

Interaction Design & Virtual Reality

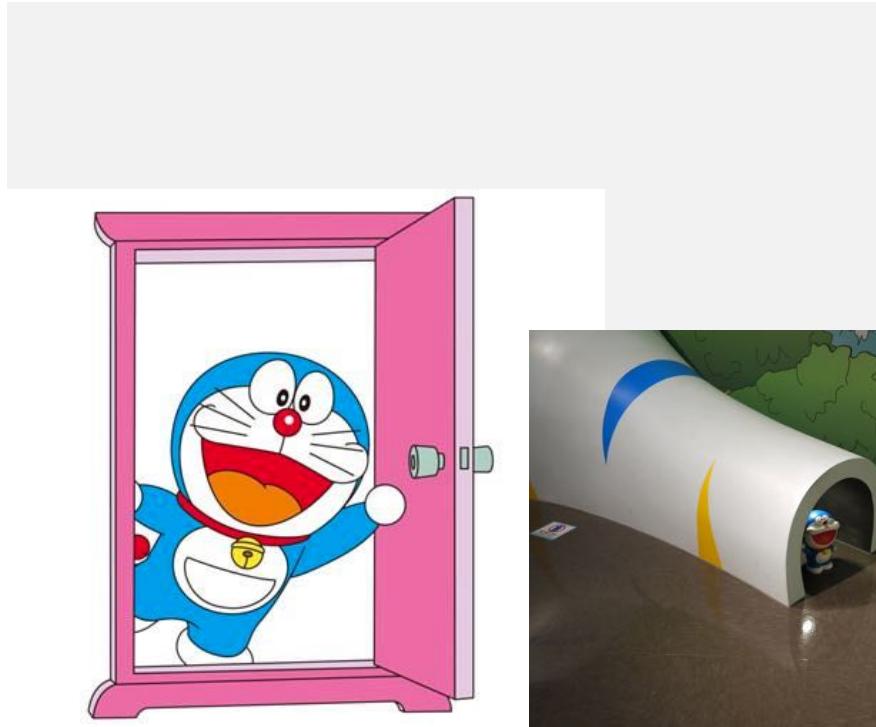
Liwei chan 詹力韋
Assistant Prof.

2016.11.01

assignment

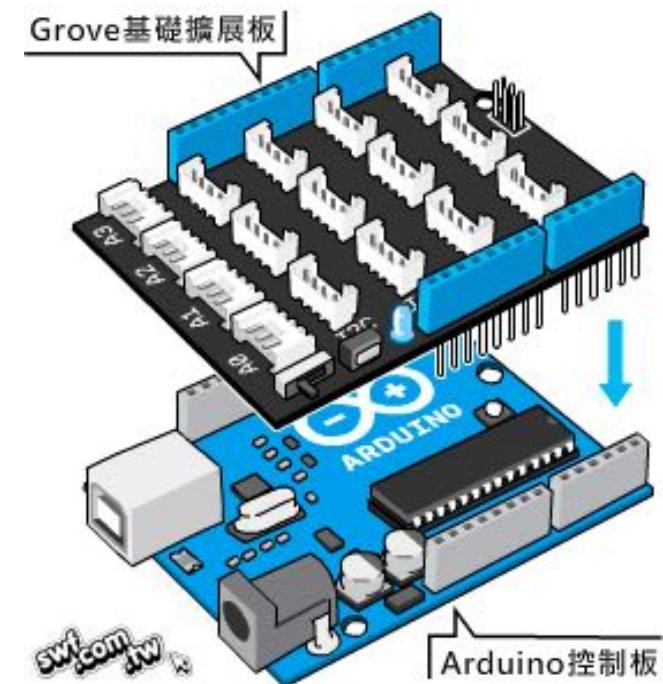
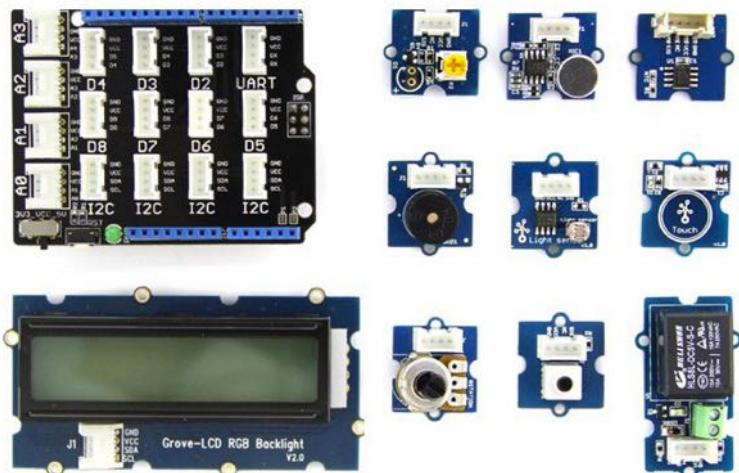
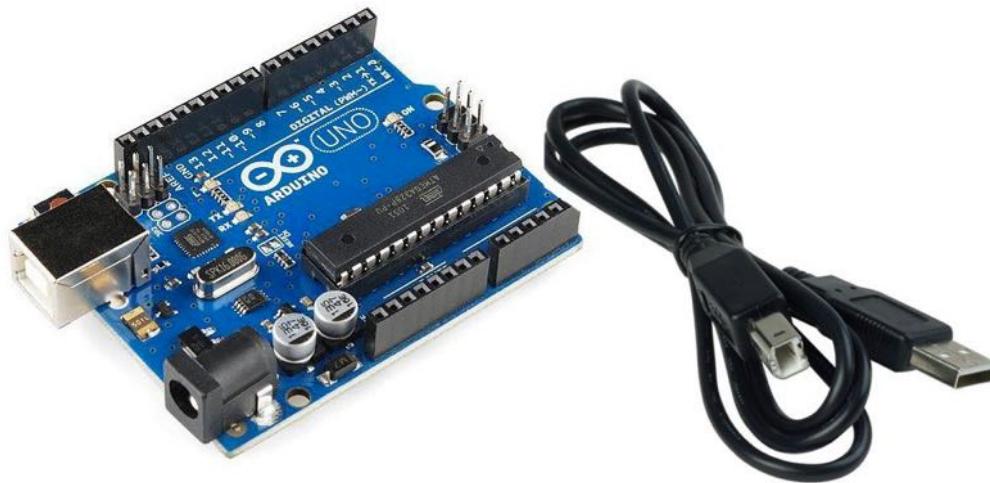
create passive tangible
interface for VR

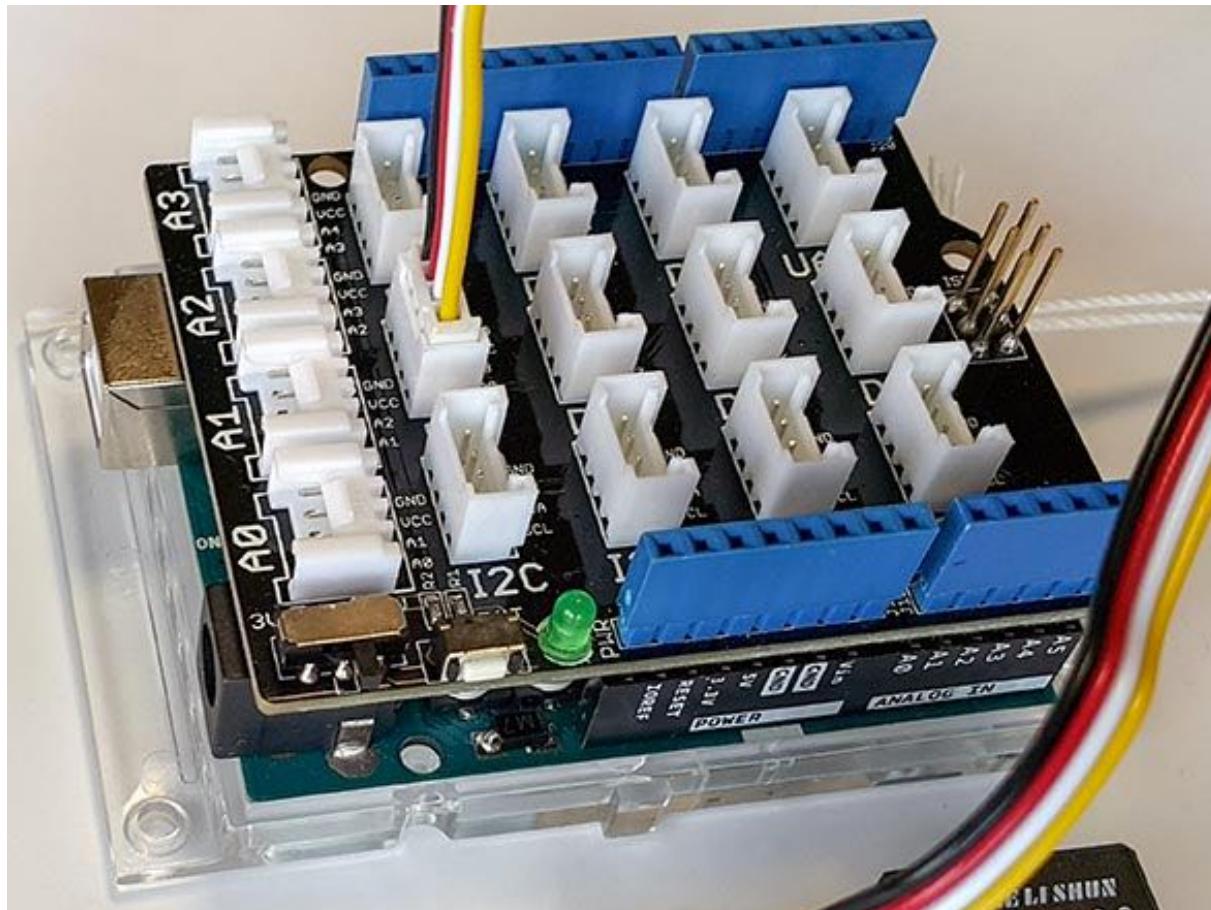
due in
three
weeks



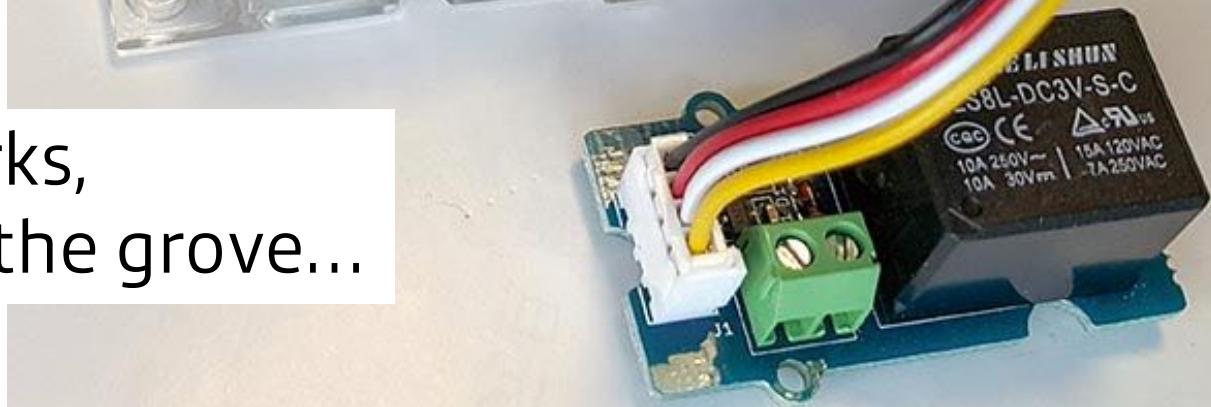


<https://www.youtube.com/watch?v=by0QG-SR-vg>

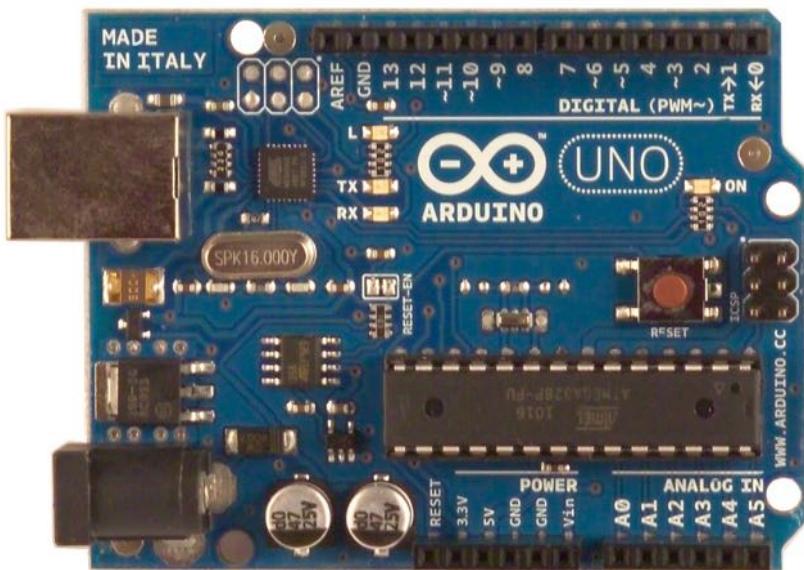
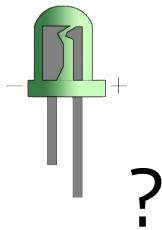


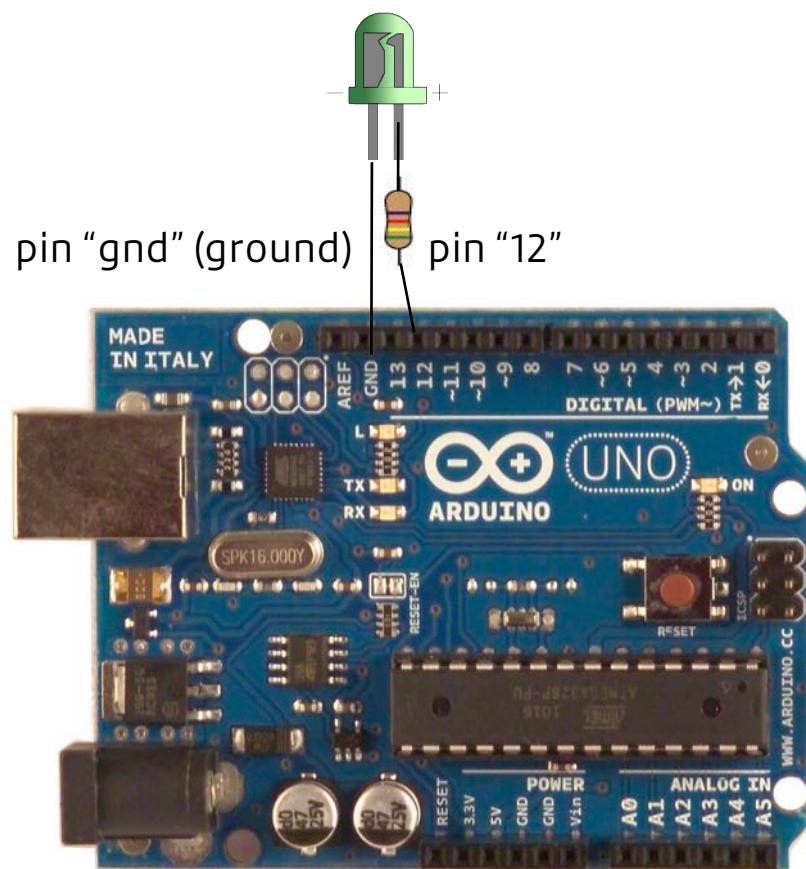


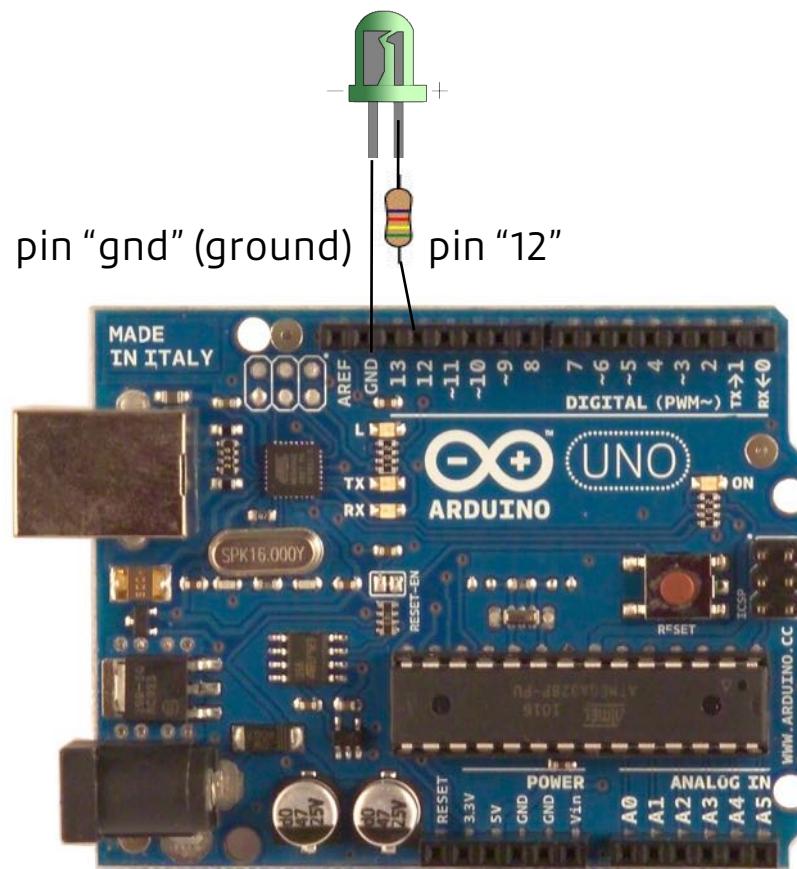
how electronics works,
however, Is hide by the grove...



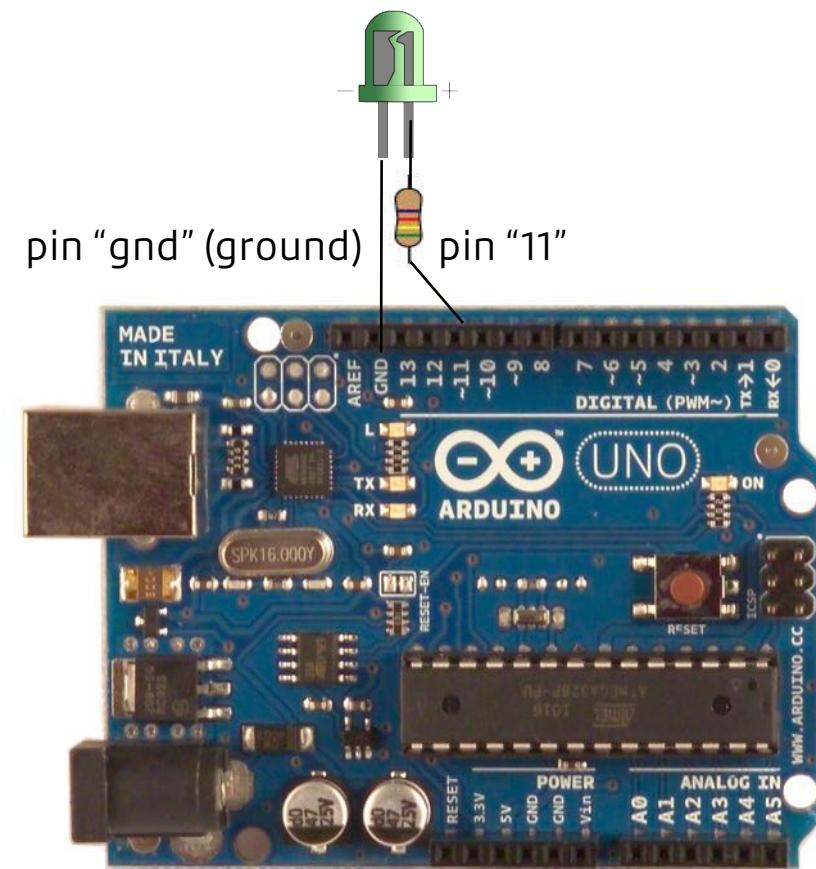
without grove...





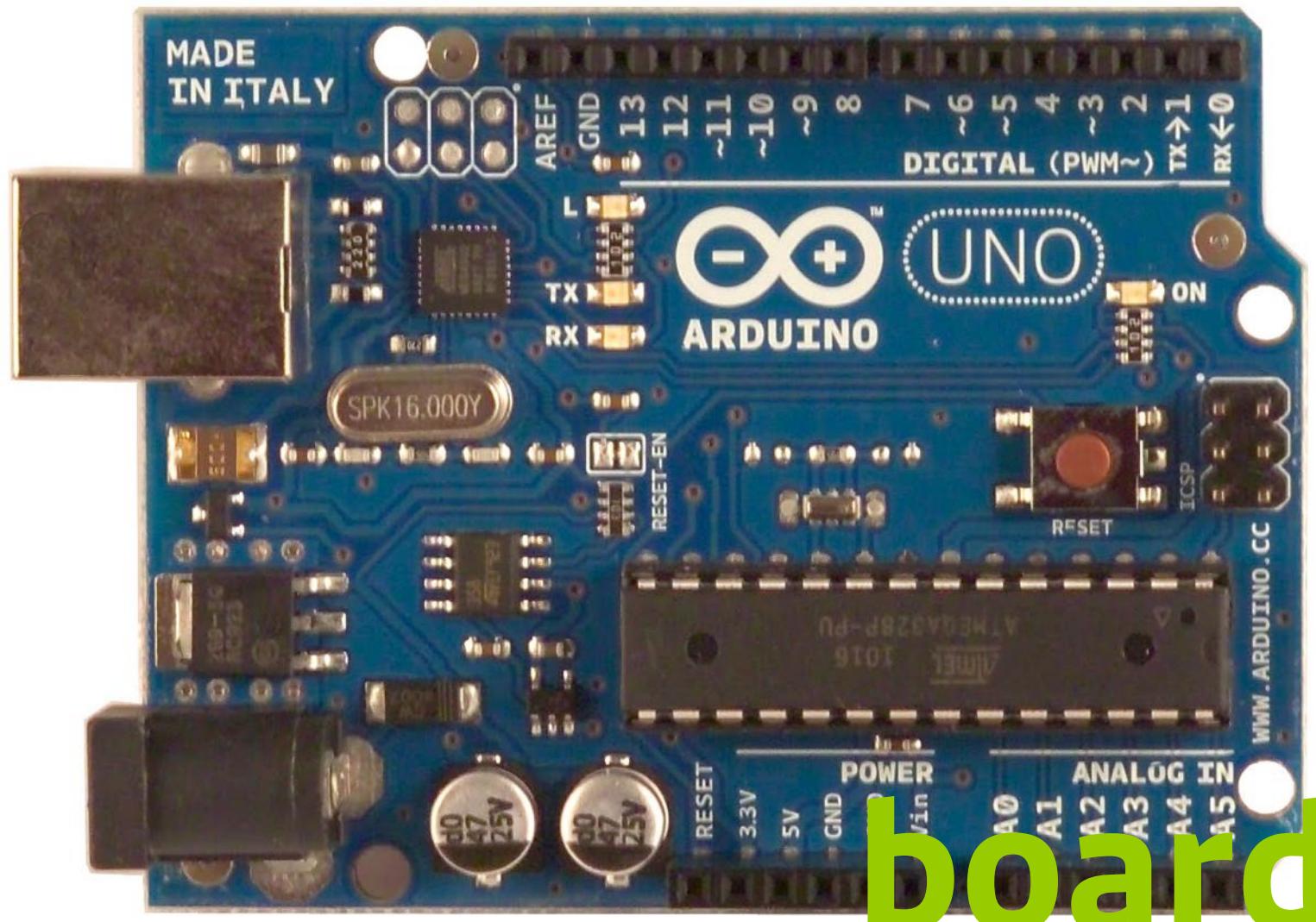


hint: pin "12" is a **digital pin**,
it outputs digital signal



hint: pin "11" is **PWM pin**,
It outputs analog signal.
(use this to control LED luminus

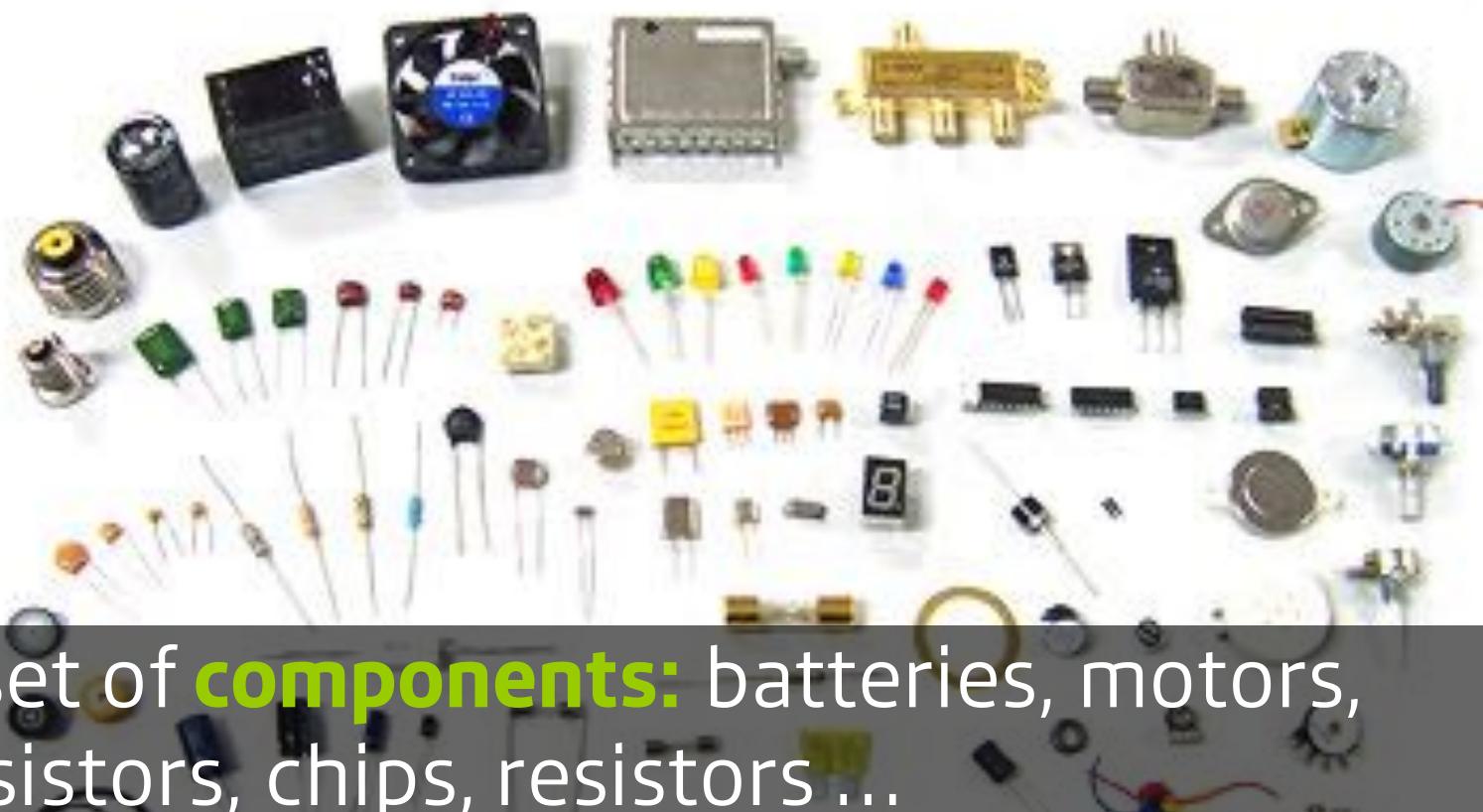
arduino basics revisited



board

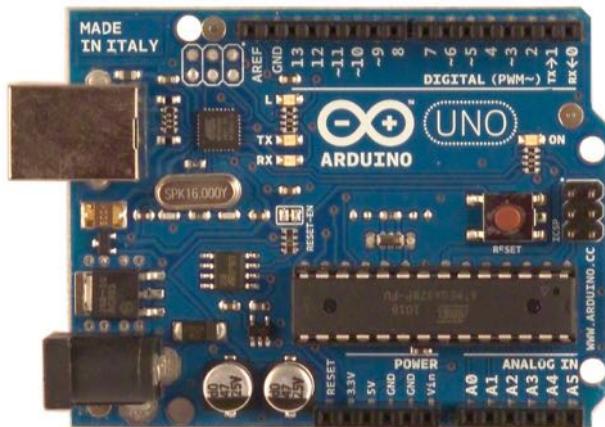
•microcontroller ::

- a small computer on a **single integrated circuit** containing a processor core, memory, and programmable input/output peripherals.
- **Program memory** in the form of NOR flash or OTP ROM is also often included on chip, as well as a typically **small amount of RAM**.
- Microcontrollers are designed for **embedded applications**, in contrast to the microprocessors used in personal computers or other general purpose applications.



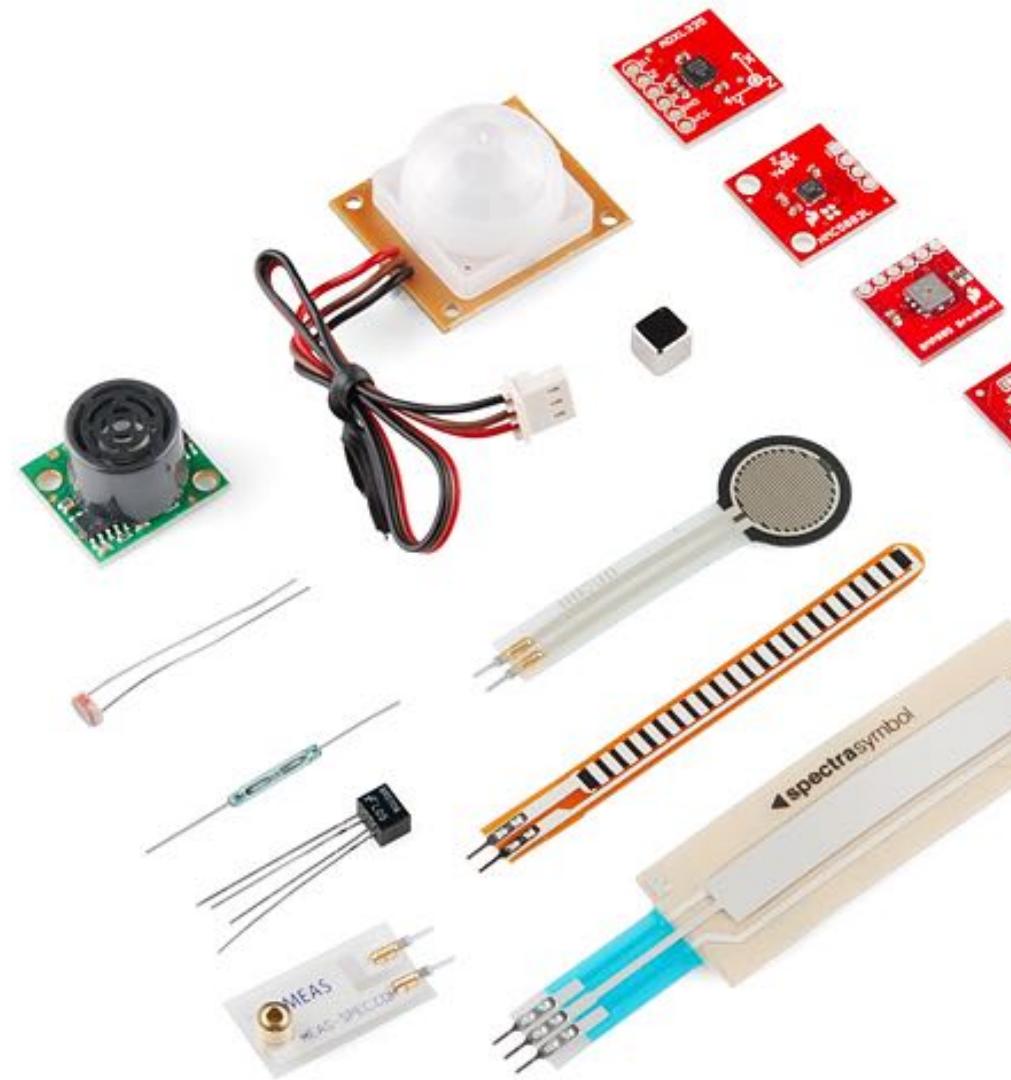
...and a set of **components**: batteries, motors, photoresistors, chips, resistors ...

computer



IO

Digital / Analog
Communication

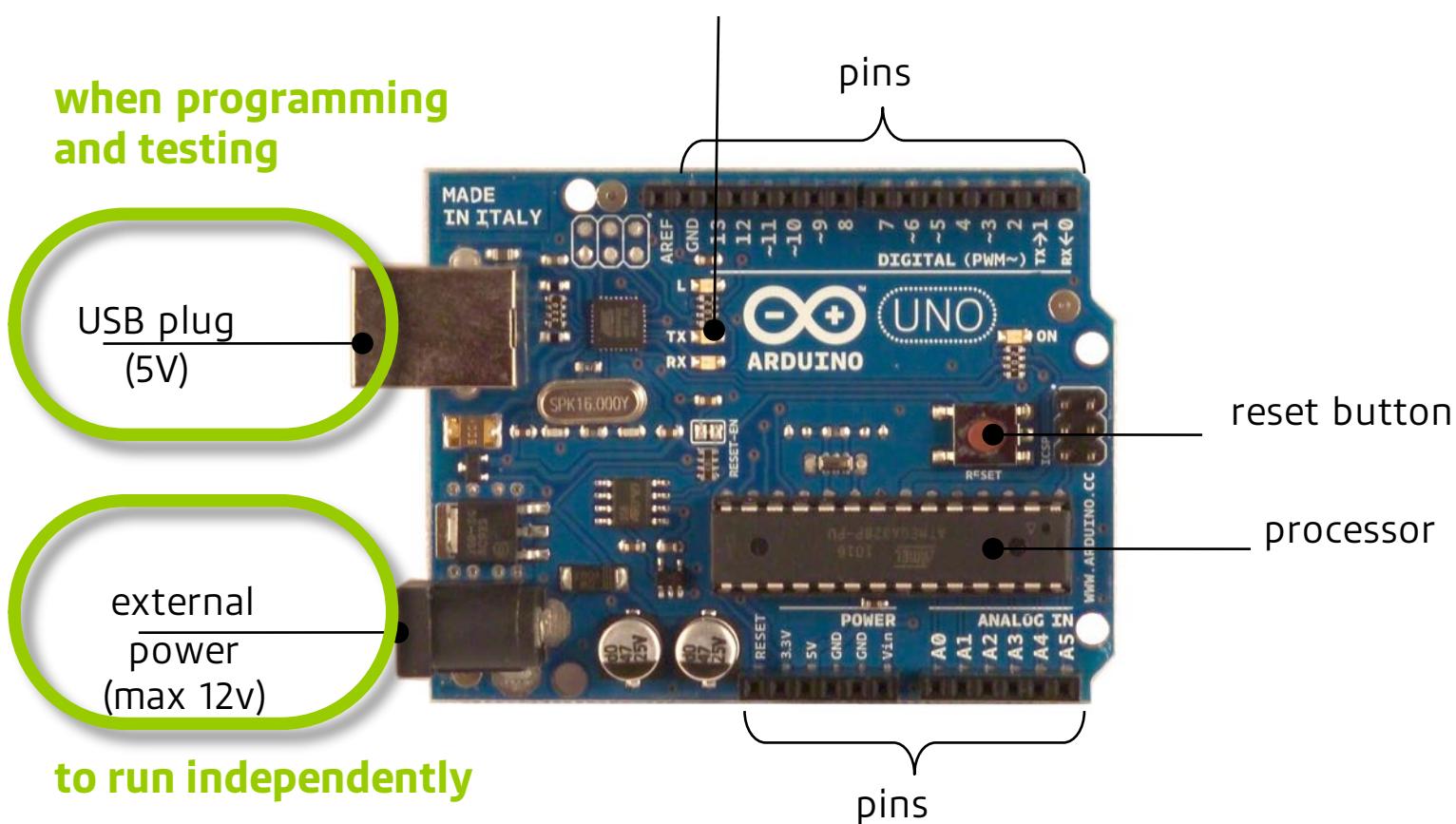


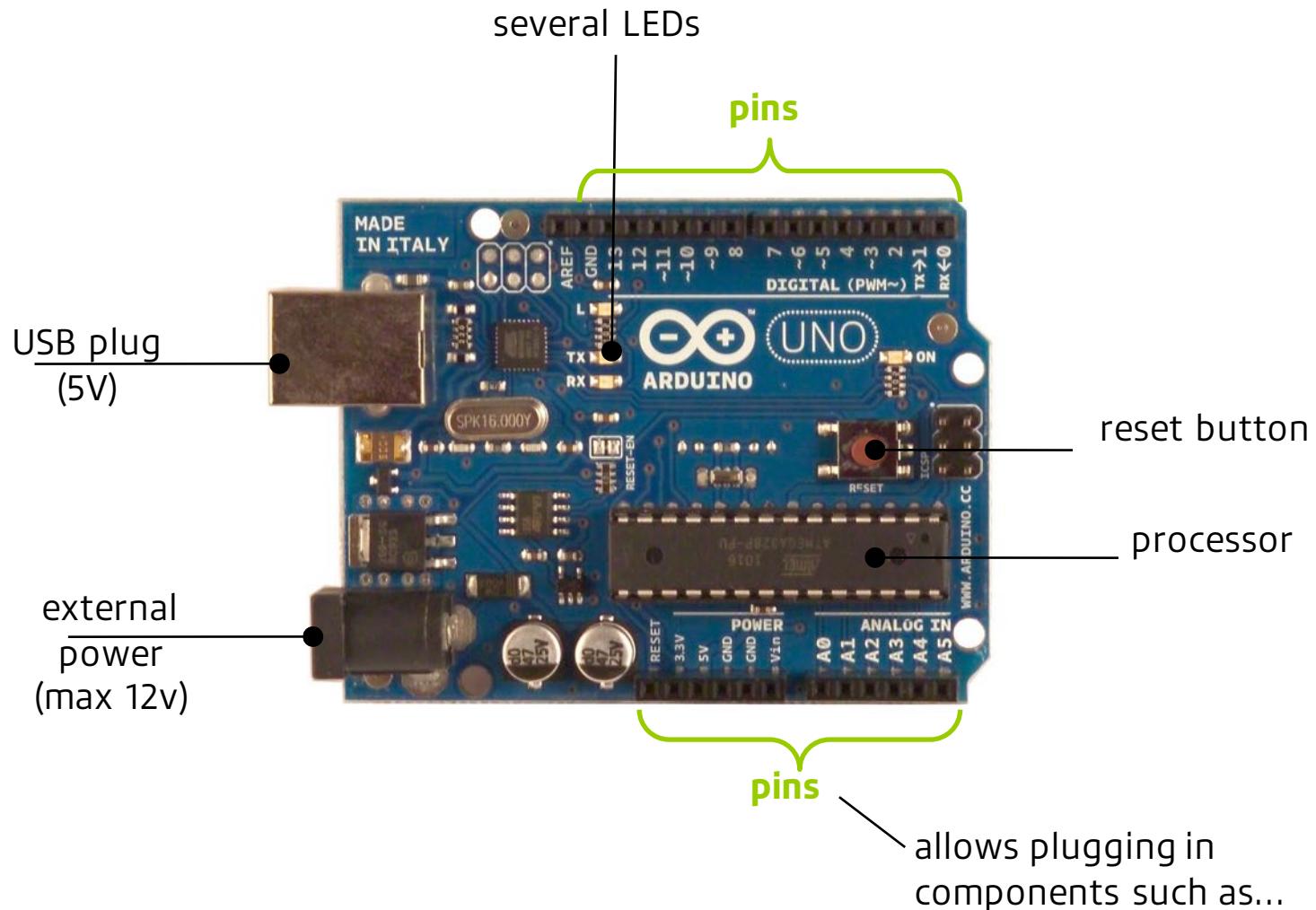
process:

1. program on PC (simplified C++)
2. upload to the board
3. separate and **run independently**

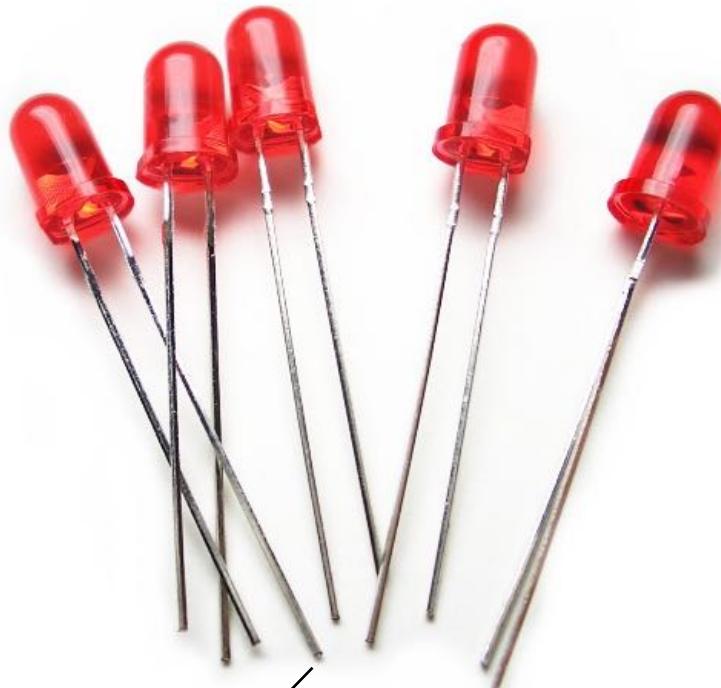
main advantage of Arduino

**when programming
and testing**

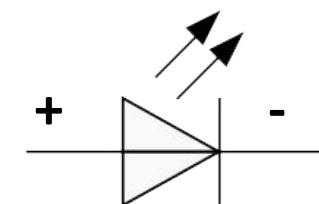


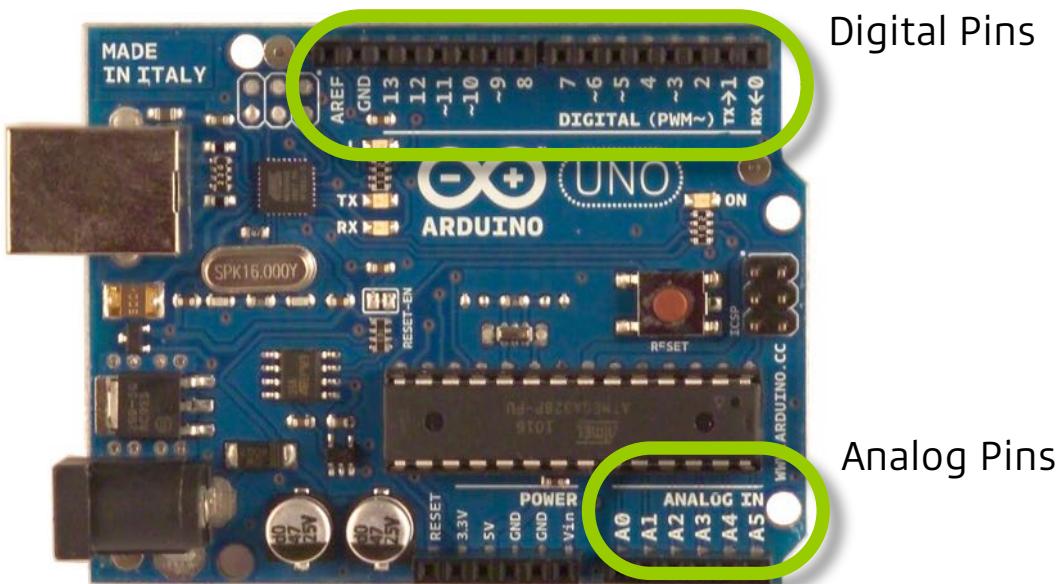


LEDs



long leg is ‘+’





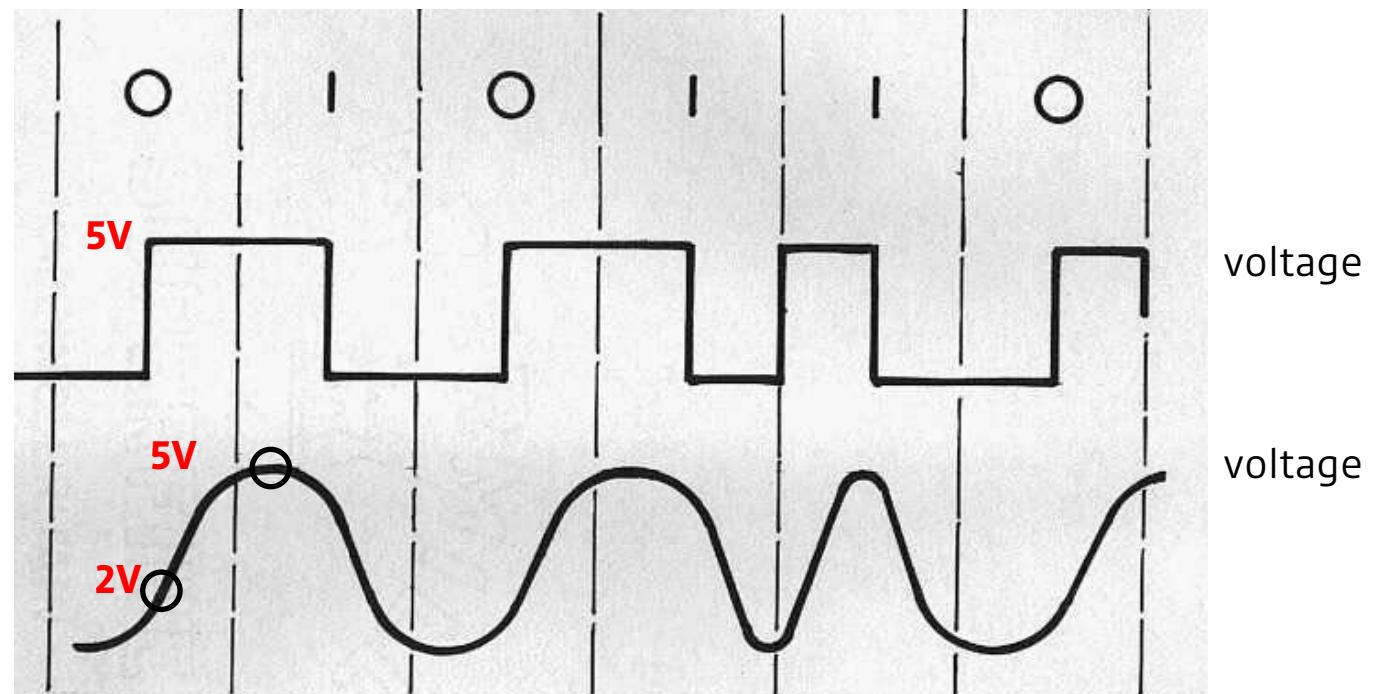
both digital and analog pins deal with voltages

reading input allows reading the state of components
that generate a voltage

Digital vs. Analog

Digital: 0 / 1
(0V / 5V)

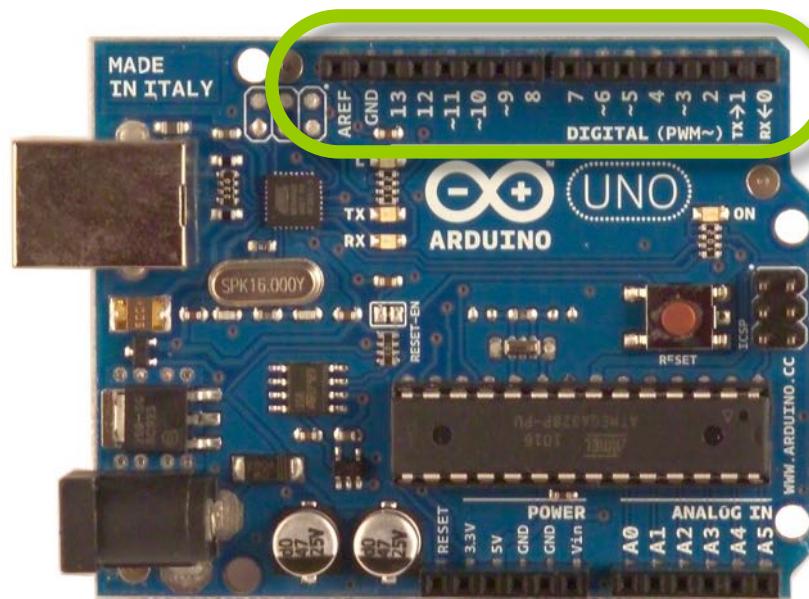
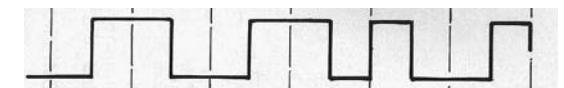
Analog: [0, 5V]



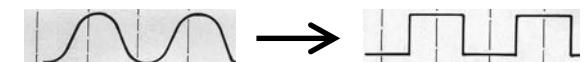
digitalWrite("pin number","HIGH or LOW")

digitalRead("pin number") -> 1 or 0 (0 if voltage < 3v)

digital pins output 0/1
(e.g., 0 / 5V)

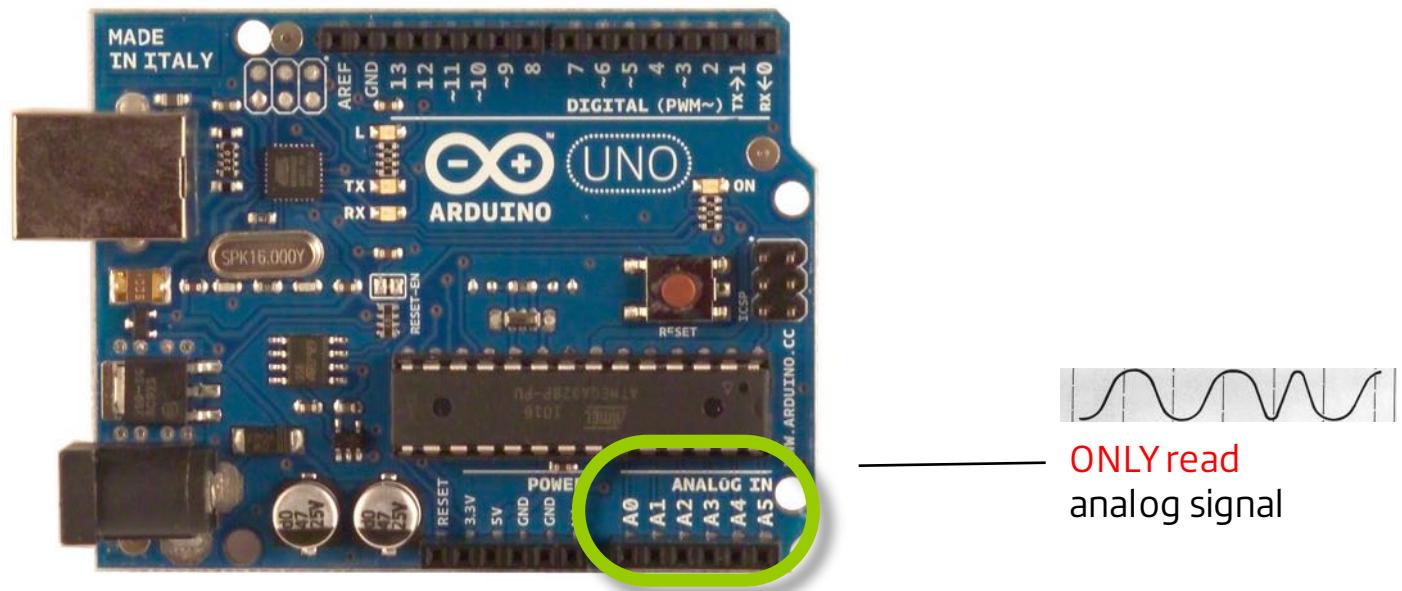


Feeding digital pins with
analog signal,
it converts that into digit (e.g., 0/1)
:: 0 if voltage < 3v

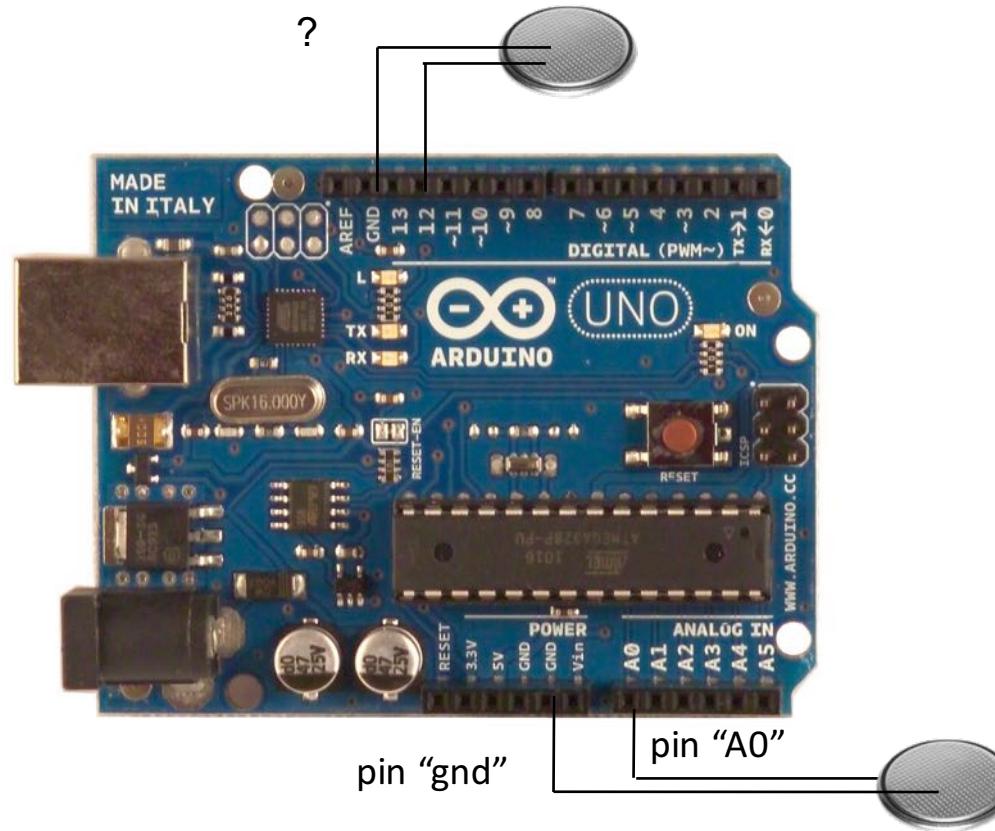


digital pins are **input and output**

analogRead("pin number") -> [0;1023]
(1023 being 5v = the maximum voltage in the board)

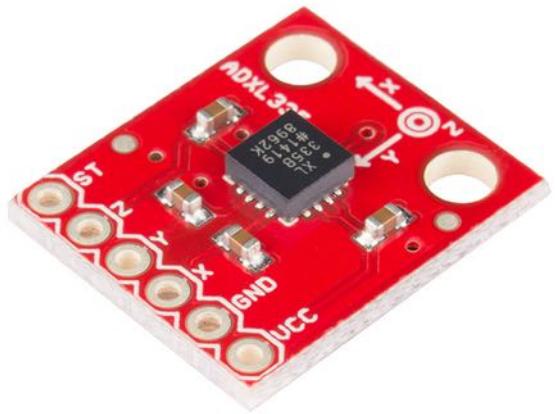


analog pins are **analog input only**

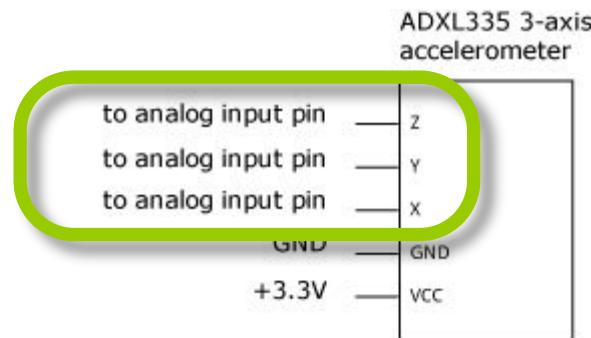


1.5V battery on A0 pin to **read its voltage**

(careful: high voltages can **damage the board**)

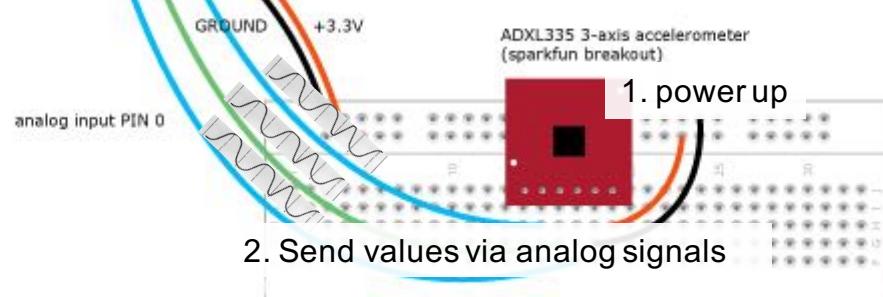


SPARKFUN TRIPLE AXIS
ACCELEROMETER BREAKOUT -
ADXL335



NOTE: +3.3V is required for this device.
Using 5V will cause permanent damage to
the component. A +3.3V pin is available on
the latest Wiring boards.

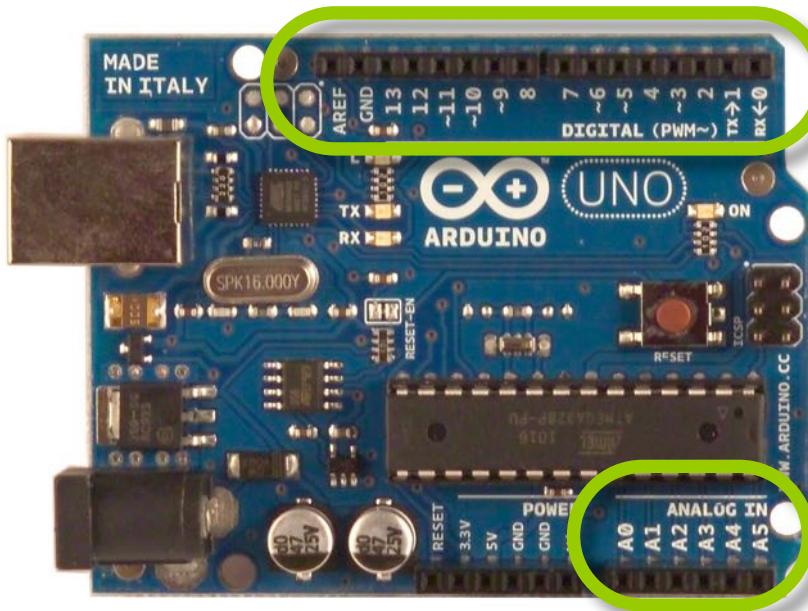
For previous boards use a 3.3V power
regulator, for an example please check
Learning / Topics / Power regulators.



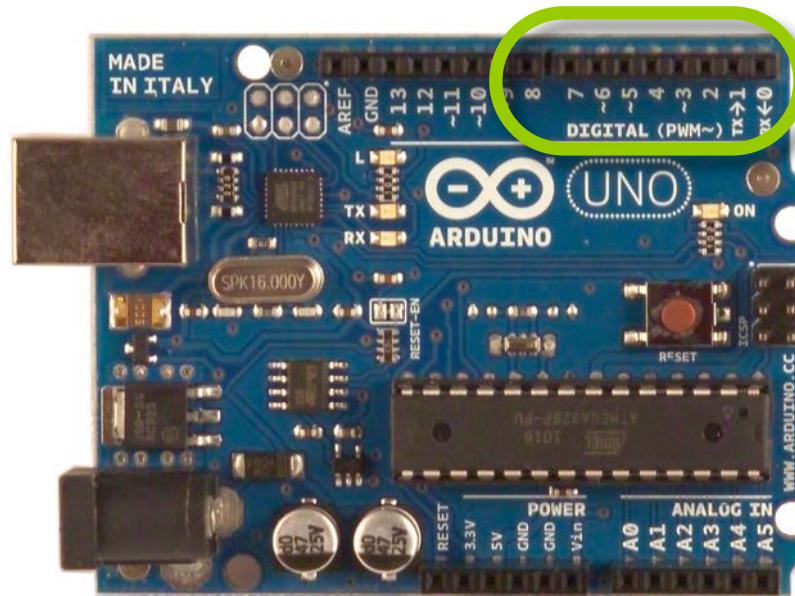
arduino doesn't do
real analog output,

It **simulates** analog output using
special digital pins, called **PWM** pins.

where is analog write?



`analogWrite("pin number", [0;255])`



Use **PWM** pins (~)
to **write**
analog output

PWM pins are **analog output only**



delay(1000) ... delay(1000)

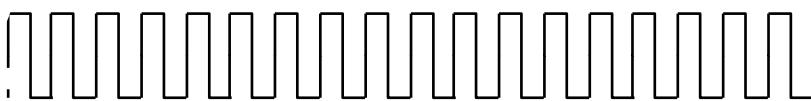


blink

bright



delay(1) ... delay(1)



less
bright



delay(1) ... delay(10)



even less
bright



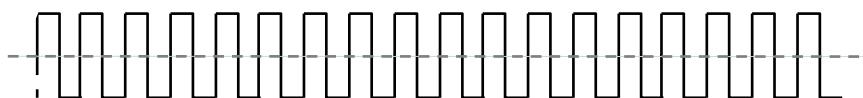
delay(1000) ... delay(1000)



voltage is either 0 or 5v



delay(1) ... delay(1)



voltage is 5V half the time



delay(1) ... delay(10)



voltage is 5V 1/11 of time

pulse width modulation ::

technique using a rectangular pulse wave whose pulse width is modulated resulting in the variation of the average value of the waveform

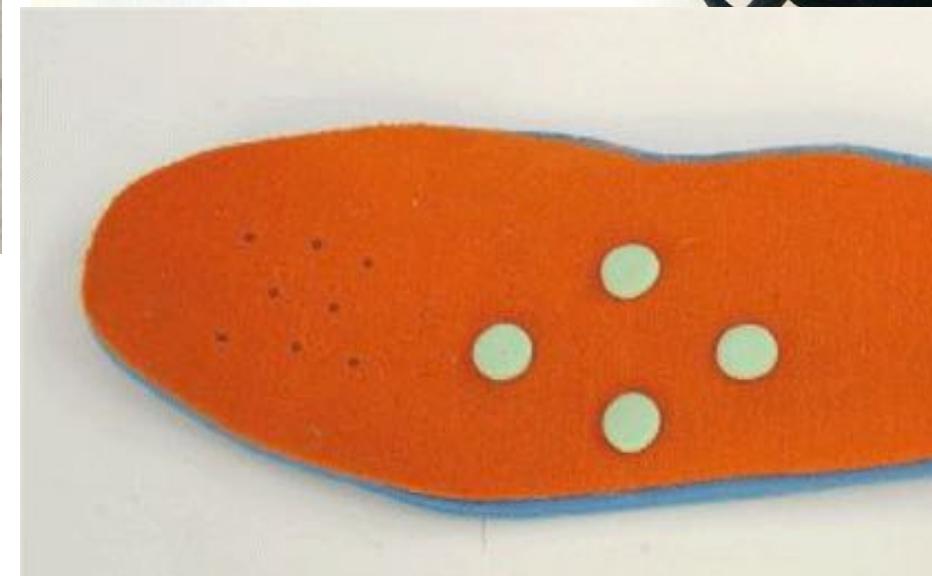
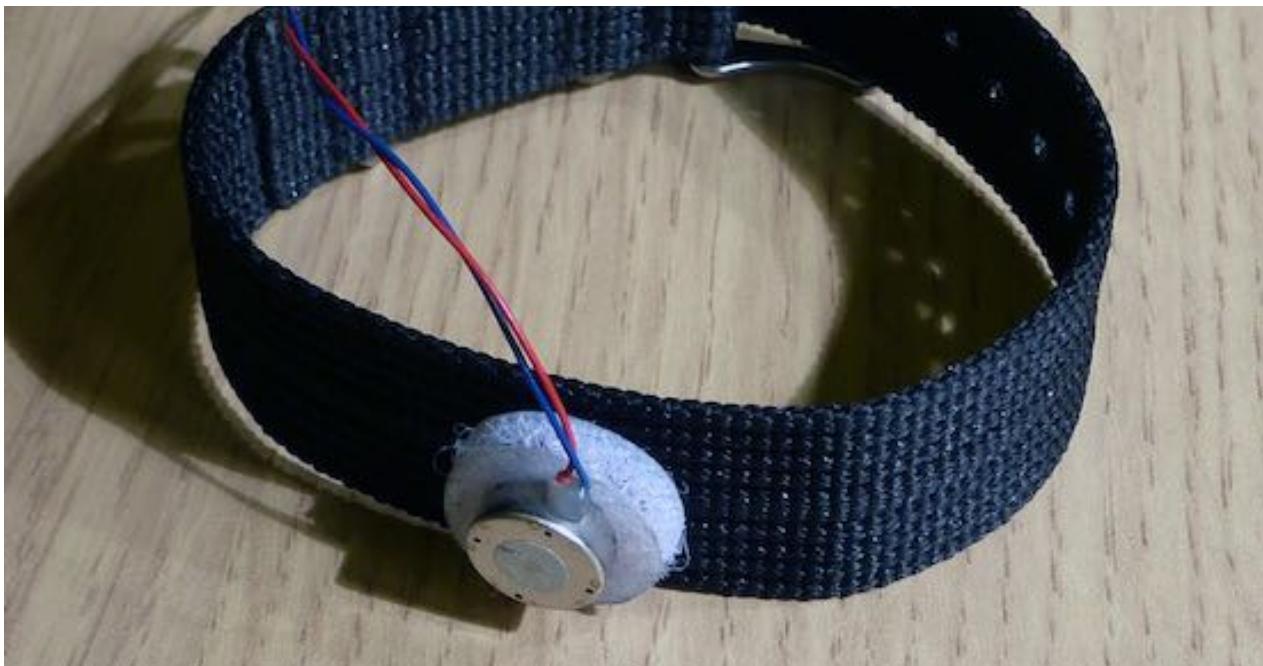
it serves to create an **analog** signal from a **digital** one

When do we need analog output (e.g., PWM pins) ?

when talking to actuators
that respond with changes in voltage.

such as... (small) LED, Vibrator, Speaker.

Vibrotactile actuator



Beyond arduino basics

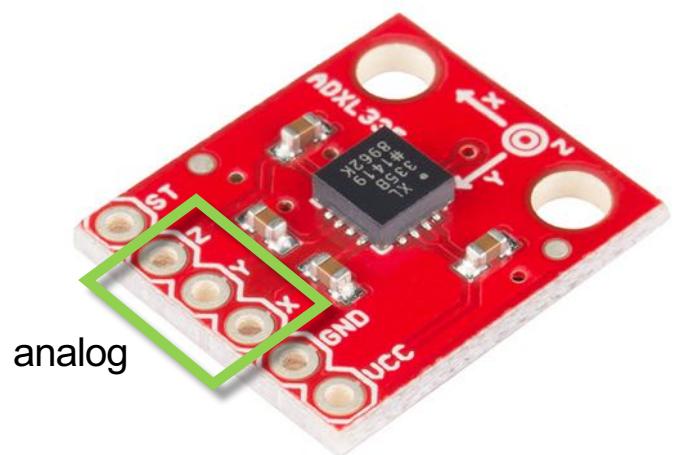
I2C

H-Bridge

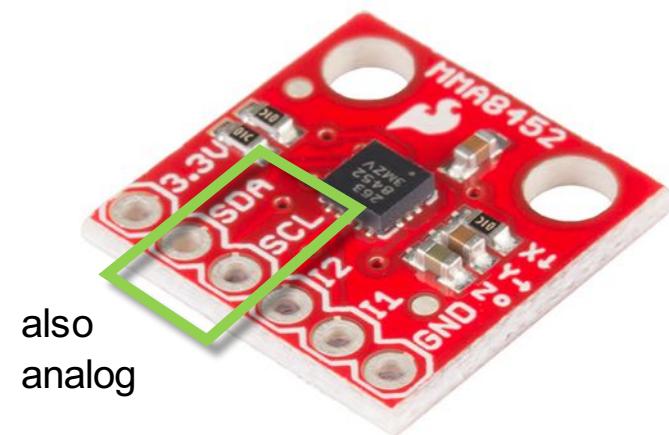
Multiplexer

I₂C

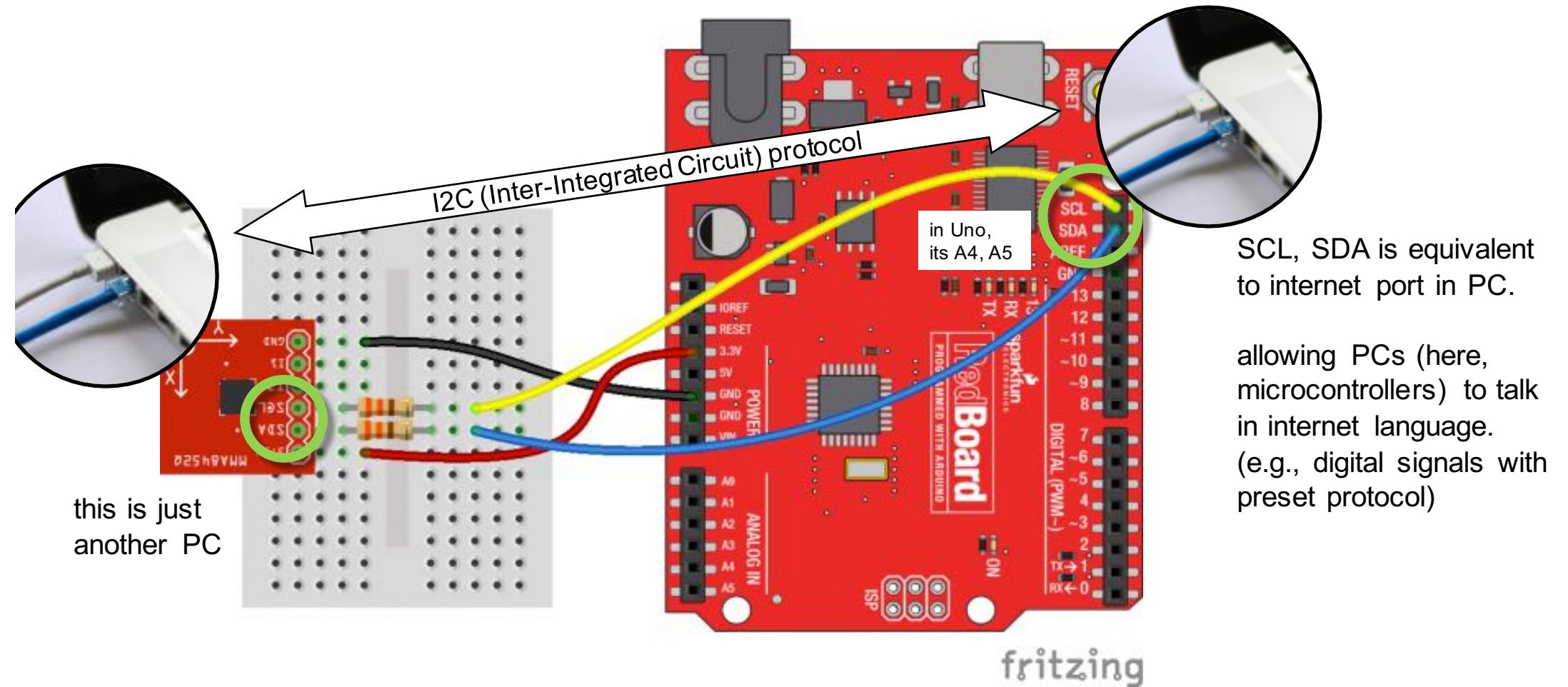
Inter-integrated circuit

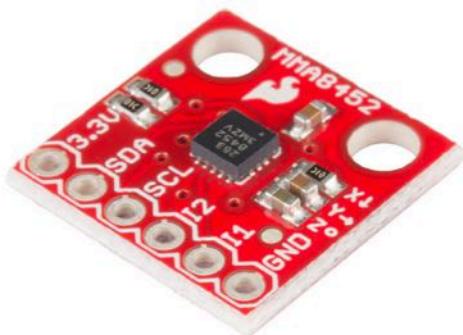


SparkFun Triple Axis
Accelerometer Breakout -
ADXL335



SparkFun Triple Axis
Accelerometer Breakout -
MMA8452Q





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SparkFun Triple Axis Accelerometer Breakout - MMA8452Q

SEN-12756 ROHS ✓ #

★★★★★ 6

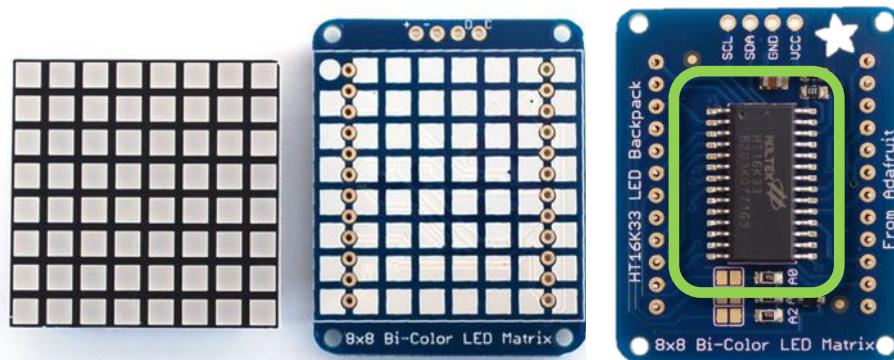
Description: This breakout board makes it easy to use the tiny MMA8452Q accelerometer in your project. The MMA8452Q is a smart low-power, three-axis, capacitive MEMS accelerometer with 12 bits of resolution. This accelerometer is packed with embedded functions with flexible user programmable options, configurable to two interrupt pins. Embedded interrupt functions allow for overall power savings relieving the host processor from continuously polling data.

The MMA8452Q has user selectable full scales of $\pm 2g/\pm 4g/\pm 8g$ with high pass filtered data as well as non filtered data available real-time. The device can be configured to generate inertial wake-up interrupt signals from any combination of the configurable embedded functions allowing the MMA8452Q to monitor events and remain in a low power mode during periods of inactivity.

This board breaks out the ground, power, I₂C and two external interrupt pins.

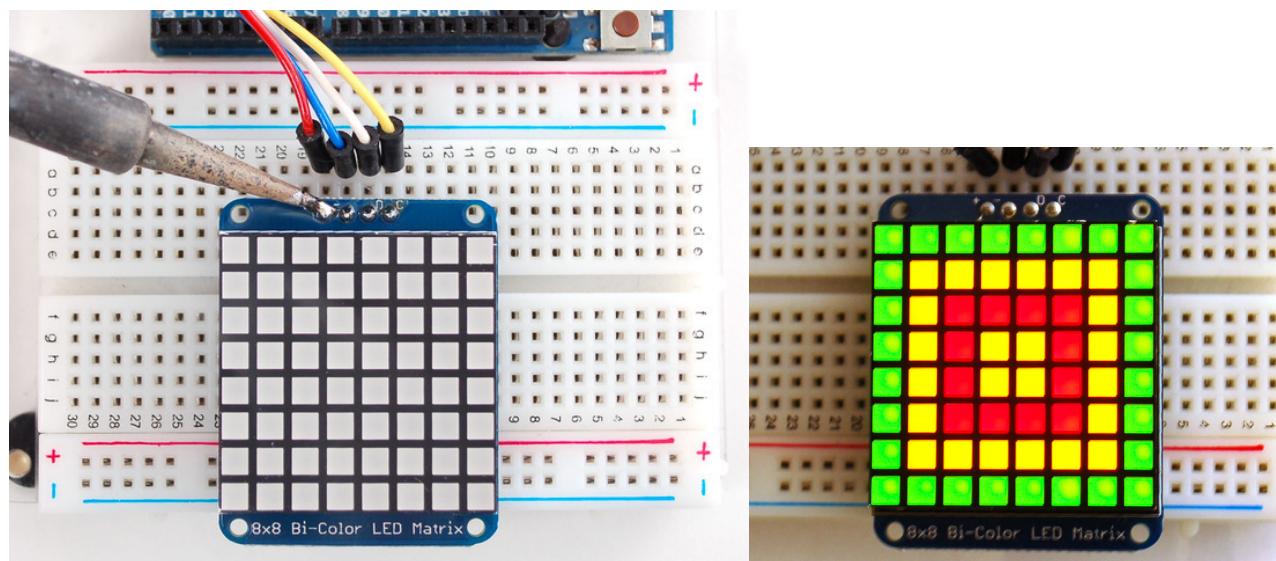
Allows to talk to it

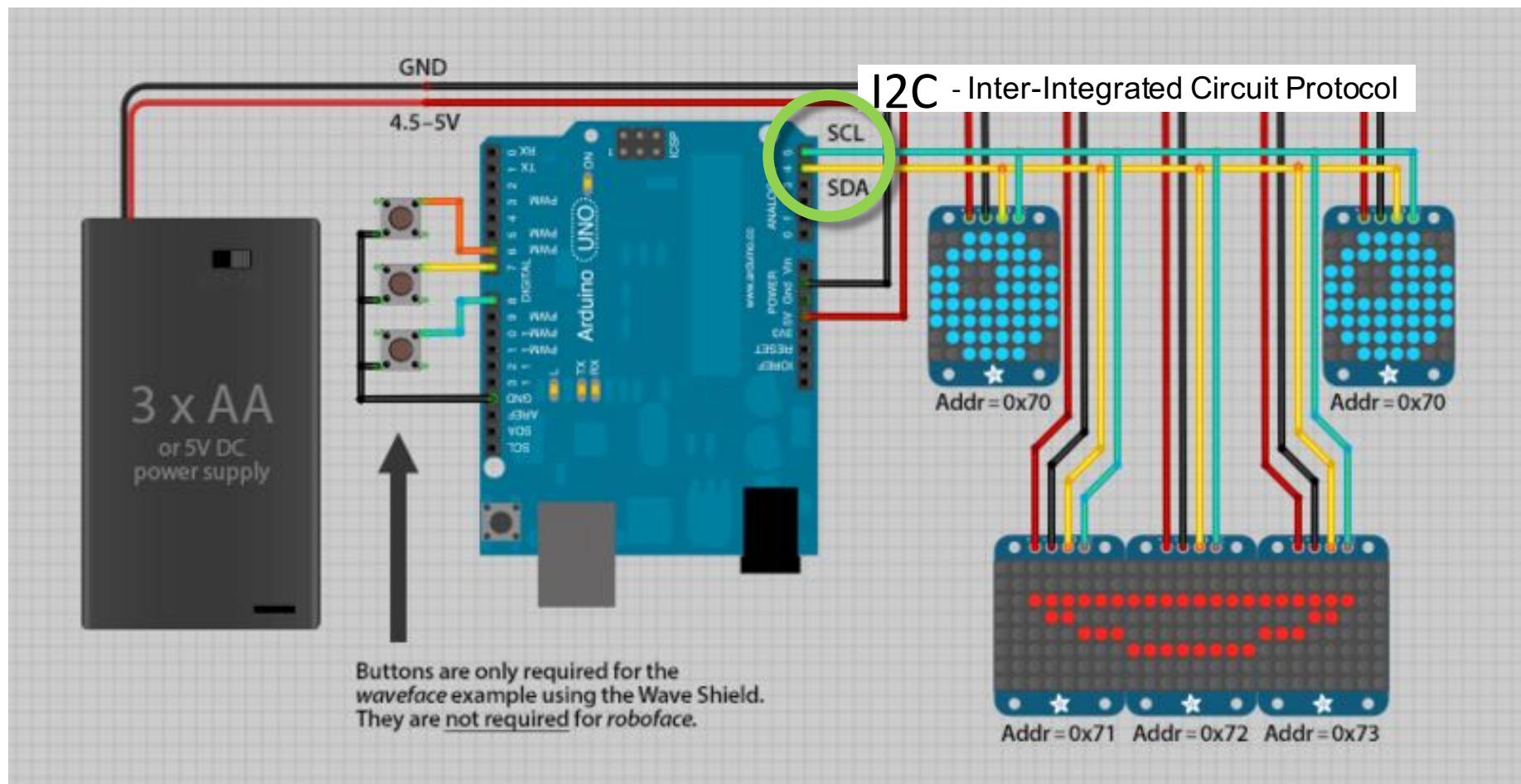
Adafruit Bi-Color
8x8 Matrix

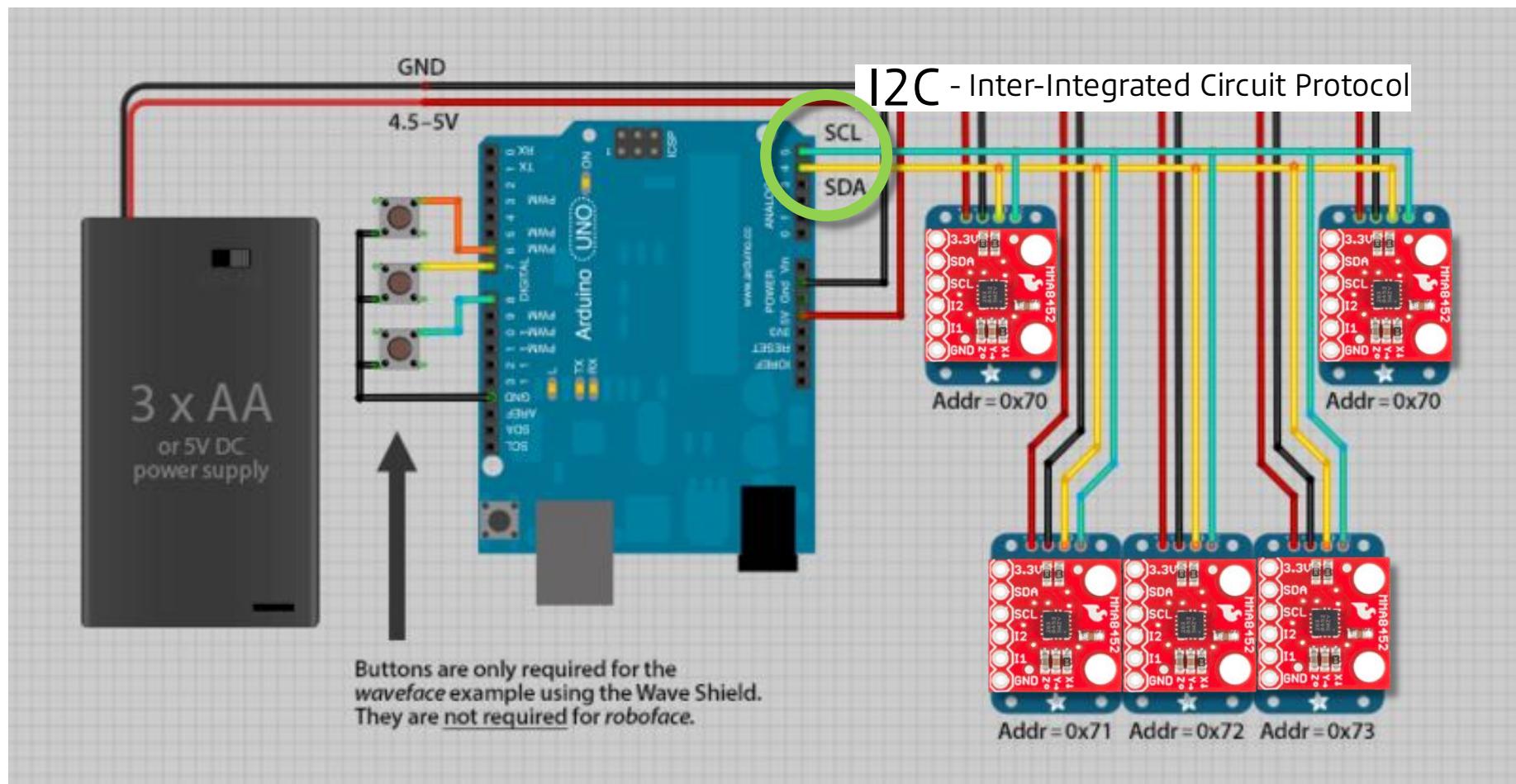


Integrated-circuit
(e.g., should be understood
as a PC)

using only SCL, SDA pins
to control individual pixels

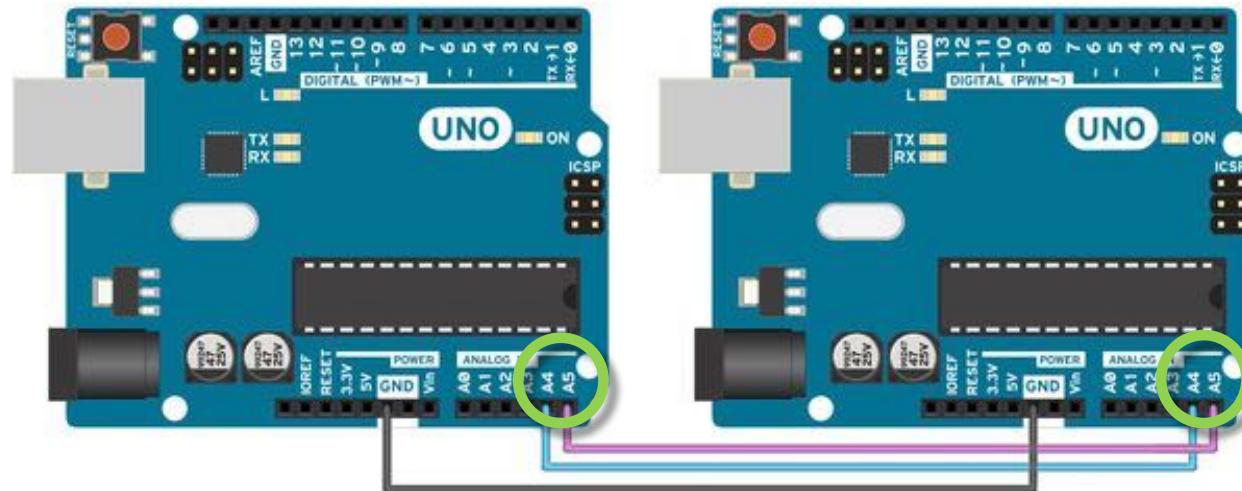




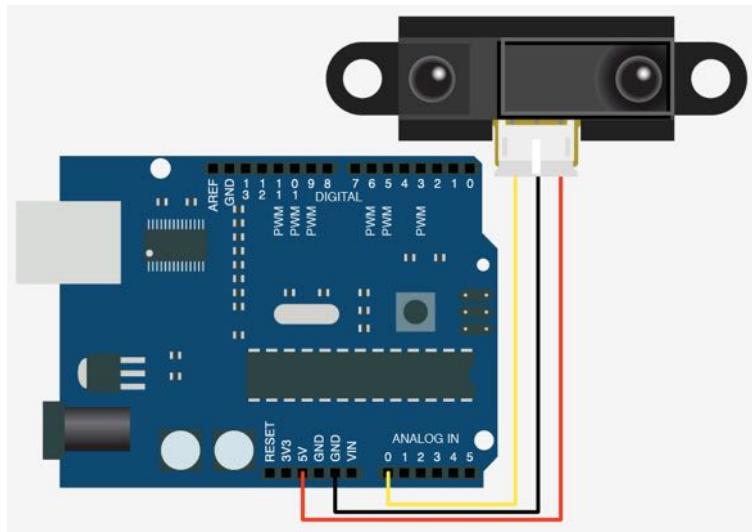


(careful: **delay** due to limited bandwidth)

Connecting Arduinos using I2C

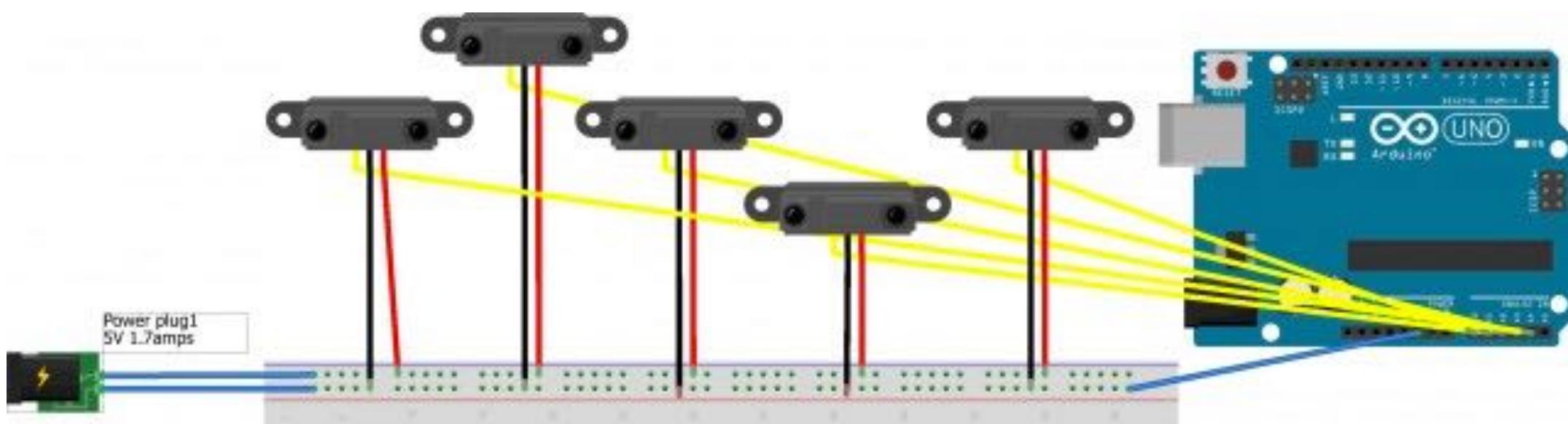


Multiplexer



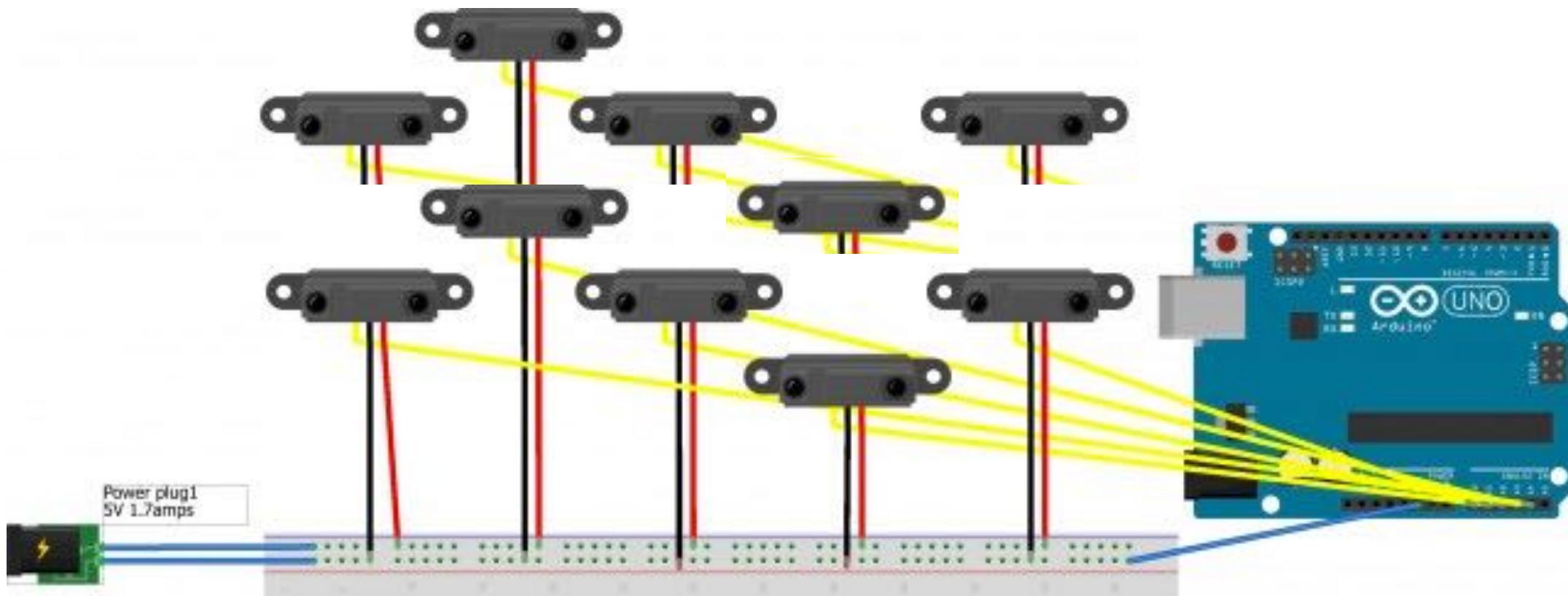
distance sensor that takes away one analog pin.

arduino can deal with 5 such sensors with its 5 analog pins



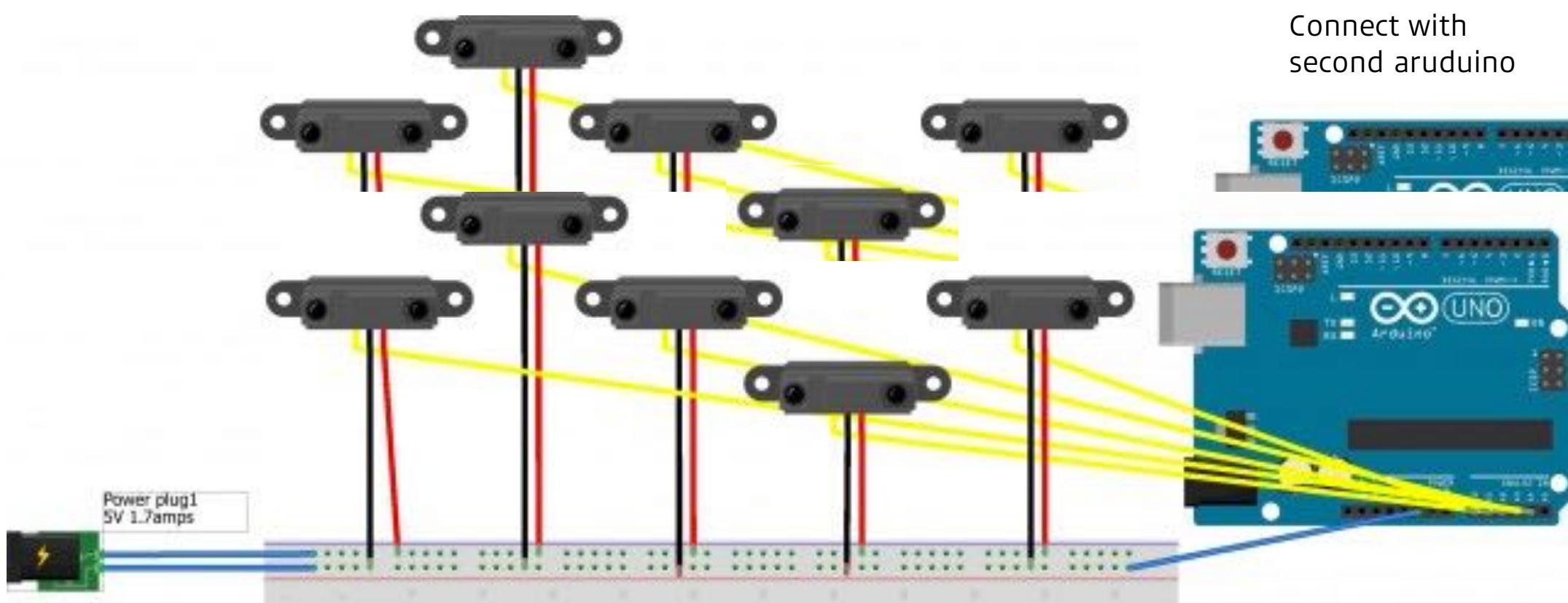
arduino can deal with 5 such sensors with its 5 analog pins

what if you need more than 5 ?

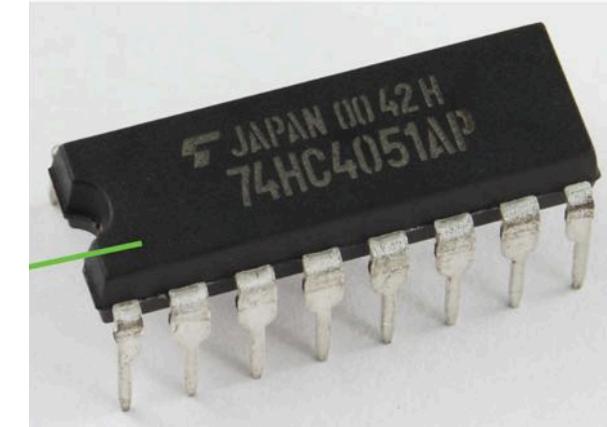


arduino can deal with 5 such sensors with its 5 analog pins

what if you need more than 5 ?

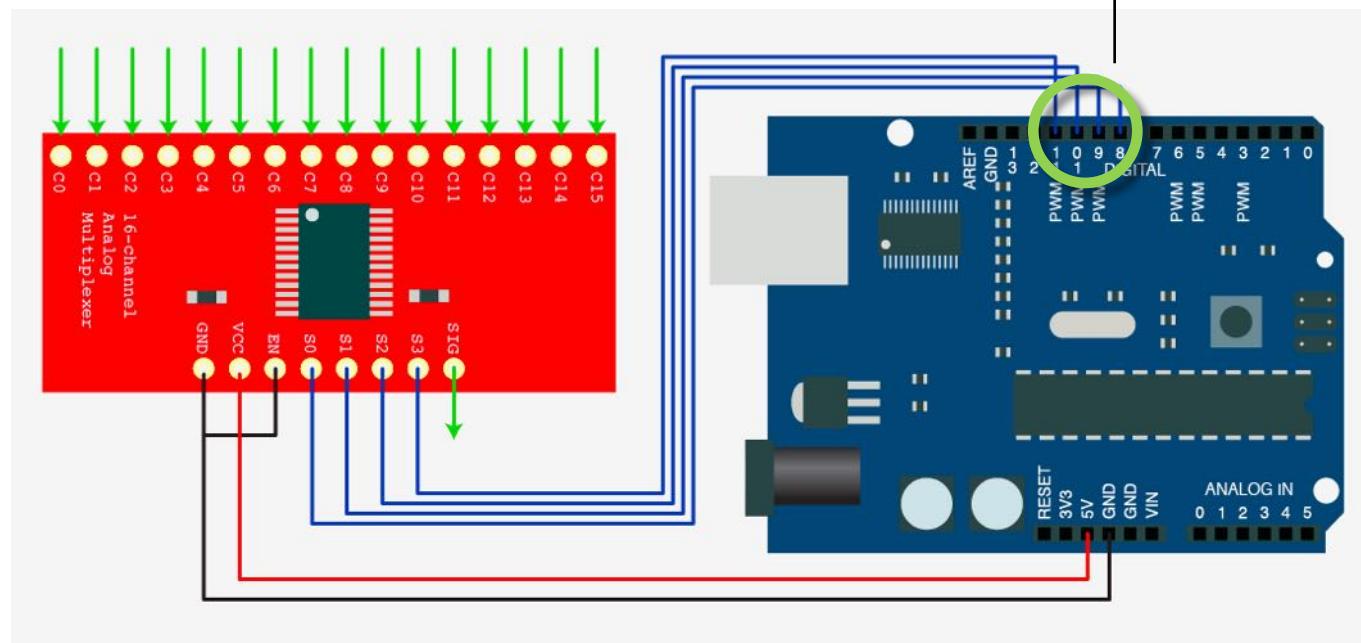


Multiplexer

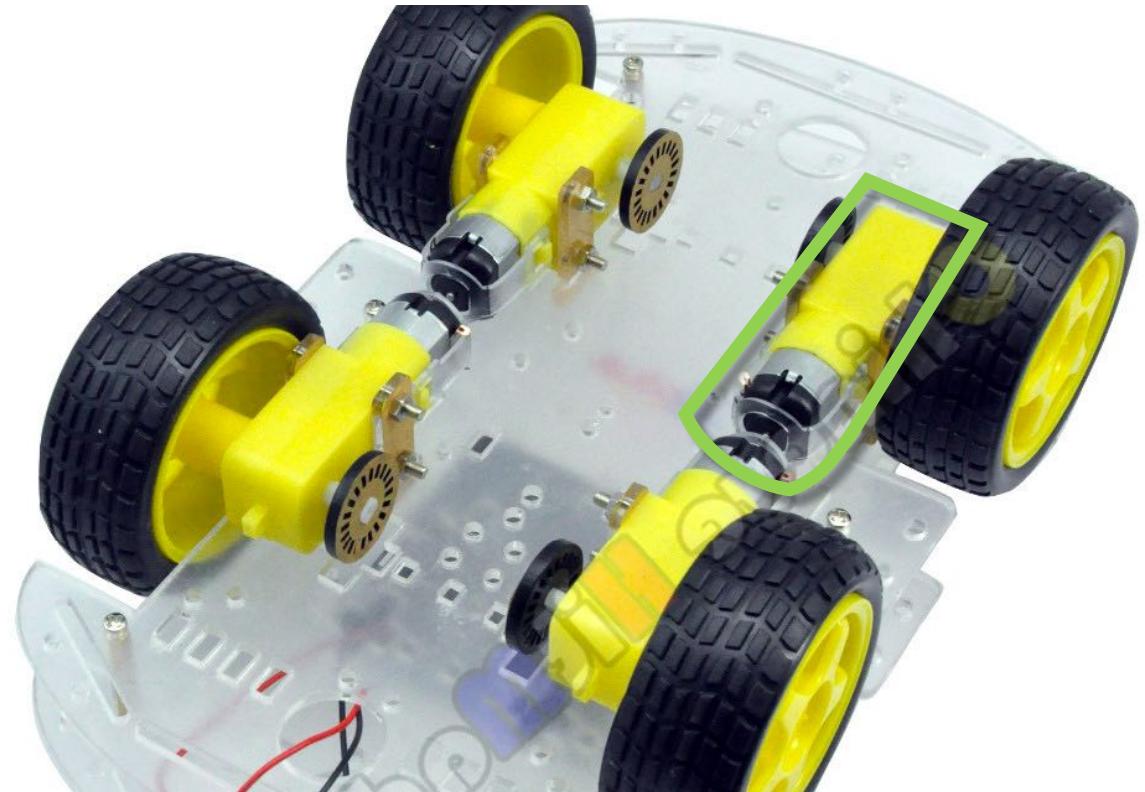


a device that selects one of several analog or digital input signals and forwards the selected input into a single line

use 4 digital pins to
exchange for 16 pins



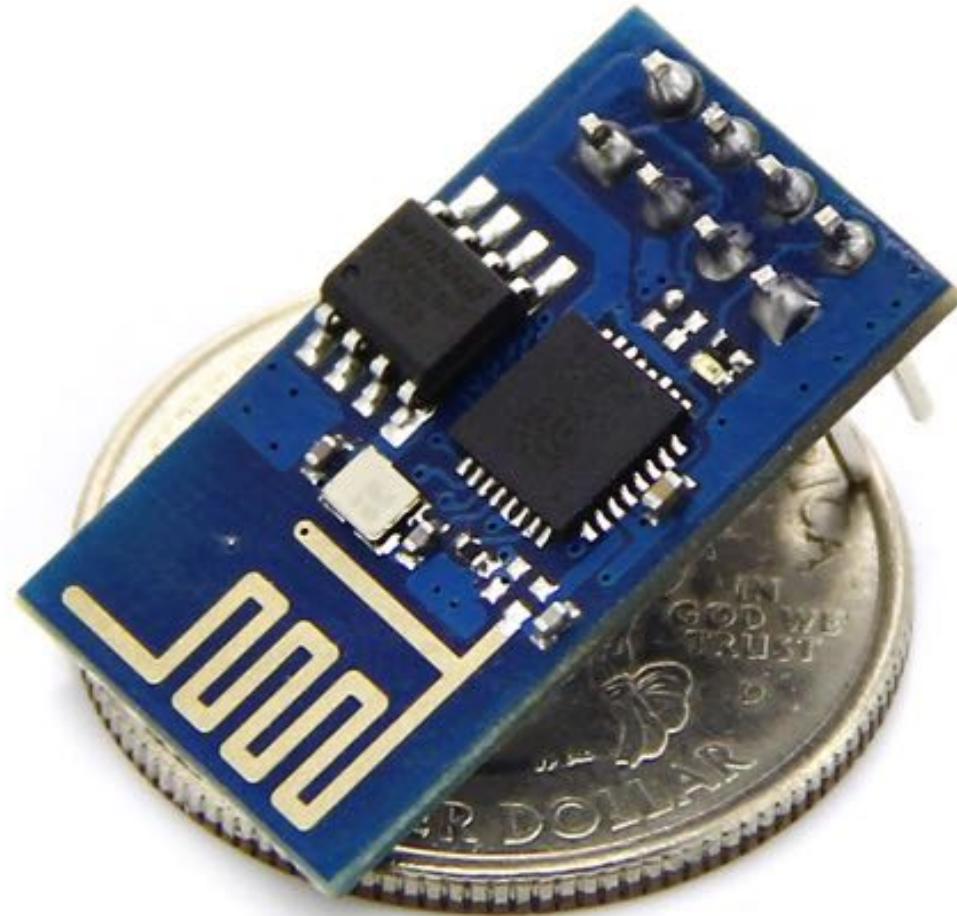
we will cover this part
when using thermo actuators

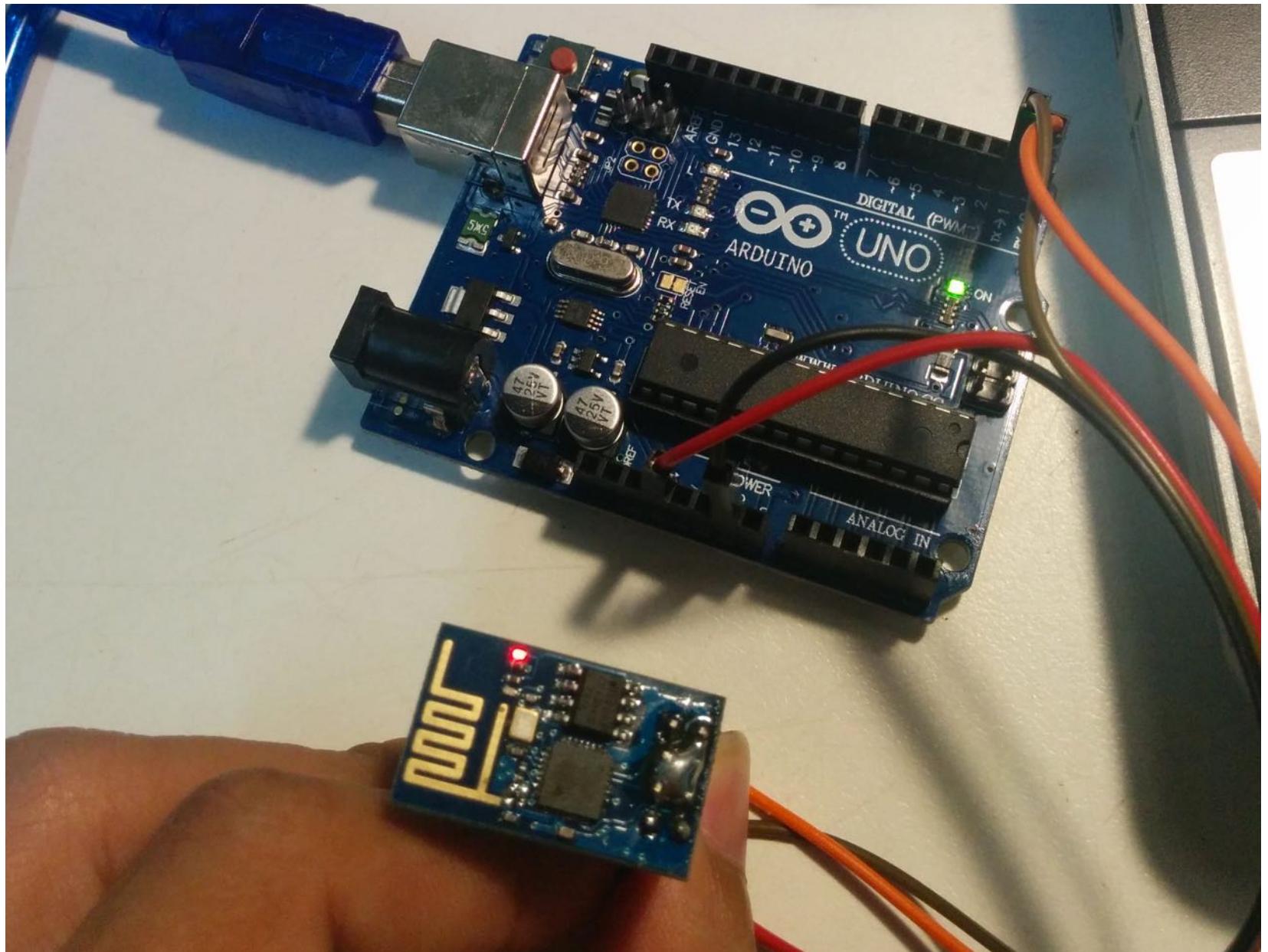


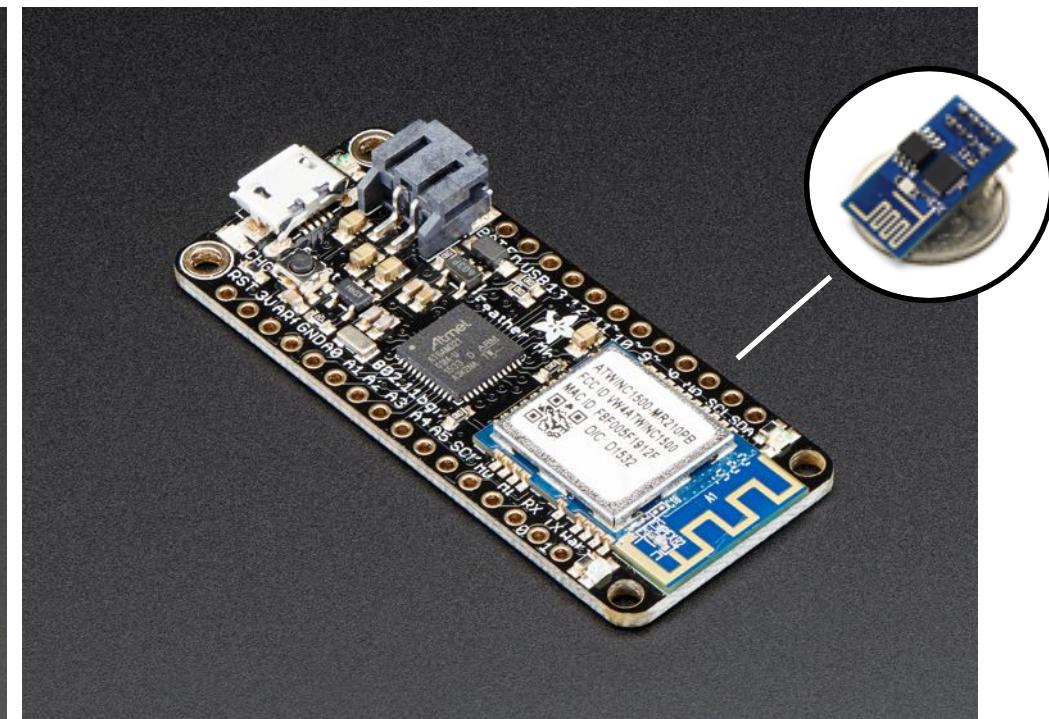
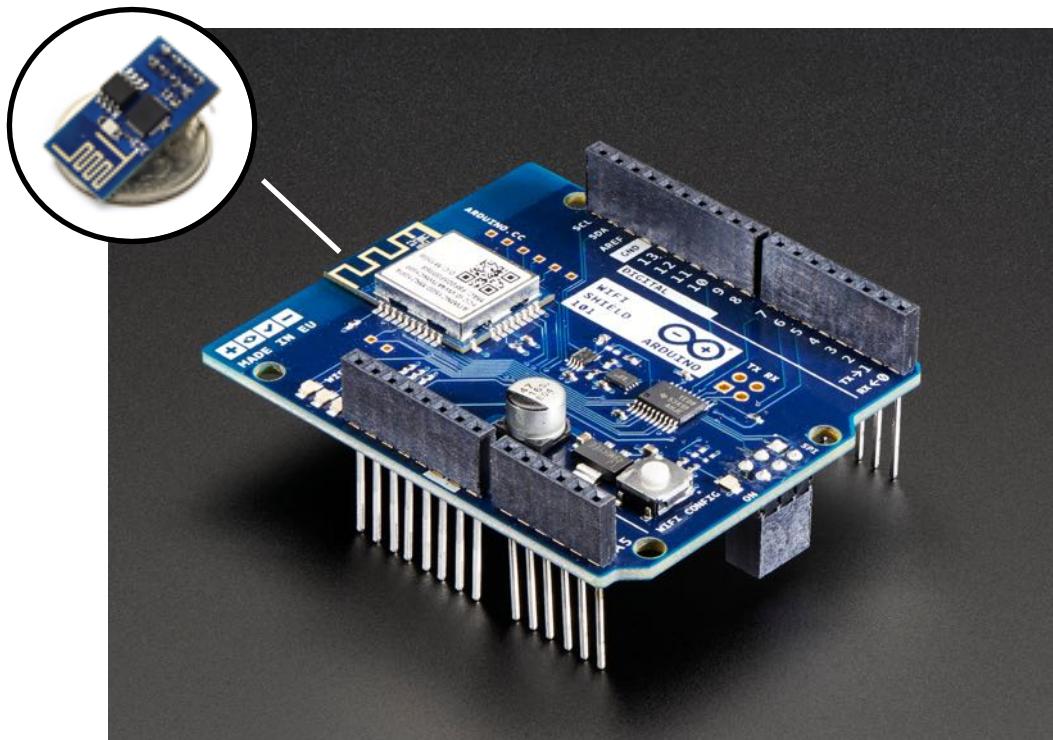
H-Bridge

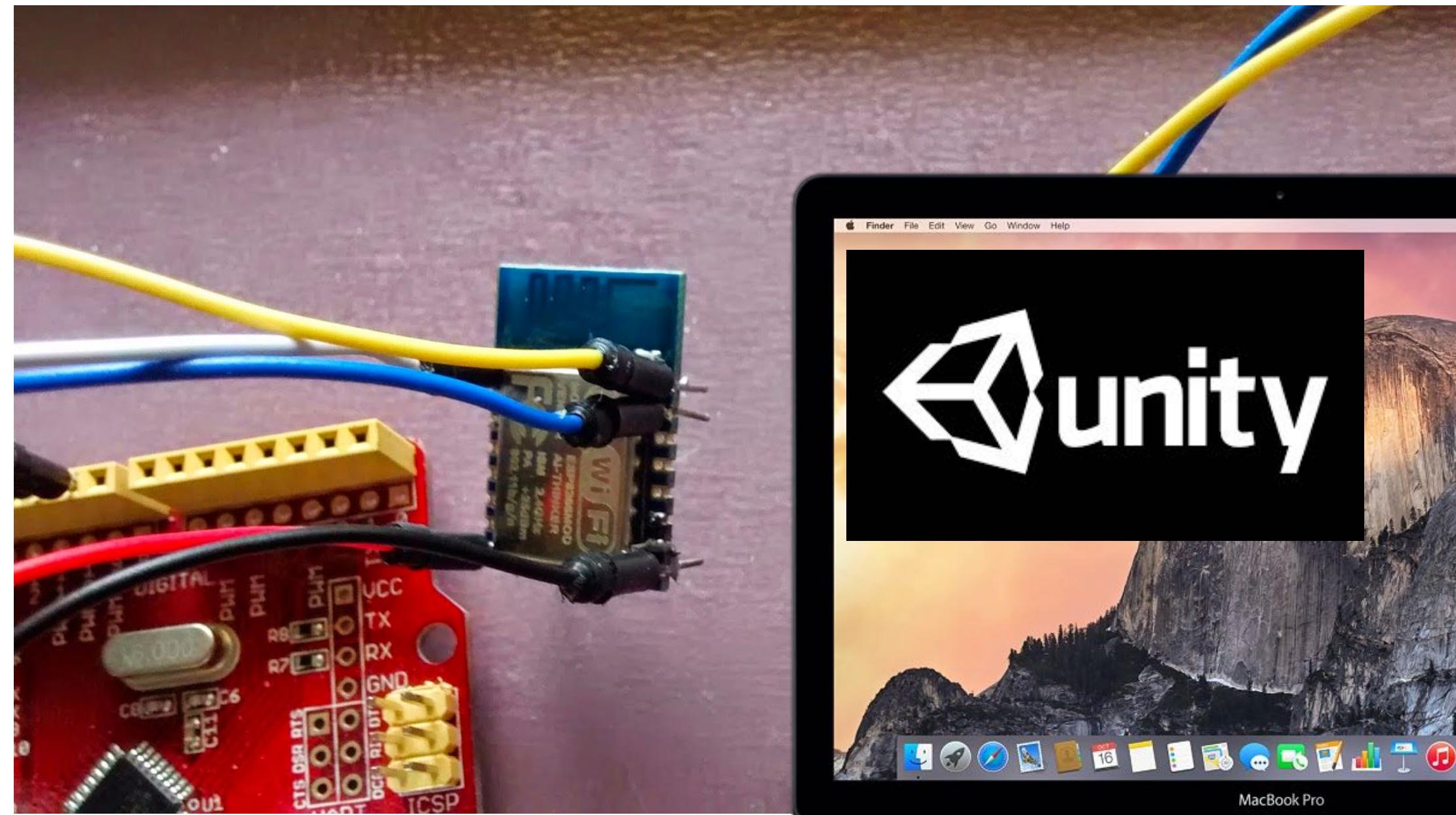
control external high-voltage power (e.g., 24V) using
low-voltage signal (e.g., 5V from Arduino)

Wireless









assignment

create passive tangible
interface for VR

due in
three
weeks

