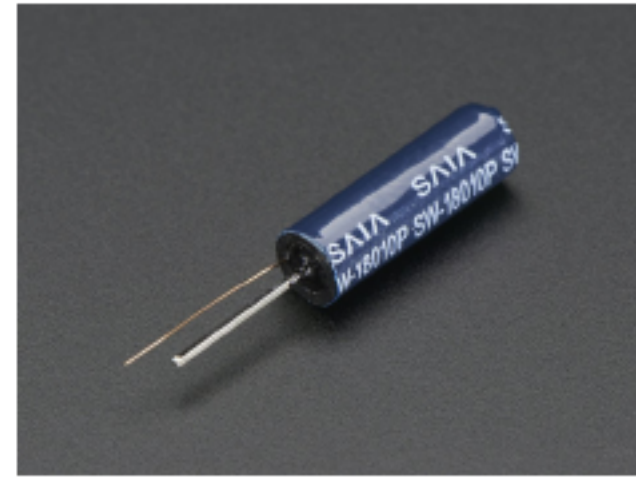
Position & Movement Sensors



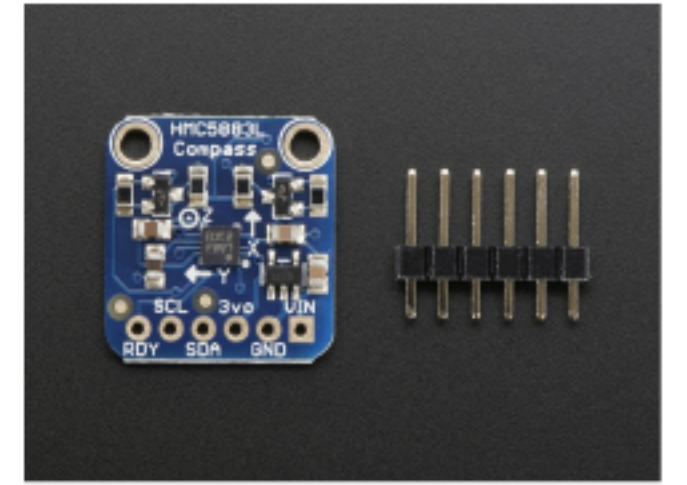
GPS



Gyro & Accelerometer

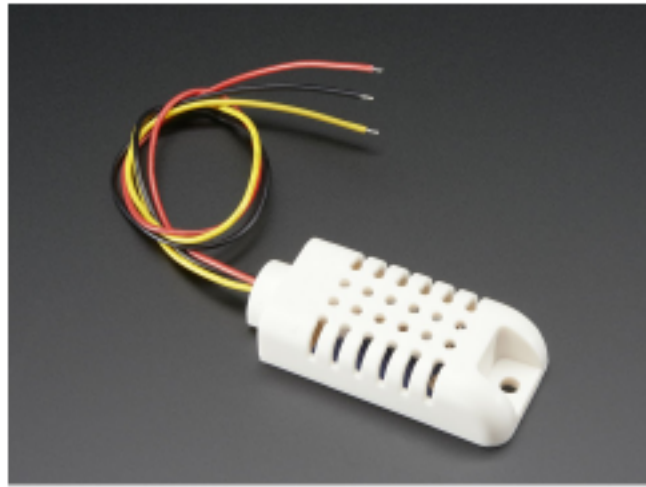


Vibration



Compass

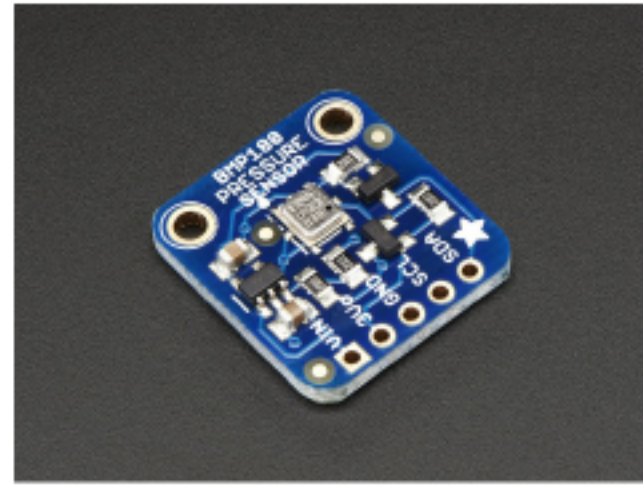
Environmental Sensors



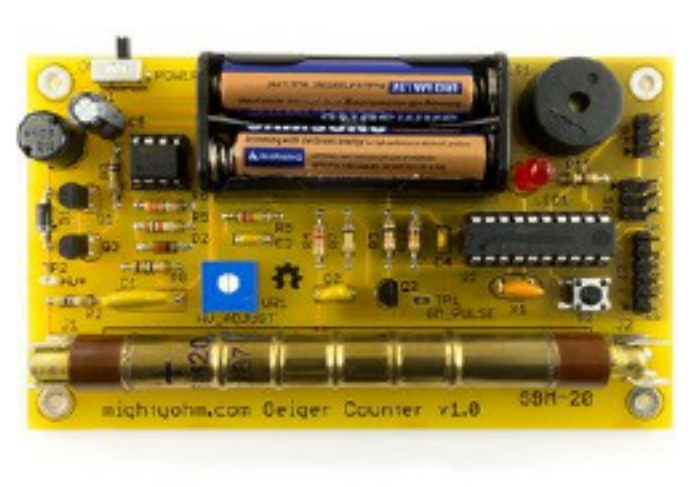
Temperature/Humidity



Wind Speed

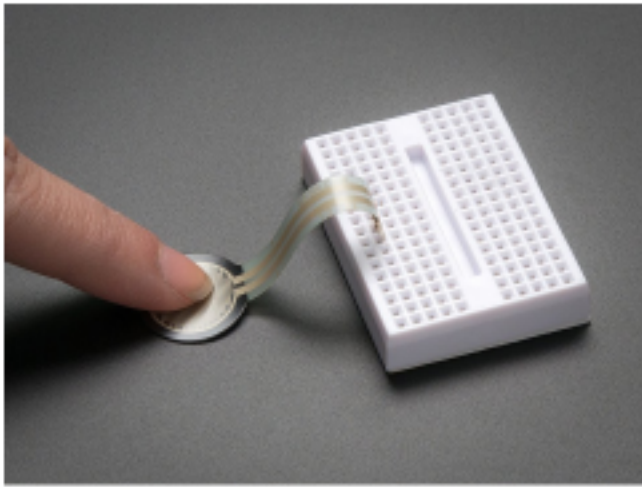


Barometric Pressure

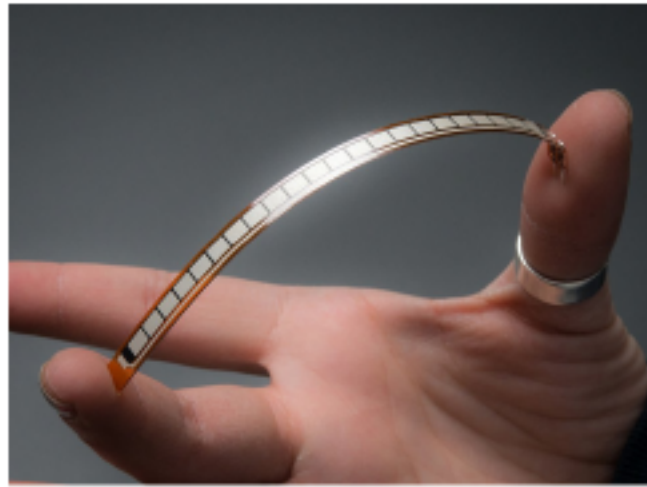


Radioactivity

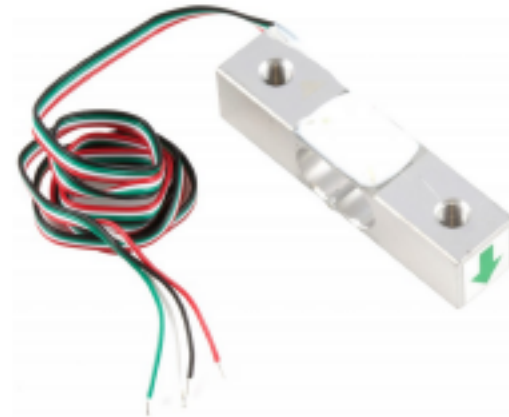
Force & Load Sensors



Force Sensor



Flex Sensor

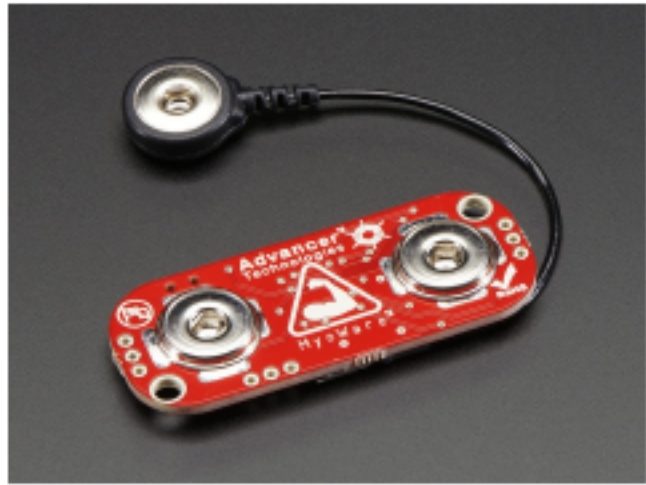


Load Cell

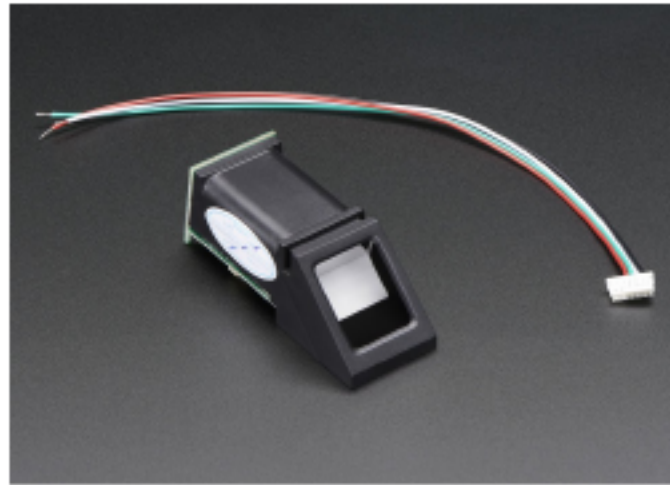


Push/Pull Force

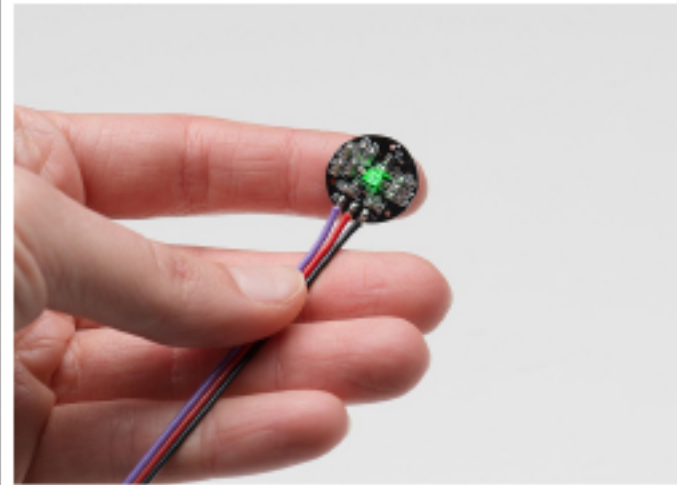
Biometric Sensors



Muscle Sensor



Fingerprint Scanner



Pulse Sensor



Heart Rate Monitor

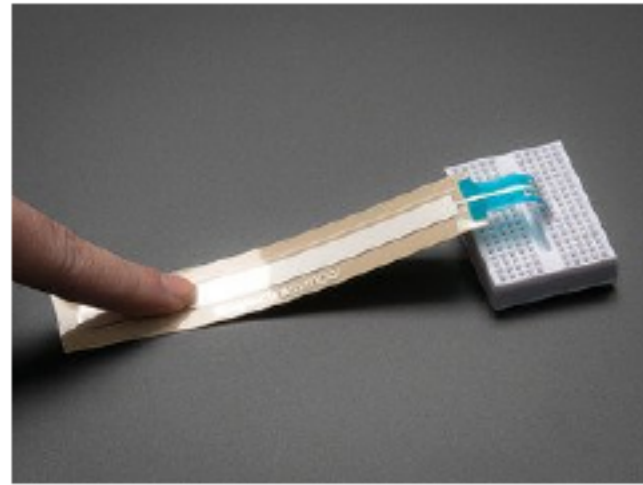
Encoders



Rotary Encoder



Analog Joystick

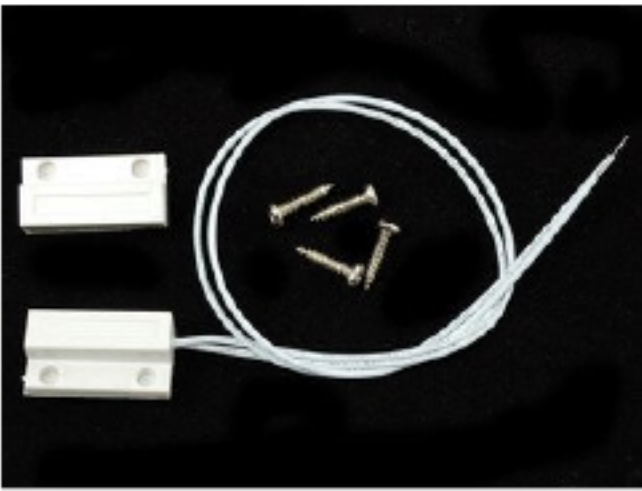


Ribbon Sensor



Linear Encoder

Switches



Magnetic Switch



Tilt Switch



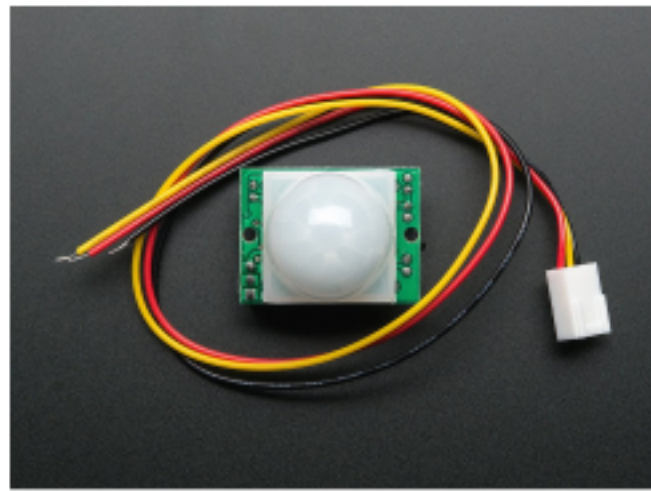
Foot Switch



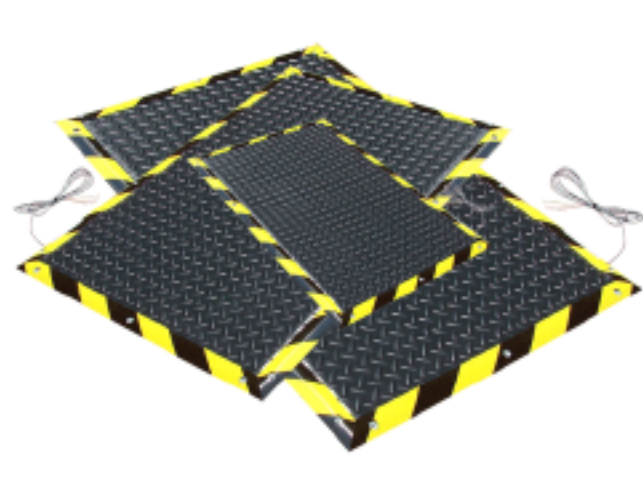
Button



Break Beam Switch



PIR Motion Switch



Mat Switch



Mechanical Joystick

Actuators

Led Lighting & EL Wire

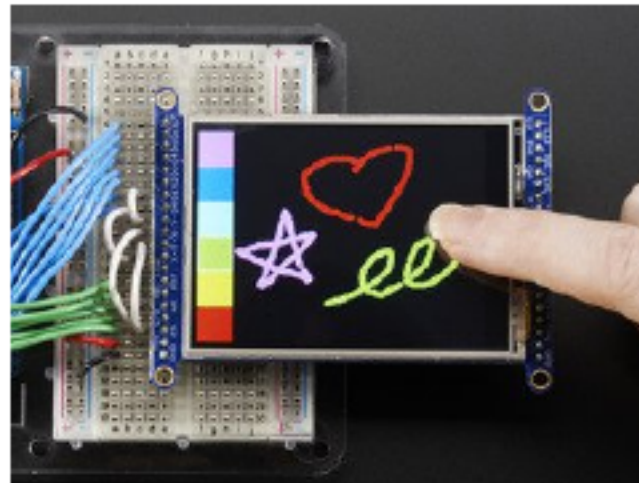


LED Lighting

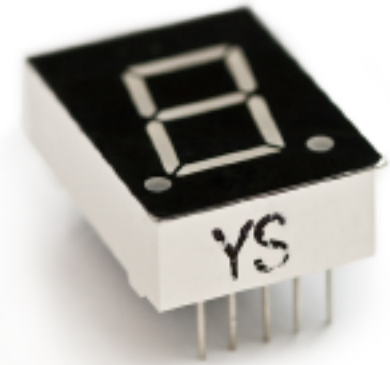


EL Wire

LCD & LED Displays



LCD Displays



LED Display

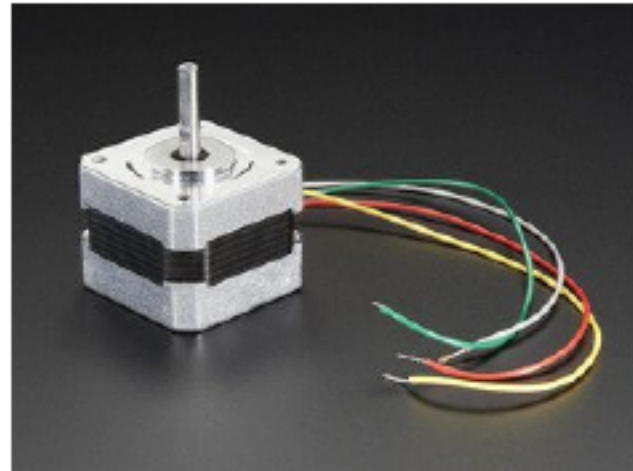
Motors



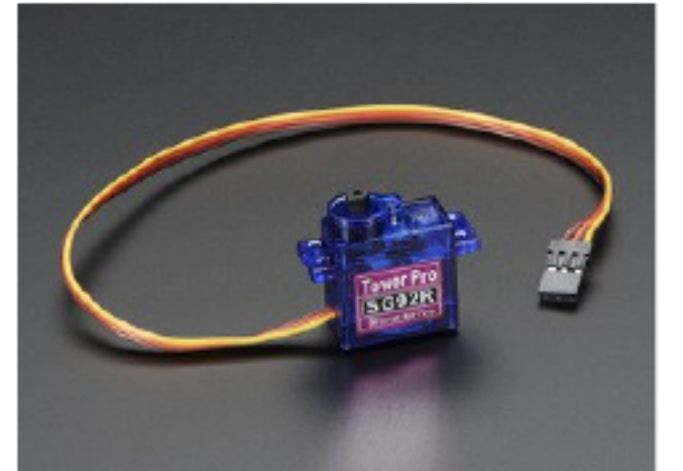
Continuous Motor



Vibration Motor

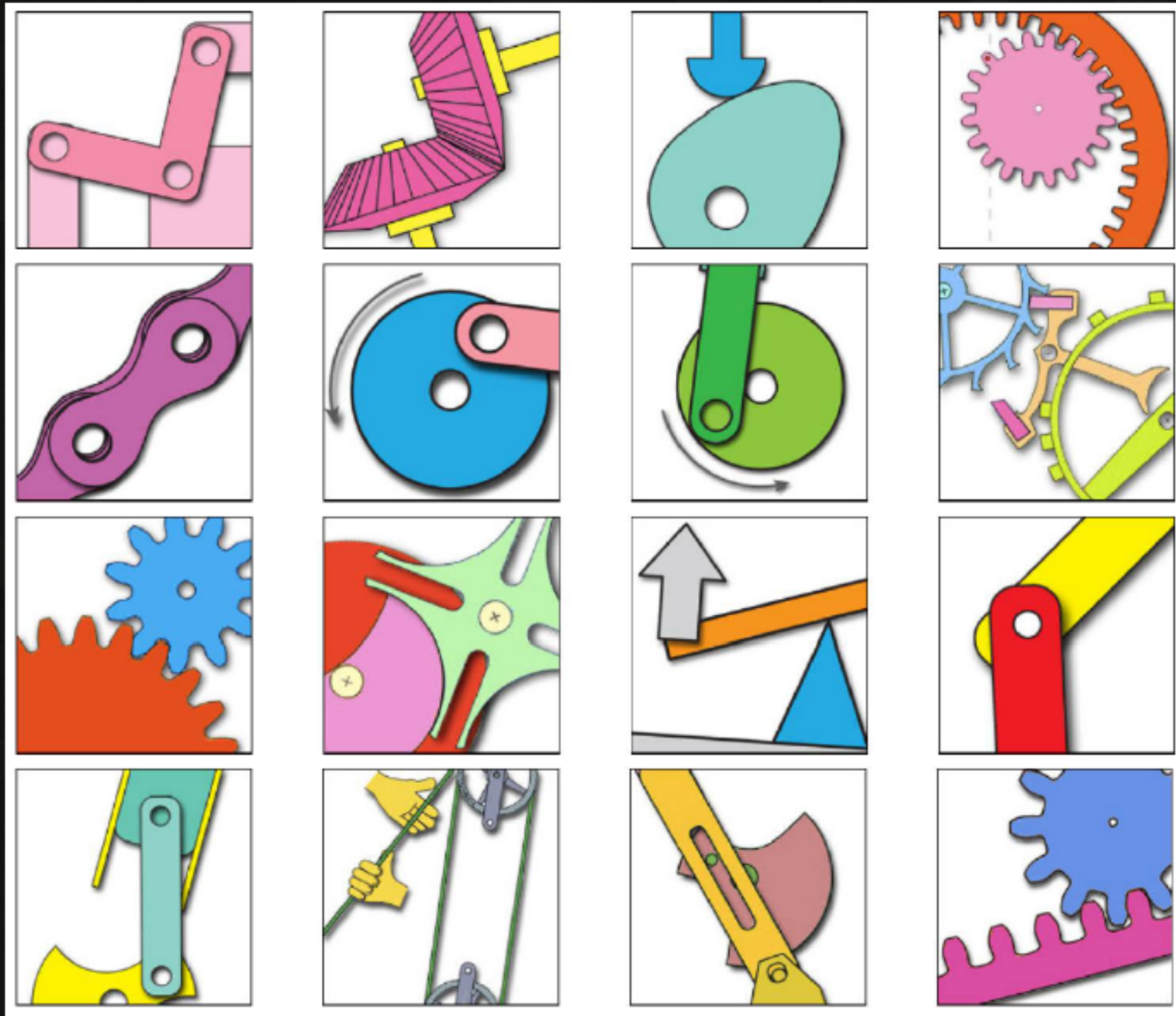


Stepper Motor



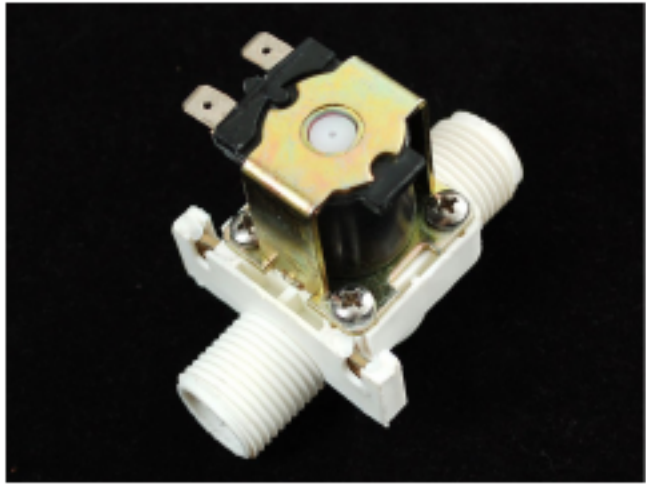
Servo Motor

Motors



<http://www.robives.com/mechs>

Pumps & Valves



Valve



Liquid Pump



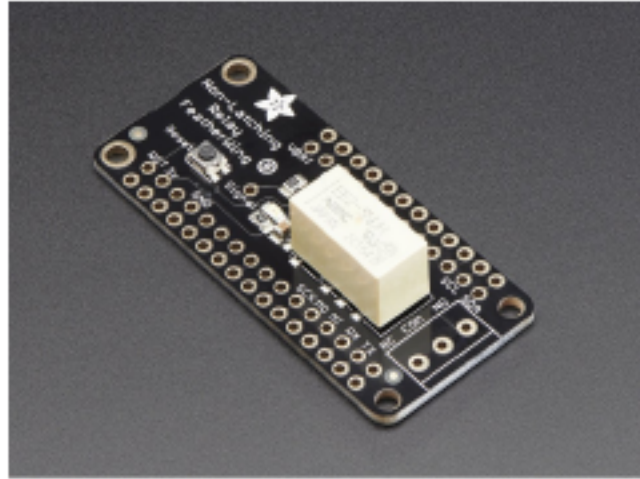
Vacuum Pump

Solenoids



Solenoids

Relays



Relay Breakout



Relay Shield

Suppliers



Source Code

<https://github.com/cotejp/camp2016-workshop>

To install all necessary Node modules for a project, issue the following command in the project's folder:

npm install



<http://tangiblejs.com/camp2016>



<http://tangiblejs.com>



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