

Wi-Fi Settings

SSID: AcroboticGuest

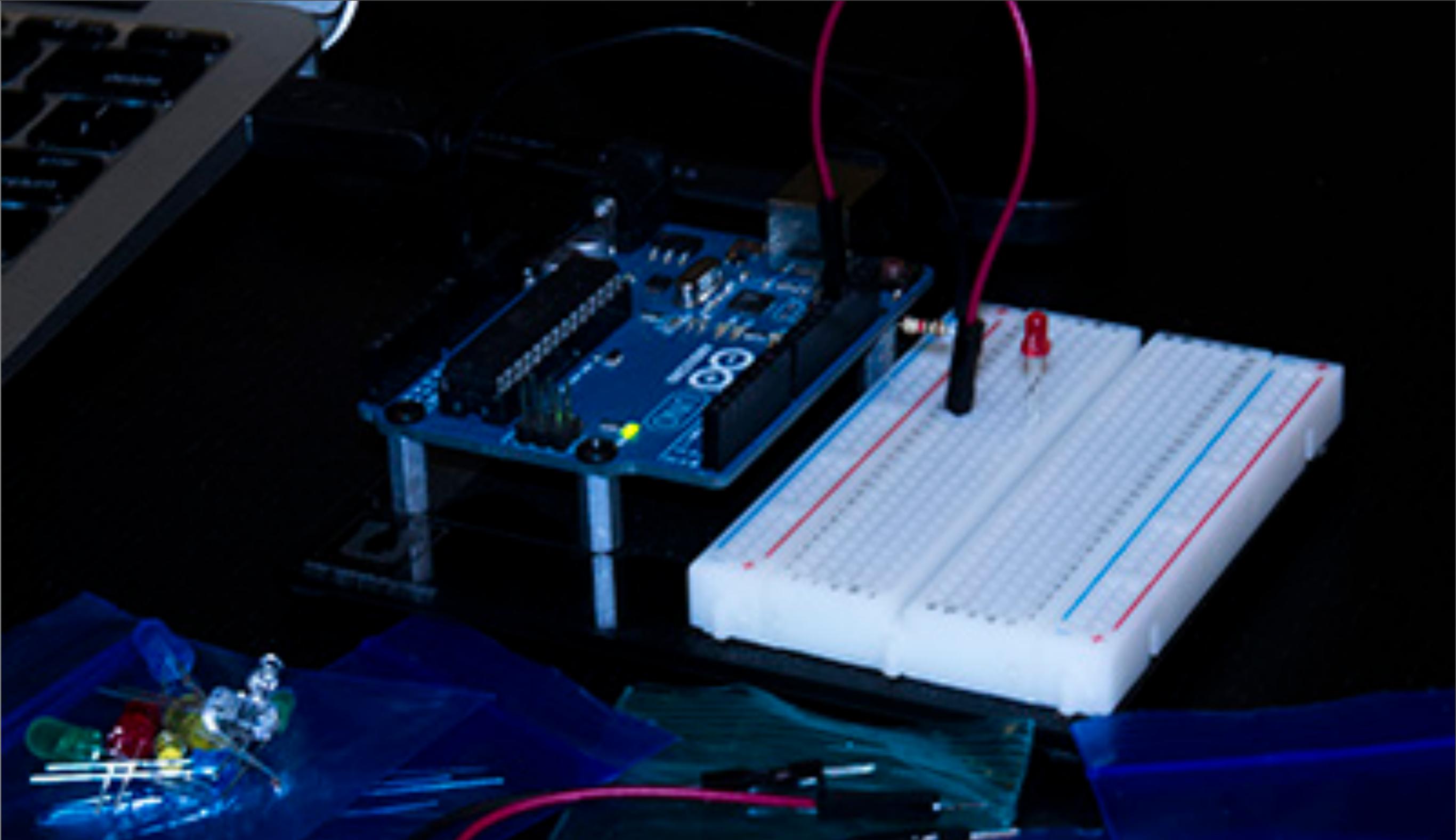
Password: 13meetup37



DIY Electronics Crash Course

<http://makerden.io>

with Sonia Parada



DIY Electronics Crash Course



<http://makerden.io>

with Sonia Parada

About Makerden

We're an Educational Makerspace where we combine the necessary tools, equipment, and instruction for hands-on learning through building things.

Members of our group vary both widely and wildly in terms of skill level and age range (10 to 68).



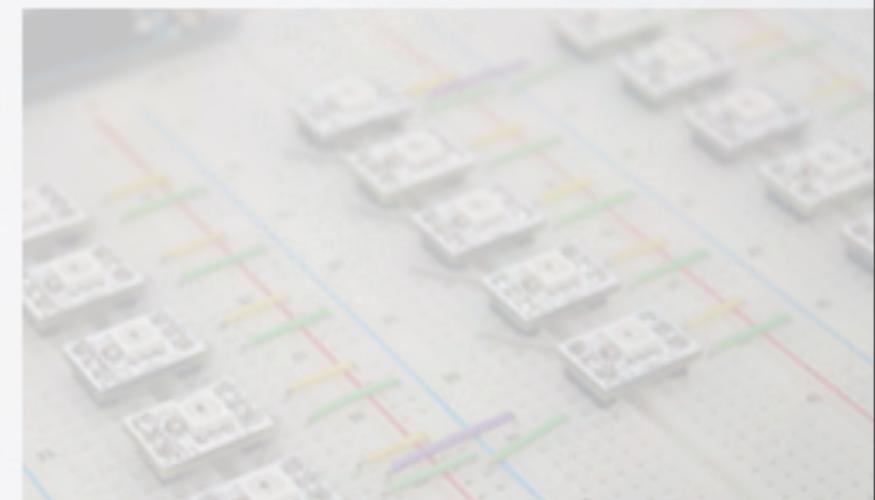
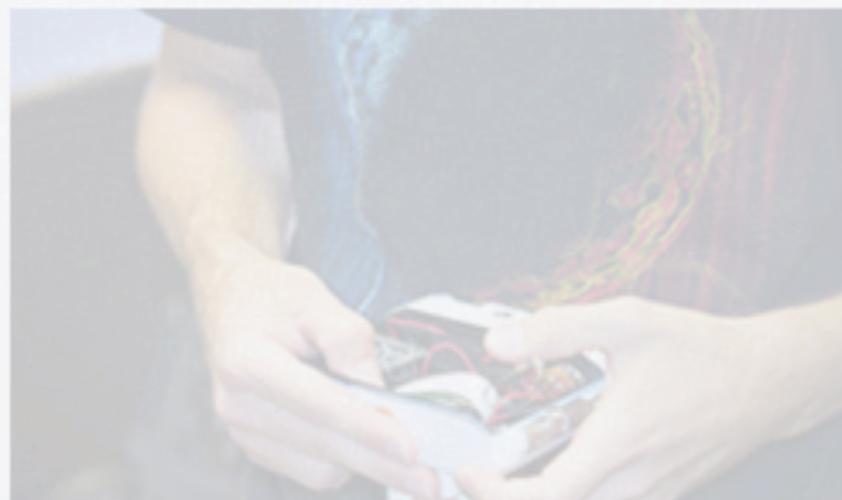
About Makerden

Events organized at our Educational Makerspace:

[DIY] These events include show-and-tells by our members followed by a work-on-your-project(s) and ask-for-help sessions.

[Workshop] An instructor leads a hands-on workshop for learning or polishing a practical skill useful for Makers (including schematic-drawing, PCB design, 3D-Printing, soldering).

[Class] An instructor leads a formal lecture featuring instructor-led activities that allow participants to learn, develop, or refine a technical skill.

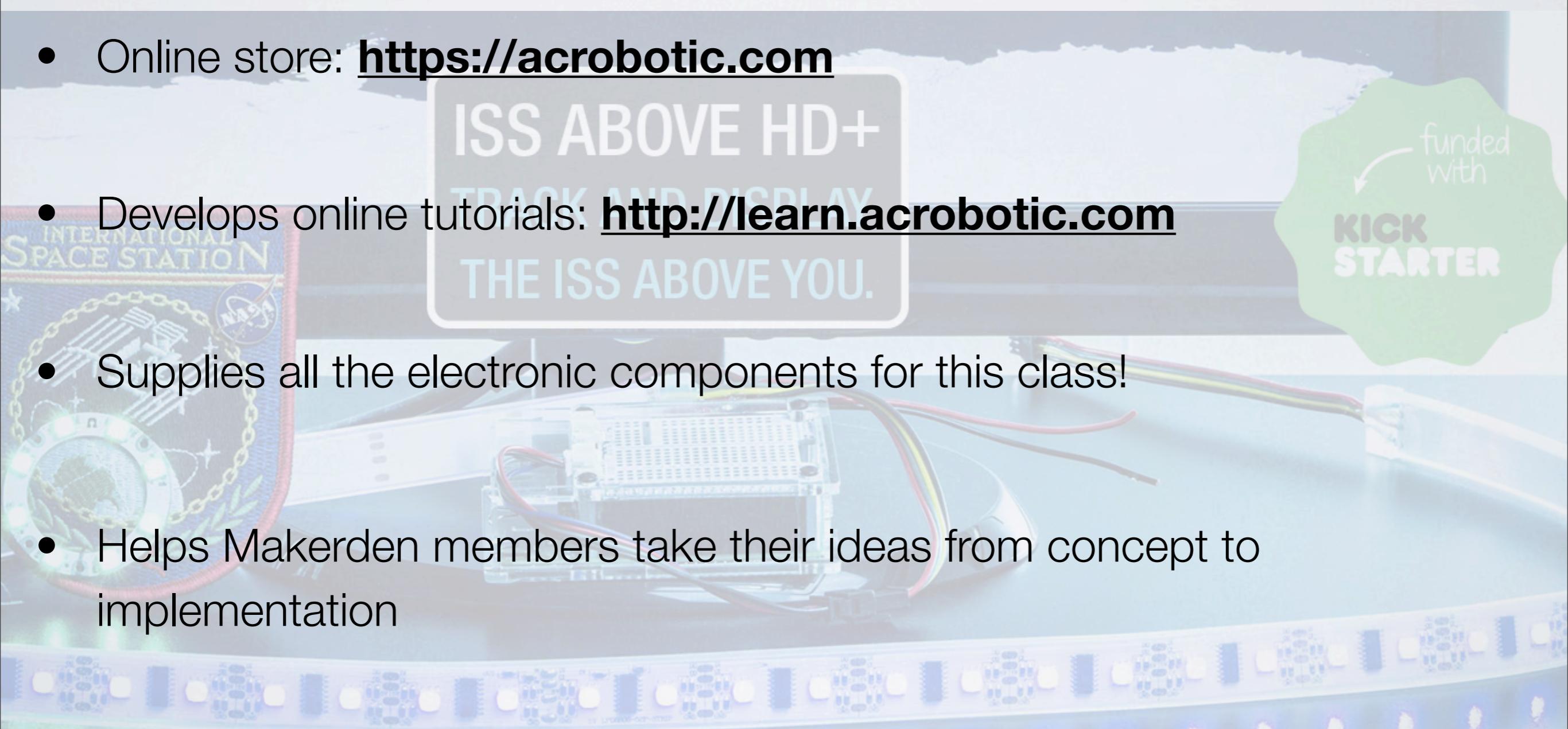


About ACROBOTIC

Makerden's Educational Electronics partner

Small, bootstrapped Open-Source electronics startup dedicated to the design of hardware and software products for use in education, DIY, hobby, arts, science, and more!

- Online store: [**https://acrobotic.com**](https://acrobotic.com)
- Develops online tutorials: [**http://learn.acrobotic.com**](http://learn.acrobotic.com)
- Supplies all the electronic components for this class!
- Helps Makerden members take their ideas from concept to implementation



Download this presentation

Navigate to:

https://github.com/MakerdenIO/Electronics_Crash_Course

Class outline

Duration: 2 hrs; Difficulty: Beginner

Circuits & Components

Datasheets & Schematics

Breadboarding

Activity 1: Building a basic circuit

Activity 2: Modifying your circuit

Working with Microcontrollers

The ESP8266 board

Activity 3: Downloading & installing software

Activity 4: Running the Blink program

Understanding code in the IDE

Activity 5: Modifying code

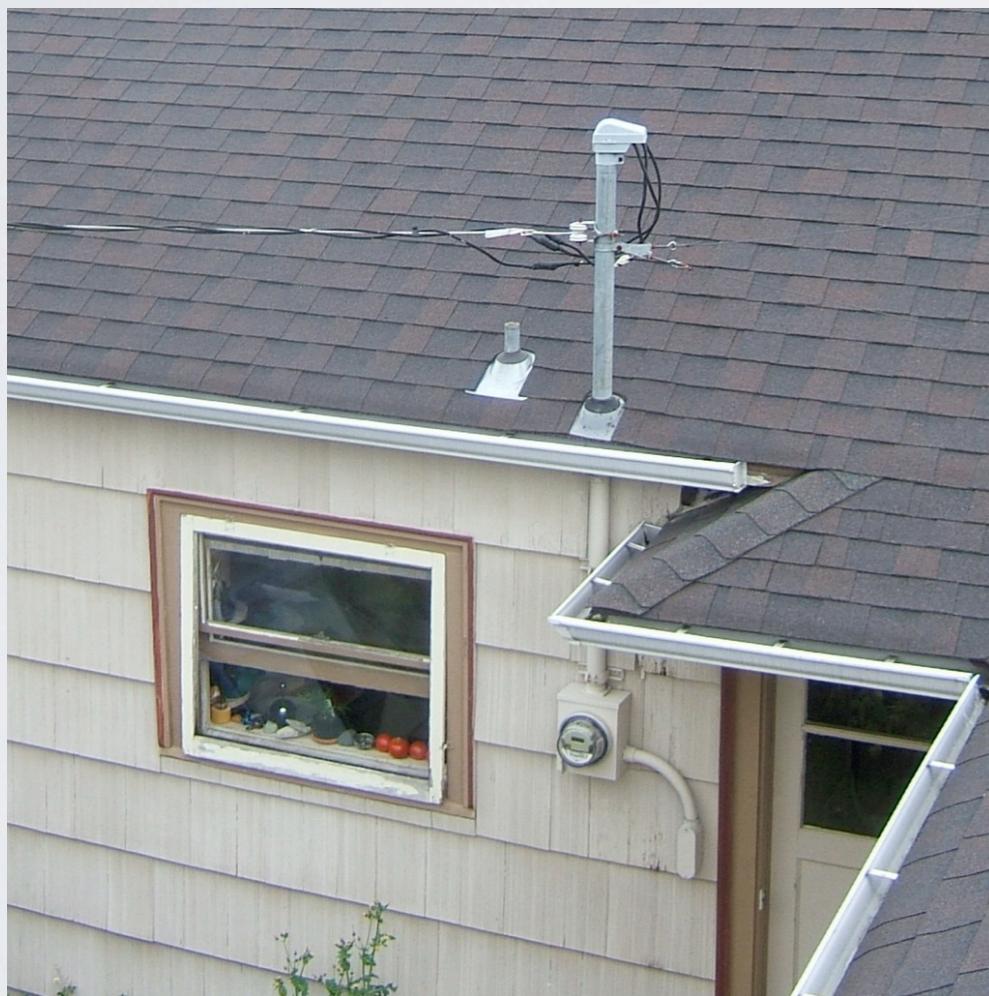
If time allows: Experimentation (Digital I/O, Analog I/O)

Circuits & Components

What makes a circuit?

Your house lights are an example:

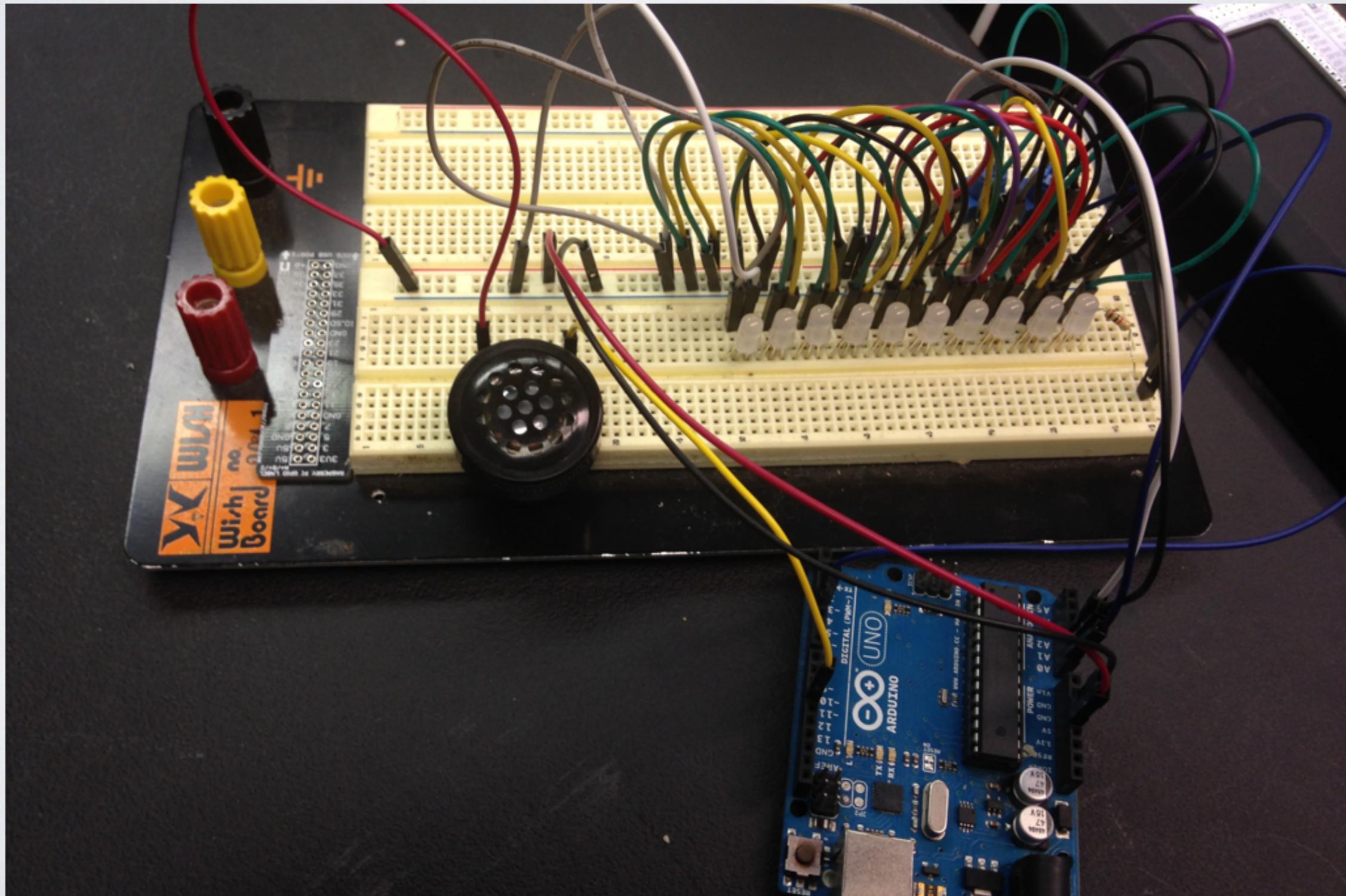
Power mains supplies electricity through wiring system to lights
Switches cut and close loop



A circuit is just a closed loop of conductive material for electricity to flow.

Small scale circuits

Use low voltages to drive small components. Make all kinds of fun projects!



What is Voltage and Current?

Voltage, V

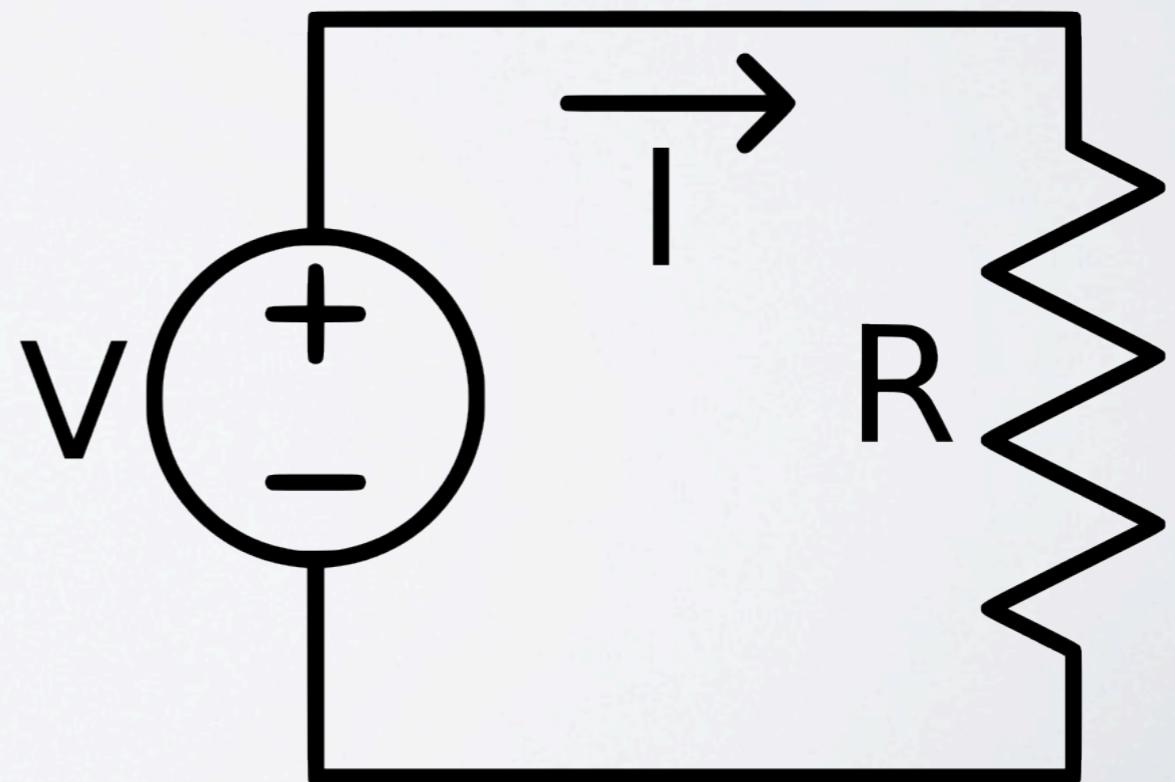
The difference of electrical charge between two points

$$V = I * R$$

$$I = V / R$$

Current, I

The rate of flow of electric charge



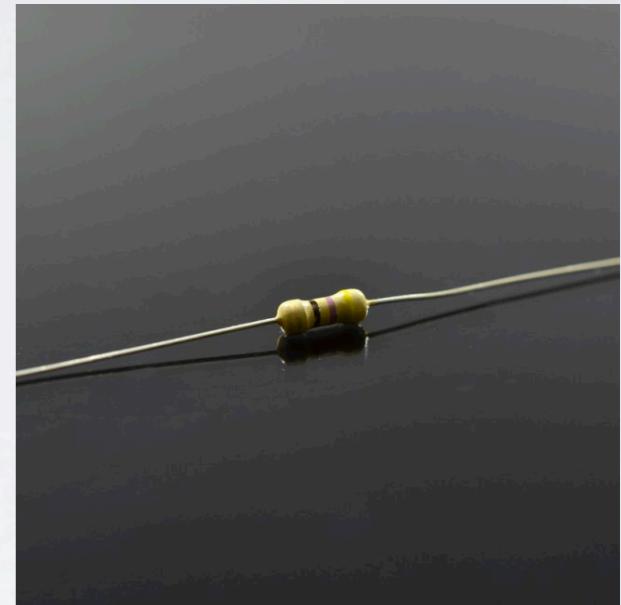
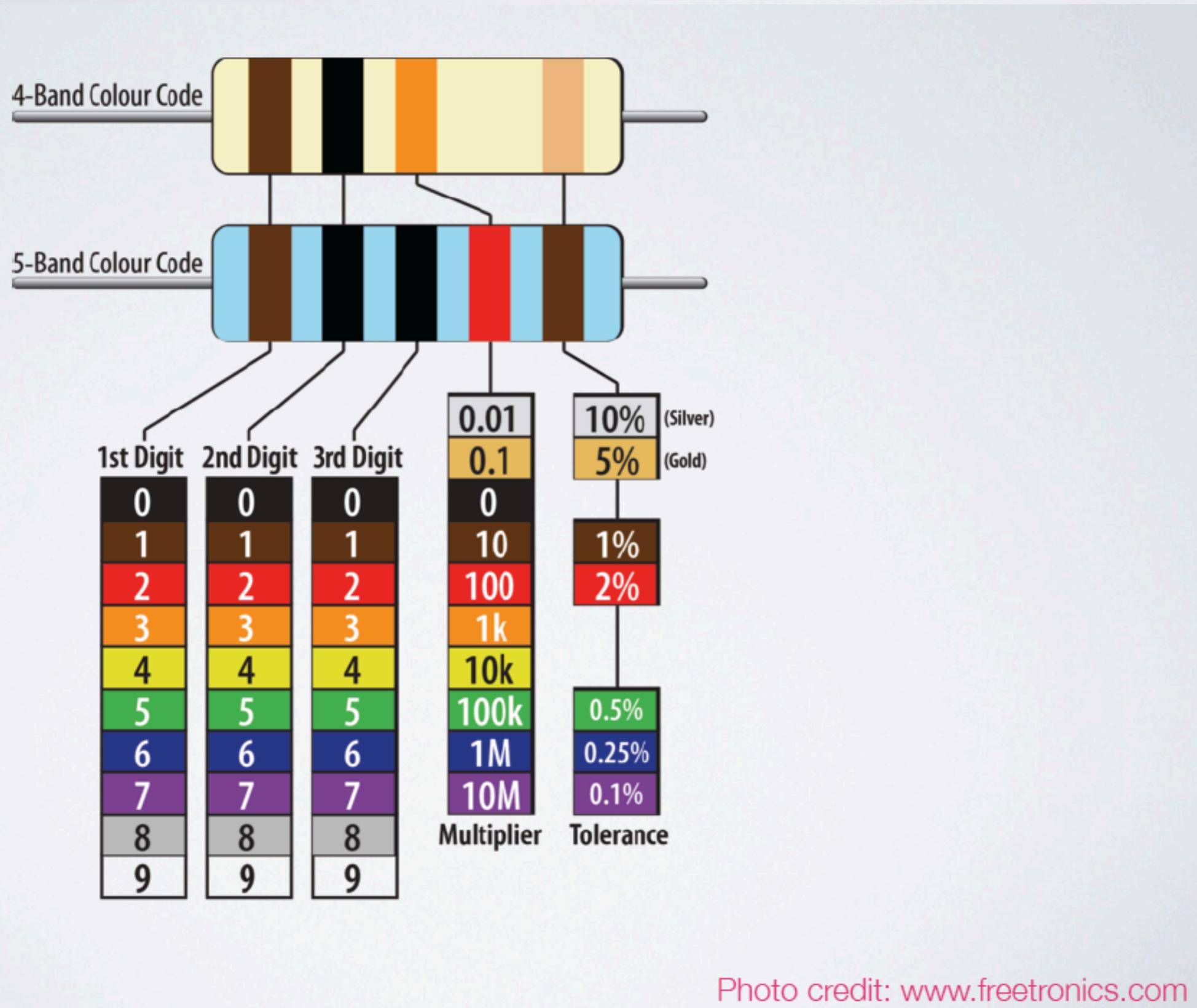
Power (Batteries)

Provide voltage to circuits and therefore create current. Many options.



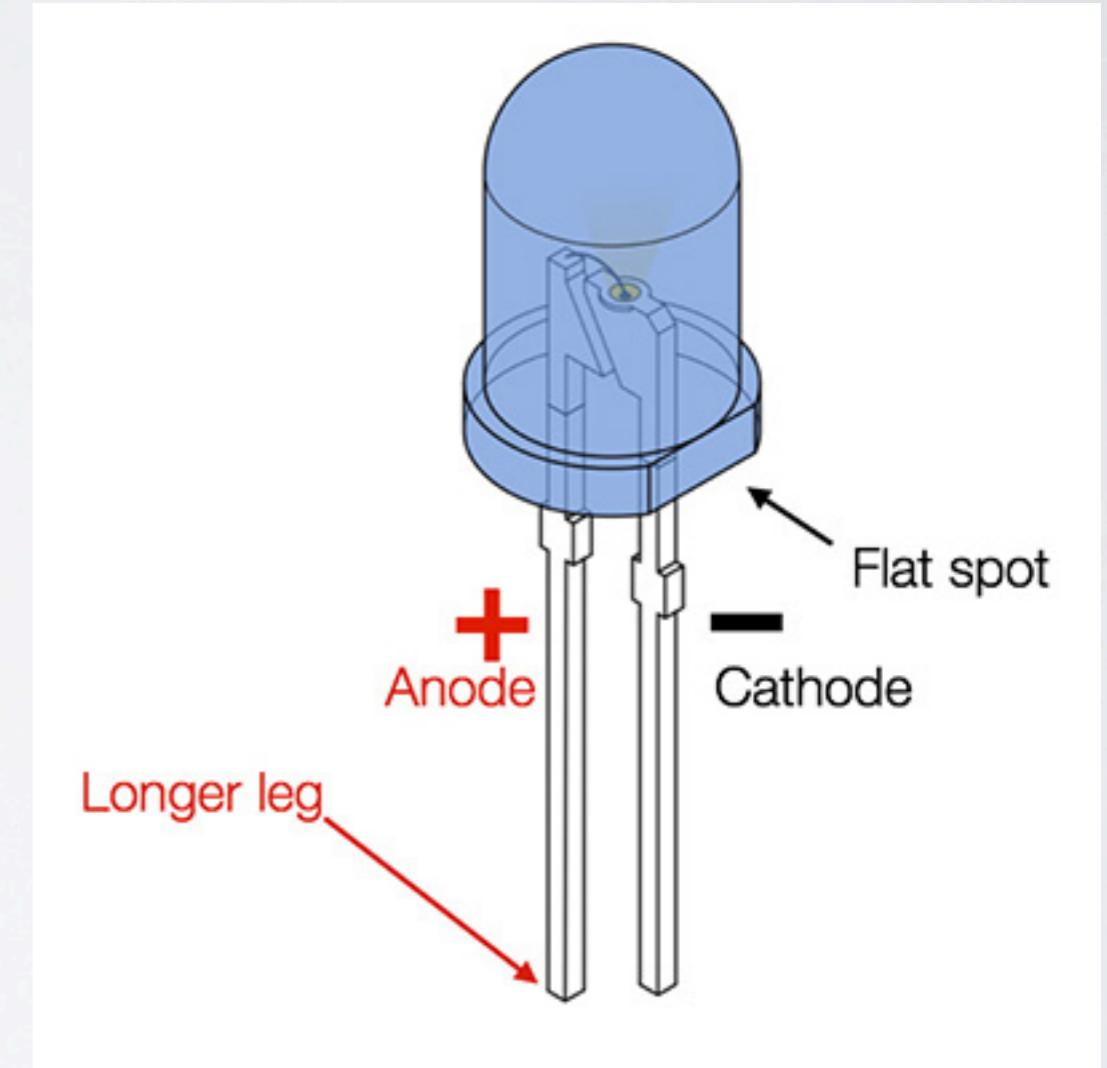
Resistors

Reduce the amount of current flowing.



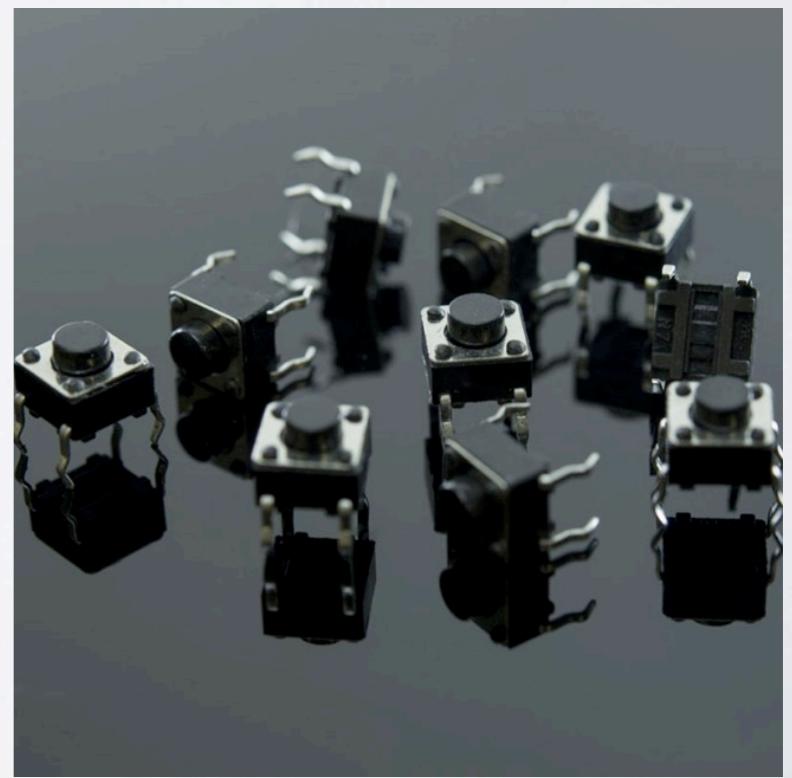
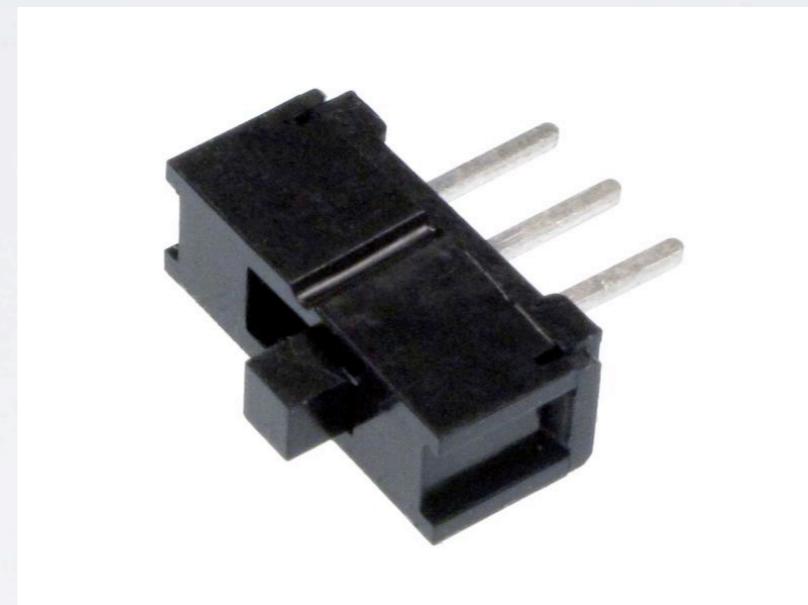
Light Emitting Diode (LED)

Shine light when current passes through. Some are smart.



Switches and buttons

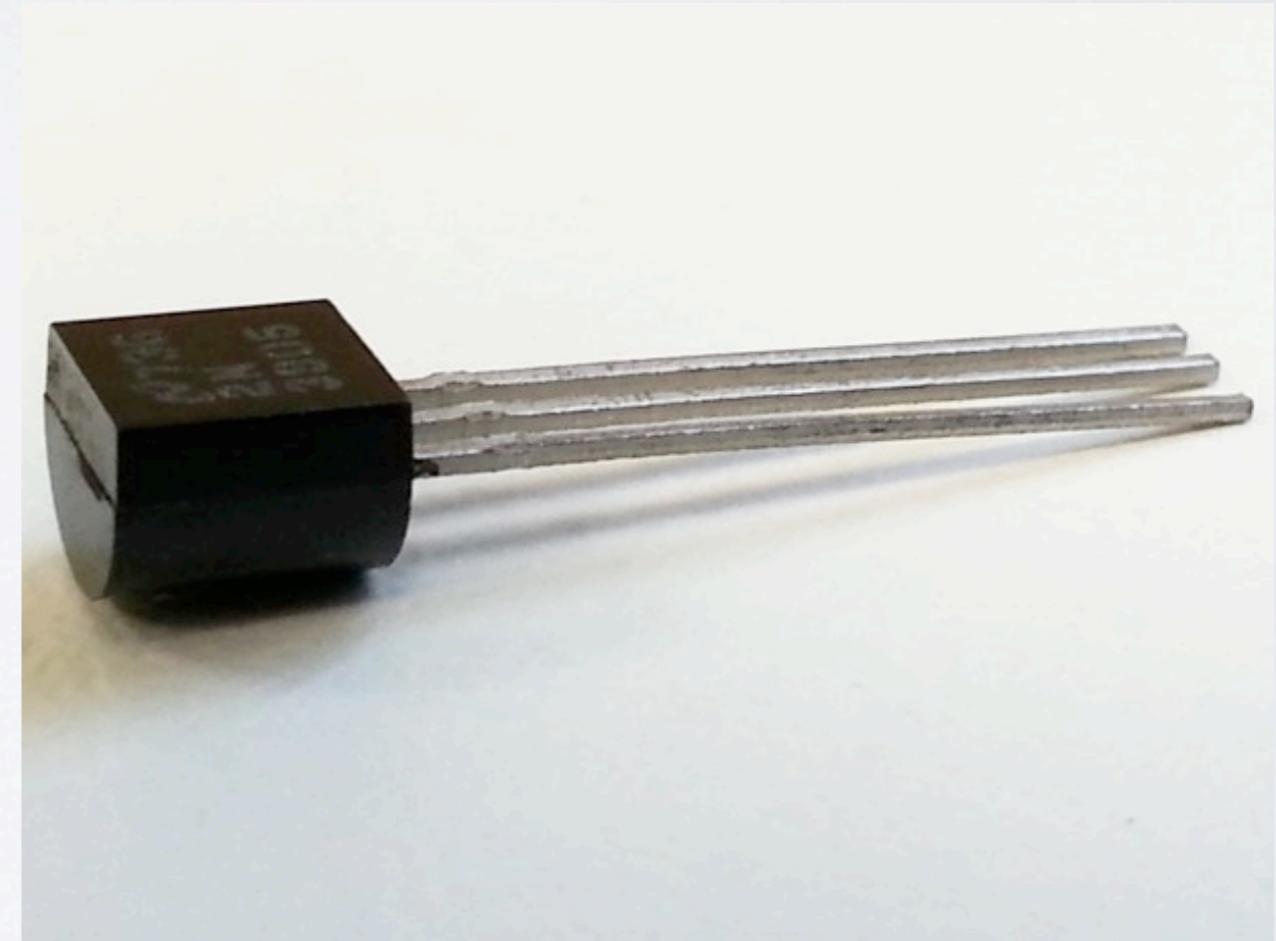
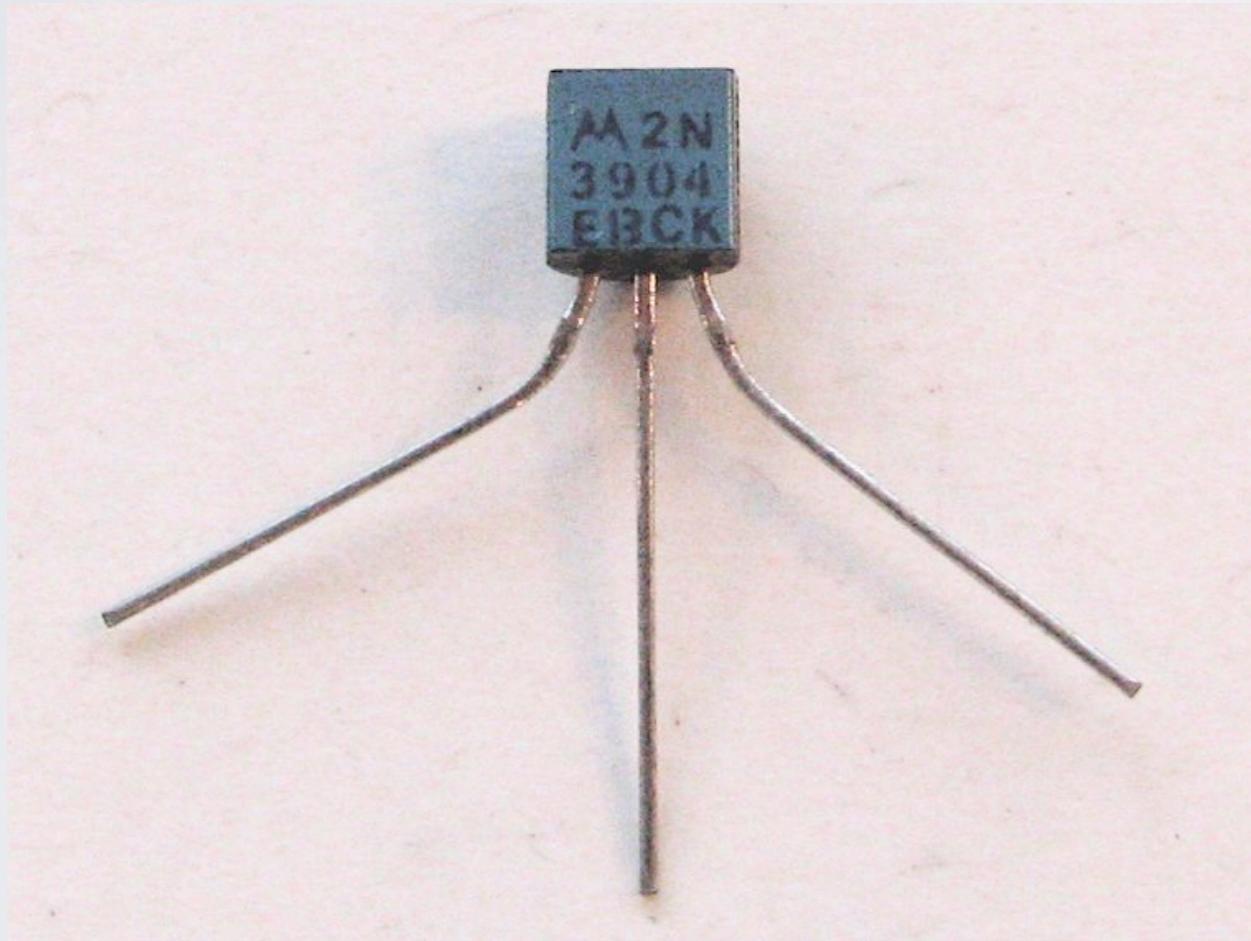
Break a connection momentarily or indefinitely.



The transistor

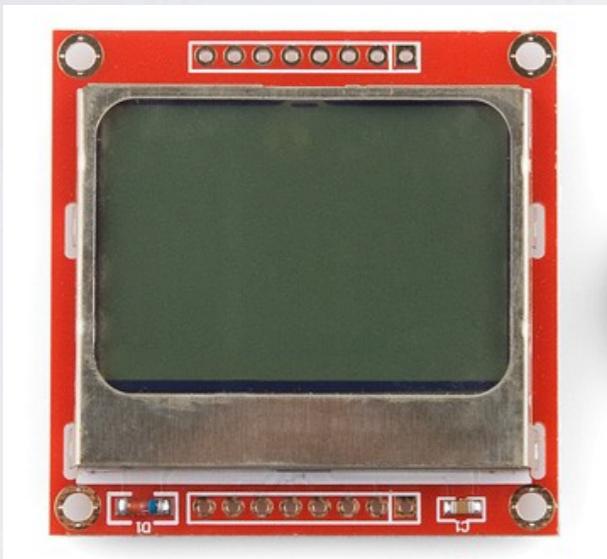
Semiconductor that acts like a switch. Can amplify power.

Game changer in electronics!

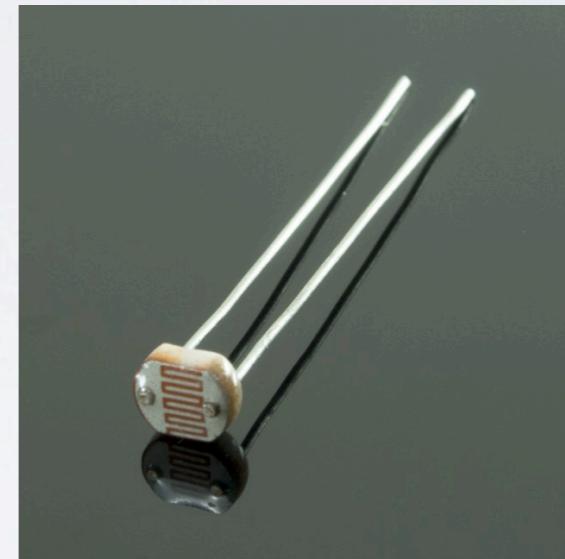


Other components

LCD



Photoresistor



Motor



Speaker



Datasheets & Schematics

Datasheets

Like a user manual for components and chips.

Describes performance and technical characteristics. Very useful!

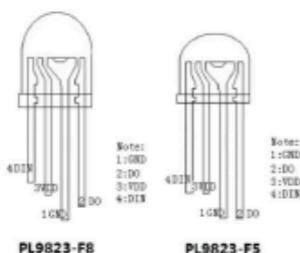
 **PL9823**

Shift register programmable RGB Lamp

Feature

- Power supply:DC4.5V~6V
- Integrate RGB LEDs with Control IC at same body
- Support 256 dimming level for each colc
- Internal frequency up to 800KHz
- Single wire signal transmission(clock and Date)
- To be controlled by external MCU to achieve trget image
- Available on ϕ 5mm, ϕ 8mm and SMD5050 Package type
- No external component required

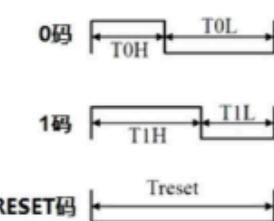
Package Type



Package selection

PART NO.	Package
PL9823-F8	ϕ 8mm
PL9823-F5	ϕ 5mm
PL9823-5050	SMD5050

Timing waveform



Name	Description	Typically	Allowable error
TOH	0 code,high level time	0.35us	$\pm 150\text{ns}$
T1H	1 code,high level time	1.36us	$\pm 150\text{ns}$
T0L	0 code,low level time	1.36us	$\pm 150\text{ns}$
T1L	1 code,low level time	0.35us	$\pm 150\text{ns}$
RES	RESET code	50us	

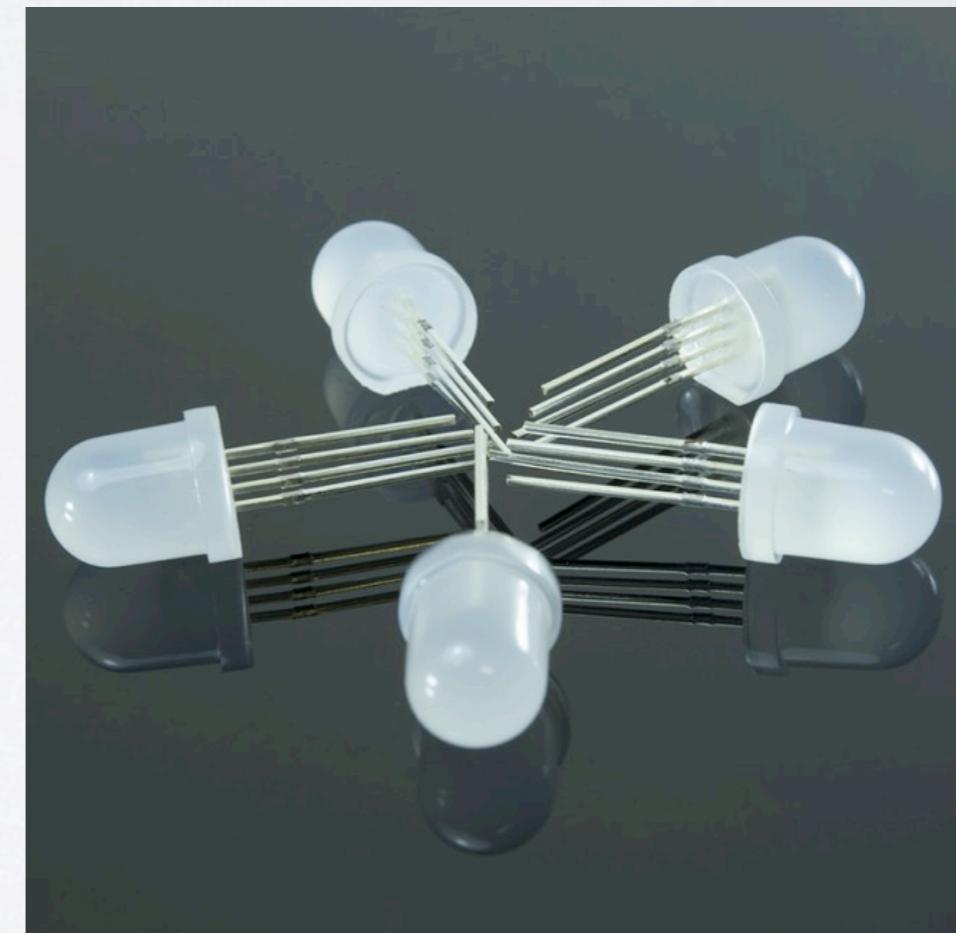
Die LEDs sind Signal-kompatibel zu WS2812.
Bei der Programmierung ist zu beachten, dass ROT und GRÜN im Vergleich mit den WS2812 vertauscht sind.

Composition of 24bit data:

R7	R6	R5	R4	R3	R2	R1	R0	O7	O6	O5	O4	O3	O2	O1	O0	B7	B6	B5	B4	B3	B2	B1	B0
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Note: Follow the order of RGB to send data and the high bit sent at first.


Diamex GmbH
Köpenicker Str. 325
Innovationspark WuhleHeide, Haus 41
12555 Berlin
030-65762630
<http://www.diamex.de>



Schematic drawings

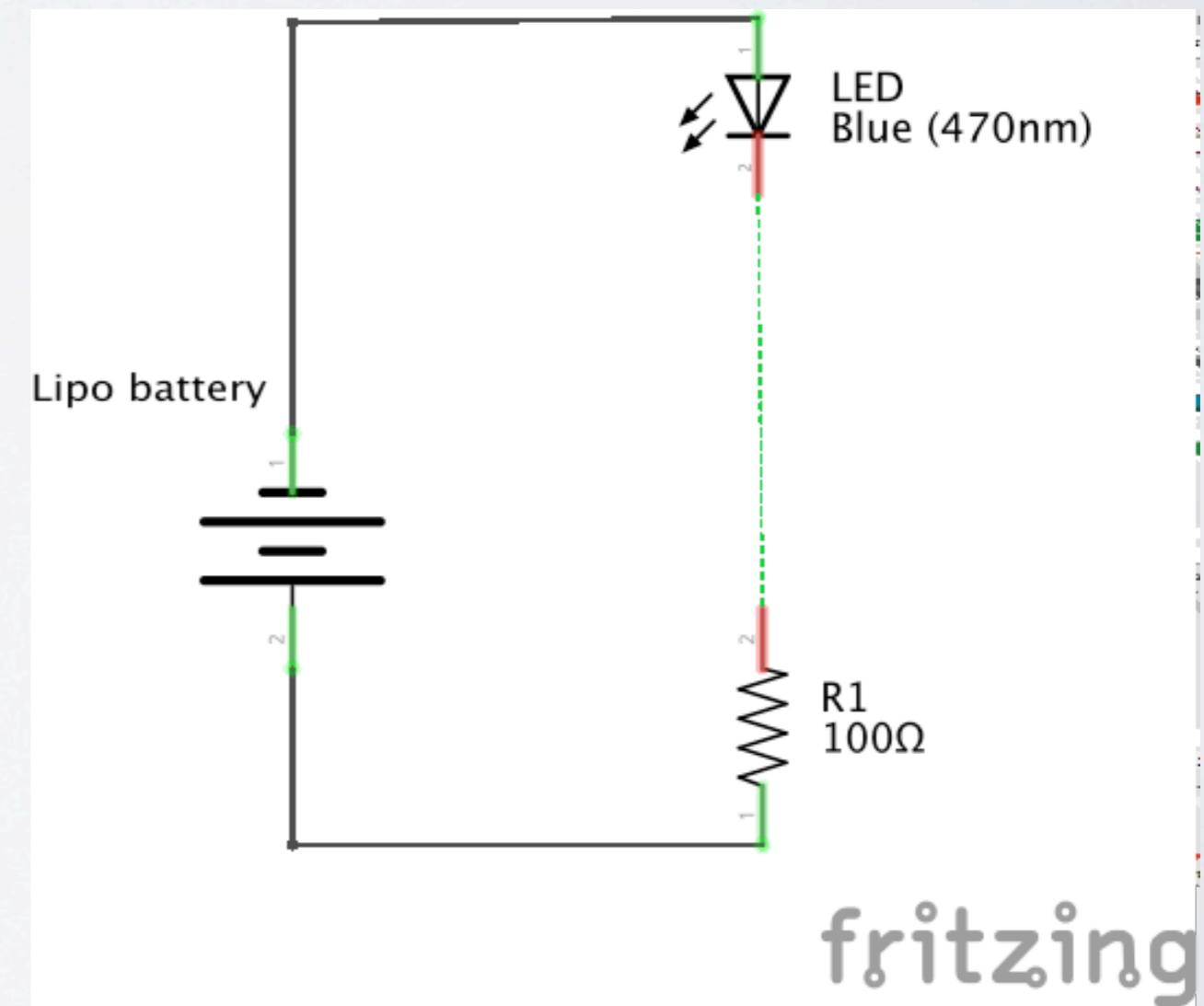
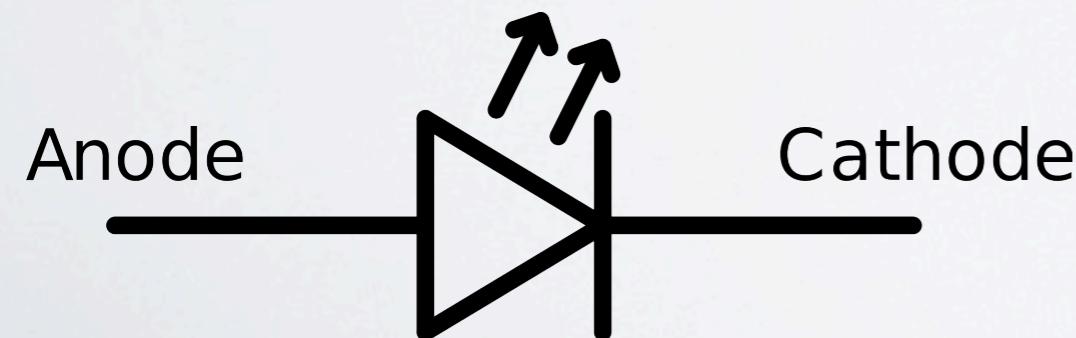
Representations of electrical connections and components as symbols.

Makes complex circuits easy to understand.

Resistor



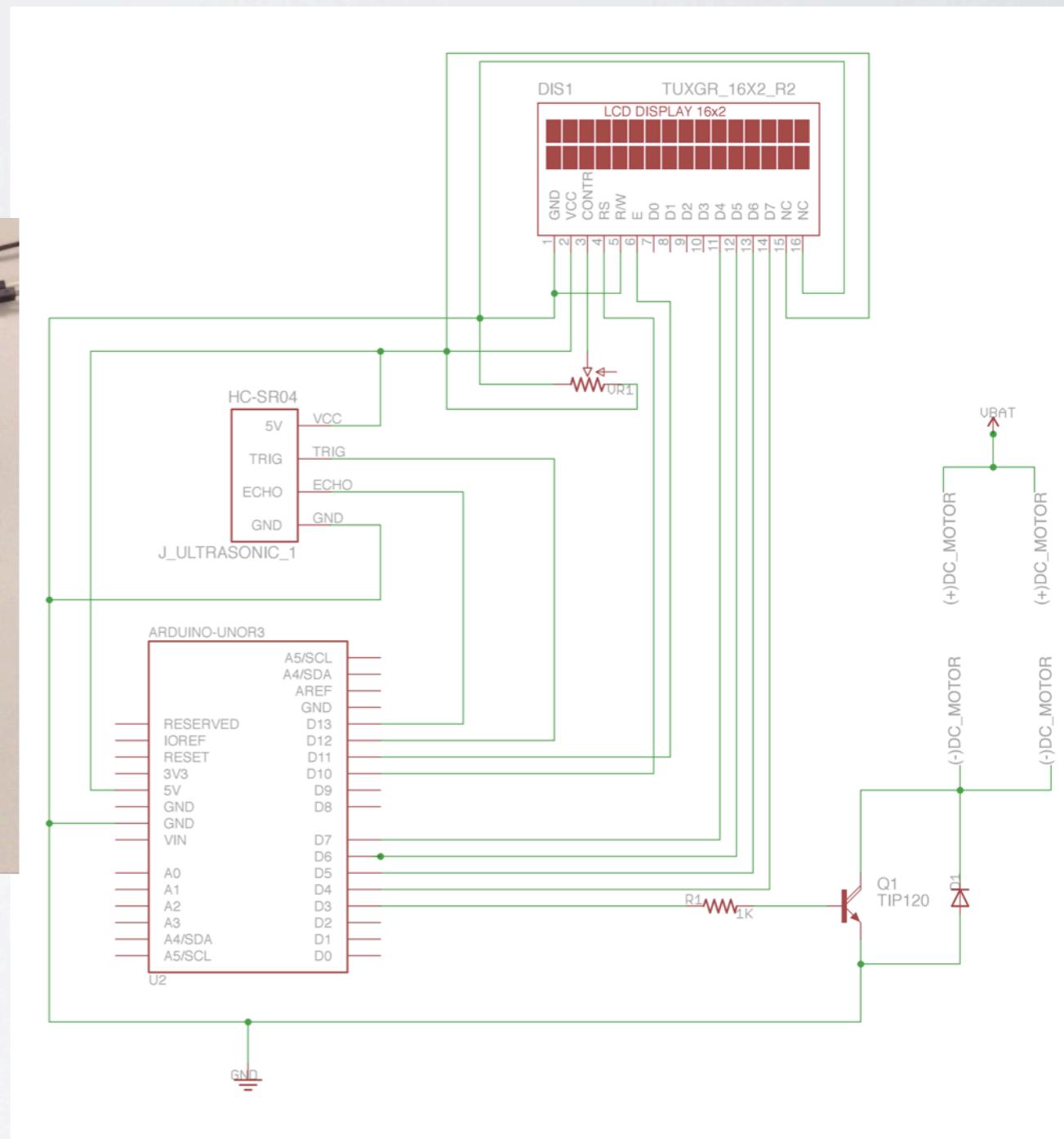
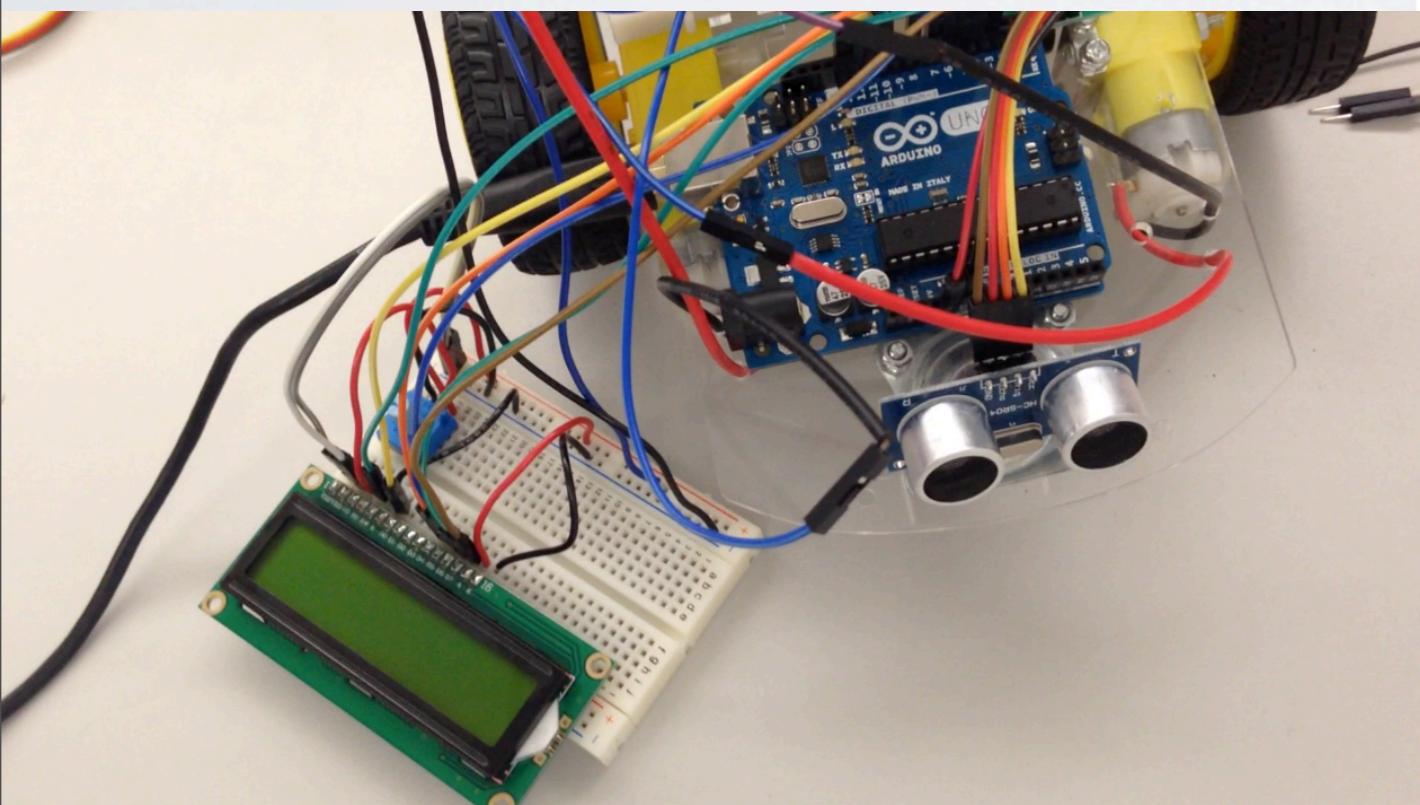
LED



fritzing

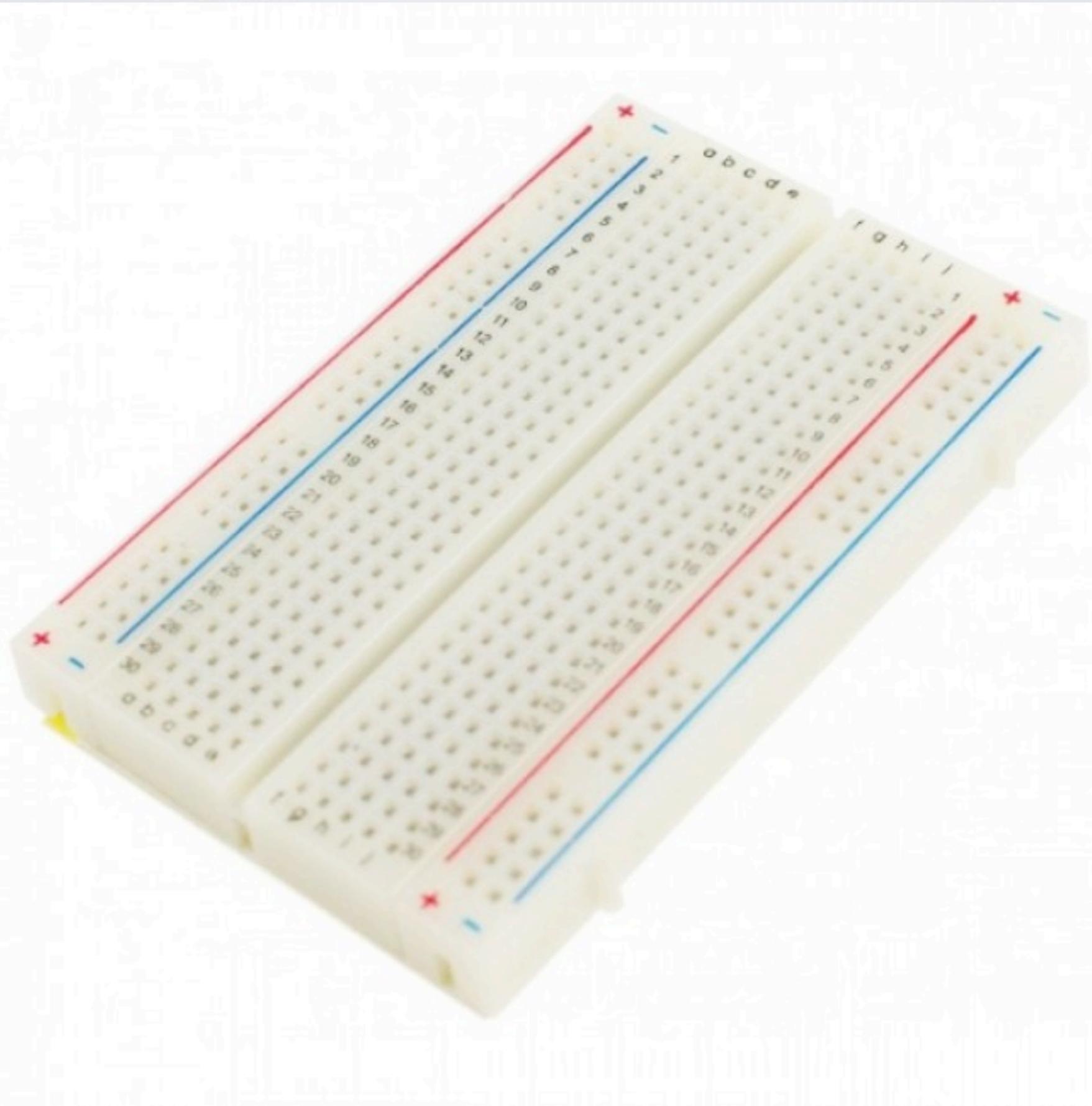
Schematic drawings

Complex projects use ICs connected together

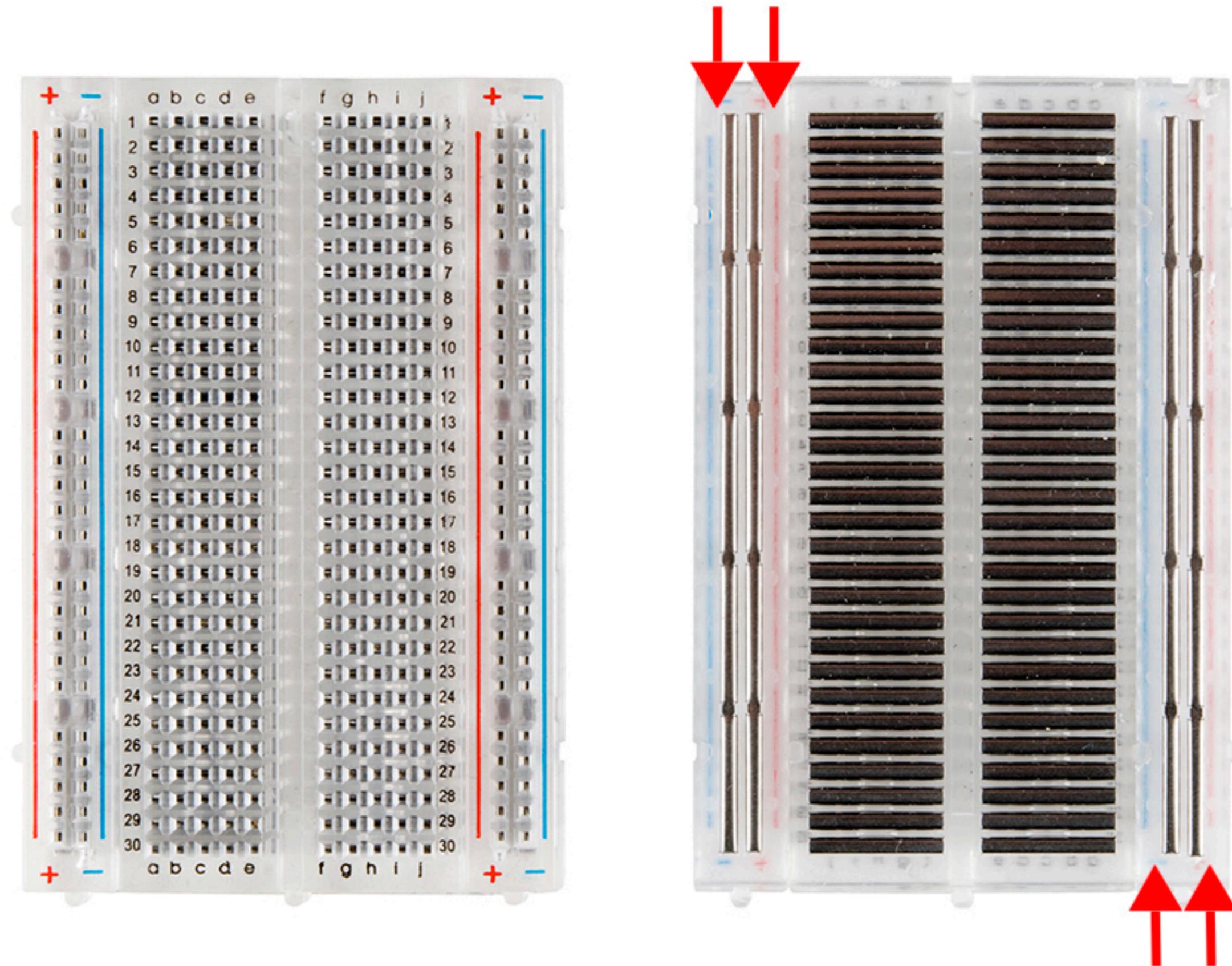


Breadboarding

Half breadboard



How the solderless breadboard works

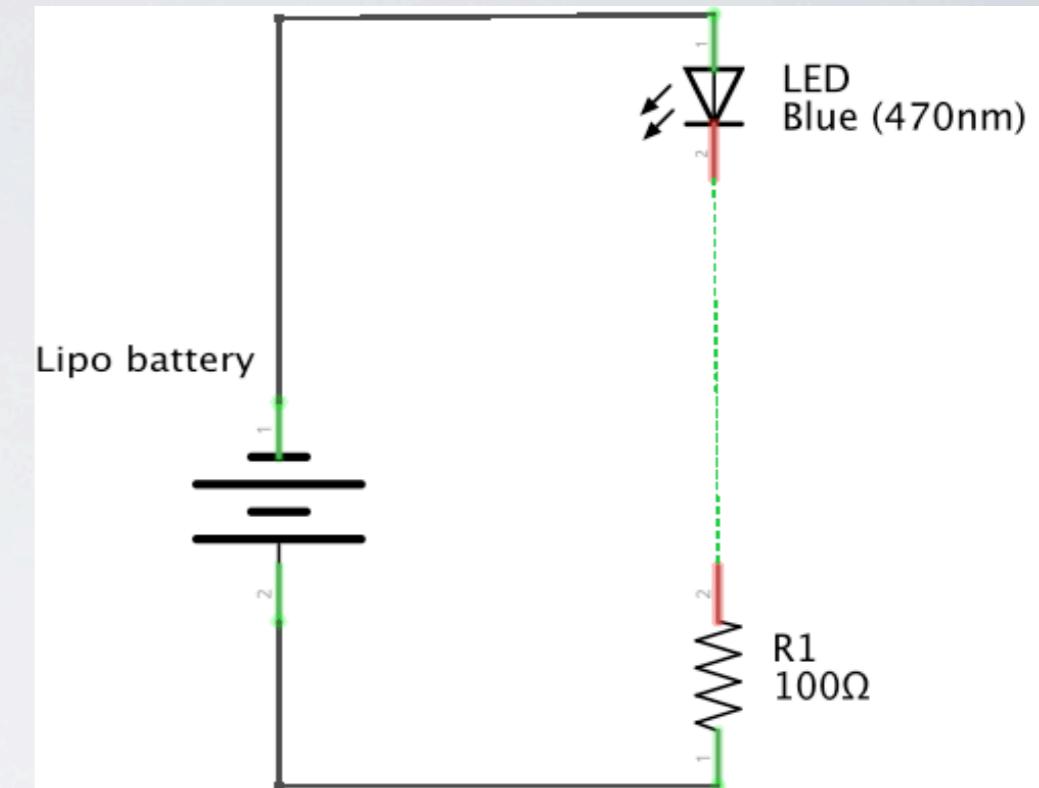
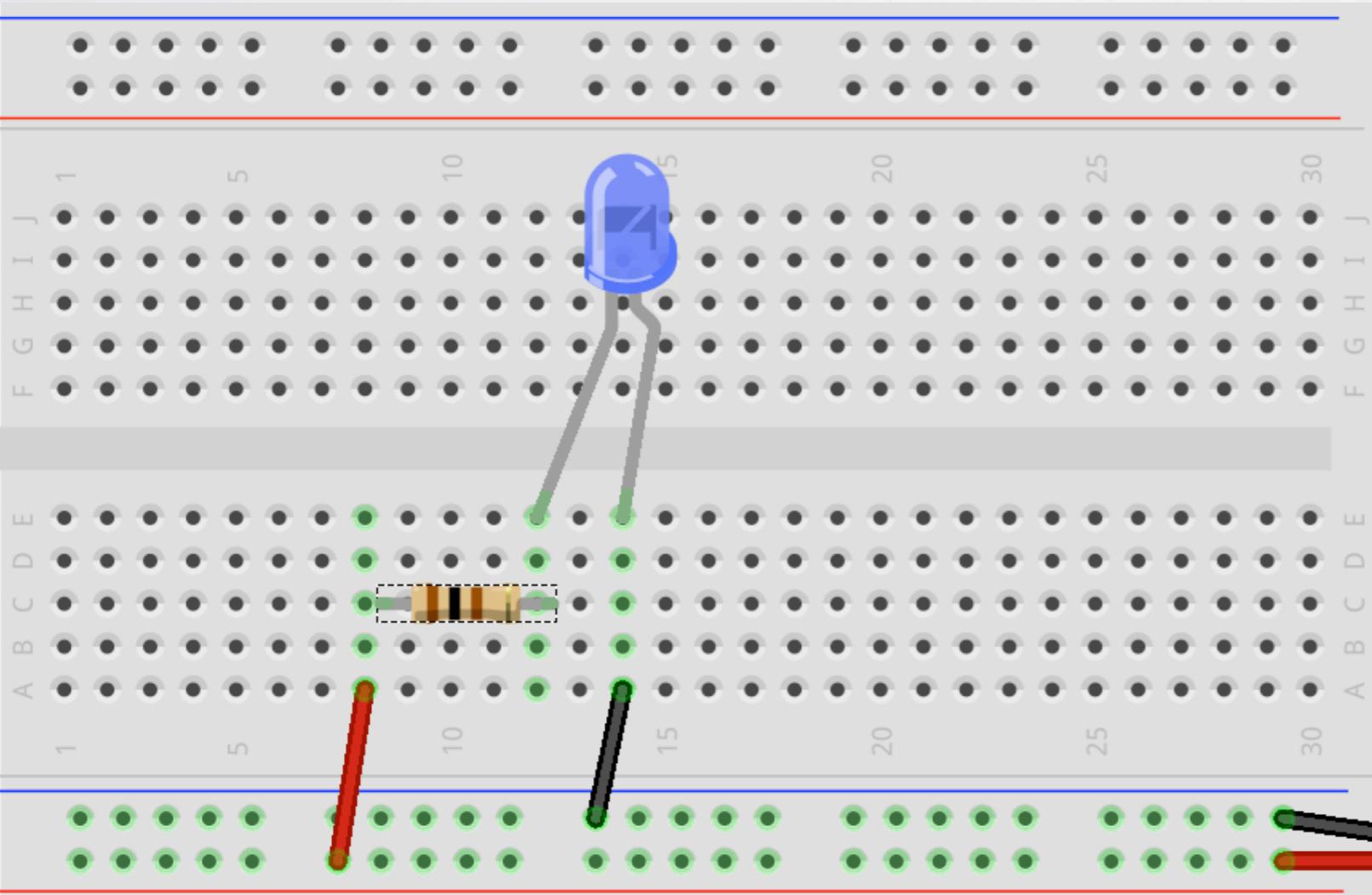


Activity 1 Building a basic circuit

1. Connect battery to red and blue rows

2. Place LED and resistors as shown

3. Use jumper wires to close the circuit



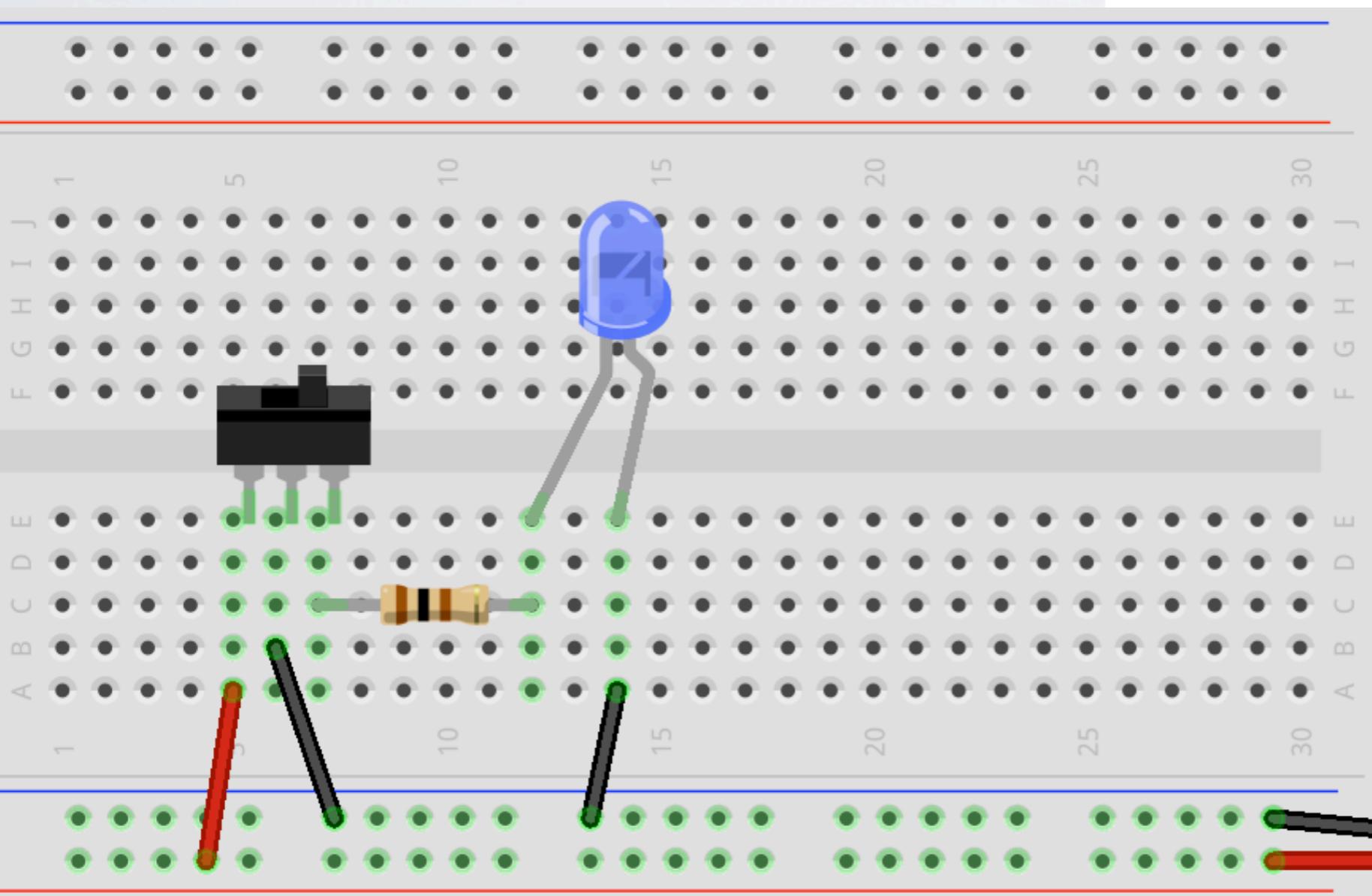
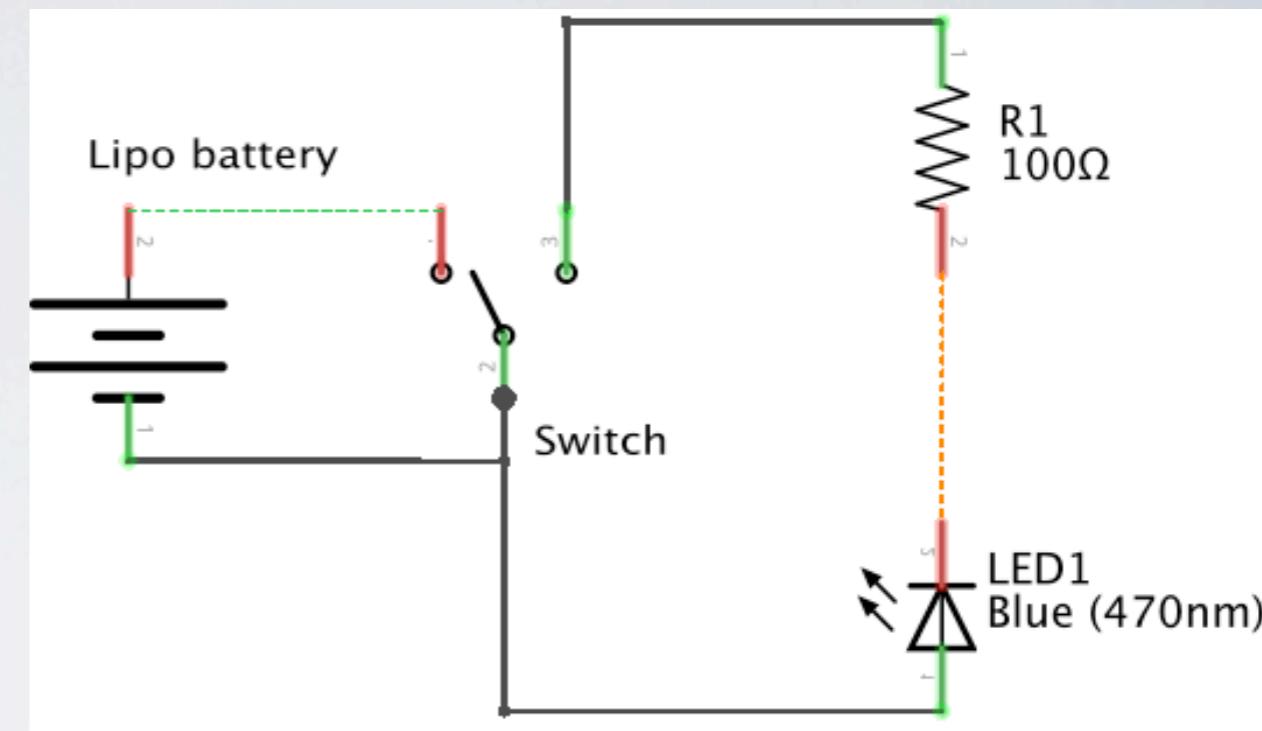
fritzing

Activity 2 Modifying your circuit

1. Remove wires from resistor to power

2. Add switch as shown

3. Use jumper wires to close the circuit



6SP 061225
110mAh 3.7V

Working with Microcontrollers

Microcontrollers

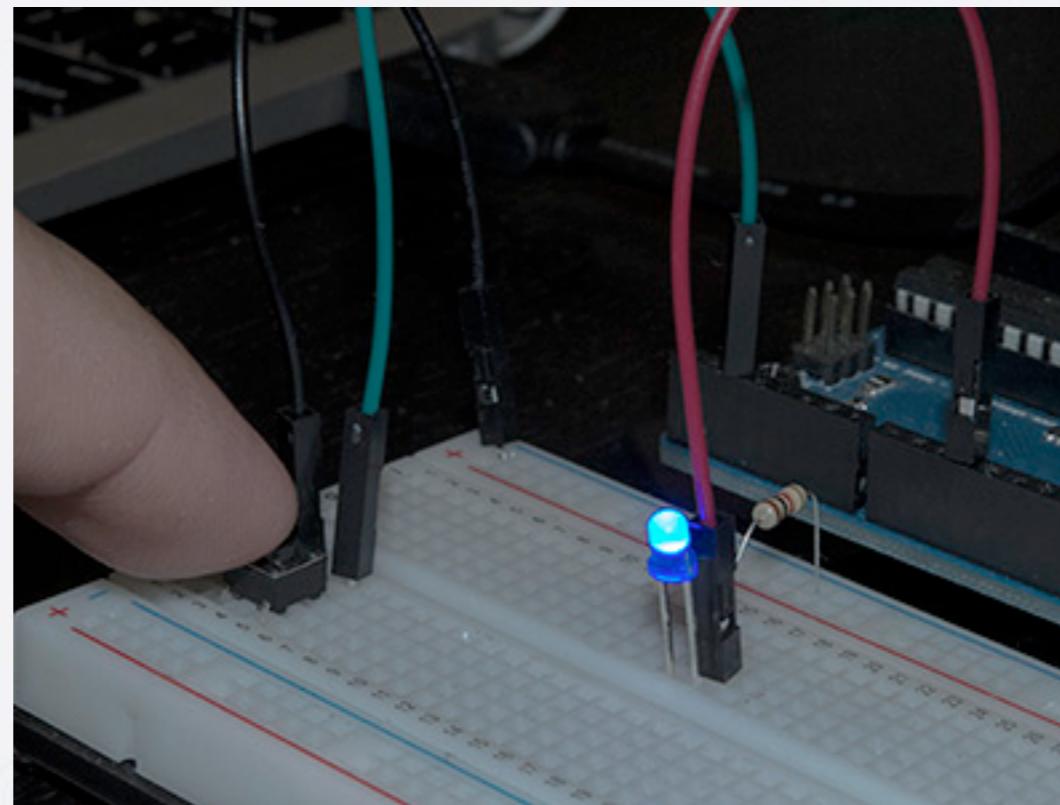
Automate

Who wants to sit and push buttons/flip switches all day?

&

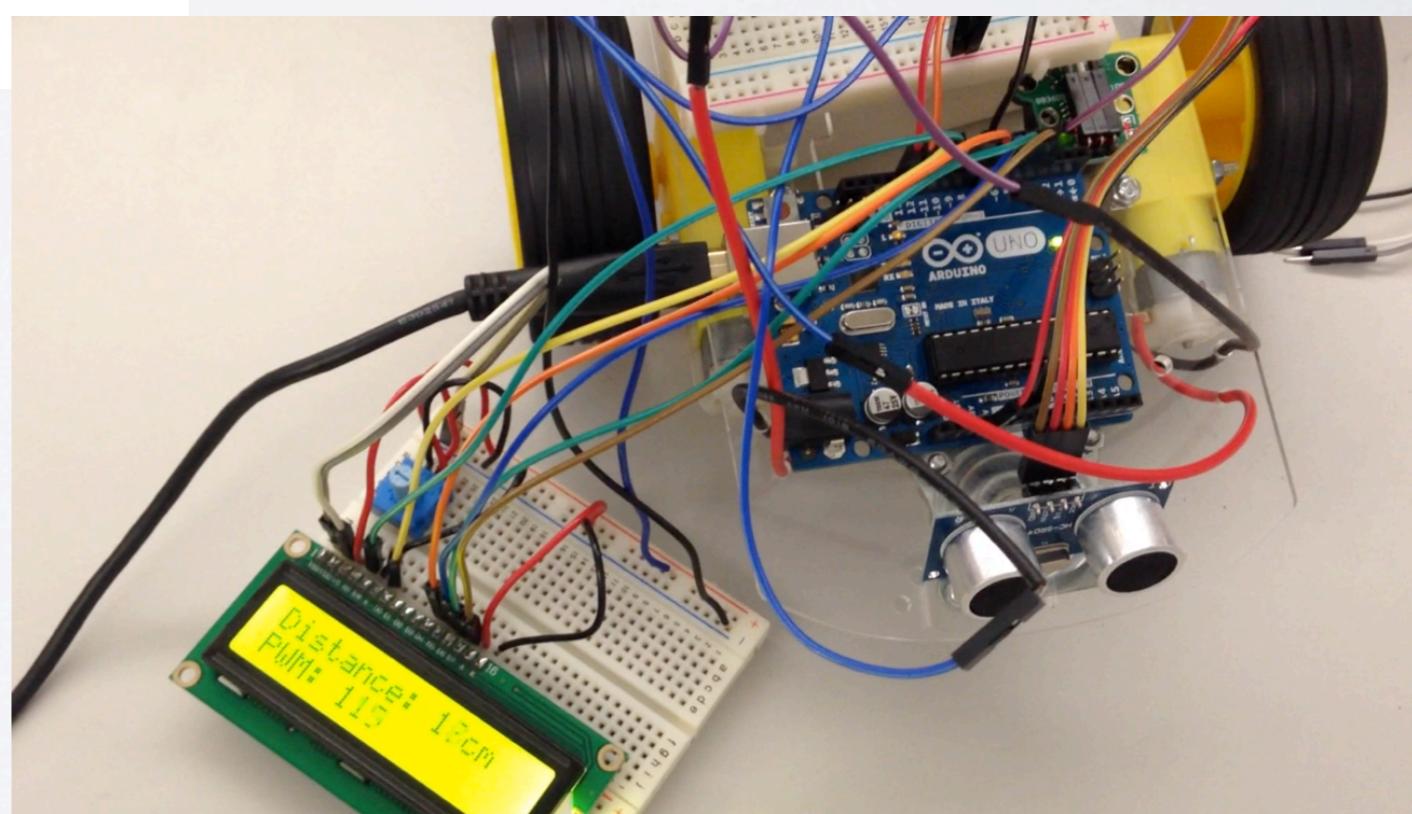
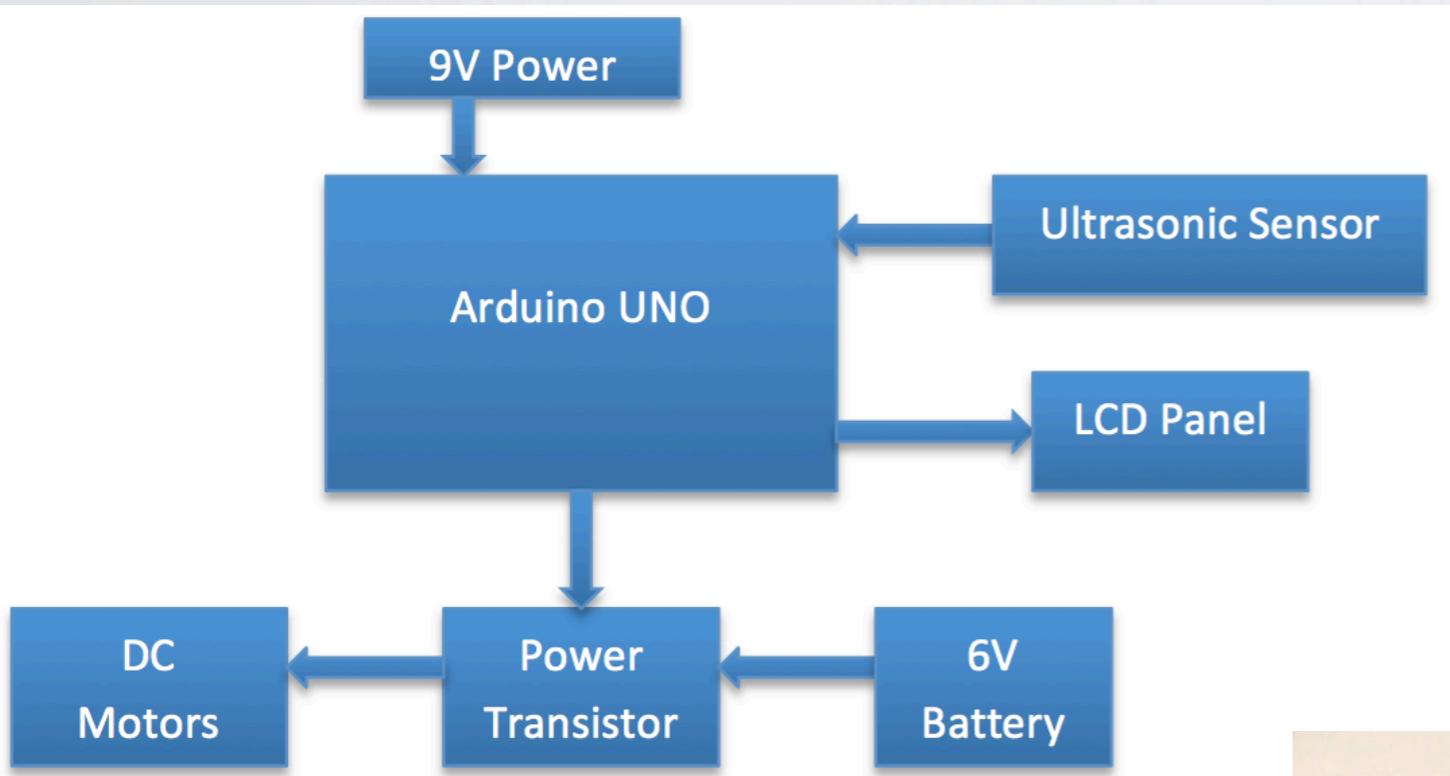
Program

What if you need to do something more complex with your circuit?



Microcontrollers

Are also components! They are the brains of your circuits.



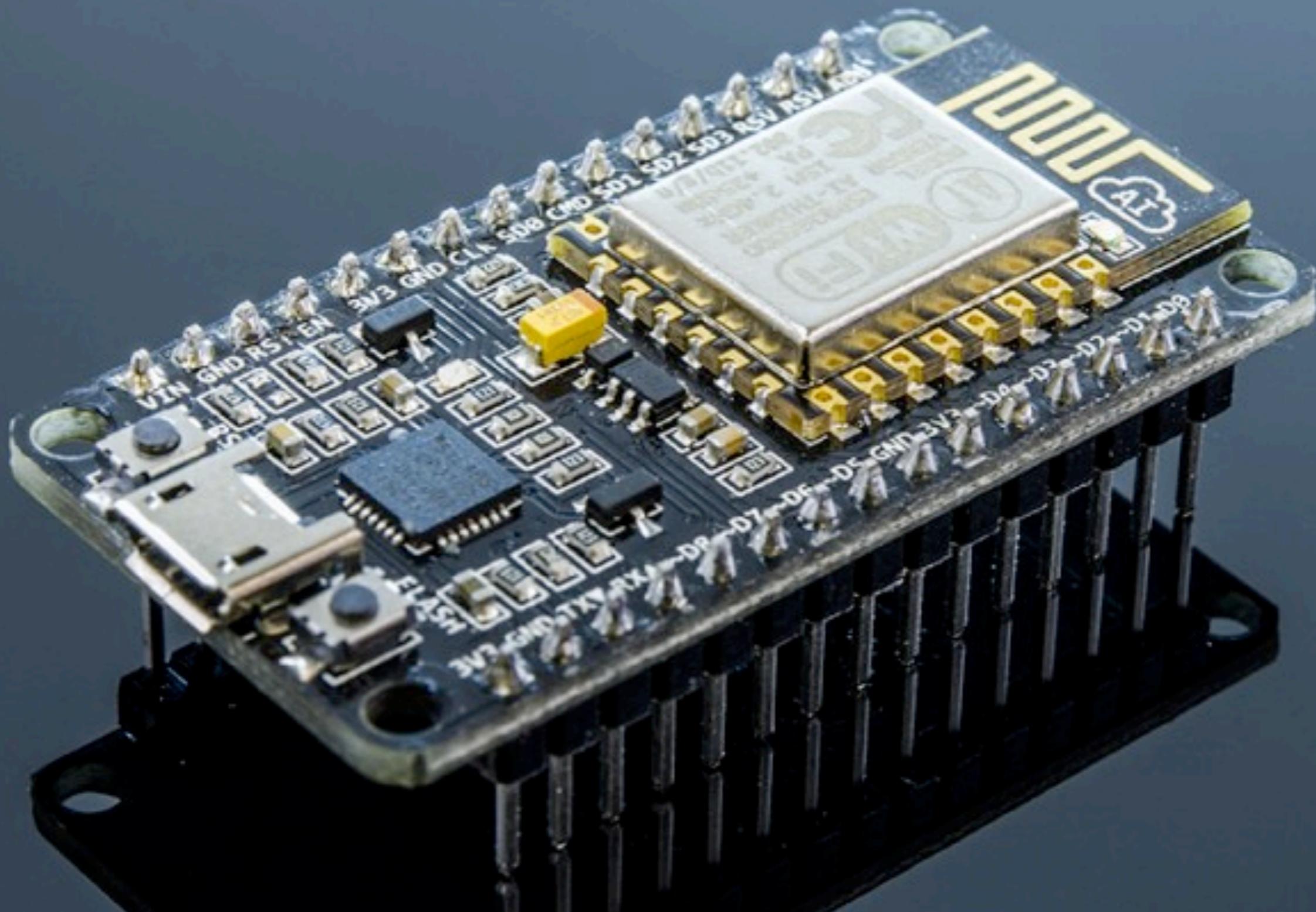
The ESP8266

Serial to Wi-Fi adapter by Expressive Systems (Summer '14)

ESP-NN 'Breakout' Modules

Development Board for ESP-12E Module More info:

<http://learn.acrobotic.com/tutorials/post/esp8266-getting-started>



Activity 3 Getting started with Arduino IDE

Installing the Arduino IDE—a computer application to edit, compile, and upload our programs, as well as communicate via USB with the ESP8266 development board (and others)

Windows

Mac (OSX 10.5+)

Linux (32-bit, 64-bit)



The screenshot shows the Arduino IDE interface with the title bar "Blink | Arduino 1.6.5". The main window displays the "Blink" sketch. The code is as follows:

```
/*
Blink
Turns on an LED on for one second, then off for one second, repeatedly.

Most Arduinos have an on-board LED you can control. On the Uno and
Leonardo, it is attached to digital pin 13. If you're unsure what
pin the on-board LED is connected to on your Arduino model, check
the documentation at http://www.arduino.cc

This example code is in the public domain.

modified 8 May 2014
by Scott Fitzgerald
*/

// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(13, HIGH);    // turn the LED on (HIGH is the voltage level)
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);     // turn the LED off by making the voltage LOW
  delay(1000);              // wait for a second
}
```

The status bar at the bottom right shows "NodeMCU 1.0 (ESP-12E Module), 80 MHz, 115200 on /dev/cu.SLAB_USBtoUART".

Activity 3 Getting started with Arduino IDE

Configuring the Arduino IDE to support the ESP8266

Download and install the USB drivers:

<http://j.mp/ESP8266-driver>

In the Arduino IDE check under:

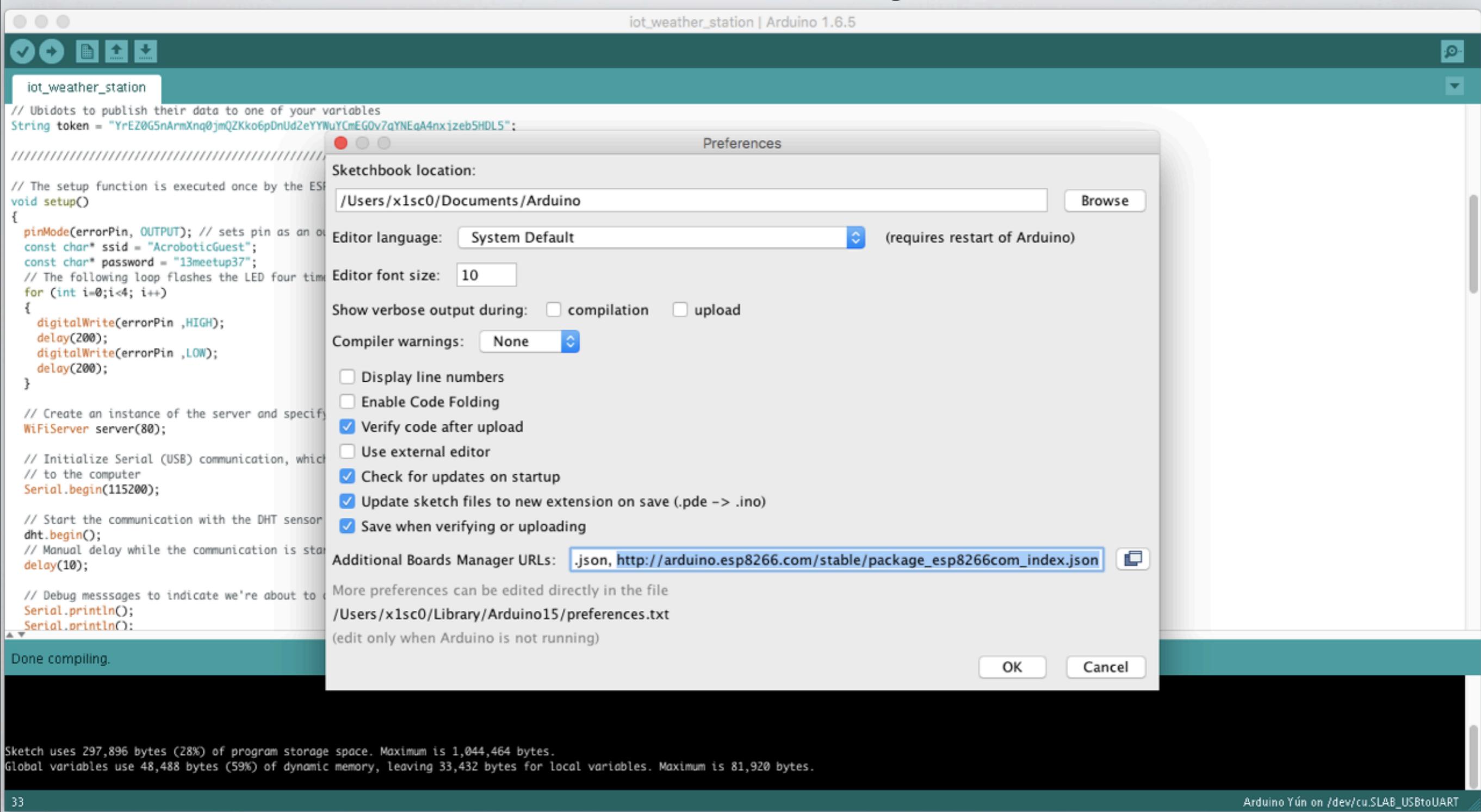
Tools > Port



Activity 3 Getting started with Arduino IDE

Configuring the Arduino IDE to support the ESP8266

Navigate to “Preferences” and under Additional Board Manager URLs enter:
http://arduino.esp8266.com/stable/package_esp8266com_index.json



Activity 3 Getting started with Arduino IDE

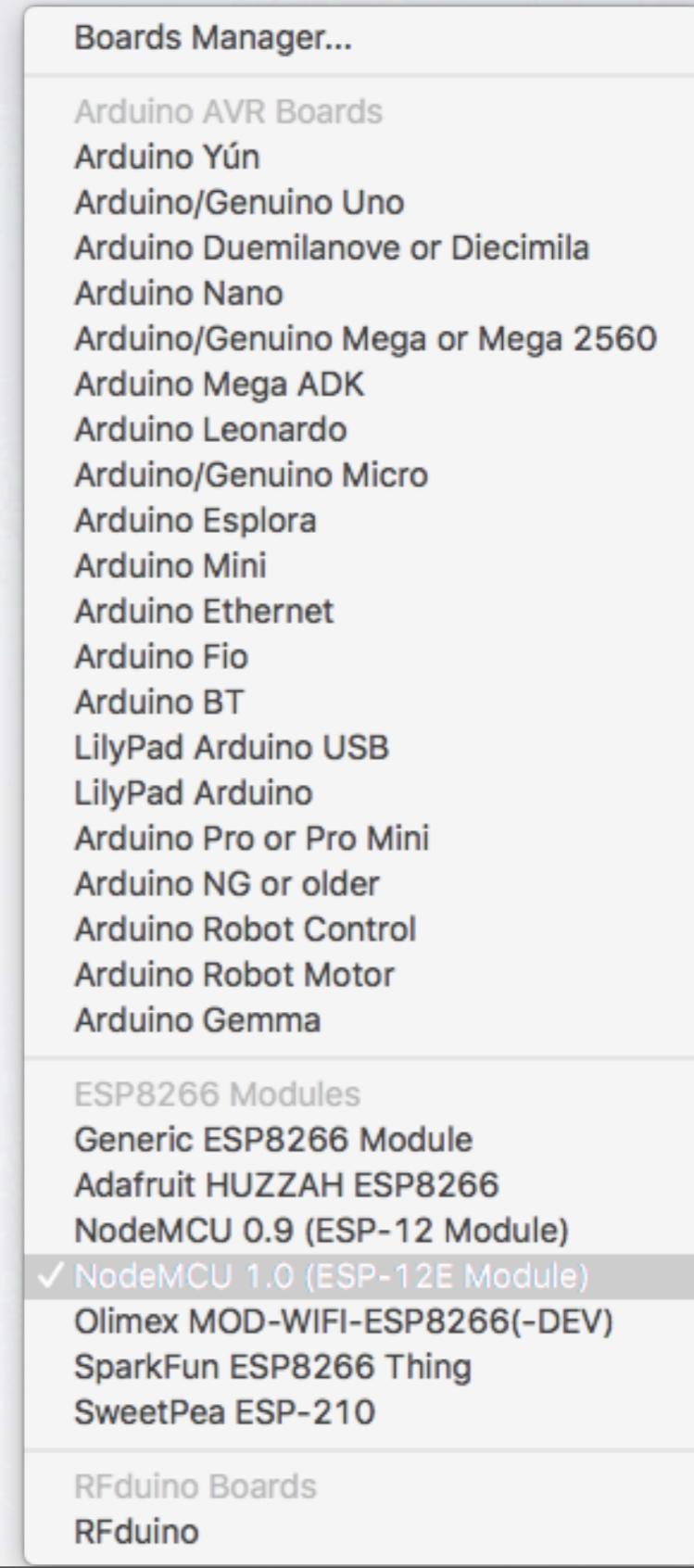
Configuring the Arduino IDE to support the ESP8266

Install the ESP8266 boards under:

Tools > Board > Boards Manager

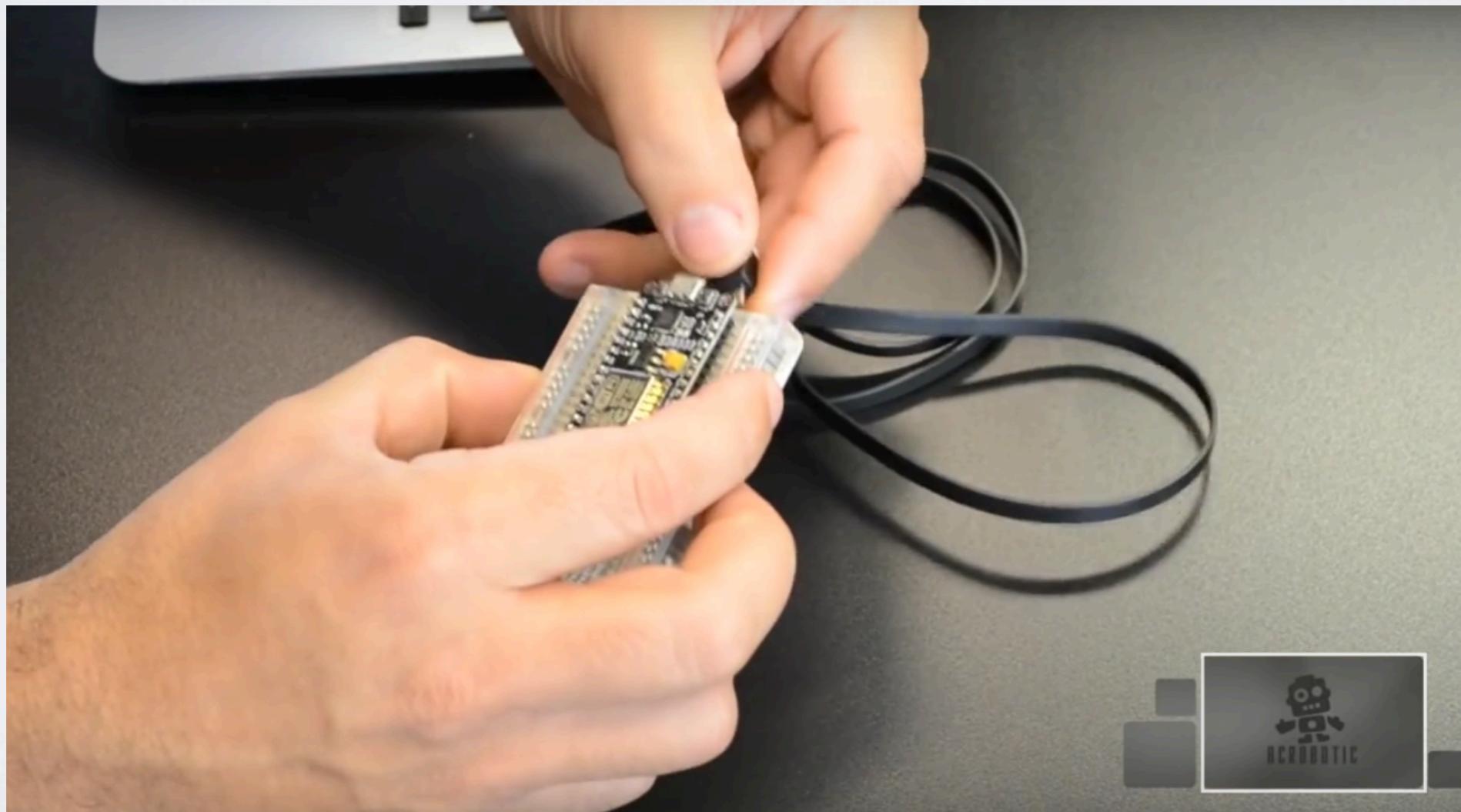
In the Arduino IDE select:

Tools > Board > NodeMCU 1.0 (ESP-12E)

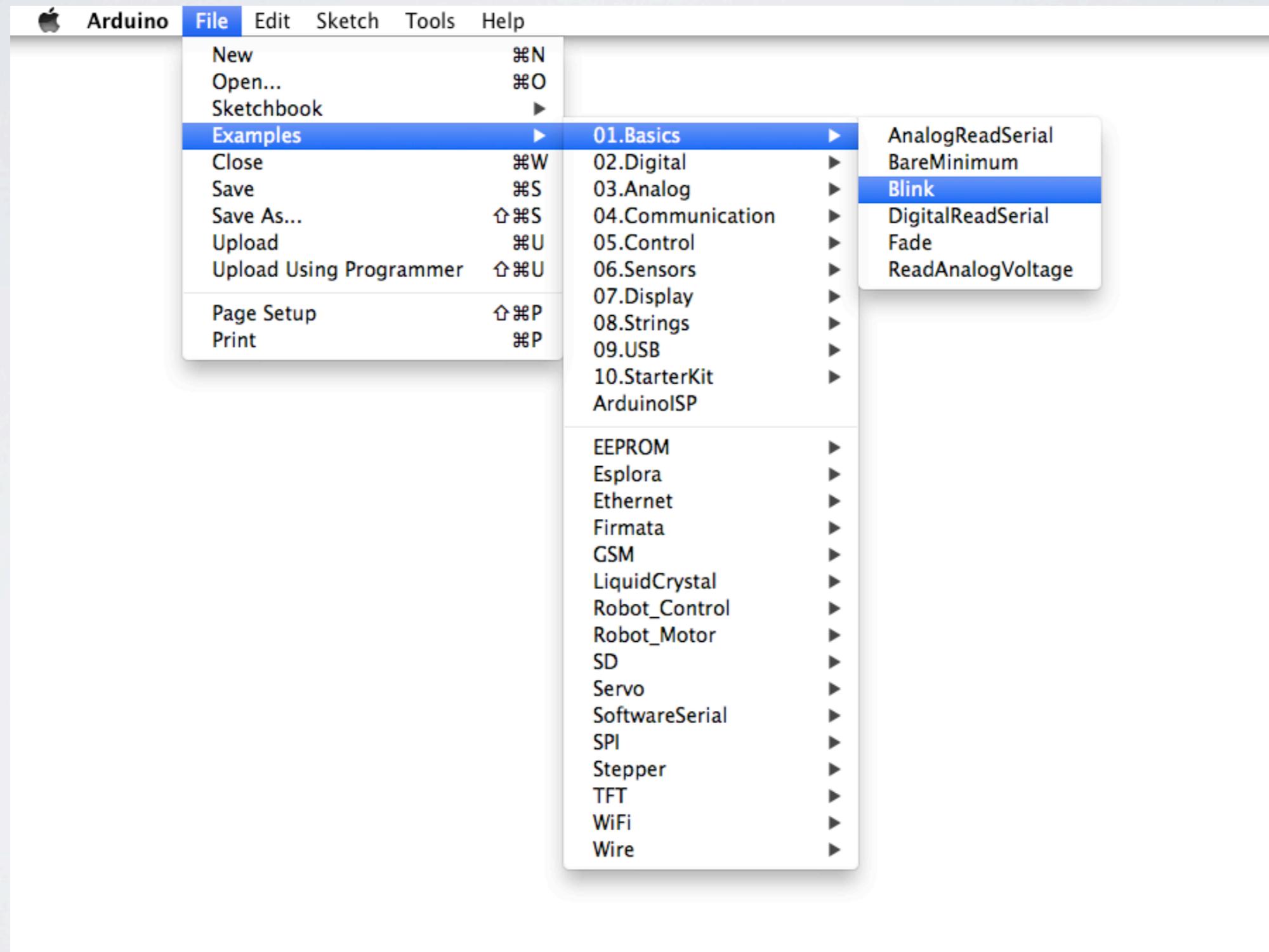


Activity 3 Final step

When you have finished installing, connect the board to your computer



Activity 4 Run the Blink.ino sketch



Activity 4 Run the Blink.ino sketch

Modify the code:

“13” -----> “16”

```
int led = 16;
```

Understanding code in the IDE

Getting Started with Arduino

Anatomy of an Arduino Program ('sketch'):

```
/*
  Blink
  Turns on an LED on for one second, then off for one second, repeatedly.

  This example code is in the public domain.
*/

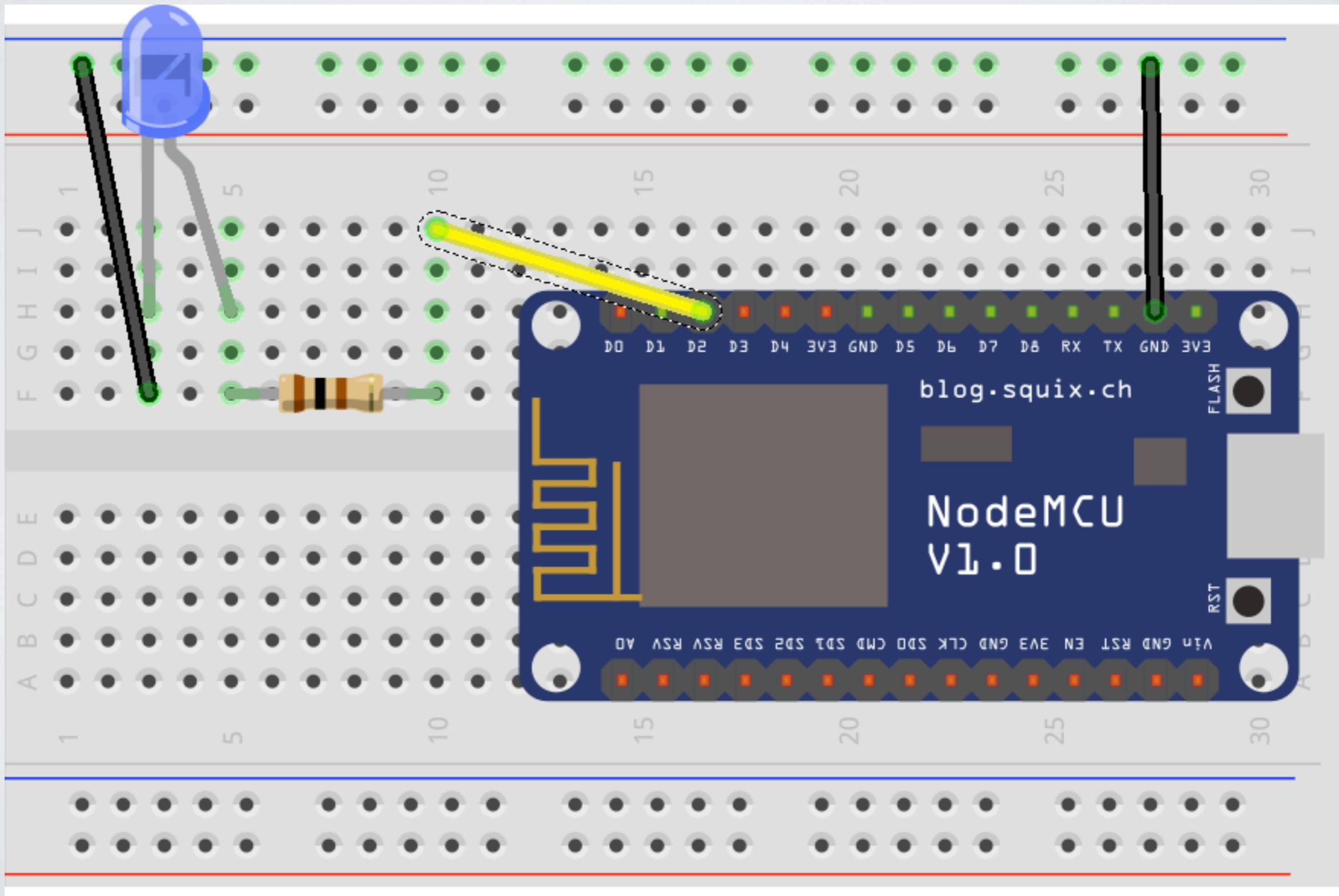
// Pin 13 has an LED connected on most Arduino boards.
// give it a name:
int led = 13;

// the setup routine runs once when you press reset:
void setup() {
  // initialize the digital pin as an output.
  pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH);      // turn the LED on (HIGH is the voltage level)
  delay(1000);                // wait for a second
  digitalWrite(led, LOW);       // turn the LED off by making the voltage LOW
  delay(1000);                // wait for a second
}
```

Activity 5

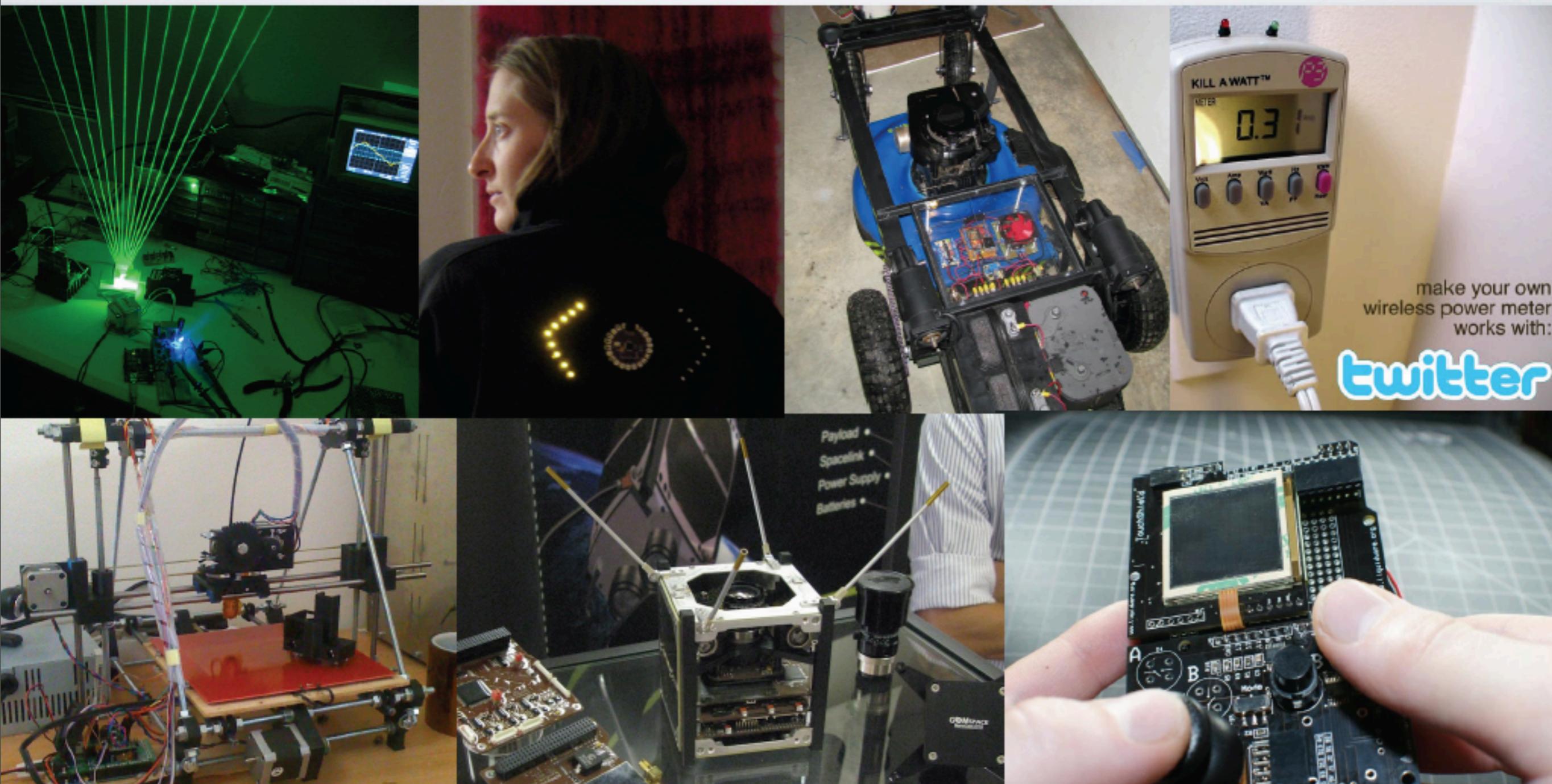
Build a circuit around the ESP8266 to control an LED



Analog and Digital I/O

Your microcontroller's I/O pins can do 4 things:

- Digital input - Digital output
- Analog input - Analog output



Getting Started with Arduino

For more info visit:

learn.acrobotic.com

learn.sparkfun.com

learn.adafruit.com

instructables.com

Thank You!