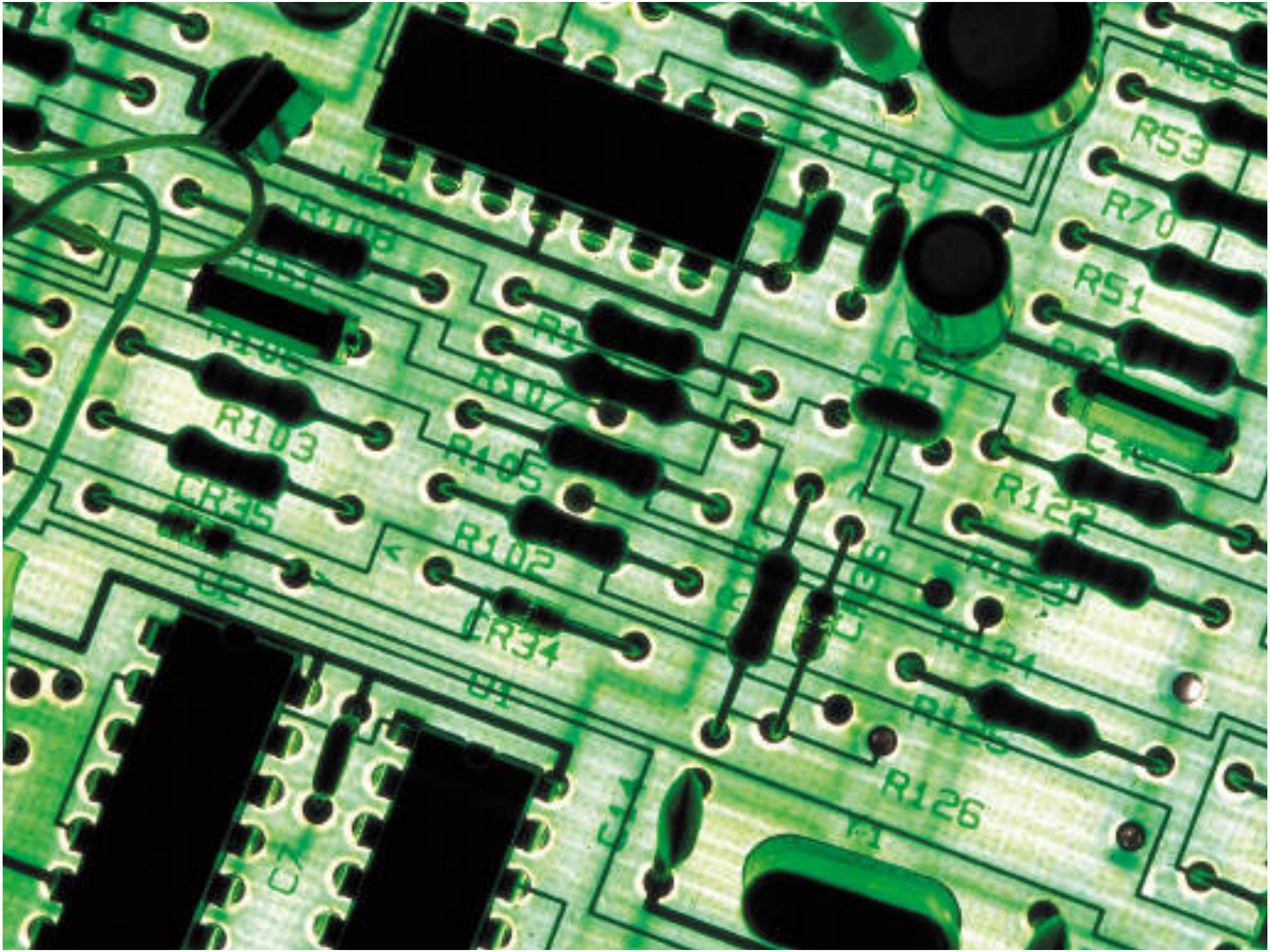

R53
R70
R51
R103
R107
R105
R123
CR25
R102
CR34
R126

“Microcontrollers”

— or —

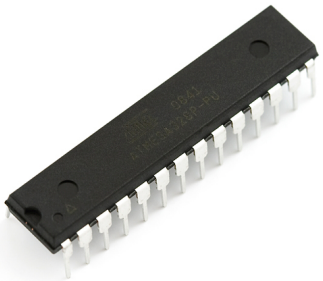
“Actually, these aren’t microcontrollers”

Kerry Veenstra

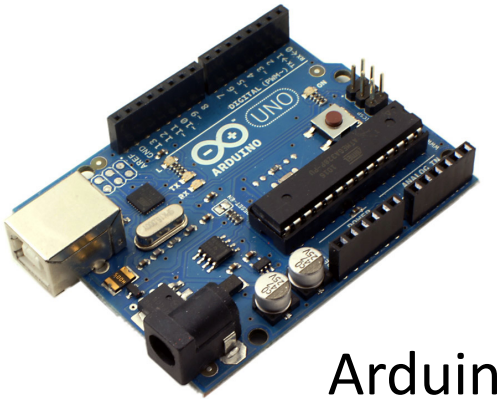
K3RRY

Microcontroller / ~~Microcontroller~~

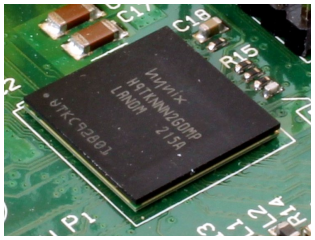
PICAXE-08M2



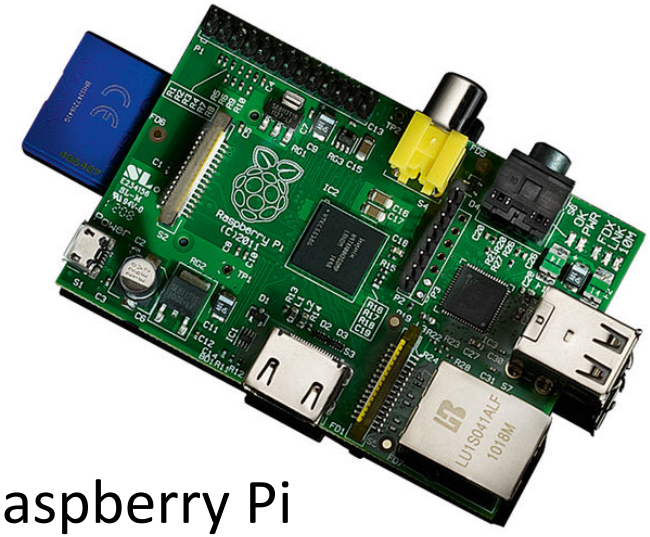
ATmega328



Arduino Uno



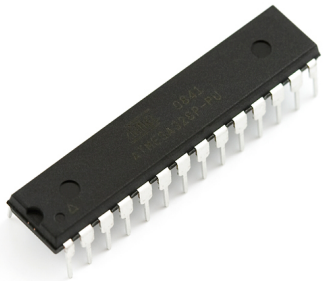
BCM2835



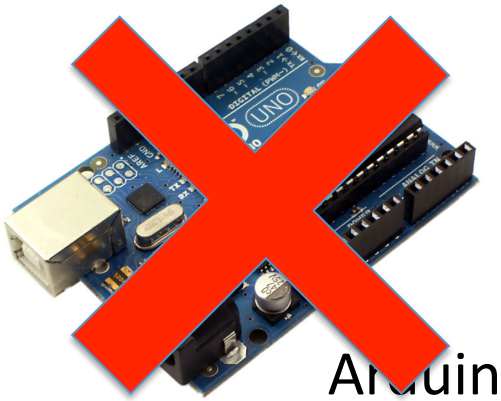
Raspberry Pi

Microcontroller / ~~Microcontroller~~

PICAXE-08M2

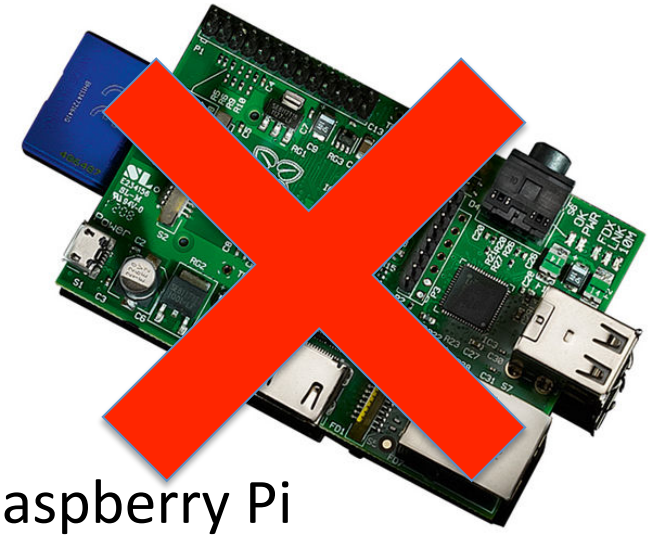


ATmega328



Arduino Uno

BCM2835

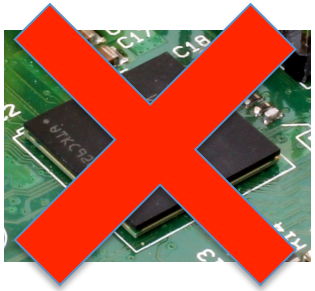


Raspberry Pi

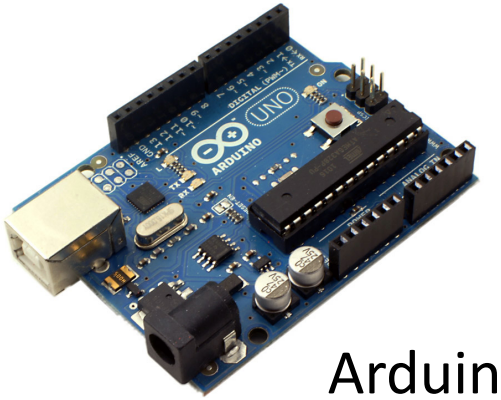
Microcontroller / ~~Microcontroller~~

PICAXE-08M2

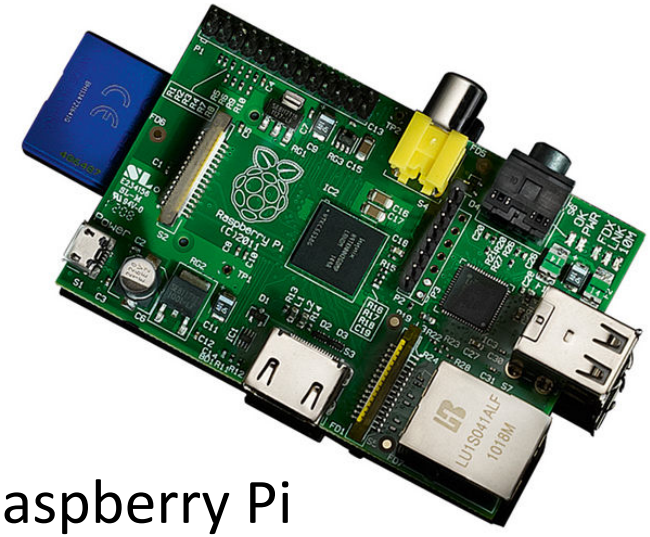
ATmega328



BCM2835



Arduino Uno



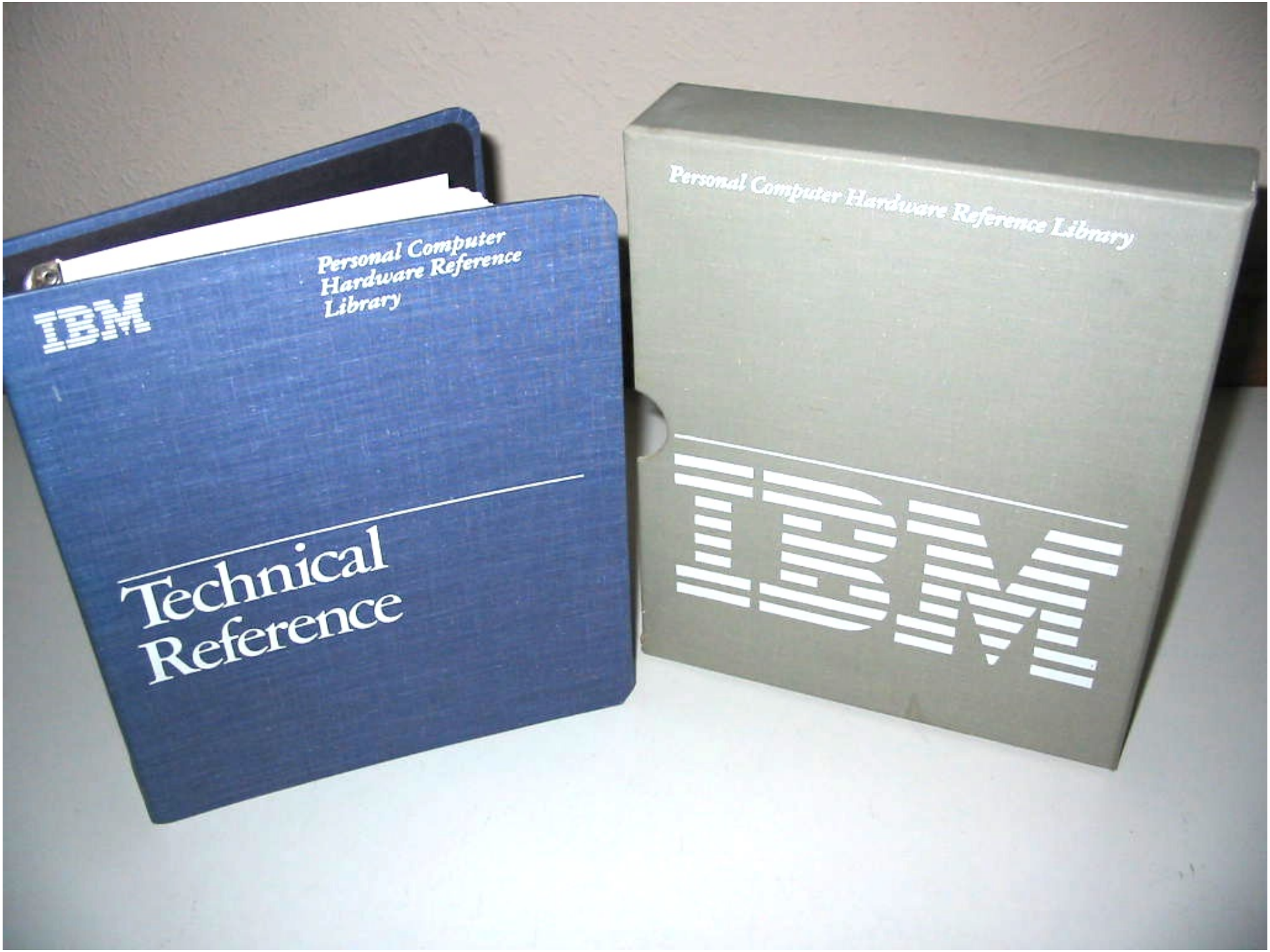
Raspberry Pi

ECOSYSTEM


DIGITAL ECOSYSTEM

DIGITAL ECOSYSTEM

- Commerce
  - Official Documentation
  - Numerous Hardware Vendors

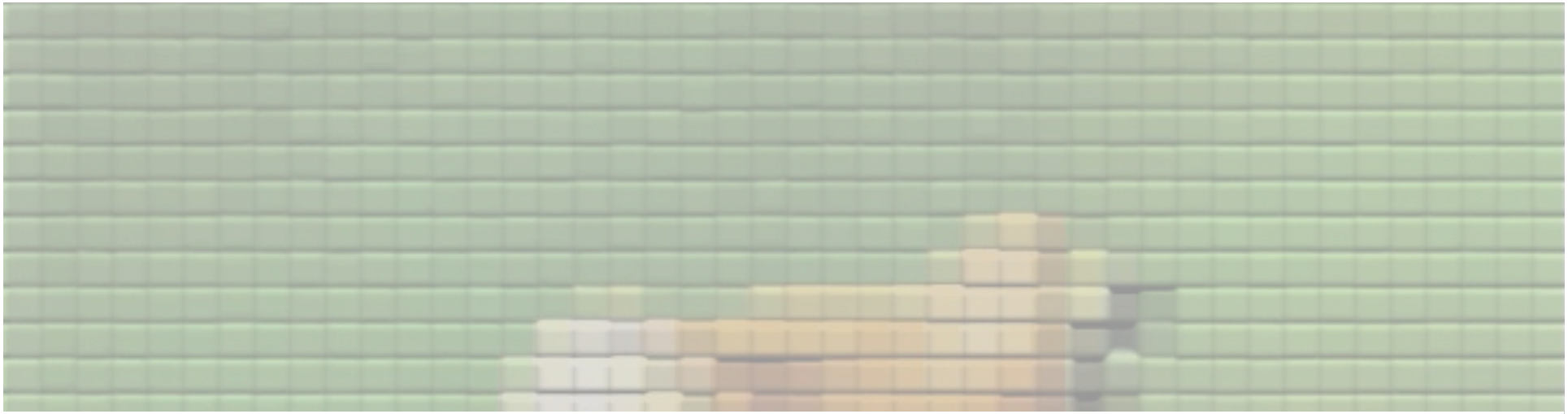

IBM
Personal Computer
Hardware Reference
Library
Technical
Reference
Personal Computer Hardware Reference Library
IBM

DIGITAL ECOSYSTEM

- Commerce
  - Official Documentation
  - Numerous Hardware Vendors
- Self-Organized Society
  - Contributed Libraries
  - Forum
  - Wiki

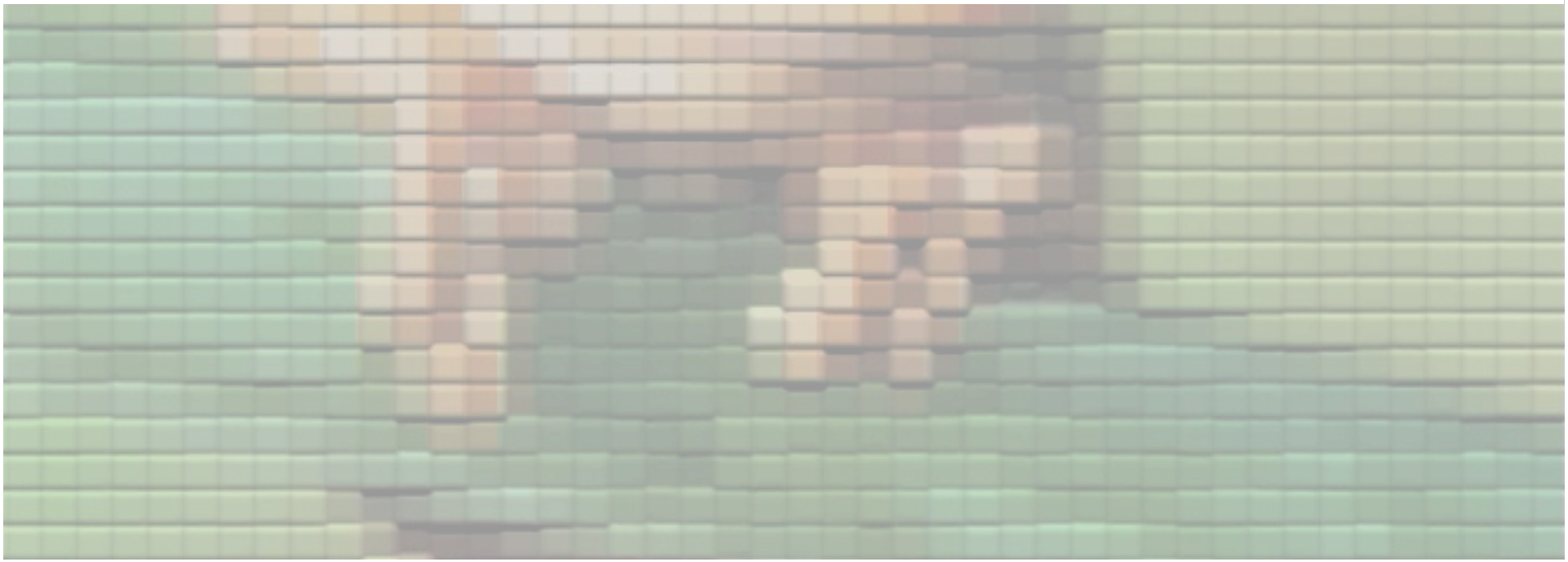
Measuring Digital Ecosystems

Platform	Google Results	O'Reilly Books
Arduino	17,000,000	69
Raspberry Pi	8,600,000	9
PICAXE	730,000	0
BASIC Stamp	740,000	0
Propeller	120,000	1



Recommendation:

Choose a Popular Platform



ARDUINO

search

Buy | Download | Getting Started | Learning | Reference | Hardware | FAQ

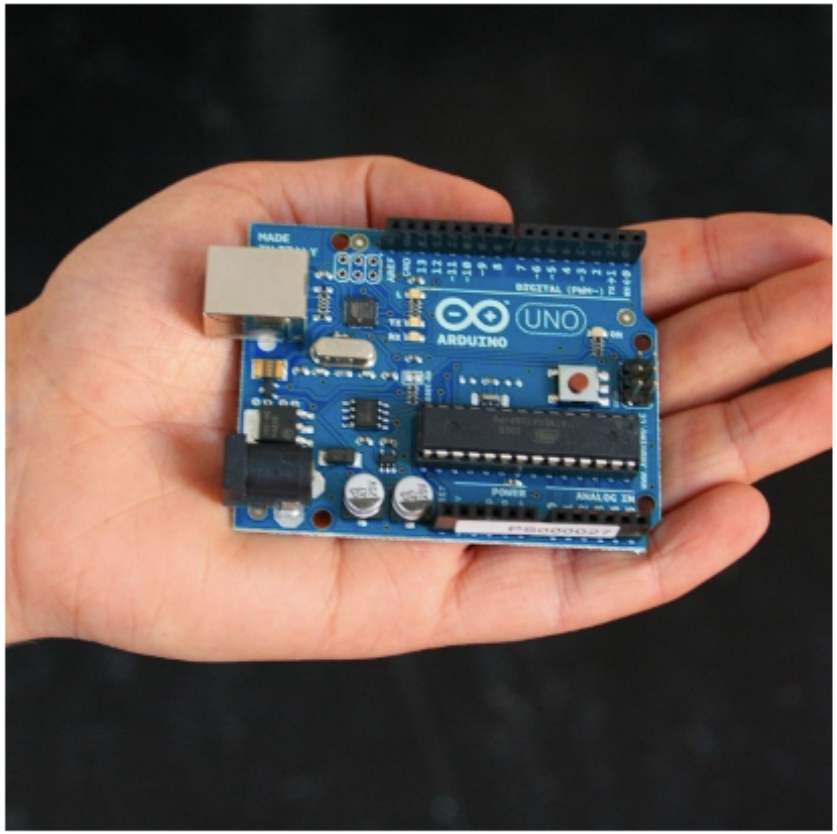
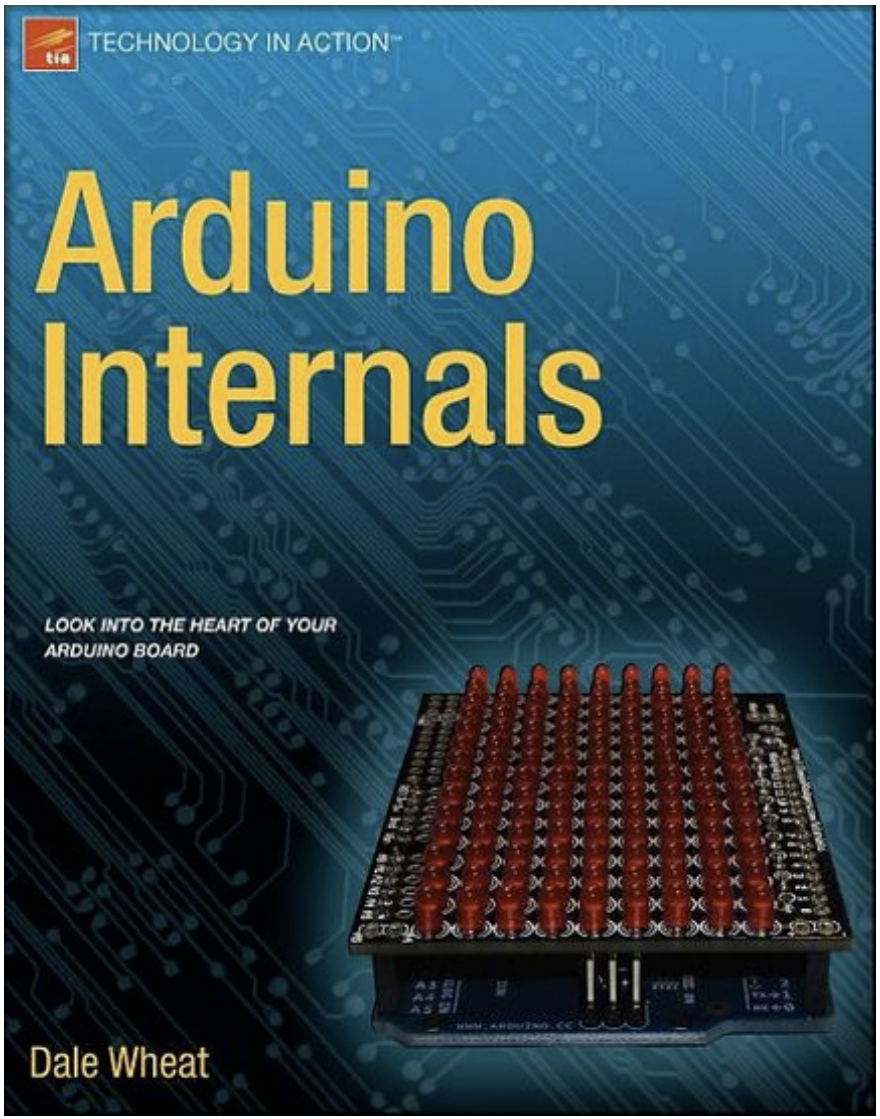


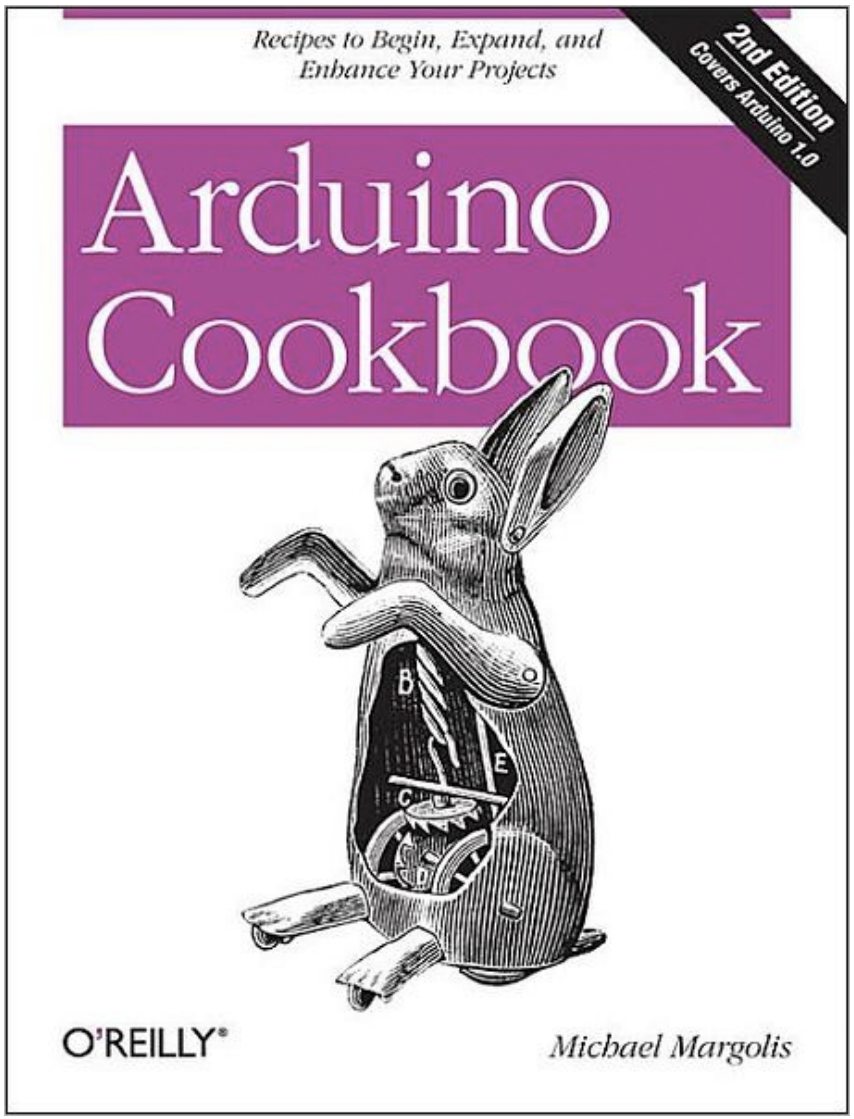
Photo by the Arduino Team

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language (based on Wiring) and the Arduino development environment (based on Processing). Arduino projects can be stand-alone or they can communicate with software running on a computer (e.g. Flash, Processing, MaxMSP).

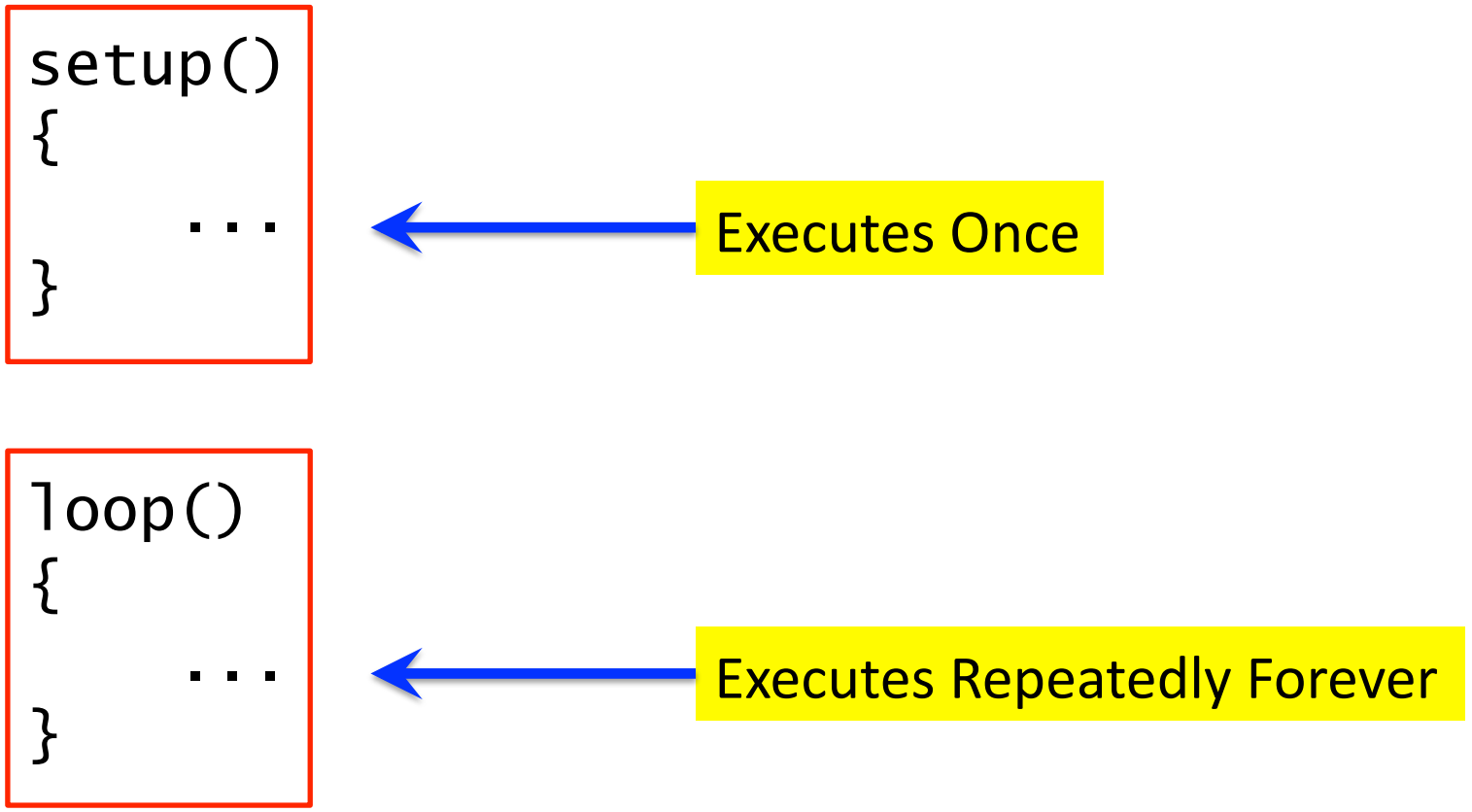
The boards can be built by hand or purchased preassembled; the software can be downloaded for free. The hardware reference designs (CAD files) are


TECHNOLOGY IN ACTION™
Arduino Internals
LOOK INTO THE HEART OF YOUR ARDUINO BOARD
Dale Wheat


Recipes to Begin, Expand, and Enhance Your Projects
2nd Edition
Covers Arduino 1.0
Arduino Cookbook
O'REILLY®
Michael Margolis

Arduino Programs are Simple

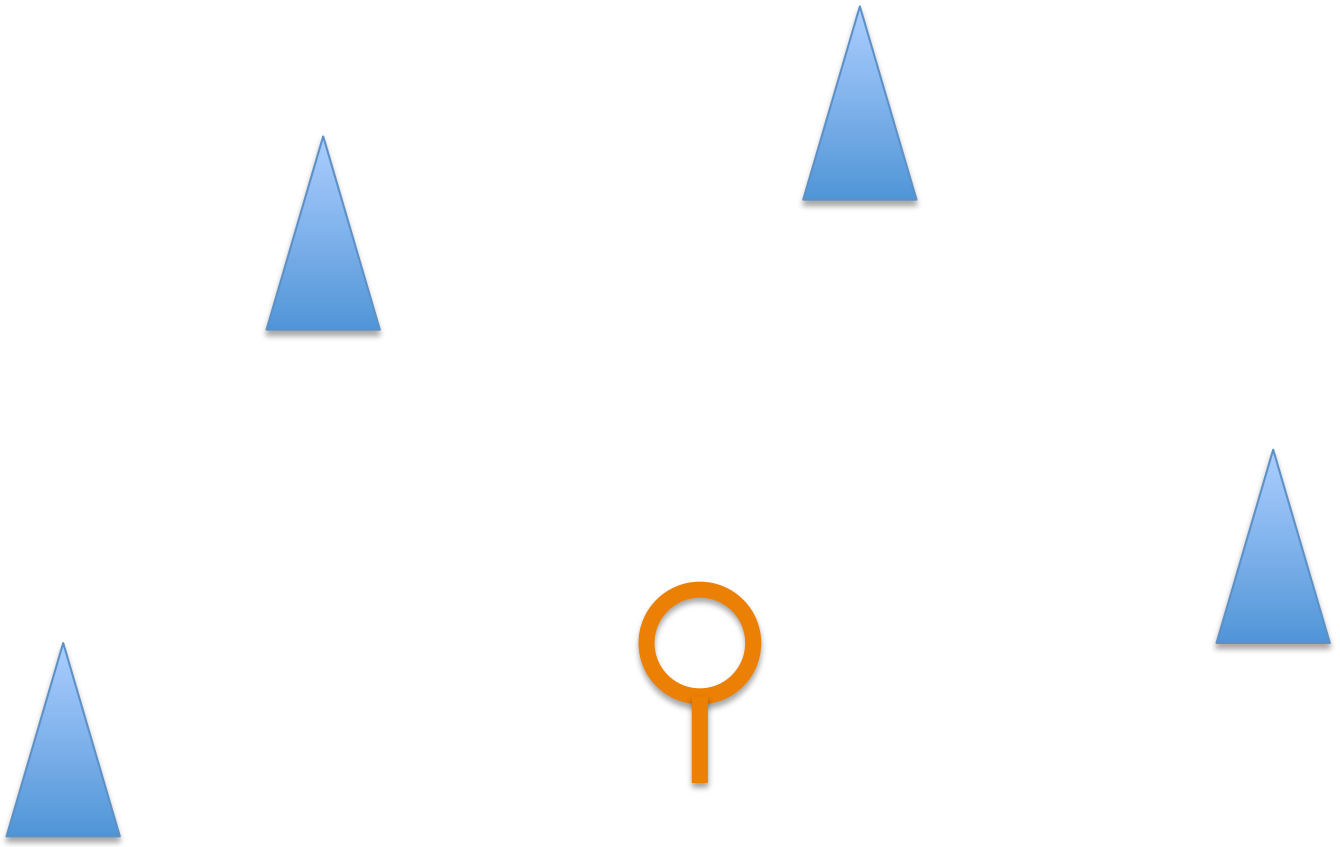
- Write two functions:



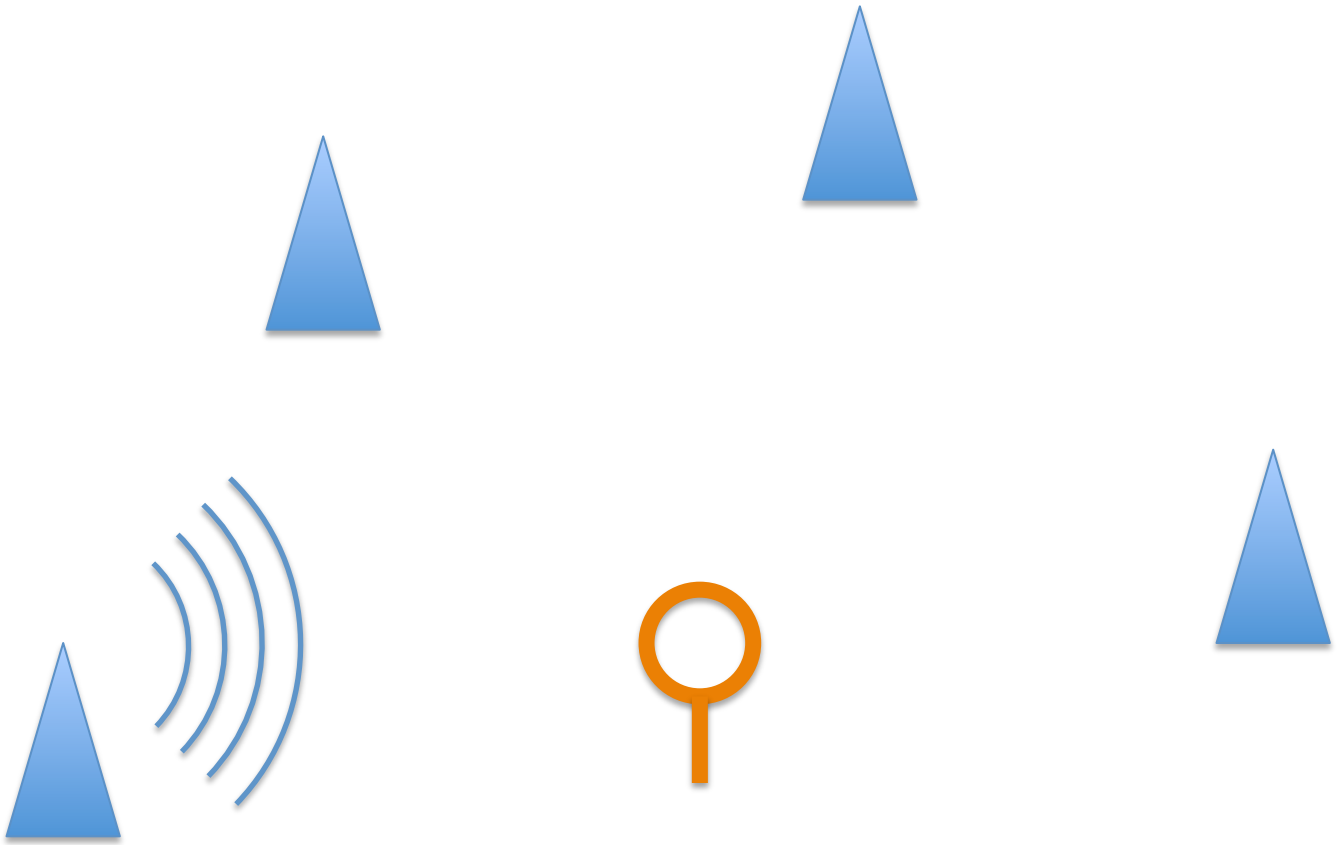
~~Transmitter Hunt Controller~~

~~Transmitter-Hunt *Transmitter* Controller~~

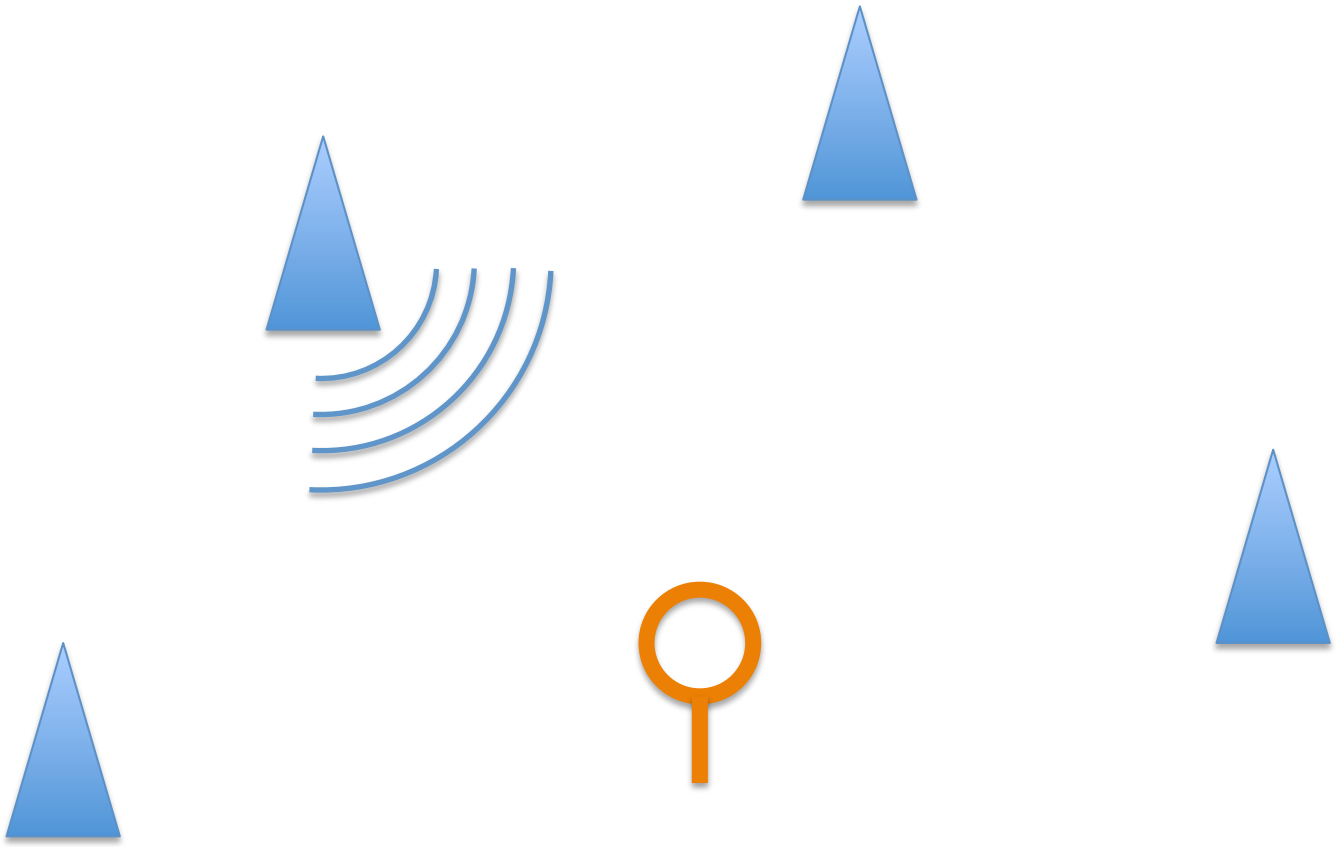
“Hunted Transmitter Controller”



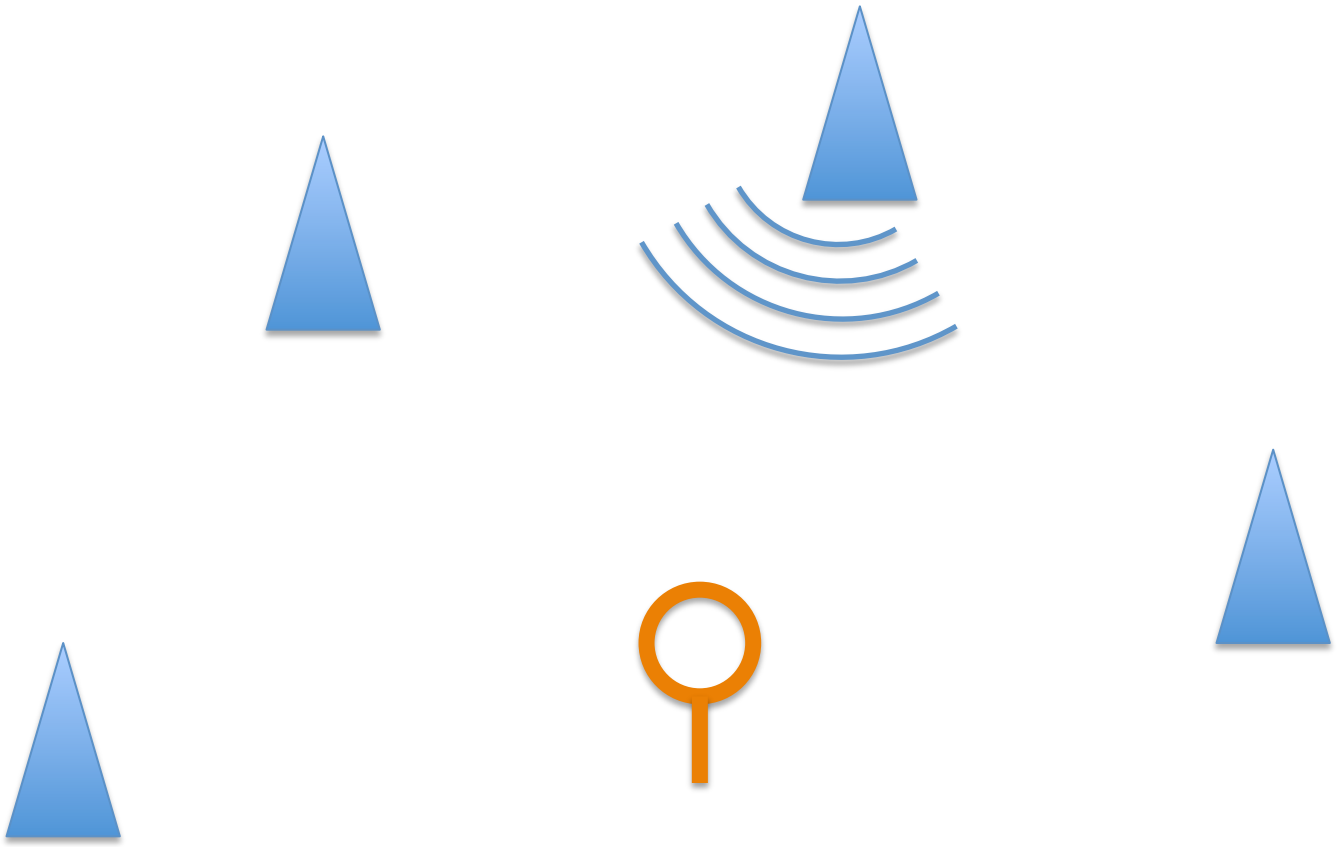
“Hunted Transmitter Controller”



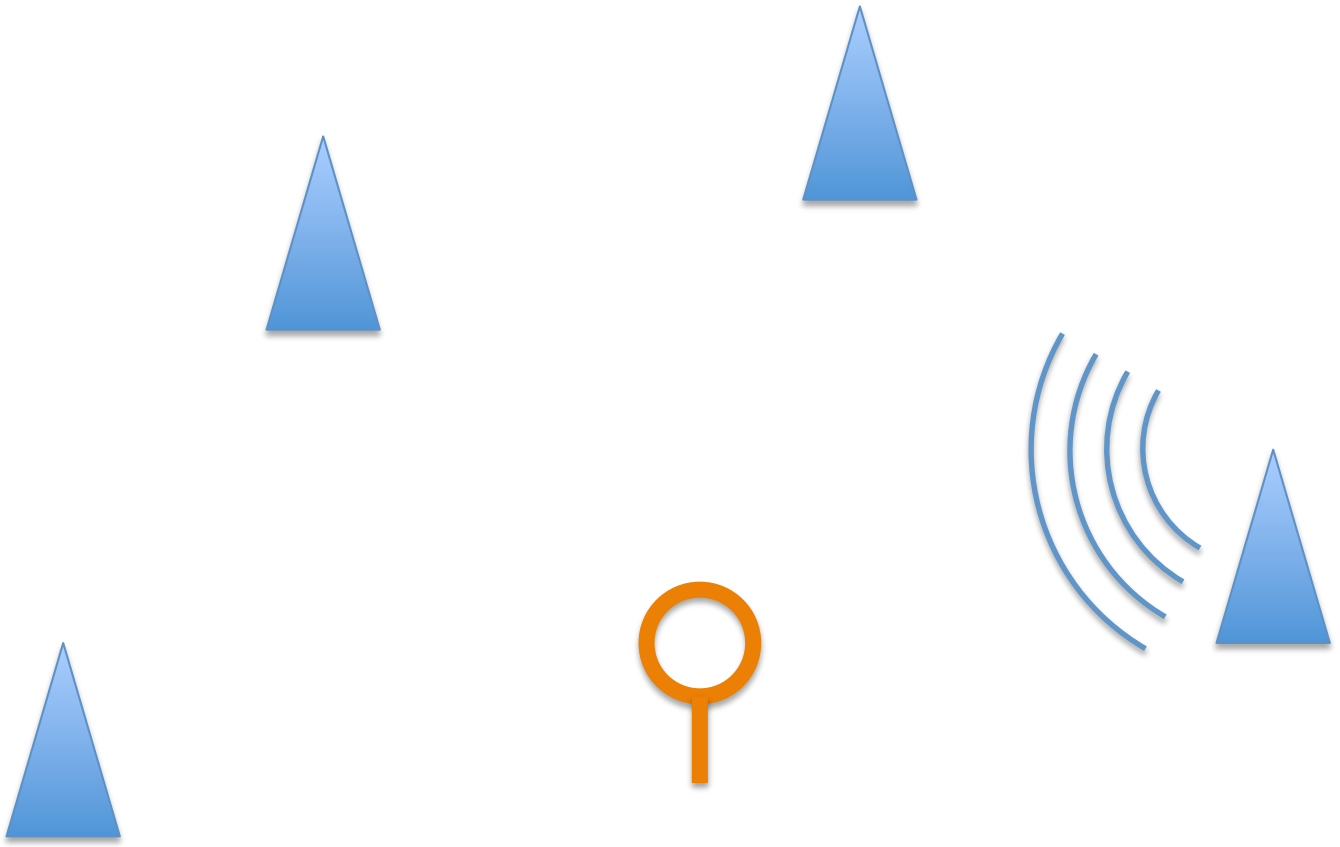
“Hunted Transmitter Controller”



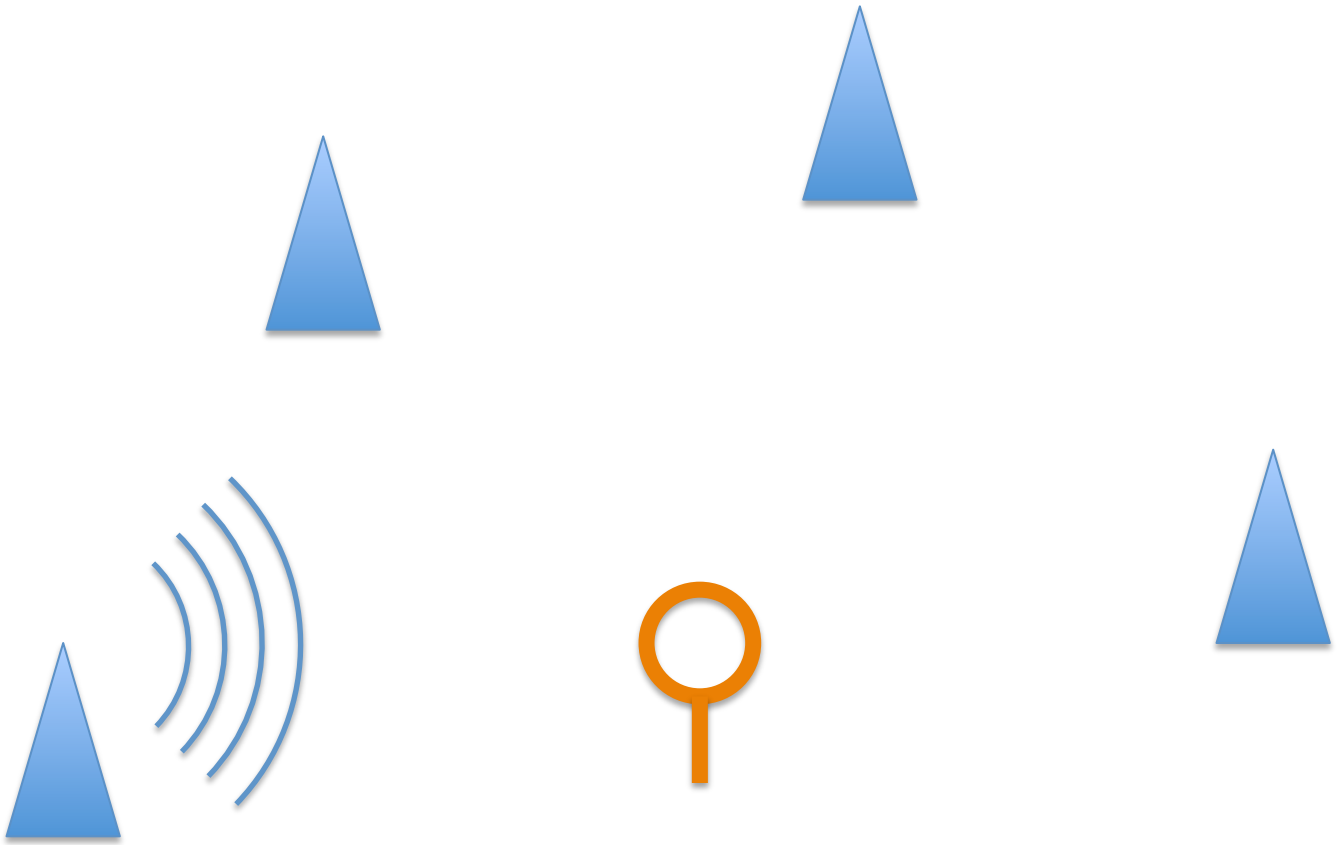
“Hunted Transmitter Controller”



“Hunted Transmitter Controller”

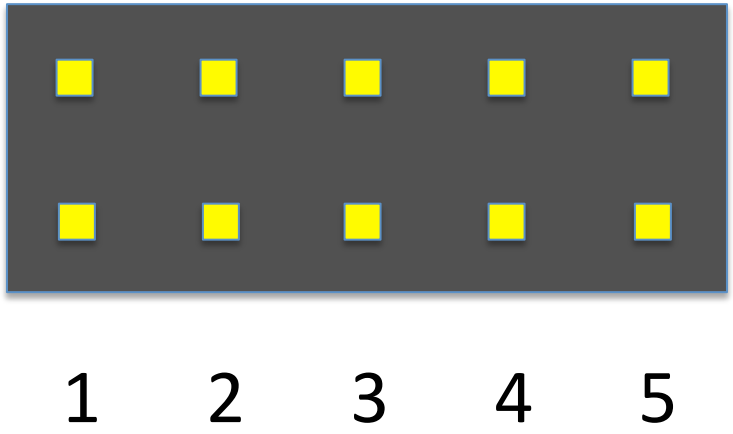


“Hunted Transmitter Controller”



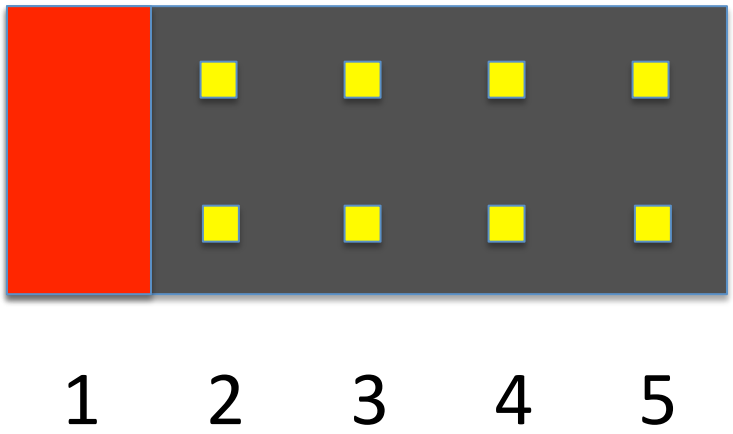
Configuring the Controller

- Transmitter ID (1–5)



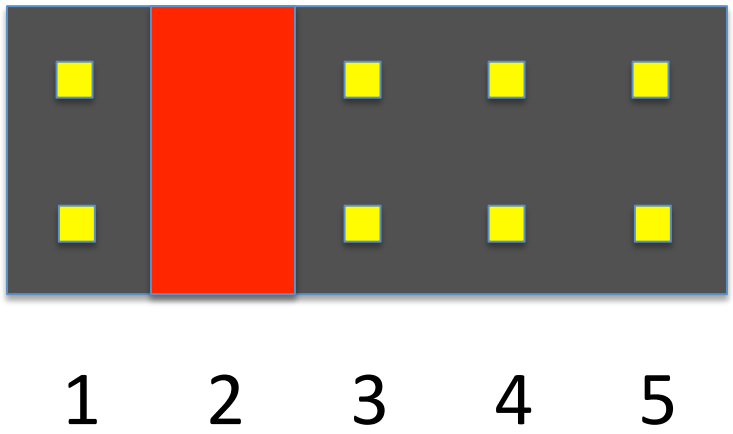
Configuring the Controller

- Transmitter 1



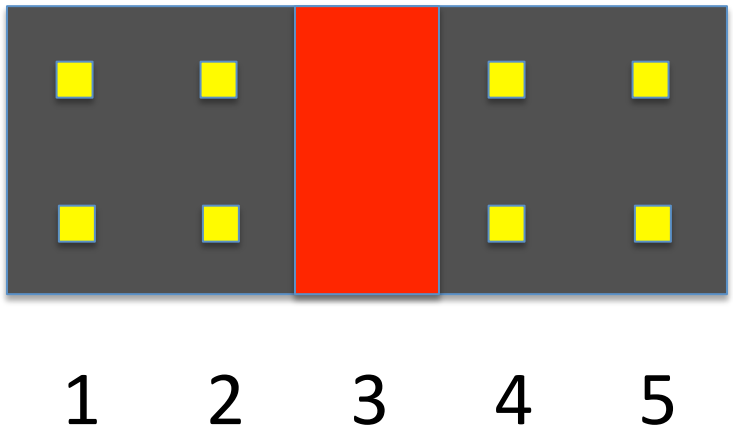
Configuring the Controller

- Transmitter 2



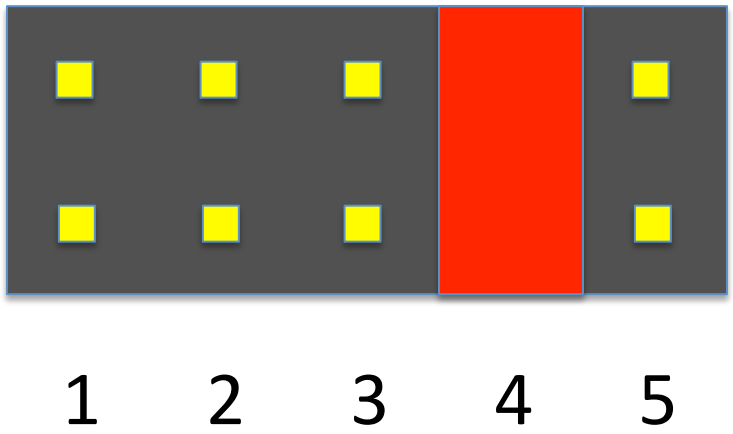
Configuring the Controller

- Transmitter 3



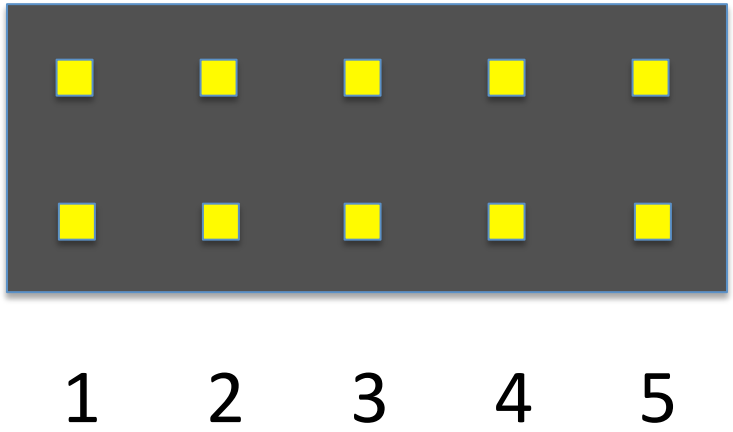
Configuring the Controller

- Transmitter 4



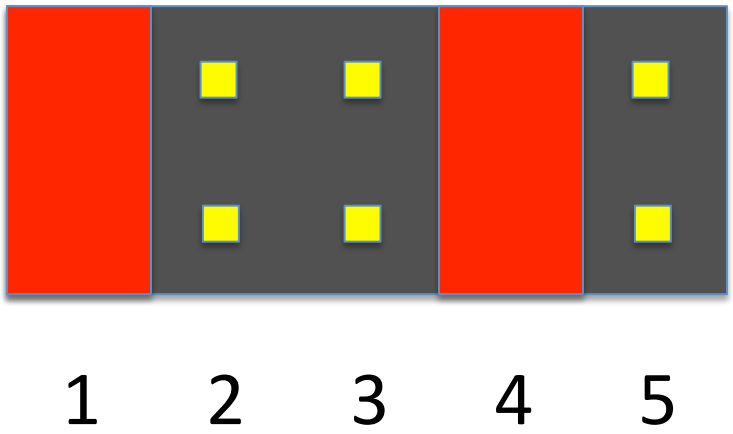
Configuring the Controller

- Transmitter ID (1–5)
- Number of Transmitters (1–5)



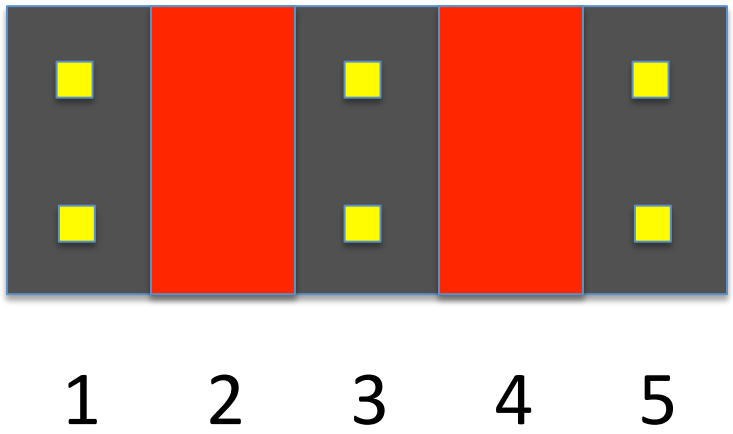
Configuring the Controller

- Transmitter 1 of 4



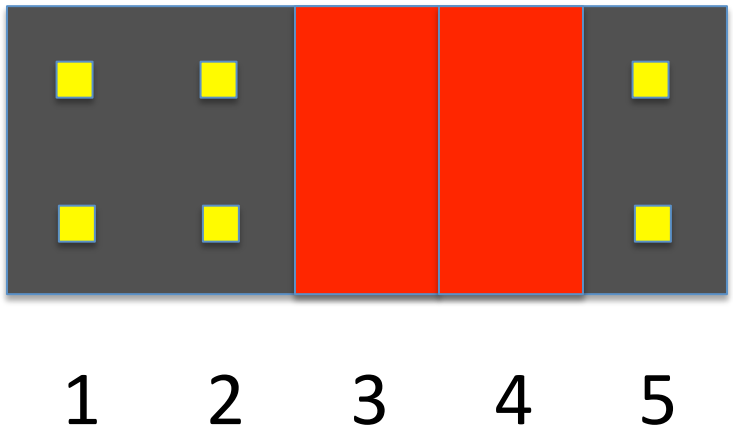
Configuring the Controller

- Transmitter 2 of 4



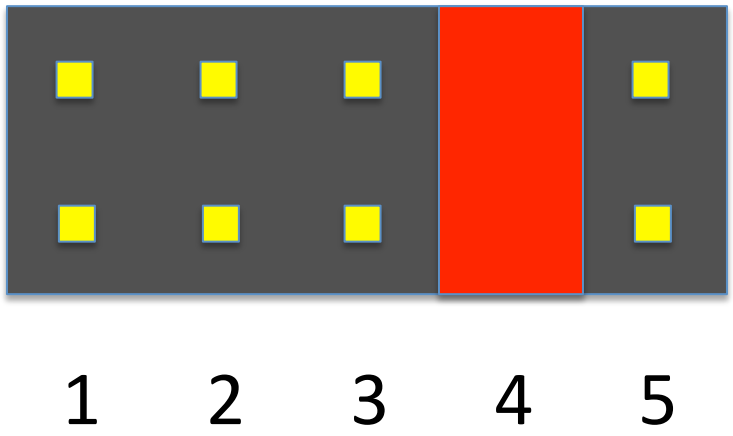
Configuring the Controller

- Transmitter 3 of 4



Configuring the Controller

- Transmitter 4 of 4



Transmitter Sends Morse Code ID

Transmitter 1	MOE	– – – – – •
Transmitter 2	MOI	– – – – – ••
Transmitter 3	MOS	– – – – – •••
Transmitter 4	MOH	– – – – – ••••
Transmitter 5	MO5	– – – – – •••••

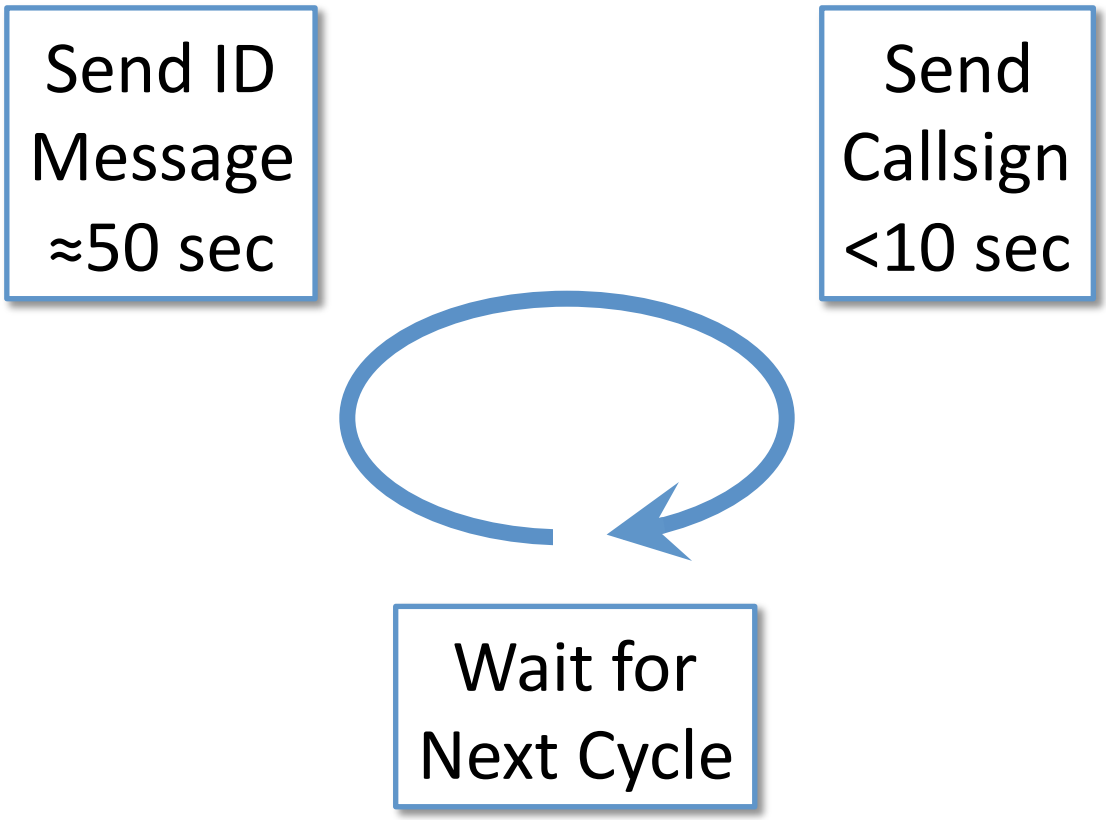
→ IDs are repeated several times

→ Followed by callsign of control operator

`setup()`

- Initialize Pins
- Read Configuration Jumpers
- Compute Messages
- Delay Until Loop Should Start

loop()


Send ID Message ≈50 sec
Send Callsign <10 sec
Wait for Next Cycle

Ideas from: Reflow Toaster Oven Controller

- Scheduling Tasks — Each Task Gets This Treatment

```
setup()
{
    unsigned long task_time = millis() + 1000;
}

loop()
{
    if (millis() > task_time)
    {
        task_time = task_time + TASK_PERIOD;
        execute_task();
    }
}
```

Ideas from: Ethernet Thermometer

- Ethernet Library is Easy to Use

```
loop()
{
    if (Ethernet.begin(mac))
    {
        delay(1000);
        if (client.connect(servername, 80))
        {
            client.print("GET /file.php?q=");
            client.print(temp);
            client.println(" HTTP/1.0");
            client.println();
            while (client.connected()) {...}
            client.stop();
        }
    }
    delay(9000);
}
```

Demo: RBG LED Controller

Where to Get Arduino?

Arduino Cost Reduction

$30	Arduino Uno
$10	Ardweeny
$6	ATmega328 (with bootloader)
$2	ATmega328 (25×)

Arduino Designs will be Posted

- Hunted Transmitter Controller
- Reflow Toaster Oven Controller
- Ethernet Thermometer
- RGB LED Controller

I'll send a link in a few days.

Photo Credits

- Arduino Uno tae09.blogspot.com
- Atmel ATmega328 sparkfun.com
- Broadcom SoC wikimedia.org
- IBM PC Manual tewell.org
- LEDs wikimedia.org
- PICAXE chip picaxe.com
- Raspberry Pi diskidee.be