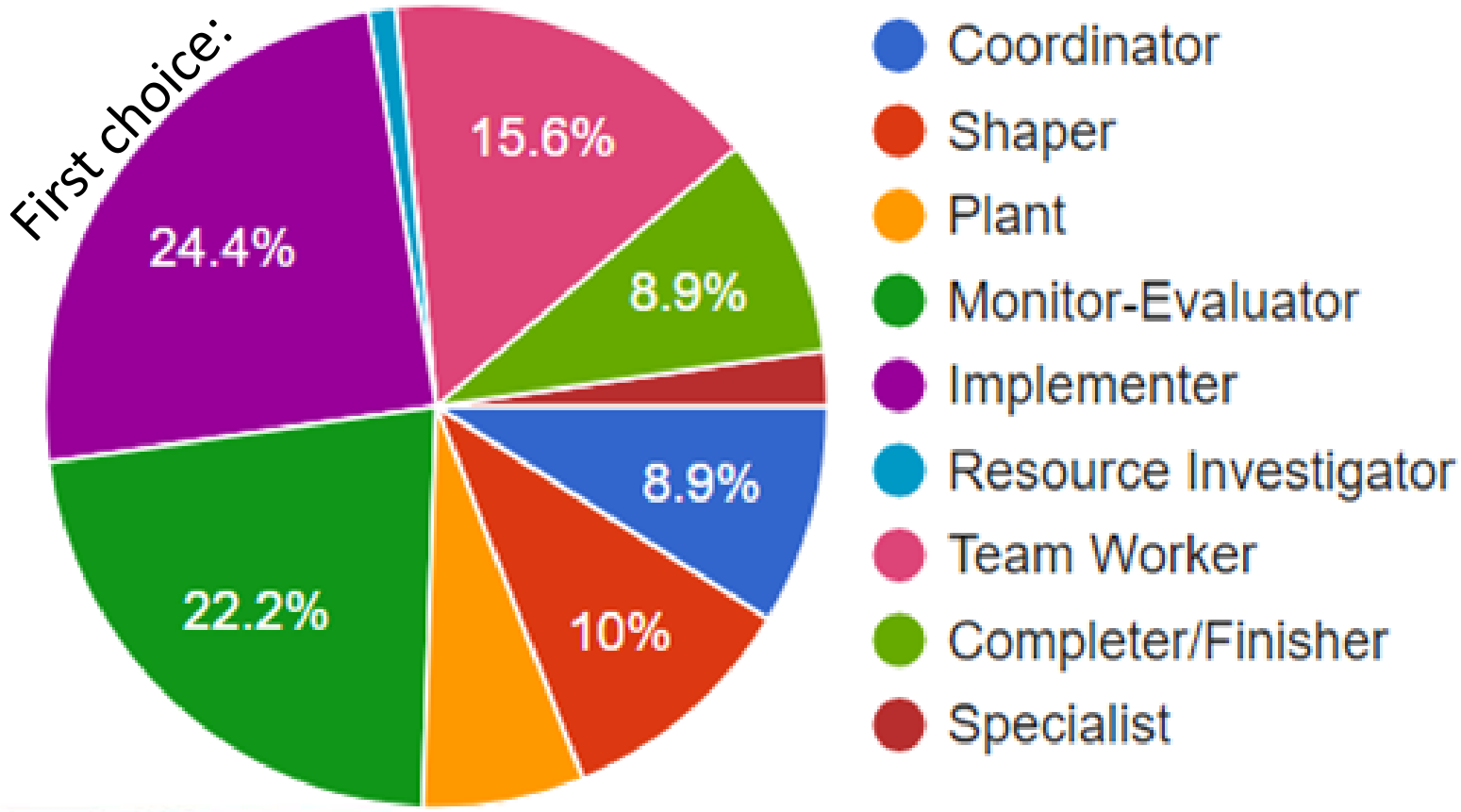
Intelligent Physical Systems

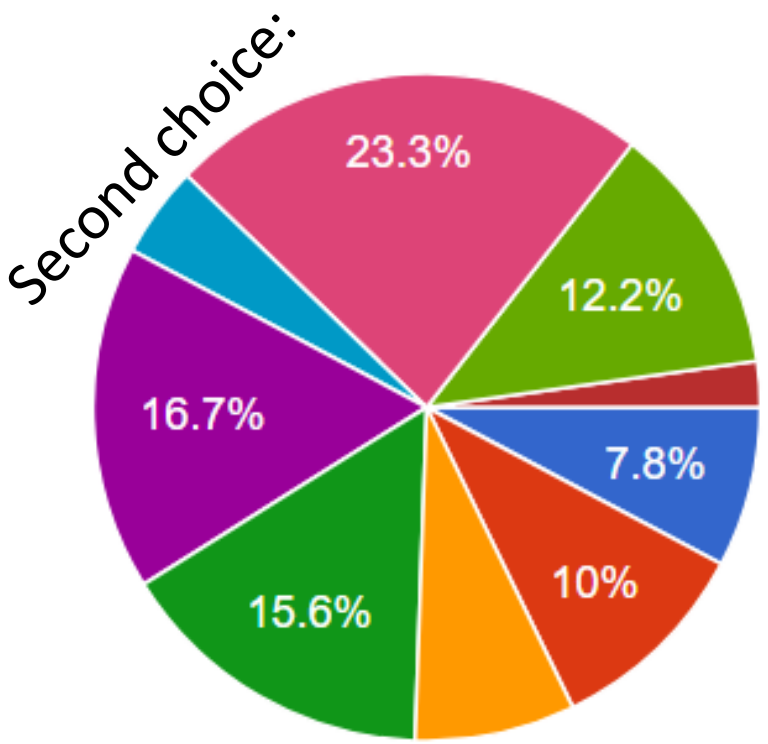
Join Piazza!

Find link on: https://cei-lab.github.io/ece3400/

Intelligent Physical Systems

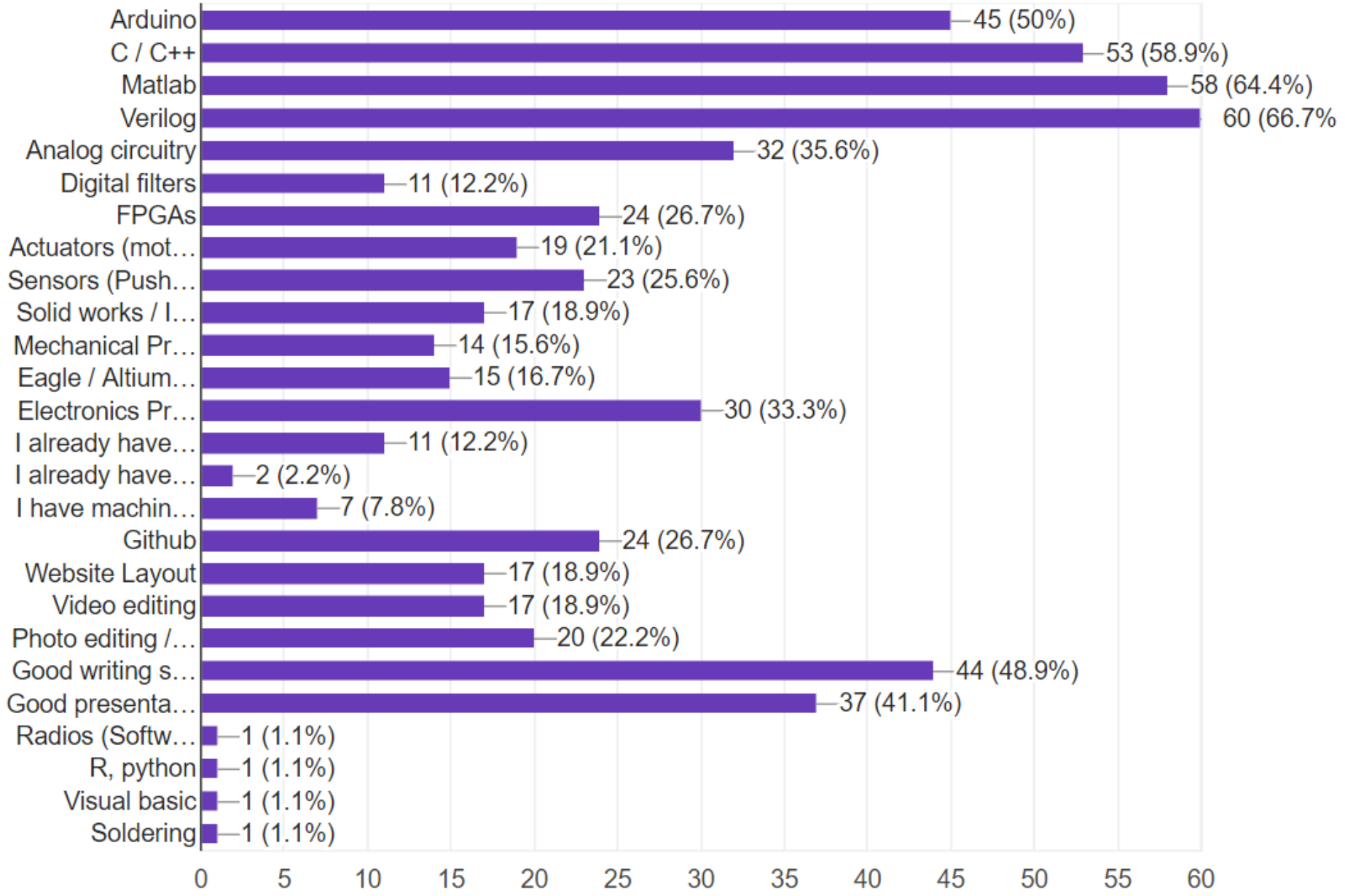
- Team compositions





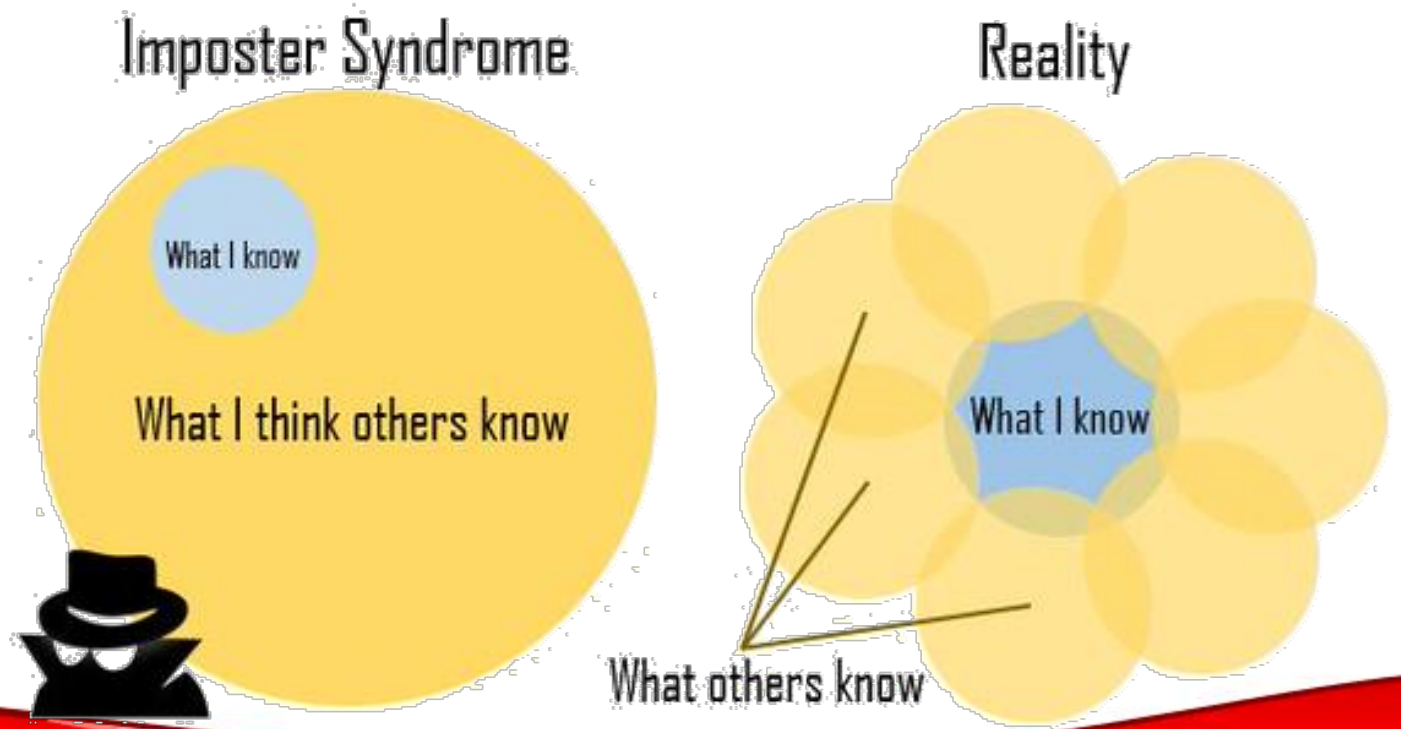
Intelligent Physical Systems

- Team compositions
- Biggest concerns
  - Technical skill
    - Electronics
    - Algorithms
    - Mechanics
    - Presentation



Intelligent Physical Systems

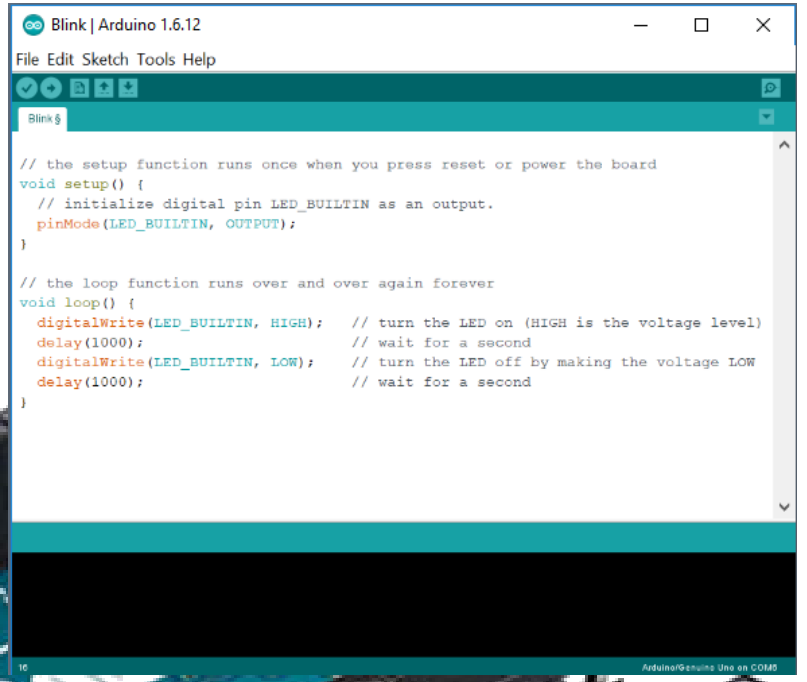
- Team compositions
- Biggest concerns
  - Technical skill (electronics, algorithms, mechanics, presentation)
  - Team
    - Dead weight
    - Not getting to do anything
  - Scheduling/finding time
  - Innovation/creativity
  - Disinterest / Laziness

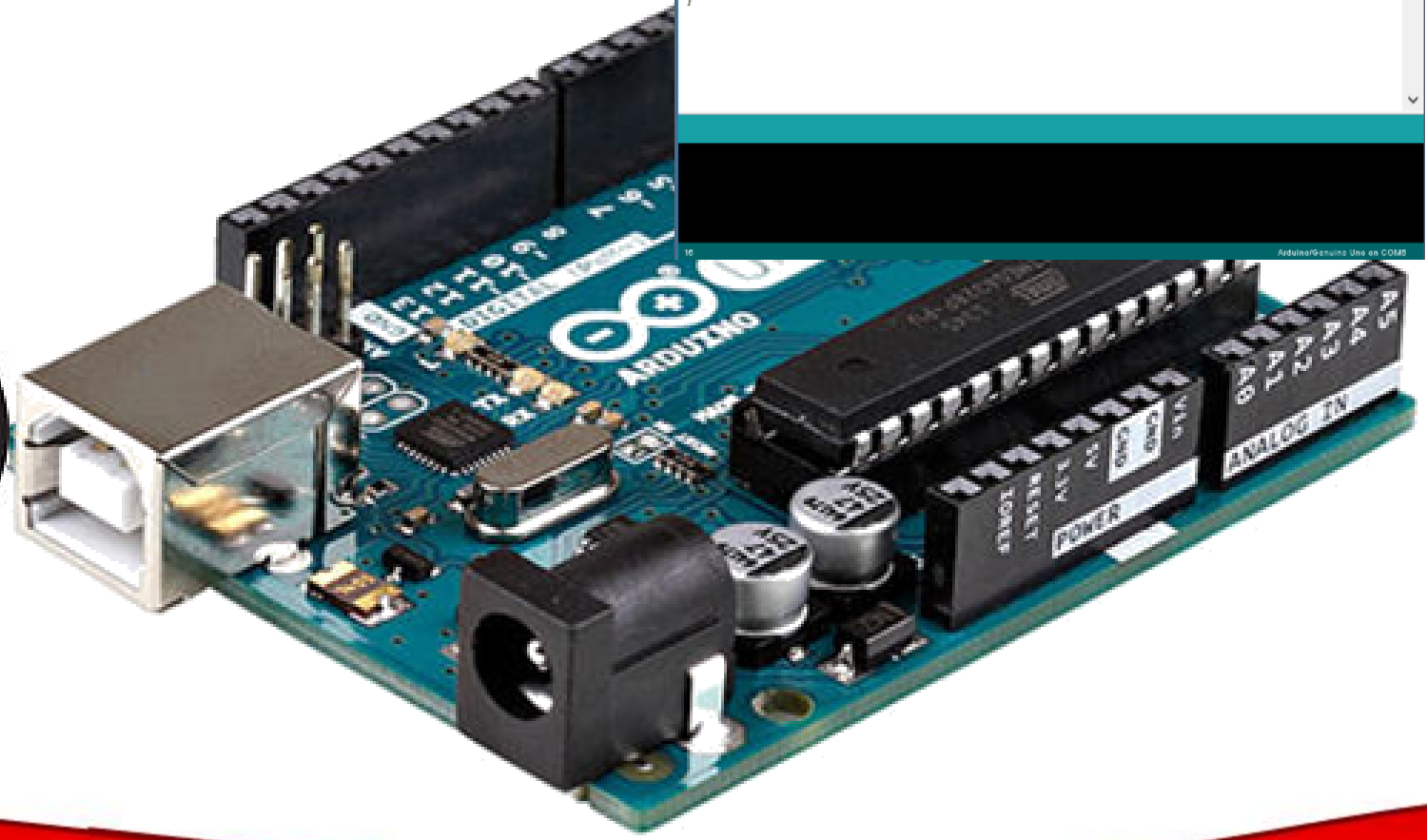


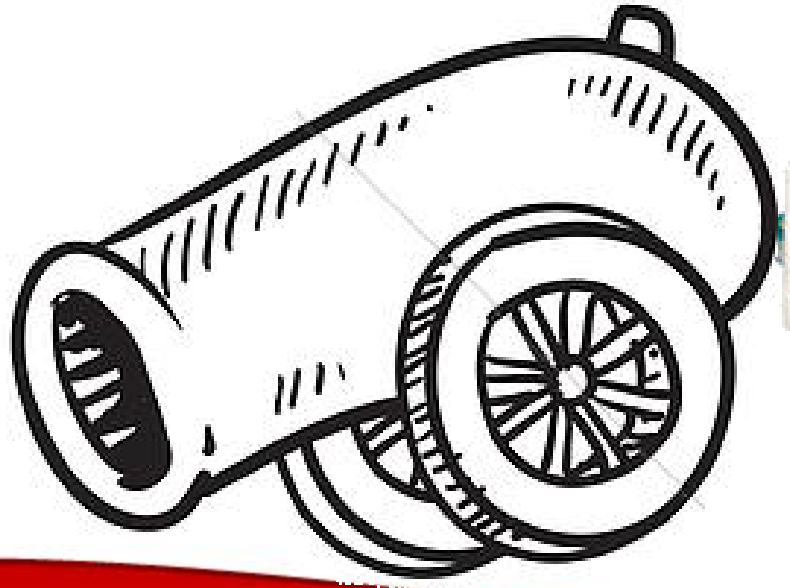
Intelligent Physical Systems

- Introduction
  - What under the hood?
  - How do you program it?

Arduino Uno

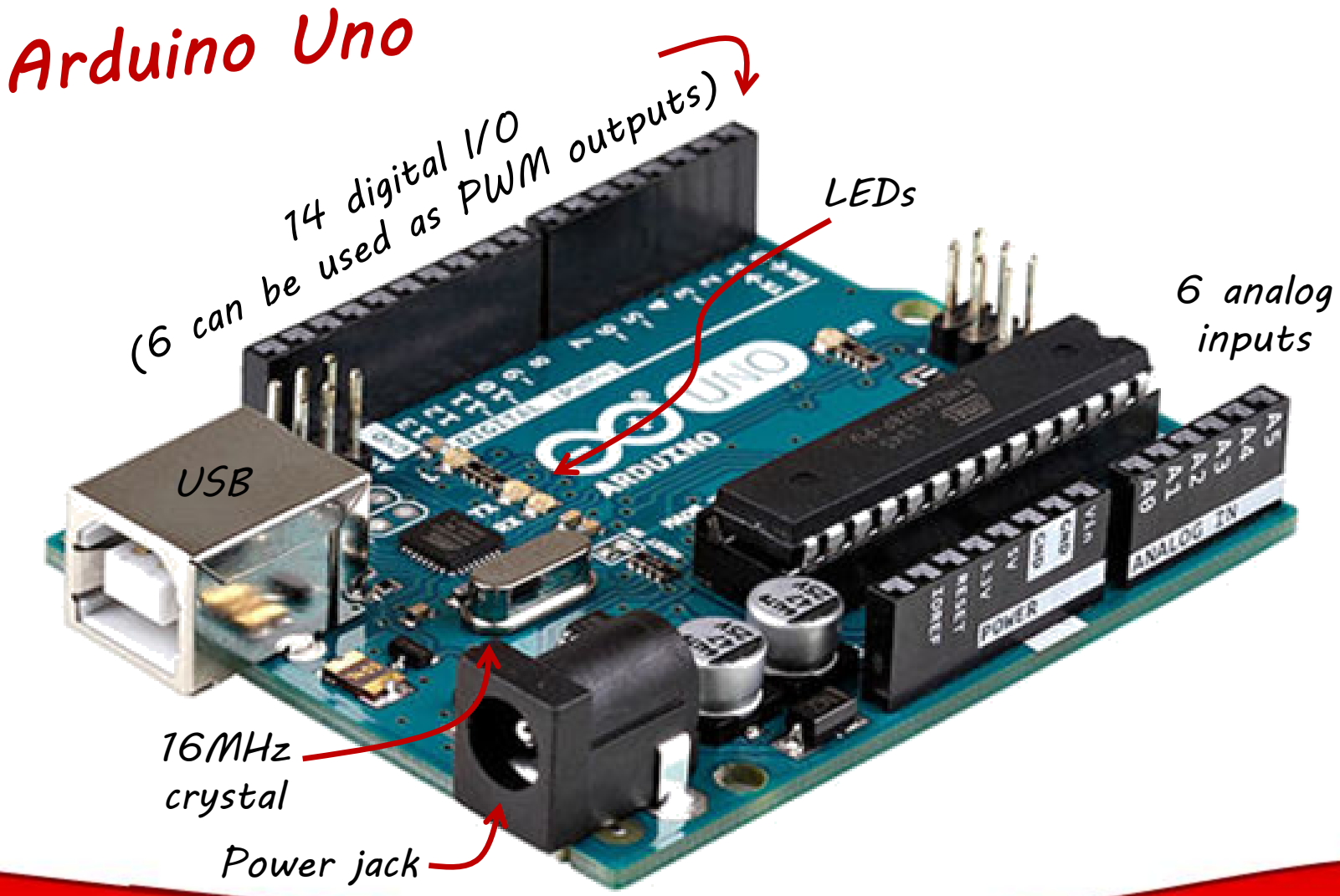






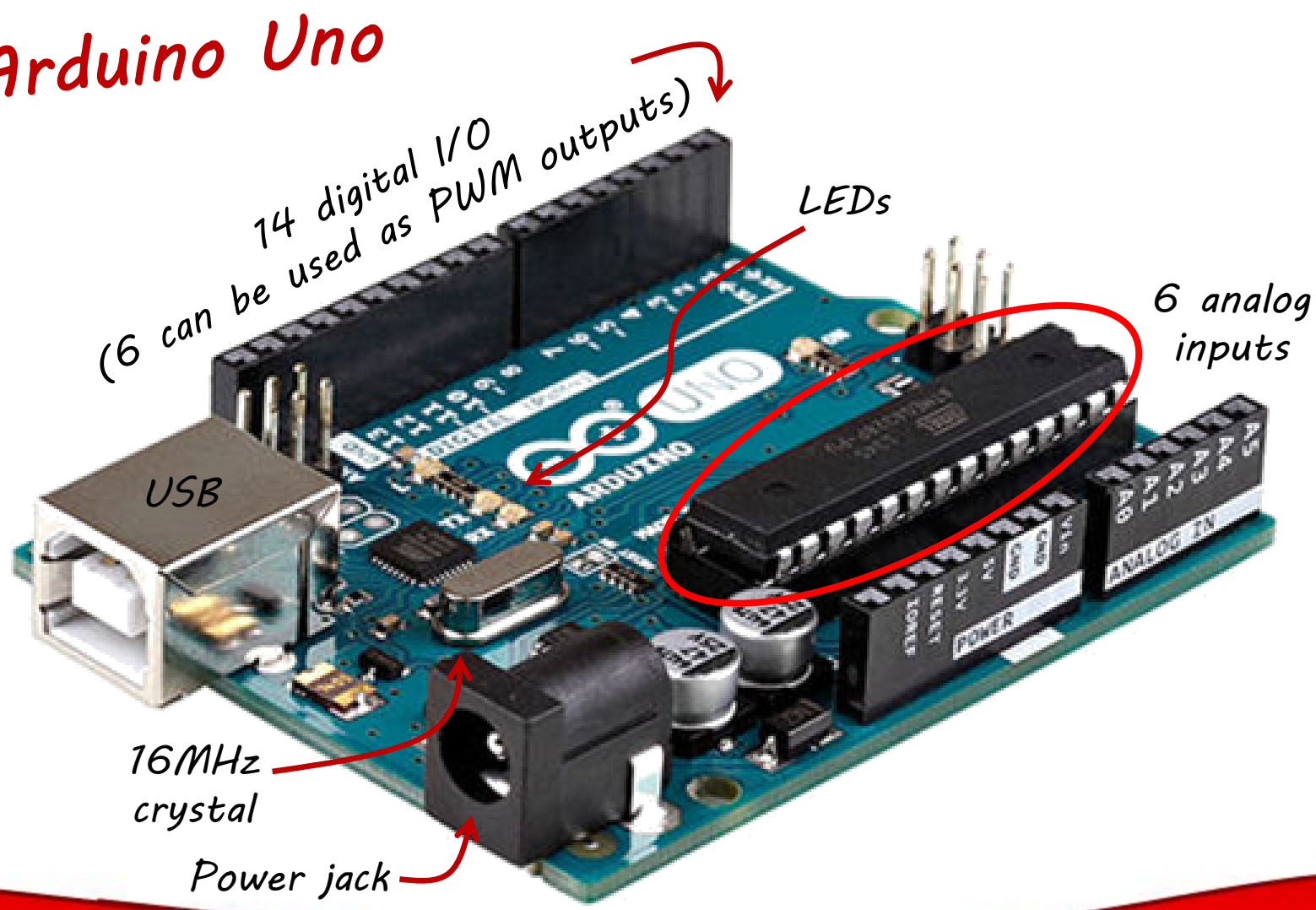
Intelligent Physical Systems

- Introduction
  - What under the hood?
  - How do you program it?



Intelligent Physical Systems

- Microcontroller (ATmega328)
- No operating system
- 32KB Flash
- 2KB SRAM
- 1KB EEPROM
- But it can do real-time control, sequential processing, timers, and interrupts!



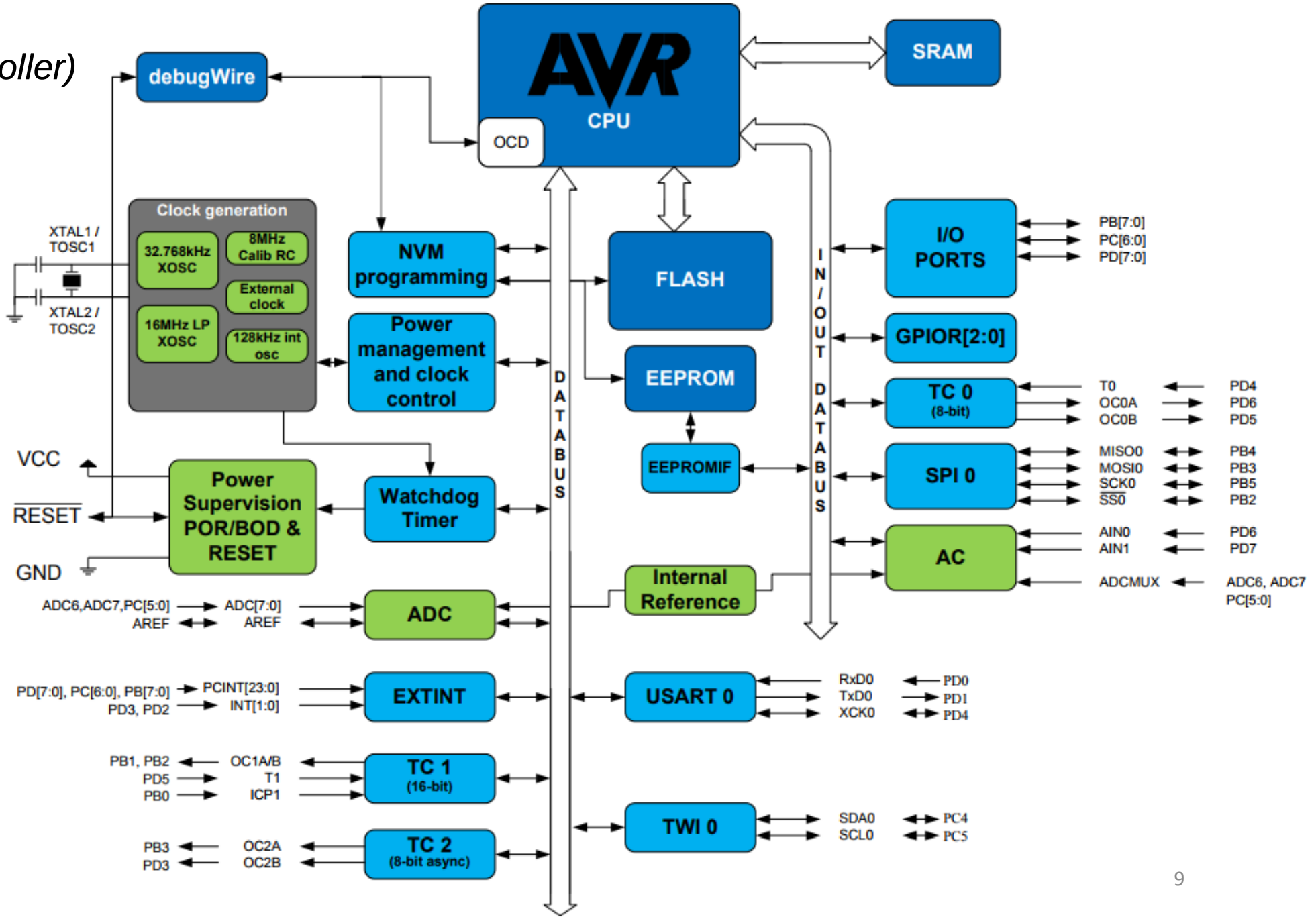
ATmega328

(Arduino Uno Microcontroller)

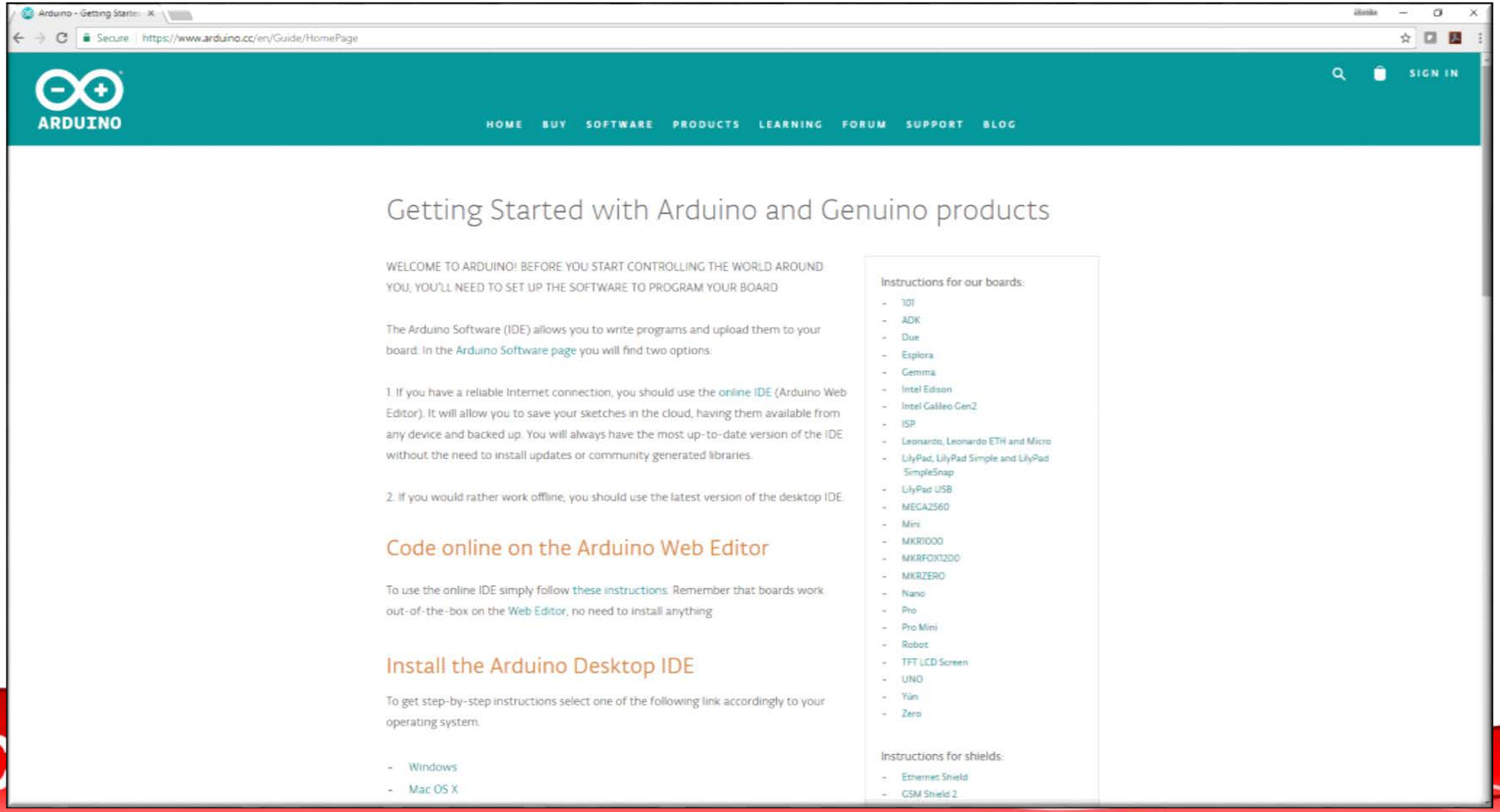
http://www.atmel.com/Images/Atmel-42735-8-bit-AVR-Microcontroller-ATmega328-328P_Datasheet.pdf

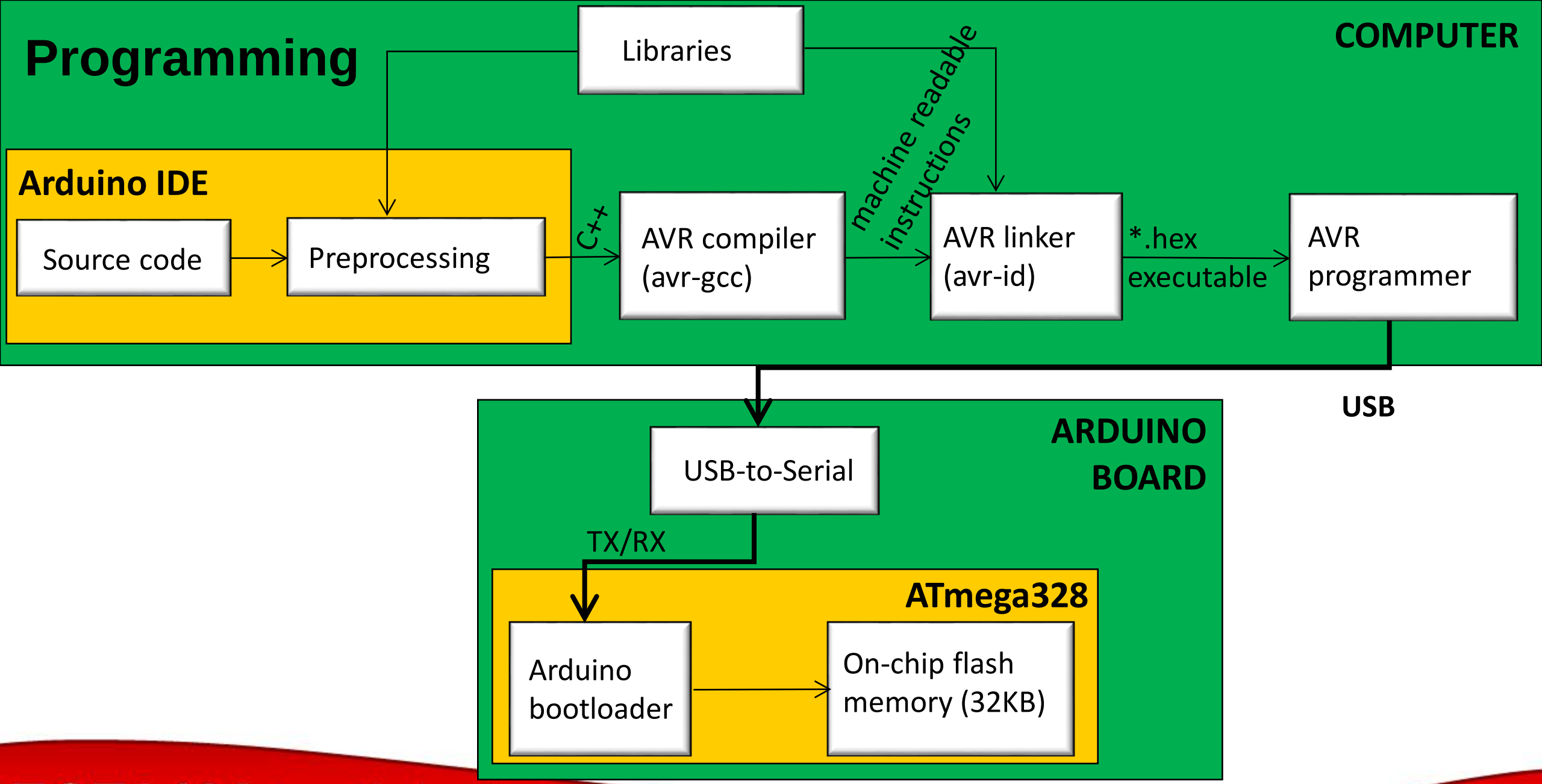
ATmega328

(Arduino Uno Microcontroller)



Arduino IDE


Arduino - Getting Started
Secure | https://www.arduino.cc/en/Guide/HomePage
ARDUINO
HOME BUY SOFTWARE PRODUCTS LEARNING FORUM SUPPORT BLOG
SIGN IN
Getting Started with Arduino and Genuino products
WELCOME TO ARDUINO! BEFORE YOU START CONTROLLING THE WORLD AROUND YOU, YOU'LL NEED TO SET UP THE SOFTWARE TO PROGRAM YOUR BOARD
The Arduino Software (IDE) allows you to write programs and upload them to your board. In the Arduino Software page you will find two options:
1. If you have a reliable Internet connection, you should use the online IDE (Arduino Web Editor). It will allow you to save your sketches in the cloud, having them available from any device and backed up. You will always have the most up-to-date version of the IDE without the need to install updates or community generated libraries.
2. If you would rather work offline, you should use the latest version of the desktop IDE.
Code online on the Arduino Web Editor
To use the online IDE simply follow these instructions. Remember that boards work out-of-the-box on the Web Editor, no need to install anything.
Install the Arduino Desktop IDE
To get step-by-step instructions select one of the following link accordingly to your operating system:
- Windows
- Mac OS X
Instructions for our boards:
- 101
- ADK
- Due
- Esplora
- Gemma
- Intel Edison
- Intel Galileo Gen2
- ISP
- Leonardo, Leonardo ETH and Micro
- LilyPad, LilyPad Simple and LilyPad SimpleSnap
- LilyPad USB
- MEGA2560
- Mini
- MKR1000
- MKRFOX1200
- MKRZERO
- Nano
- Pro
- Pro Mini
- Robot
- TFT LCD Screen
- UNO
- Yún
- Zero
Instructions for shields:
- Ethernet Shield
- GSM Shield 2


Programming
Libraries
COMPUTER
Arduino IDE
Source code
Preprocessing
C++
AVR compiler
(avr-gcc)
machine readable
instructions
AVR linker
(avr-id)
*.hex
executable
AVR
programmer
USB
ARDUINO
BOARD
USB-to-Serial
TX/RX
ATmega328
Arduino
bootloader
On-chip flash
memory (32KB)

Input/Output Ports

DDxn	PORTxn	PINxn	Setup
1	0	X	Output low
1	1	X	Output high
1	X	1	Toggle output
0	1	X	Input
0	0/1	X	Tri-state

Input/Output Ports

Variable	Memory	Max (unsigned) value	Max signed value
Boolean	8 bits / 1 byte	-	-
Char	8 bits / 1 byte	2^8	2^7
Int	16 bits / 2 bytes	2^{16}	2^{15}
Double	32 bits / 4 bytes	2^{32}	2^{31}
Float	32 bits / 4 bytes	-	2^{31}

Alternatives

ARDUINO UNO

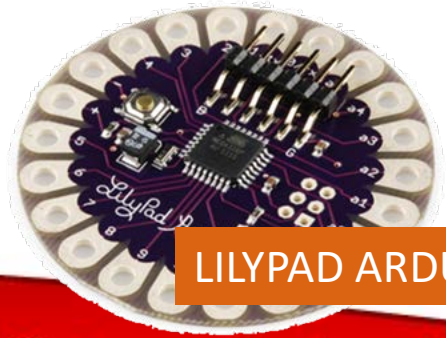
ARDUINO LEONARDO

ARDUINO 101

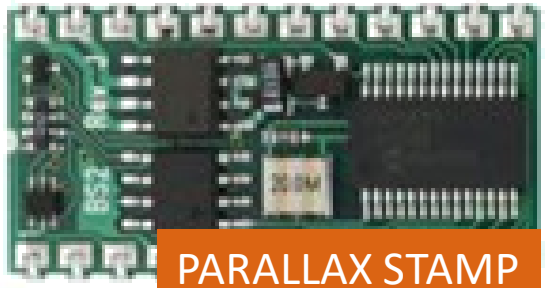

ARDUINO ESPLORA

ARDUINO MICRO


ARDUINO NANO



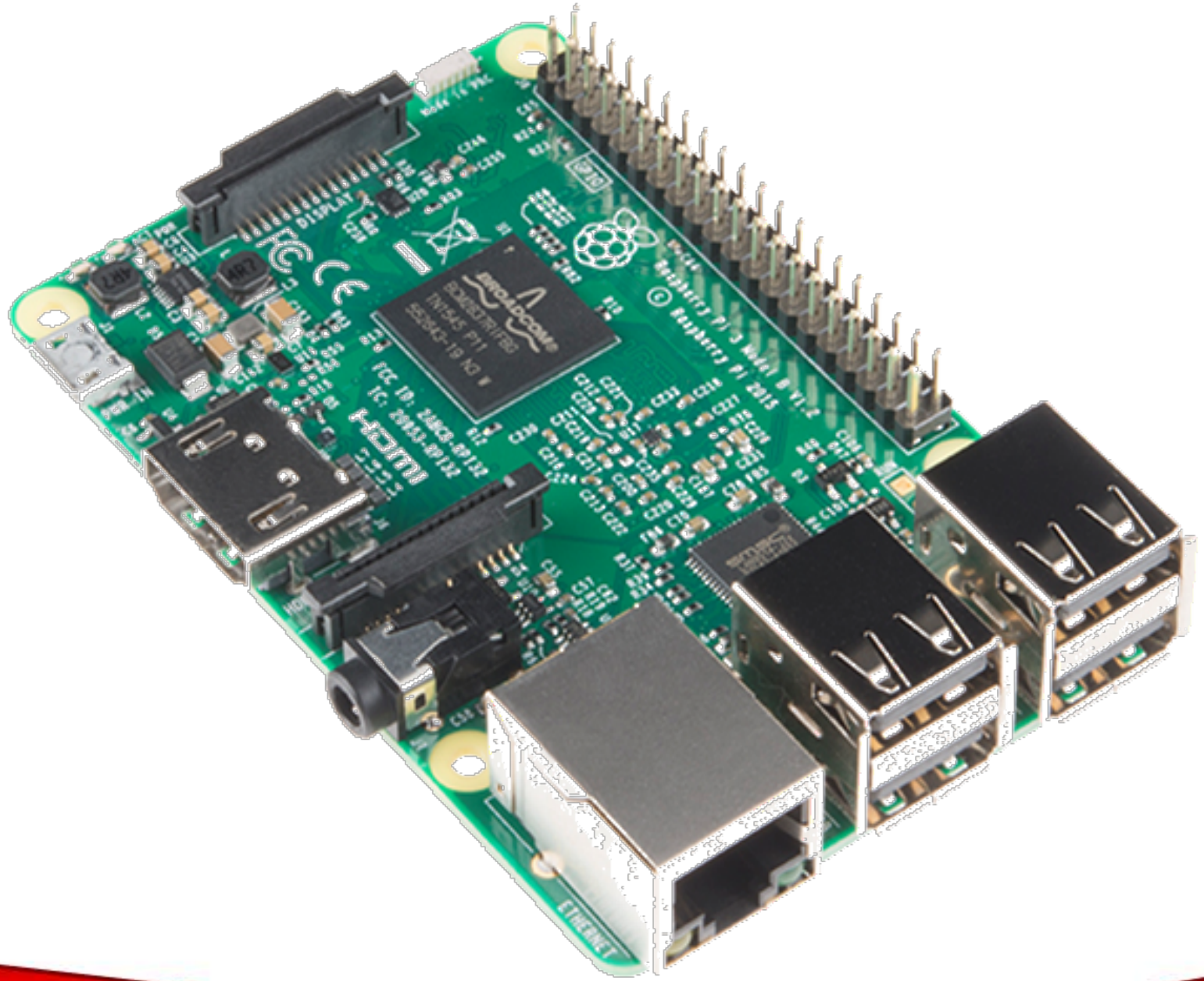
LILYPAD ARDUINO


PARALLAX STAMP

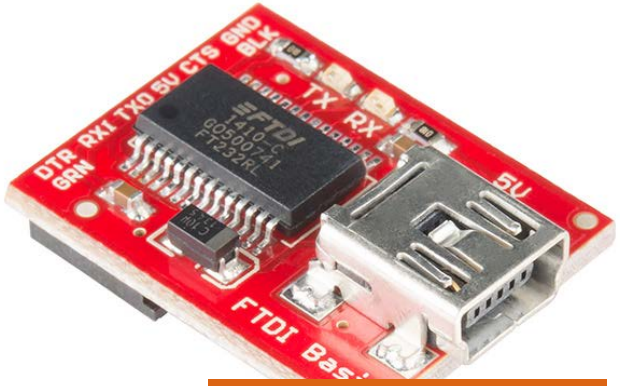
ARDUINO MINI

Alternatives

Raspberry Pi's and other mini computers



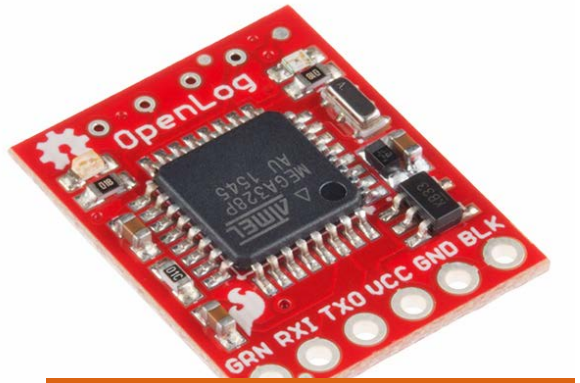
Add-Ons



FTDI CONVERTERS

BLUETOOTH

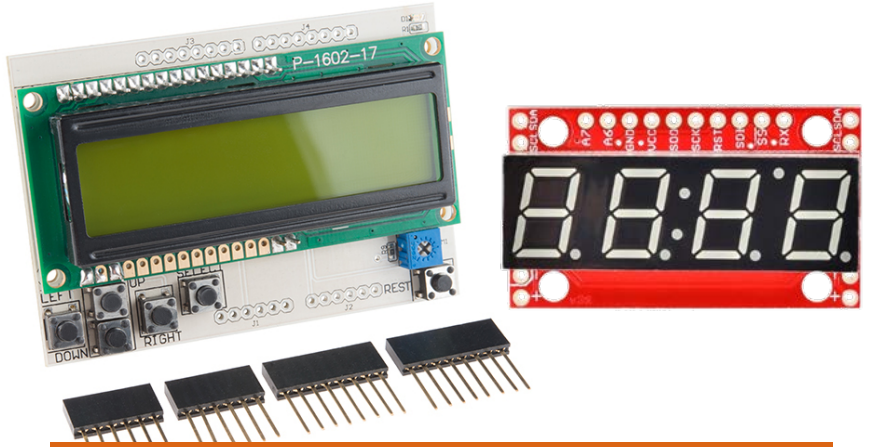
WIRELESS MODULE



DATA LOGGER (SD CARD)

MOTOR DRIVERS

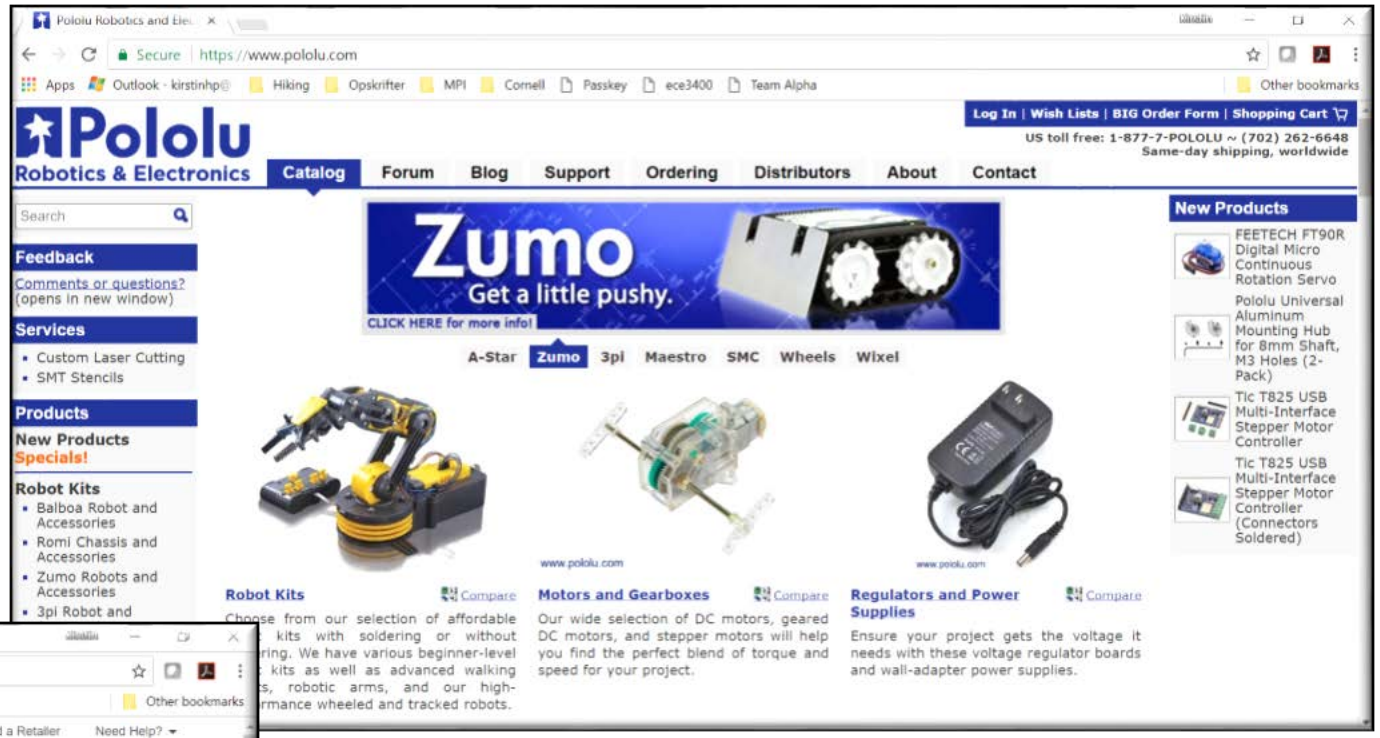
SENSORS

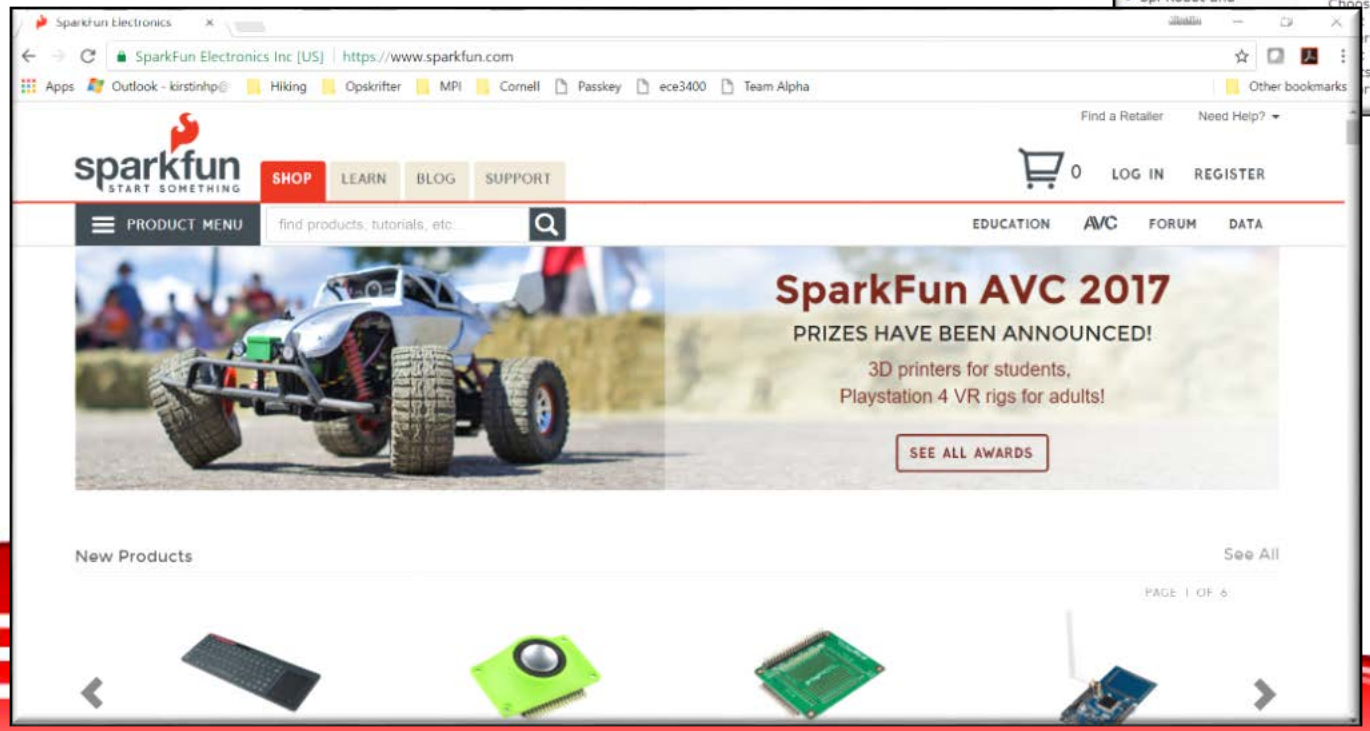


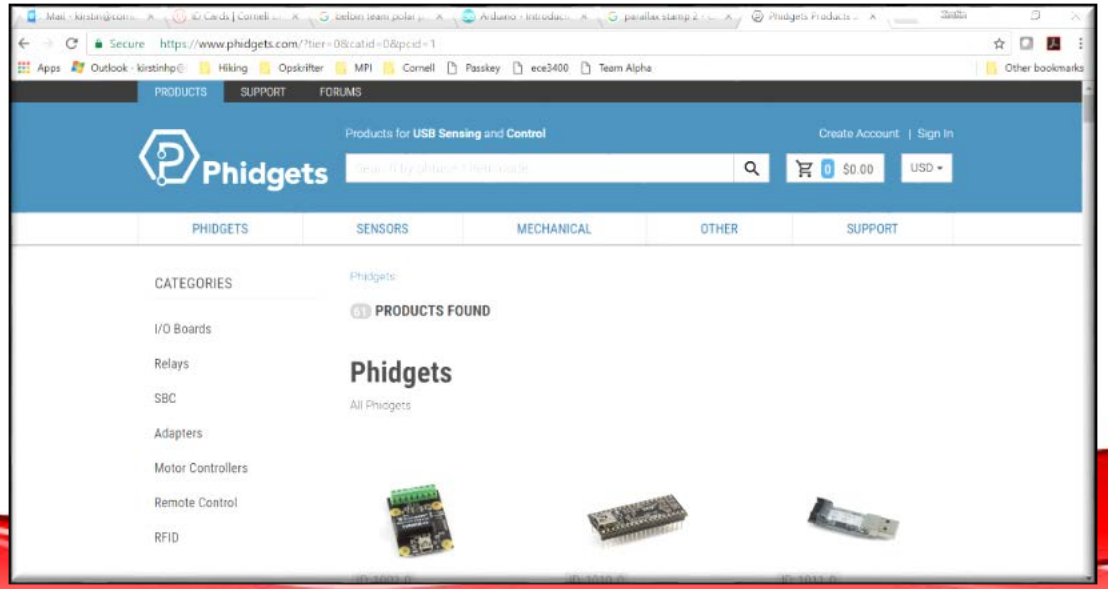
LCD SHIELD / 7-segment LED displays

Commercial Vendors

- **Components:** Digikey, Allied, Mouser, Newark, Circuit Specialists
- **Robotics:** Parallax, Lynxmotion, Tower Hobbies, Hobbyking, Sparkfun, Polulu, Jameco, Phidgets
- **Mechanics:** McMaster, Stock Drive Products







Go Build Robots!

Class website: https://cei-lab.github.io/ece3400/

Piazza: https://piazza.com/cornell/fall2017/ece3400/home