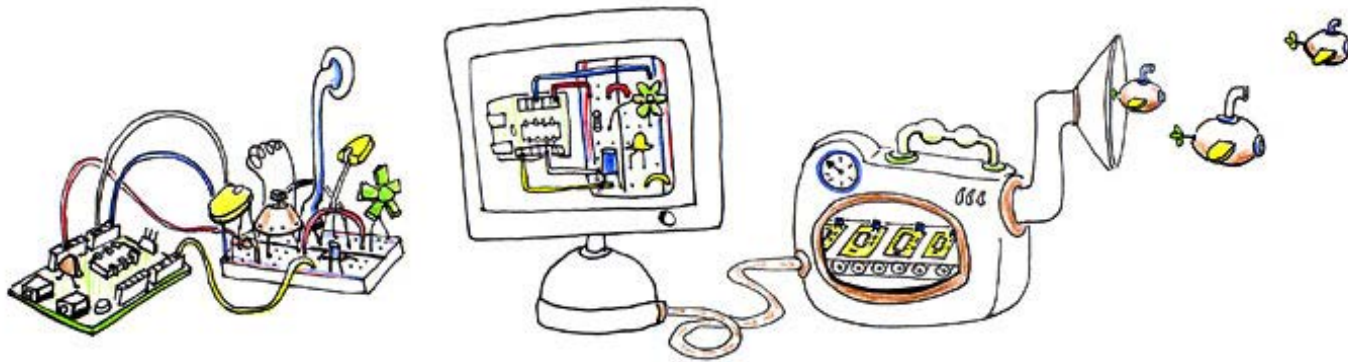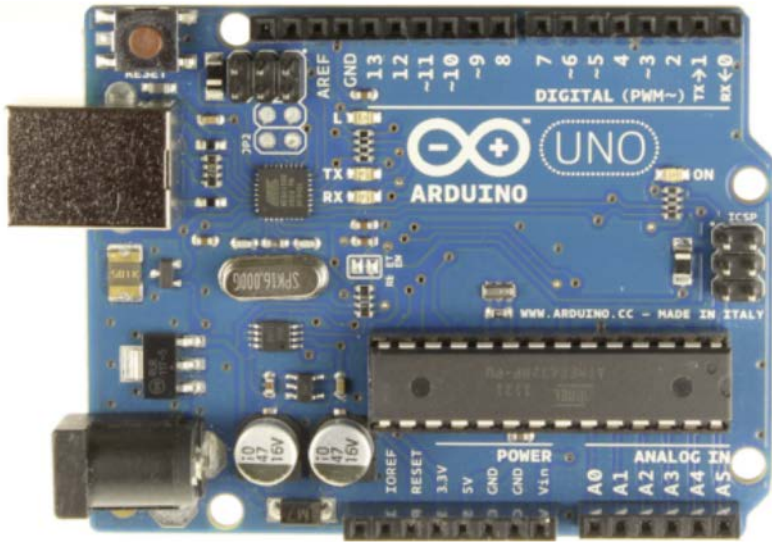# Arduino

part 1: the beginning

Labs and supporting material were devised in
collaboration with Camille Moussette - Umeå Institute of
Design. Core assignment is adapted with permission
from Mousette's August 2011 workshop at UBC.

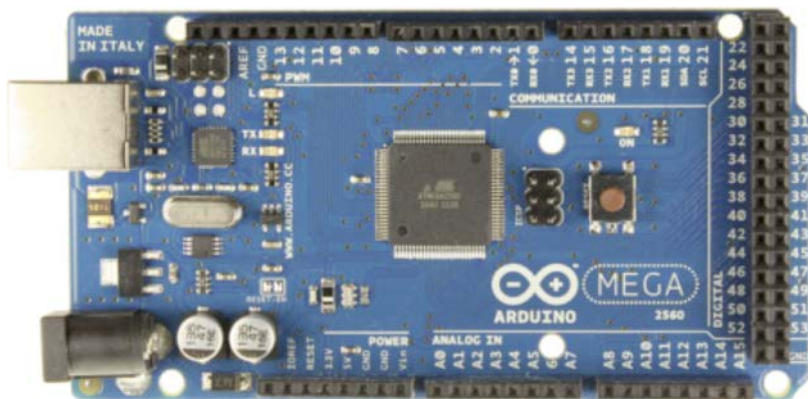image from Fritzing.org

What is Arduino?

- Arduino Board (I/O device with microcontroller)
- Arduino IDE (programming application)
- Open Source hardware + community
- http://www.arduino.cc

- Many variations

Arduino Family (ever changing!)

Uno + Arduino software
= official reference designs

Lilypad
wearables

Mini
tiny jobs
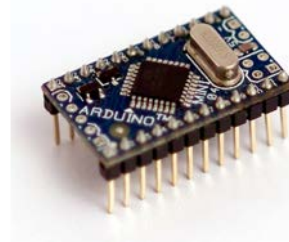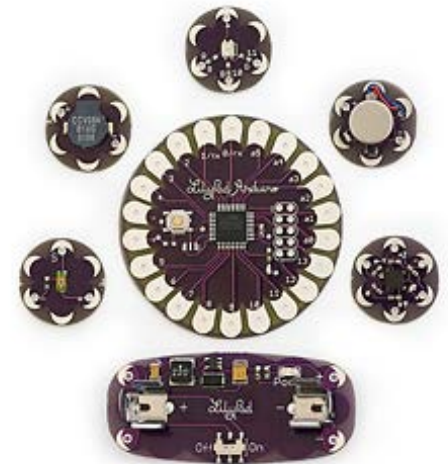
Mega
more channels

Fio
wireless; XBee
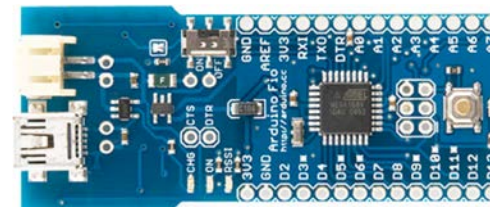
Useful Peripherals (examples)

Uno Overview (R3)
https://www.arduino.cc/en/Main/ArduinoBoardUno
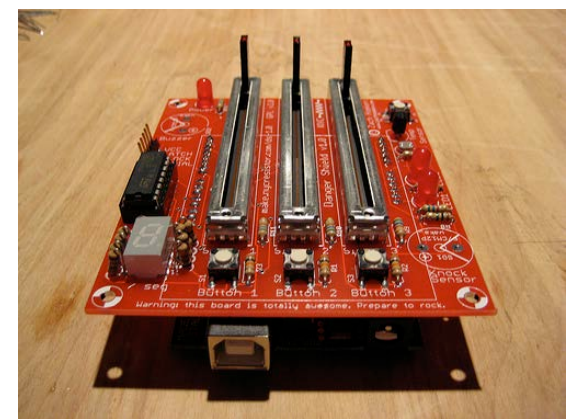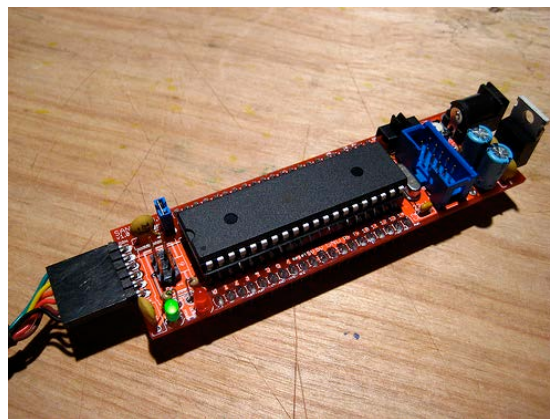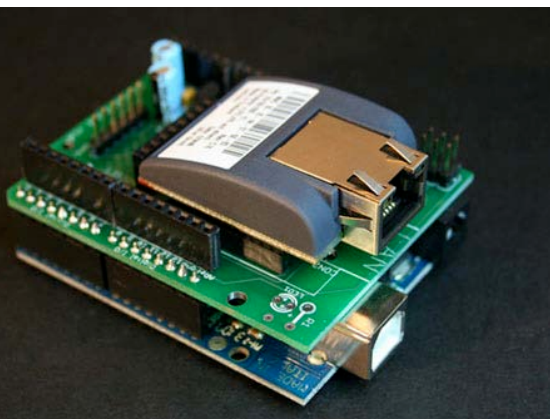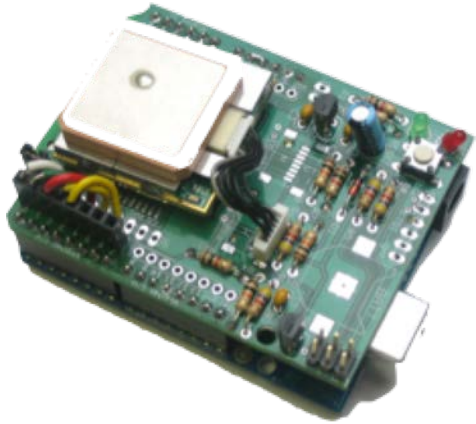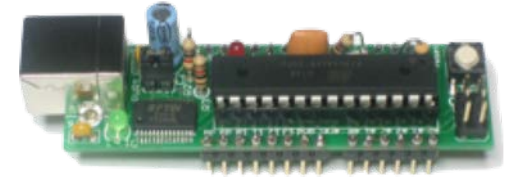
As of 2018 Sept:

- Atmel microcontroller: ATMega328P
- 14 digital I/O pins (6 PWM)
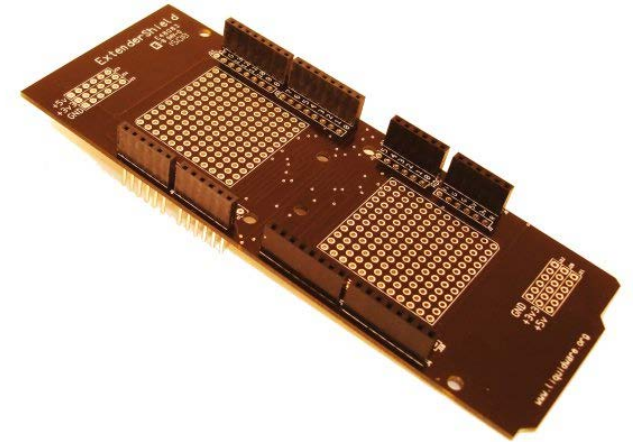- 6 analog inputs
- 16 MHz crystal oscillator
- USB connection
- power jack
- reset button

Uno: Processor
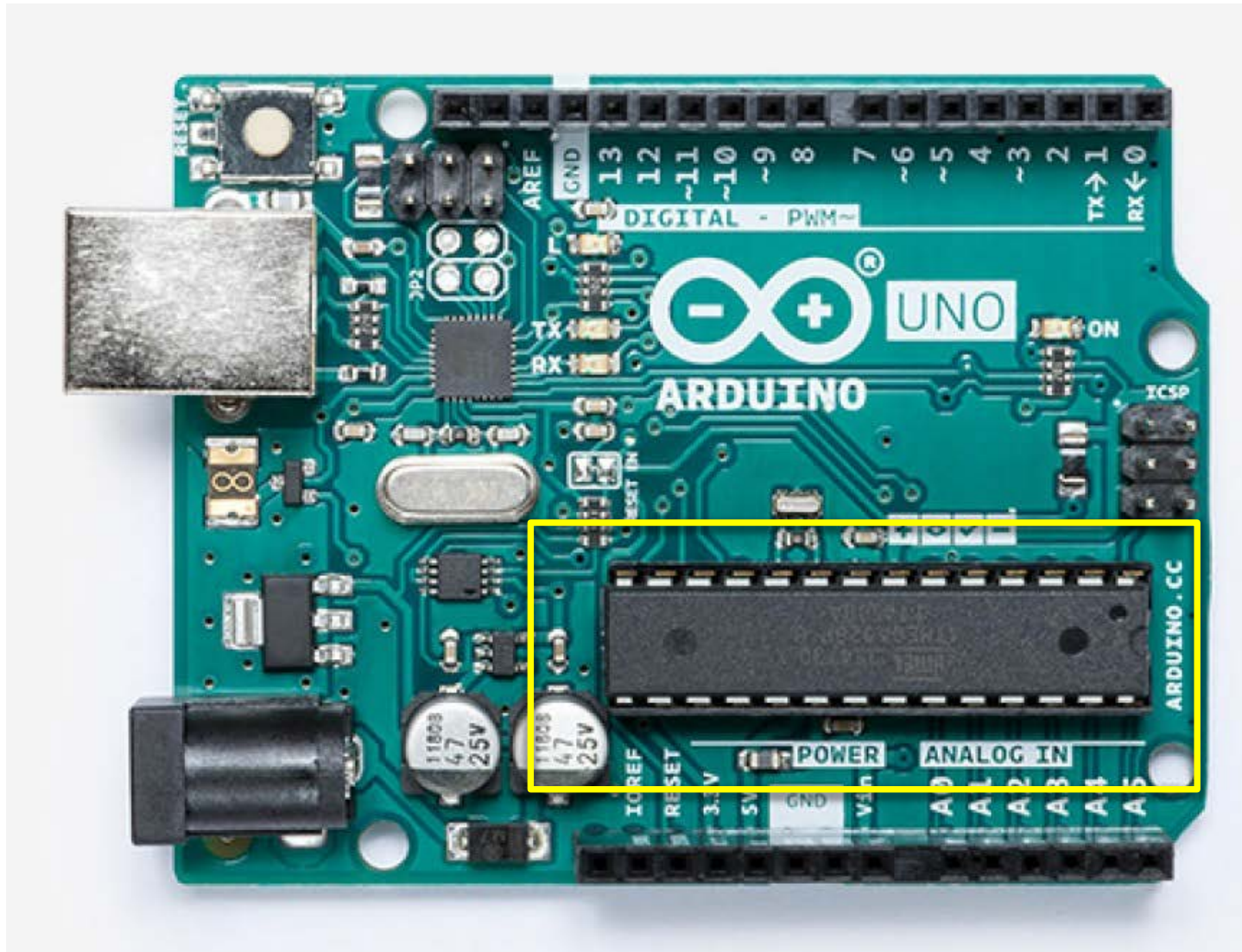
Atmel microcontroller - ATMega processor family
ATmega328

Uno: External Power Connections

USB

DC jack
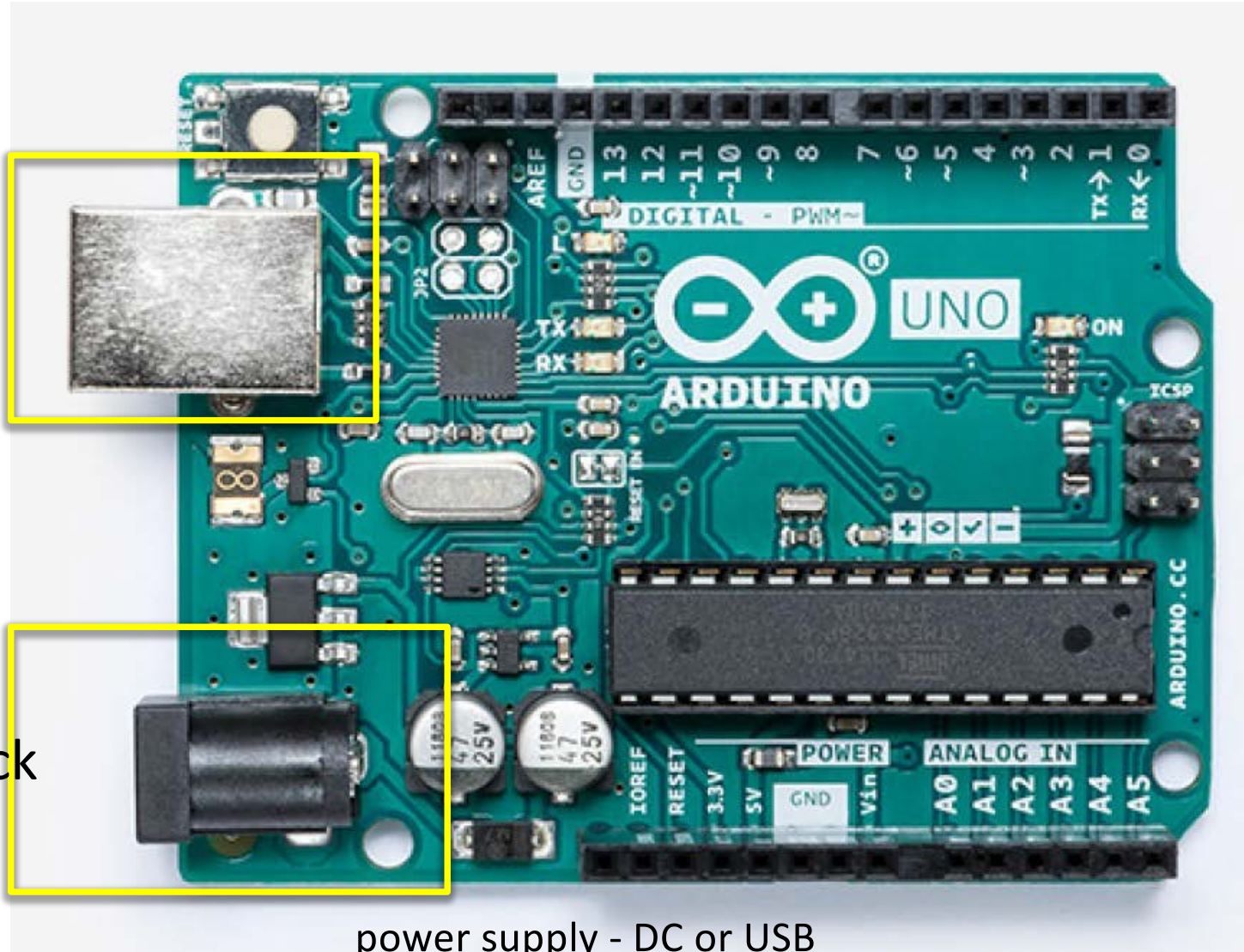
power supply - DC or USB
auto-switching on newer boards (including R3)
jumper on older boards

Uno: Serial Communication

USB/Serial communication (TX/RX)

Uno: Digital I/O
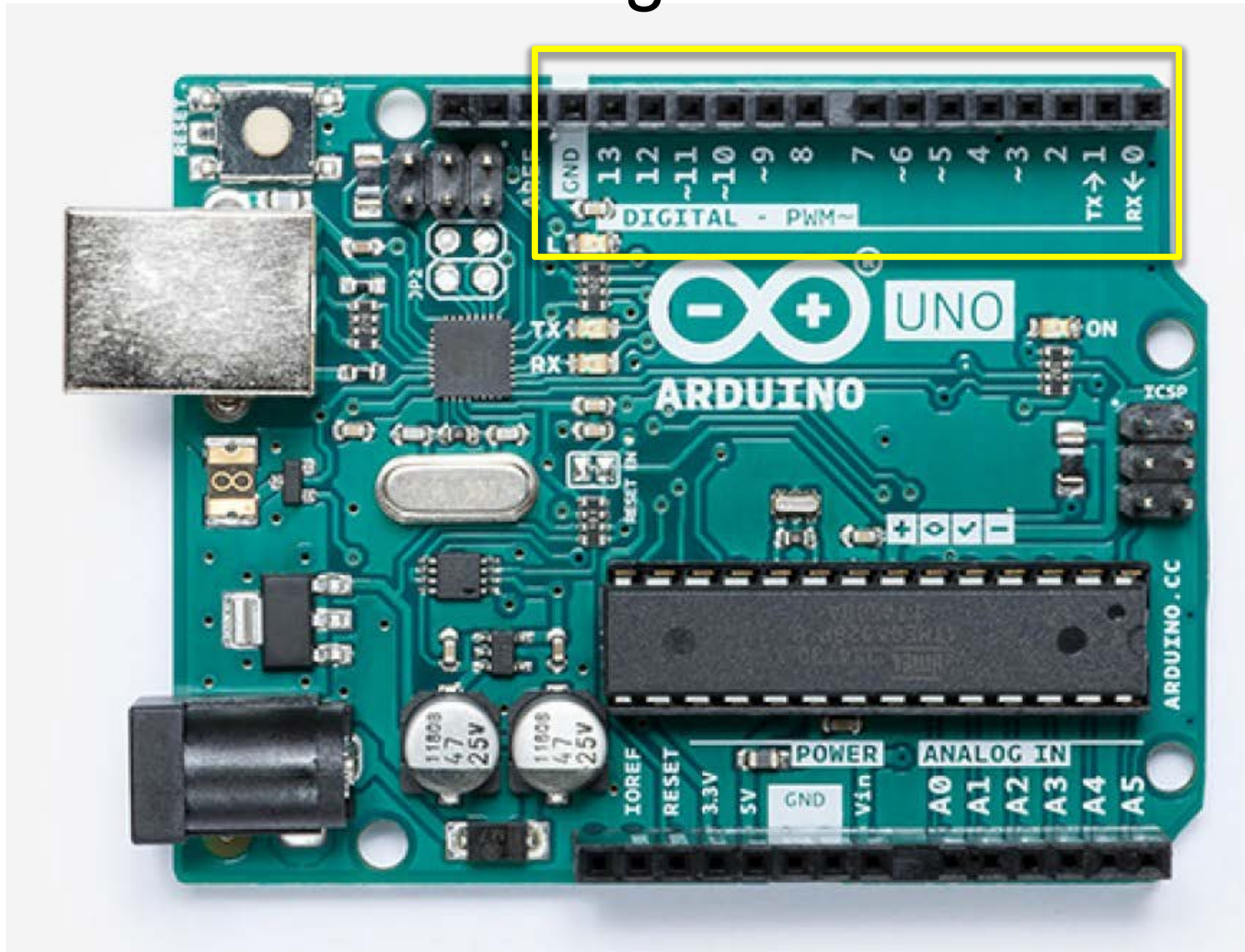
14 digital I/O pins @ 20 Amps DC (6 usable as PWM outputs)

Uno: onboard LED indicator

Pin 13 has an onboard LED attached

Uno: analog input
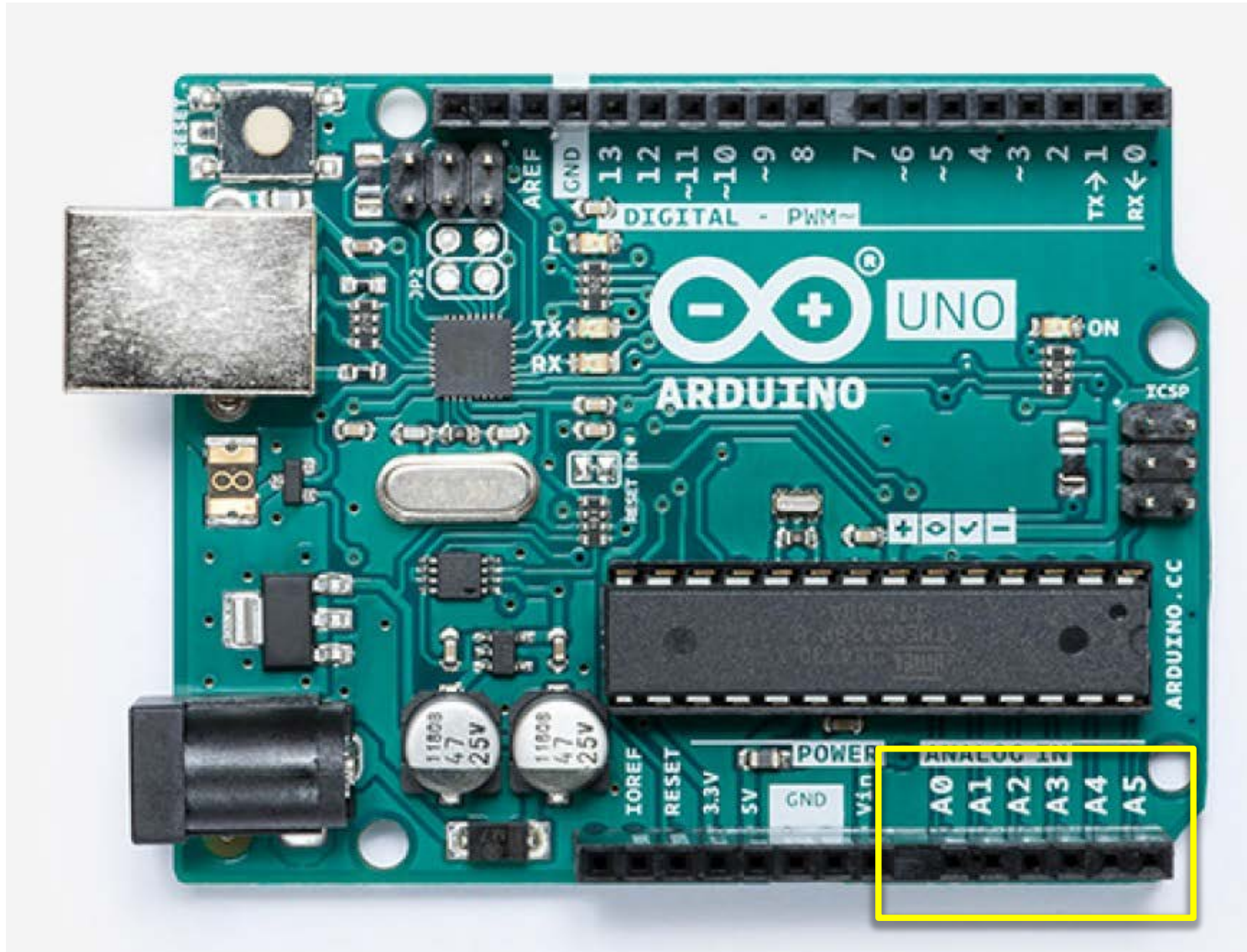
6 analog input lines (A0-A5)
10 bits (1024 values) -- measured from GND to 5V

Uno: power output & other special lines
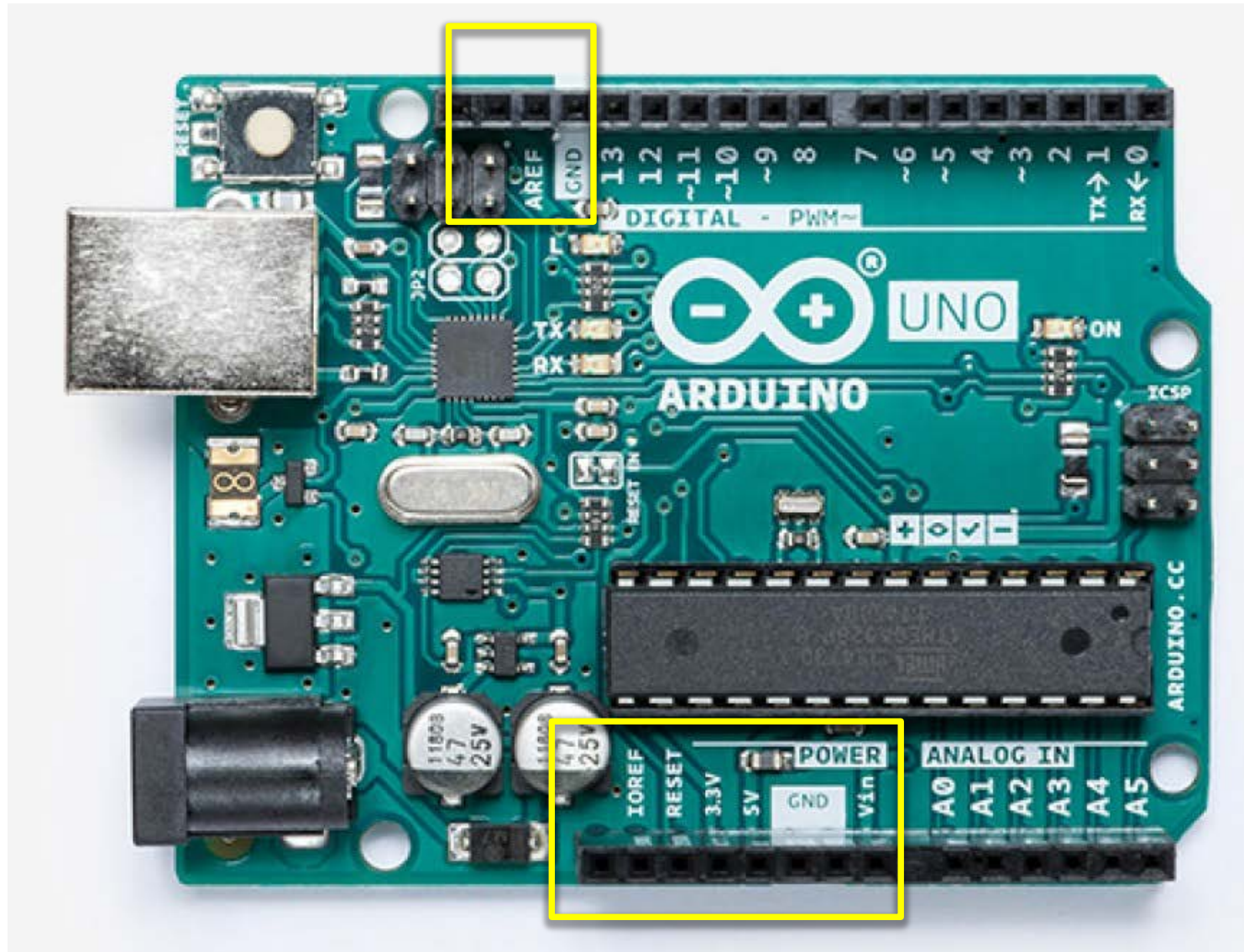
Your breadboard can access the Arduino's Power, Ground, Reset, 5V, 3.3V

Uno: physical reset button & ICSP

Physically reset the Uno board (restart the loaded program);
or externally program it using the ICSP block (more advanced)

Arduino IDE
(integrated development environment)

http://www.arduino.cc

plain old c, but friendlier

Install USB driver first

Follow well-illustrated instructions for your OS at:
http://arduino.cc/en/Guide/HomePage

structure of "Blink" program


```
int ledPin = 13;      // LED connected to digital pin 13

// The setup() method runs once, when the sketch starts

void setup()   {
  // initialize the digital pin as an output:
  pinMode(ledPin, OUTPUT);
}

// the loop() method runs over and over again,
// as long as the Arduino has power

void loop()
{
  digitalWrite(ledPin, HIGH);   // set the LED on
  delay(1000);                  // wait for a second
  digitalWrite(ledPin, LOW);    // set the LED off
  delay(1000);                  // wait for a second
}
```
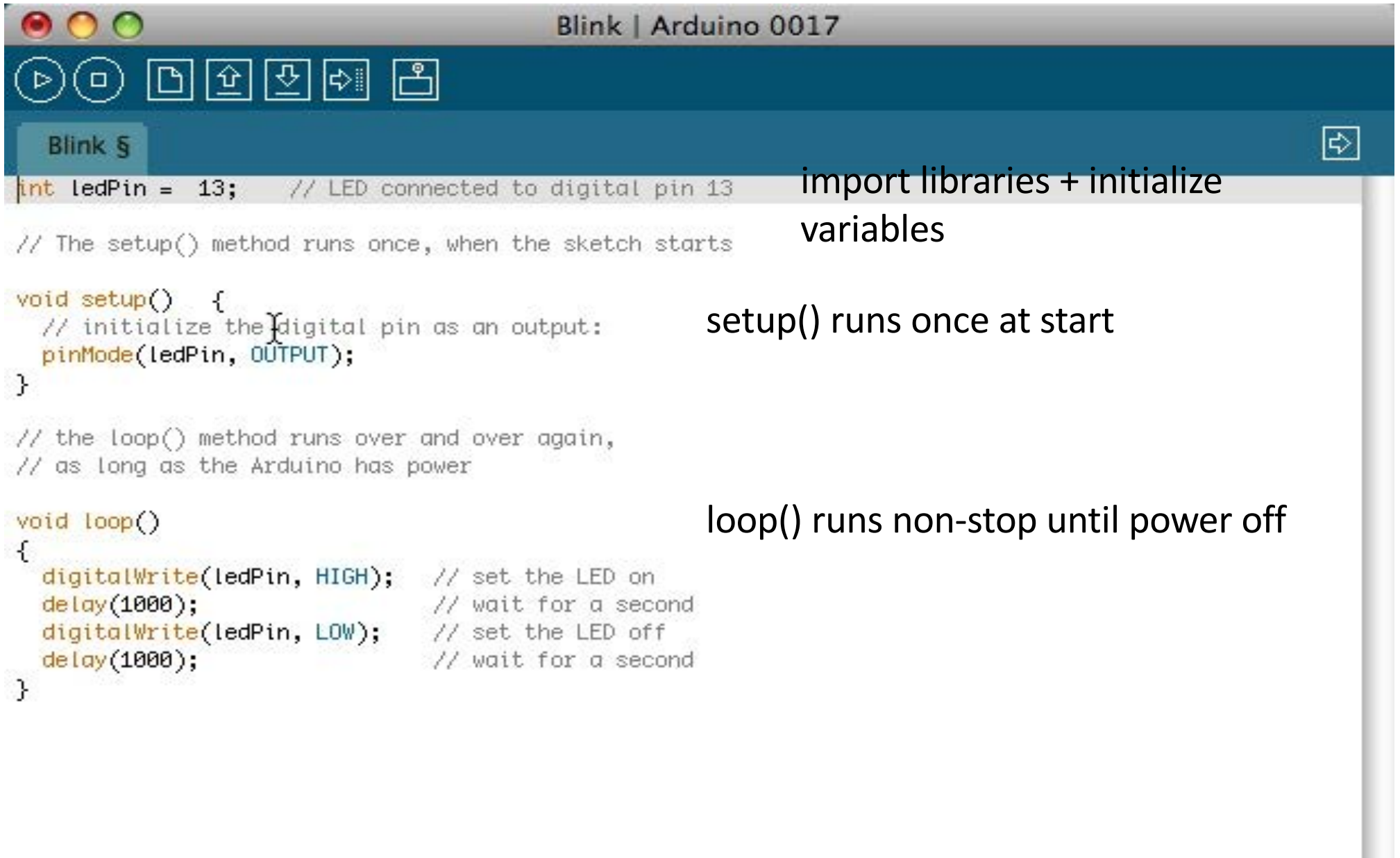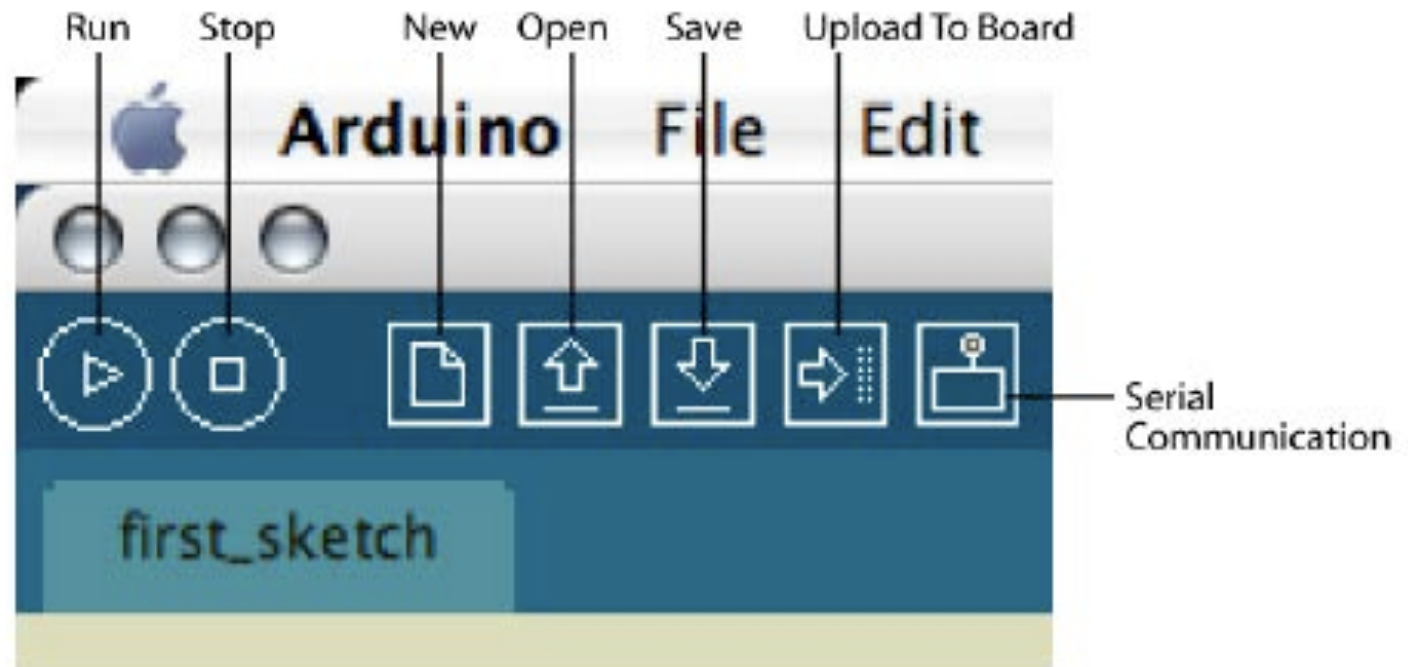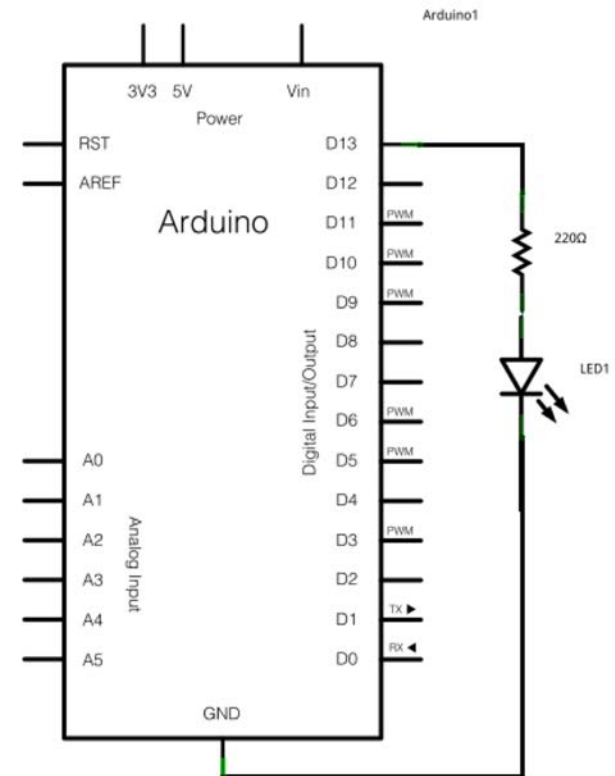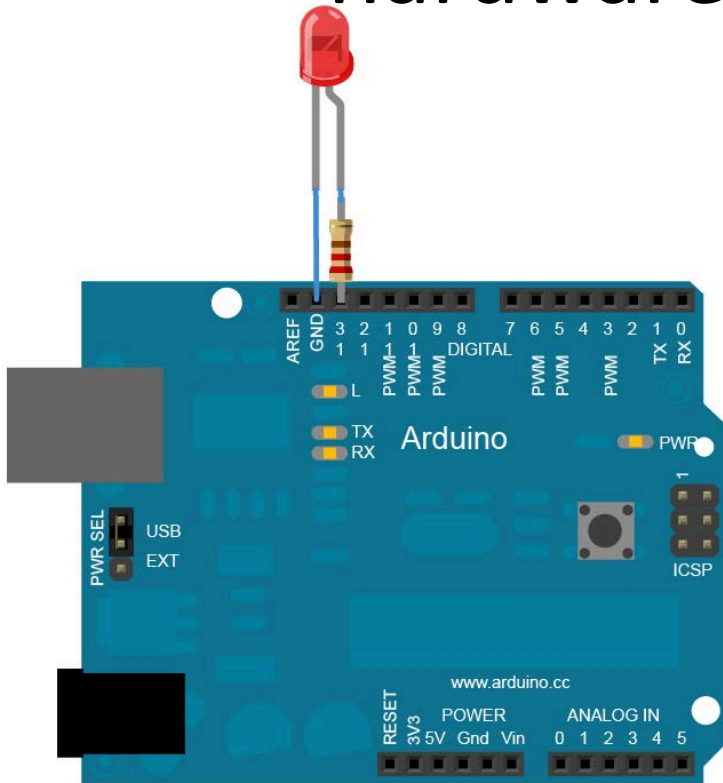
import libraries + initialize variables

setup() runs once at start
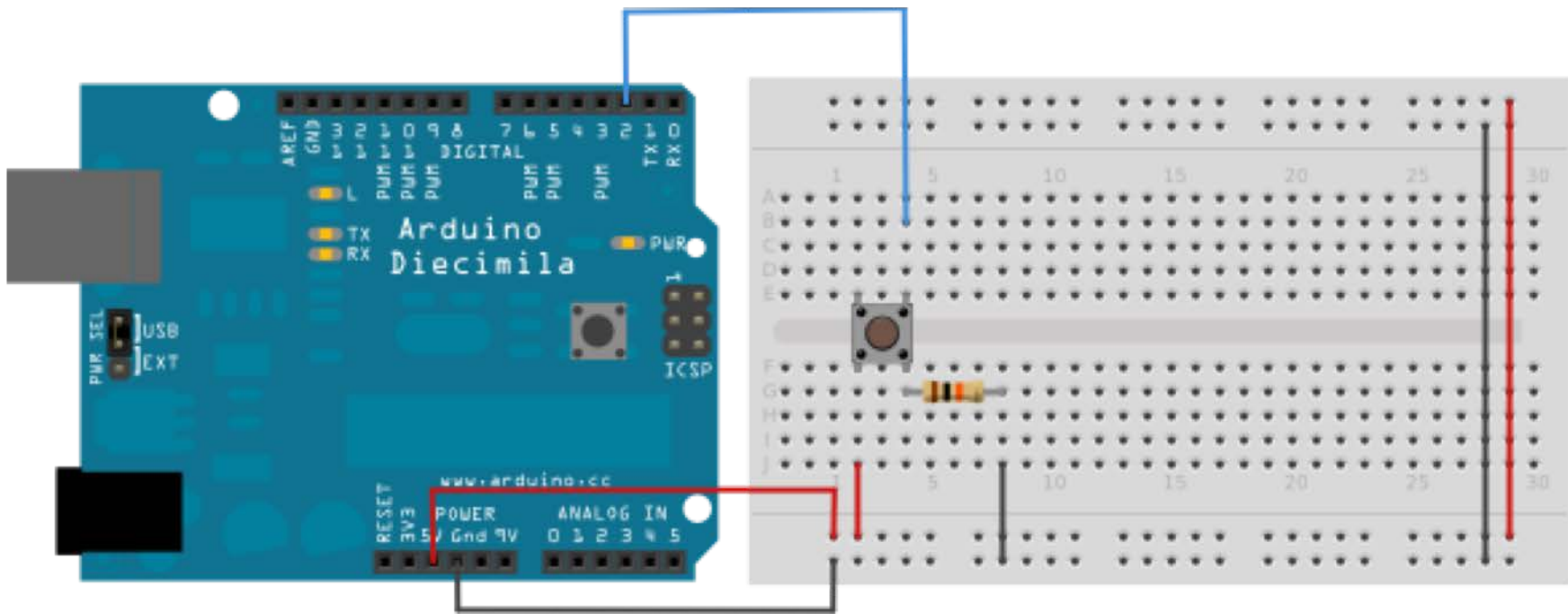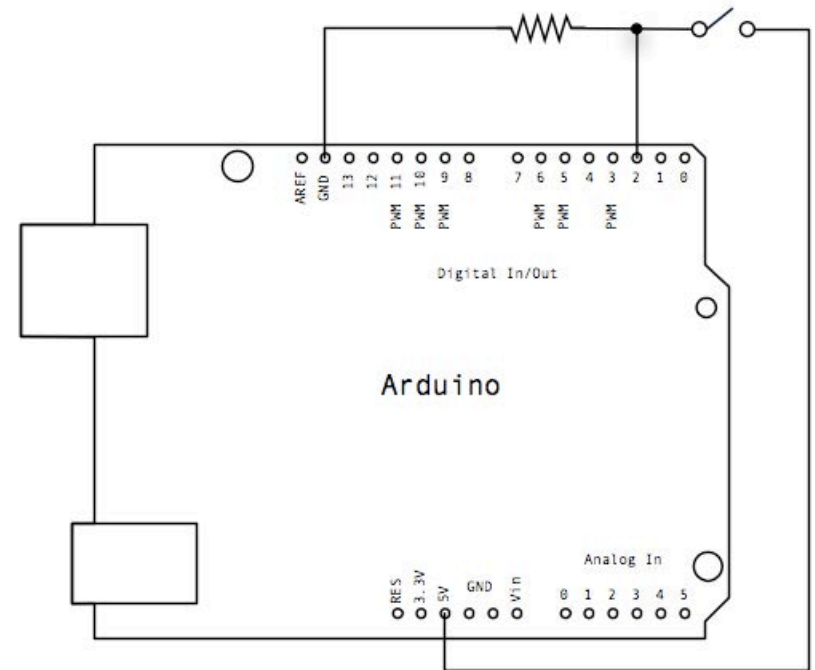
loop() runs non-stop until power off

IDE controls

hardware context of Blink

add a digital button using a breadboard

converting rotary to linear motion

TABLE 8-1 Converting Between Types of Motion

		INPUT				
		ROTARY	OSCILLATING	LINEAR	RECIPROCATING	INTERMITTENT
OUTPUT — CONVERSIONS	ROTARY	Gears, pulleys and belt, sprockets and chain, crank slider	Crank	Rack and pinion, linkage	Piston, bell crank	
	OSCILLATING	Crank, quick return			Linkage	
	LINEAR	Wheels, rack and pinion, scotch yoke	Scotch yoke	Scissor linkage		
	RECIPROCATING	Cam, crank, piston	Crank, cam, bell crank			
	INTERMITTENT	Geneva stop	Ratchet		Ratchet	
	IRREGULAR	Cam	Cam			
OUTPUT — TRANSFORMATIONS	INCREASE/ DECREASE	Gears, pulleys and belt, sprockets and chain	Gears		Lever	Lever, gears
	REFLECT	Gears	Gears	Pulley, lever	Pulley, lever	Pulley, lever
	ROTATE	Bevel gear, worm gear	Bell crank	Bell crank	Bell crank	Bell crank

Tinkering is what happens when you try something you don't quite know how to do, guided by whim, imagination, and curiosity. When you tinker, there are no instructions, but there are also no failures, no right or wrong way of doing things. It's about figuring out how things work and reworking them.

—Massimo Banzi