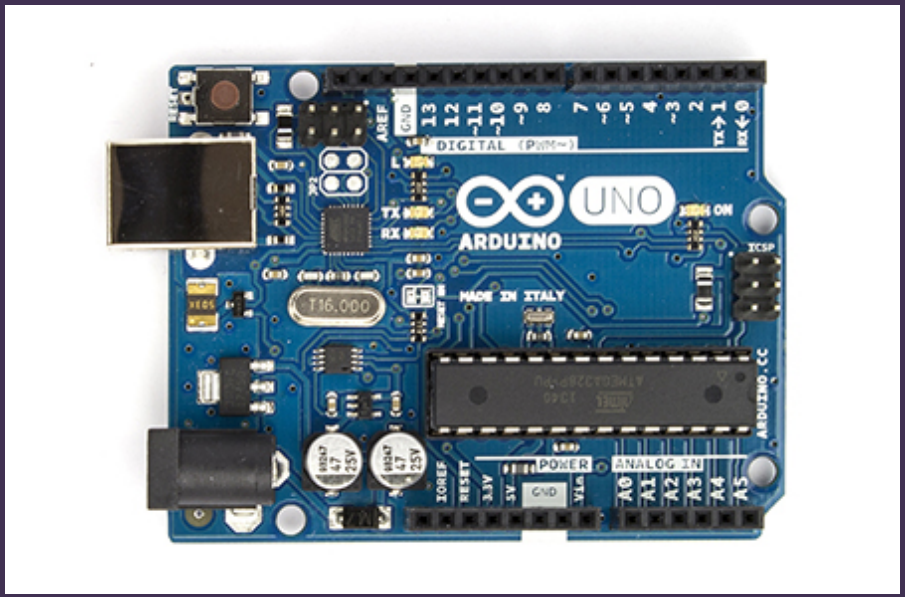
COMP140 GAM160: Hacking Hardware/Advanced Programming

Session 6: 12

Learning outcomes

- **Identify** the various parts of the Arduino and their function
- **Explain** the difference between analog and digital
- **Implement** a basic interface using Arduino and openFrameworks

What is an Arduino?



Sensors & Actuators

Figure: Just another input / output controller

What is an Arduino?

- Open Source
- The Arduino is a small microcontroller board
- Basically, a small computer
- Perfect for rapid prototyping physical computing systems
- Arduino Uno is based on the Atmel ATmega328P

The basics

The Arduino can only prcesses electronic signals. This means that stimuli from the physical world need to be transduced to electrical signals before they can be processed from within your code.

- 14 Digital IO pins (0-14)
- 6 Analogue in pins(0-5)
- 6 Analogue out pins(3,5,6,9,10, and 11)

Technical specs

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

Figure: A more in depth version of what the Arduino Uno has to offer

Memory

- Flash memory (program space), is where the Arduino sketch is stored.
- SRAM (static random access memory) is where the sketch creates and manipulates variables when it runs.
- EEPROM is memory space that programmers can use to store long-term information.

Power

You can power the board using a USB port or DC power supply such as a 9v battery. The Arduino will default to the external power supply if there is one available.

Figure: Arduino can be powered by a DC supply 7-12v

Analogue vs. Digital Signal

What is the difference?

Analogue vs. Digital Signal

What is the difference?

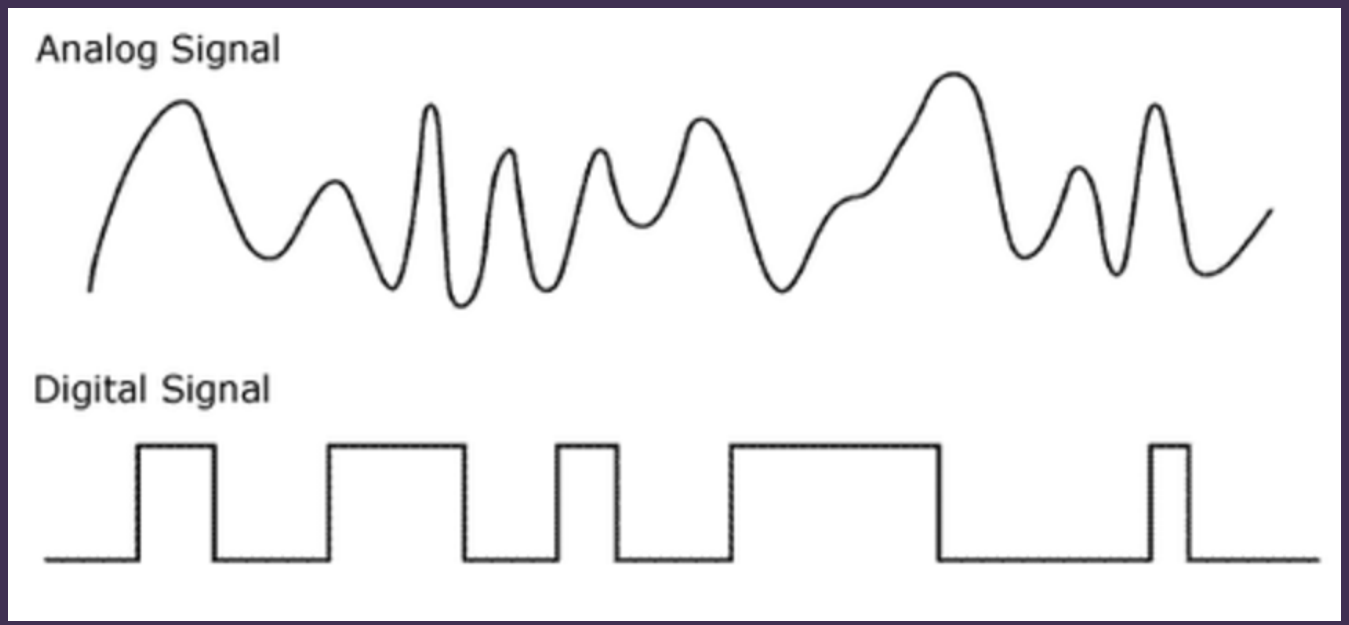
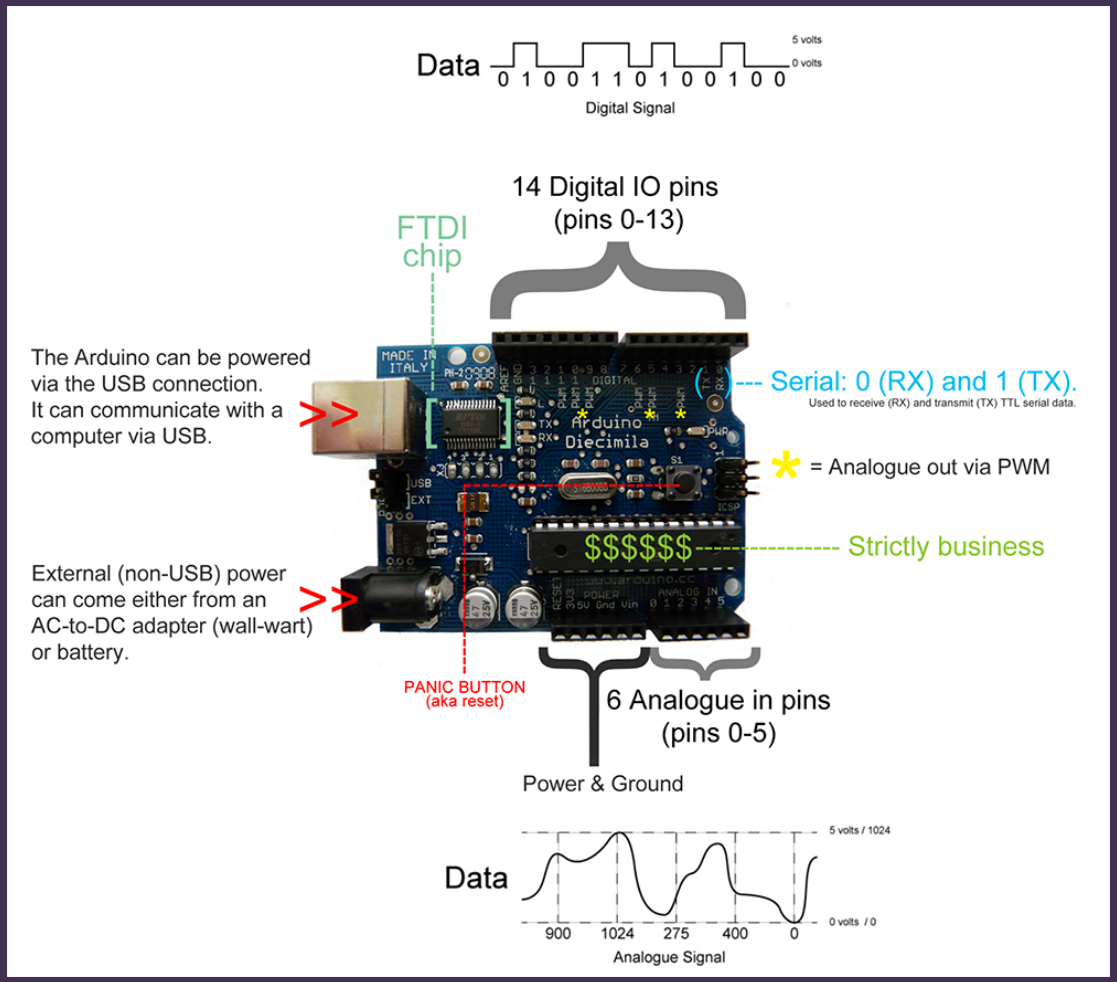
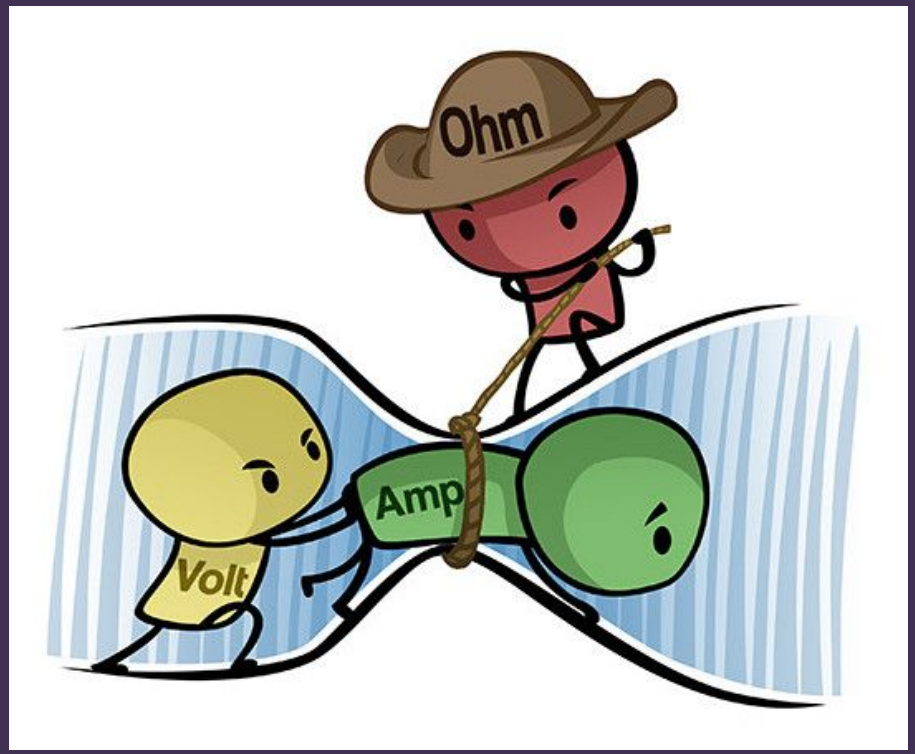


Figure: Arduino can be powered by a DC supply 7-12v

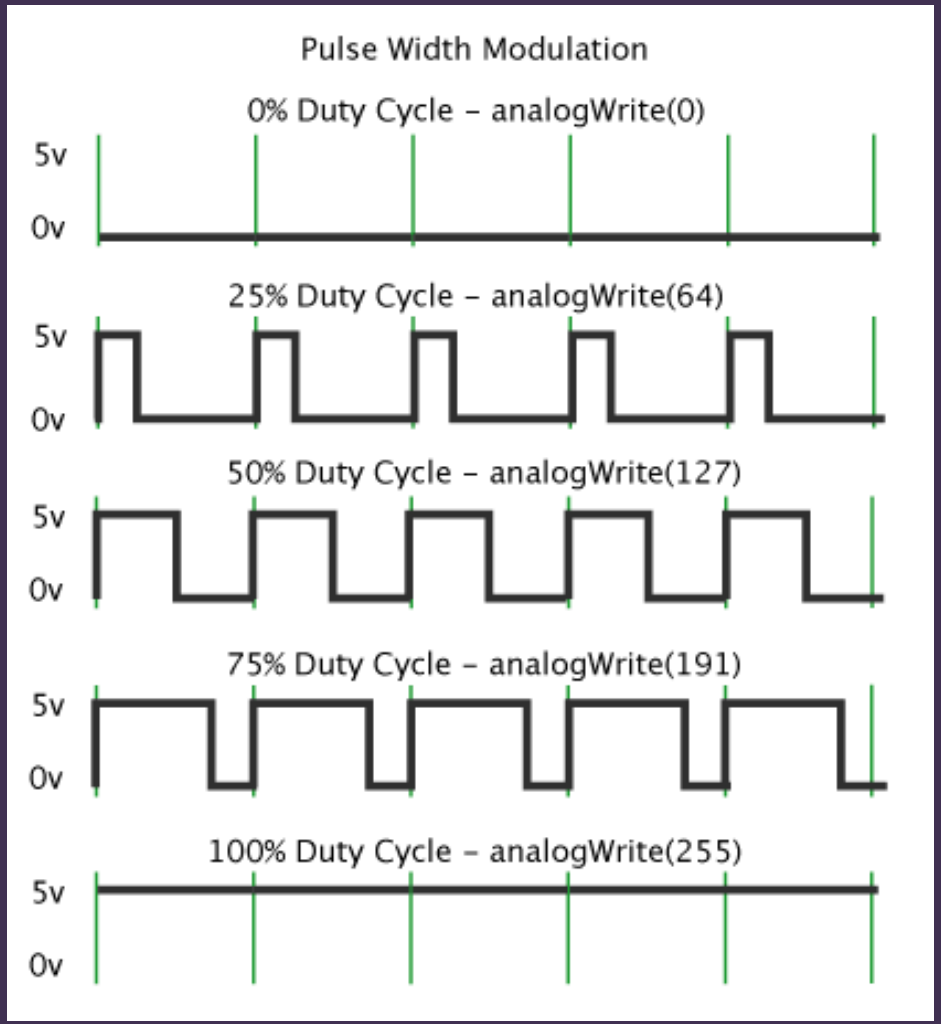
Arduino


Data
5 volts
0 volts
0 1 0 0 1 1 0 1 0 0 1 0 0
Digital Signal
14 Digital IO pins
(pins 0-13)
FTDI
chip
The Arduino can be powered via the USB connection. It can communicate with a computer via USB.
--- Serial: 0 (RX) and 1 (TX).
Used to receive (RX) and transmit (TX) TTL serial data.
= Analogue out via PWM
$$$$$$ ---------- Strictly business
External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery.
PANIC BUTTON
(aka reset)
6 Analogue in pins
(pins 0-5)
Power & Ground
Data
5 volts / 1024
0 volts / 0
900
1024
275
400
0
Analogue Signal

Ohms Law - Comic



Analogue Out - PWM



Serial Communication

Serial communication on pins TX/RX uses TTL logic levels (5V or 3.3V depending on the board).

It communicates on digital pins 0 (RX) and 1 (TX) as well as with the computer via USB. Thus, if you use these functions, you cannot also use

pins 0 and 1 for digital input or output.
Serial is used for communication between the Arduino board and a computer or other devices.

Driving Bigger Loads

Breadboard

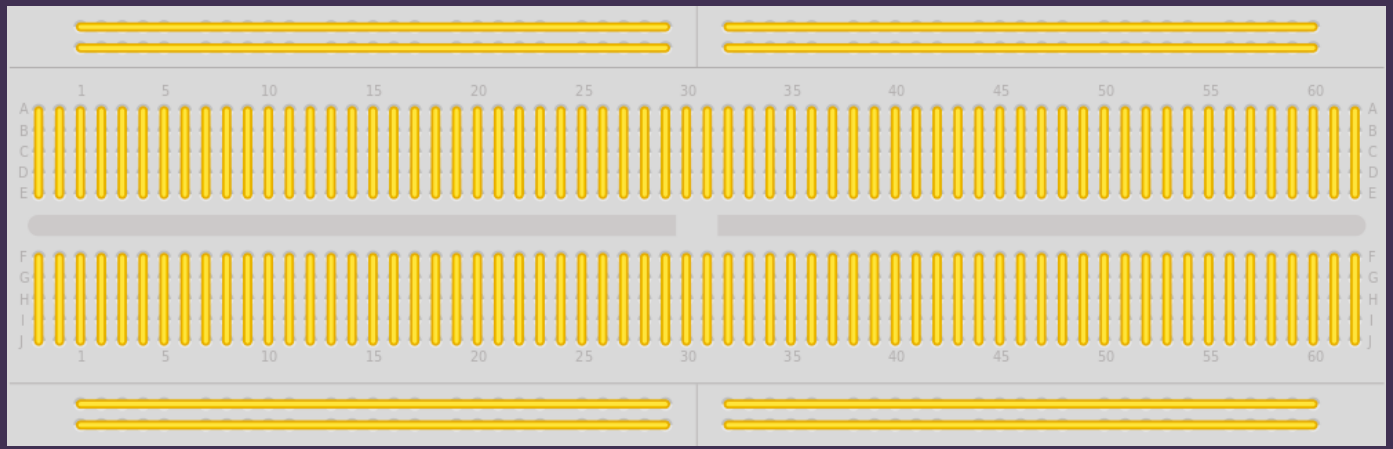
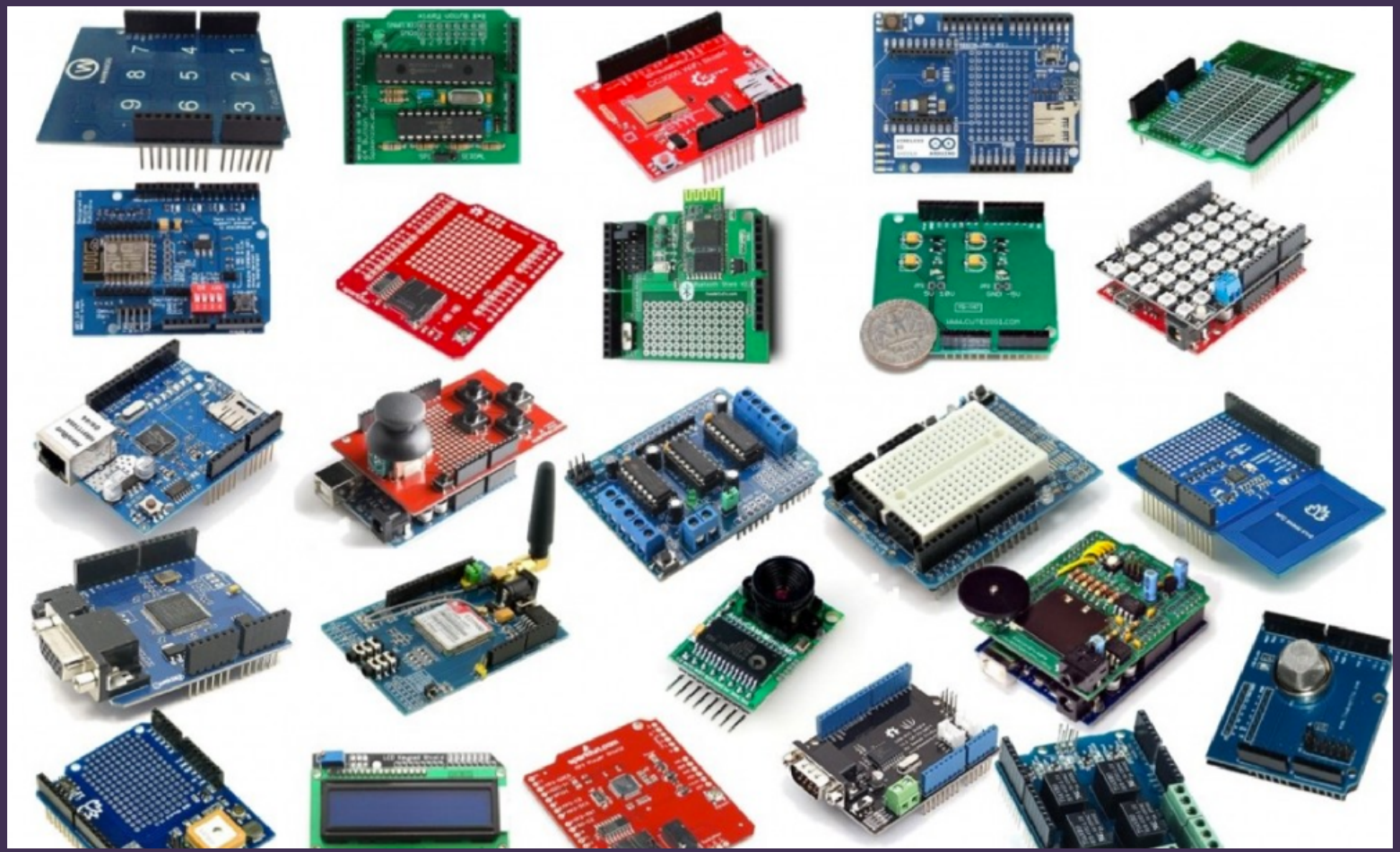
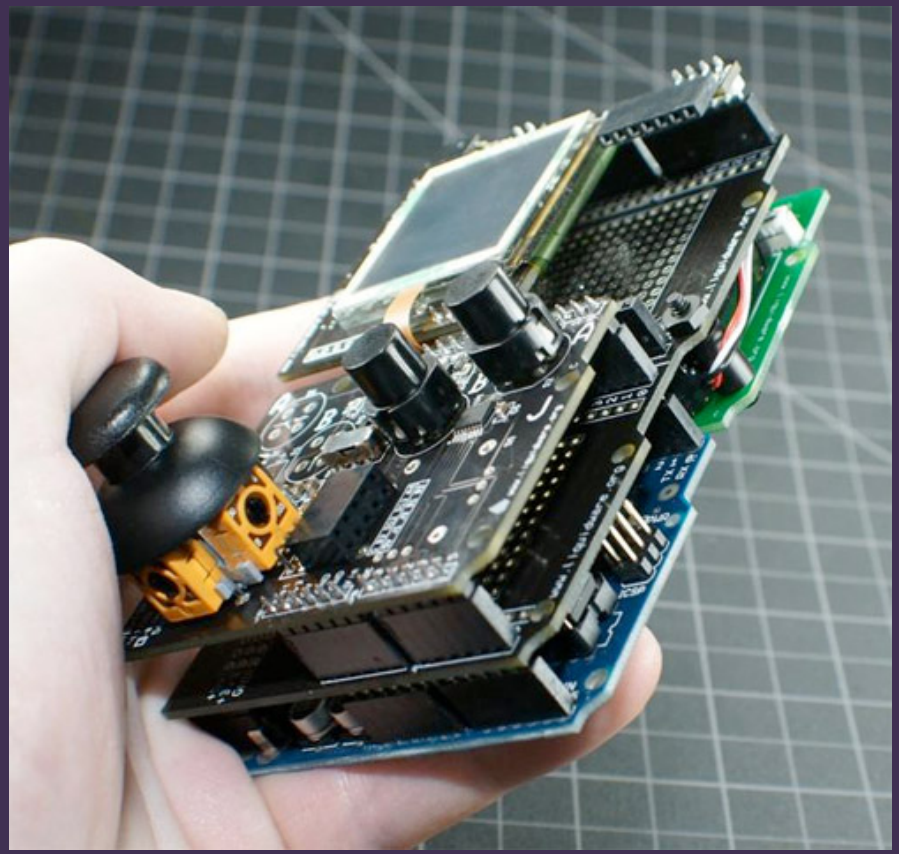


Figure: The layout of the connectors inside the bread board

Breadboard



Game Boy Clone



Places to buy components

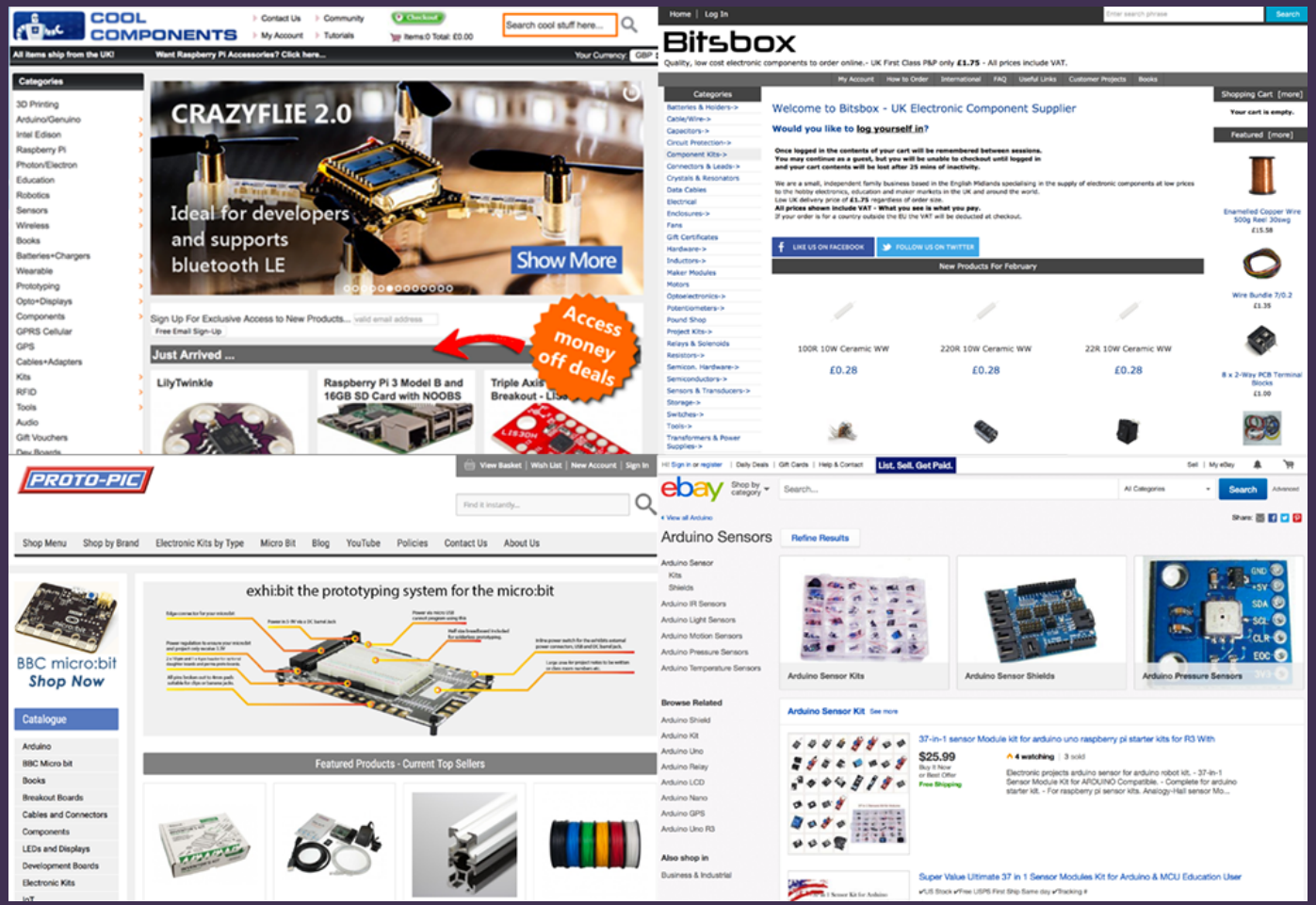


Figure: Insure that you buy your components from UK sellers, especially on Ebay