中小學
Primary &
Secondary Schools

校園發明大賽

INVENTION FOR SCHOOLS CONTEST

Introduction to Credit Card-Sized Computers
卡片式電腦

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Topics to cover...
內容...

- What is a credit card-sized computer?
  什麼是卡片式電腦？

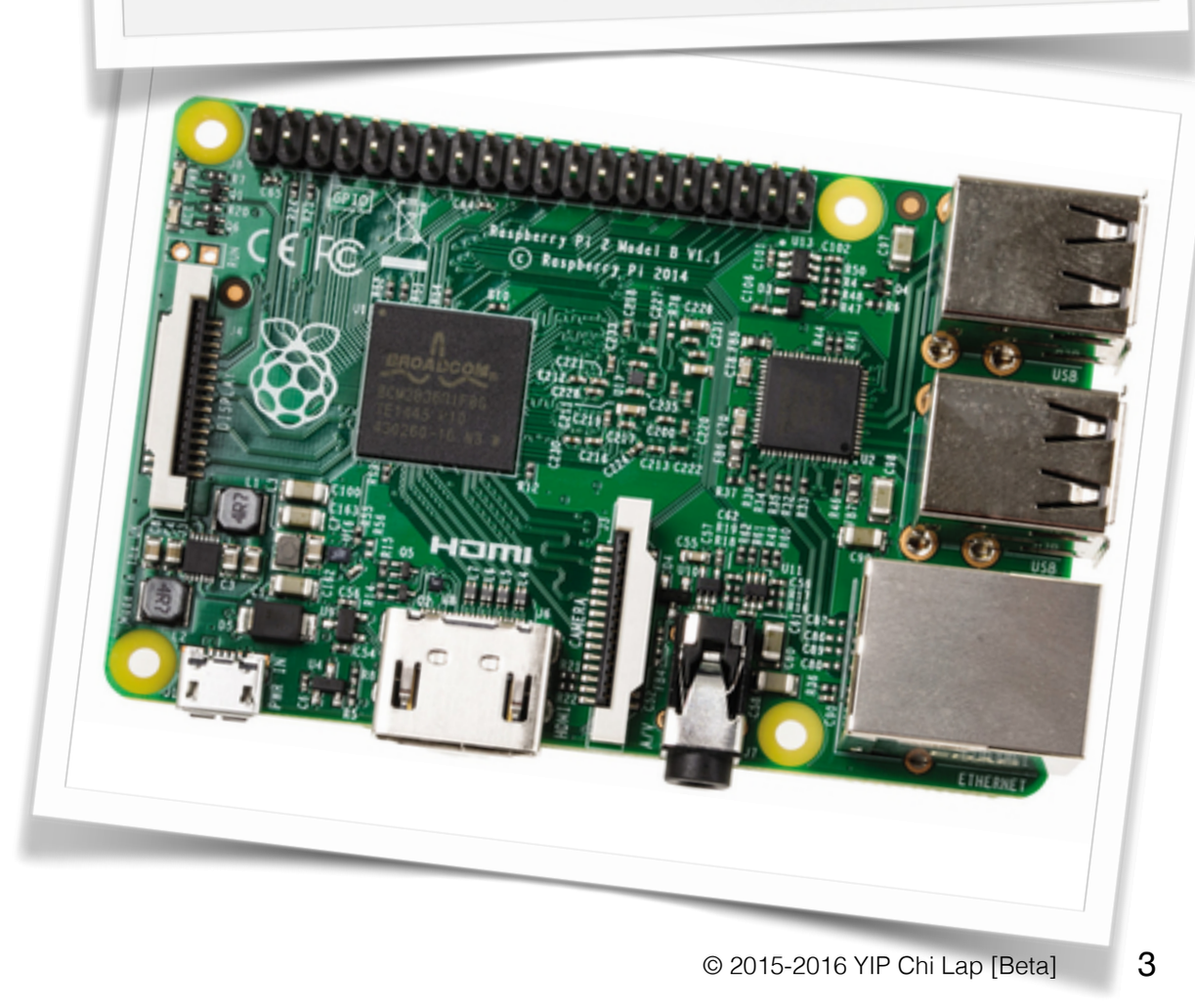
- What is Raspberry Pi?
  什麼是樹莓派？

- What is Arduino?
  什麼是 Arduino?

- Steps for creating your invention
  製作你的發明

Credit-card sized computers

卡片式電腦



Computers
電腦

Image source:

- http://store.hp.com/
- http://www.apple.com
- http://dell.com

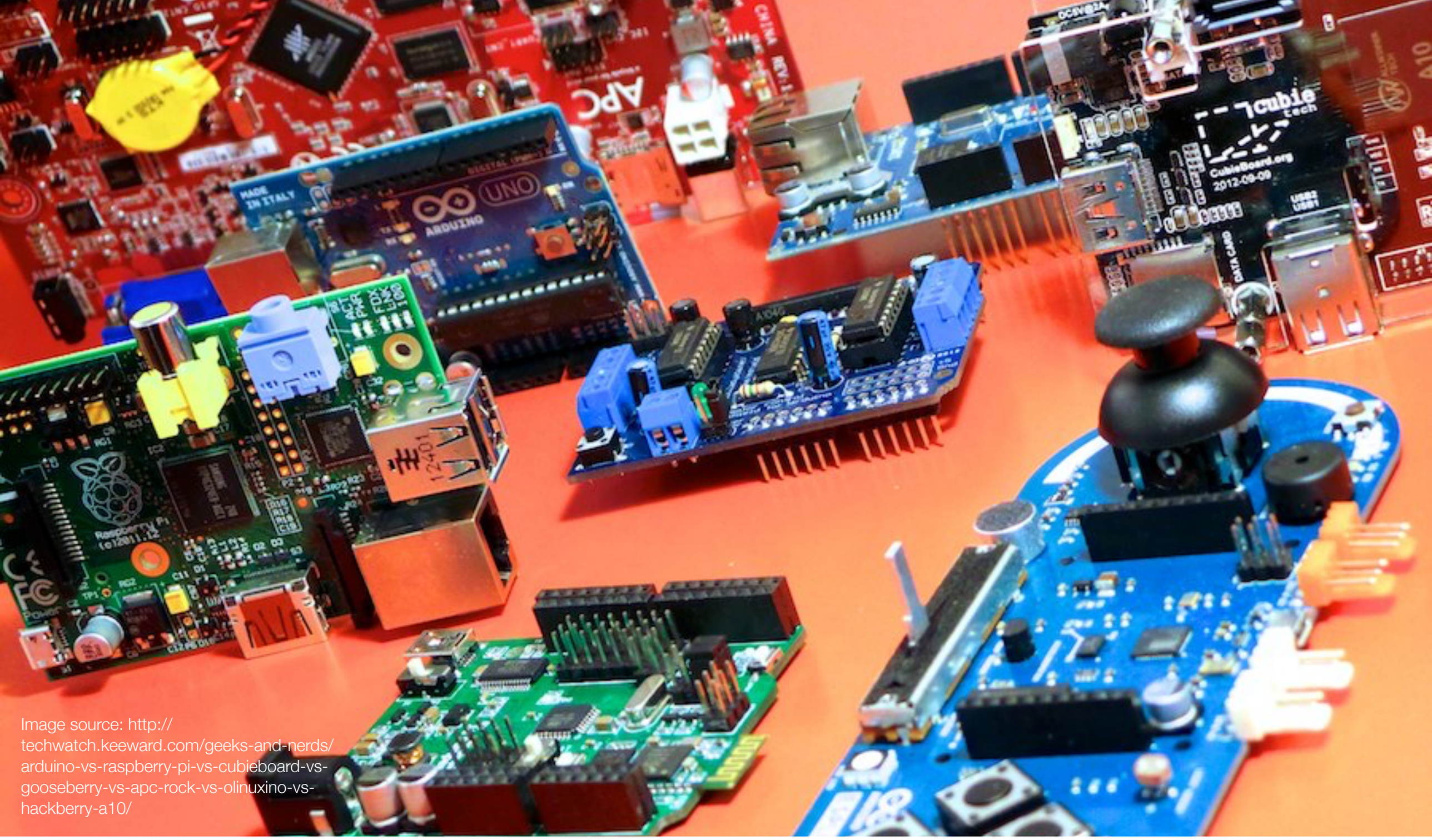


Image source: http://techwatch.keeward.com/geeks-and-nerds/arduino-vs-raspberry-pi-vs-cubieboard-vs-gooseberry-vs-apc-rock-vs-olinuxino-vs-hackberry-a10/

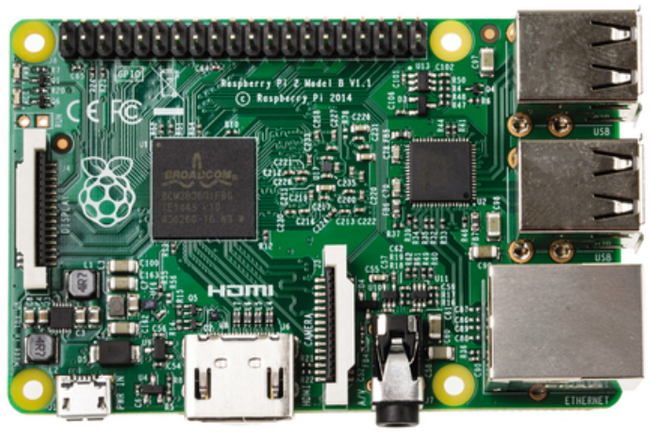
Credit card-sized computer
卡片式電腦

Low cost 便宜

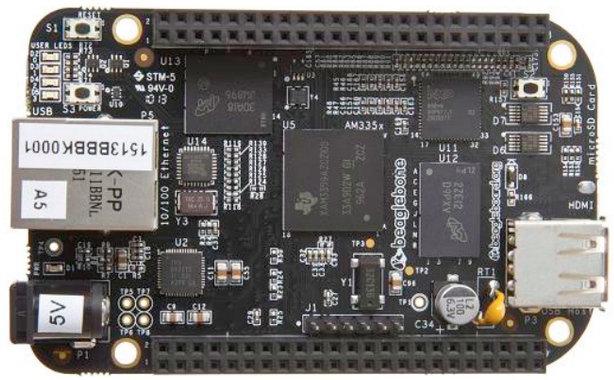
Small 小巧

Examples of credit card-sized computer
卡片式電腦例子

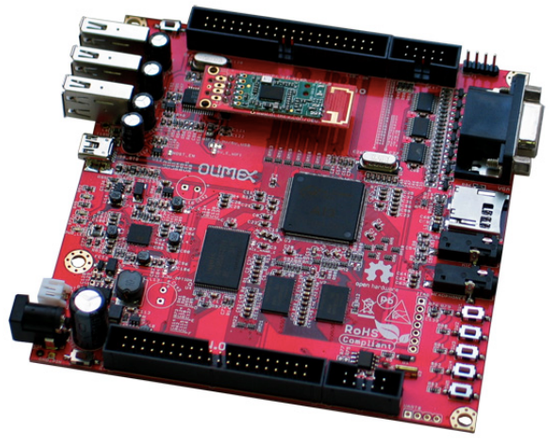
Arduino
https://www.arduino.cc



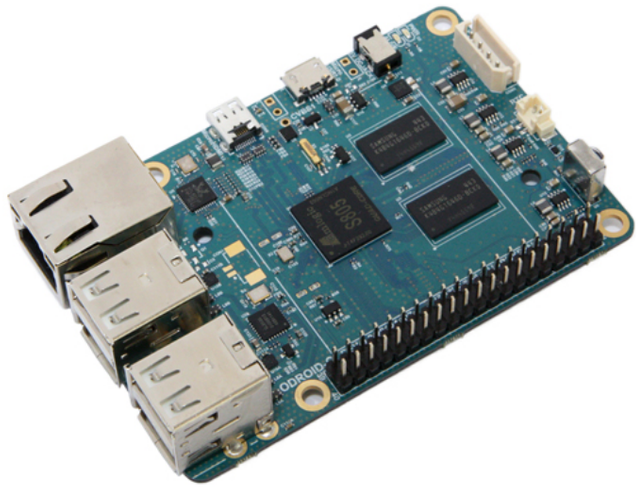
Raspberry Pi
https://www.raspberrypi.org



BeagleBone Black
http://beagleboard.org/black



OLinuXino
https://www.olimex.com/Products/OLinuXino

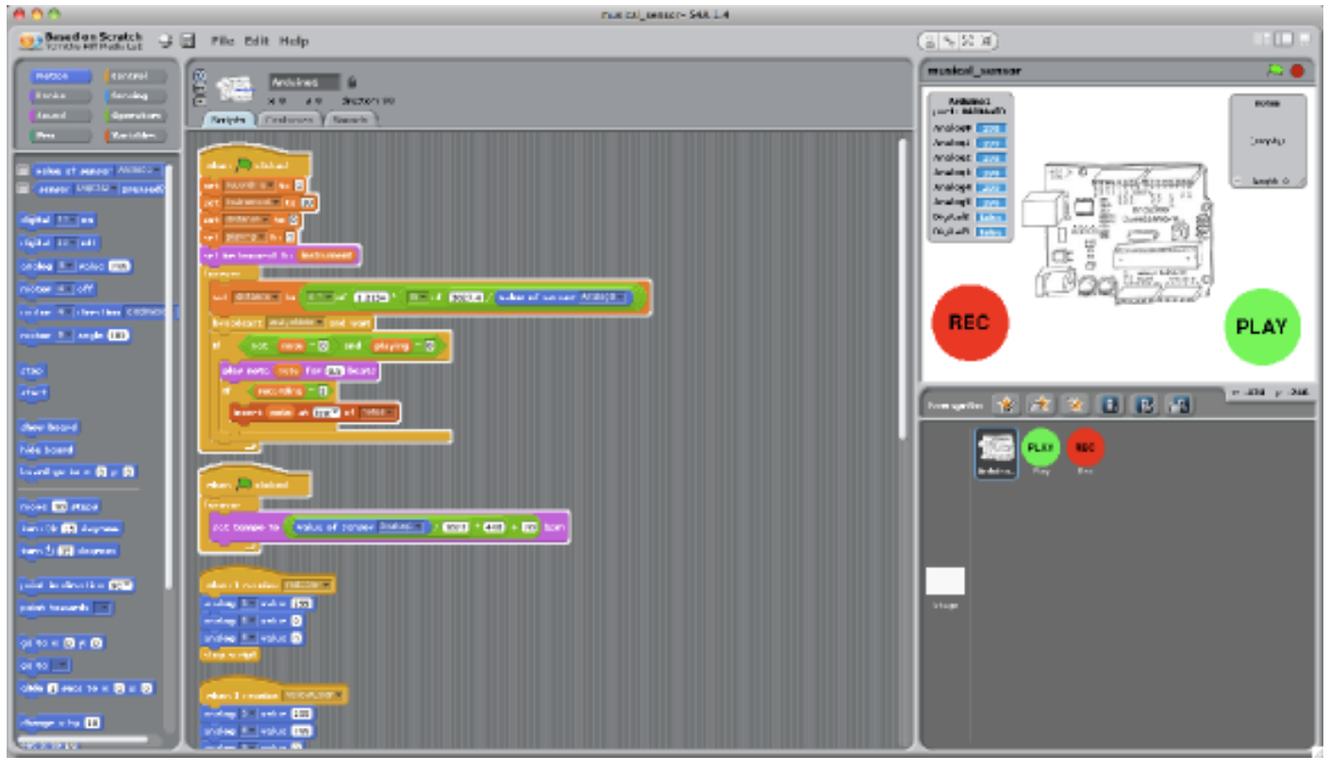


ODROID-C1
http://www.hardkernel.com/

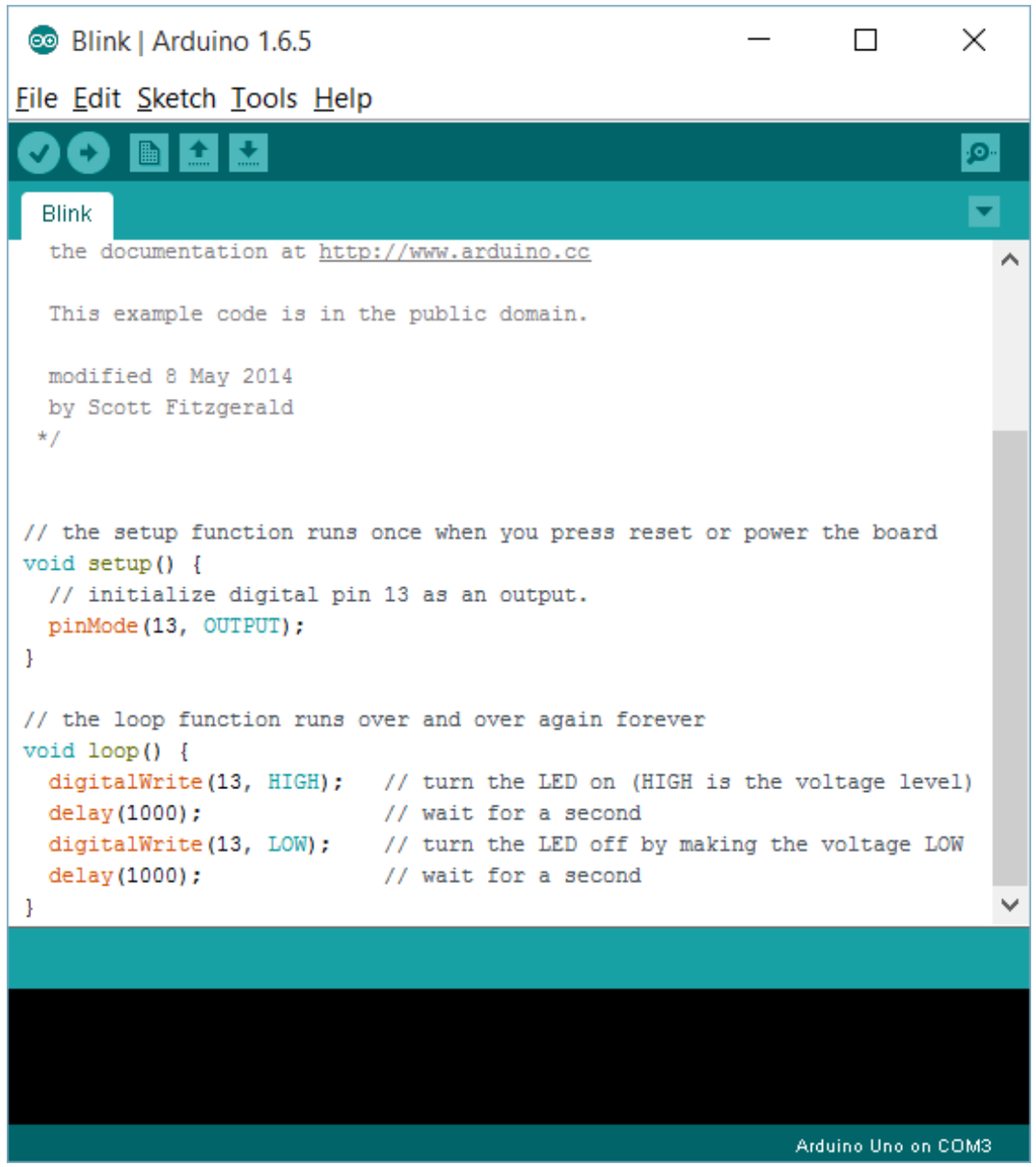
Why credit card-sized computers?
為什麼使用卡片式電腦?

- Low cost 便宜
- Small 小巧
- Portable 易攜
- Programmable 可編寫程式
- Can be used as a desktop computer
  可作桌面式電腦使用
- Can be connected to other electronic components to make different devices 可連接到其他電子零件去製作出不同的裝置

I don't know programming...
不懂得編寫程式，怎麼辦？



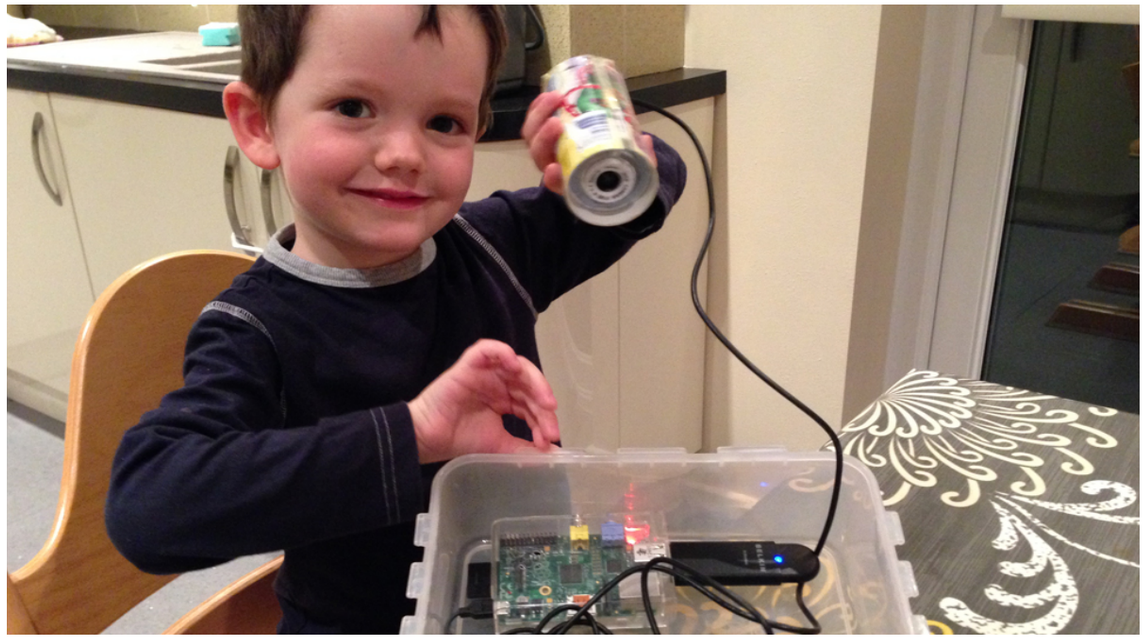
Programming using drag-and-drop interface
可以拖放方式來編寫程式



Easy-to-learn programming tools are available
有易於學習的程式開發環境

Image source:
- http://s4a.cat
- https://www.arduino.cc/en/Guide/Windows

Kids all over the world start learning credit card-sized computers ...
各地的中小學生均開始學習及使用卡片式電腦...



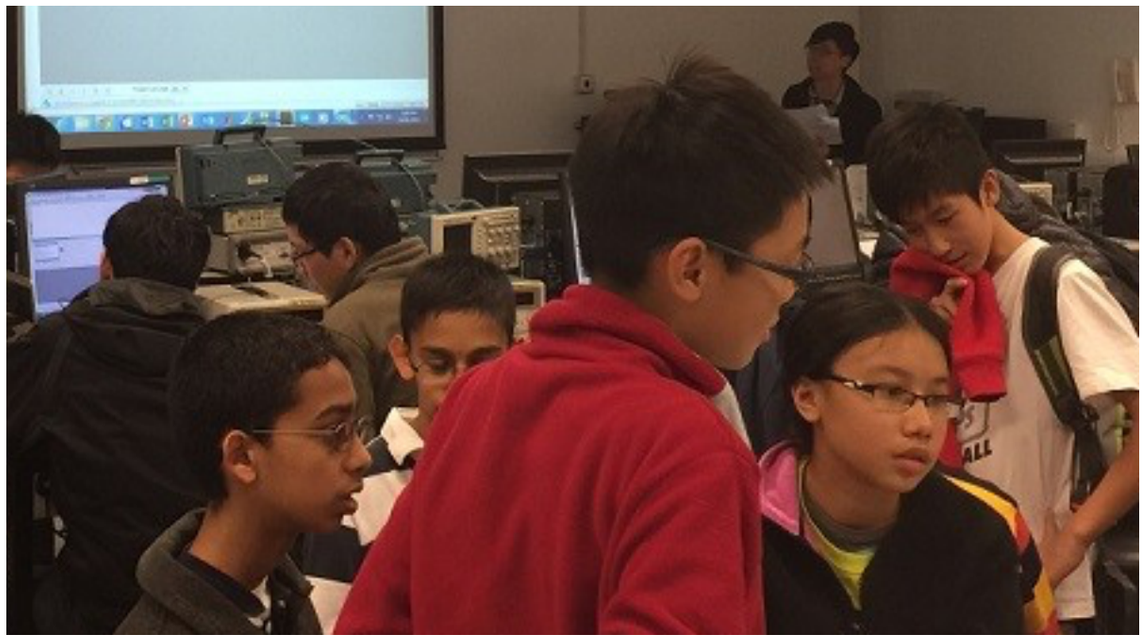


Image source:

- https://www.raspberrypi.org/blog/annabels-goblin-detector/
- https://www.raspberrypi.org/blog/lincoln-heard-minibeasts-and-raspberry-pi/
- http://www.rs-online.com/designspark/electronics/blog/designspark-pcb-winter-workshops-in-hkust

Inventions using credit card-sized computers by kids all over the world…
小朋友製造的卡片式電腦裝置...

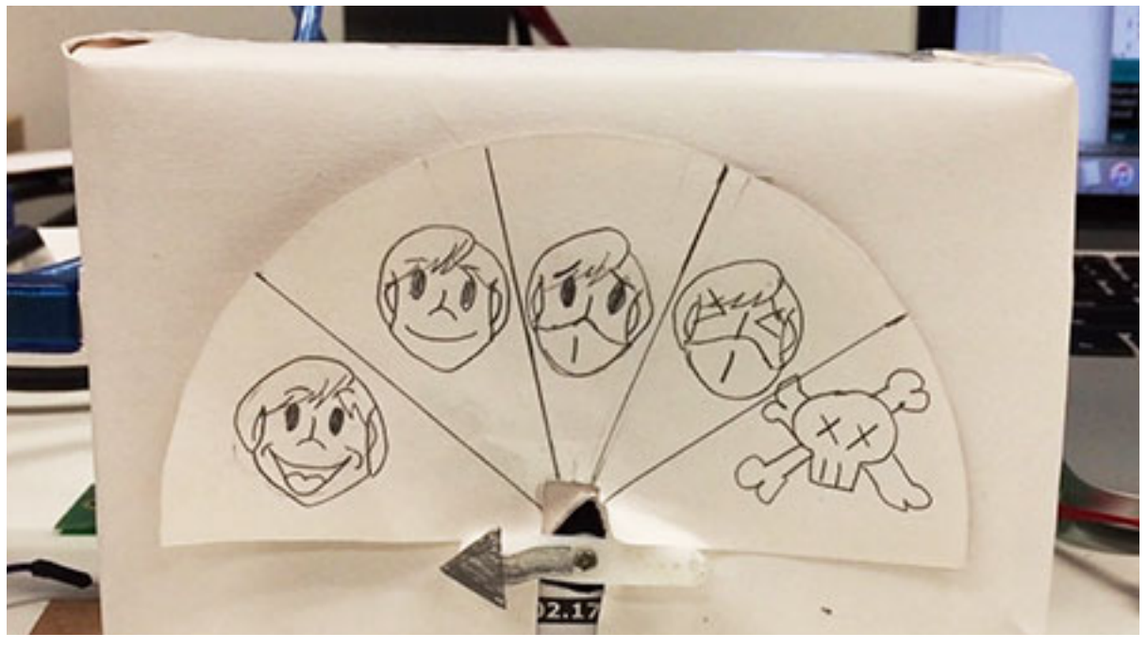


Image source:

- https://www.raspberrypi.org/blog/annabels-goblin-detector/
- http://www.penguintutor.com/electronics/bee
- https://blog.arduino.cc/2015/10/20/increasing-citizens-responses-to-the-haze-with-arduino-uno/
- https://www.youtube.com/watch?v=s7eNVSqUSpA

Raspberry Pi

樹莓派

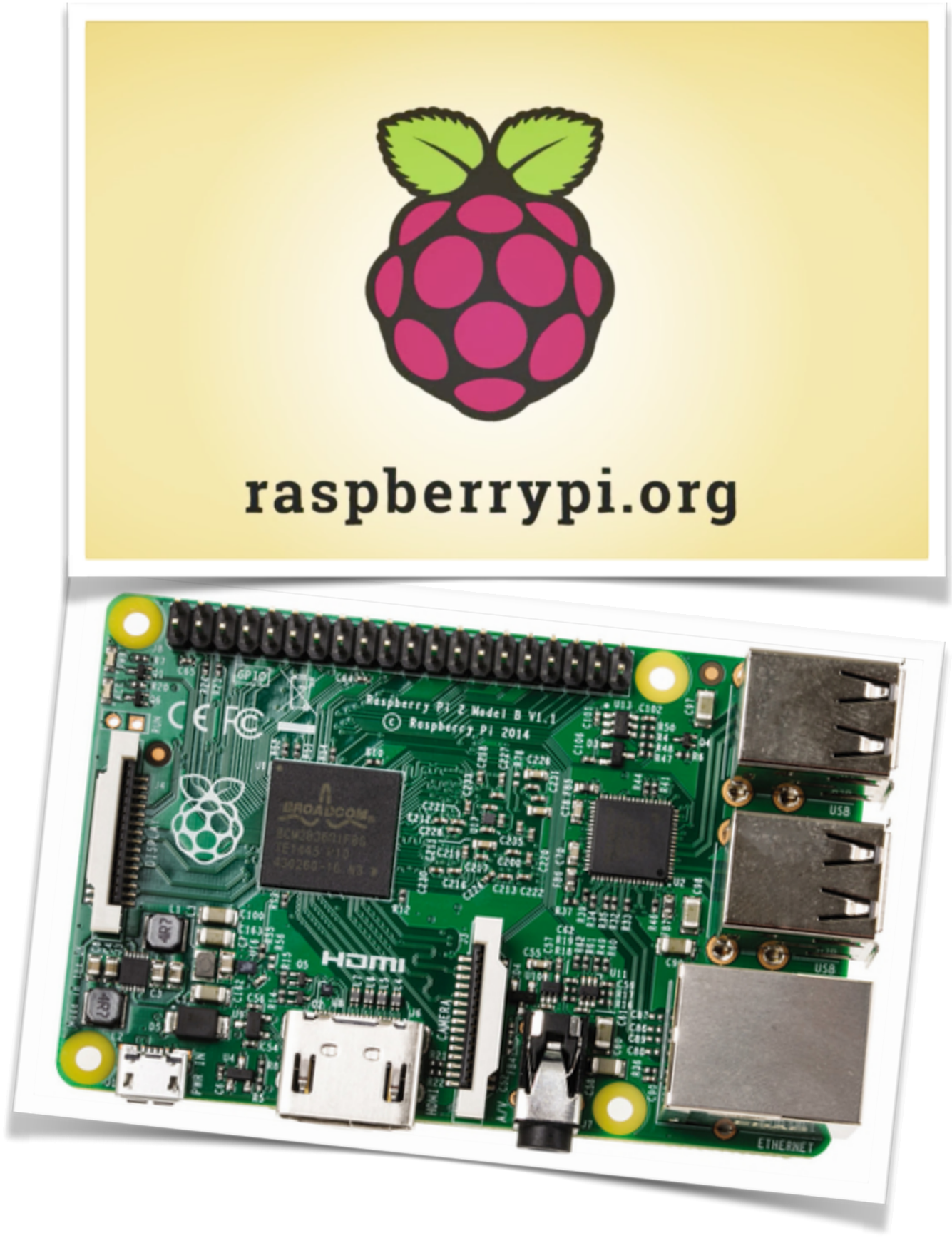
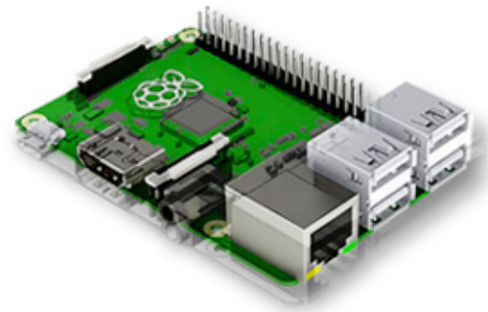


Image source:

- https://www.raspberrypi.org/

What is Raspberry Pi?
什麼是樹莓派？



Raspberry Pi

- Low cost, credit card-sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse 便宜的卡片式電腦，可接駁顯示屏、鍵盤及滑鼠使用

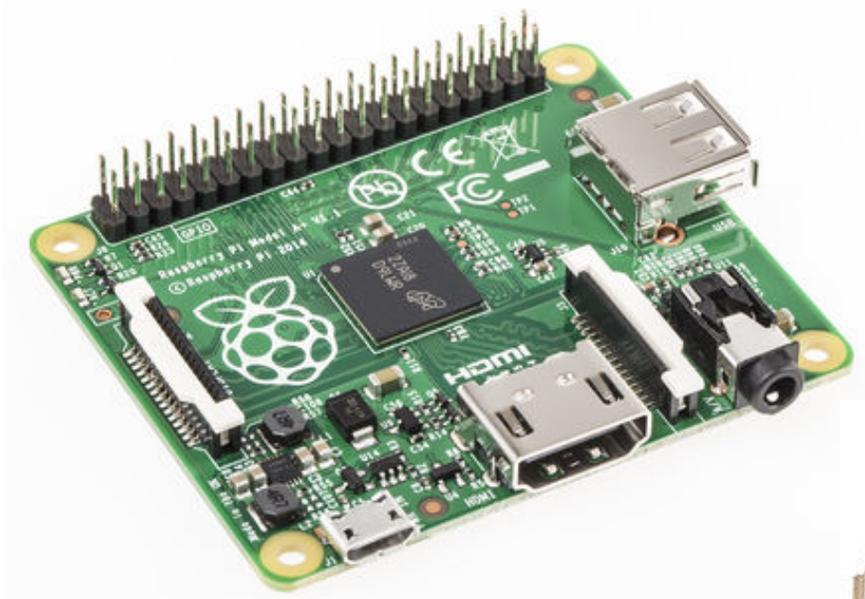
- Capable of doing everything you'd expect a desktop computer to do, from browsing the Internet and playing high-definition video, to making spreadsheets, word-processing, and playing games 可作桌面式電腦使用，能用以瀏覽網頁、播放影片、製作試算表、文字報告或玩電腦遊戲等

- Can be connected to other electronic components to make different devices 可連接到其他電子零件去製作出不同的裝置

- Can be used to learn how to program in languages like Scratch and Python 可用以學習程式編寫如 Scratch 及 Python

Image source:
- http://hken.rs-online.com/

Raspberry Pi models
樹莓派類型



Raspberry Pi A+

Raspberry Pi B+

Raspberry Pi 2 B

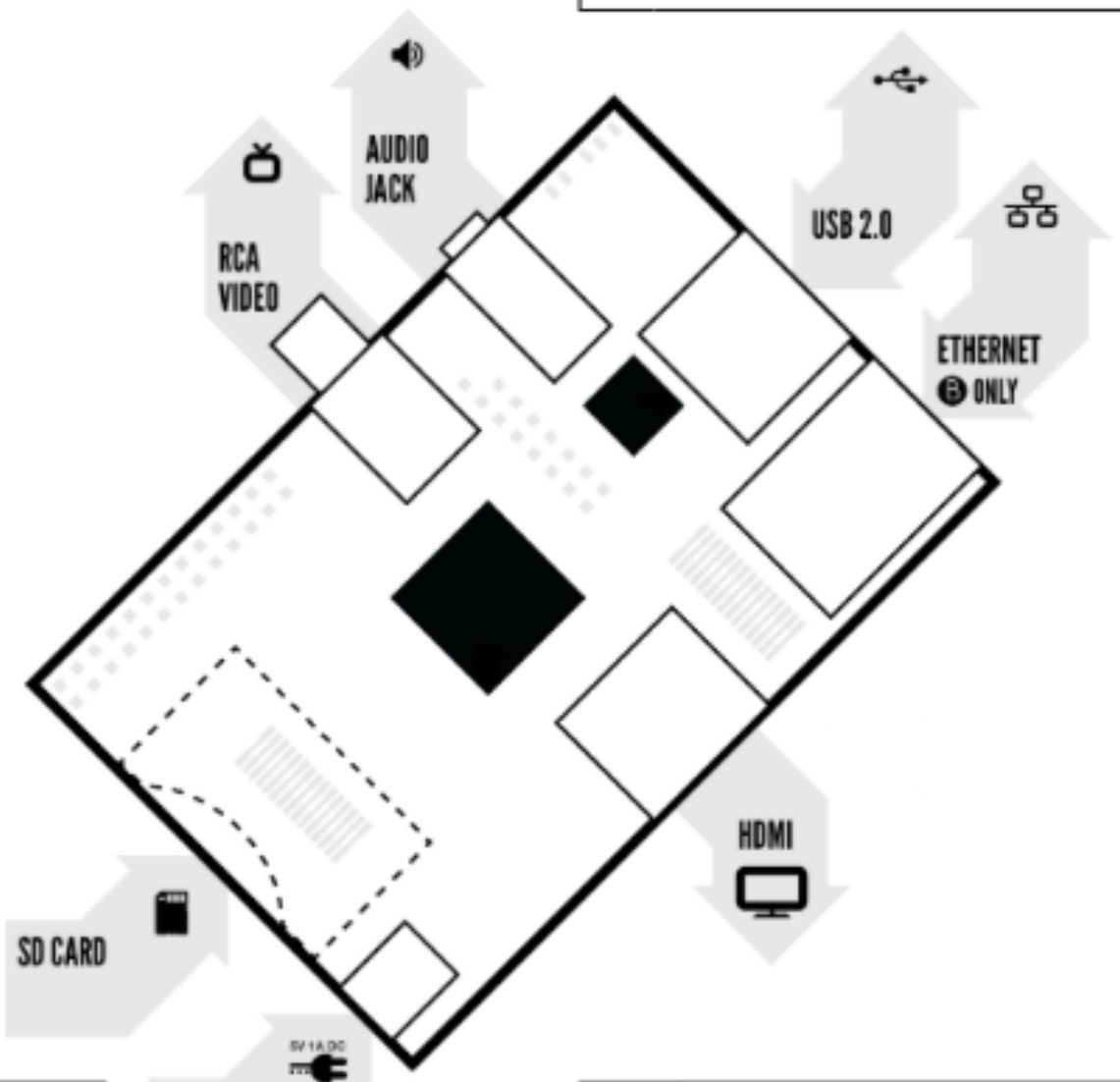
Comparison 比較：
https://www.raspberrypi.org/documentation/hardware/raspberrypi/models/specs.md

3 Connect input

Plug in a USB keyboard and mouse

接駁輸入裝置

接駁 USB 鍵盤及滑鼠



接駁網絡

4 Connect network

Connect to your wired network [optional]

1 Insert SD card

插入 SD Card

5 Power up

接駁電源

2 Connect display

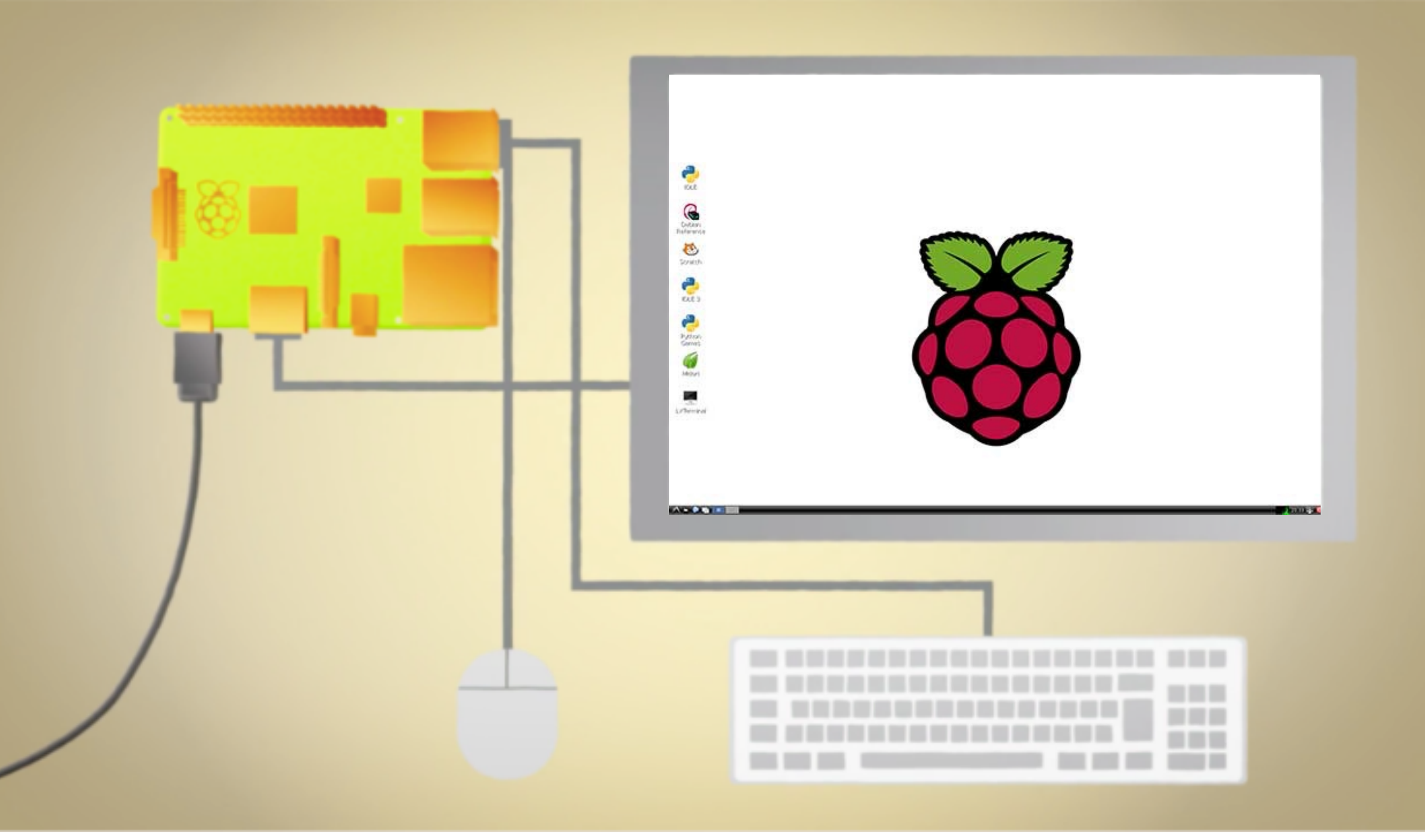
Plug in your digital TV or monitor

接駁顯示屏

以HDMI或模擬輸入接駁顯示屏

Image source:

- https://www.raspberrypi.org/wp-content/uploads/2012/12/quick-start-guide-v1.1.pdf



Connect to a display, keyboard and mouse

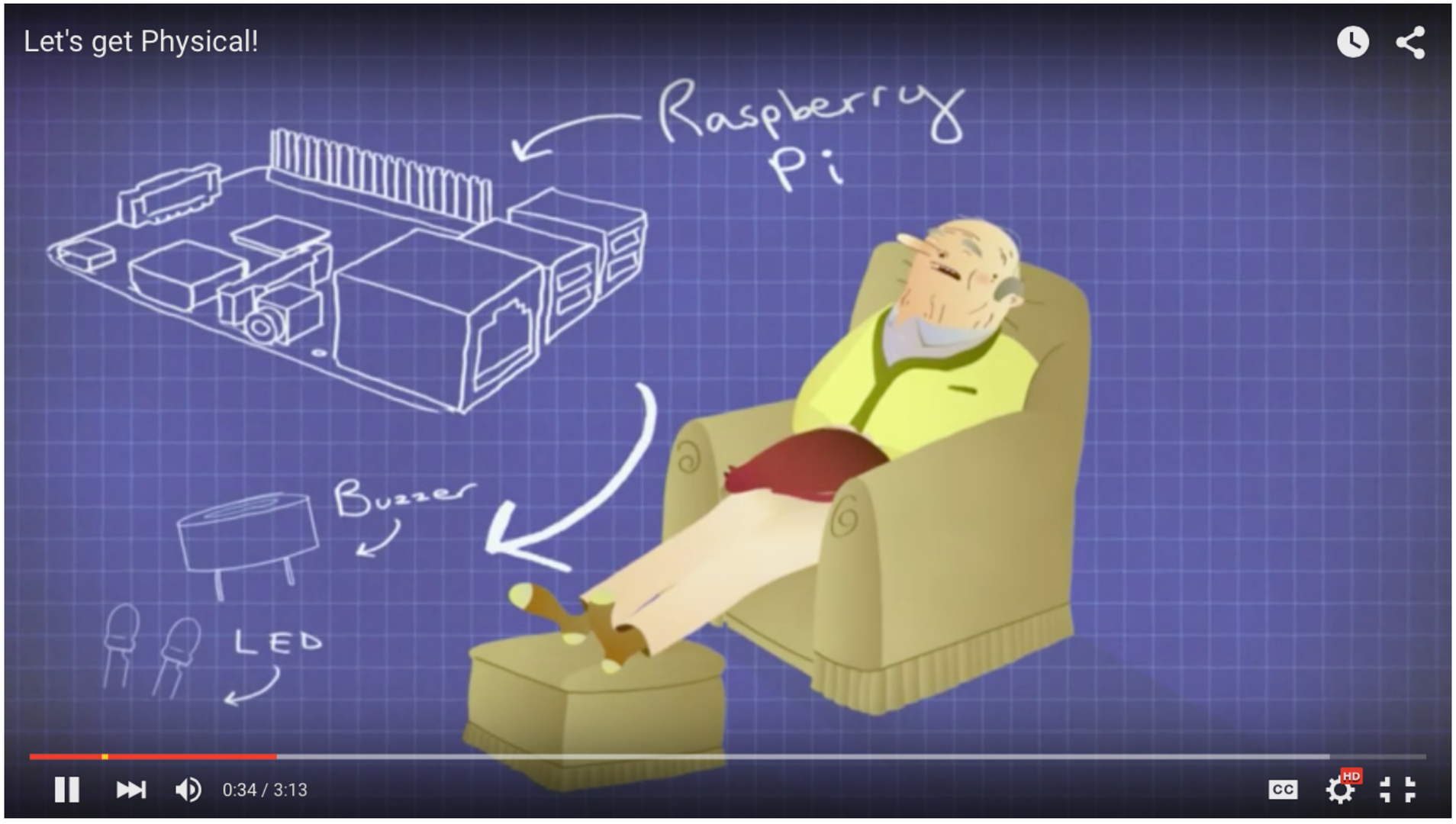
接駁顯示屏、鍵盤及滑鼠

Raspberry Pi

What can Raspberry Pi be used for?
樹莓派可以用來做什麼？

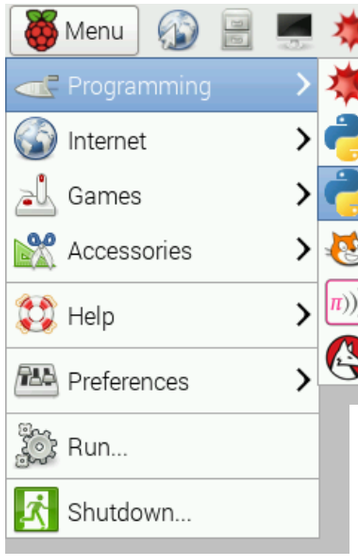
- Browsing the internet 瀏覽網頁
- Playing music and video 播放音樂及影片
- Word processing 文字處理
- Learning mathematics 學習數學
- Learning programming 學習編寫程式
- Playing games 玩電腦遊戲

Raspberry Pi connects to the Physical World...
利用樹莓派製作不同的裝置

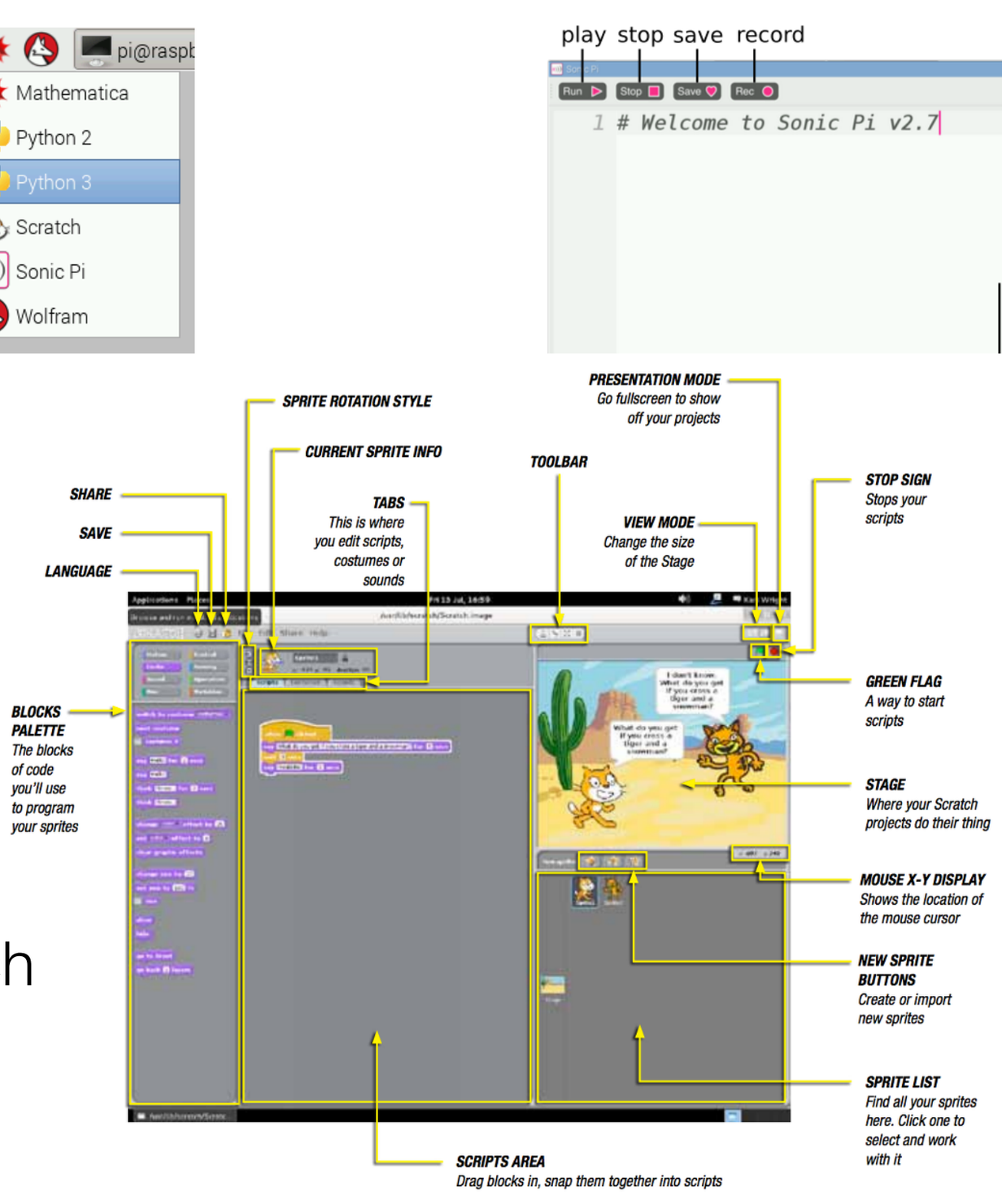


https://www.youtube.com/watch?v=VZx22ZWTnb0

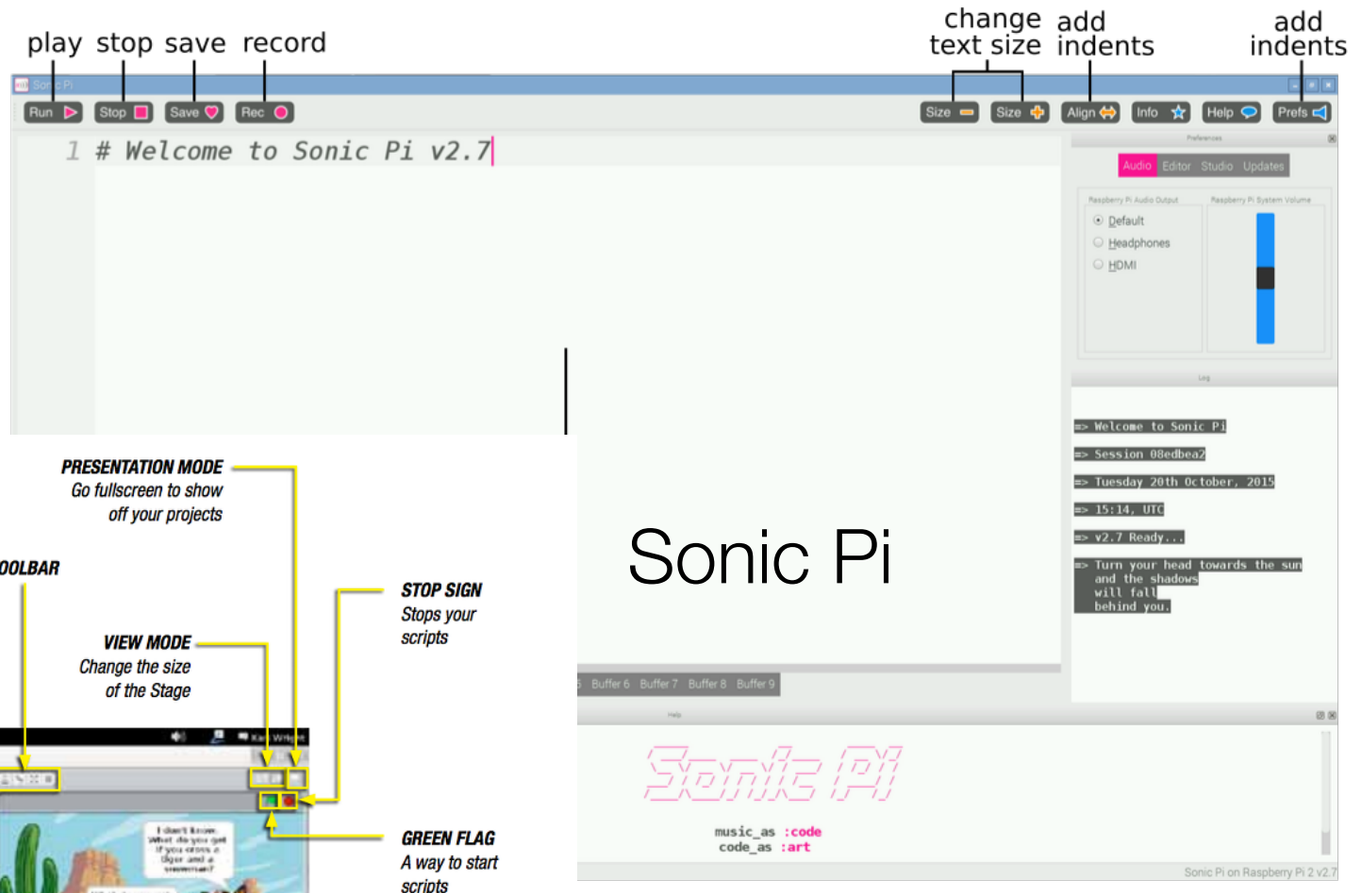
Programming with Raspberry Pi
利用樹莓派編寫程式



Python



Scratch



Sonic Pi

- You can also use C, C++, Java, HTML, etc.
- 你亦可使用 C, C++, Java, HTML 等

Arduino

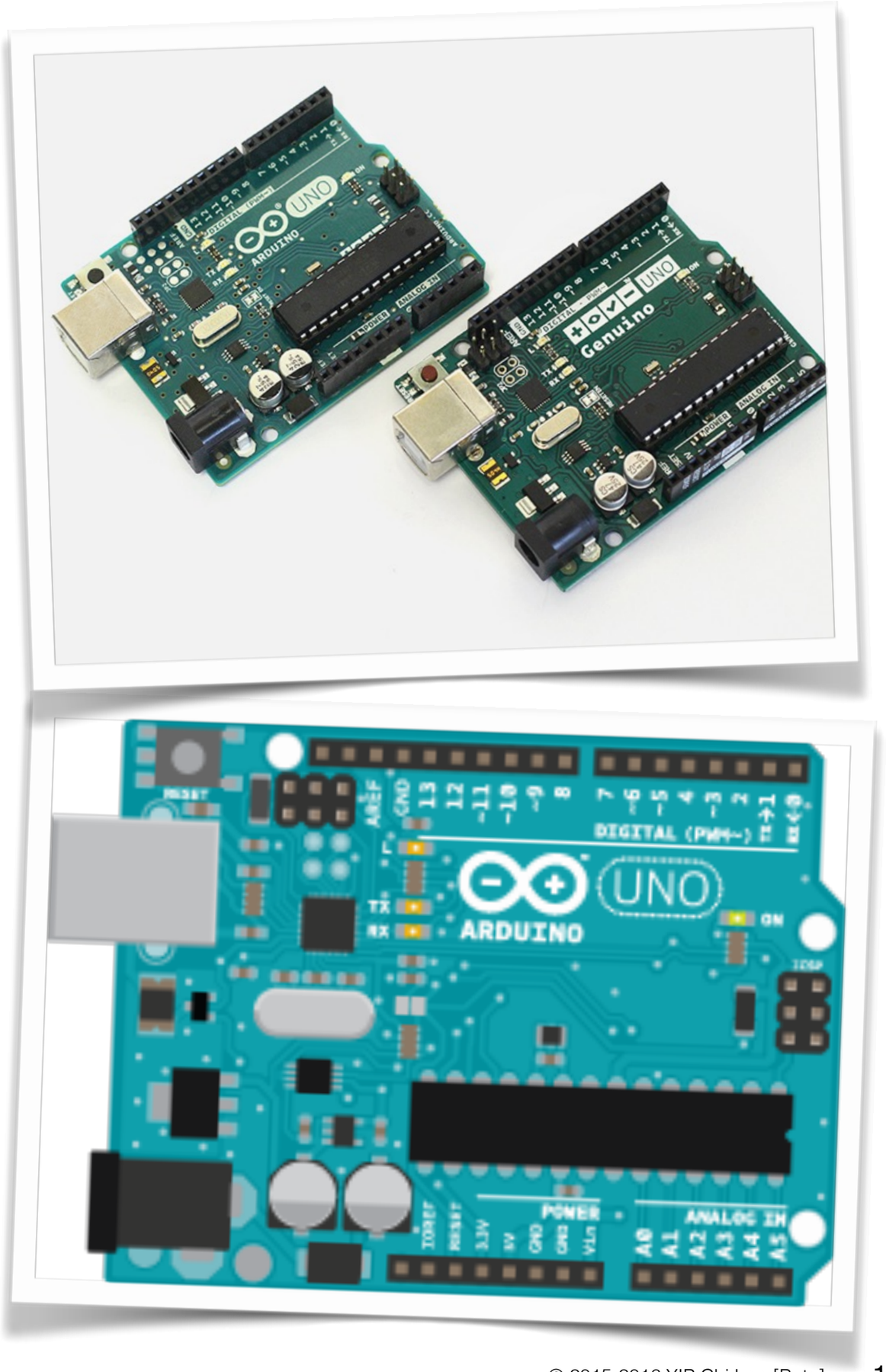


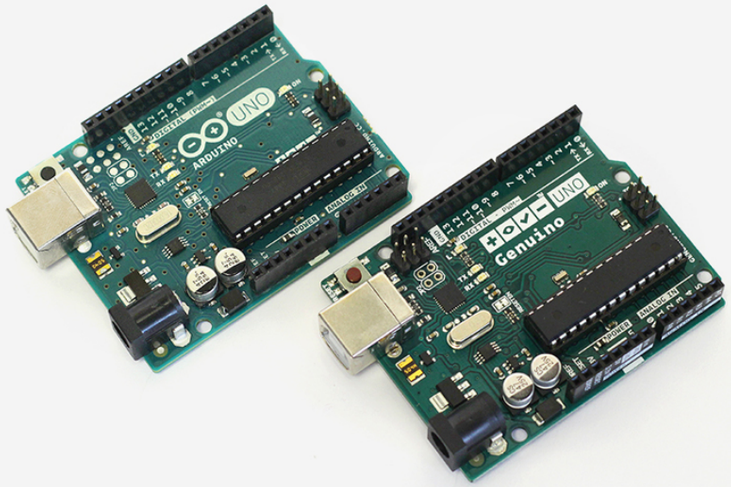
Image source:

- https://www.arduino.cc

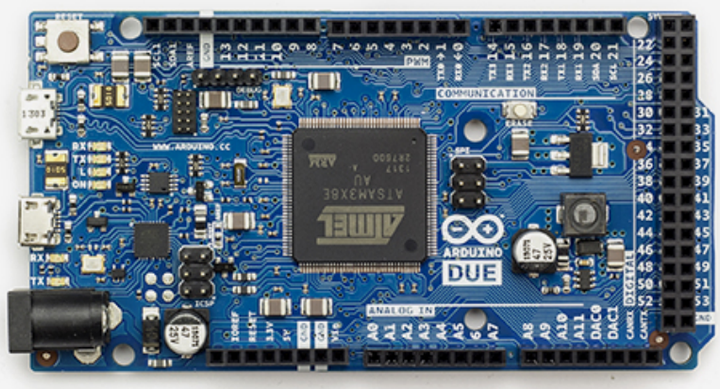
What is Arduino?
什麼是 Arduino？

- An open-source prototype platform based on easy-to-use hardware and software
  一套易用且建基於開放源碼平台的硬件和軟件
- Can be connected to other electronics components to make different devices
  可連接到其他電子零件去製作出不同的裝置

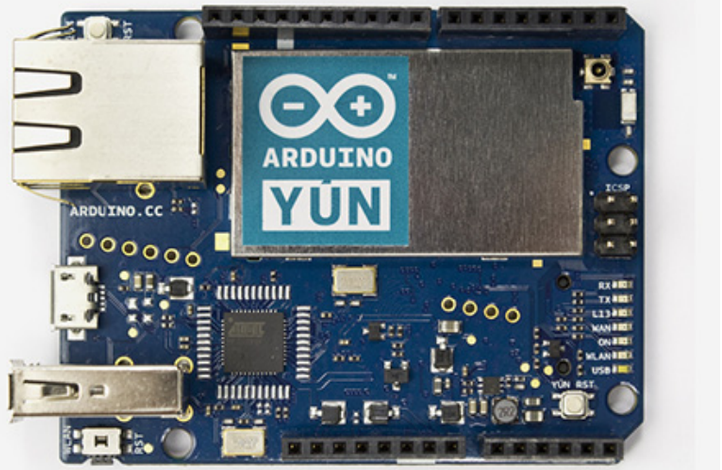
Some of the Arduino models
部分的 Arduino 類型



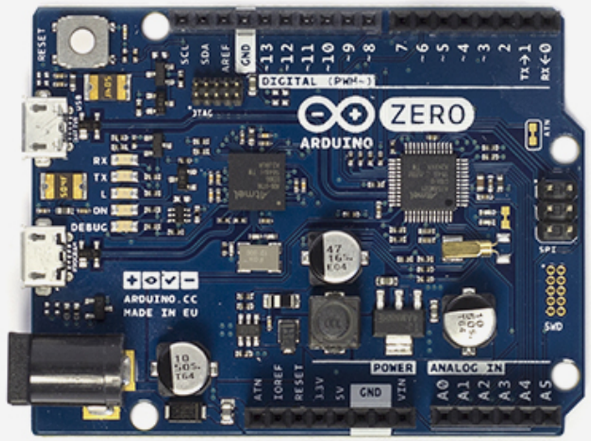
Arduino UNO / Genuino UNO



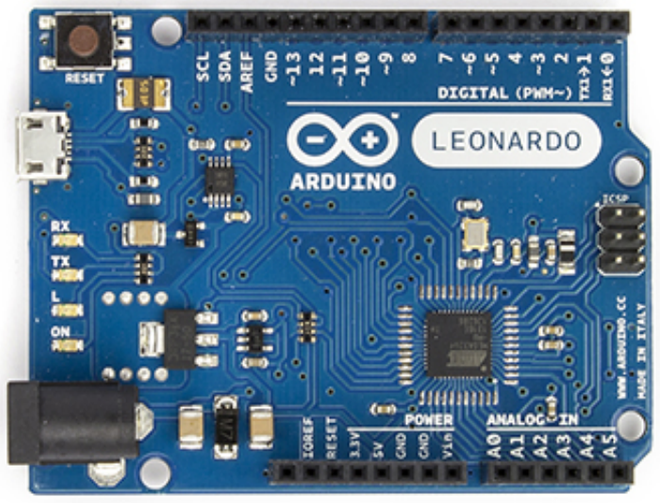
Arduino Due



Arduino Yun



Arduino Zero

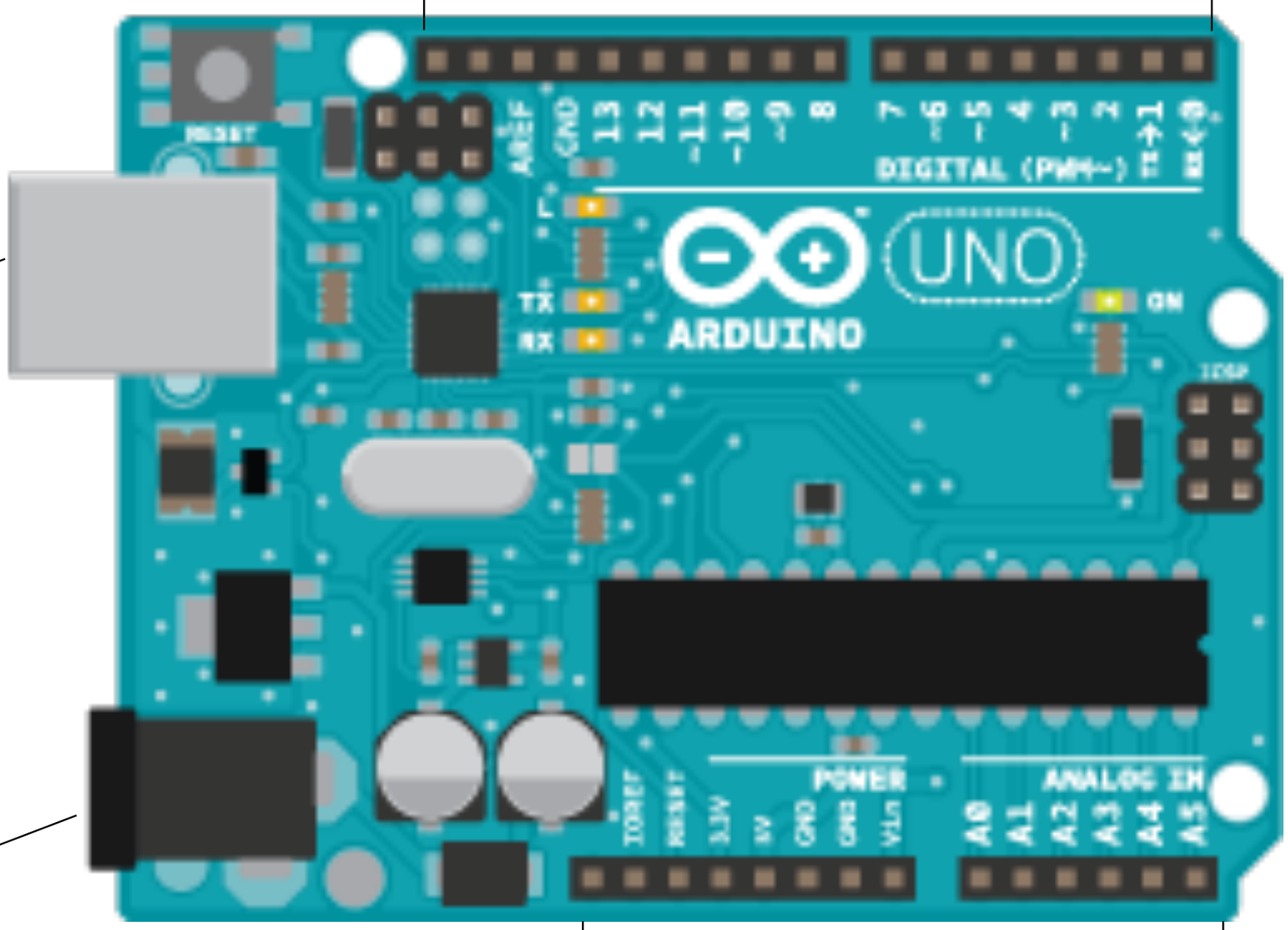


Arduino Leonardo

Comparison 比較：
https://www.arduino.cc/en/Products/Compare

Sockets for connecting the Arduino to other electronics
用以接駁電子零件

USB connector used to load programs on to Arduino from computer USB 插頭，用以上載程式到 Arduino



Power connector
接駁電源

Sockets for connecting the Arduino to other electronics
用以接駁電子零件

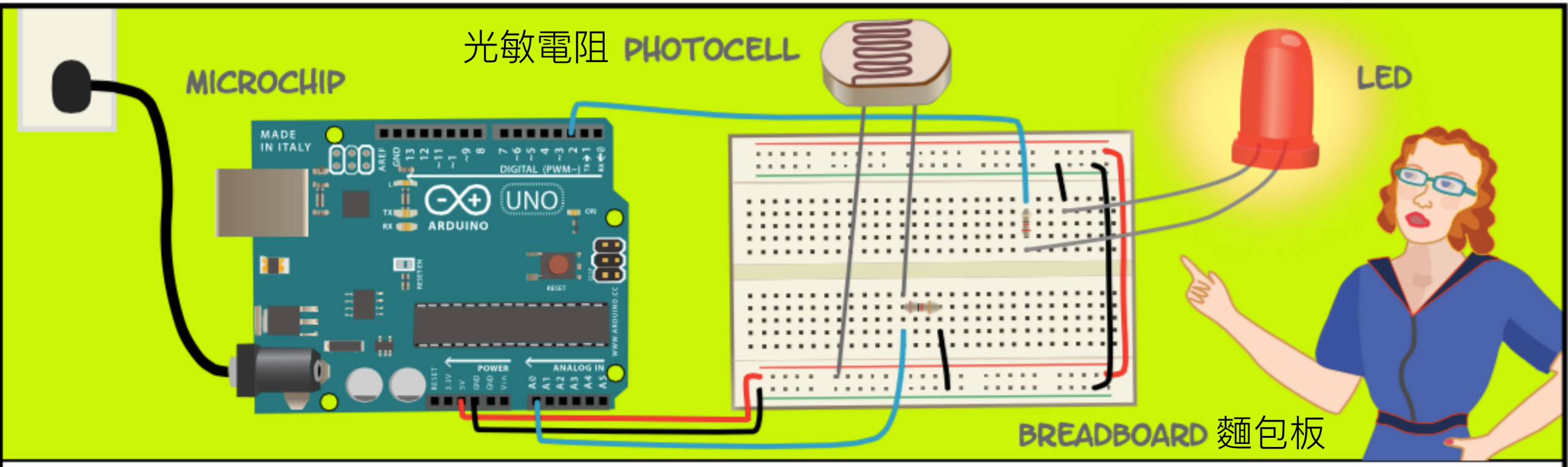
Image source:
- https://www.arduino.cc

What can Arduino be used for?
Arduino 可以用來做什麼？

- Able to read inputs, such as light on sensor, a finger on a button, or a Twitter message
  能夠讀取各種輸入如：感應器偵測到光線、手指按動按鈕、或一個Twitter訊息

- Generate an output such as activating a motor, turning on an LED, publishing something online
  變成輸出如：啟動摩打、點亮LED燈或在網上發佈信息等

What can Arduino be used for?
Arduino 可以用來做什麼？



Arduino 內有一微控制器，是一可讓你編寫程式的小電腦，你可以接駁感應器去量度不同的環境狀況（如室內環境的光暗度），再由Arduino 變成輸出（如房間太暗則點亮LED燈）

Image source:
- http://playground.arduino.cc/Main/ArduinoComic

Programming the Arduino: Arduino IDE
編寫程式以控制 Arduino: Arduino IDE

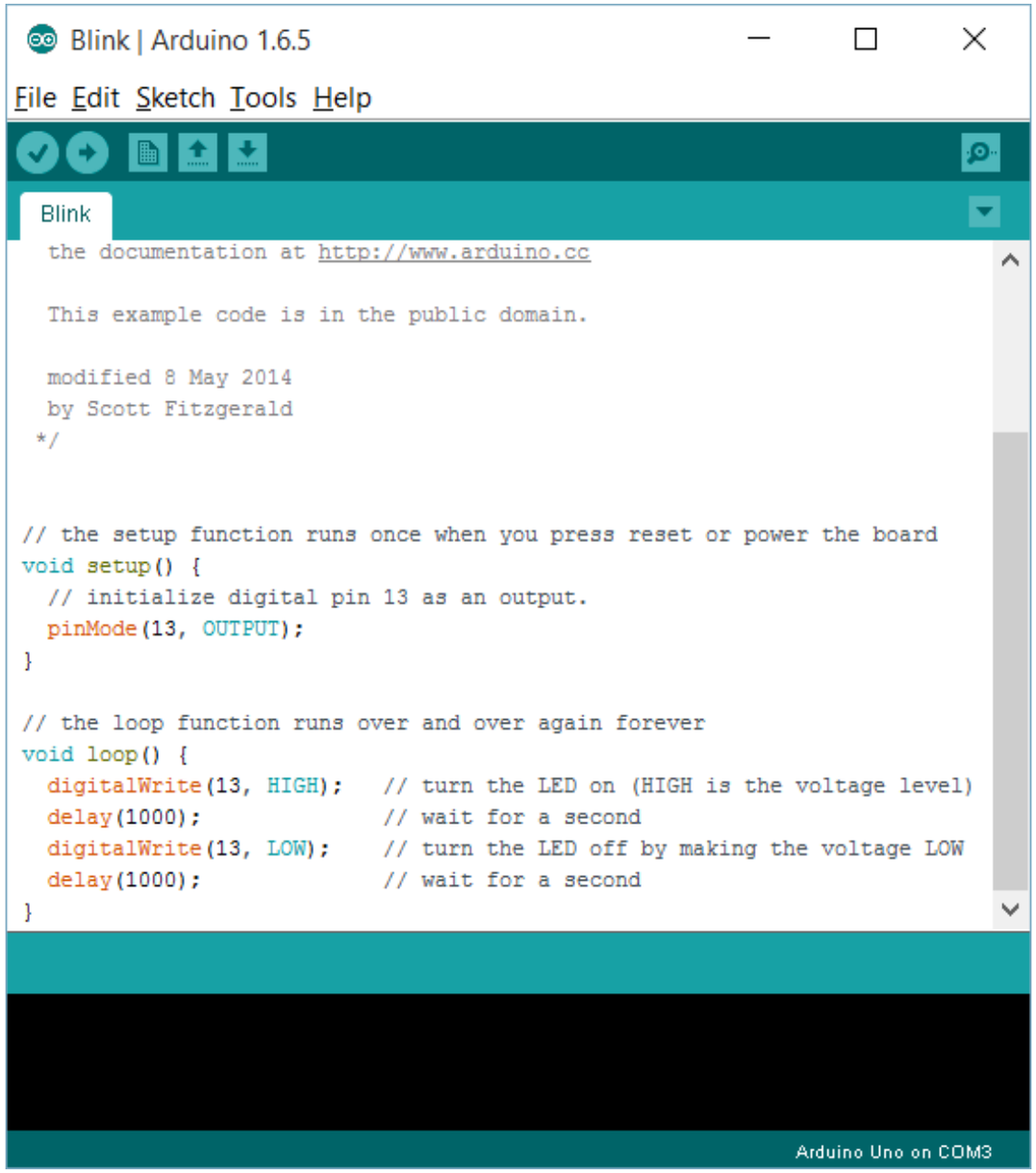


Image source:

- https://www.arduino.cc

Programming the Arduino: Scratch for Arduino
編寫程式以控制 Arduino: Scratch for Arduino

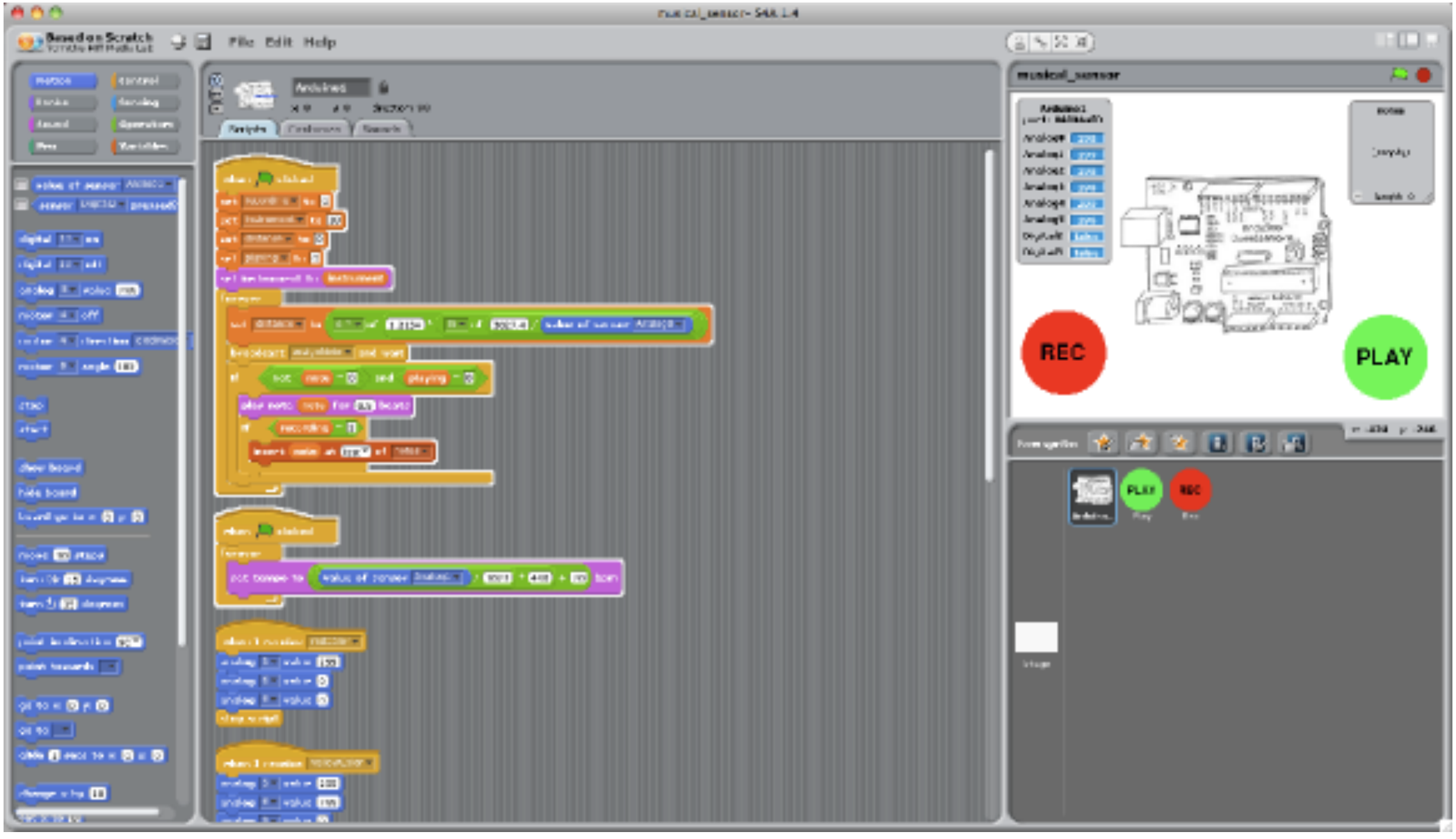


Image source:

- http://s4a.cat

Steps for creating your invention

製作你的發明

What is an invention?
什麼是發明？

- Any product / device that is created by you
  任何一件你自己製作的物品或裝置

- Innovative 創新

- Practical 實用

Motivation
動機

- You have identified some problem in your daily life that you would like to solve
  在日常生活中，你發現了一些問題，希望可以解決

- Example 例子：

  - Your classmate always forget to turn off the light before they leave the classroom, which is not environmentally friendly 你的同學經常忘記在離開課室前把燈關掉，你覺得很不環保

  - Can you invent a device to solve the problem? 你能否發明一個裝置去解決這問題？

  - If there is no one in the room for a long time, then light will turn off automatically. 如果發現過了一段時間，課室仍沒有人，就把燈自動關掉

Design…
設計...

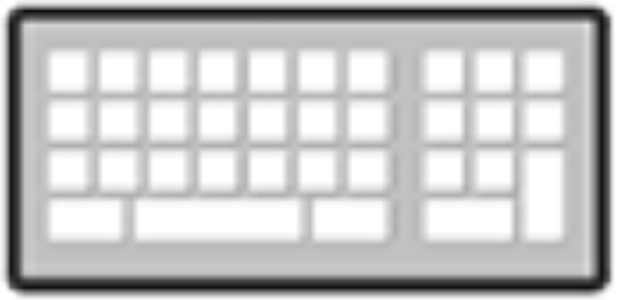
Input
輸入

Output
輸出

Process
處理

Input ➔ Process ➔ Output

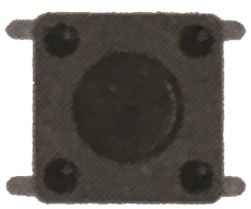
輸入 ➔ 處理 ➔ 輸出



輸入
Input

輸出
Output

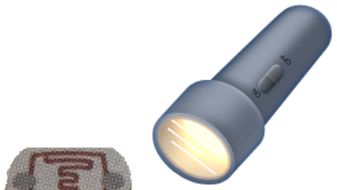
Input
輸入

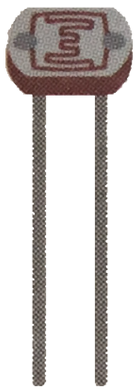


Button
按鈕

Rotary switch
旋轉開關

Bar code reader





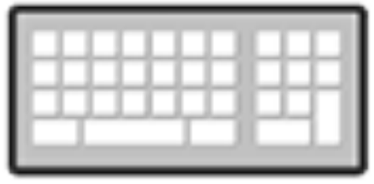
Light sensor
光感應器

Power switch
電源開關

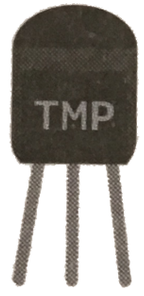
Camera, Webcam
相機、網絡相機

Tilt switch
傾斜感應開關

Music keyboard
音樂鍵盤



Keyboard, mouse, joystick
鍵盤、滑鼠、操縱桿

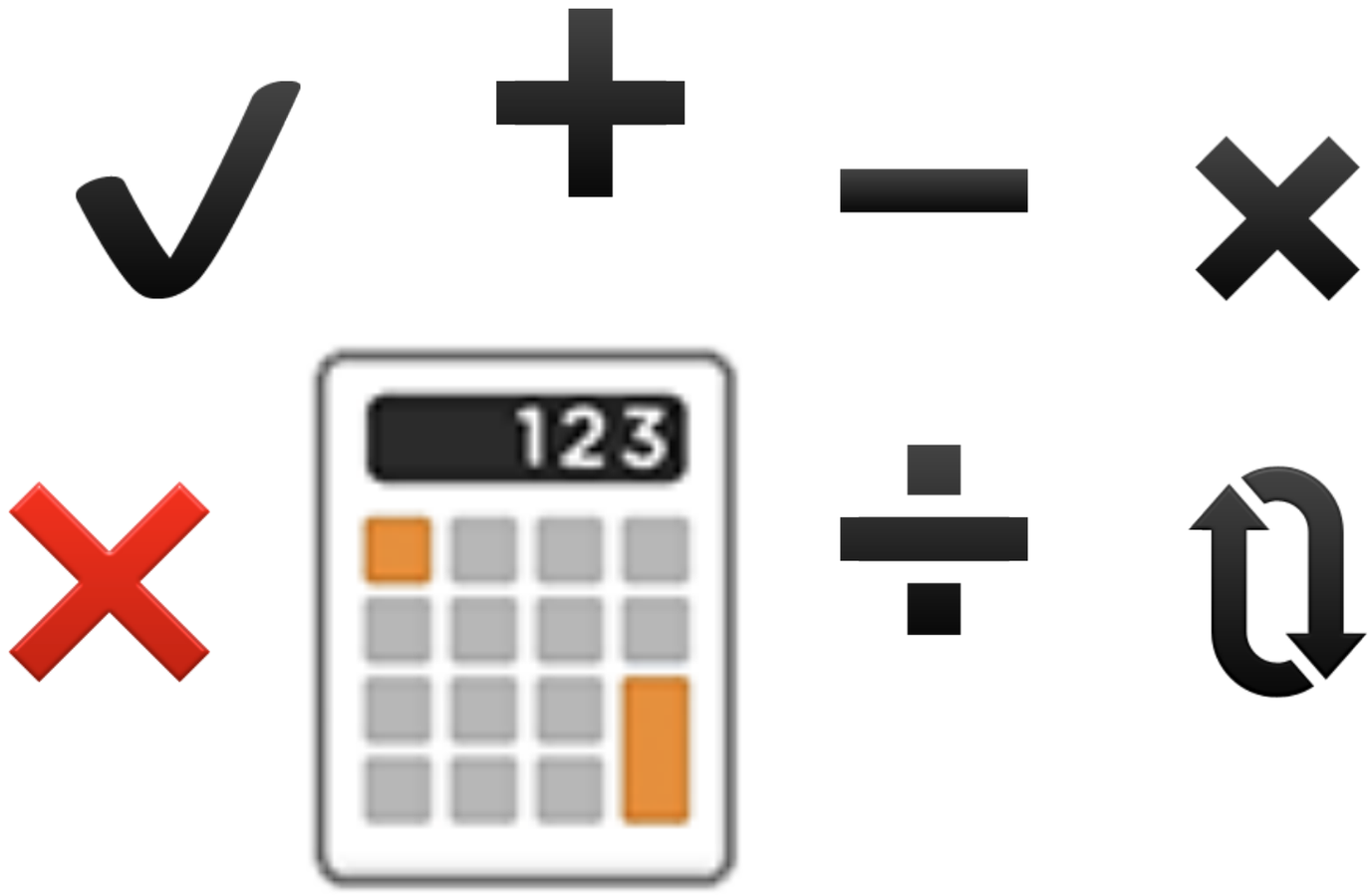


Temperature sensor
溫度感應器

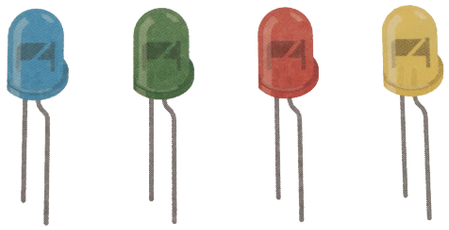
… What else ?
… 其他?

Process
處理

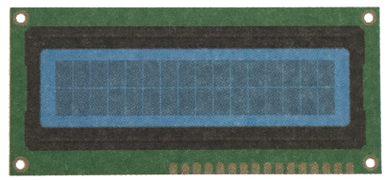
- Turn the input data into something we want and output
  將輸入的數據轉變為我們想要的資料，然後輸出



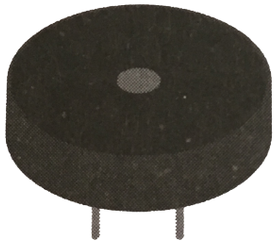
Output
輸出



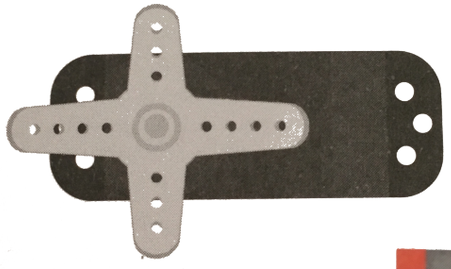
Light
光



Graphic / Text Display
圖像 / 文字顯示



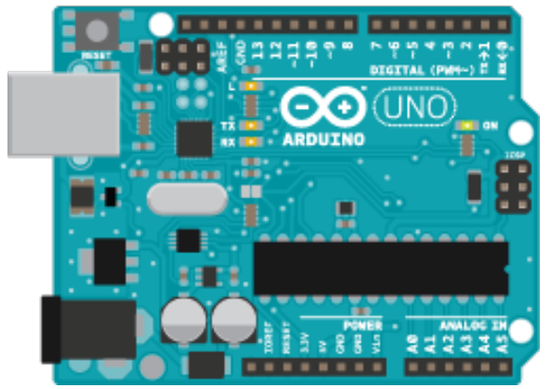
Sound
聲音



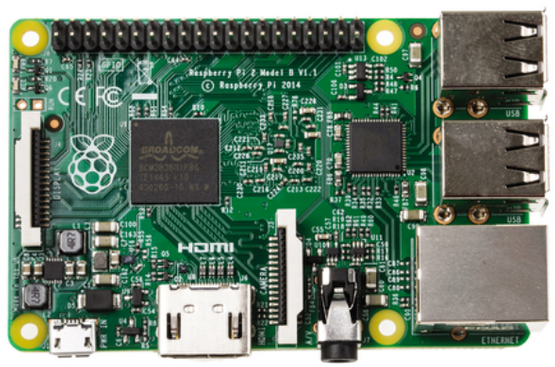
Motion
動能

… What else ?
… 其他?

Use of Raspberry Pi and Arduino…
利用樹莓派及Arduino…



Input
輸入



Process
處理

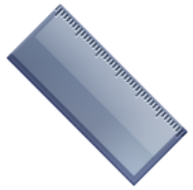
Output
輸出

Decorate your invention
佈置你的發明



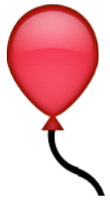











Test your invention
測試你的發明

- Design an experiment plan
  設計測試方法

- Carry out the experiment and collect the data / result
  進行實驗並收集數據及結果

- Improve your invention according to the result of the experiment
  根據實驗結果改良你的發明

Upcoming events 活動預告

- **2015-11-14[Sat]**
  - **am** Talk on “Basic Raspberry Pi”
    「樹莓派入門」講座
  - **pm** Talk on “Basic Arduino”
    「Arduino入門」講座

- **2015-12-05[Sat]**
  - **am** Talk on “Intermediate Raspberry Pi”
    「樹莓派進階」講座
  - **pm** Talk on “Intermediate Arduino”
    「Arduino進階」講座

Reference
參考

- Arduino
  https://www.arduino.cc/

- Raspberry Pi
  https://www.raspberrypi.org/

- RS Components, Ltd
  http://hken.rs-online.com/web/

- Invention for Schools Contest 校園發明大賽
  http://i.cs.hku.hk/~i4s/

Thank you 謝謝

Questions? 問題?