Introduction to Arduino

Rochester MakerSpace

2019

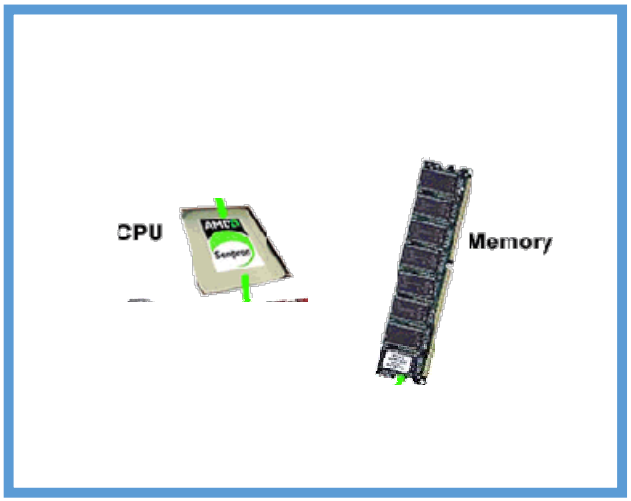
Class Objectives

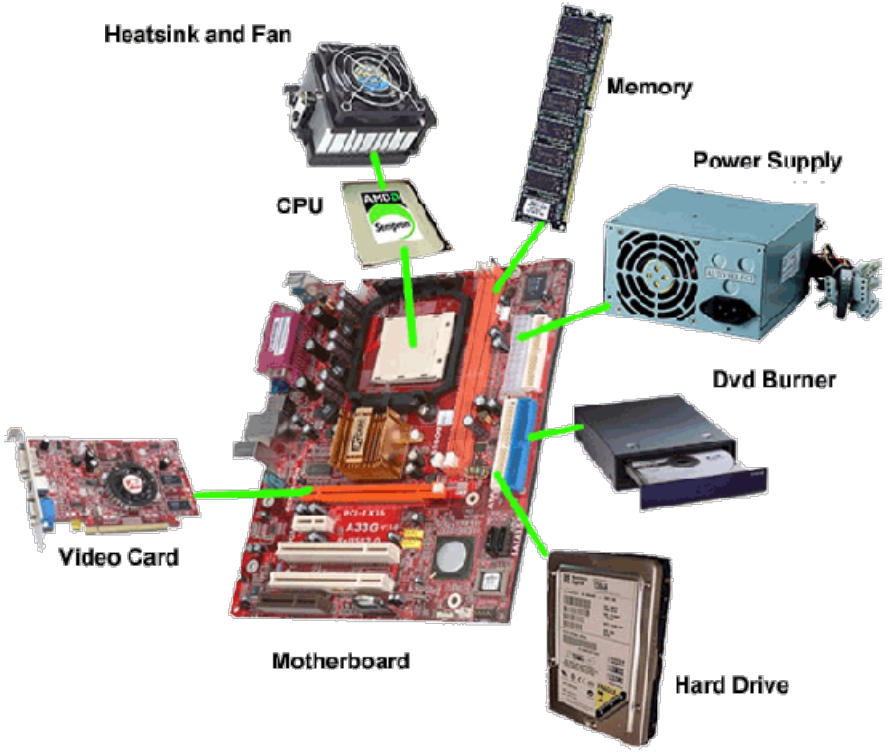
1. Become familiar with Arduino hardware and software
2. Be aware of the range of Arduino-supported boards and how to choose one for your project
3. Understand how to connect and operate Arduino hardware from a PC or Mac
4. Understand how to create and run a program on an Arduino
5. Understand how to control a simple circuit from an Arduino
6. Get a starter list of resources for learning more
7. Be excited by the possibilities!

Computers, Microcontrollers, Arduino

- Conventional computers can be described by 5 main components:
  - CPU – the Central Processing Unit executes instructions
  - Program memory – the instructions
  - Data memory – the data
  - I/O interfaces and devices – connecting disks, screens, keyboards, mice, etc.
  - Software - Operating system, utility programs, applications
- Microcontrollers are a computers on a chip typically including a CPU, and program and data memory with connectors for General Purpose Input and Output (GPIO).
- Arduino is an open-source board design, originally designed in 2006, that is combined with a free, basic development environment

Microcontrollers → Computer systems





Arduino Uno R3

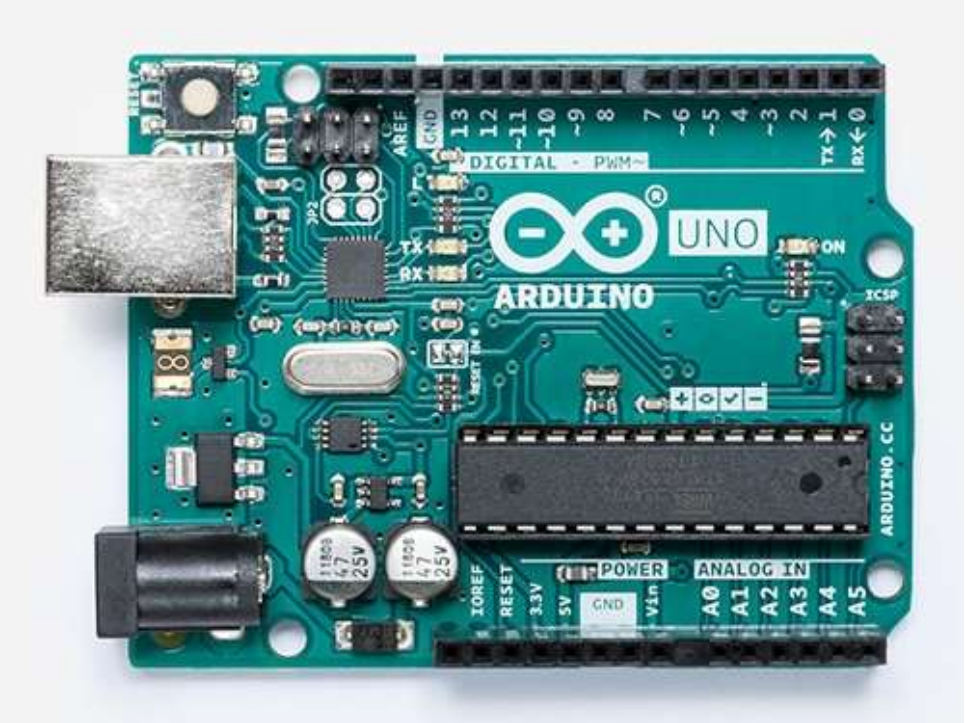
The canonical Arduino design

Focus is on experimentation and learning

Simple, low-cost, small computer

- Modest processing power
- Small space for code
- Small space for data
- Wide range of GPIO connectivity options for devices or circuits
- Easy USB connection and good, free software development environment

Huge community of ‘makers’ providing videos, tutorials, examples, projects, devices, advice

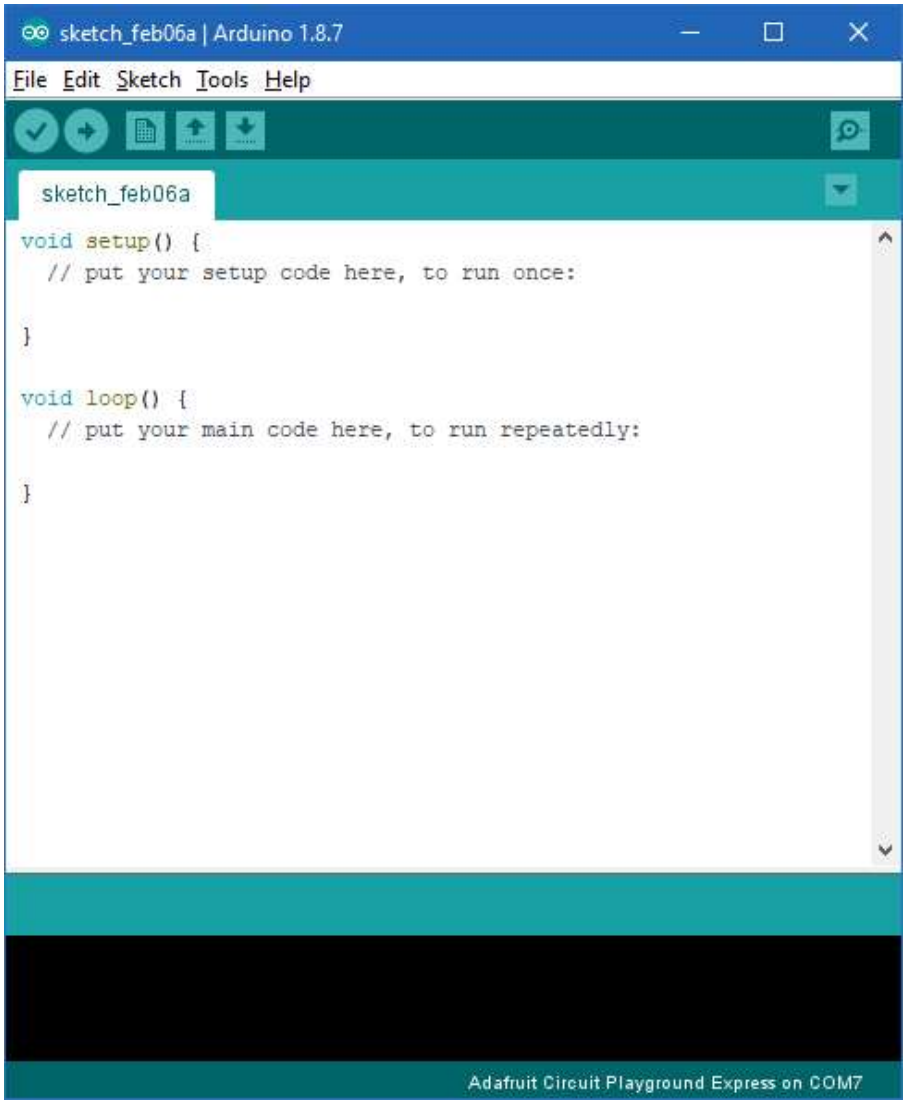


Arduino Integrated Development Environment

Free download from
https://www.arduino.cc/en/Main/Software

Simple, fixed program structure

Uses a programming language that is a simplified variant of c++



Many Arduino variants

Faster processor

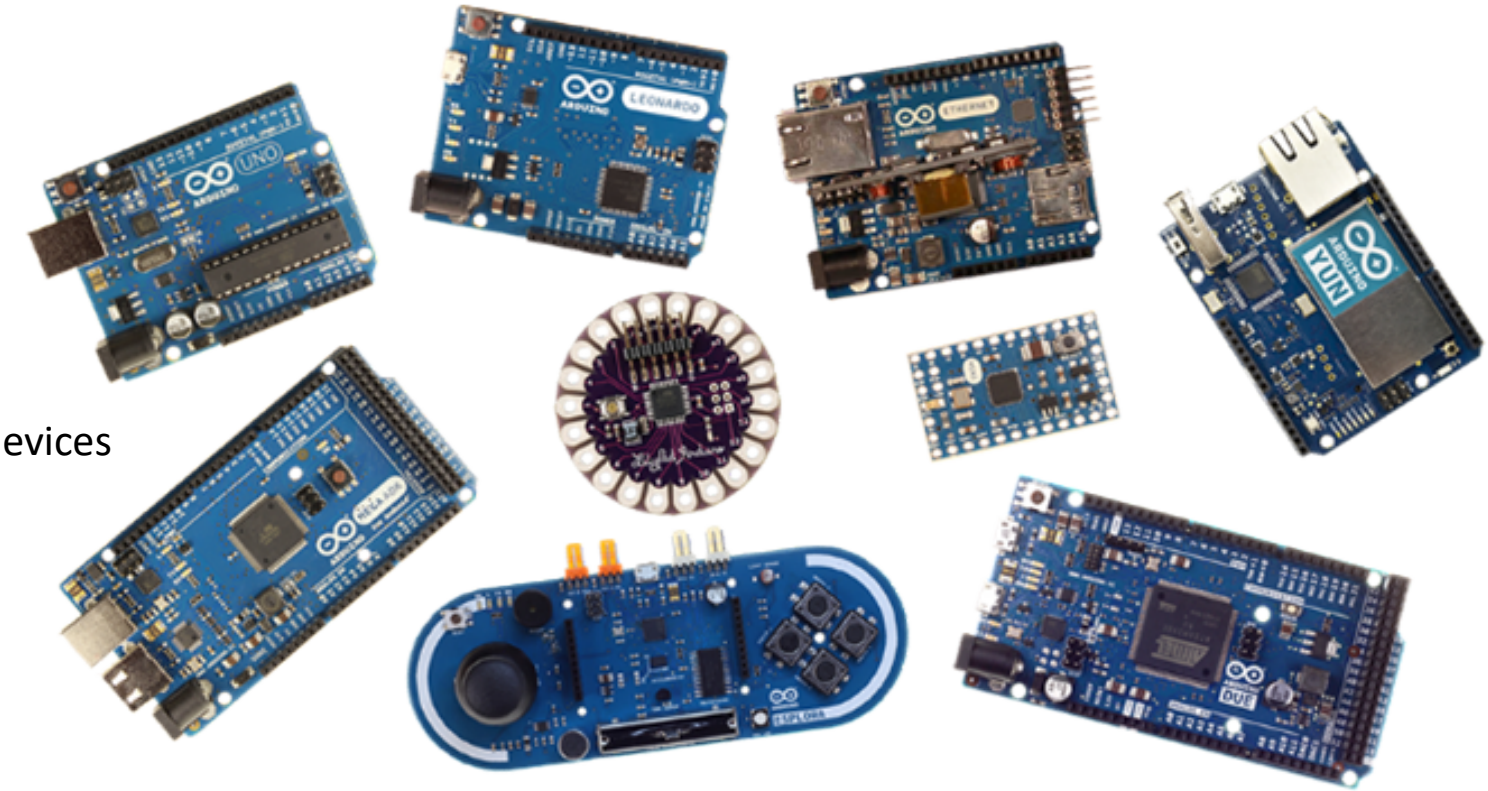
Bigger programs

More data

More pins to connect devices

More portable

Different form factor



Arduino GPIO

Simple direct connection for digital input and output

Simple direct connection for analog input

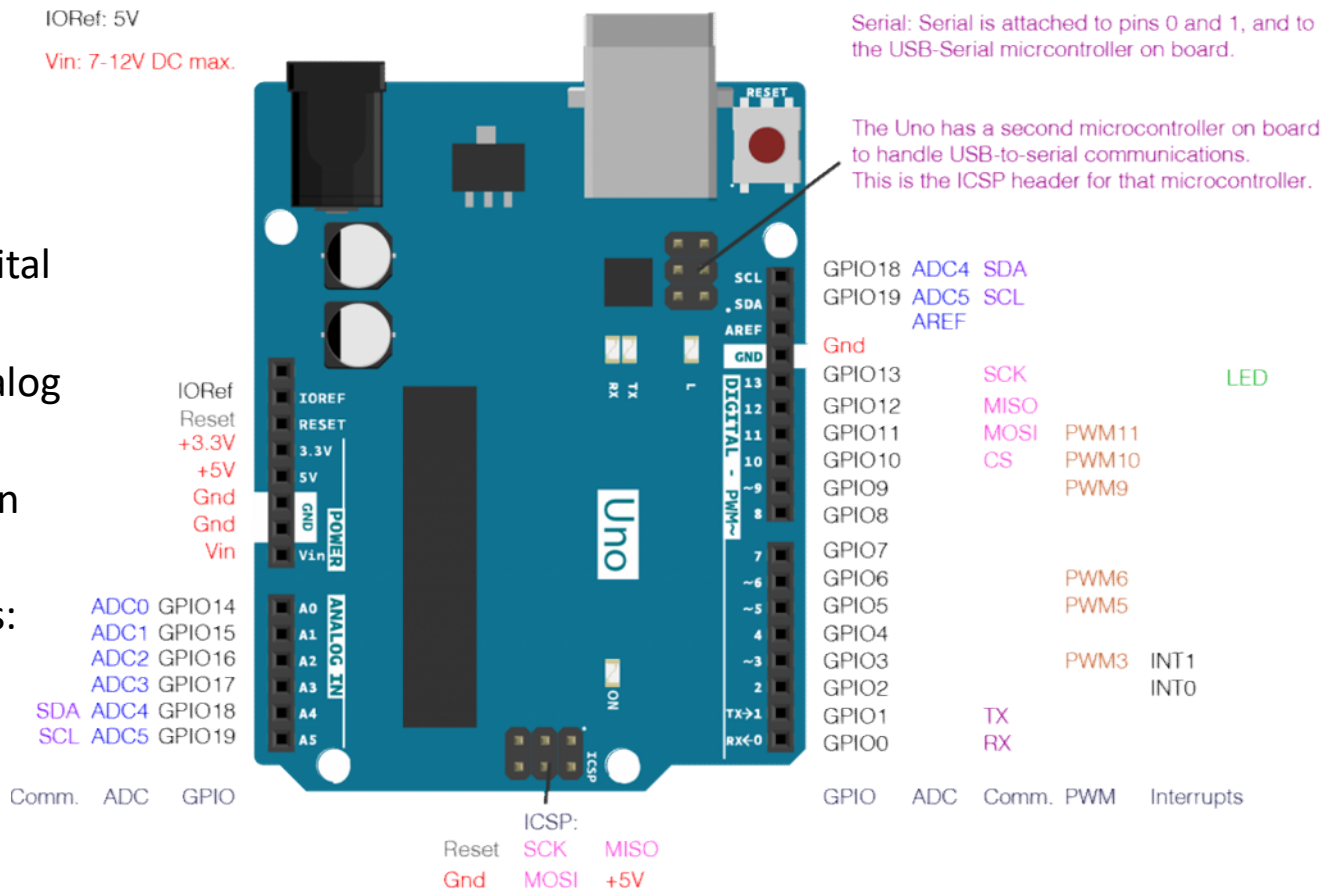
Onboard pulse width modulation (PWM)

3 ways to connect to other chips:

I2C – Inter-Integrated-Circuit

SPI – Serial Peripheral Interface

Serial – asynchronous serial



I2C

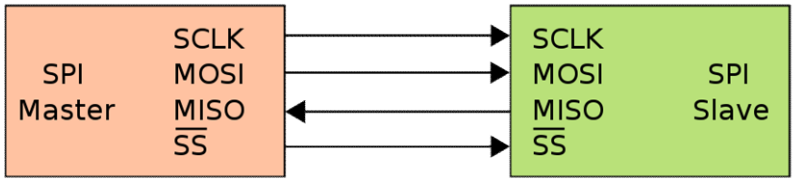
- I²C (Inter-Integrated Circuit), pronounced I-squared-C , is a synchronous , multi-master, multi-slave , packet switched , single-ended , serial computer bus invented in 1982 by Philips Semiconductor (now NXP Semiconductors). It is widely used for attaching lower-speed peripheral ICs to processors and microcontrollers in short-distance, intra-board communication. Alternatively I²C is spelled I2C (pronounced I-two-C) or IIC (pronounced I-I-C).

Wikipedia

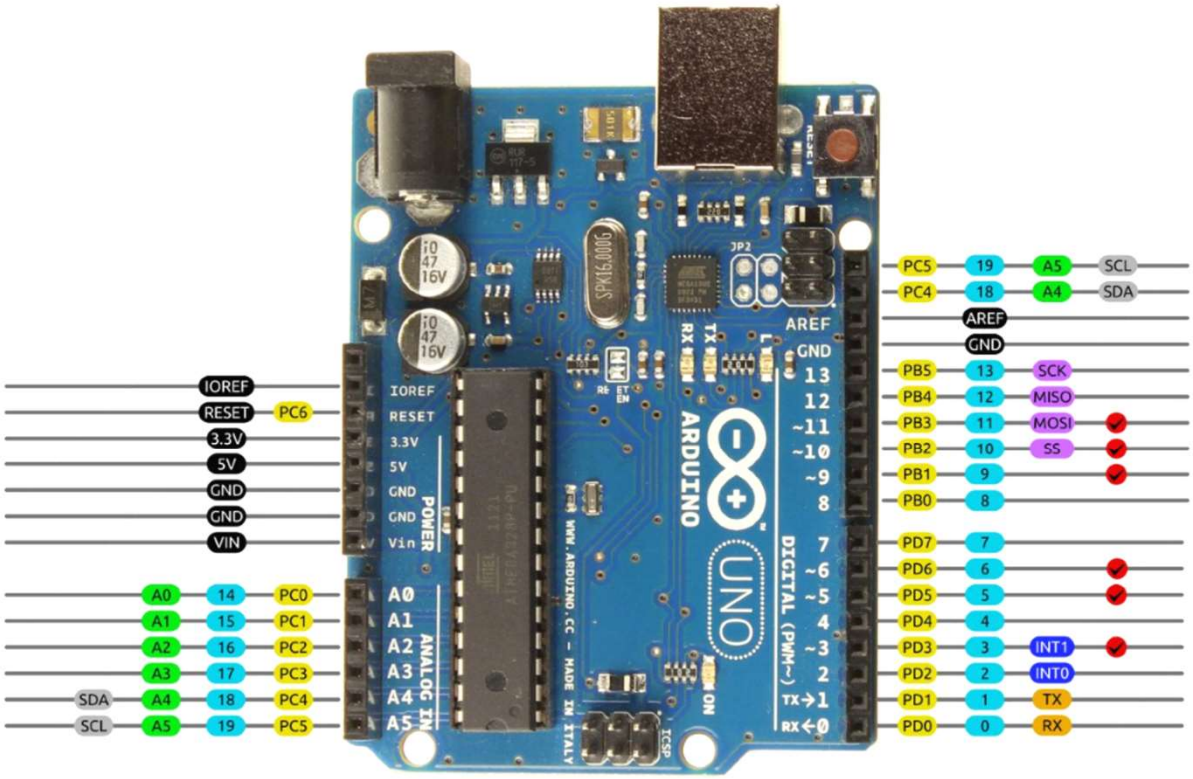
SPI

- The **Serial Peripheral Interface** (**SPI**) is a synchronous serial communication interface specification used for short distance communication, primarily in embedded systems. The interface was developed by Motorola in the mid 1980s and has become a *de facto* standard. Typical applications include Secure Digital cards and liquid crystal displays.

Wikipedia



Arduino Uno R3 Pinout



AVR DIGITAL ANALOG POWER SERIAL SPI I2C PWM INTERRUPT

2014 by Bouni
Photo by Arduino.cc

Resources

- **https://www.instructables.com/id/Arduino-Projects/**
  A great source of inspiration
  Shows many cool projects you can accomplish with an Arduino
- **Introduction to Arduino: A piece of cake!**
  Alan G. Smith (alan@introtoarduino.com)
  Hardcopy available at http://www.amazon.com
  The most recent PDF is free at http://www.introtoarduino.com
- https://www.arduino.cc
  The official web site for Arduino
  Tutorials, documentation, example projects, shop
- https://www.adafruit.com
  A DIY site loaded with Arduino and Raspberry Pi products
  Tutorials, step-by-step instructions, example projects, shop
- https://www.sparkfun.com/
  An electronics retailer with lots of Arduino and Raspberry Pi products
- https://www.pololu.com/
  An online retailer with lots of robotics components
- https://www.youtube.com/
  Countless tutorial videos and example projects

Getting started hands-on

- Night Light – a simple circuit to switch on an LED when it gets dark
  - Demonstrates use of analog input and digital output
- PWM (https://www.youtube.com/watch?v=Y1QraI5i_XM)