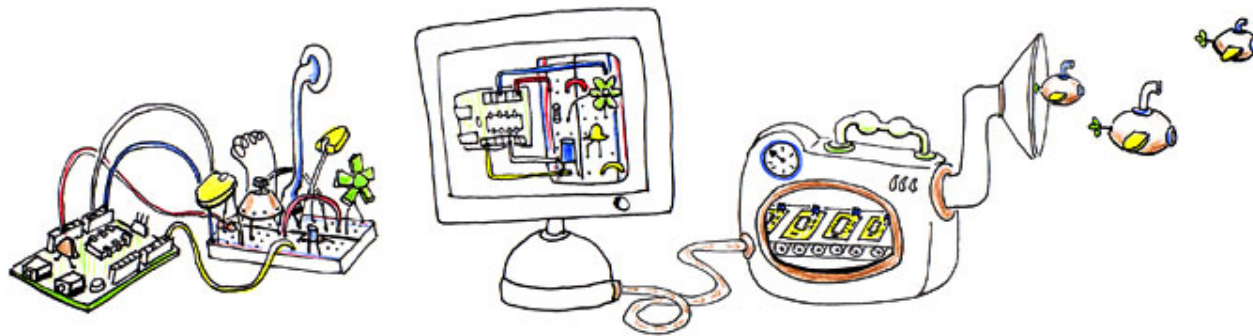


Arduino



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 Moussette's August 2011 workshop at UBC.

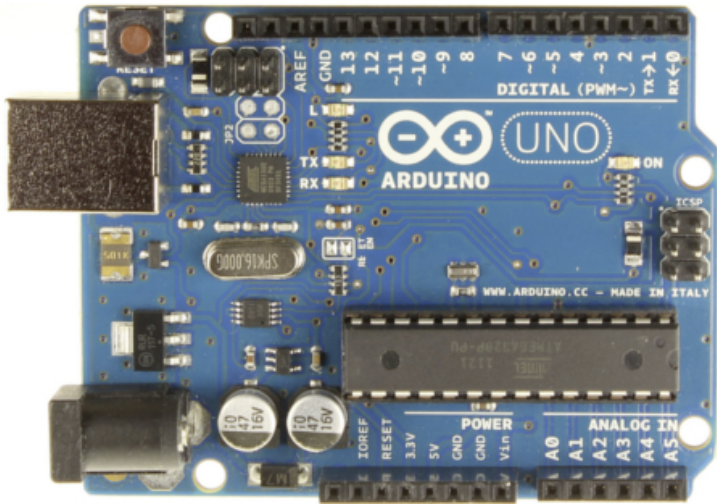
image from Fritzing.org

What is Arduino?

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

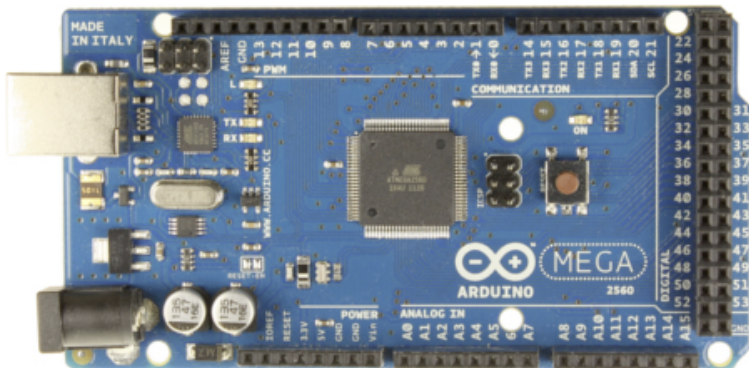
- Many variations

Arduino Family (ever changing!)

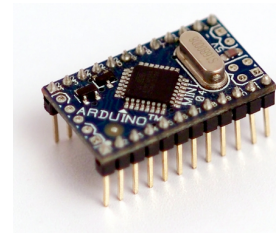


Uno R3 + Arduino software
= official reference designs
(original: Nov 2011)

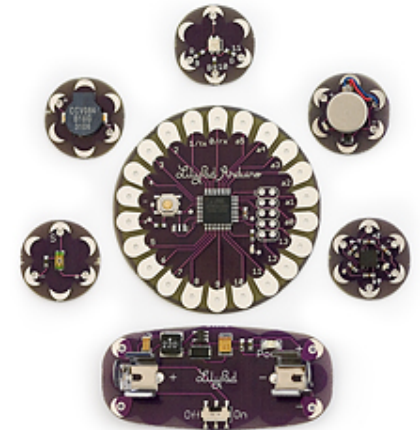
Mega
more channels



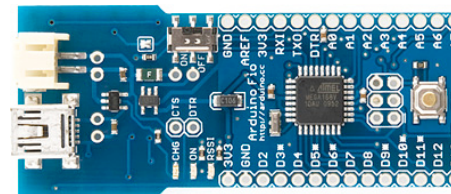
Mini
tiny jobs



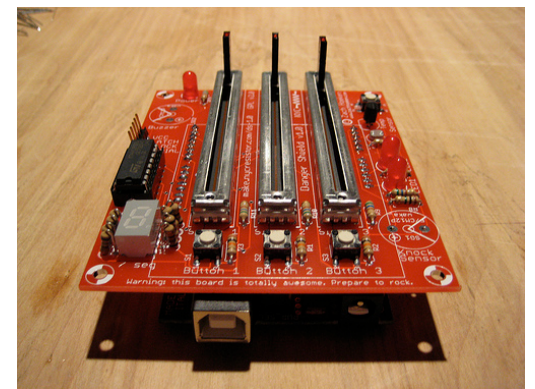
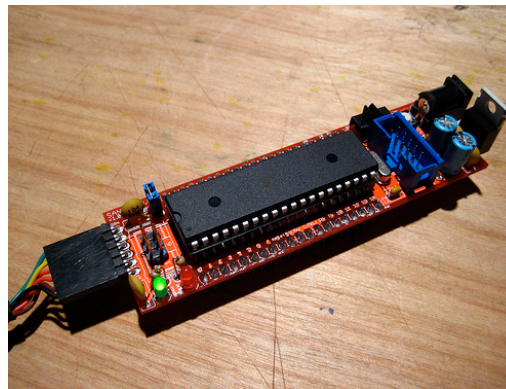
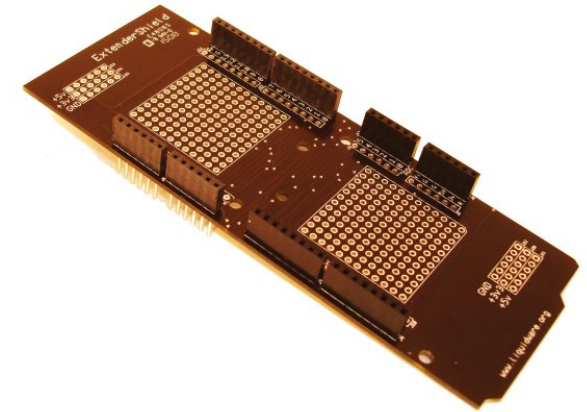
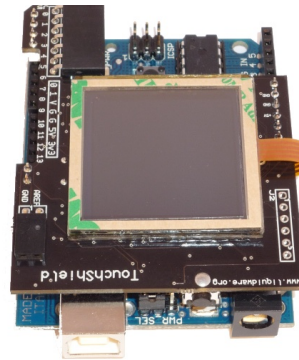
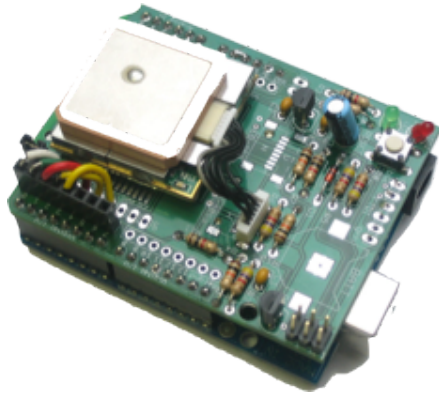
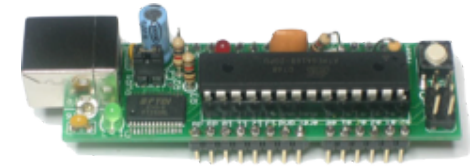
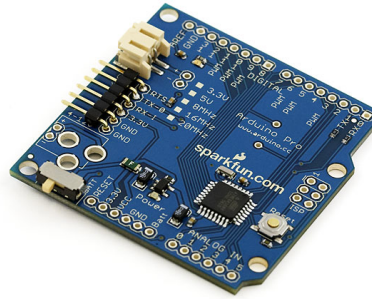
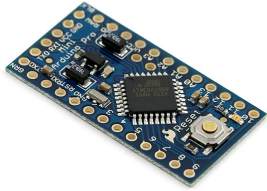
Lilypad
wearables



Fio
wireless; XBee

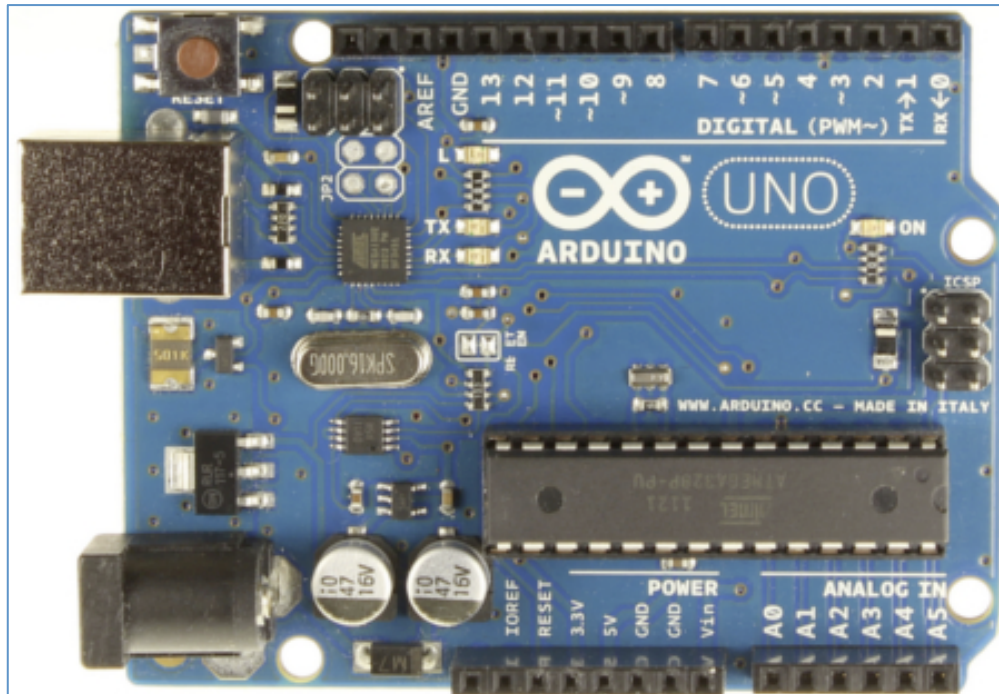


Useful Peripherals (examples)



Uno Overview

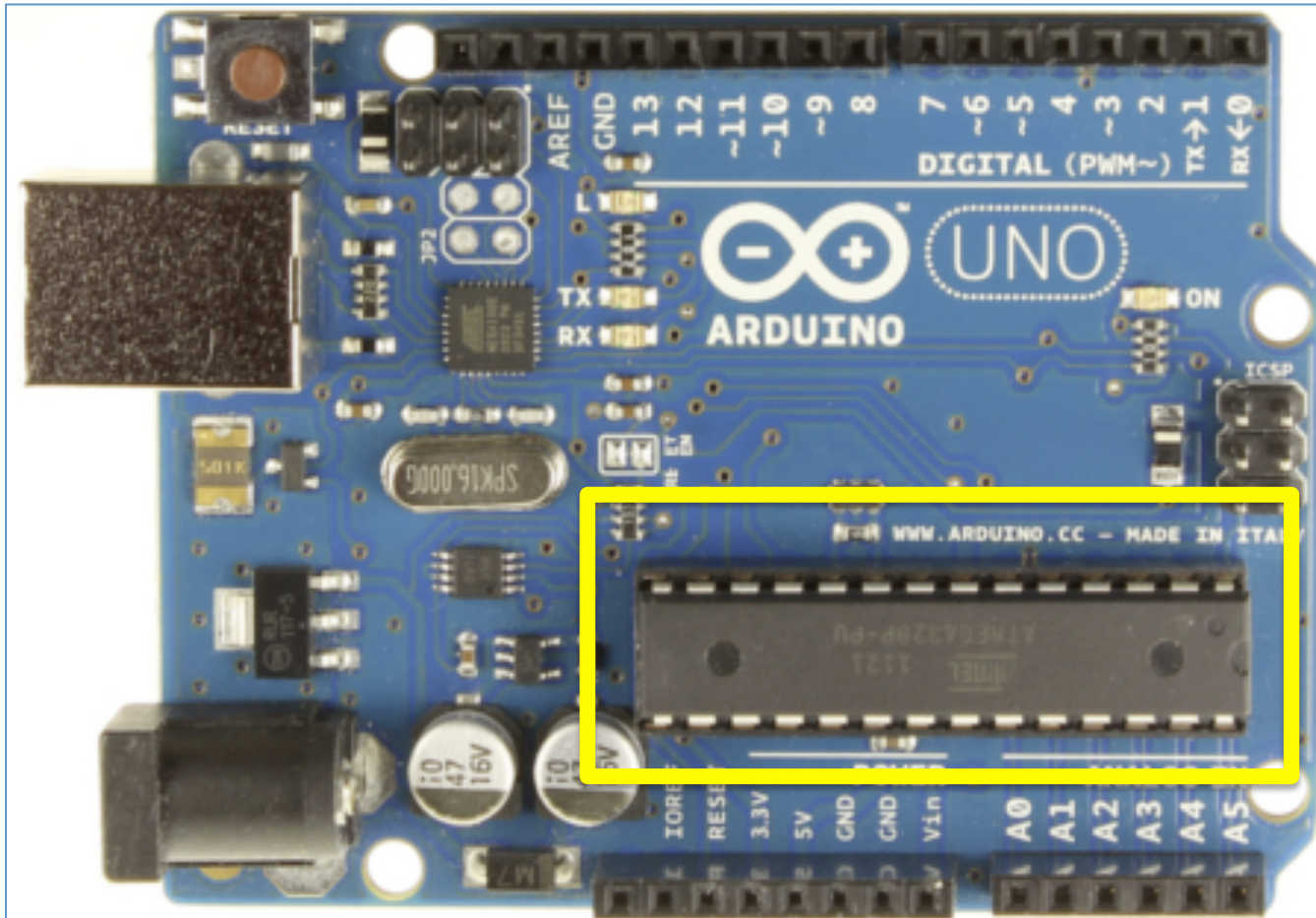
<https://www.arduino.cc/en/Main/ArduinoBoardUno>



As of 2016 Jan:

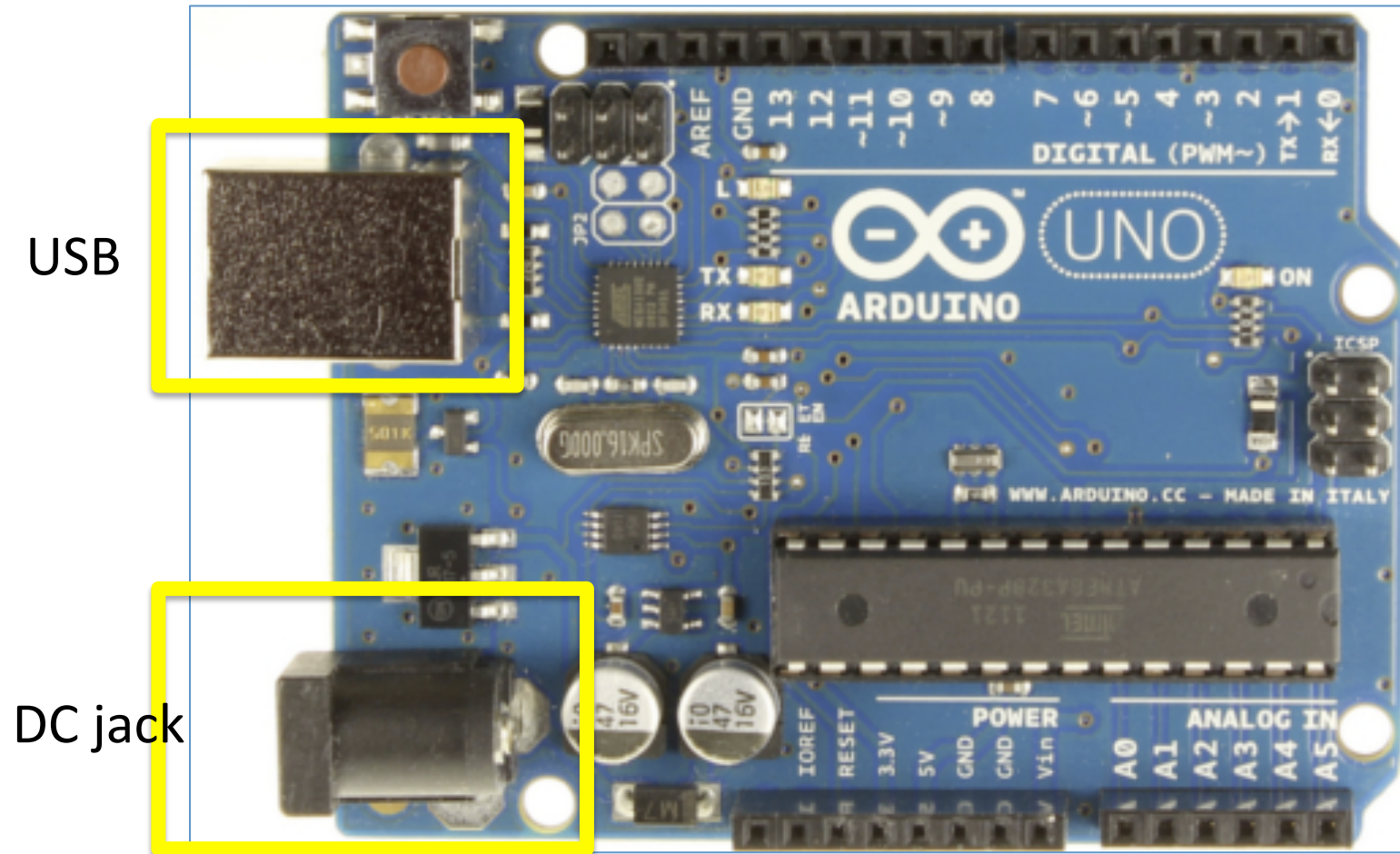
- Atmel microcontroller: ATmega328P
- 14 digital I/O pins (6 PWM)
- 6 analog inputs
- 16 MHz crystal oscillator
- USB connection
- power jack
- reset button

Uno: Processor



Atmel microcontroller - ATmega processor family
ATmega328

Uno: External Power Connections

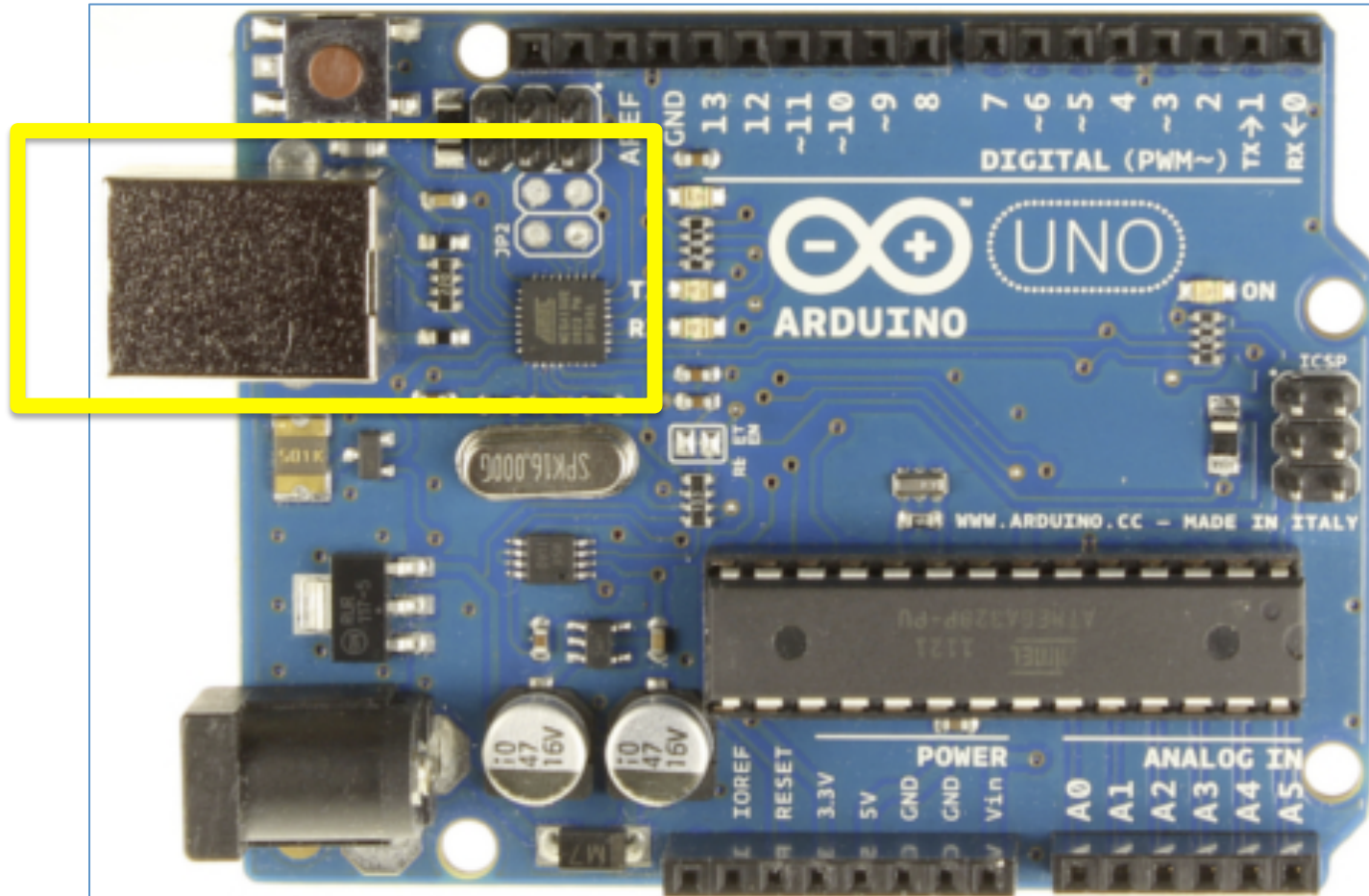


USB

DC jack

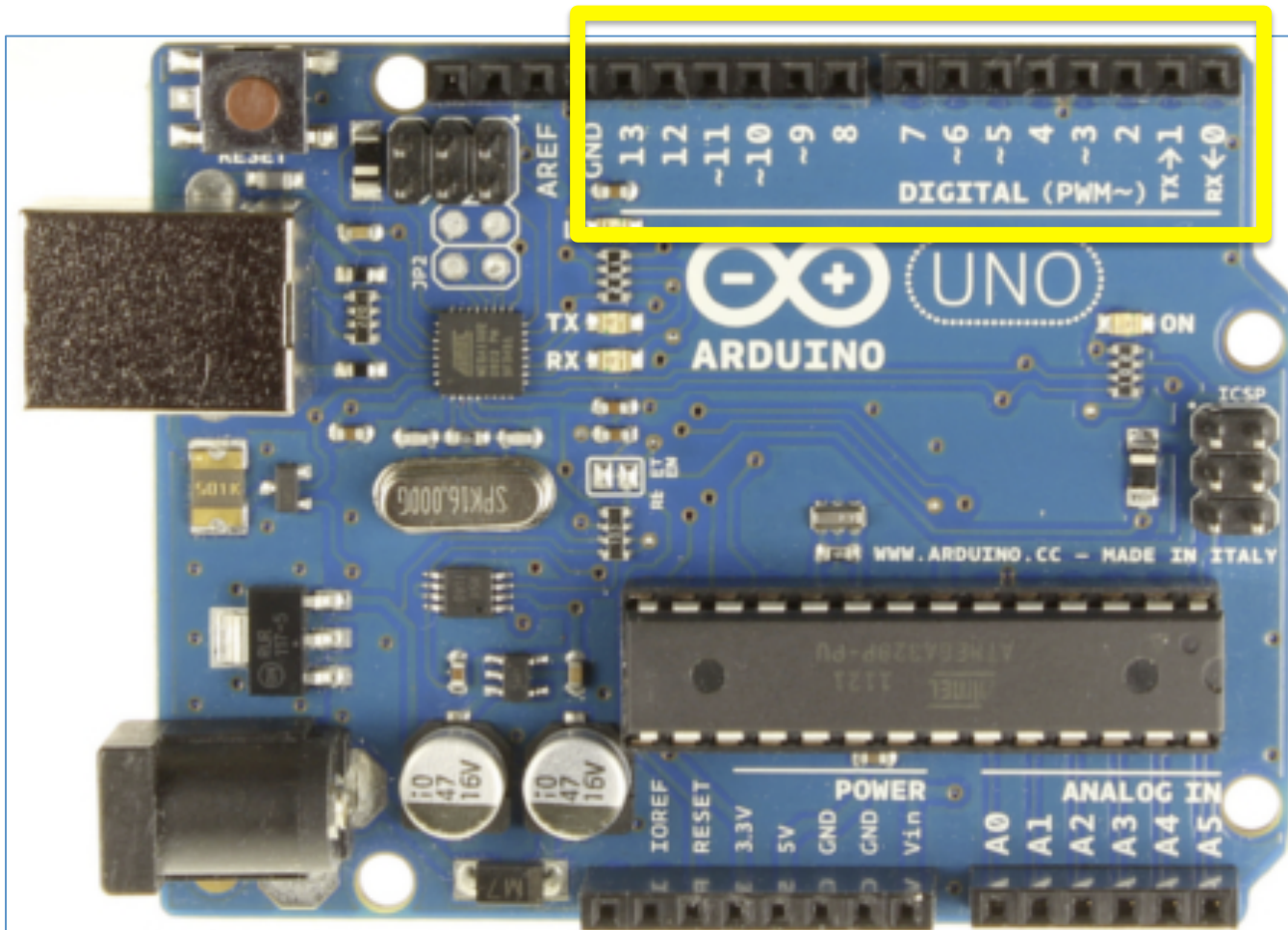
power supply - DC or USB
auto-switching on newer boards (including R3)
jumper on older boards

Uno: Serial Communication



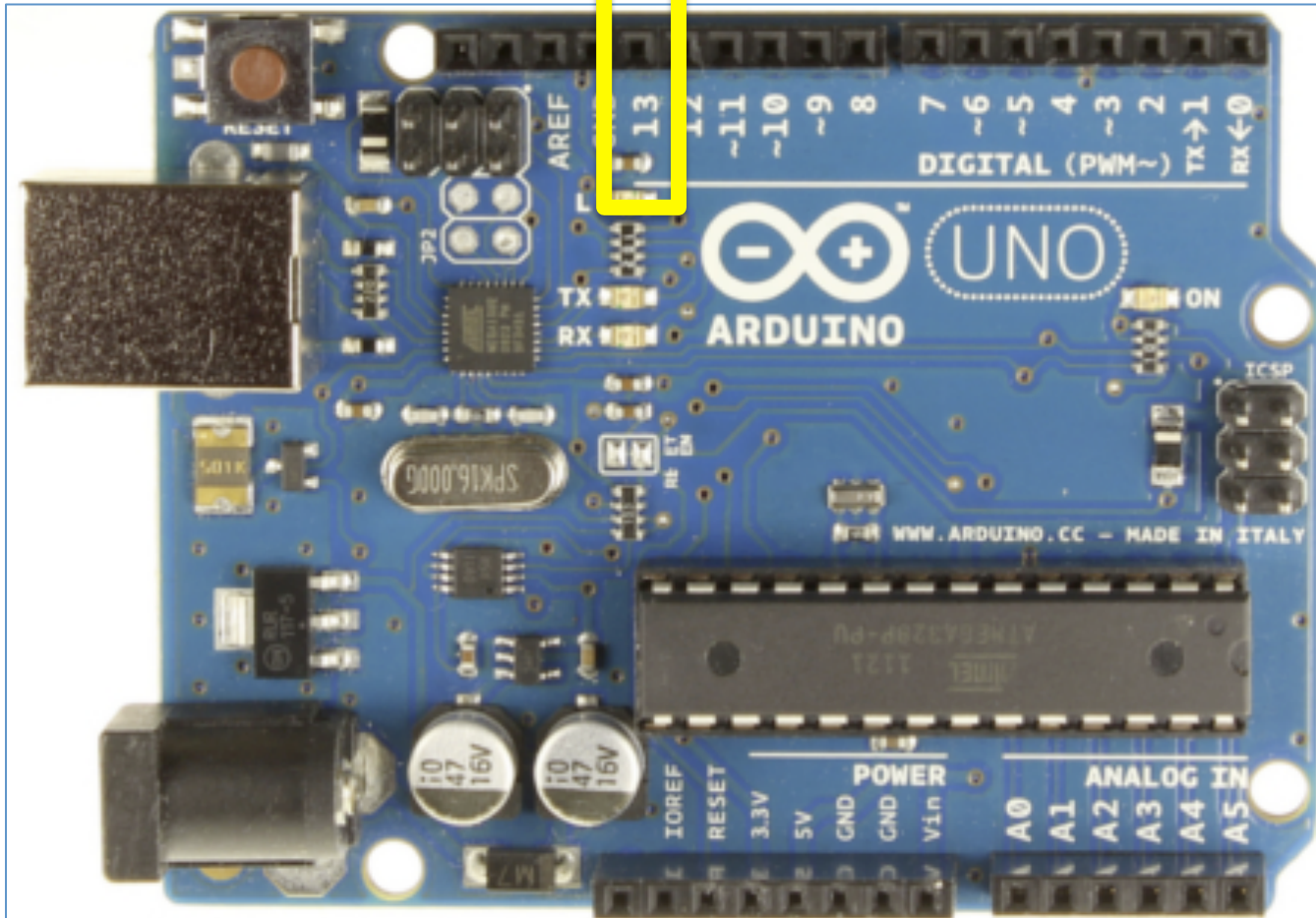
USB/Serial communication (TX/RX)

Uno: Digital I/O



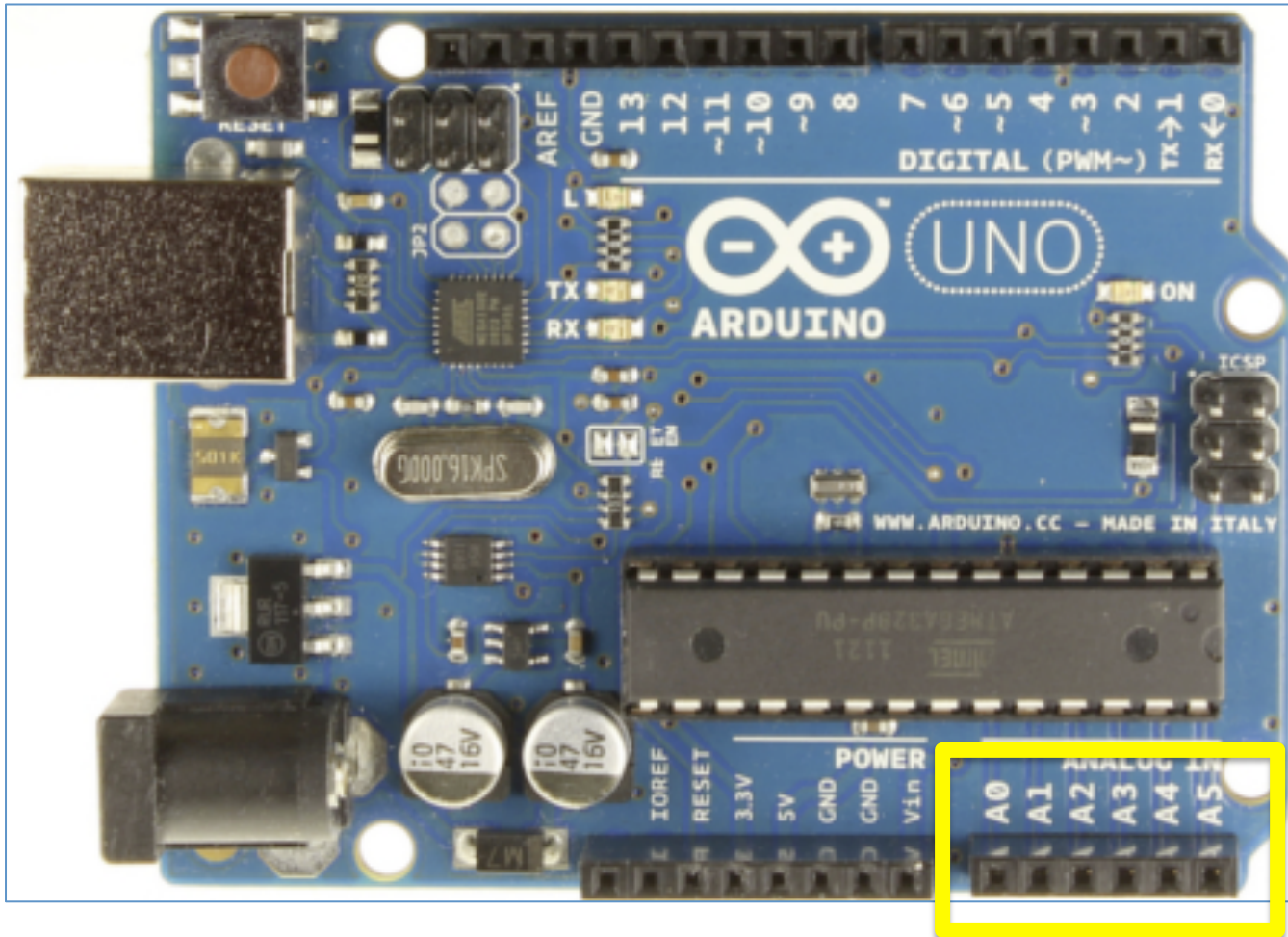
14 digital I/O pins @ 20 Amps DC (6 usable as PWM outputs)

Uno: onboard LED indicator



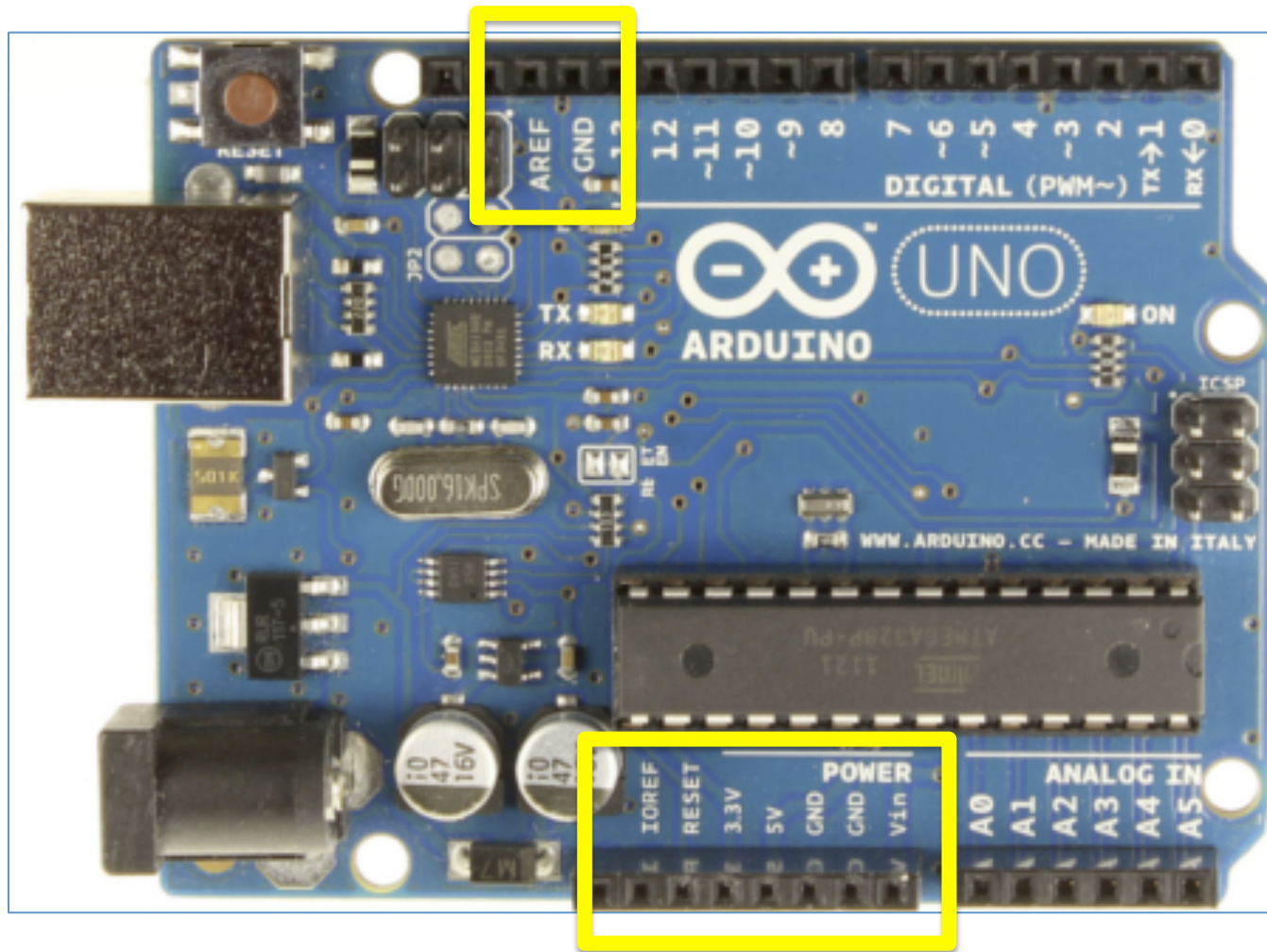
Pin 13 has an onboard LED attached

Uno: analog input



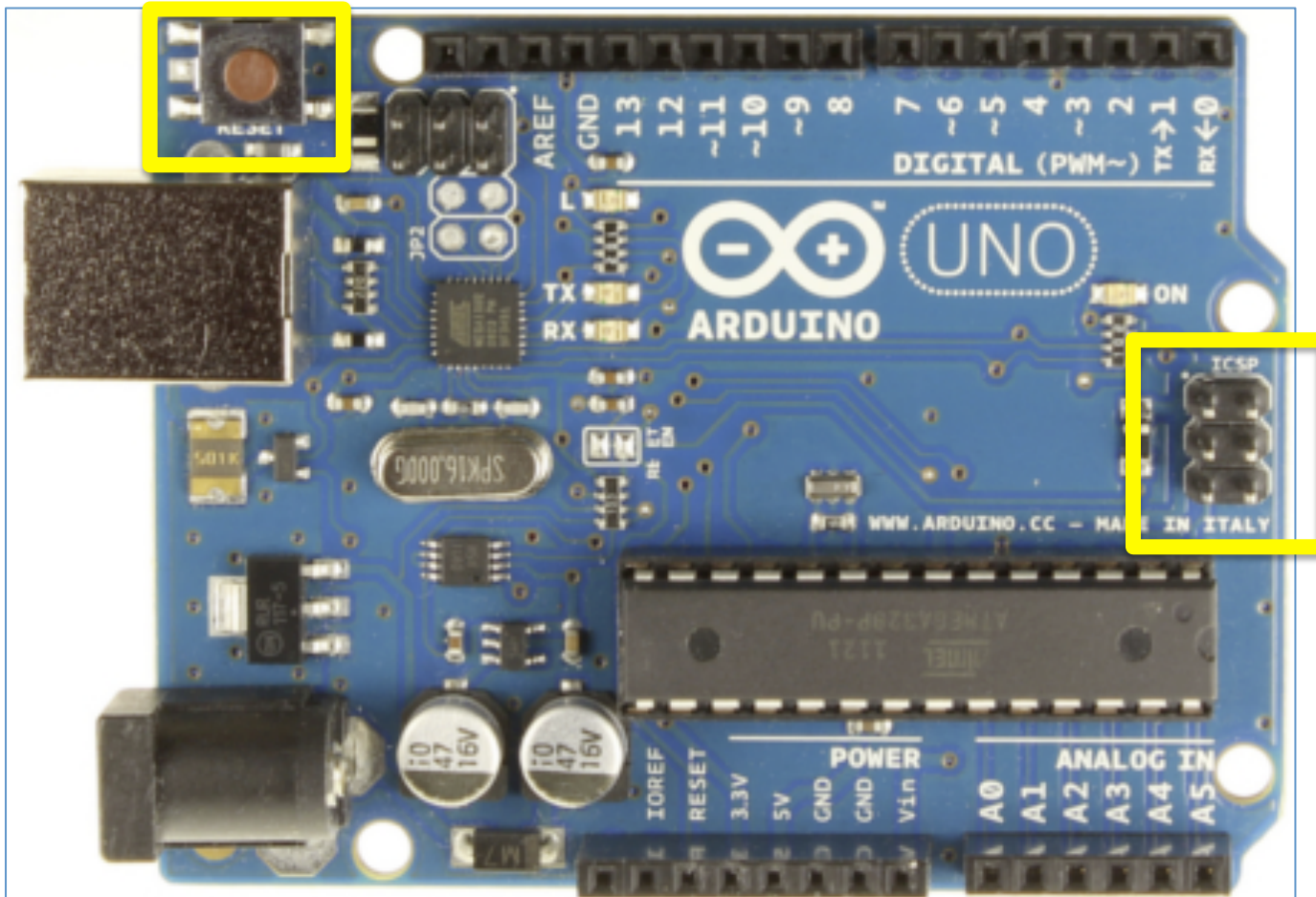
6 analog input lines (A0-A5)
10 bits (1024 values) -- measured from GND to 5V

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>

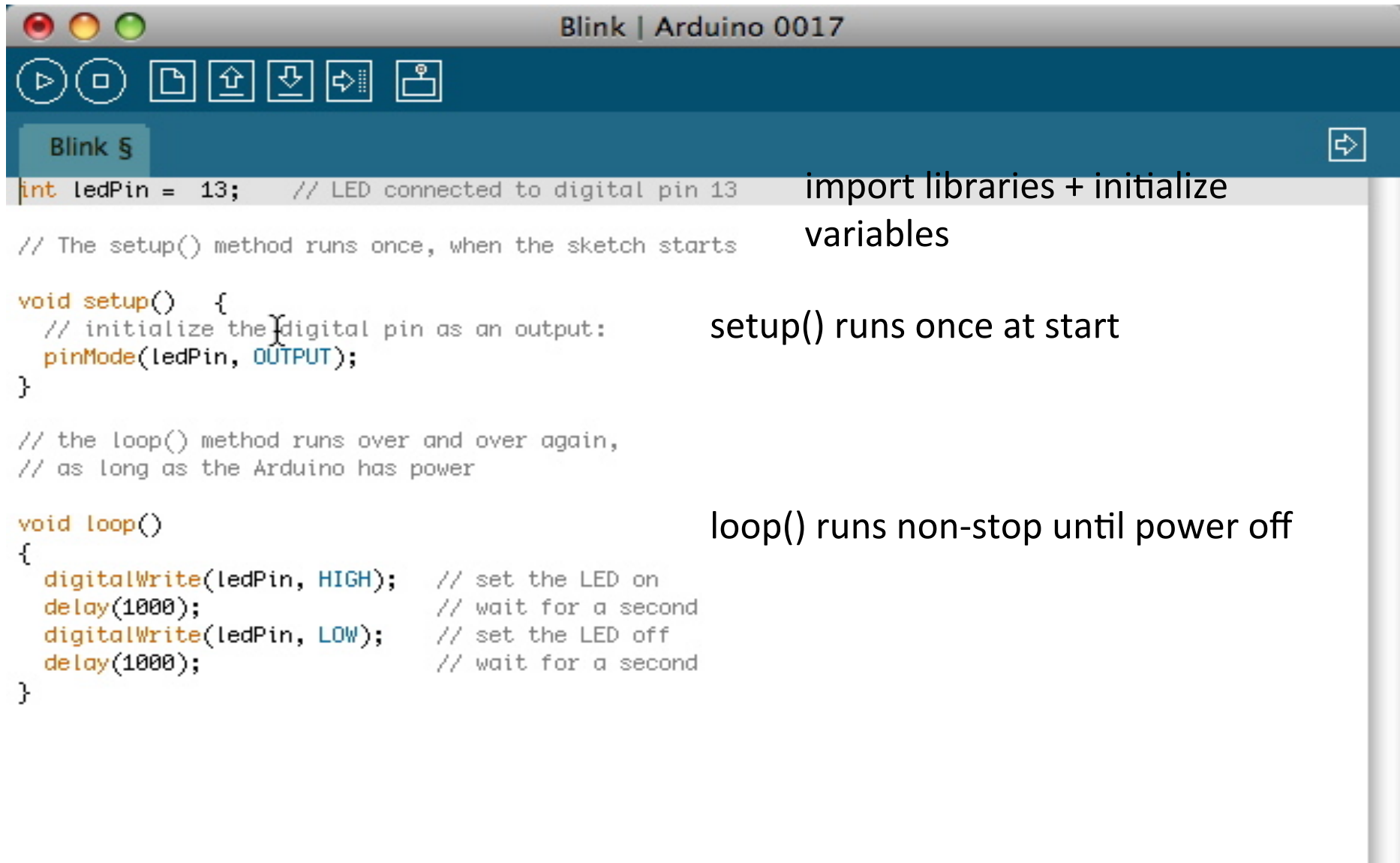
plain old c, but friendlier

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

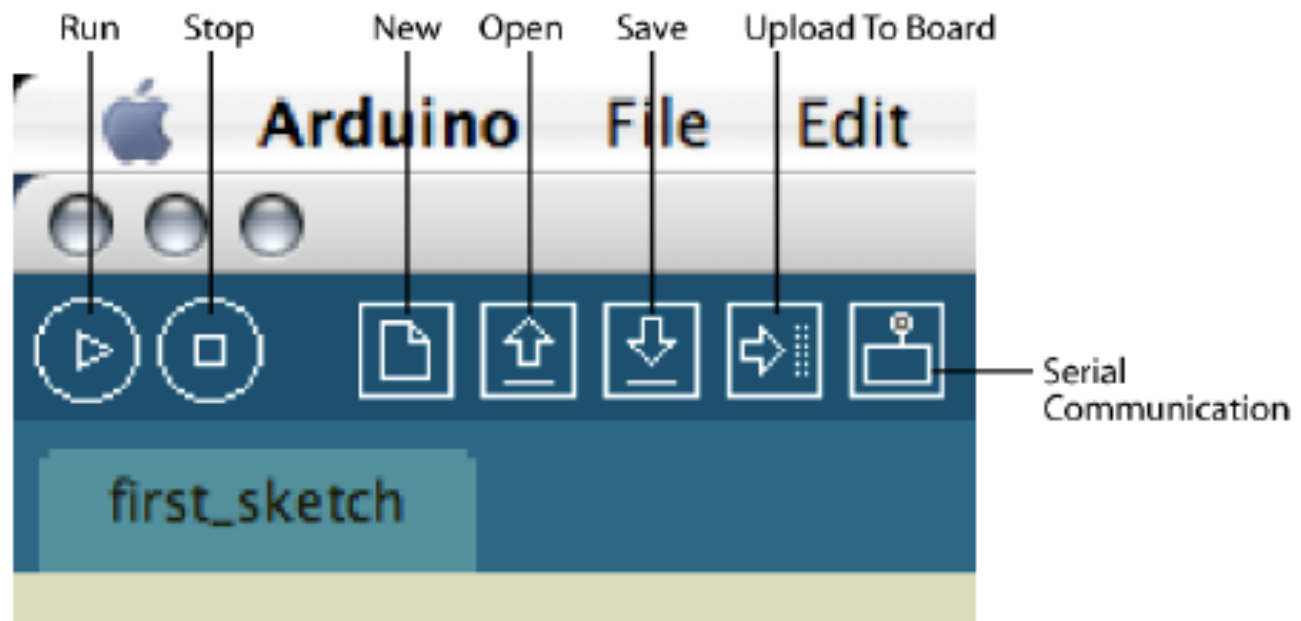
void loop()
{
  digitalWrite(ledPin, HIGH); // set the LED on
  delay(1000); // wait for a second
  digitalWrite(ledPin, LOW); // set the LED off
  delay(1000); // wait for a second
}
```

import libraries + initialize variables

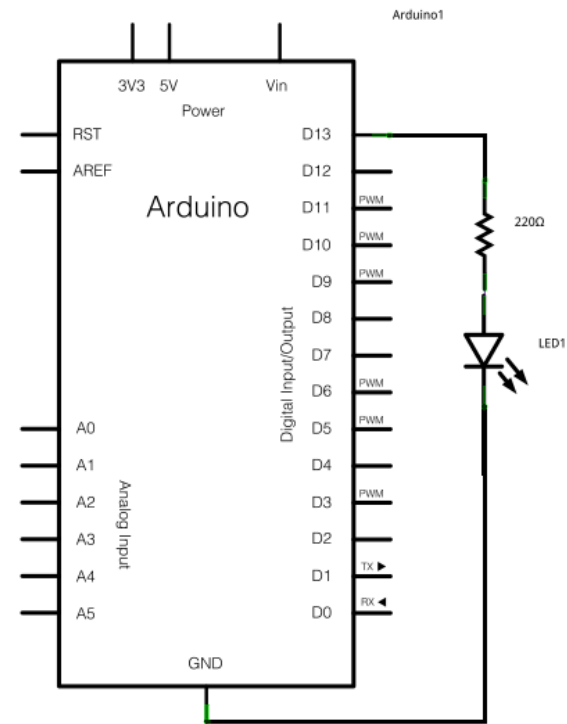
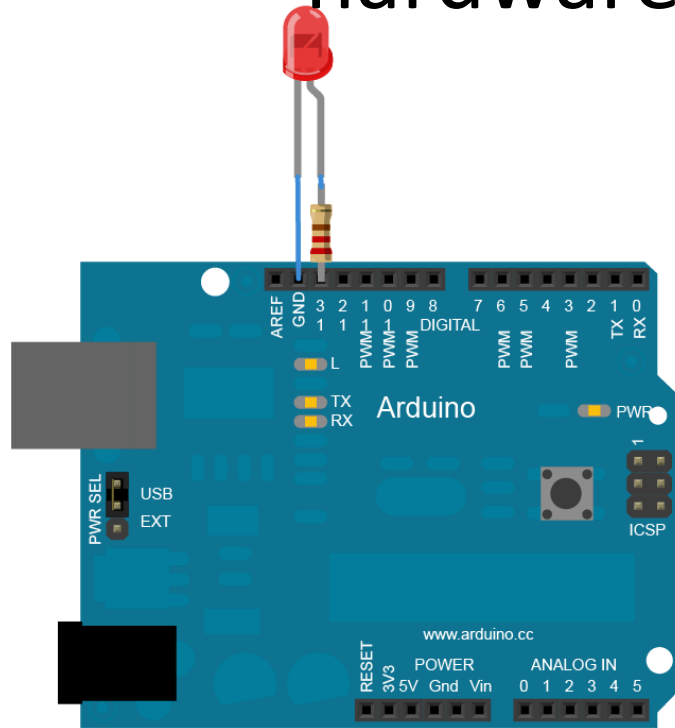
setup() runs once at start

loop() runs non-stop until power off

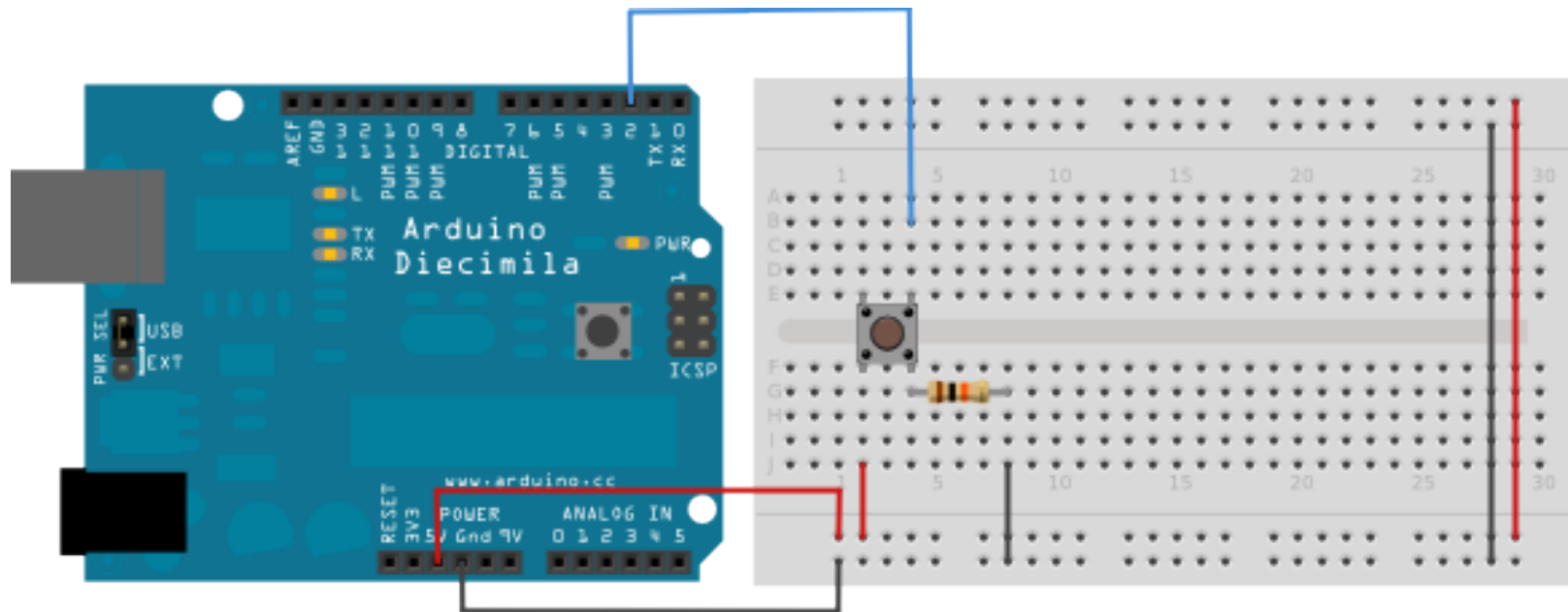
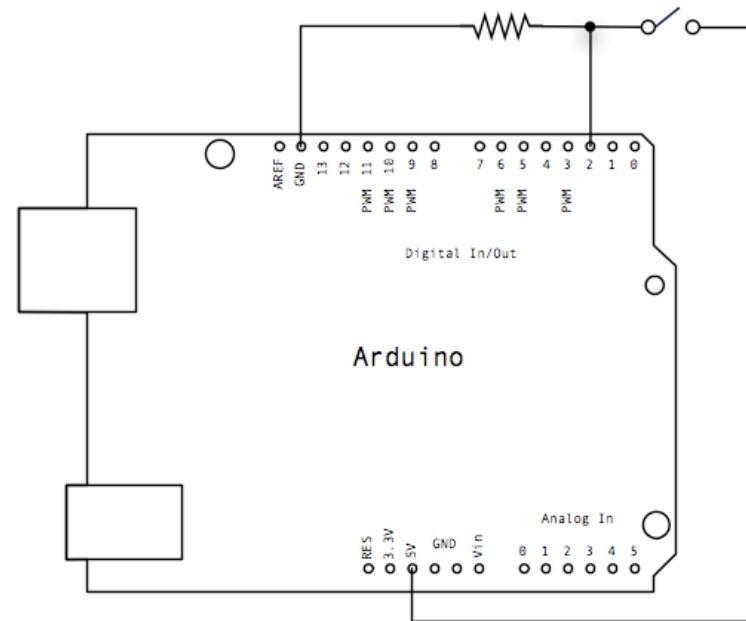
IDE controls



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			
	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