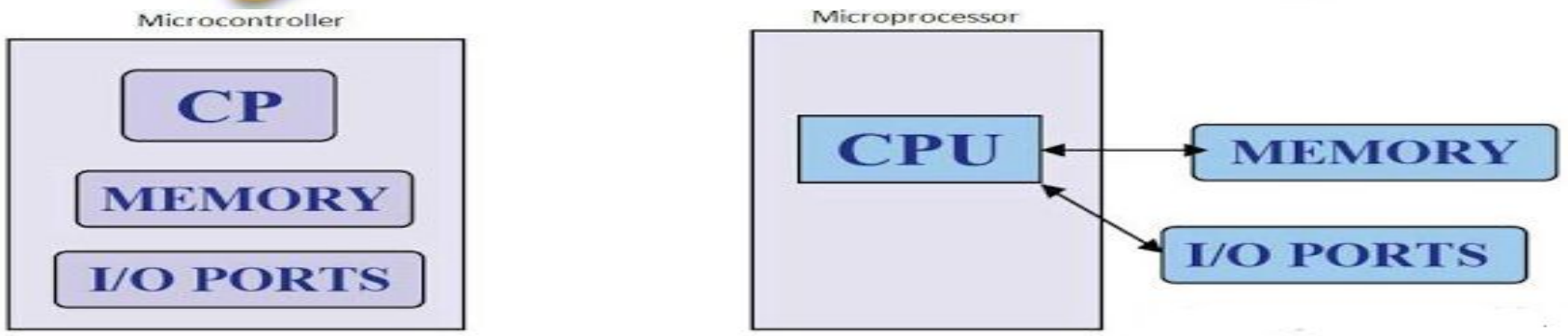
Unit – 4
Arduino



µP	µC
Applications which demand intense processing tasks	Applications which demands specific tasks.
Internal Structure – ONLY CPU (other peripherals are added externally)	Internal Structure – All in one chip
Processing power (Clock speed in GHz) and Memory (GB and TB) -> high.	Processing power (Clock speed in MHz) and Memory (KB and MB) -> relatively low.

Arduino – An Introduction

Sparkfun Electronics :

- ✔Arduino is an open-source platform used for building electronics projects.
- ✔Design files including board schematics ,codes – Freely available
- ✔Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.
- ✔Flexibility to modify the design

https://www.arduino.cc/

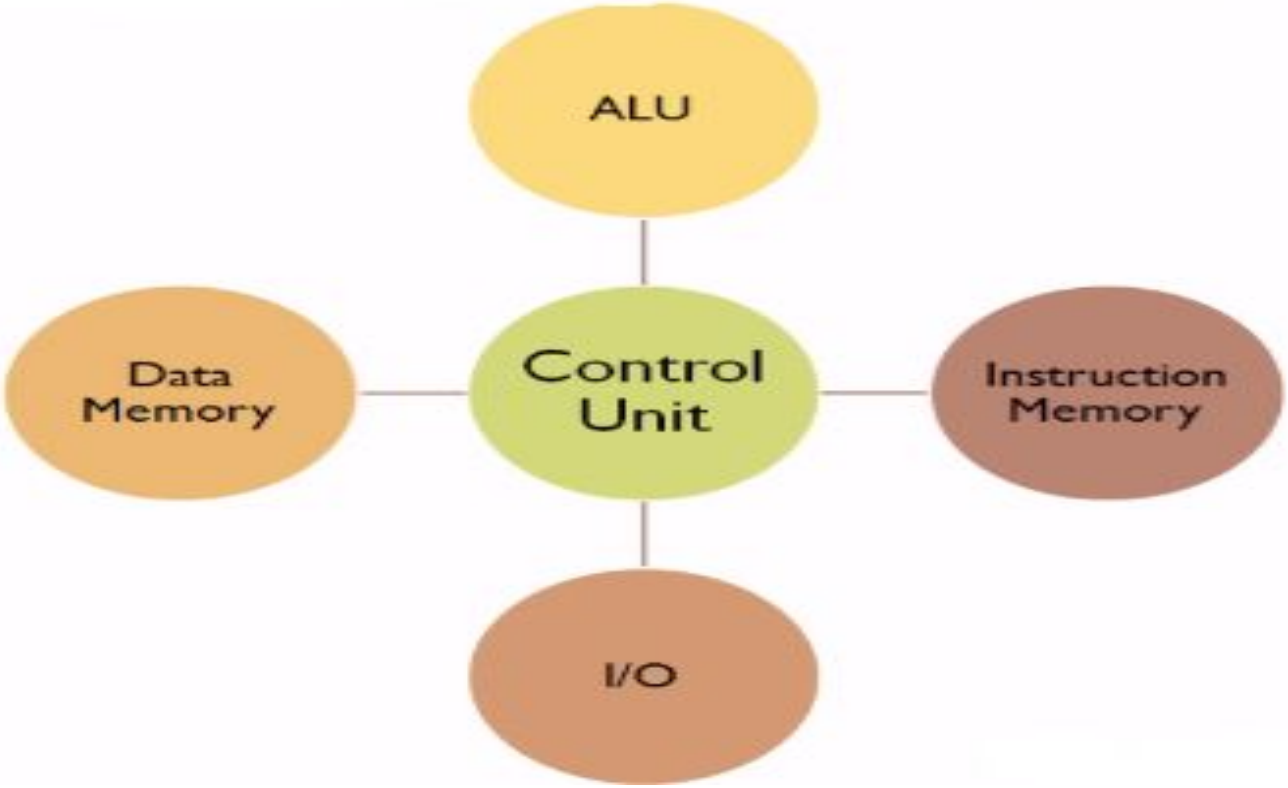
https://www.arduino.cc/

Arduino to innovate in music, games, toys, smart homes, farming, autonomous vehicles, and more.

Originally started as a research project by Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis at the Interaction Design Institute of Ivrea in the early 2000s, it builds upon the Processing project, a language for learning how to code within the context of the visual arts developed by Casey Reas and Ben Fry as well as a thesis project by Hernando Barragan about the Wiring board.

The first Arduino board was introduced in 2005 to help design students — who had no previous experience in electronics or microcontroller programming — to create working prototypes connecting the physical world to the digital world. Since then it has become the most popular electronics prototyping tool used by engineers and even large

Microcontroller

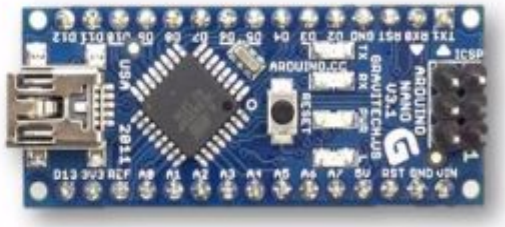


- Hardware – Arduino Boards
- Software – Arduino IDE

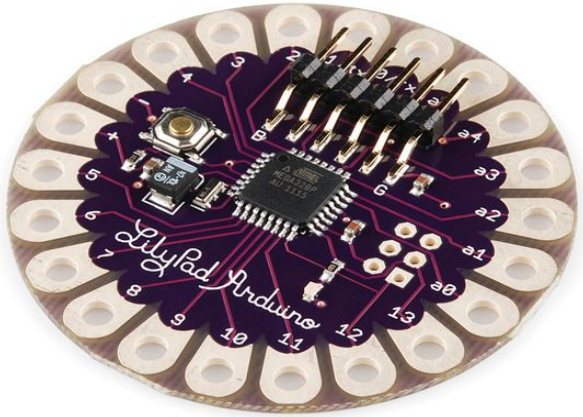
Arduino Family – Types of Boards

Arduino UNO

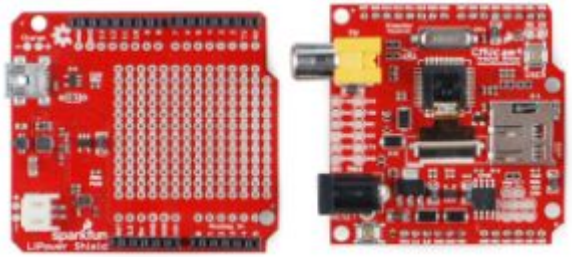
Arduino Nano



Arduino Lilypad



Arduino Motor Shield



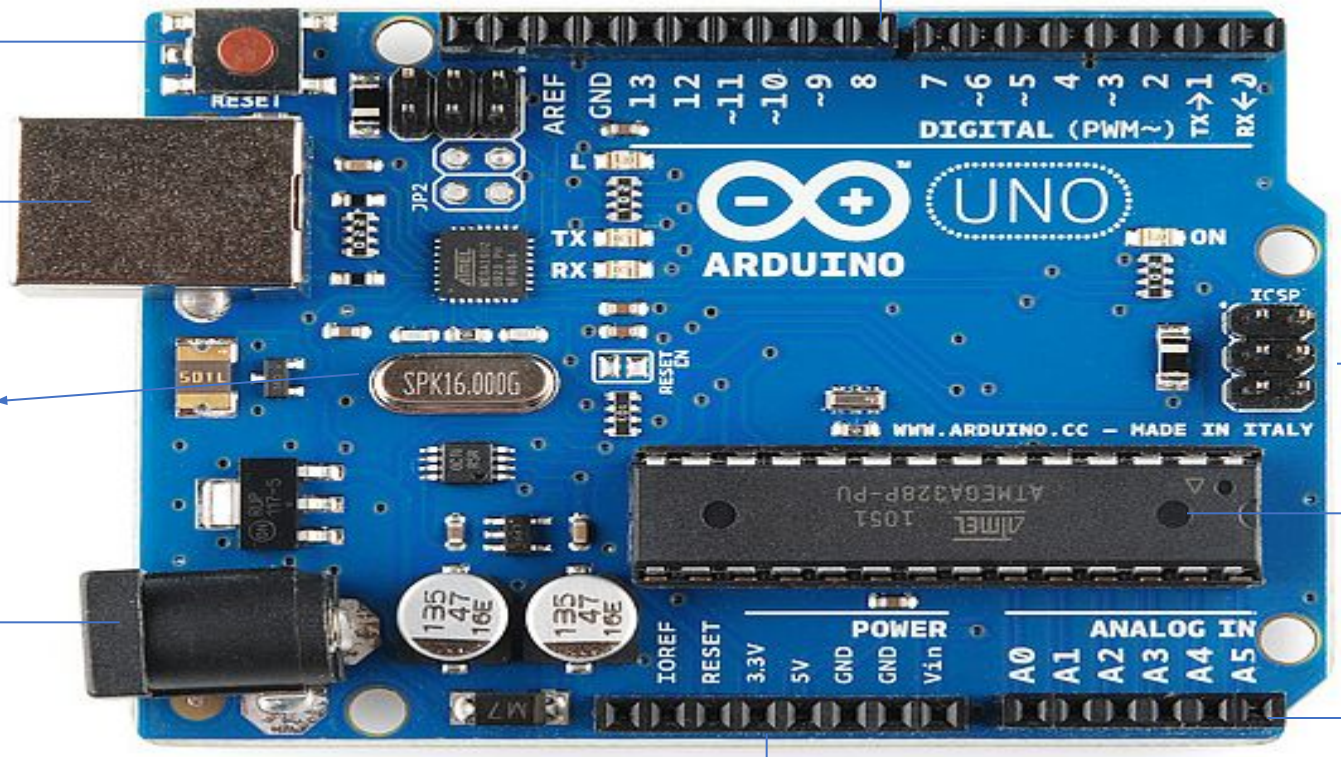
Arduino Mega

Arduino – An Introduction

Advantages

- Inexpensive
- Cross – Platform
- Simple & Clear Programming environment
- Open source and Extensible software
- Open source and Extensible hardware

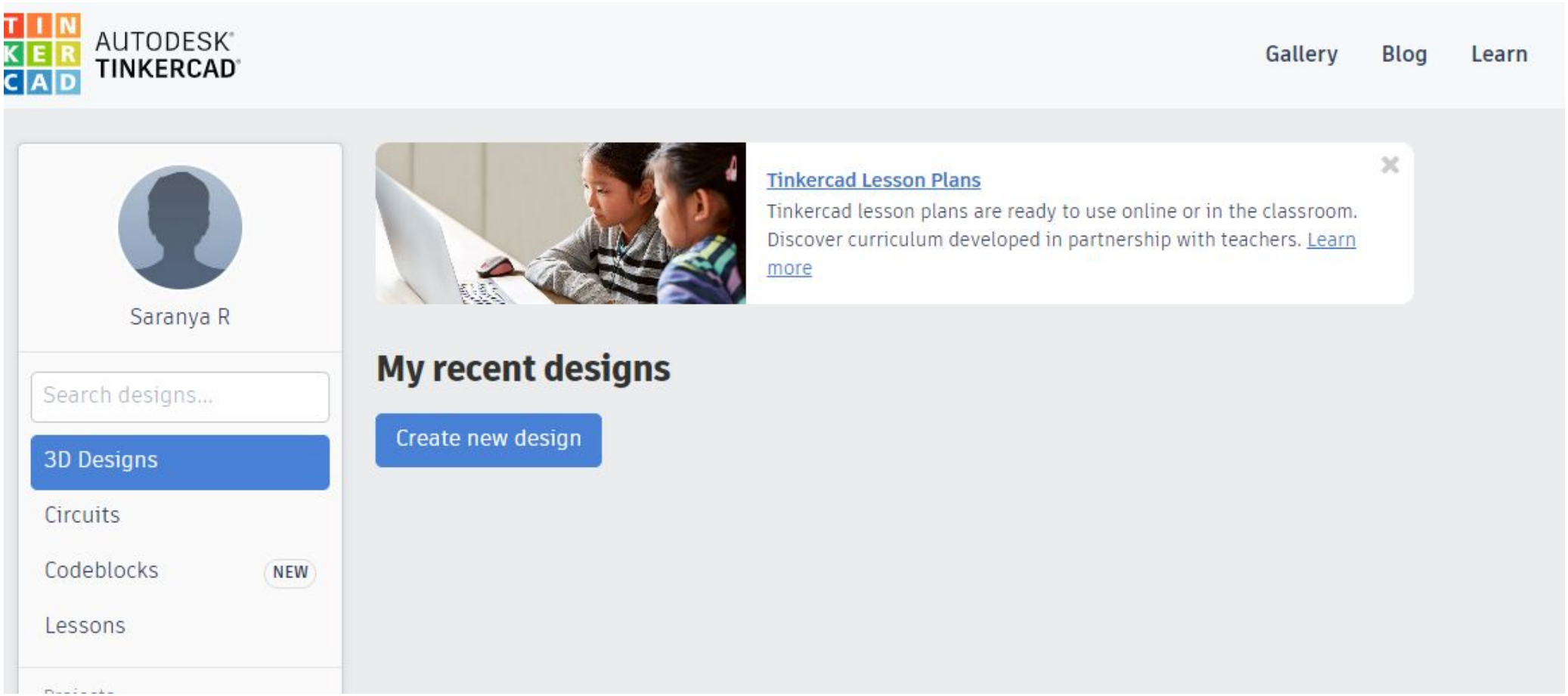
Arduino Uno


Digital pins
Reset button
USB to UART port
Crystal Oscillator
Power Supply Jack
In – System Programming (ISP) pins
Atmega 328 microcontroller
Analog pins
Power supply pins
DIGITAL (PWM~)
POWER
ANALOG IN
ARDUINO
UNO
WWW.ARDUINO.CC – MADE IN ITALY
SPK16.000G

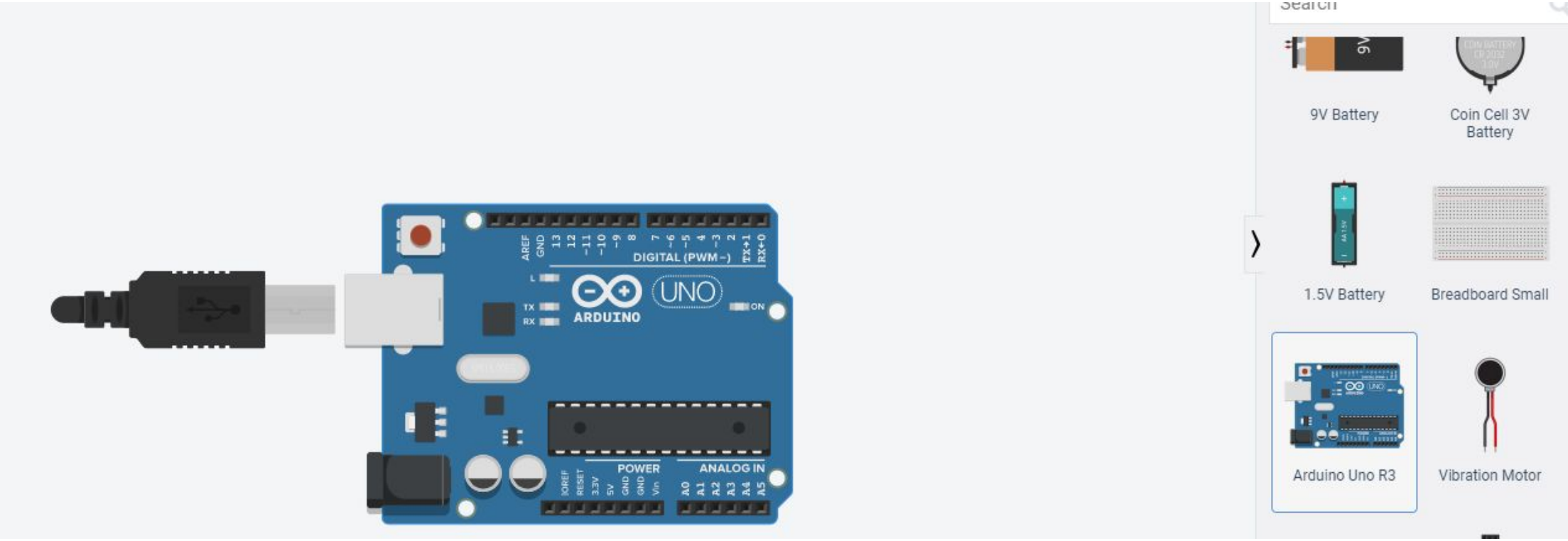
IoT Simulation tools

- Tinkercad (https://www.tinkercad.com/dashboard) – Open source
- ArduinoSim
- Node-Red
- http://www.cupcarbon.com/
- NS3
- Proteus Simulator
- **Simulator for Arduino – paid**
- **http://iot.appinventor.mit.edu/#/ - Open source (Home automation)**
- https://tutorial45.com/arduino-simulator-emulator/ - gives you the list of simulator
- Simple and intuitive tutorials available here - https://www.javatpoint.com/arduino-blinking-two-led

Sample – Tinkercad.com



Sample – Tinkercad.com



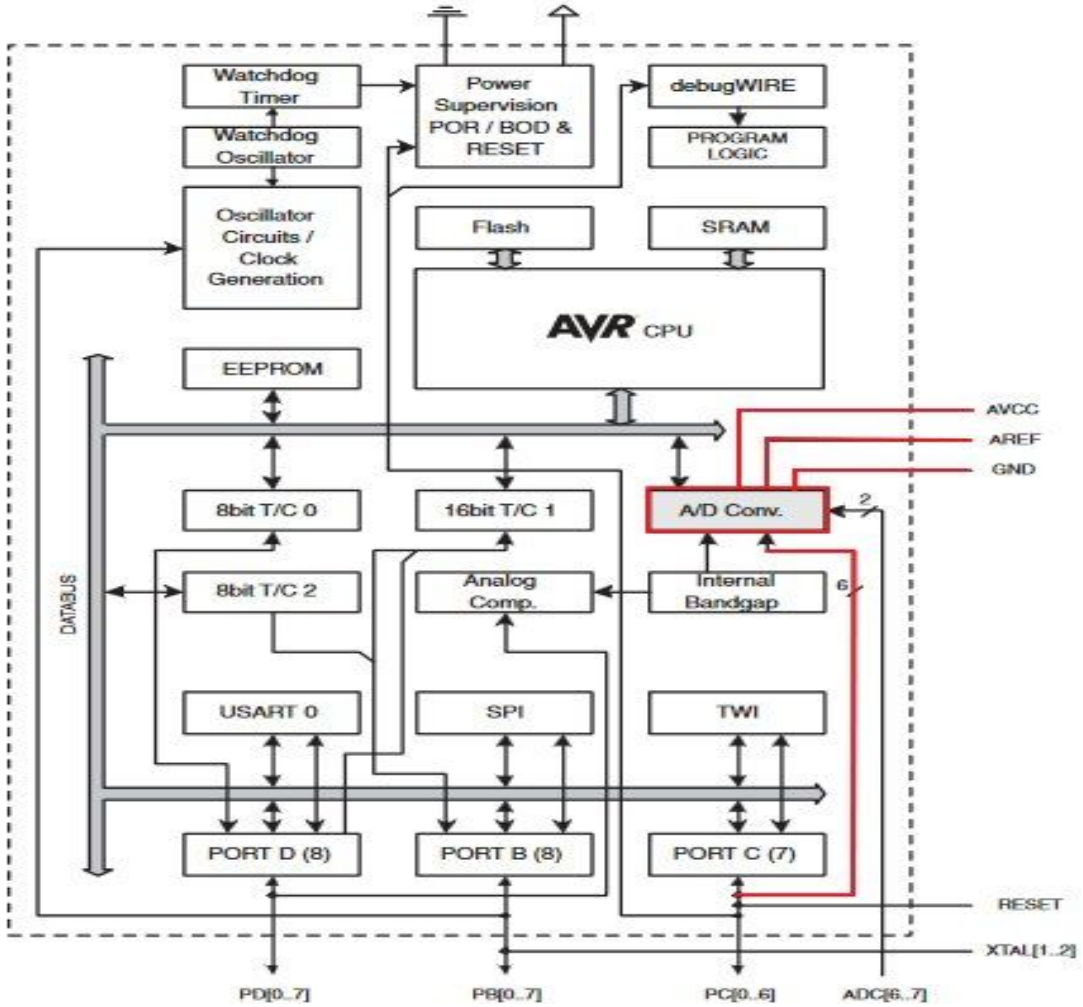
Arduino Architecture – Structure & Features

Microcontroller in Arduino

- Microcontrollers used mostly in Arduino
  - ATmega8
  - ATmega168
  - ATmega328

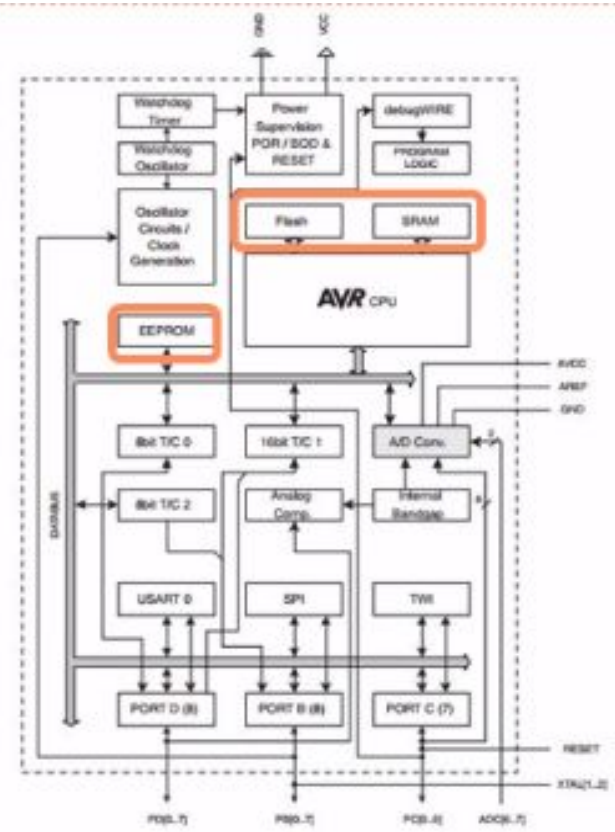
- AVR Microcontroller developed by Atmel

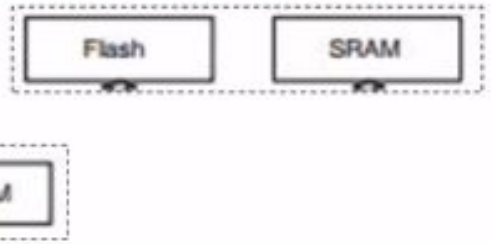
AVR Architecture - CPU



- Central Processing Unit
  - ALU
  - General Purpose Registers
  - Interrupts
  - Instruction Control

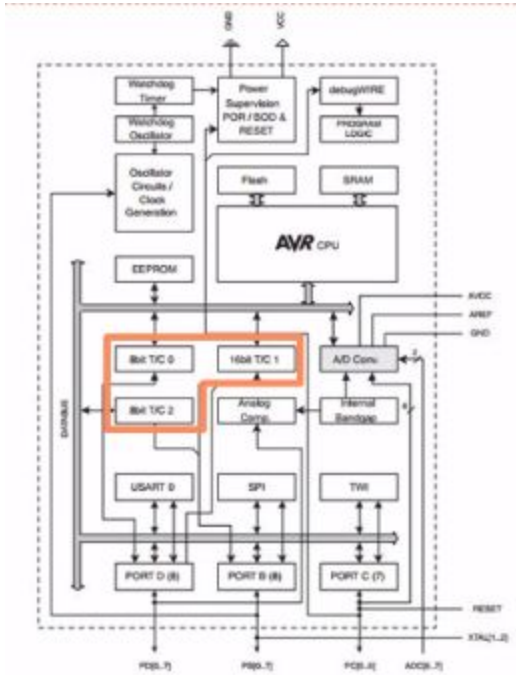
AVR Architecture - Memory





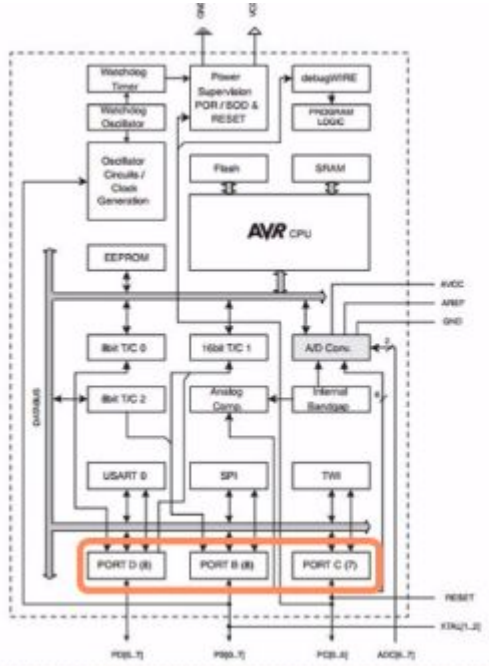
- Memory
- E^2PROM (Electrically Erasable Programmable ROM) – Non-Volatile
- Flash – Non-Volatile
- SRAM (Static RAM) – Volatile

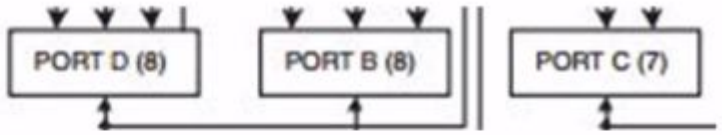
AVR Architecture - Timers



- Timers
  - Counting and Timing
  - Frequency of instruction execution

AVR Architecture – I/O





- Input/Output Ports
  - 8-bit ports
  - Each bit → one I/O pin
  - Digital pins

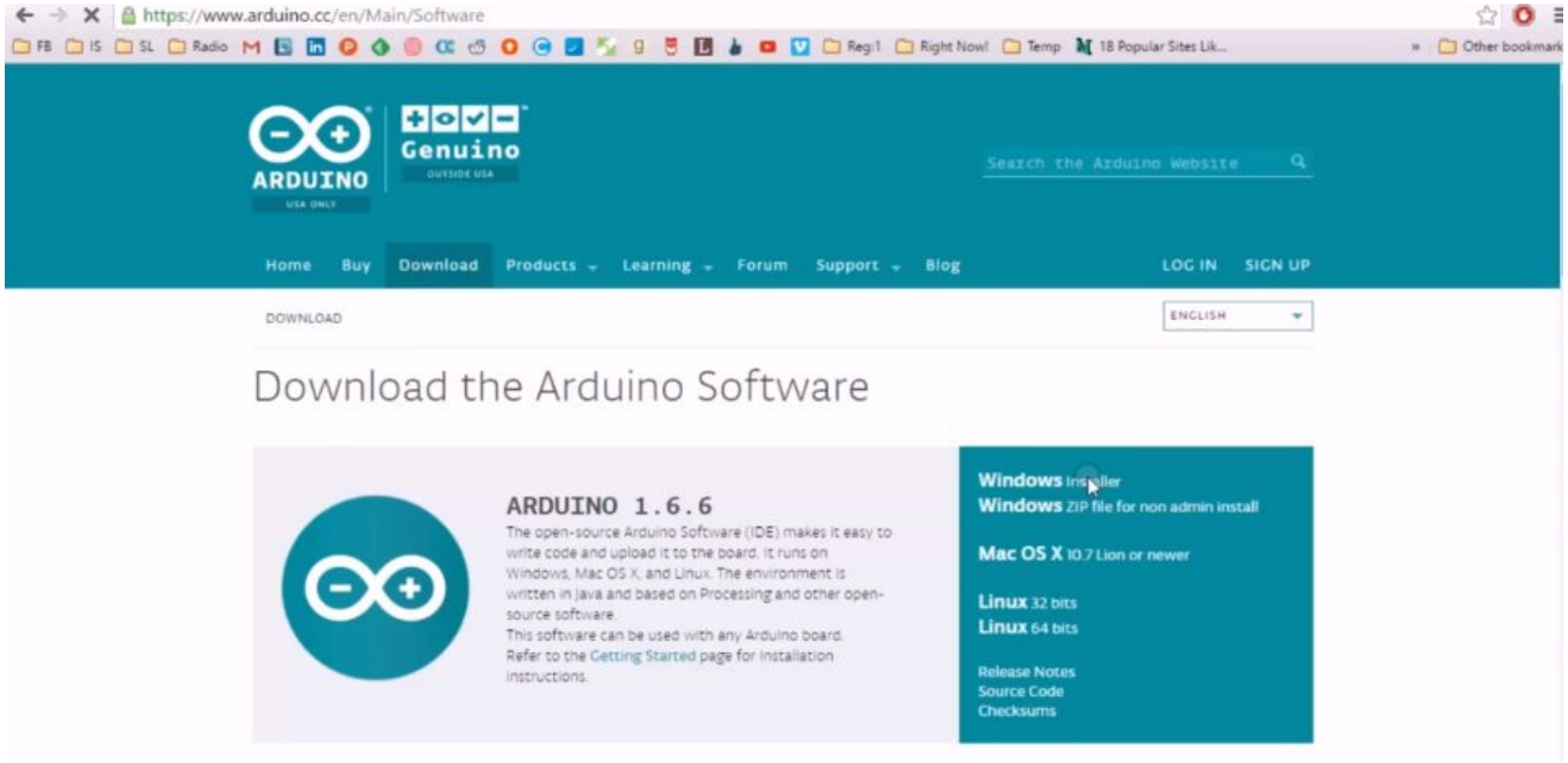
Summary of Arduino Uno

- Advanced RISC Architecture
- 3 PWM Channels
- Programmable Serial USART
- External and Internal Interrupt Sources
- Operating Voltages 4.5V - 5.5V
- On-chip Analog Comparator
- 8-channel ADC with 10-bit Accuracy

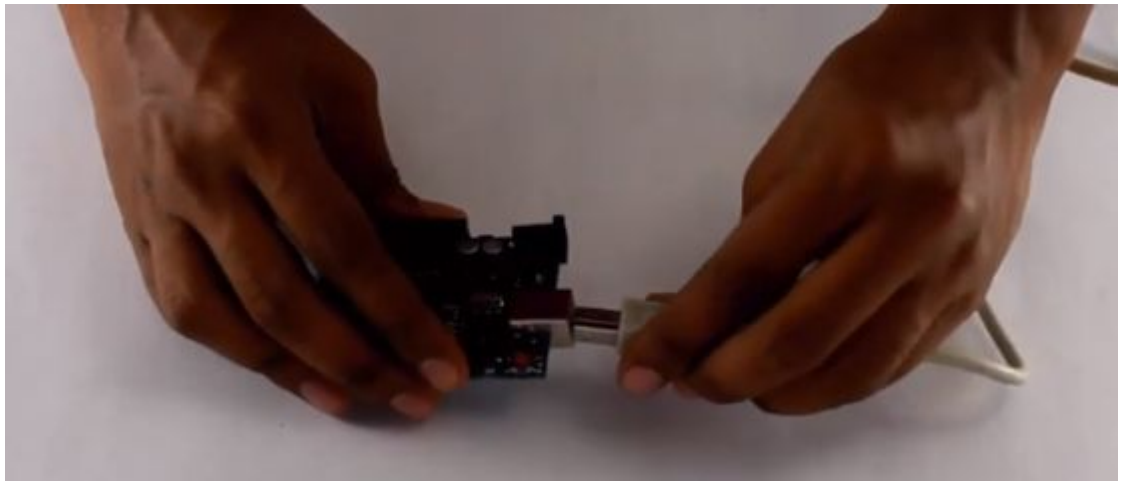
Interfacing Arduino
Connect and Detect Arduino Uno

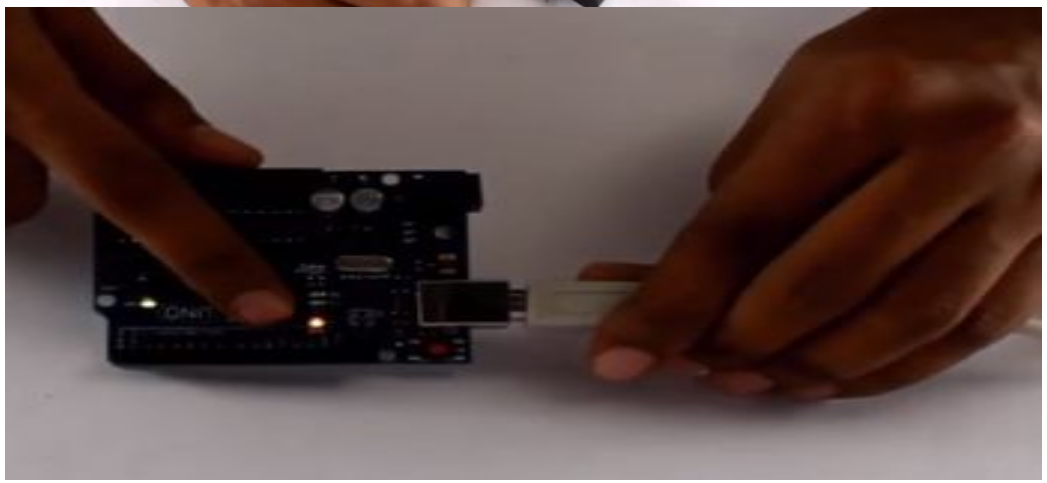
Software Requirements

- **Arduino IDE -** https://www.arduino.cc/en/Main/Software



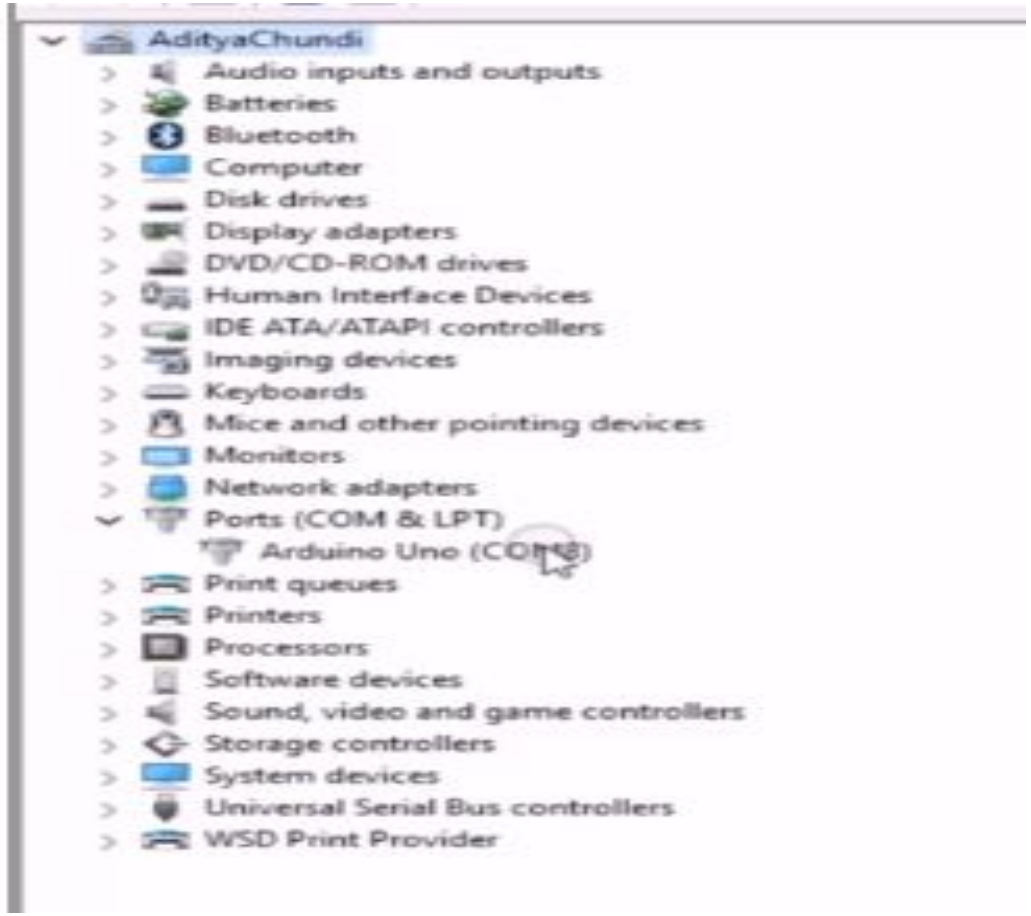
Interfacing Arduino
Connect and Detect Arduino Uno

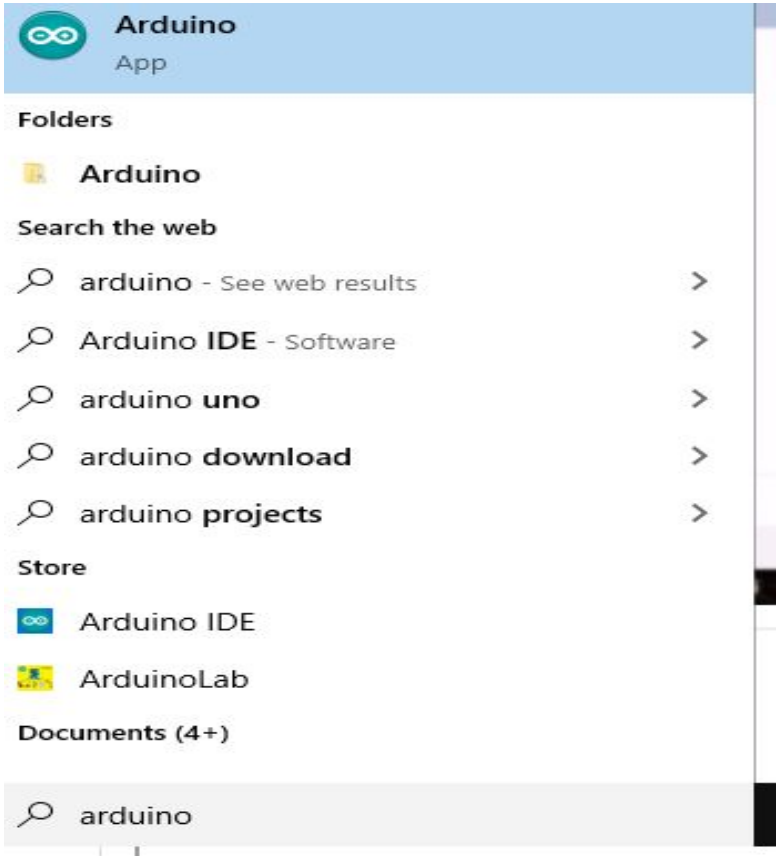




Interfacing Arduino

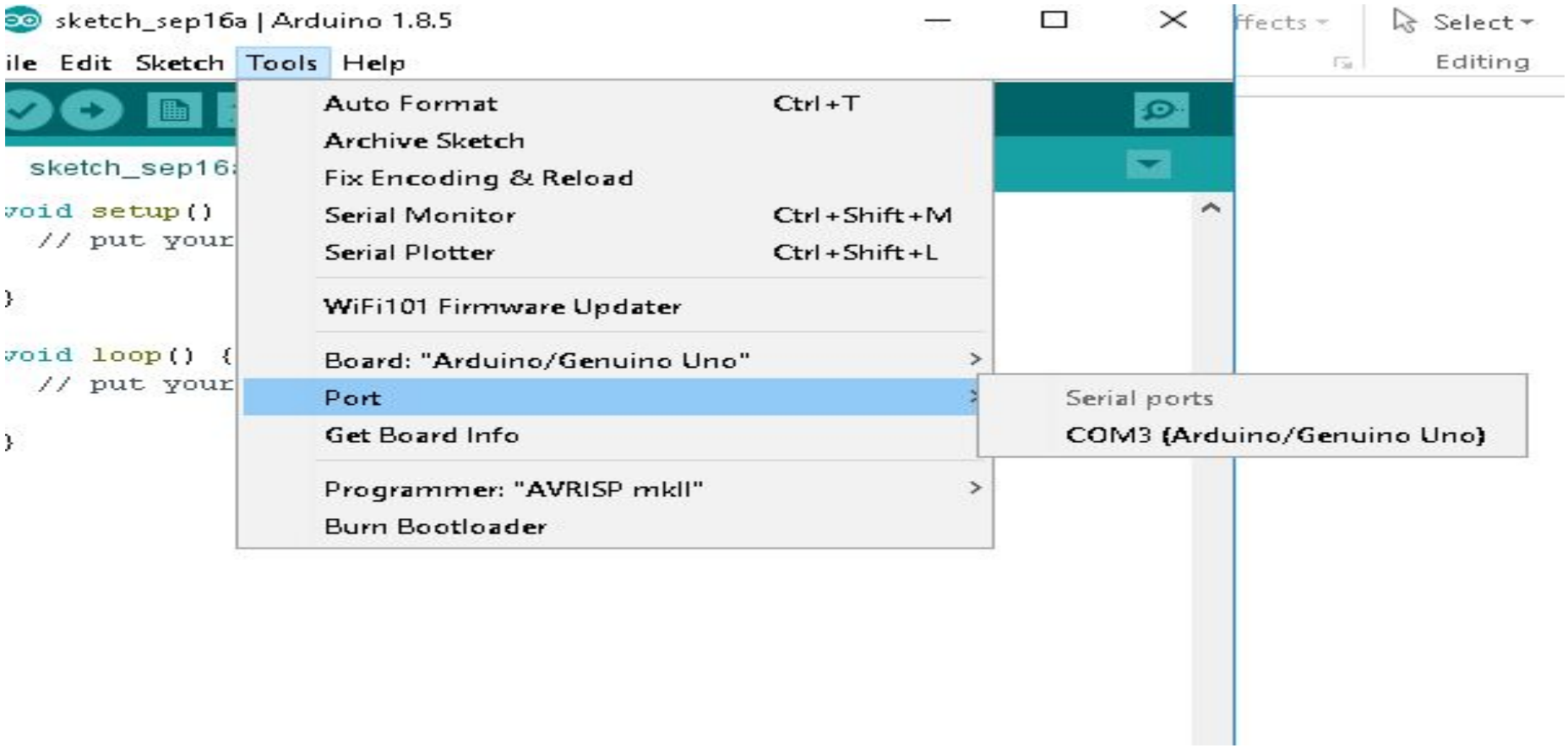
Connect and Detect Arduino Uno





Interfacing Arduino

Connect and Detect Arduino Uno



References

- Skifi labs
- Sparkfun Learn
- https://www.incognito.com/blog/