

# 微控制器&Arduino

## DOCUMENTATION, MICROCONTROLLERS & ARDUINO

Day\_01\_3



Aan Le Zhou

Interactive Installation Design



记录  
DOCUMENTATION

Week 01 - 1.2

# 做记录 | DOCUMENTATION

Documentation is the process of creating a record of the work that you have done. For the purposes of this class it provides evidence that you have completed the exercise and learned from the experience. Documentation is also helpful because it archives information in a way you can later reference or easily share with others.

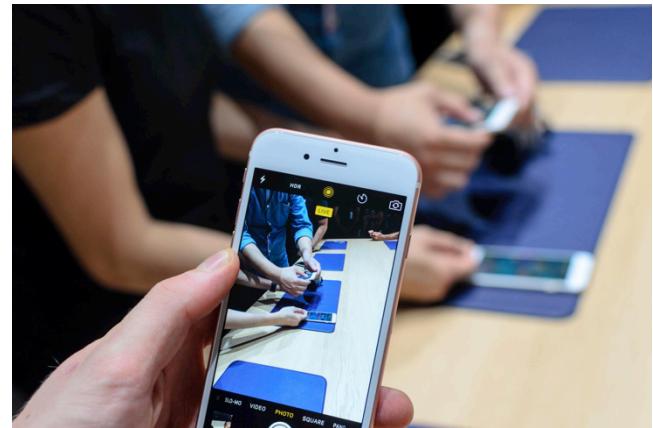
**做记录** 的对象是你的项目包括过程和结果。对这堂课而言，它是你完成了课堂 / 课后任务的凭证，通过对结果和过程的描述有助于你对相关课题的理解。同时还能给你自己在今后做参照也利于分享。



# 做记录 | DOCUMENTATION

Celebrate your achievements by taking photos or shooting video of your lab exercises or projects as you build them. Also document when things do not work, because these moments are not really failures, but important lessons learned. Documentation requirements are flexible, because the specifics of each project should inform the documentation process.

每当你成功完成某个步骤用你的手机 / 相机拍好照片 / 视频，同时，当你挣扎很久也无法成功克服某个技术障碍或者其他典型的失误时也请记录下来，有助于你自我学习纠正

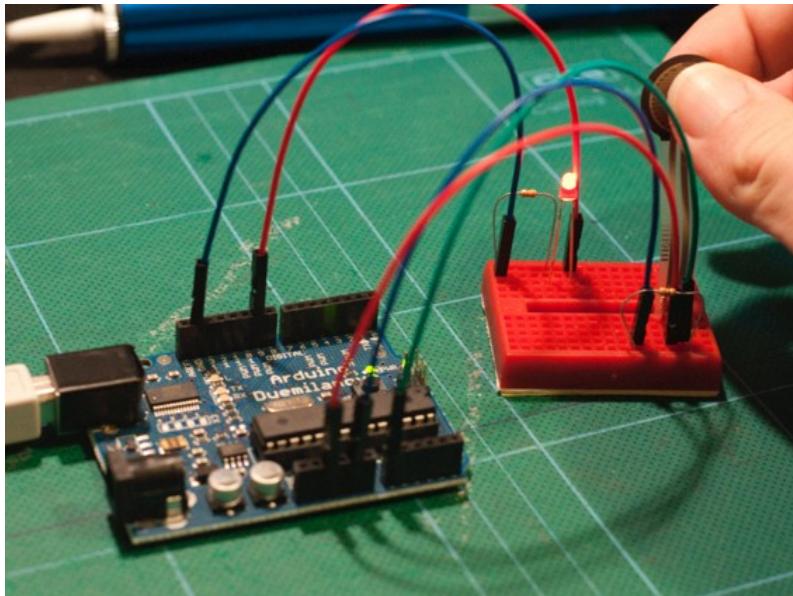


# WHAT IF YOU DO NOT?



Interactive Installation Design

# 记录要点 | DOCUMENTATION TIPS



The names of everyone involved  
Photos and / or video  
Text description of goals, process and results  
Source code with comments  
Schematics  
Credit for and links to any resources used  
所有参与者的姓名  
完成照片 / 视频  
文字描述目标 / 实现过程和结果  
源代码和备注  
电路图  
注明引用资源的链接





微控制器 | Microcontrollers

# 计算机 | COMPUTER



We often think of computers as those things that sit on our desk and which allow us to more effectively work, play, and communicate. In generic terms a computer is anything that can run a program, or series of instructions. Computers have both hardware and software elements.

提到计算机，通常大家想到的是工作和学习中那个搞笑的工具，或者生活中供你娱乐的设备。但从广义的计算机的定义上讲，任何可以运行程序或者执行系列特定指令的设备都应属于计算机。计算机由硬件和软件构成。

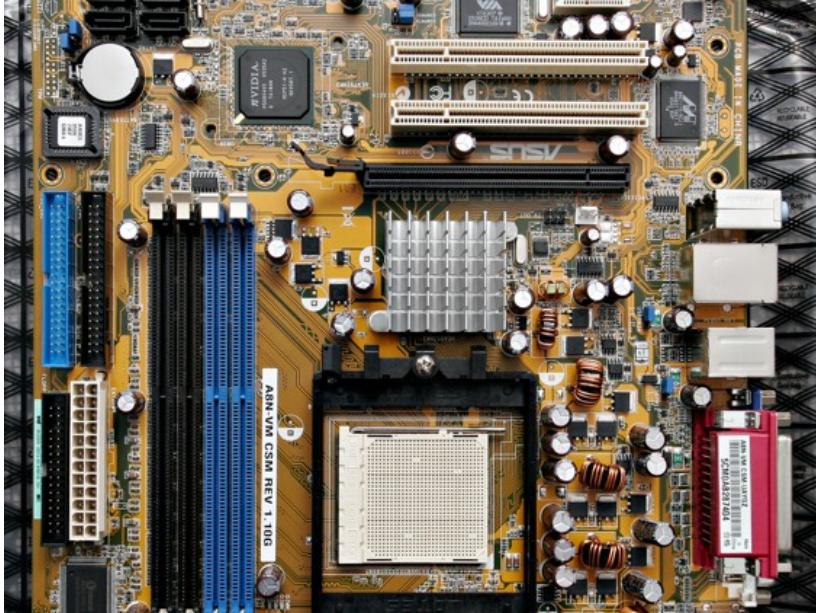


# 微控制器 | MICROCONTROLLER

A microcontroller is a small computer on a single integrated circuit that has the ability to interface with the physical world through integration with various input circuits (sensors) and output circuits (actuators).



# 硬件 | HARDWARE



Hardware refers to any of the physical components that make up a computer.

硬件指所有构成计算机的物理元件



# 微控制器构成 | MICROCONTROLLER PARTS

微处理器构成应包括以下内容：

Central Processing Unit 中央处理单元

Clock Generator 时钟发生器 / 脉冲产生器

Memory 内存

General Purpose Input / Output Pins 通用型输入输出引脚

Analog-to-Digital Converter 模拟数字转换器

Digital-to-Analog Converter 数字模拟转换器

Universal Asynchronous Receiver / Transmitter  
通用异步收发传输器



# 中央处理器 | CENTRAL PROCESSING UNIT

The central Processing Unit (CPU) is the part of a computer that carries out the instructions of the program by performing the logical, arithmetical and input / output operations of the system.

中央处理器, 缩写: CPU, 是计算机的主要设备之一, 功能主要是解释计算机指令以及处理计算机软件中的数据。计算机的可编程性主要是指对中央处理器的编程。

1970年代以前, 中央处理器由多个独立单元构成, 后来发展出由集成电路制造的中央处理器, 这些高度收缩的组件就是所谓的微处理器, 其中分出的的中央处理器最为复杂的电路可以做成单一微小功能强大的单元。



Anne Li Zhou

# 时钟发生器 | CLOCK GENERATOR



Acting as a timing device, a clock generator, usually a crystal oscillator, produces a signal which is used to synchronize the operation of the circuit.

时钟发生器（脉冲产生器）：通常是通过一个晶体振荡器产生周期性的脉冲信号用以控制和电路同步



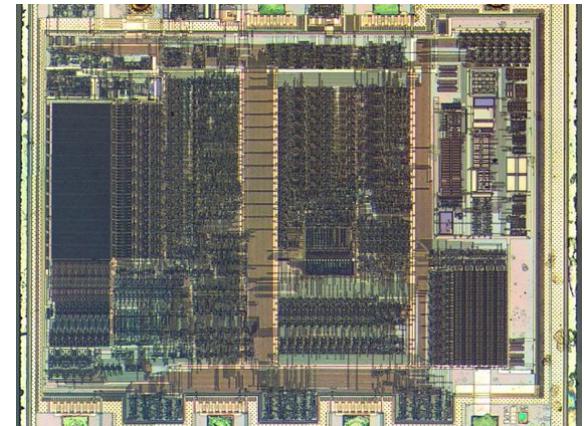
# 内存 | MEMORY

A combination of Random Access Memory (RAM), Read Only Memory (ROM) and Electrically Erasable Programmable Read-Only Memory (EEPROM) work in concert to provide access to information (Data and Programs) stored within the Microcontroller.

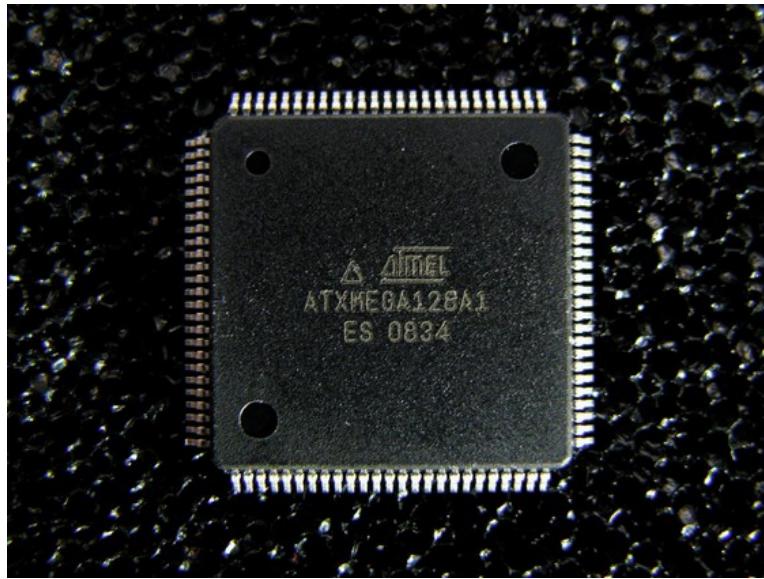
**随机存取存储器：**Random Access Memory，简称RAM，是与[CPU](#)直接交换数据的内部存储器，也叫主存。它可以随时读写，速度快，为[操作系统](#)或其他正在运行中的程序的临时数据存储媒介。用来加载各式各样的程序与数据以供[CPU](#)直接运行与运用。

**只读内存：**Read-Only Memory，ROM，是一种[半导体内存](#)，其特性是一旦存储[数据](#)就无法再将之改变或删除，且内容不会因为[电源](#)关闭而消失。在[电子](#)或[电脑](#)系统中，通常用以存储不需经常变更的程序或数据，例如[个人电脑的BIOS](#)（基本输入输出系统）与其他各种微电脑系统中的[固件](#)，均存储在ROM内。

**电子抹除式可复写只读内存**，Electrically-Erasable Programmable Read-Only Memory，简称EEPROM是一种可以通过电子方式多次复写的半导体存储设备，它被广泛用于需要经常擦除的BIOS芯片以及[闪存](#)芯片，并逐步替代部分有断电保留需要的RAM芯片



# 通用型输入输出引脚 | GENERAL PURPOSE INPUT / OUTPUT PINS



General Purpose Input / Output (GPIO) Pins are pins on a microcontroller, capable of taking a voltage as an input or of supplying a voltage as an output, and whose behavior can be controlled by the user at run time.

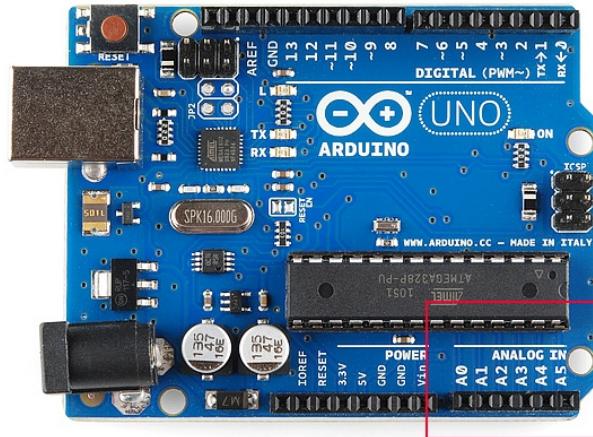
通用型输入输出引脚指的是微控制器上能被使用者选择控制既能读取输入电压又能提供电压输出的引脚



# 模拟信号 | ANALOG

Information expressed as a continuously variable physical quantity such as a position or voltage. This form of data is not easily understood or expressed by a computer.

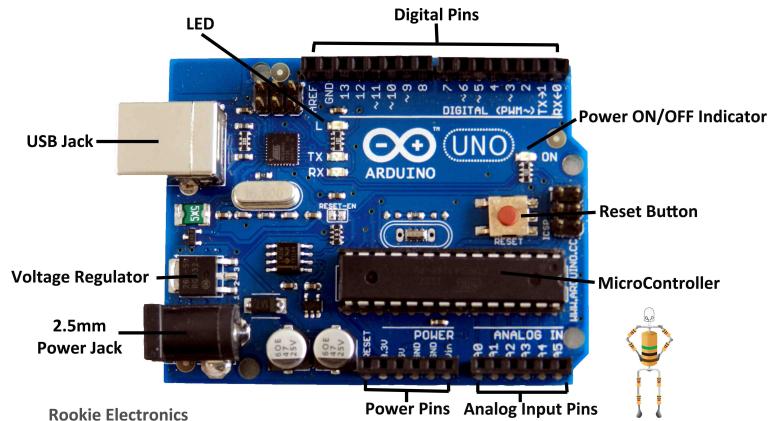
指连续变化的物理量比如位置或者电压，计算机很难准确描述和理解这些数据。



# 数字信号 | DIGITAL

Information expressed as a series of discrete values, often binary (0 or 1). This form of data is easily understood and expressed by a computer.

指离散的物理量使用二进制（0或1），计算机容易描述和理解这些数据。



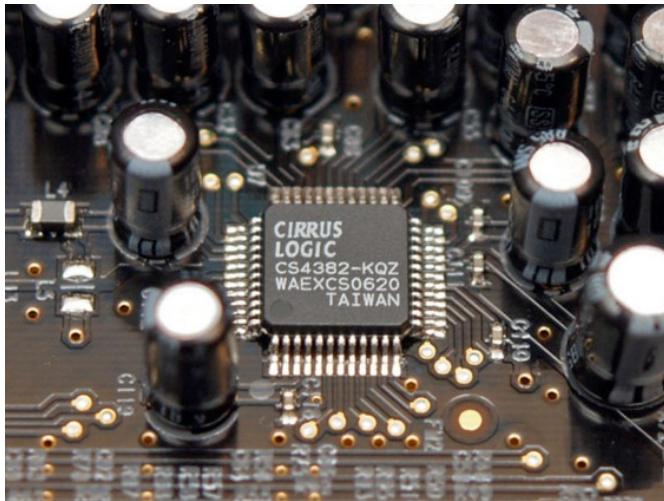
# 模拟数字转换器 | ANALOG-TO-DIGITAL CONVERTER

An Analog-to-Digital Converter (ADC) is a device that converts a continuously variable physical quantity, such as a voltage, into a discrete value, usually a digital number.

模拟数字转换器，Analog-to-digital converter, ADC, A/D 或 A to D，是用于将模拟形式的连续信号转换为数字形式的离散信号的一类设备。一个模拟数字转换器可以提供信号用于测量。



# 数字模拟转换器 | DIGITAL-TO-ANALOG CONVERTER



A Digital-to-Analog Converter (DAC) is a device that converts a discrete value, usually a digital number, into a continuously variable physical quantity, such as a voltage.

数字模拟转换器（英语：Digital to analog converter，英文缩写：DAC）是一种将数字信号转换为模拟信号（以电流、电压或电荷的形式）的设备。

数模转换。



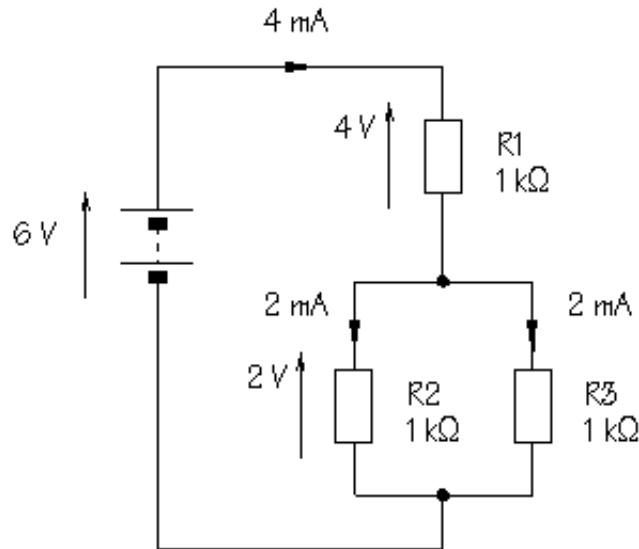
# 串口通信 | SERIAL

Serial may refer to either of two things:  
A form of communication which happens by sending data  
as a sequence, one bit at a time.

串口通信是一种通信方式，传输方式是串行式，数据是逐位传输的



# 串联&并联 | SERIAL & PARALLEL



Serial may refer to either of two things:  
Electrical components arranged in such a way that  
electricity moves through each one in sequence.

串联: 电流依次通过电路中各个元件

Parallel may refer to either of two things:  
Electrical components arranged in such a way that  
electricity moves through all of them at the same time.

并联: 电路同时通过各并联支路上的各个元件



# 并行通信 | PARALLEL



Parallel may refer to either of two things:  
A form of communication which happens by sending  
multiple bits of data simultaneously.

并行通信是另一种通信方式，传输方式是并行式进行，8位数据同时通过。

串口形容一下就是一条车道，而并口就是有8个车道同一时刻能传送8位（一个字节）数据。但并不是并口快，由于8位通道之间的互相干扰。传输时速度就受到了限制。而且当传输出错时，要同时重新传8个位的数据。串口没有干扰，传输出错后重发一位就可以了。所以要比并口快



# 通用异步收发传输器 | UART

## UNIVERSAL ASYNCHRONOUS RECEIVER / TRANSMITTER



Hardware that translates data between serial and parallel formats is called a Universal Asynchronous Receiver / Transmitter (UART).

通用异步收发传输器，Universal Asynchronous Receiver / Transmitter，通常称作UART，转换串行通信与并行通信数据格式的硬件





# 软件工程术语 | Software Engineering Terminology

# 软件 | SOFTWARE



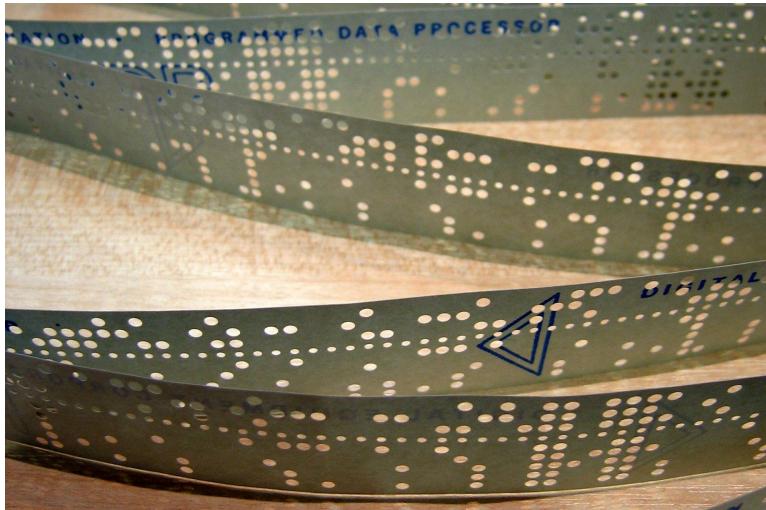
Software refers to the intangible programs and information used by a computer during operation.

软件



Interactive Installation Design

# 程序 | PROGRAM



A program is a set of coded instructions designed to be read and interpreted by a computer so that the computer can perform a particular operation.

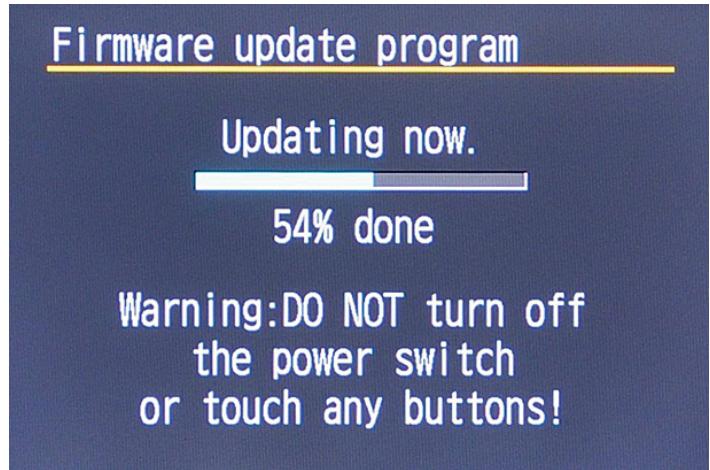
程序



# 固件 | FIRMWARE

Firmware is a type of permanent or semi-permanent program that is used to provide basic control for the device it is installed on. Computers, Computer peripherals, digital cameras, household appliances, mobile phones, remote controls, and many other electronic devices all rely on firmware.

固件是一种嵌入在硬件设备中的软件。通常它是位于特殊应用集成电路 (ASIC) 或可编程逻辑器件 (PLD) 之中的闪存或EEPROM或PROM里，有的可以让用户更新



# 基本输入输出系统 | BIOS(BASIC INPUT-OUTPUT SYSTEM)



A Basic Input-Output System (BIOS) is another type of small firmware program, typically used to load an operating system into memory.

基本输入输出系统，是一种业界标准的固件接口。BIOS这个字眼是在1975年第一次在操作系统中出现，BIOS是个人电脑启动时加载的第一个软件。BIOS用于电脑开机时运行系统各部分的自我检测(Power On Self Test)，并加载引导程序或存储在主存的系统。



# 启动管理程序 | BOOTLOADER



A Bootloader or Bootstrap Loader is a small firmware program designed to facilitate the startup process for a computer. The Bootloader is used to load a more complex program into memory, and may aid in the reprogramming of the computer.



# 操作系统 | OPERATING SYSTEM

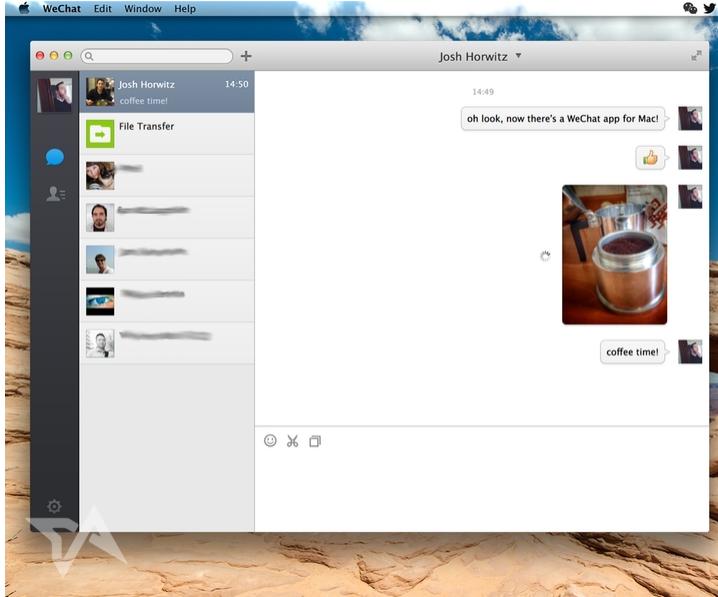


An Operating System (OS) is a piece of software that manages access to hardware and software resources and runs additional application programs.

操作系统是管理计算机硬件与软件资源的计算机程序，同时也是计算机系统的内核与基石



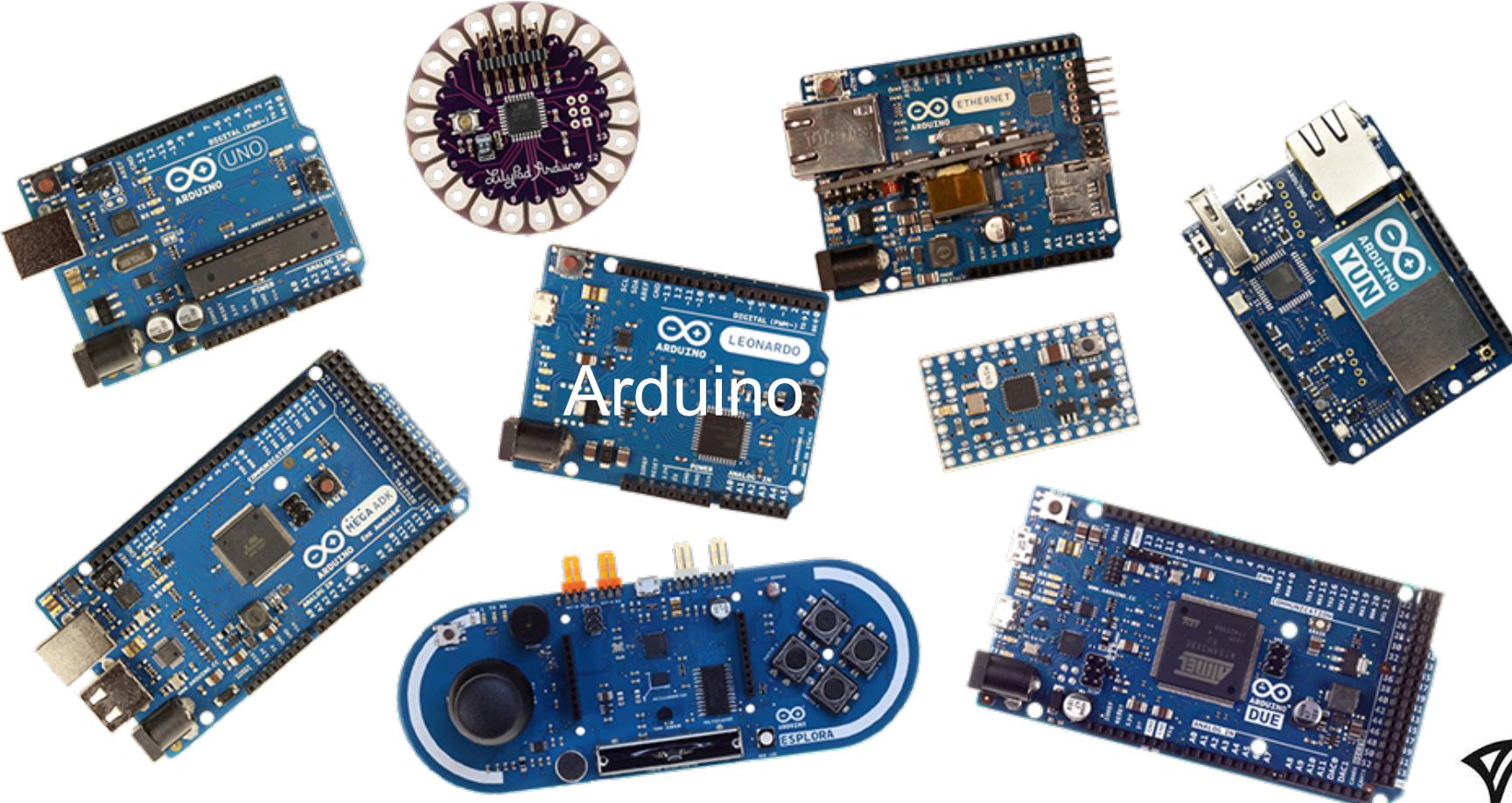
# 应用程序 | APPLICATION



An Application (or App) is a program that is designed to facilitate specific tasks on a computer, and which must be run inside an operating system.

应用程序（APP）是可以在计算机操作系统中运行并能完成指定任务的程序



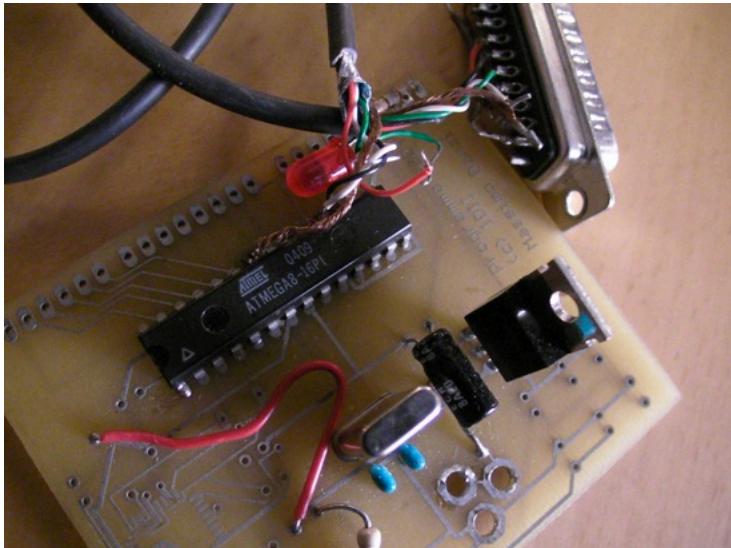


# Arduino



Interactive Installation Design

# Arduino

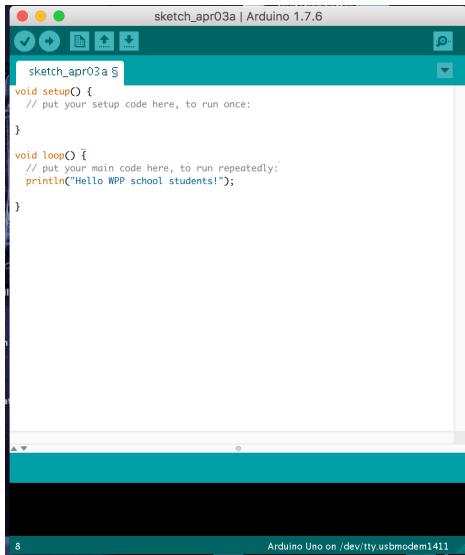


Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists and anyone interested in creating interactive objects or environments.

Arduino 是一块开源电子开发平台，由硬件——简单易用的电子开发板（Arduino板）和软件——Arduino集成开发环境组成。它是为艺术工作者、设计师、电子爱好者或其他任何对创造交互设计而开发的工具



# Arduino 开发环境 | ARDUINO IDE



```
sketch_apr03a | Arduino 1.7.6

sketch_apr03a S

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

void loop() {
  // put your main code here, to run repeatedly:
  println("Hello WPP School students!");
}
```

8 Arduino Uno on /dev/tty.usbmodem1411

The Arduino IDE (Integrated Development Environment) is a software application where you write Arduino programs written in C / C++ and upload them to your Arduino.

Arduino 集成开发环境：基于C / C + +语言的用于编写上传Arduino程序的应用软件



# 开发环境安装 | INSTALLING THE ARDUINO IDE



Visit the following URL and download the Arduino IDE:

- [arduino.cc/en/Main/Software](https://arduino.cc/en/Main/Software)

You may also need to install the Java Runtime Environment (JRE) from one of these websites:

- <https://www.java.com/en/>

## Java 包安装



# MASSIMO BANZI: HOW ARDUINO IS OPEN-SOURCING IMAGINATION



Interactive Installation Design

# GNU通用公共许可协议 | General Public License



GNU通用公共许可协议，缩写：GNU GPL或者GPL，是一个被广泛使用的自由软件许可协议条款，保证终端用户运行、学习、分享（复制）及编辑软件之自由。GNU GPL最初由理查德·斯托曼为GNU计划而撰写。于2007年6月29日发布。

GNU是一个自由操作系统，其内容软件完全以GPL方式发布，作为操作系统，GNU的发展仍未完成，其中最大的问题是具有完备功能的内核尚未被开发成功



# 知识共享许可协议 | Creative Commons license



知识共享许可协议，简称CC许可，是一种公共版权许可协议，其允许分发受版权保护的作品。

一个知识共享许可用于一个作者想给他人分享，使用，甚至创作派生作品的权利。

知识共享提供给作者灵活性（例如，他们可以选择允许非商业用途使用他们的作品），保护使用或重新分配他人作品的人，所以他们只要遵守由作者指定的条件，不必担心侵犯版权



# GENUINO

In 2015, after a trademark ownership dispute between the Arduino founders erupted, four of the five founders (Massimo Banzi, David Cuartielles, Tom Igoe, and David Mellis) began using the Genuino brand name to distinguish official boards sold outside of the United States.

genuine / genius



# Arduino价值观 | THE ARDUINO WAY

In Getting Started with Arduino, Massimo Banzi talks about the things that are philosophically important to the Arduino team:

**Prototyping**

**Tinkering**

**Patching**

**Circuit Bending**

**Hacking Toys**

**Collaboration**



# 原型 | PROTOTYPING

Prototyping involves any number of methods that attempt to create a working model of something so that it can be tested, evaluated, and refined through an iterative design and development process.



# TINKERING

Tinkering is the process of casually or aimlessly experimenting with something, usually as an attempt to improve it.



# PATCHING

In the context of electronics, patching means to temporarily make a connection between two or more things with a cable or wire.



# 改装电路 | CIRCUIT BENDING

Circuit bending is the creative alteration of an existing circuit, usually through patching and adding components such as switches and potentiometers. Circuit bending is often performed on inexpensive electronic devices that produce sound.



# 玩具改造 | HACKING TOYS

Hacking toys can be accomplished by attaching switches and microcontrollers to off-the-shelf toys so that they can be controlled remotely.



# Arduino 资源 | ARDUINO RESOURCES

[ladyada.net/learn/arduino/](http://ladyada.net/learn/arduino/)

[learn.adafruit.com](http://learn.adafruit.com)

[instructables.com/id/Arduino-Projects/](http://instructables.com/id/Arduino-Projects/)

[stackoverflow.com/search?q=arduino](http://stackoverflow.com/search?q=arduino)

[hackaday.com/category/arduino-hacks/](http://hackaday.com/category/arduino-hacks/)

[arduino.cc/en/Tutorial/Foundations](http://arduino.cc/en/Tutorial/Foundations)

[playground.arduino.cc](http://playground.arduino.cc)

[makezine.com/arduino/](http://makezine.com/arduino/)

[itp.nyu.edu/physcomp/](http://itp.nyu.edu/physcomp/)

[tigoe.net/pcomp/](http://tigoe.net/pcomp/)

[shieldlist.org](http://shieldlist.org)

