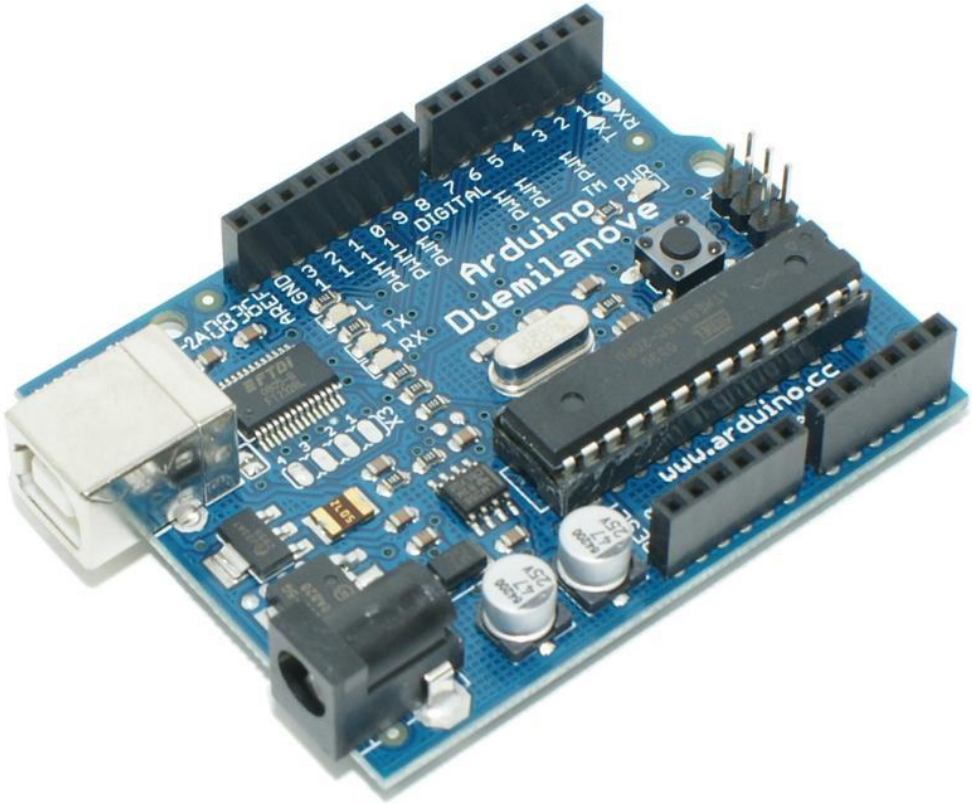
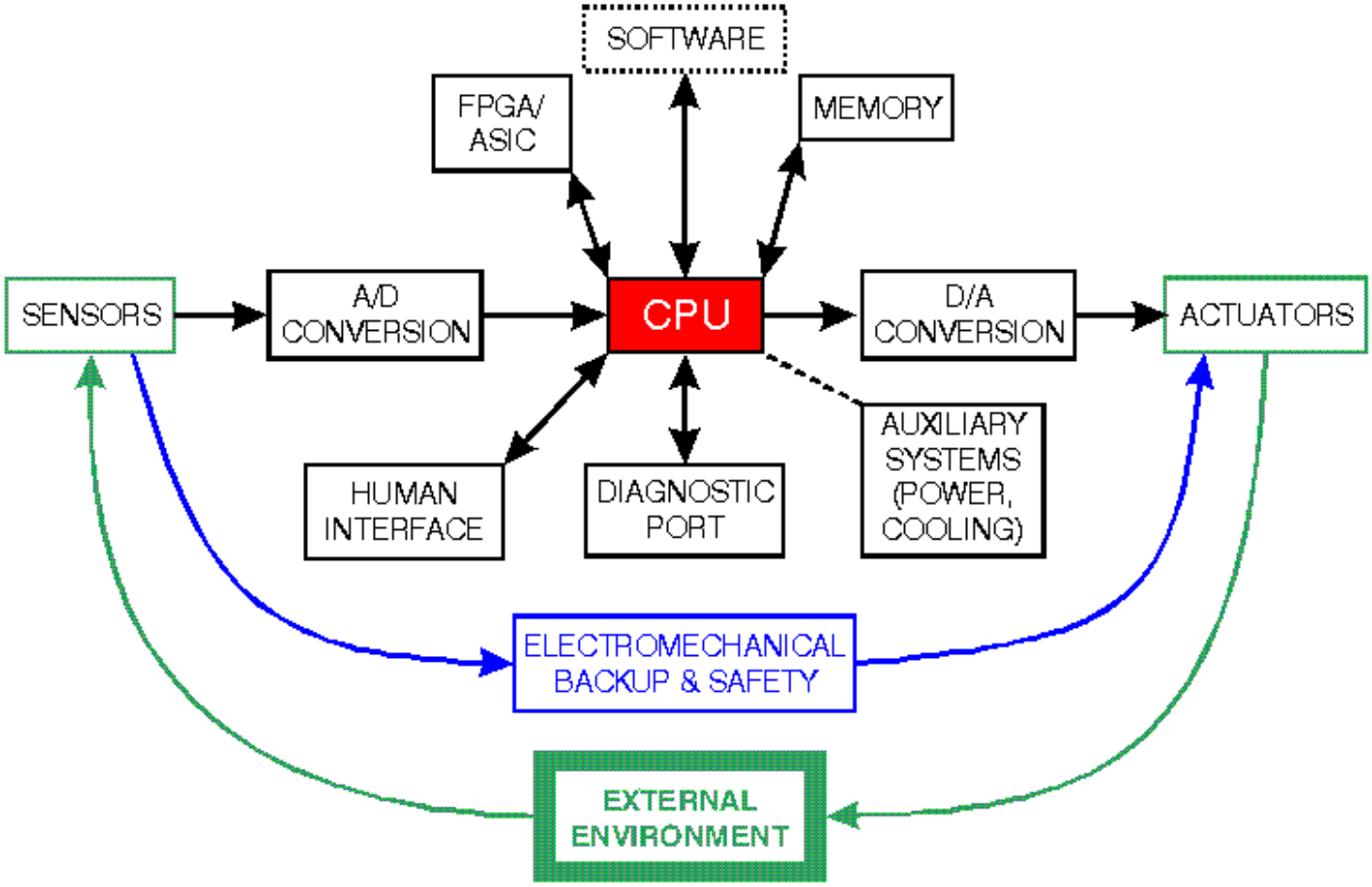
Embedded Systems with Arduino



Choose

- A Cassette Player
- An MP3 player
- A Laptop

What is an Embedded System



Coffee Vending Machine

- Water tank
- Heater
- Temperature sensor
- Stirrer / mixer
- Dispenser valve
- Buttons
- Display

Embedded Systems (cont)

- **Analog + Digital Circuits**
  - Definitely possible to make
  - Modification is difficult
  - Protection of IP is not possible
- **Embedded System**
  - Computerized, very easy to design and modify
  - Addition of new features / removal is easy
  - IP is protected

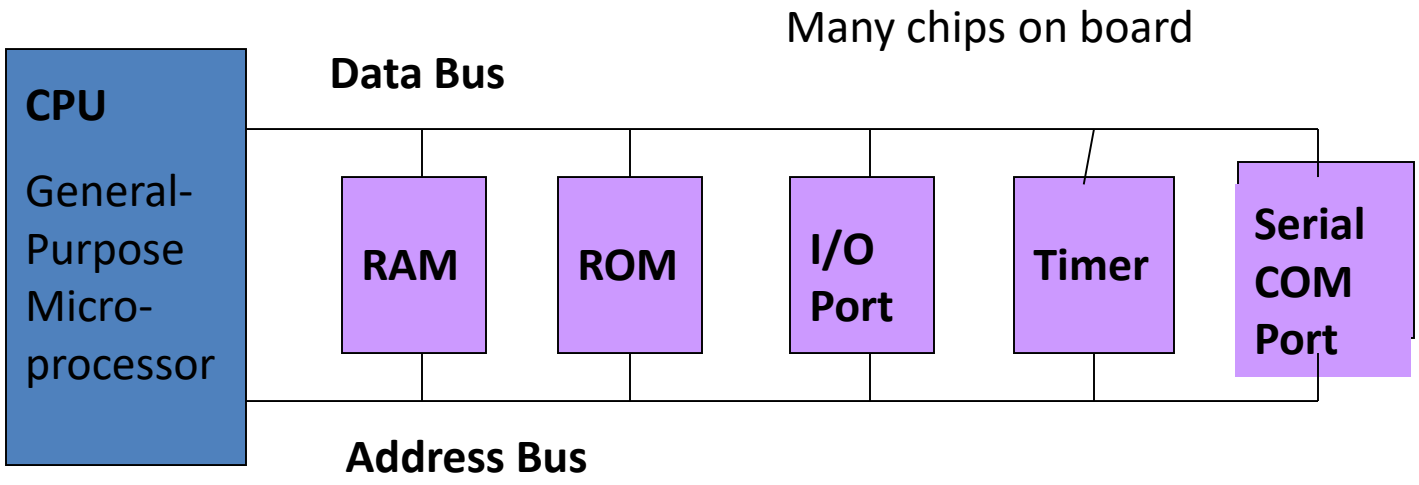
Embedded Devices

- Micro-processors
- Micro-Controllers
- PLDs
- System on Chip

Microprocessors

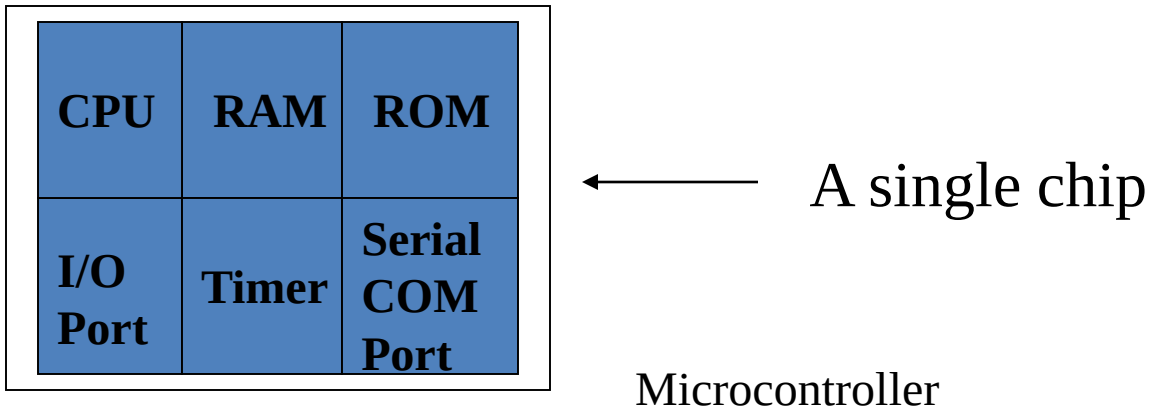
General-purpose processor

- CPU for Computers
- No RAM, ROM, I/O on CPU chip itself
- Example：Intel’s x86, Motorola’s 680x0, AMD
- Connect all peripherals externally



Microcontroller :

- A smaller computer
- On-chip RAM, ROM, I/O ports...
- Example：Motorola’s 6811, Intel’s 8051, Zilog’s Z8 and PIC 16X



Microcontroller Programming

- For ELECTRONICS/Computer engineering people
- Deep understanding of architecture
- Sound Programming knowledge
- Assembly / C interworking
- Requires special circuits like dev board and programmer
- NOT for non electronics background people

Microcontroller use Process

- Use an IDE to write down C / assembly code
- Generate .hex file
- Use a device programmer hardware
- Use a device programmer software
- Burn the .hex file on microcontroller
- Use it in device

The Big Picture PROJECT

I Don't Know about any thing of these

Microcontroller Architecture

Assembly /C? Interfacing Codes???

Project Hardware, PCB, Programmer???

Arduino

- Microcontroller Board
- Open Source Hardware
  - Hardware schematics and layouts freely available
  - The boards can be built by hand or purchased preassembled
- Open Source Software
  - Special programming software FREE
  - The software can be downloaded for free
- Flexible, easy-to-use hardware and software

How it Works

ARDUINO

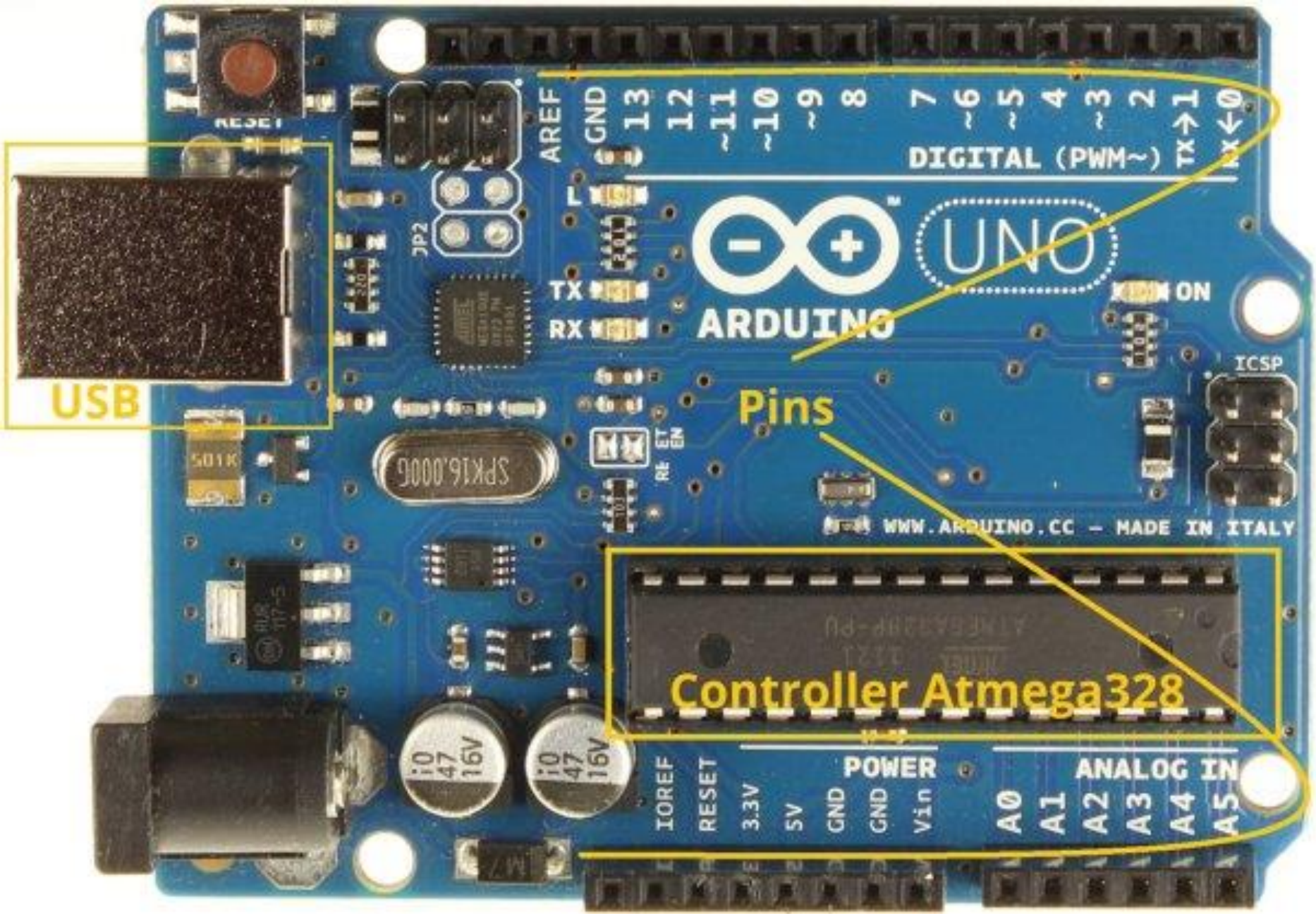
USE THIS

Microcontroller

Instead of this

History

- In 2005, in Ivrea, Italy
- Multidisciplinary Project work
- Simple to understand Hardware
- Hundreads of precompiled libraries for various advanced interfaces
- Ready for small projects to standard products
- Built using 8-bit AVR RISC microcontroller


USB
Pins
Controller Atmega328
DIGITAL (PWM~)
POWER
ANALOG IN
ARDUINO
UNO
WWW.ARDUINO.CC – MADE IN ITALY

Bare Minimum

```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

Arduino Targets

- Made for enthusiasts, engineers and artists
- No microcontroller knowledge required
- Very easy to use software, no previous C/C++/assembly knowledge required
- Programming is based on hardware “WIRING”
- Suitable for all students willing to learn
- Its Built for everyone

Open Source

- Open Source Software
- Open Source Hardware
- Visit Arduino.cc

Arduino Boards

- Uno
- Mega
- Nano
- micro
- Leonardo
- Due
- Esplora
- Yun
- Zero
- Mkr
- Many more