ARDUINO

Programmers' physical toy

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Hardware Freedom Day 2015

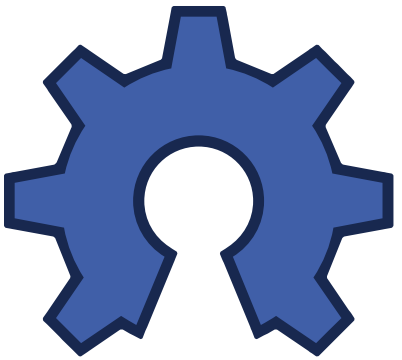
Hardware Freedom Day #hfd2015

2nd year in hack66!

Open (Source) Hardware

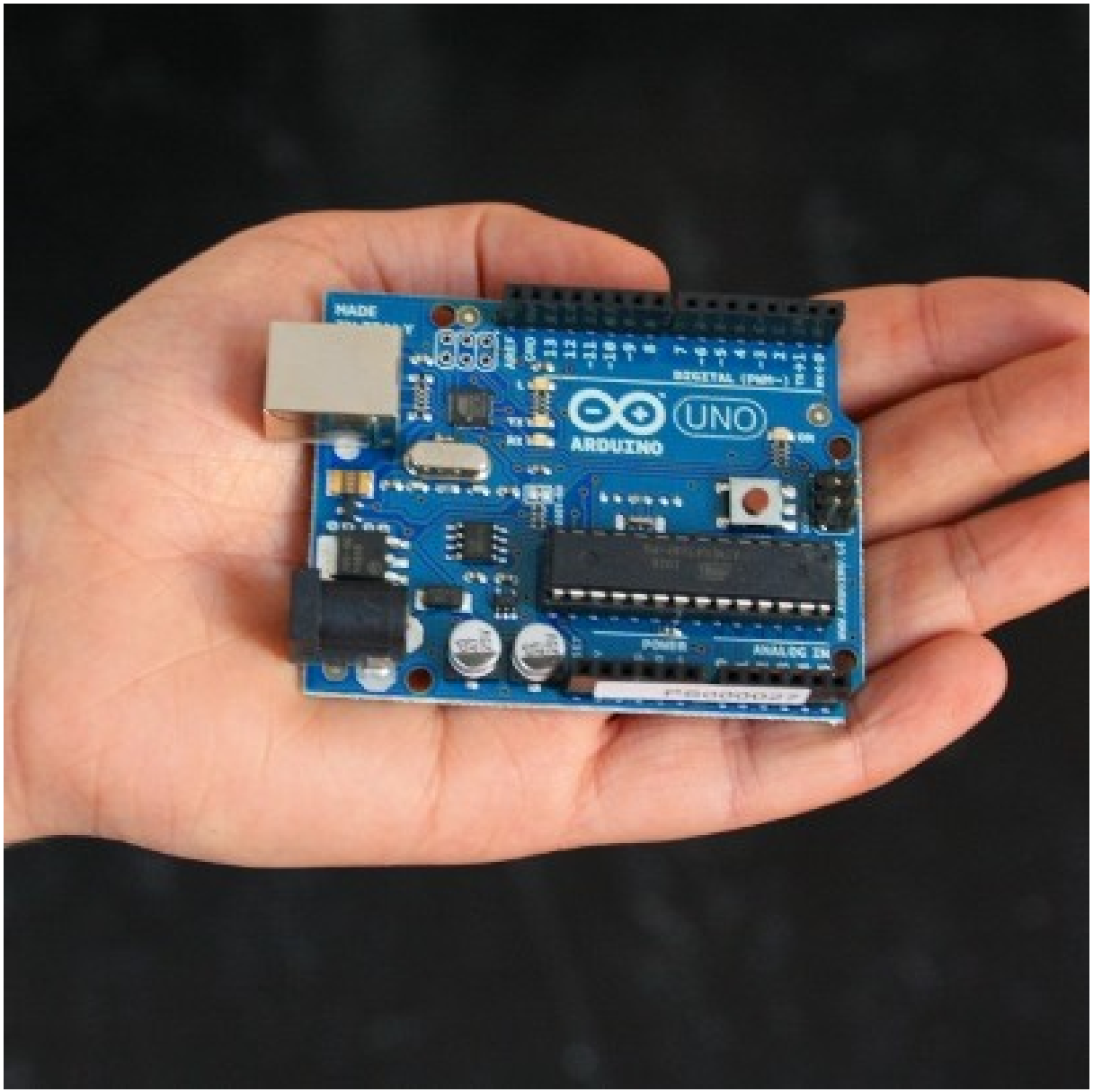
“... physical objects which design is created and shared publicly without restriction, allowing people to modify, improve and redistribute their contributions.”

- hfd.org

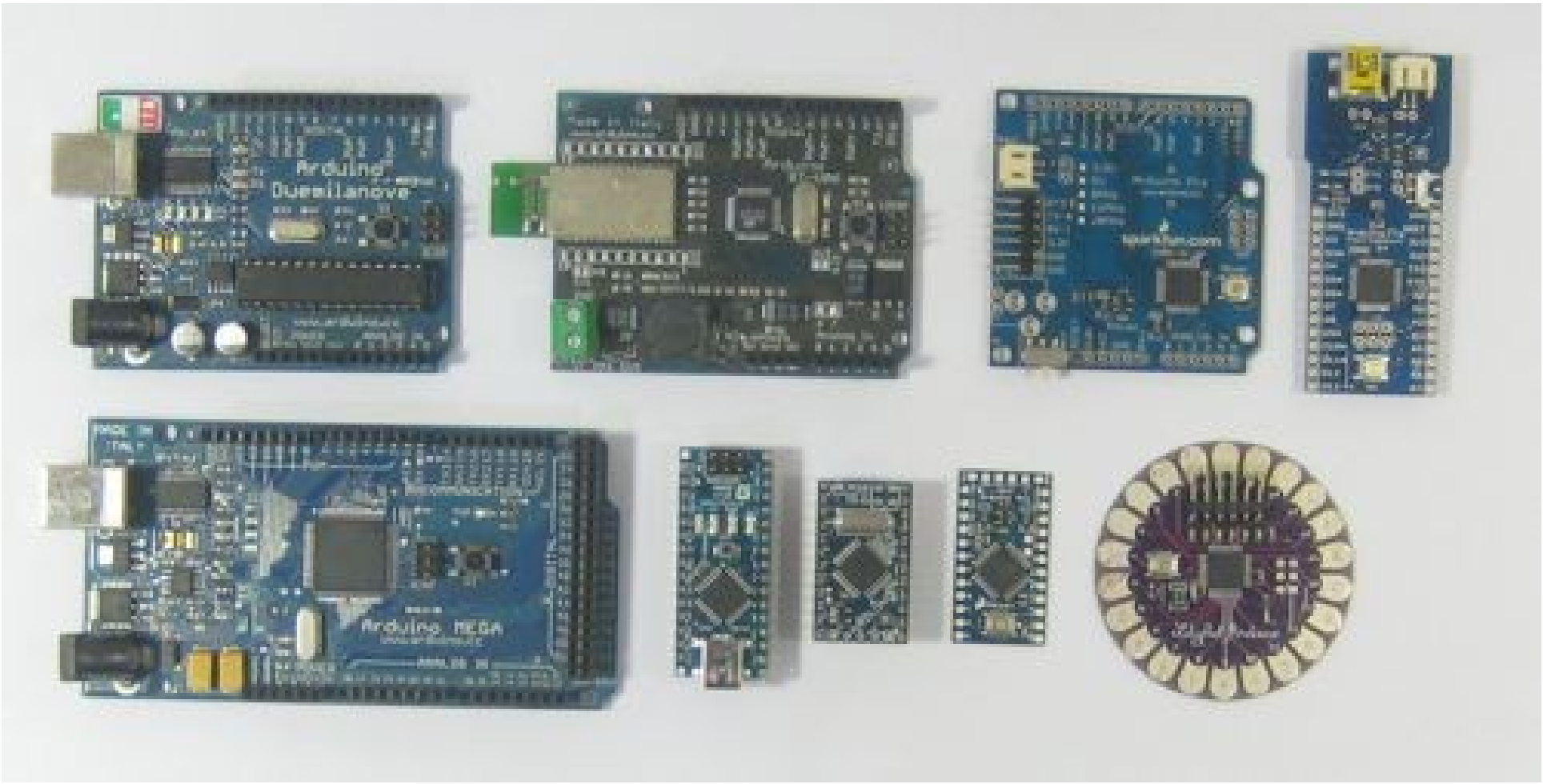


Open (Source) Hardware

ARDUINO



...or ARDUINO?



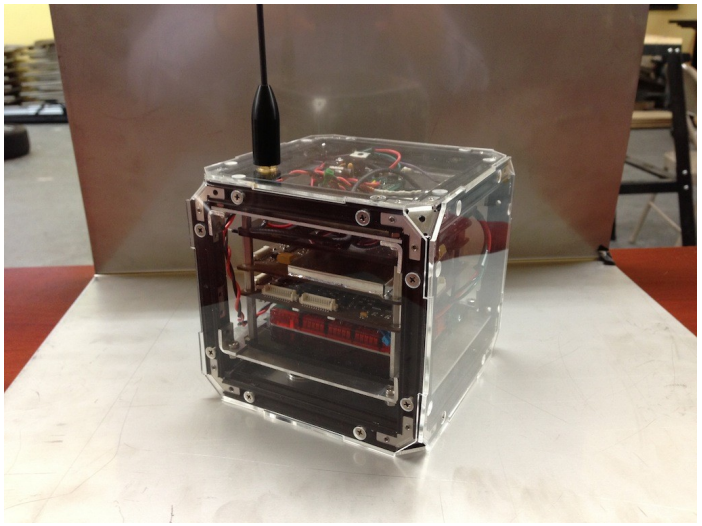
Why ARDUINO?

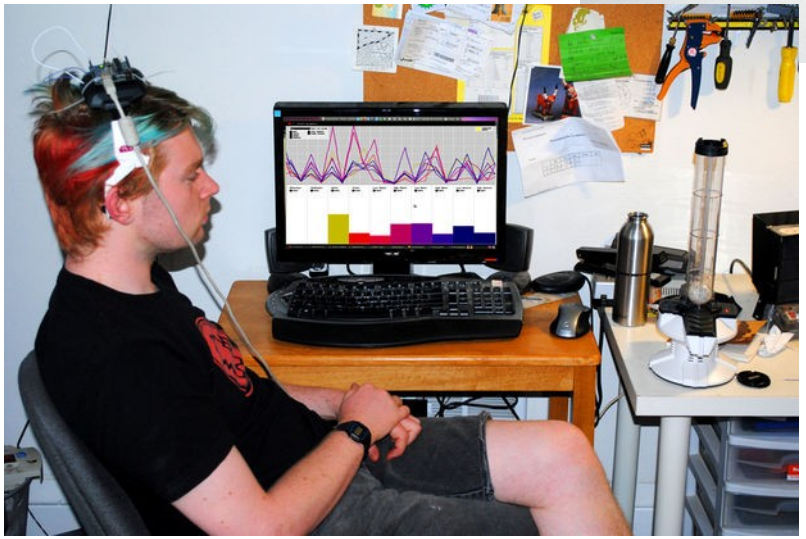
- Program in a C-like language, upload “sketches” over USB
- ARDUINO IDE, Codebender, Fritzing
- A load of compatible spin-offs and modules to conquer the world
- 99% newbie-proof
- Easy and cheap to find

Get yours!

- Official store.arduino.cc
- Ali express (~3 USD incl. shipping)
- eBay
- Local stores (http://arduino.cc/en/main/buy)
- Experiment with the ones we have in the hackerspace :)

ARDUINO projects





Basic connections

- Print common schematics (how to connect a LED, a pushbutton, a stepper...)
- ABC (ARDUINO Basic Connections) is a crowd-funded effort
  http://www.pighixxx.com/abc-english-version/
- Use a voltage meter before connecting the actual electronic parts

Describe the circuit in your source code files

- For integrated circuits (like sensors / operational amplifiers etc.) write down their number and manufacturer
- Also include schematics as separate files

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Hardware:
    * Arduino Yun board (connected via Ethernet to the Internet)
    * NPN Hall Effect Sensor A 42E

The circuit:
    * Vcc of the hall effect sensor to +3.3V
    * GND of the hall effect sensor to ground
    * OUTPUT of the hall effect sensor to digital pin 12
    * 220 Ohm transistor between Vcc and Output of the sensor
```

setup() and loop()

Stall == Death

- Draw a flow chart. Make sure your logic does not get “trapped”
  - Programming for microcontrollers is heavily based on conditionals
- Give feedback from time to time by blinking a LED or by printing to the serial port

Power Back plan

- Reset using the physical reset button, code, or the RESET pin
- If your sketch has to access initialization values stored on external sources (e.g. an SD card or the Internet), hard-code a default value
- Your circuit might also need initialization (e.g. clearing an LCD screen)

You name it

- Use #define or constants to give code-names to pin numbers
- powerLed and temperatureInput are easier to remember than “13” or “12”
- Giving friendly names to pins helps you configure your code for other boards
- Write comments, split your code in functions with appropriate names

Beyond ARDUINO limits

- ARDUINO can power modules with 3.3V or 5V. Use an external power source for motors, servos etc.
- Use shift registers to free pins. Recursively.
- ThereIsAShieldForThat(tm)
  - Ethernet, WiFi, SD Card, LCD screen...
- Power ARDUINO with a 9V battery and take it for a walk
- Utilize the PWM pins

Learn the hard way

- ICs you've been waiting for months smell like roast chicken when they get burned
- Electronic parts ship without spec documents
- If you only had that 470 Ohm resistor!
- Wait, was this functional amplifier non-functional since the beginning?
- Wire a circuit correctly at the first attempt. Now check again.
- Ignore sensors input noise
- Power ARDUINO with an unreliable charger
- Short Vin to GDN, exceed total microcontroller current, apply >3.3V to the 3.3V Connector Pin
- Burn a wrong bootloader
- Divide by ZERO

Thanks!

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