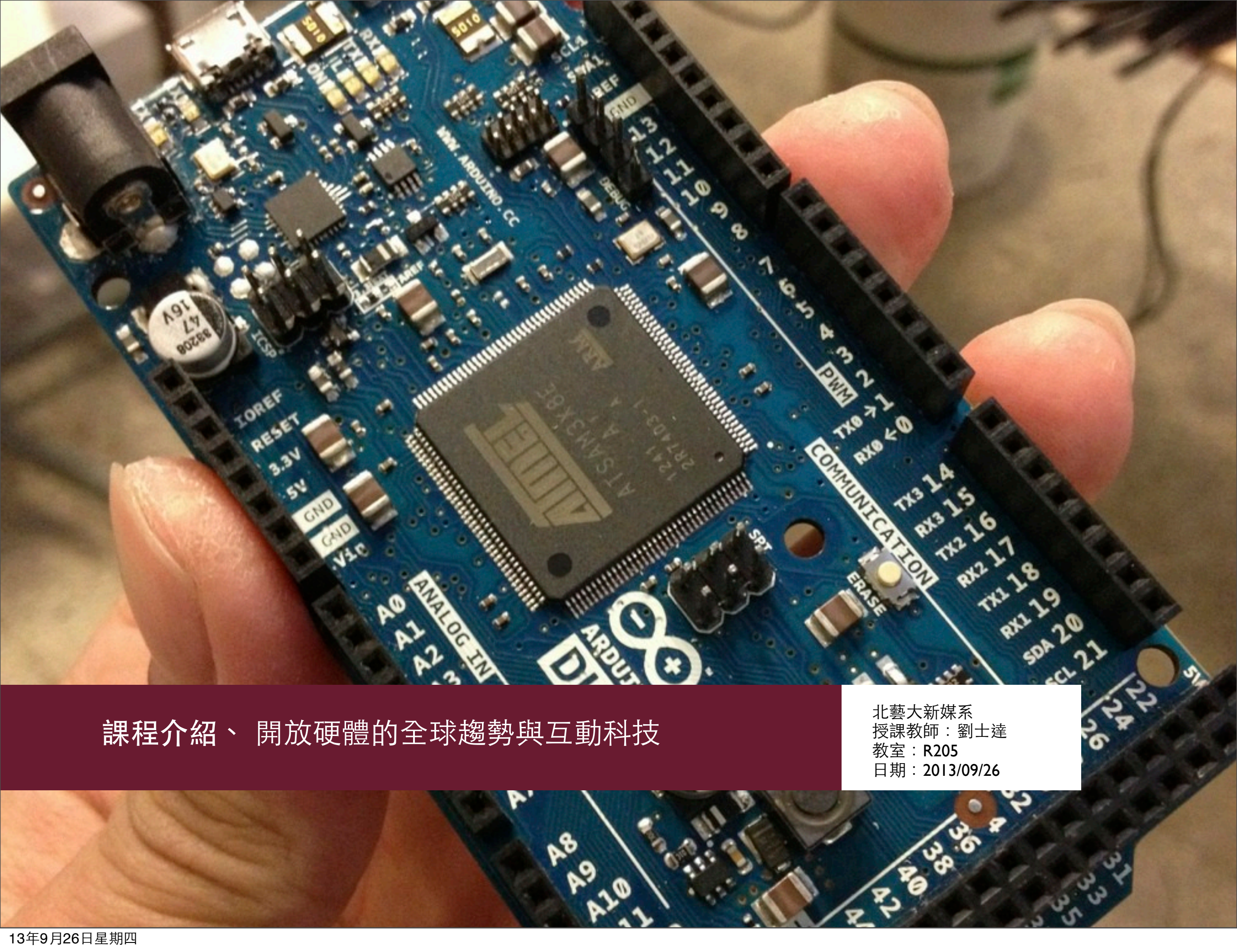




課程介紹、開放硬體的全球趨勢與互動科技

北藝大新媒系
授課教師：劉士達
教室：R205
日期：2013/09/26

講師介紹

劉士達

- 帝凱科技有限公司共同創辦人
- Arduino.TW共同創辦人
- 台灣大學網媒所博士班
- 台北藝術大學科技藝術研究所碩士
- 南台科大資傳系
- 聯絡方式：ken@decade.tw



課程介紹

- 9/26 課程介紹、OSHW
- 10/3 Arduino與電子電路概論、Arduino與LED控制、開關控制
- 10/17 Arduino與距離感測器、加速度感測器、力度感測器(實習作業一)
- 10/24 Arduino與可變電阻、光敏電阻、溫度感測
- 10/31 Arduino與繼電器、電晶體、邏輯IC
- 11/7 Arduino與電腦的通訊方式(Arduino + Processing/MAXMSP)
- 11/14 期中作業報告
- 11/21 Arduino與馬達控制
- 11/28 Arduino與LED燈串、LED矩陣顯示
- 12/5 Arduino與無線訊號傳輸控制

課程介紹

- 12/12 Arduino與聲音控制
- 12/19 PCB電路設計概論(實習作業二)
- 12/26 PCB電路設計實務
- 1/2 互動藝術作品分析與設計實務(將邀請業界人士演講)
- 1/9 互動科技開發實務與作業指導
- 1/16 期末作業報告

計分方式

感測器實習作業(30%) + 期中作業(30%) + 期末作業(40%)

課程介紹

感測器實習作業

1. 把題目做出來並上傳影片到youtube給我連接
2. 自己做出一個不錯的題目並上傳影片到youtube給我連結

期中作業

運用目前教的獨立訂一個題目並做出來，在課堂上報告(含電路實際操作 + 口頭說明原理，在5~10分鐘內)

期末作業

2~3人為一組的小型互動裝置創作，可裝設在桌面上呈現為主，若需老師移駕到其他教室請先預約，以及講解創作意涵與作品實際DEMO

開放硬體的全球趨勢與 互動科技

©







越是開放；越有創意

開放硬體與封閉式硬體

- 封閉式硬體設計

- 如早期的手機、電鍋、電冰箱、電扇、夾娃娃機...等等
- 廠商在設計之初就不公開電路設計方法以及程式碼，造成市場上的專利競爭
- 好處在於一間廠商承擔所有管理、銷售、研發、售後服務等責任
- 市場因封閉式硬體設計無法延伸更多創意，消費者被禁錮在特定的產品上

開放硬體與封閉式硬體

- 開放式硬體(軟體)設計

- 如Android手機平台、最近的DIY 3D Printing、小米手機...等
- 開放電路設計圖、原始程式碼，提供一些工具給喜好研發的人員使用
- 創意可更基於此開放硬體的基礎上延伸更多創意
- 減少研發、資金、除錯、產品售後服務的則人，利用消費者喜好破解的心態幫忙除錯
- 建立社群網站或直銷經營可免除銷售通路問題

timeline of
decade year



- 1981 Intel 8051 8bit
- 1989 GNU/GPL
 - Copyright!!
 - Copyleft!?



timeline of
decade year



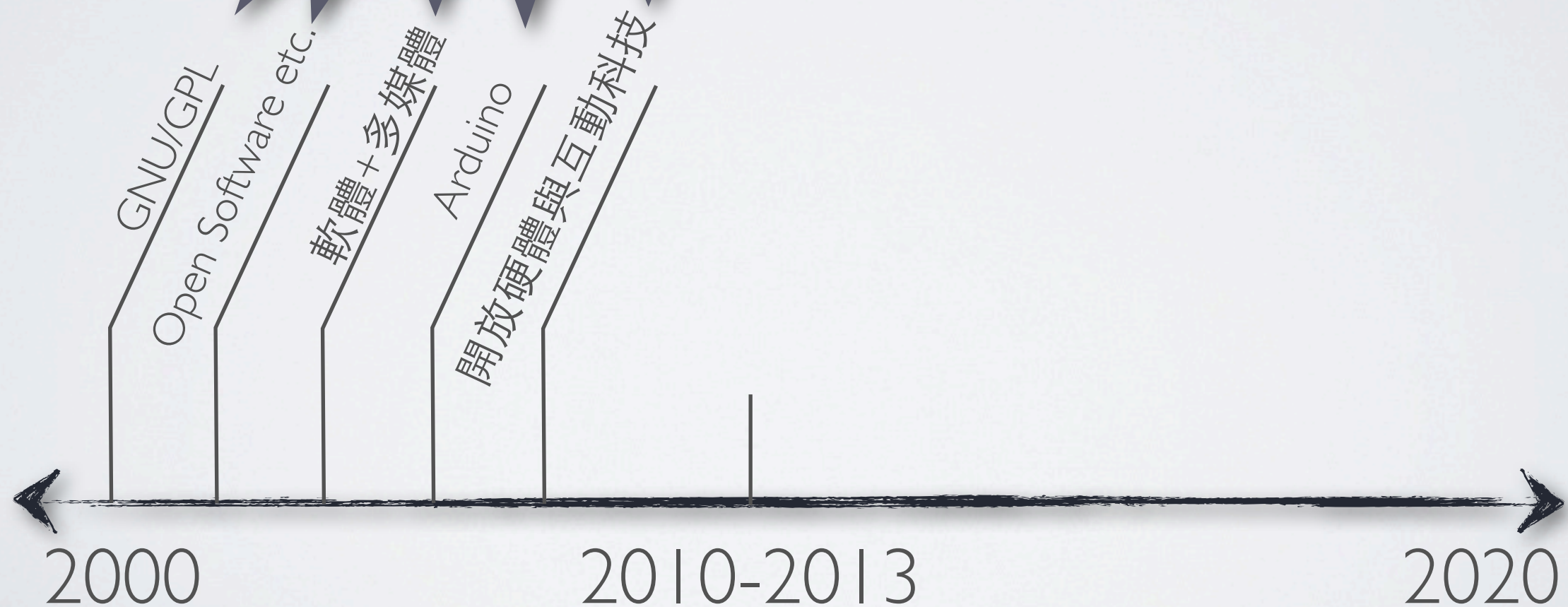
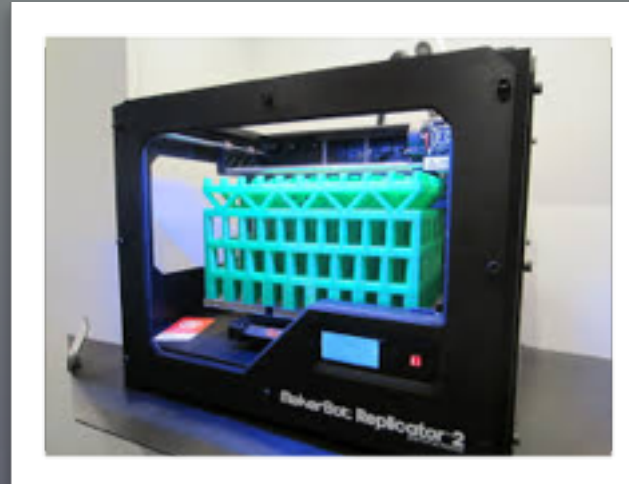
- OpenSource的多媒體應用
 - 3D 遊戲製作
 - VR、AR
 - J2ME



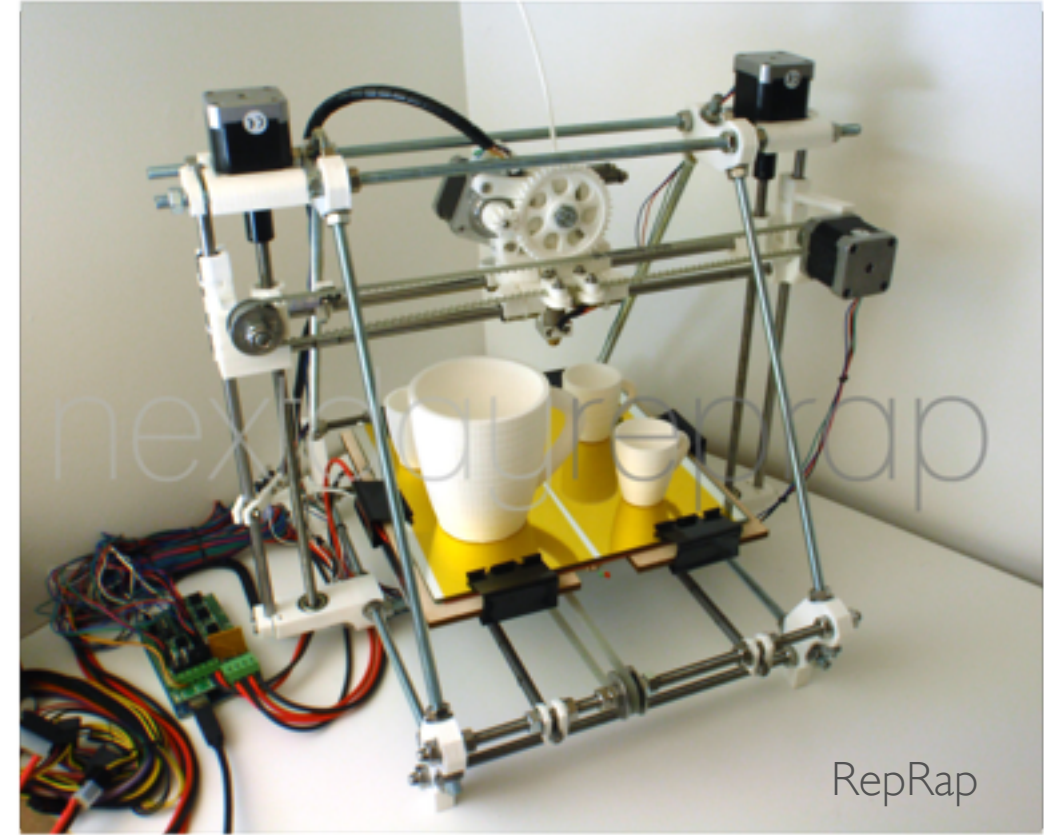
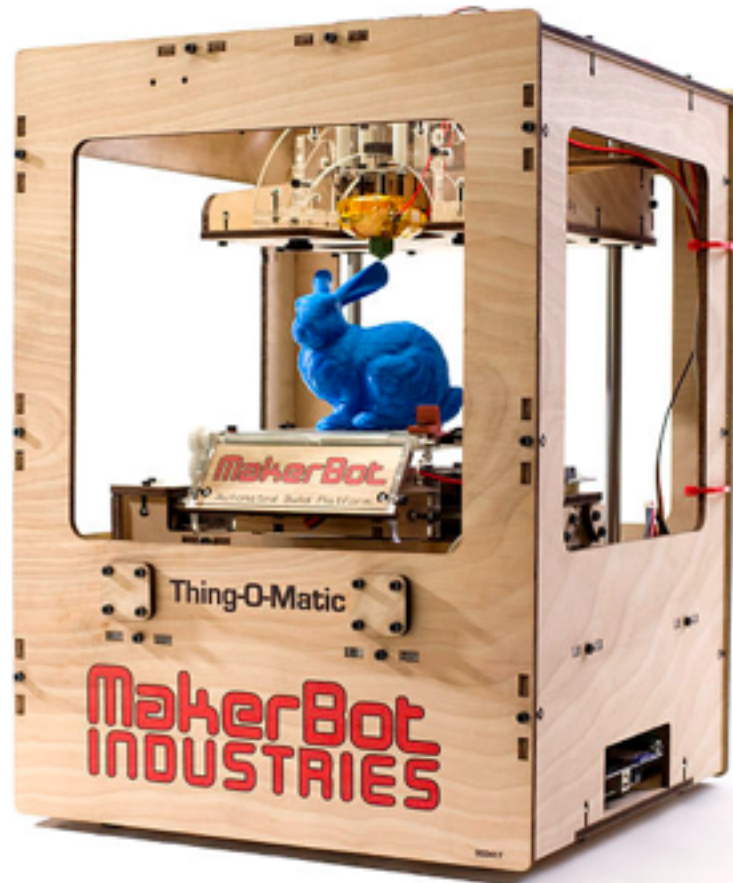
- 2006
 - BasicStamp
 - Wii
 - Arduino



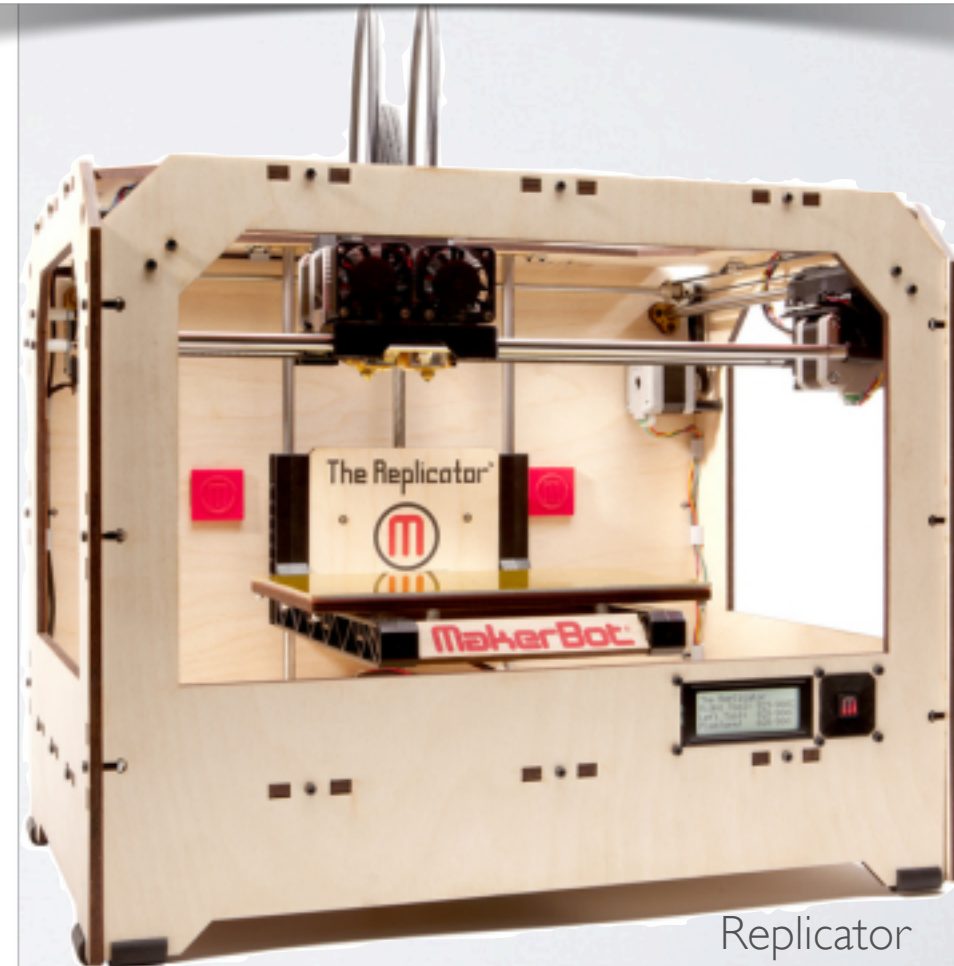
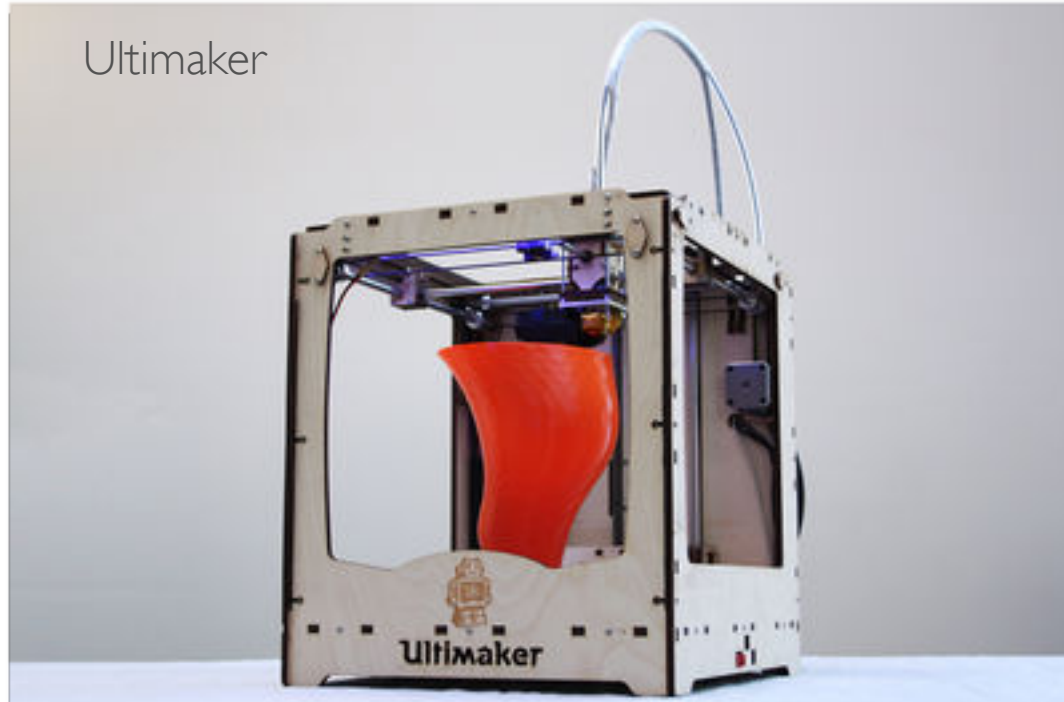
- 3D Printing
- LeapMotion



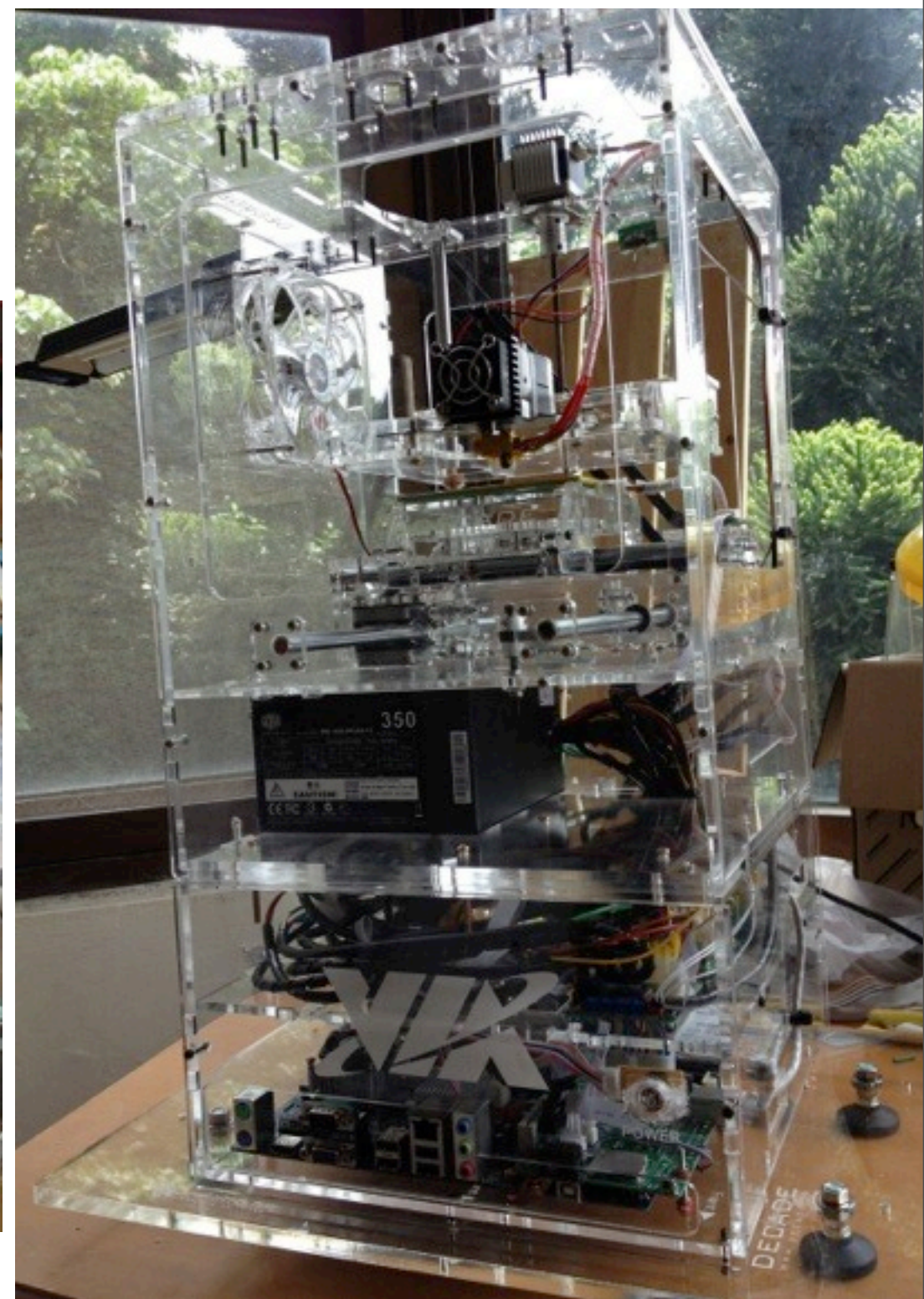
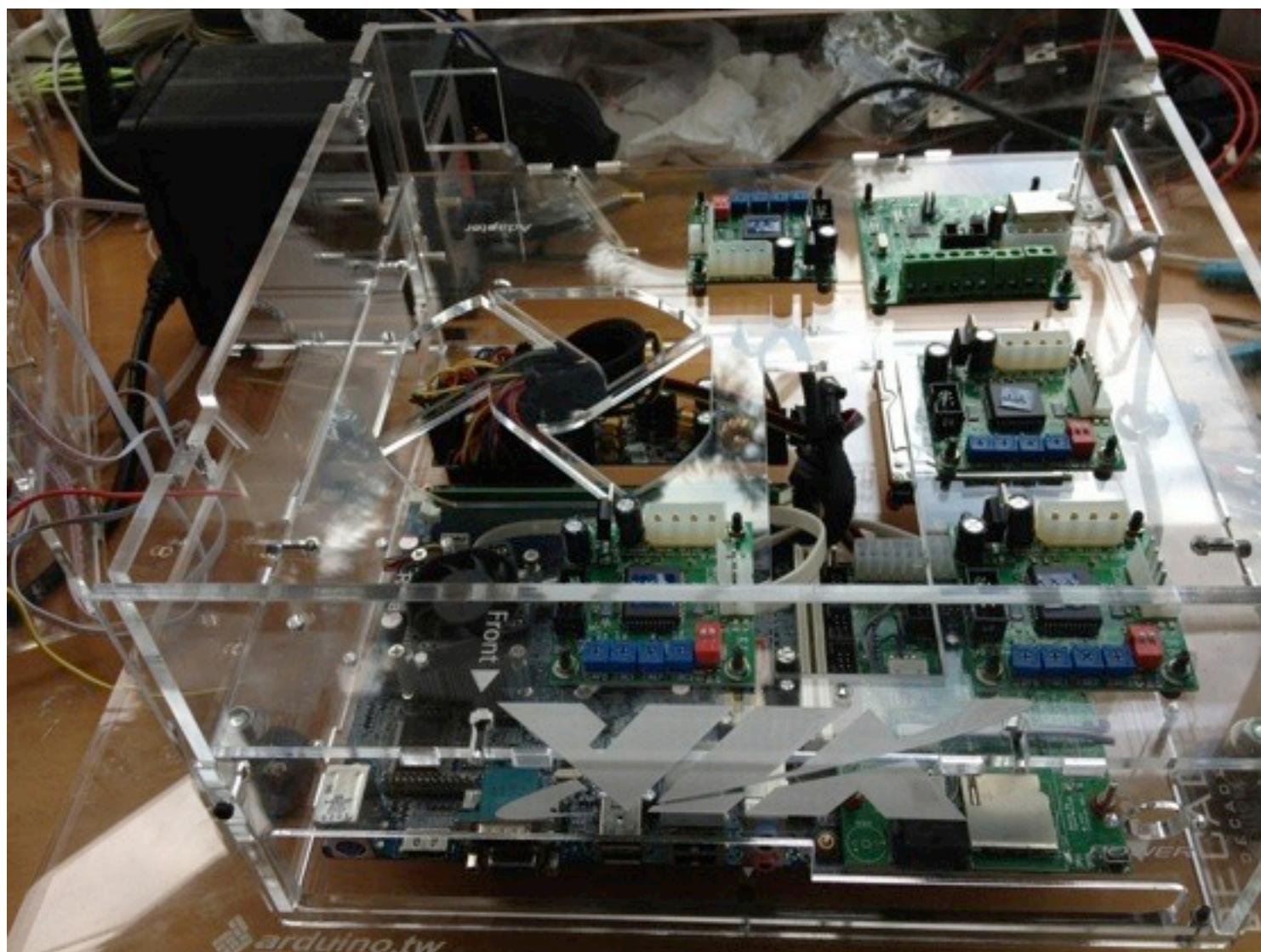
Thing-O-Matic



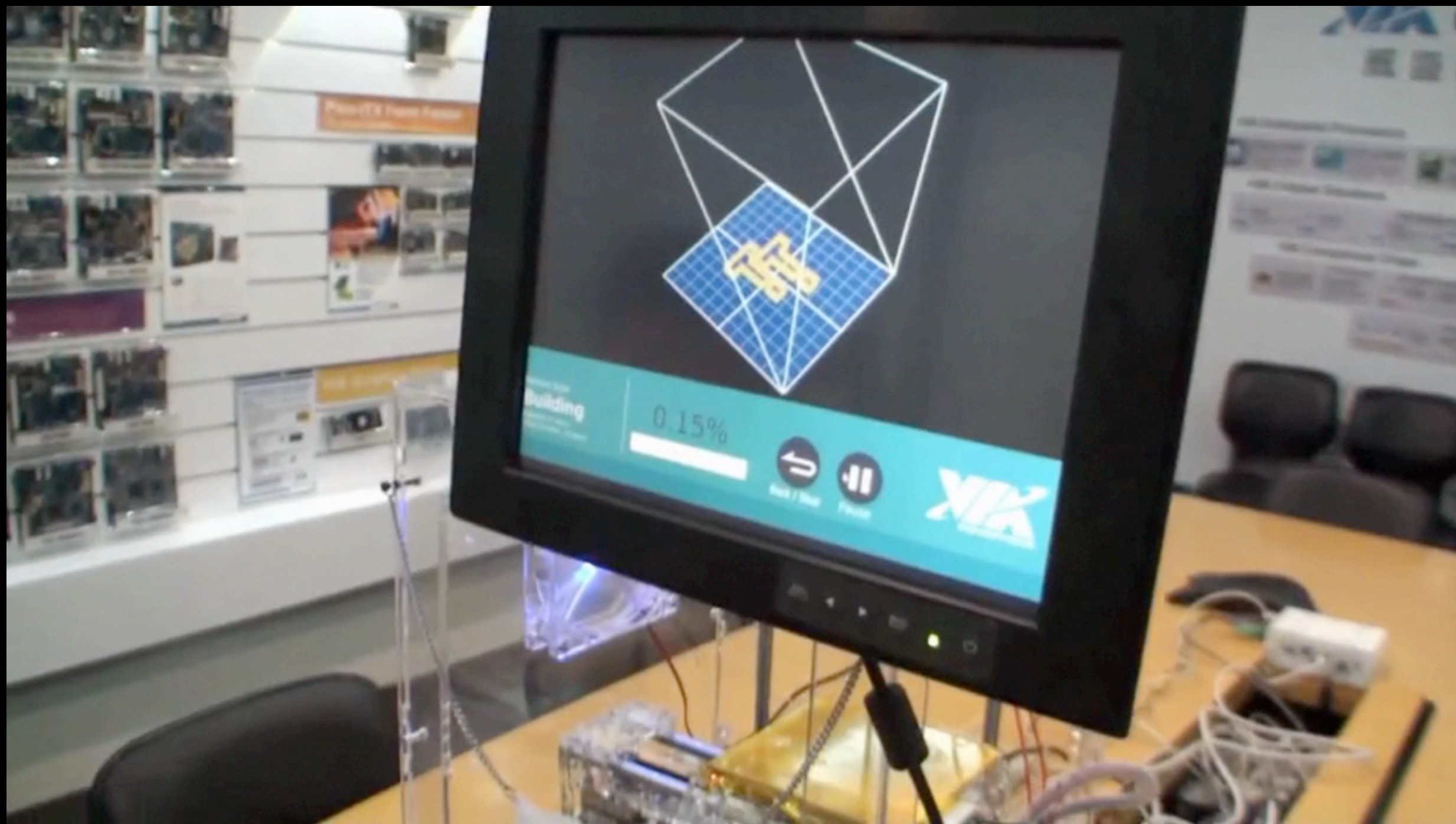
Ultimaker







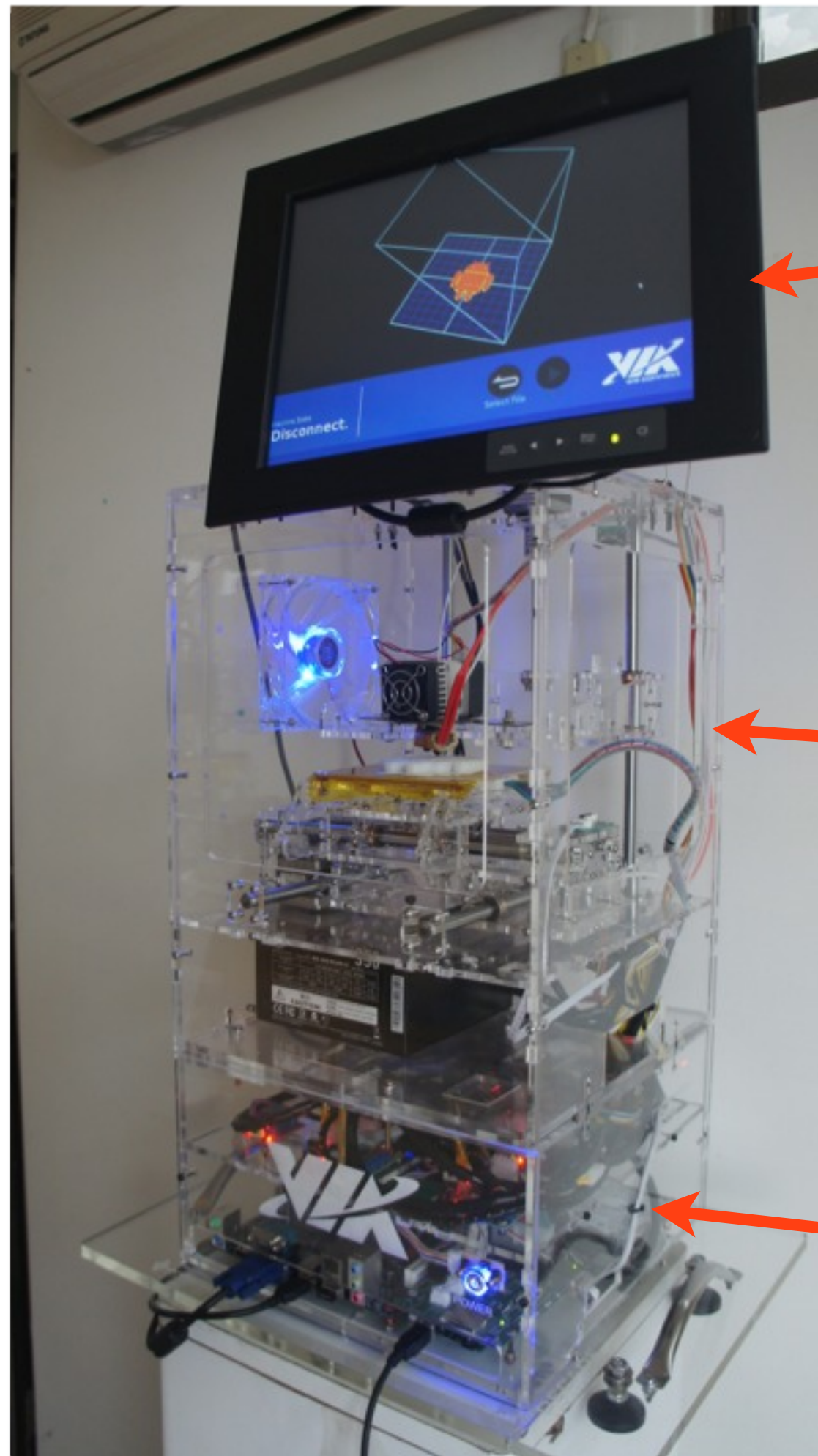




3D Printer DEMO in VIA Tech.

機型比較

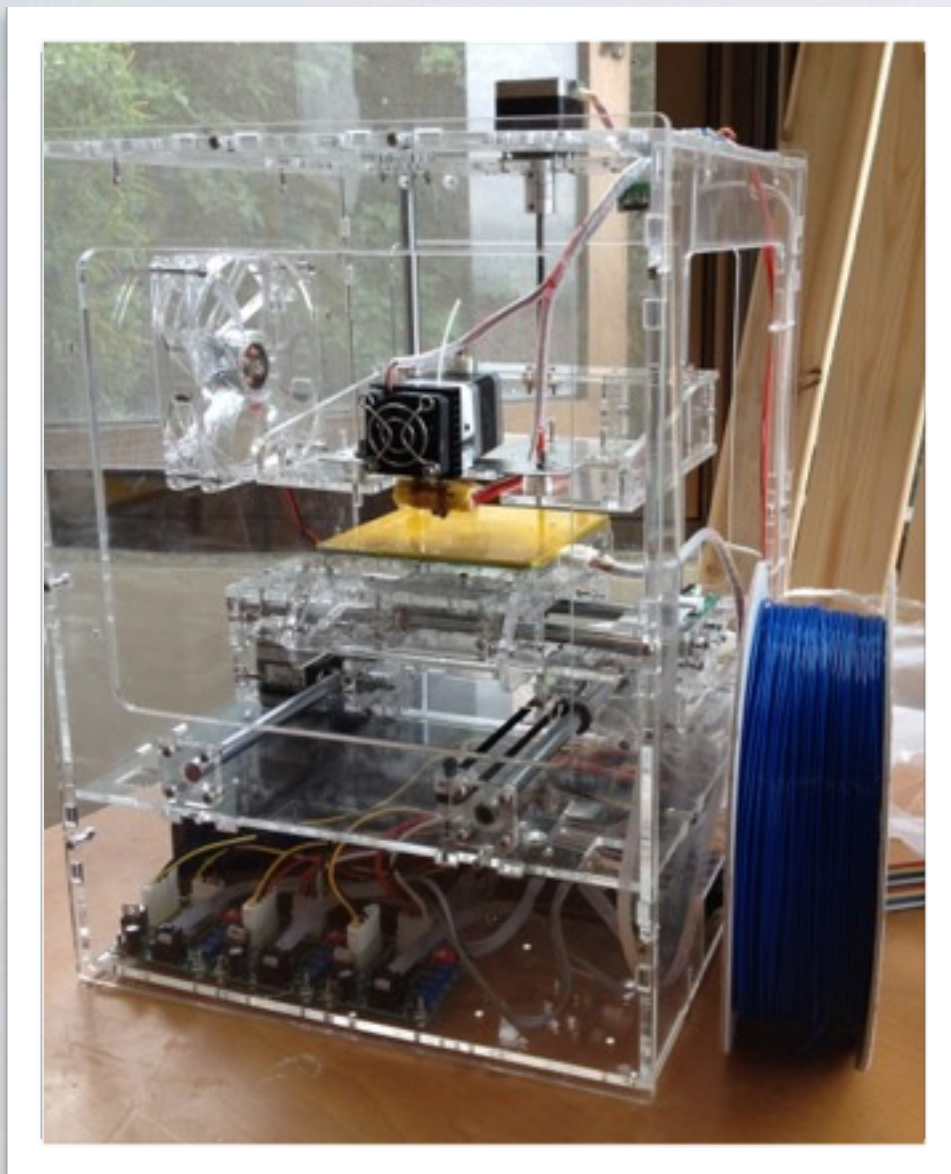
項目/機型	Thing-O-Matic MK7	Replicator MK8	Ultimaker	RepRap
外觀尺寸(cm)	30 × 30 × 14	32 × 46.7 × 38.1	35 × 35 × 39	44 × 47 × 37(約略)
重量(kg)	5	14.5	9	?
印製尺寸(cm)	9.6 × 10.8 × 11.5	22.5 × 14.5 × 15	21 × 21 × 22	20 × 20 × 20
噴嘴孔徑(mm)	0.4	0.4	0.4	?
解析度(mm)	0.2	0.2~0.3	?	?
印製速度(mm/s)	33	40	150~400	?
消耗功率(W)	350	350	120	?
購買等待時間	1~2周	8周	4~6周	?
使用材料	1.75mm ABS/PLA	1.75mm ABS/PLA	2.8~3.1mm ABS/PLA	?
使用軟體	ReplicatorG	ReplicatorG	ReplicatorG/NetFabb	ReplicatorG
價格(美元換算後)	NTD\$36,859(Kit)	NTD\$57,032	NTD\$52,647	?



觸控螢幕

Thing-O-Matic

VE900主機底座

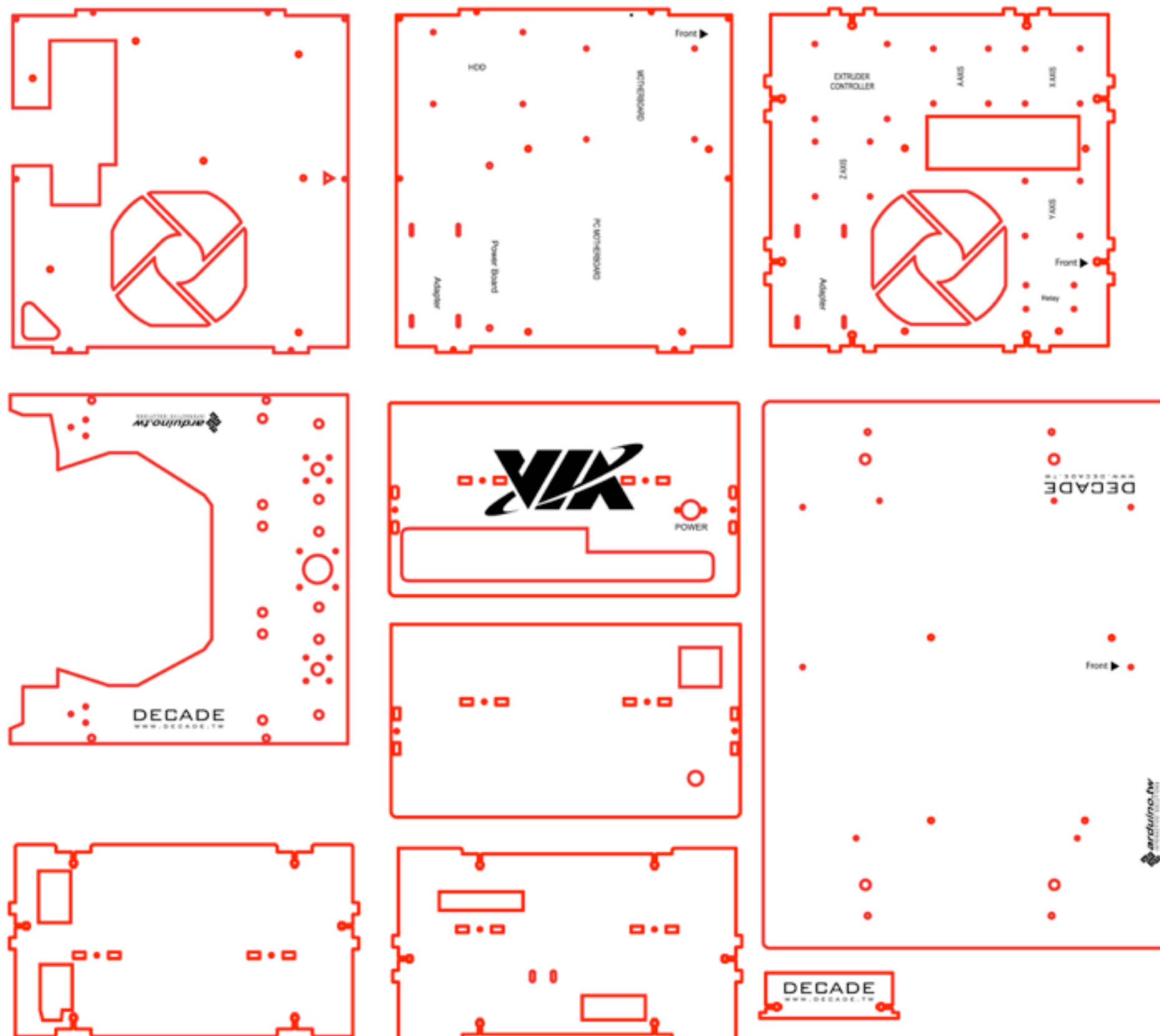


Thing-O-Matic

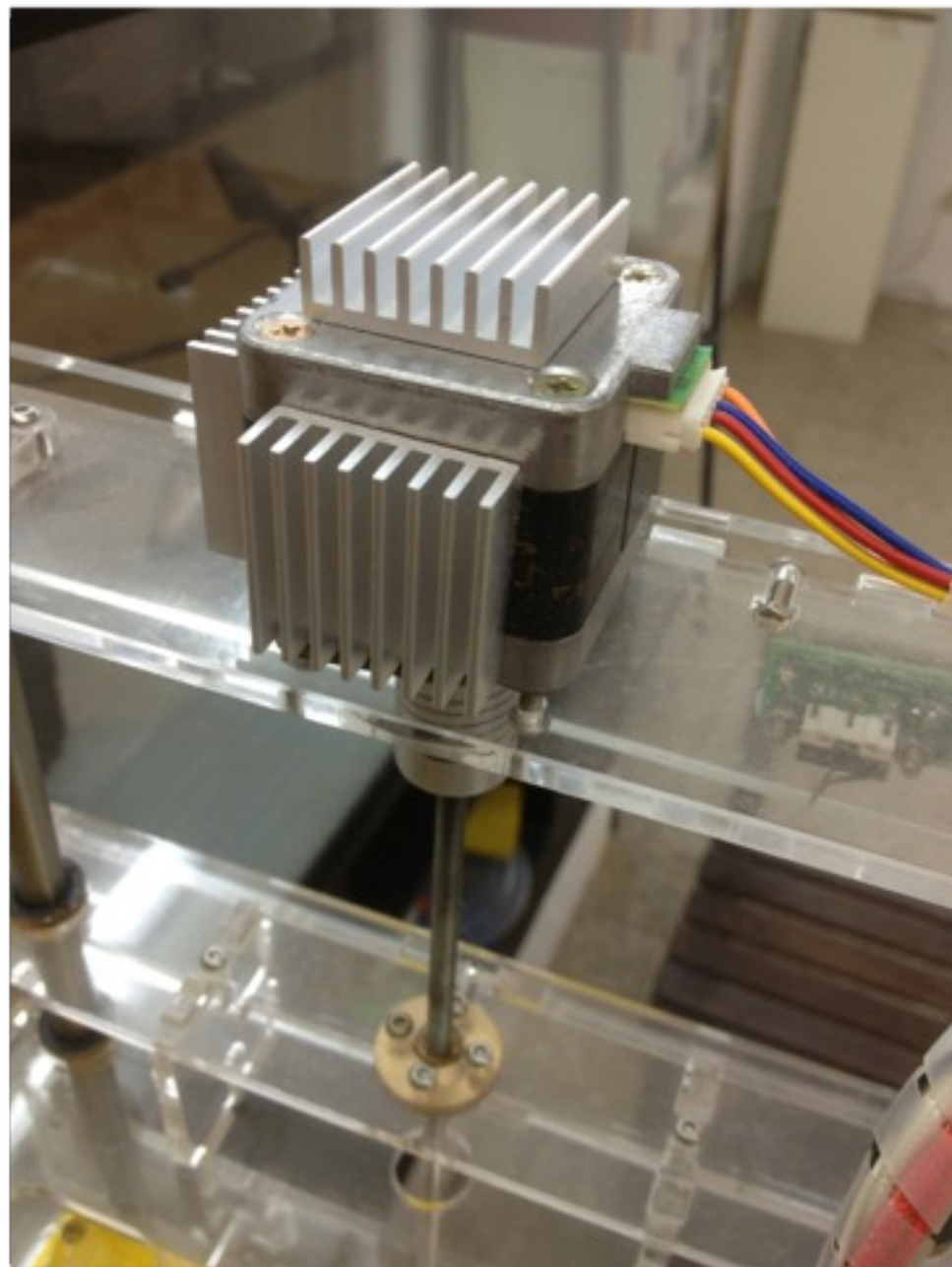
+



底座



增加步進馬達散熱片



4線式步進馬達



微動開關(歸零點)

Z軸

噴嘴系統 MK7

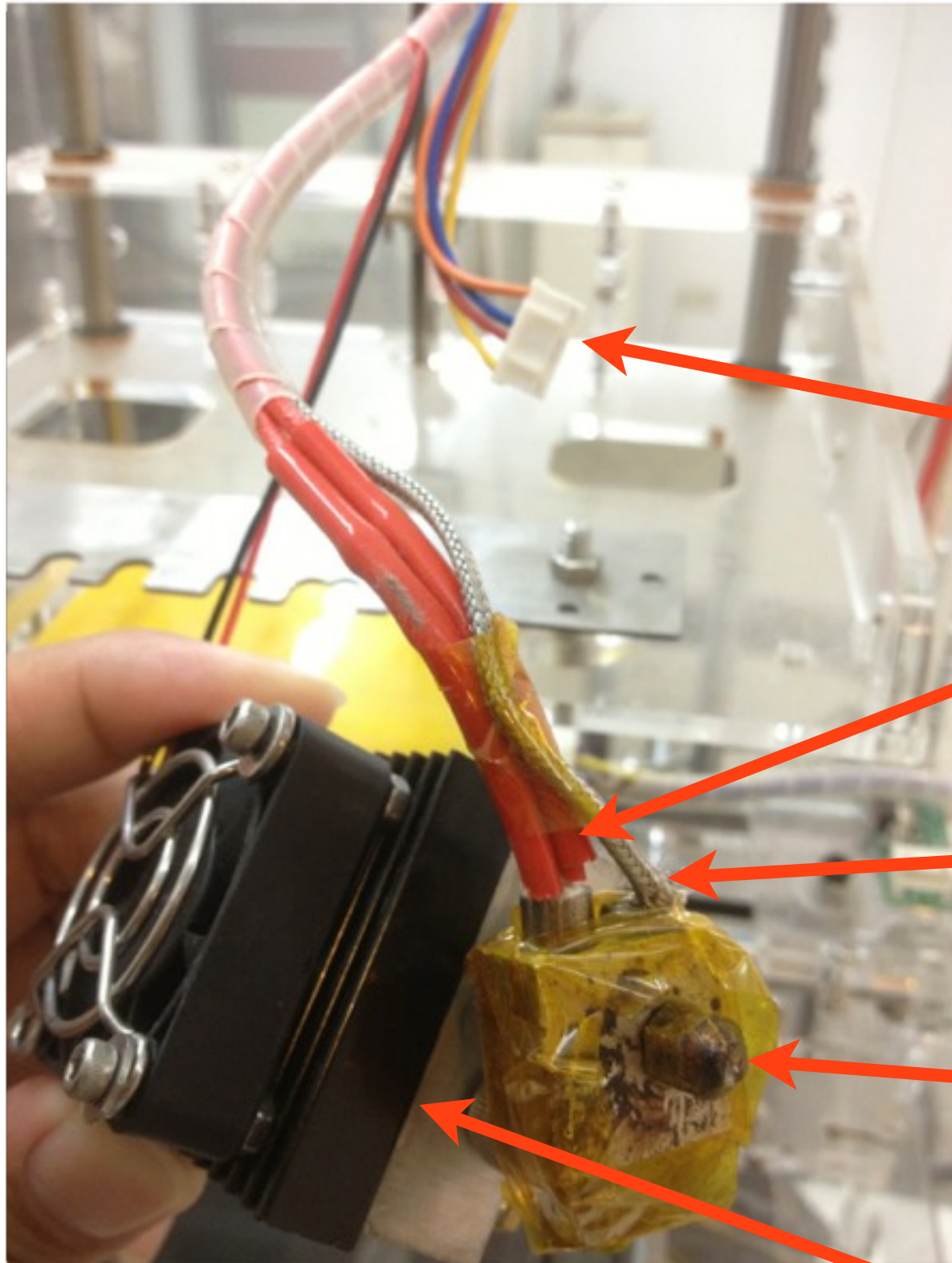
步進馬達連接頭

加熱線

溫度感測

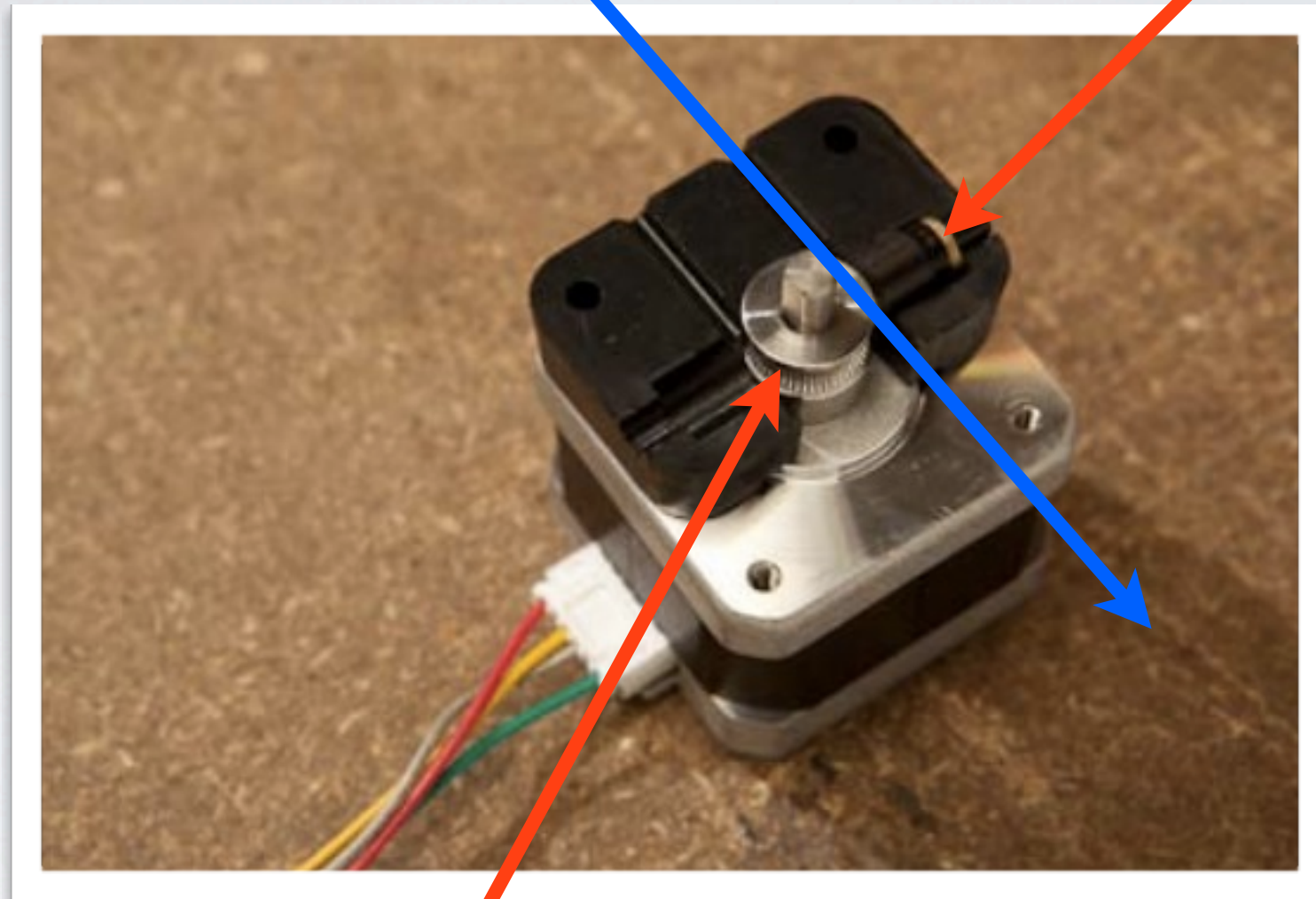
噴嘴 最容易堵塞的地方

散熱風扇 + 散熱片



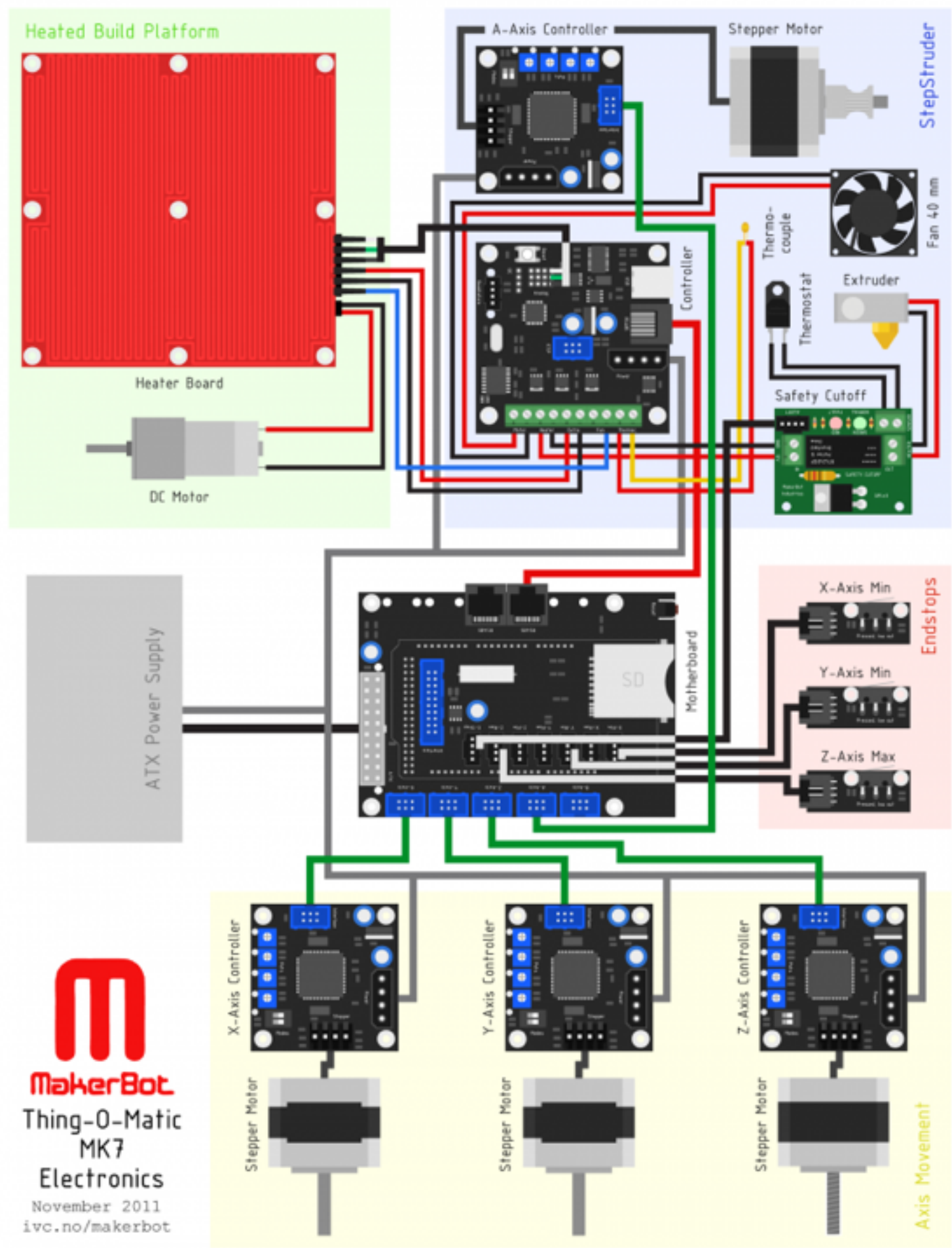
送料方向

彈簧卡榫



齒輪

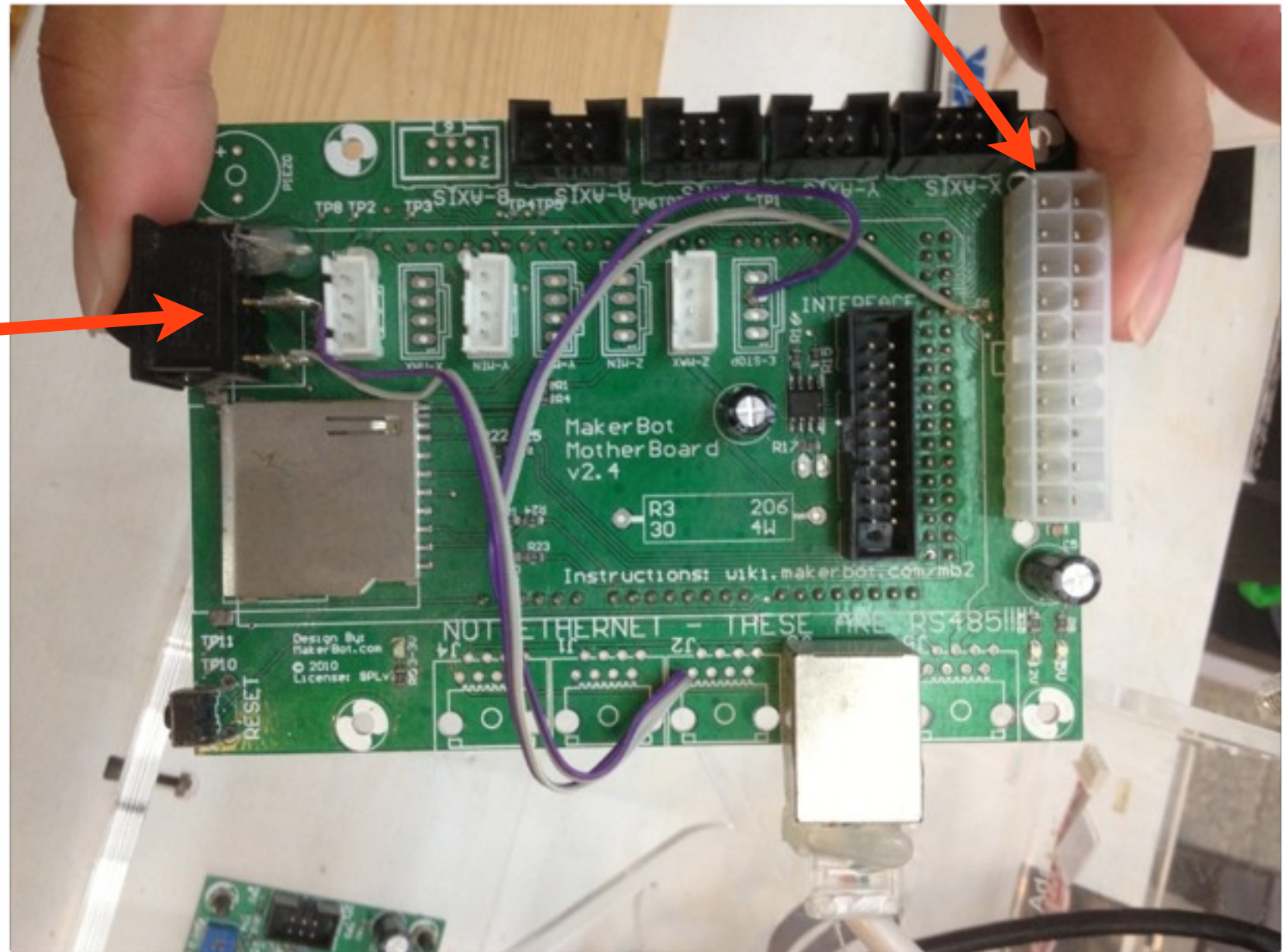
彈簧太緊容易將ABS擠壓變形，導致齒輪一直打滑，但噴嘴還是會一直加熱，因此容易造成送料不連續，印製出來的模型會倒塌

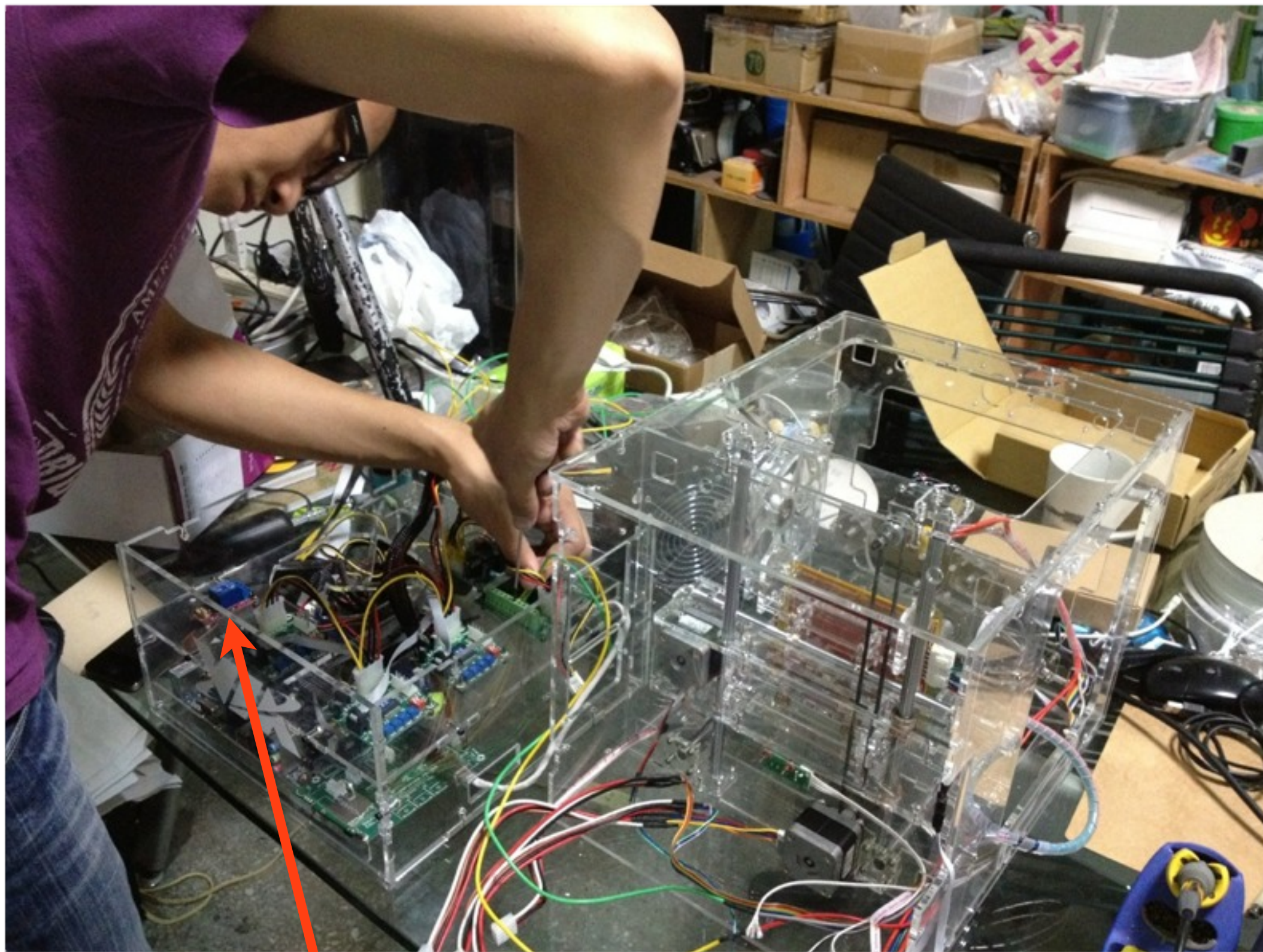



MakerBot
 Thing-O-Matic
 MK7
 Electronics
 November 2011
ivc.no/makerbot

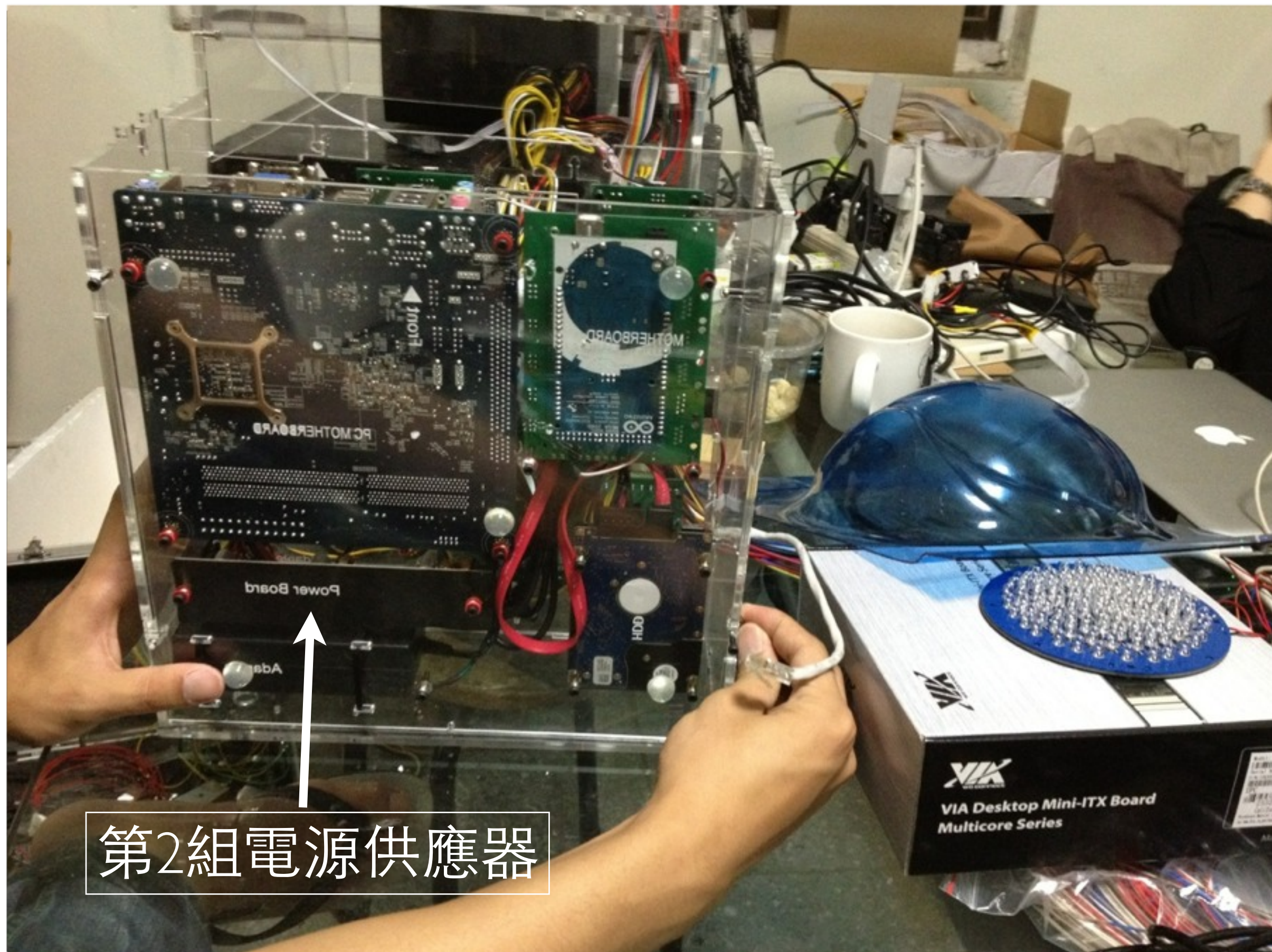
ATX電源分接成兩條

引出MotherBoard
上的Power接點

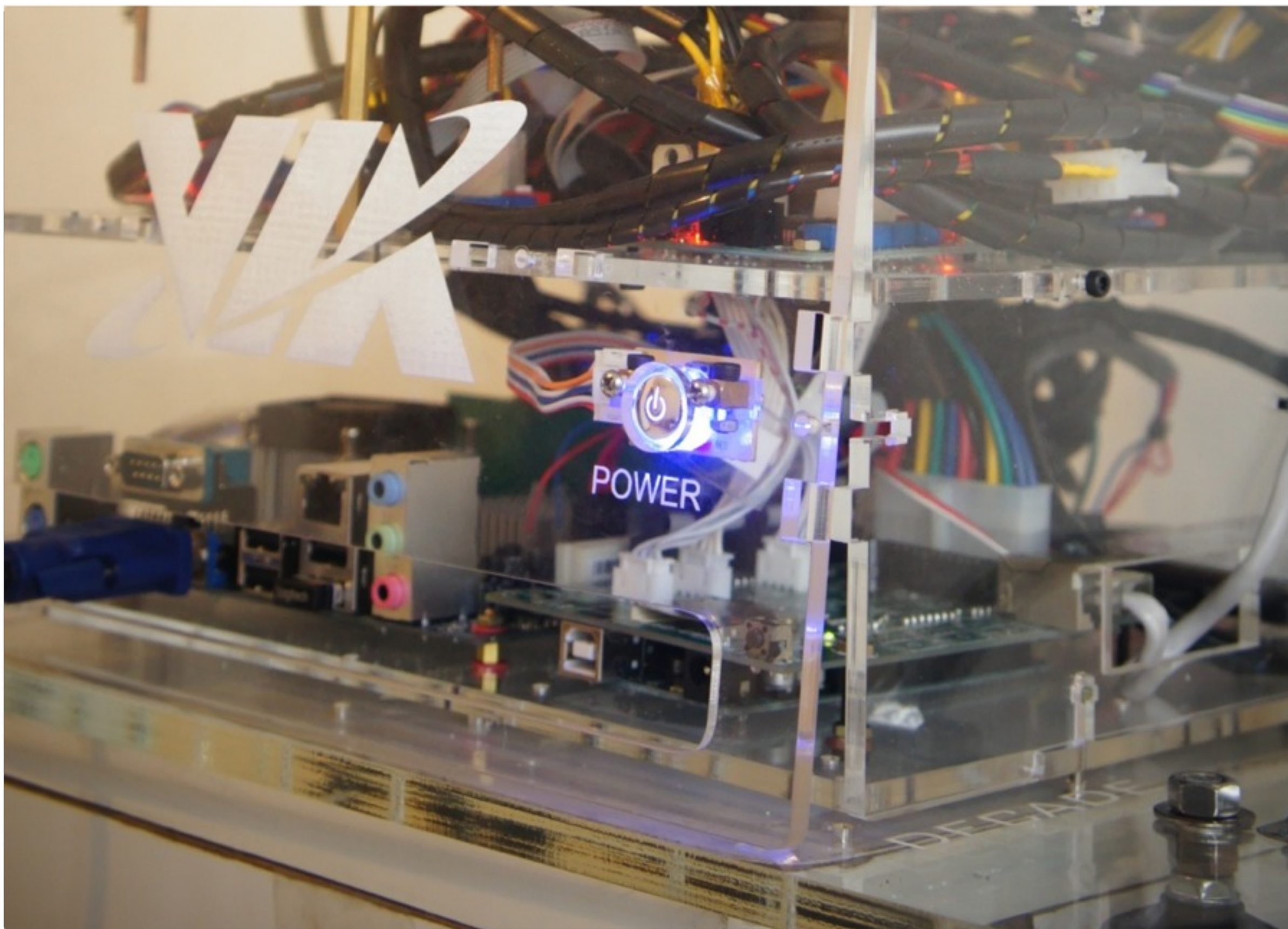


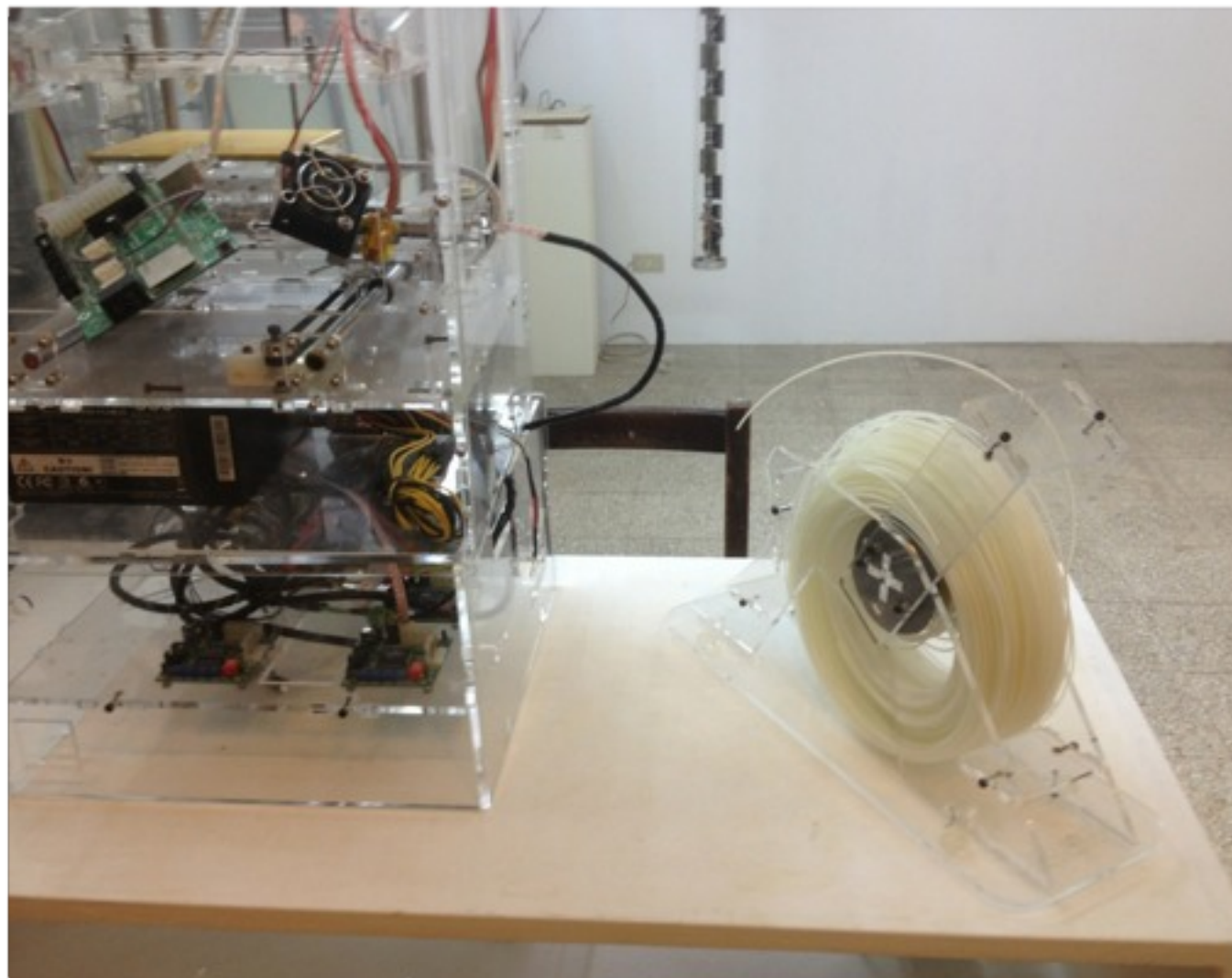


增加繼電器驅動2組電源供應器

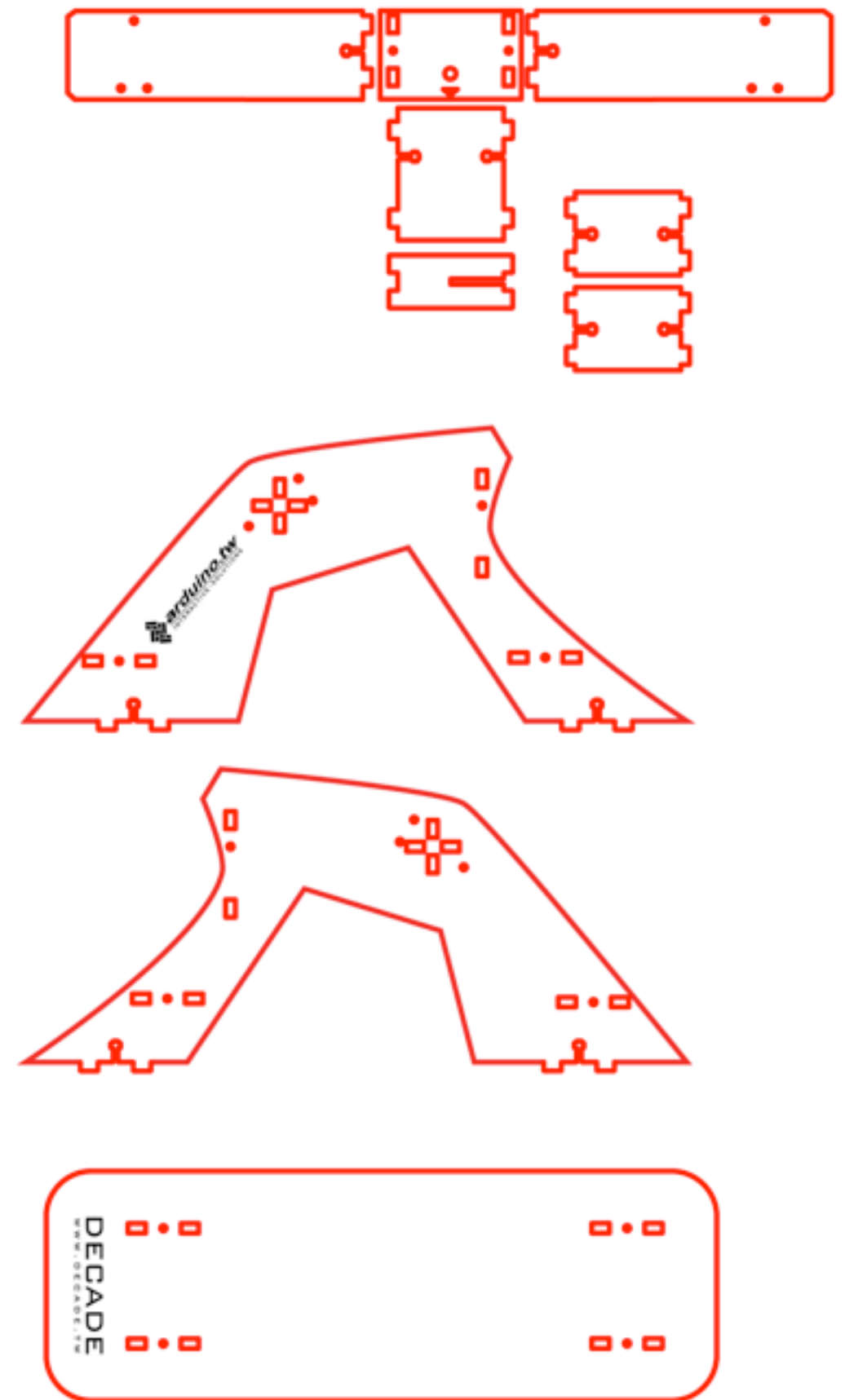


第2組電源供應器





ABS材料放置架

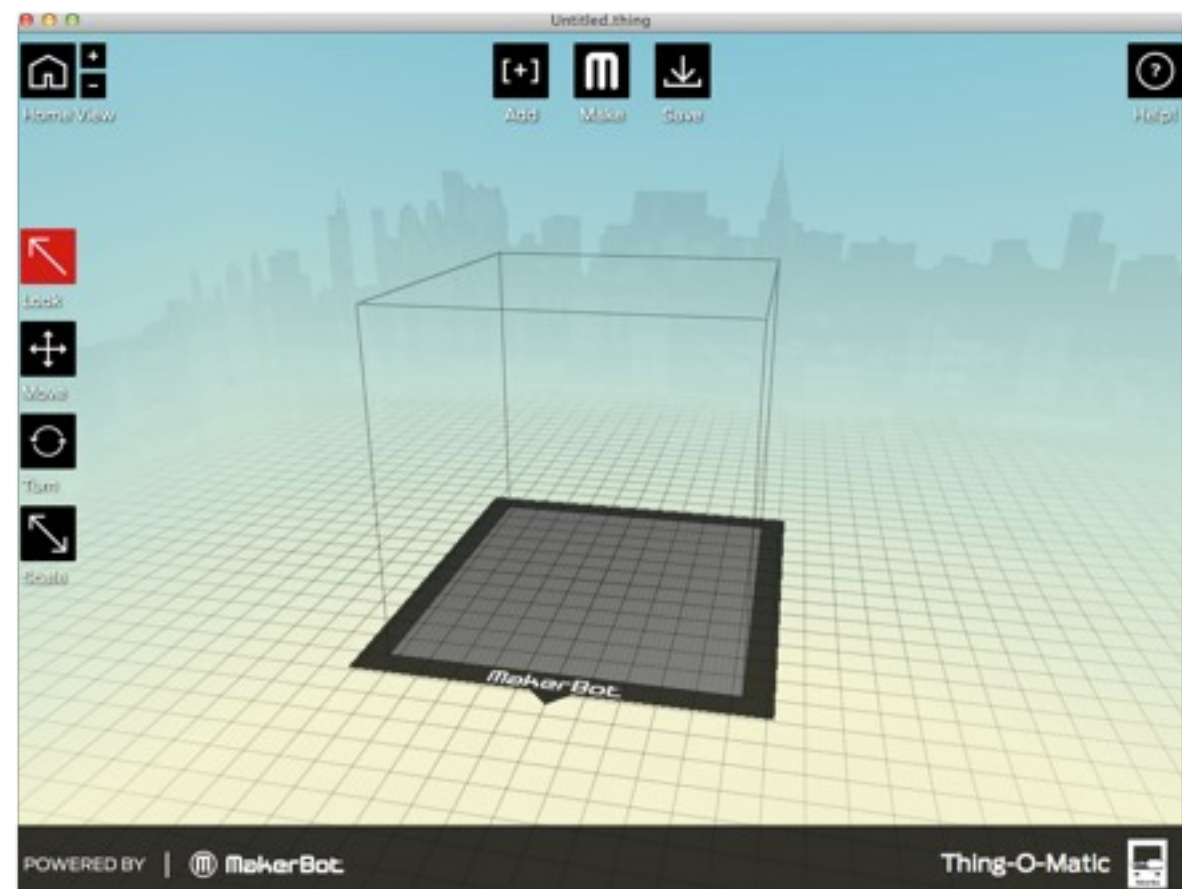
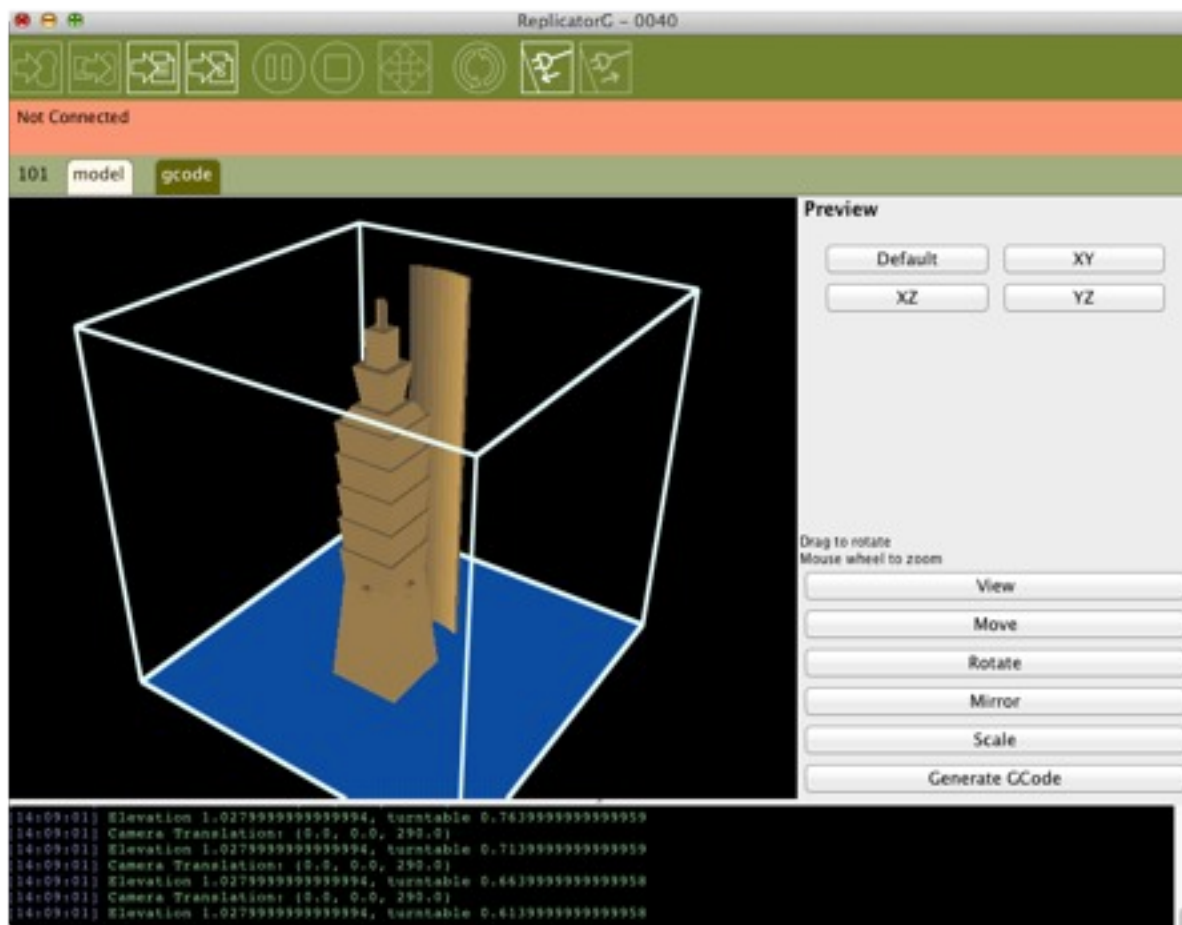


Hack into Software

ReplicatorG

MakerWare

VIA3DTouch



Open File



Print Setup



Power Off



Machine State
Disconnect.

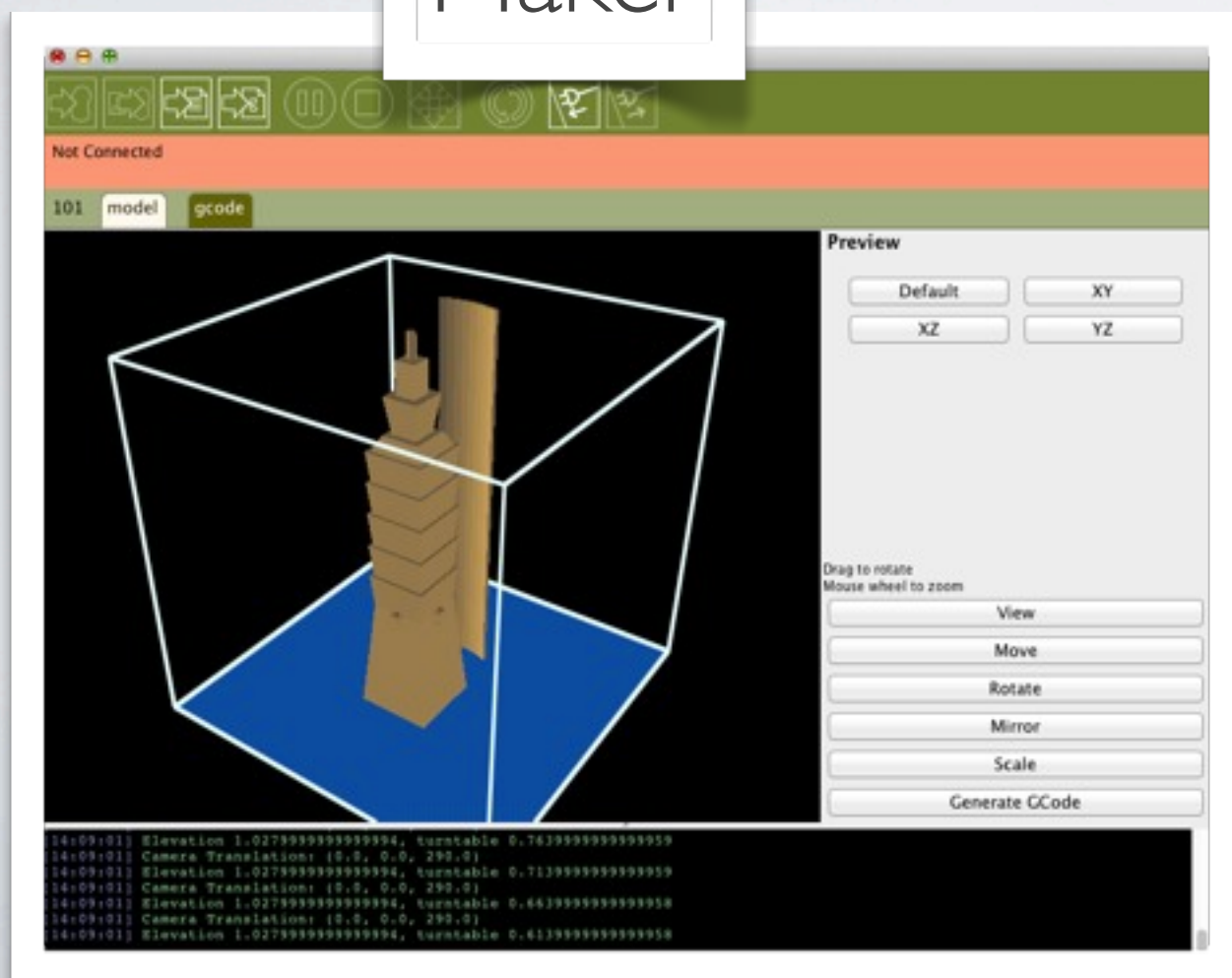
Extruder Temperature[0/260]

Platform Temperature[0/120]

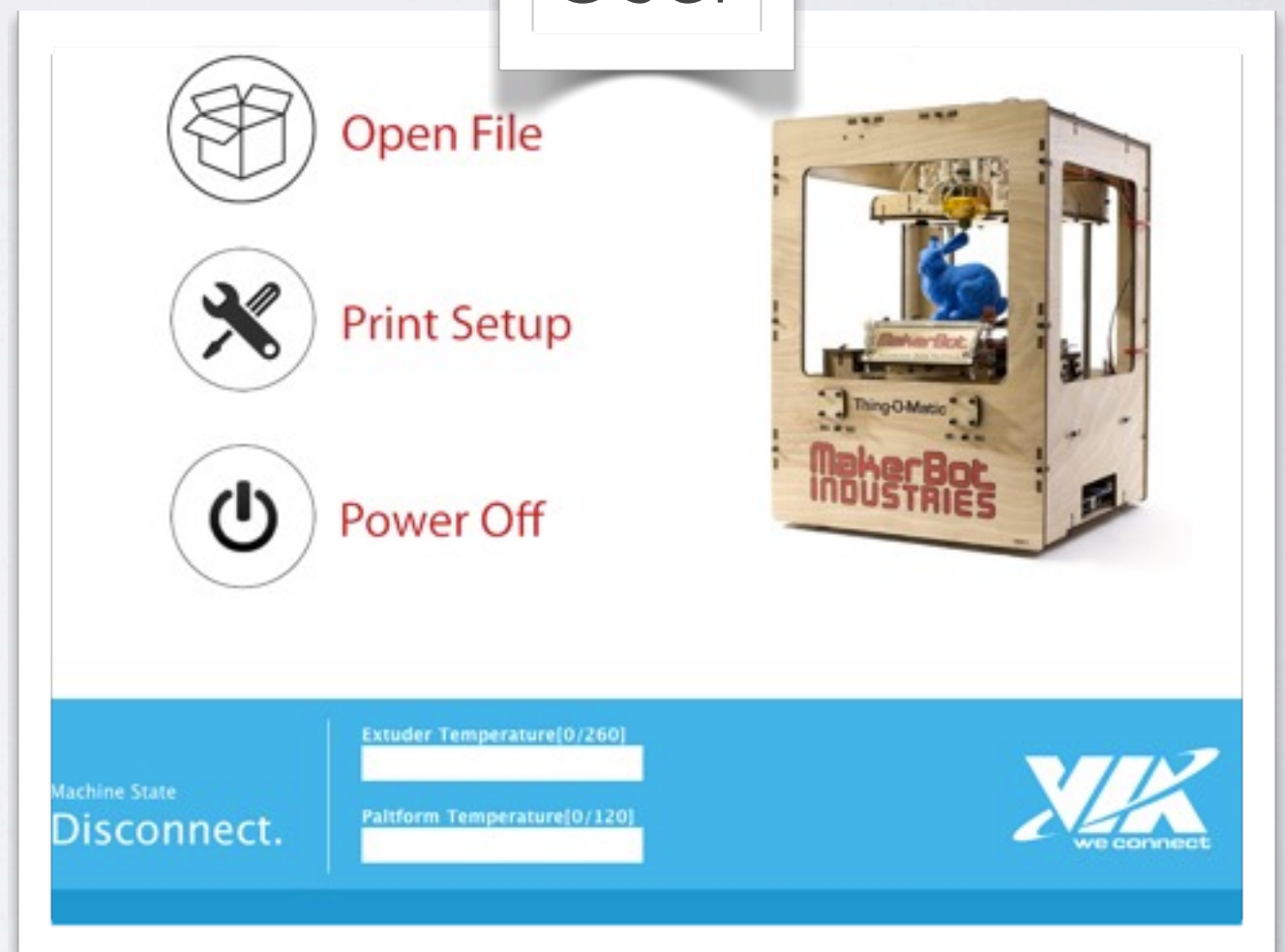


DESIGN FOR

Maker

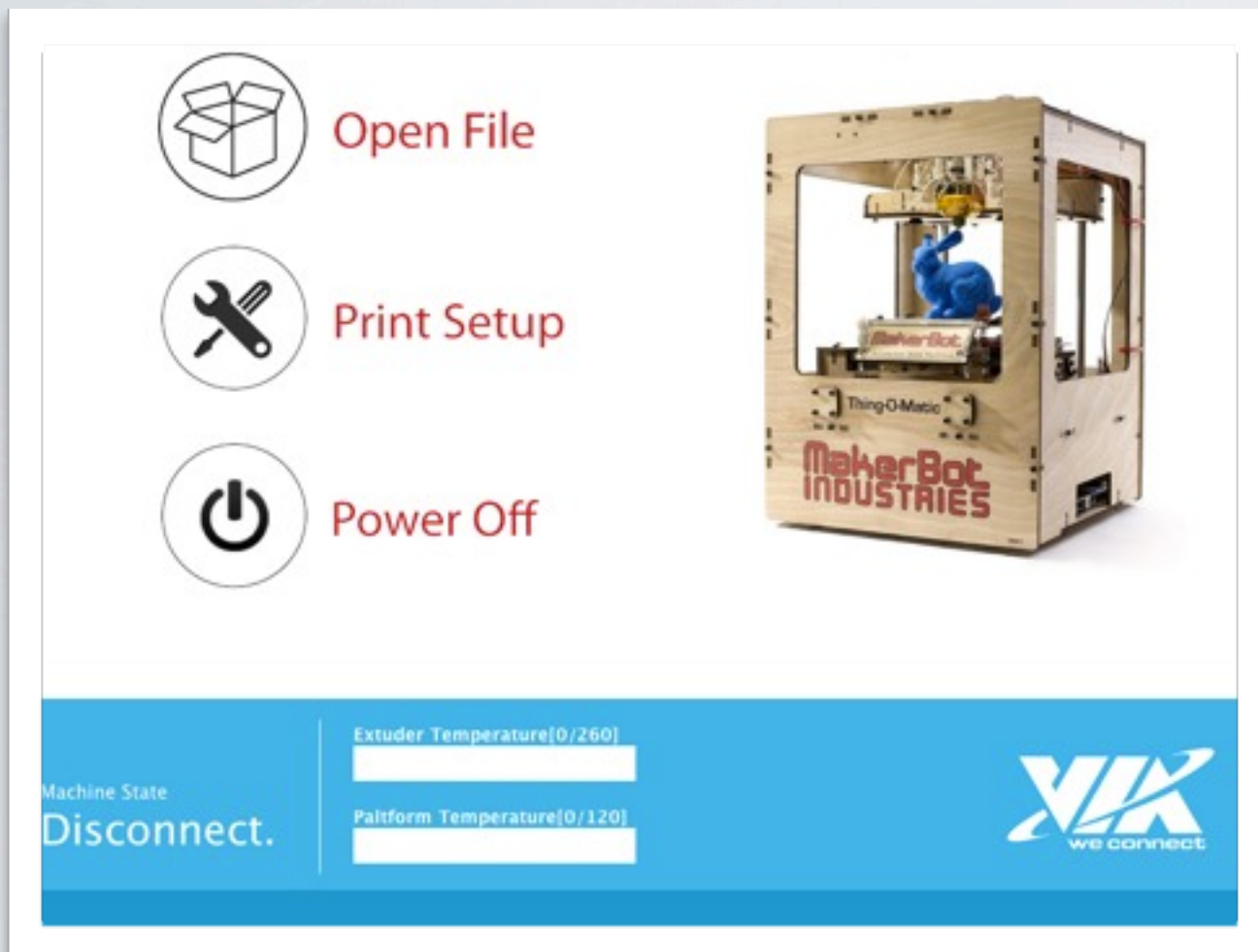


User

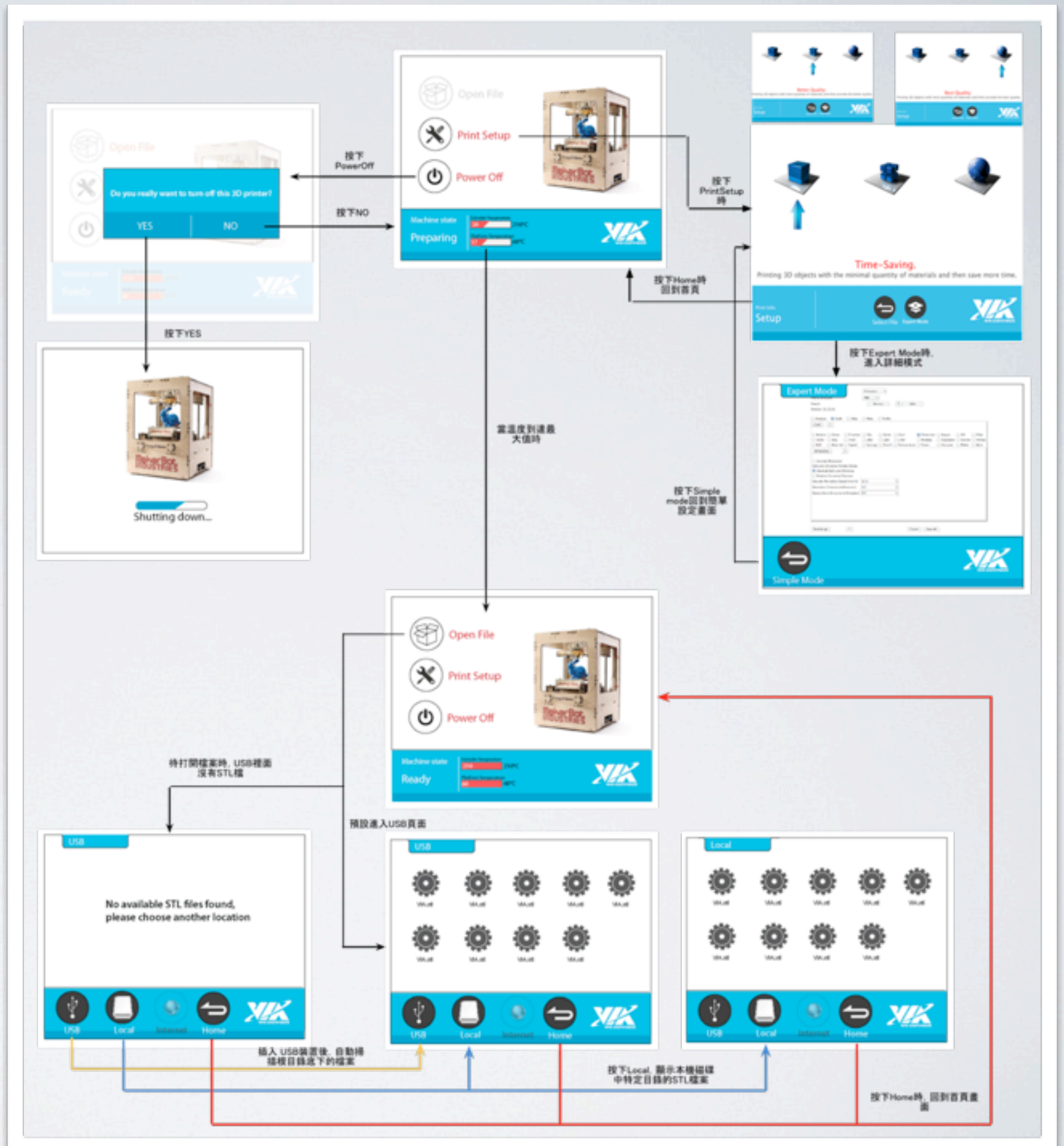


TOUCH TO PRINT

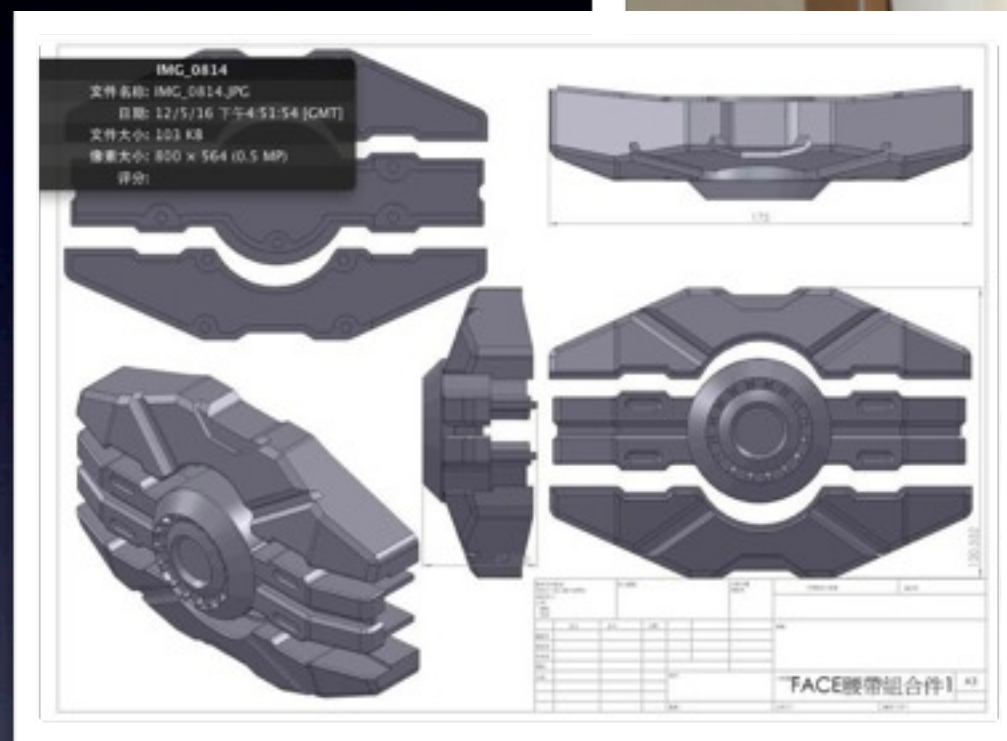
- Touch
- USB 、 Cloud Print
- Be a Vender not machine
- Made for User
- Autoget RP size, temperature (Firmware rebuild)



Main UI Flowcharting



製作電影道具



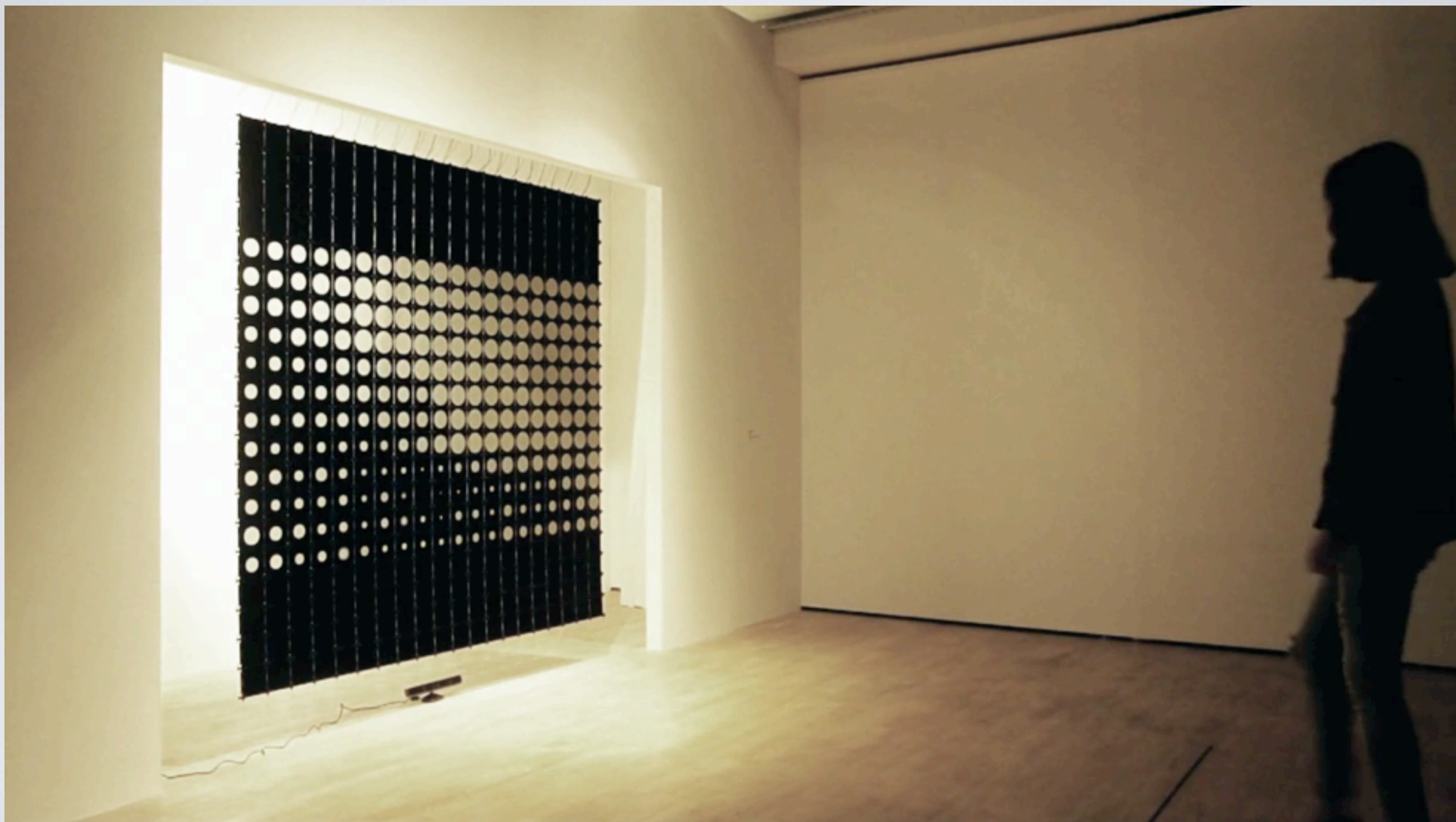
PROGRESS OF 2D & 3D PRINTING

- Edit Software(PE2, Word, MAYA)
- Printing and Scanning Machine
- Material Recovery Maker(ABS/PAL)

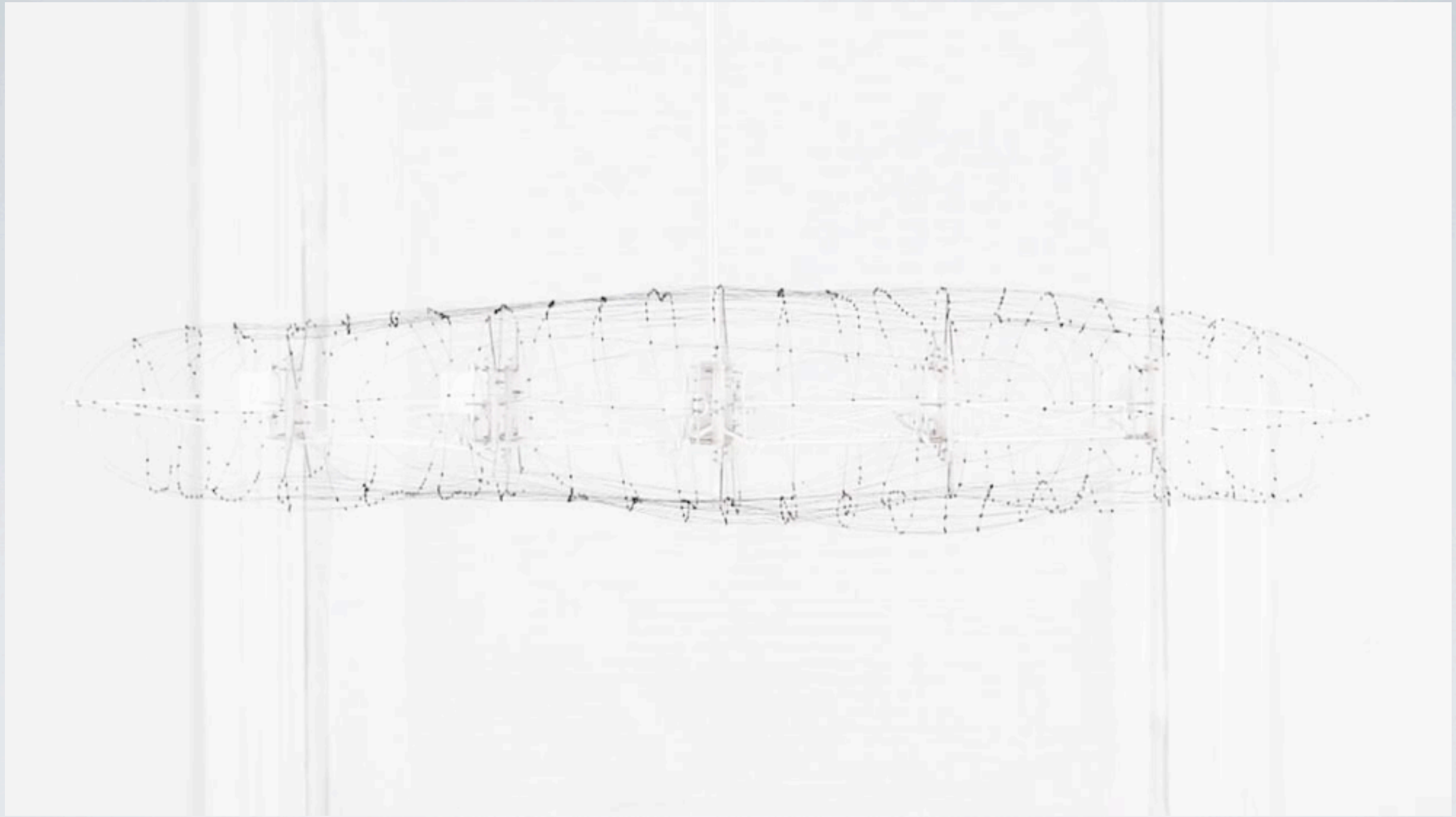


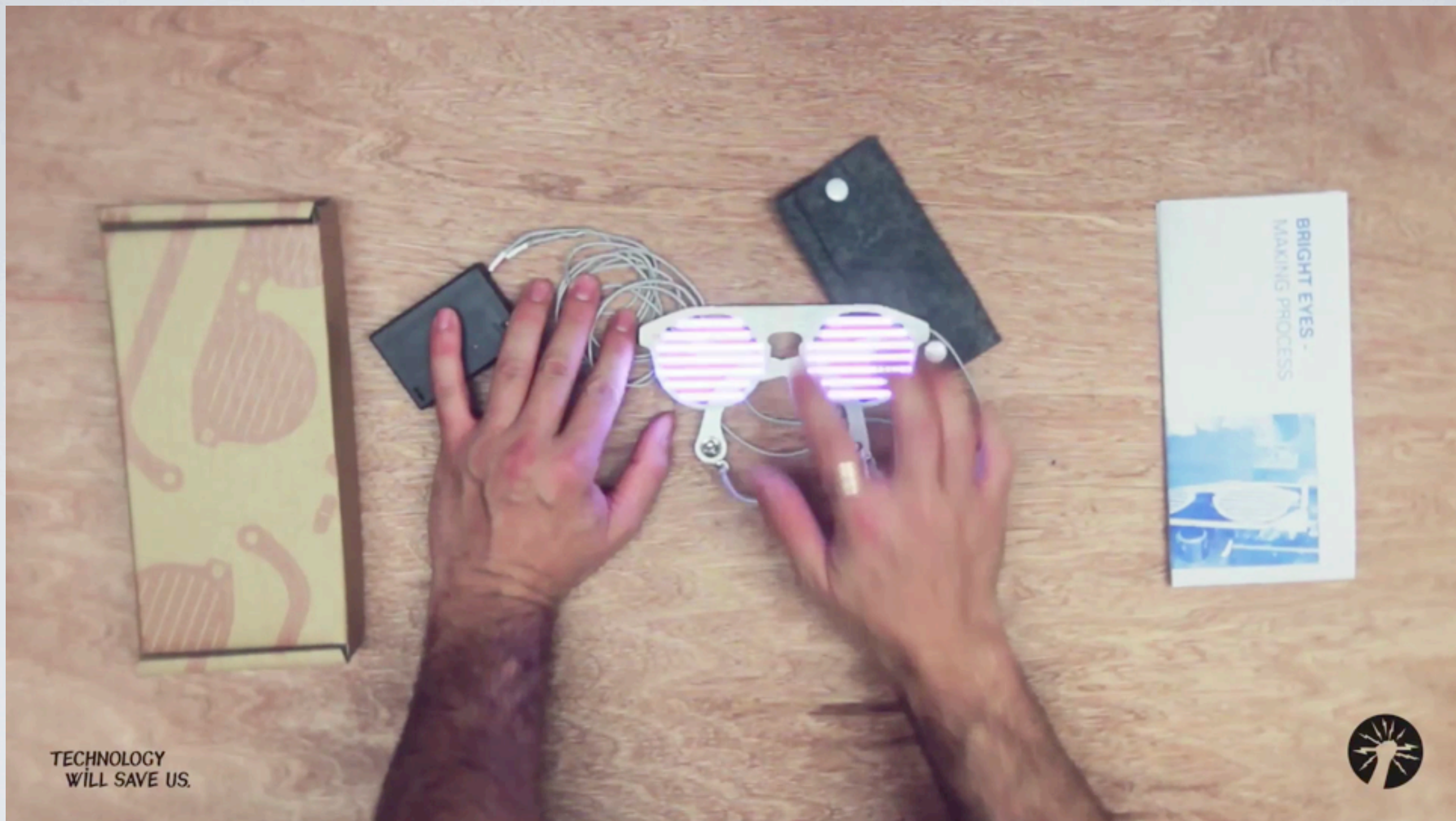
其他開放硬體製作的專案

- HYBE
- Point Cloud
- Bright Eyes
- Makey Makey



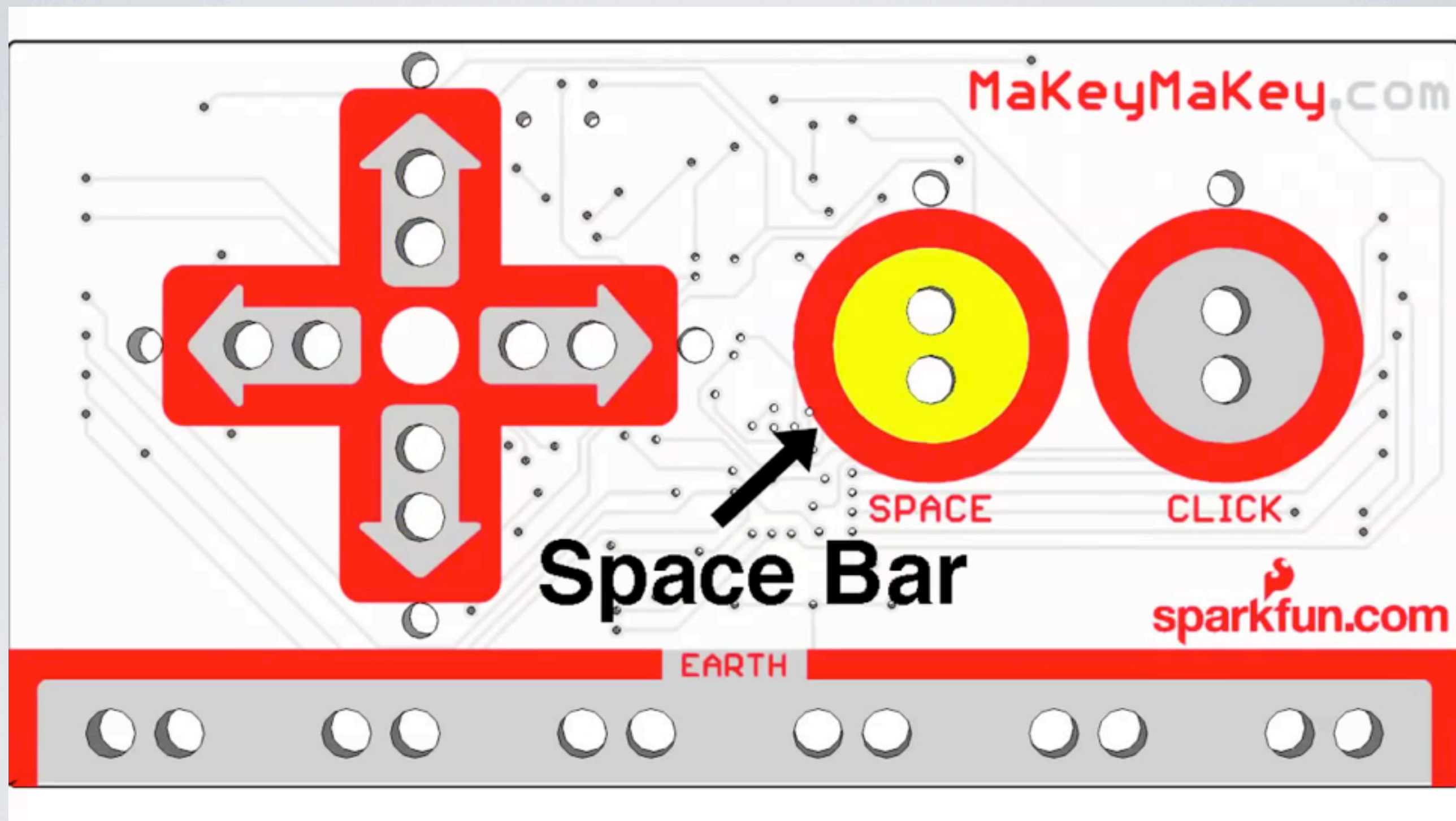






TECHNOLOGY
WILL SAVE US.





開放硬體包含什麼？

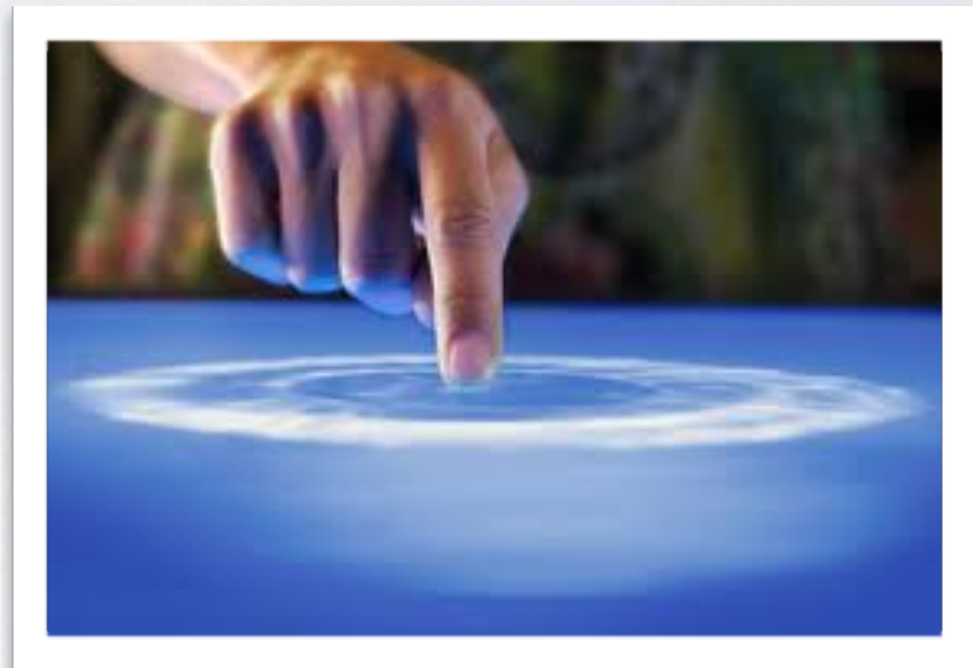
- 創新的IDEA
- 一個新的產品名稱或是專案名稱
- 開放部分的開發環境 or 相關說明
- 公開設計圖、電路圖、製作材料等等
- 有獨立的網站、社群、論壇、教學
- 包裝精美、Logo、視覺形象



Bartendro B3

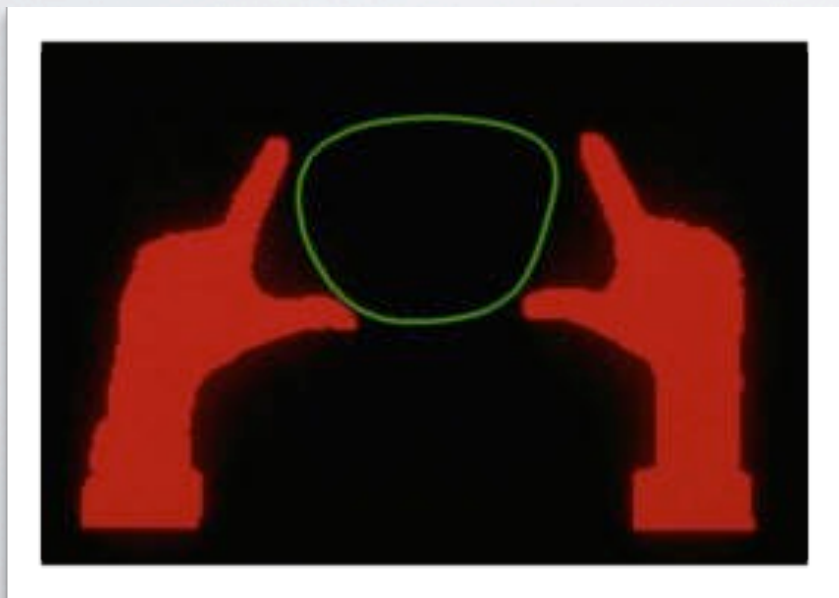
開放硬體與互動科技脈絡

- 牆
- 桌子
- 地板



最早的互動牆

- Myron Krueger
- Artificial Reality
- Video Place (1983)



<http://www.youtube.com/watch?v=dqZyZrN3PI0>

互動牆

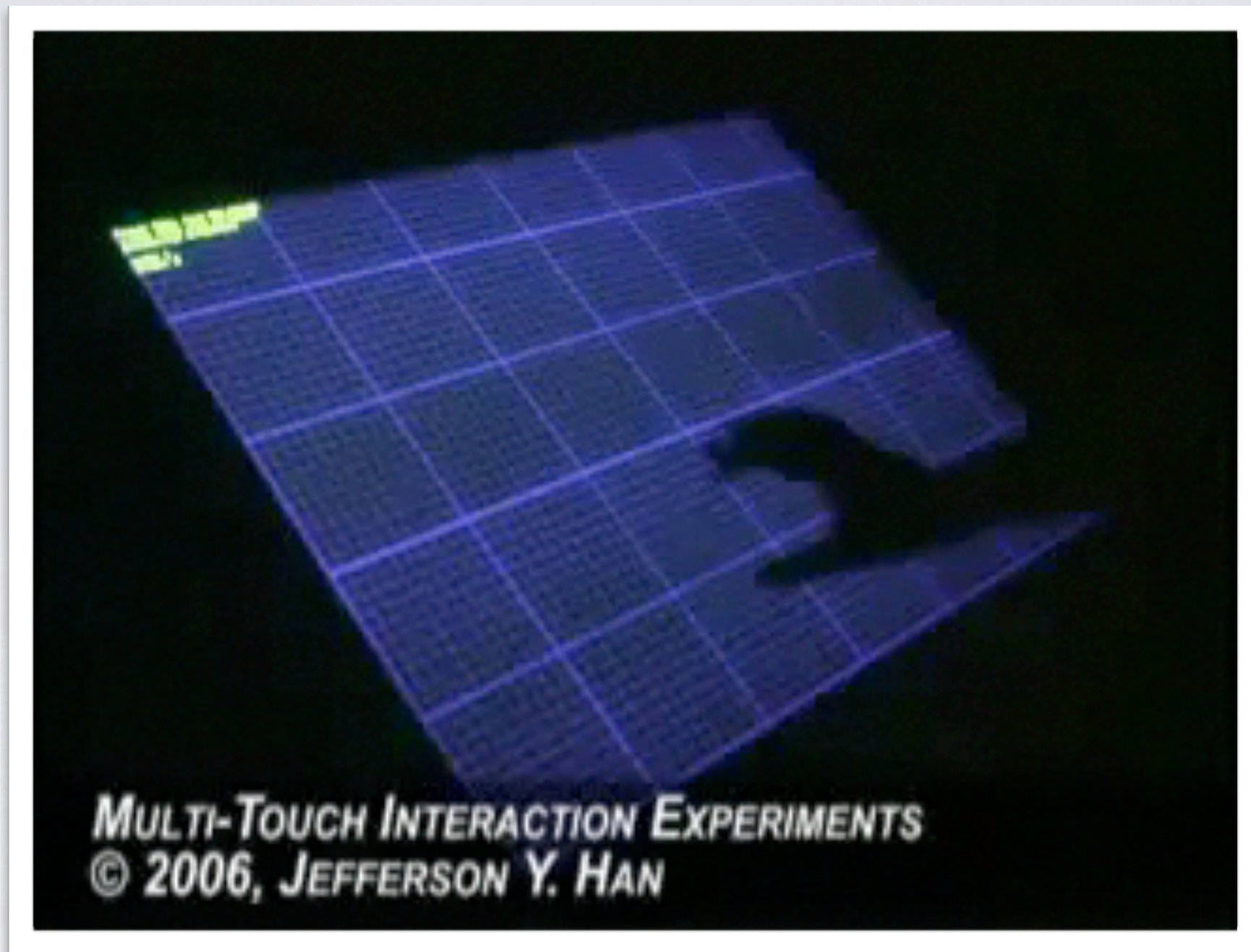


Golan Levin and Zachary

美聲演繹

<http://www.youtube.com/watch?v=GfoqiyBIndE>

互動桌

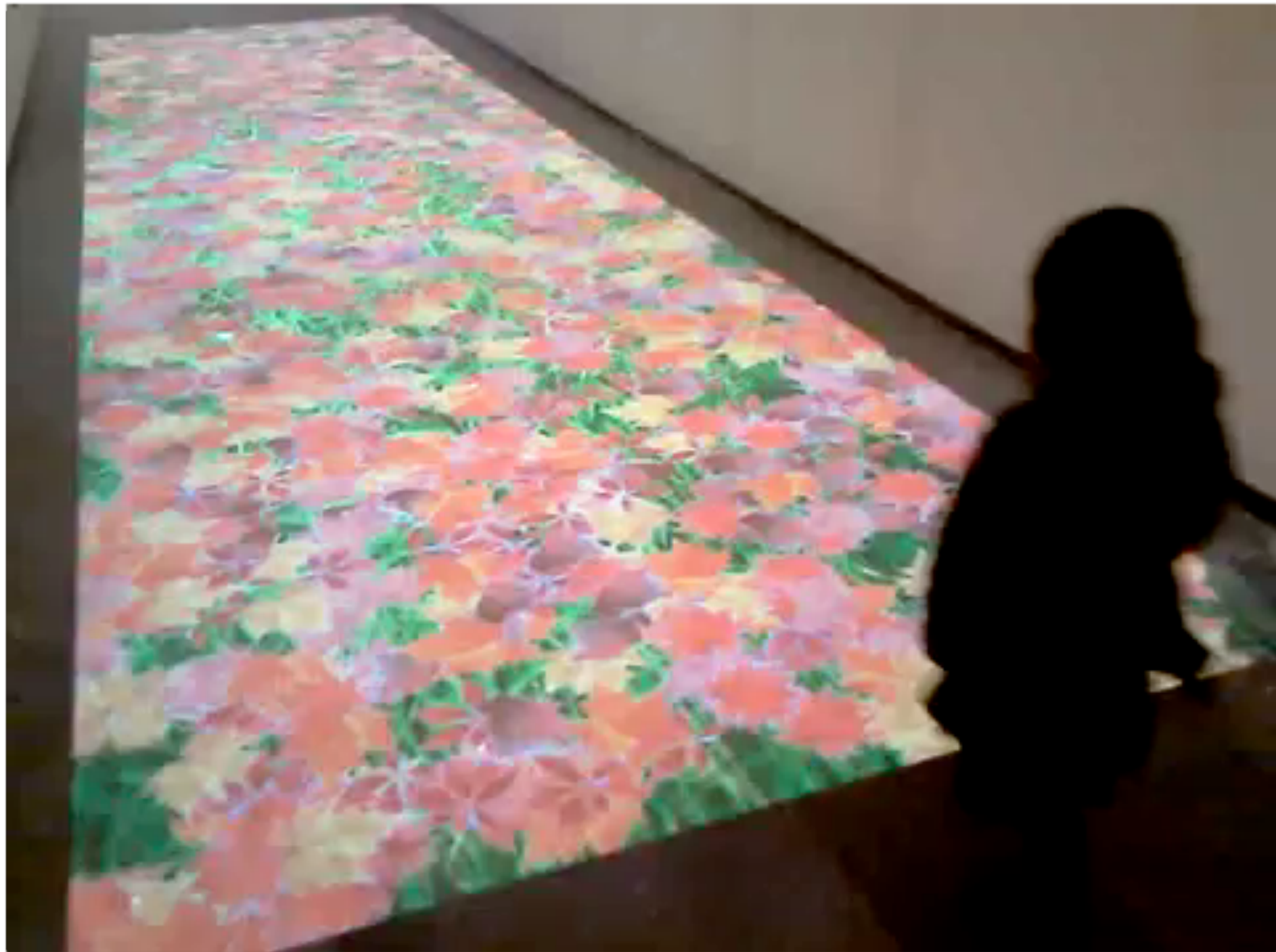


Jefferson Y. Han

多點觸控桌

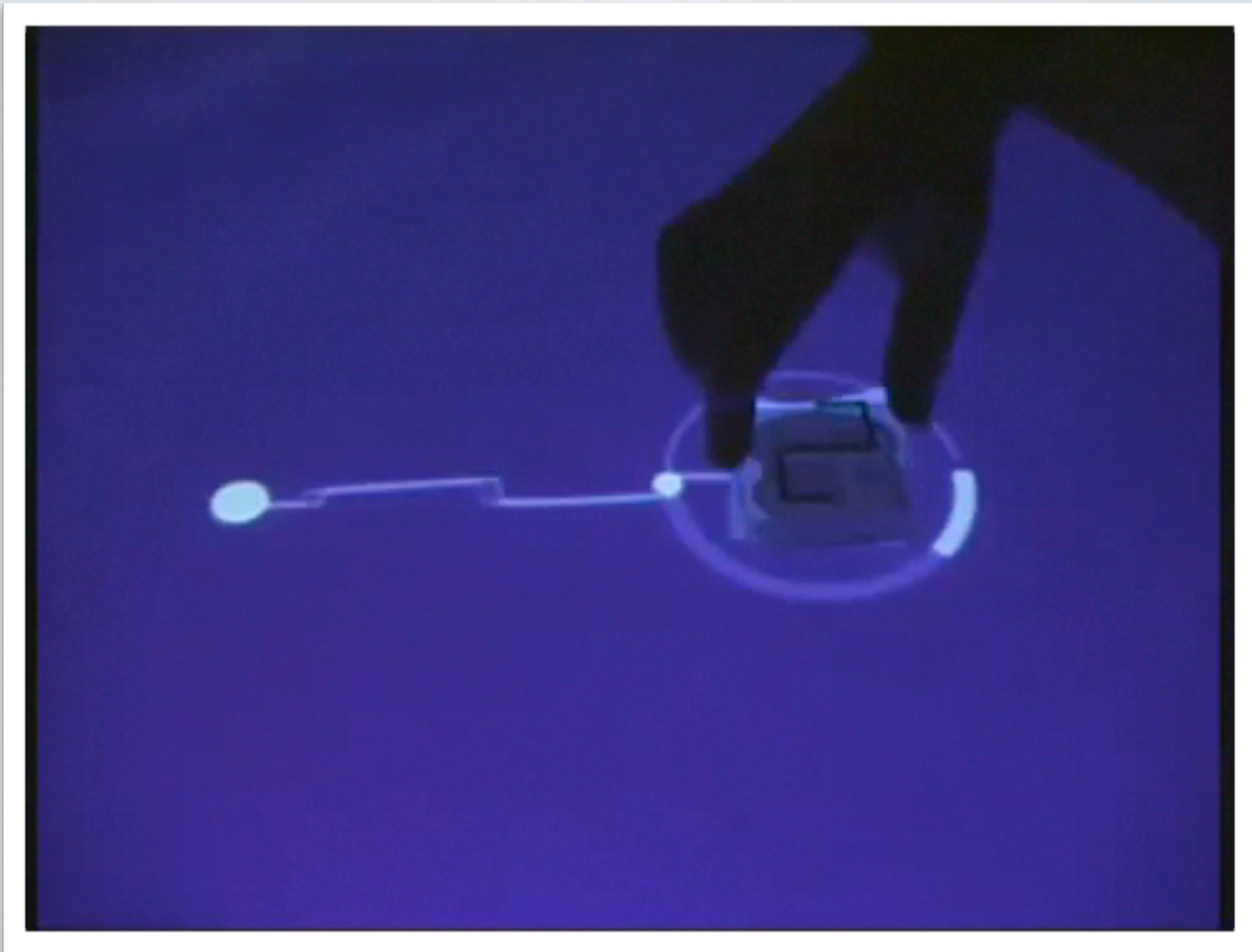
<http://www.youtube.com/watch?v=EiS-W9aeG0s>

互動地板



<http://www.youtube.com/watch?v=dOIEwxZIHVo>

REACTABLE



<http://www.youtube.com/watch?v=0h-RhyopUmc>

互動介面技術

- 軟體面

- 透過影像辨識的互動介面(互動桌、互動牆、互動地板)
- 用投影的方式呈現畫面，非接觸性的與畫面互動
- PC / MAC / Phone / Tablet

- 硬體面

- 透過感測器(溫度、濕度、光線、動作、加速度、壓力、繞曲、方向、距離、磁場等等)接收人們動作感知
- 無線傳輸、有線傳輸
- 接觸或非接觸、直接或間接

未來10年

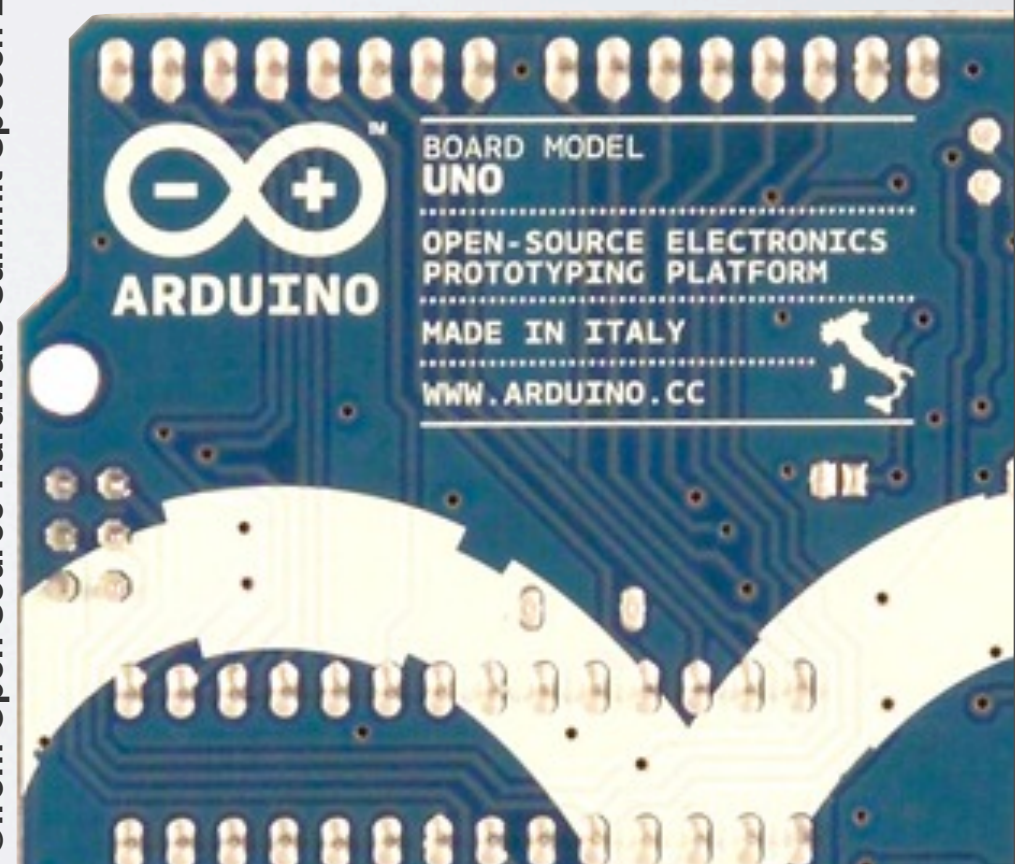
- 運用開放硬體工具達成**新型**互動科技手法已成趨勢
- 具有藝術美感的創作(產品)才能具有**獨賣增值**
- Arduino = 幫助各位踏進互動科技的一小步

2013

2023

ARDUINO

@from Open Source Hardware Summit Speech 2011







Daniela Antonietti
CFO

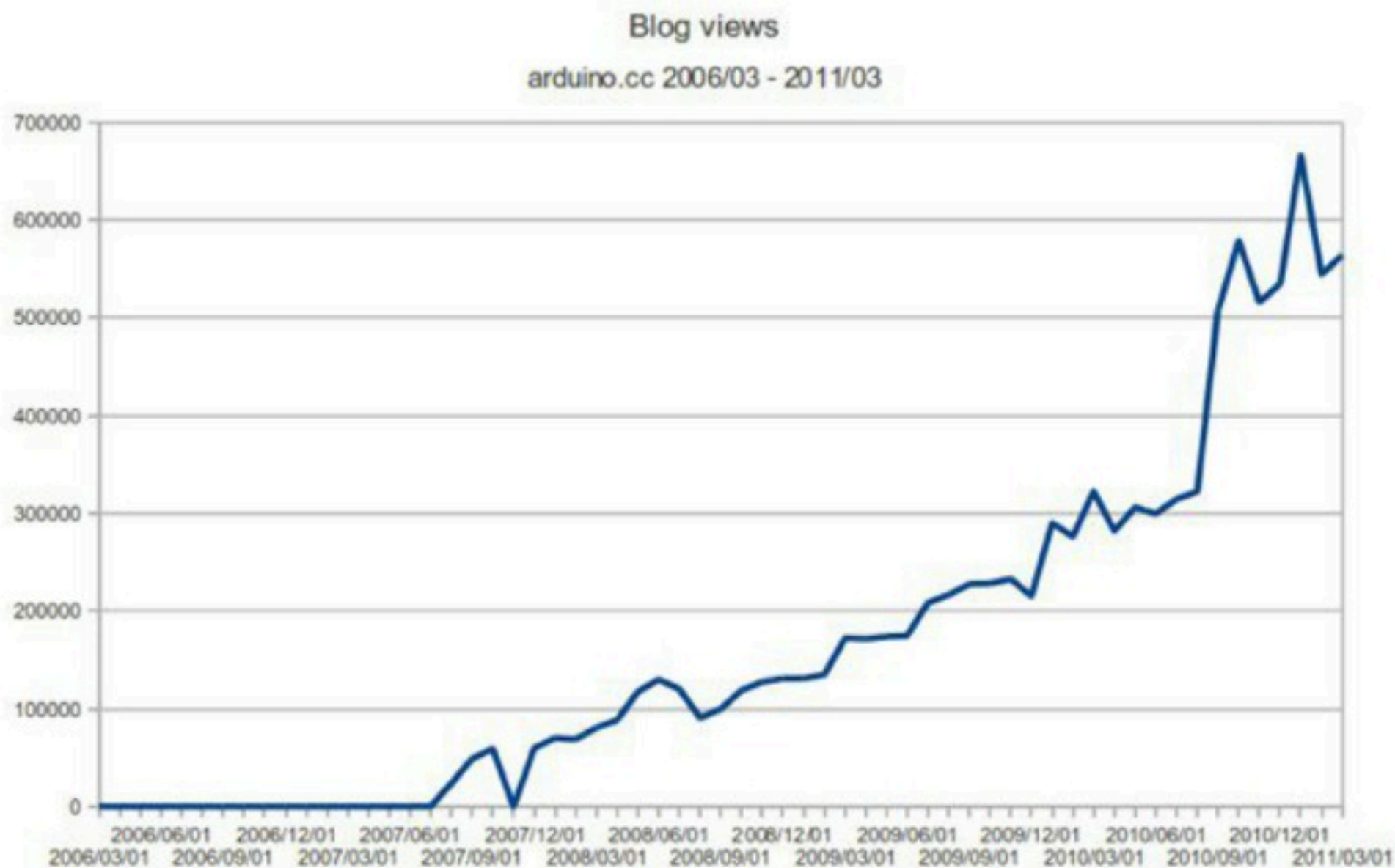
Massimo Banzi
CEO/Product Manager
Professor at SUPSI and CIID Copehagen

David Cuartielles
Education /WEB Services
Professor at K3 University of Malmo

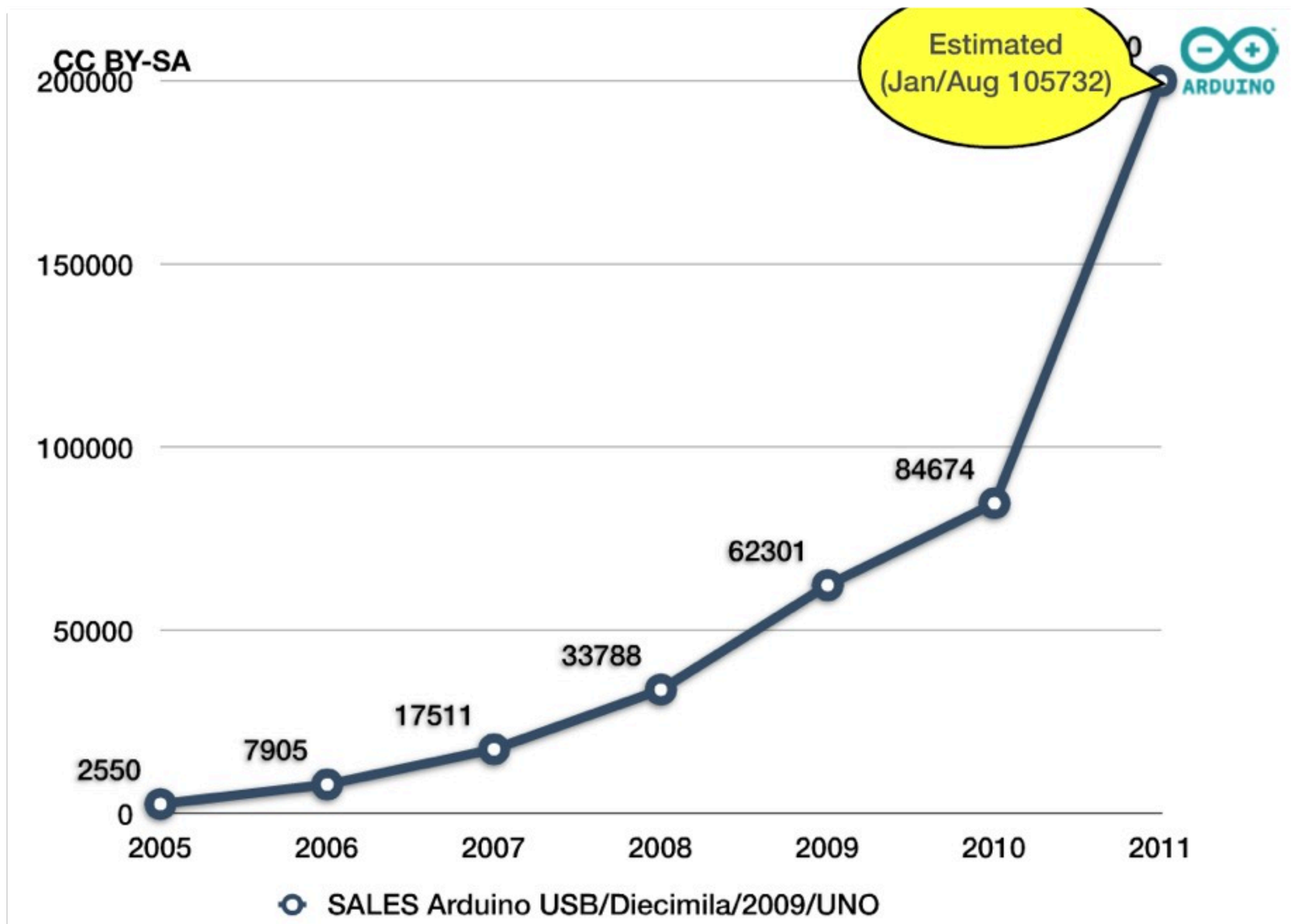
Tom Igoe
Documentation
Professor at ITP, New York University

Gianluca Martino
Hardware Design, Mfg and Distrivution

David A. Mellis
Software
PHd Student at MIT Media Lab



Blog views 2006-2011



Forum

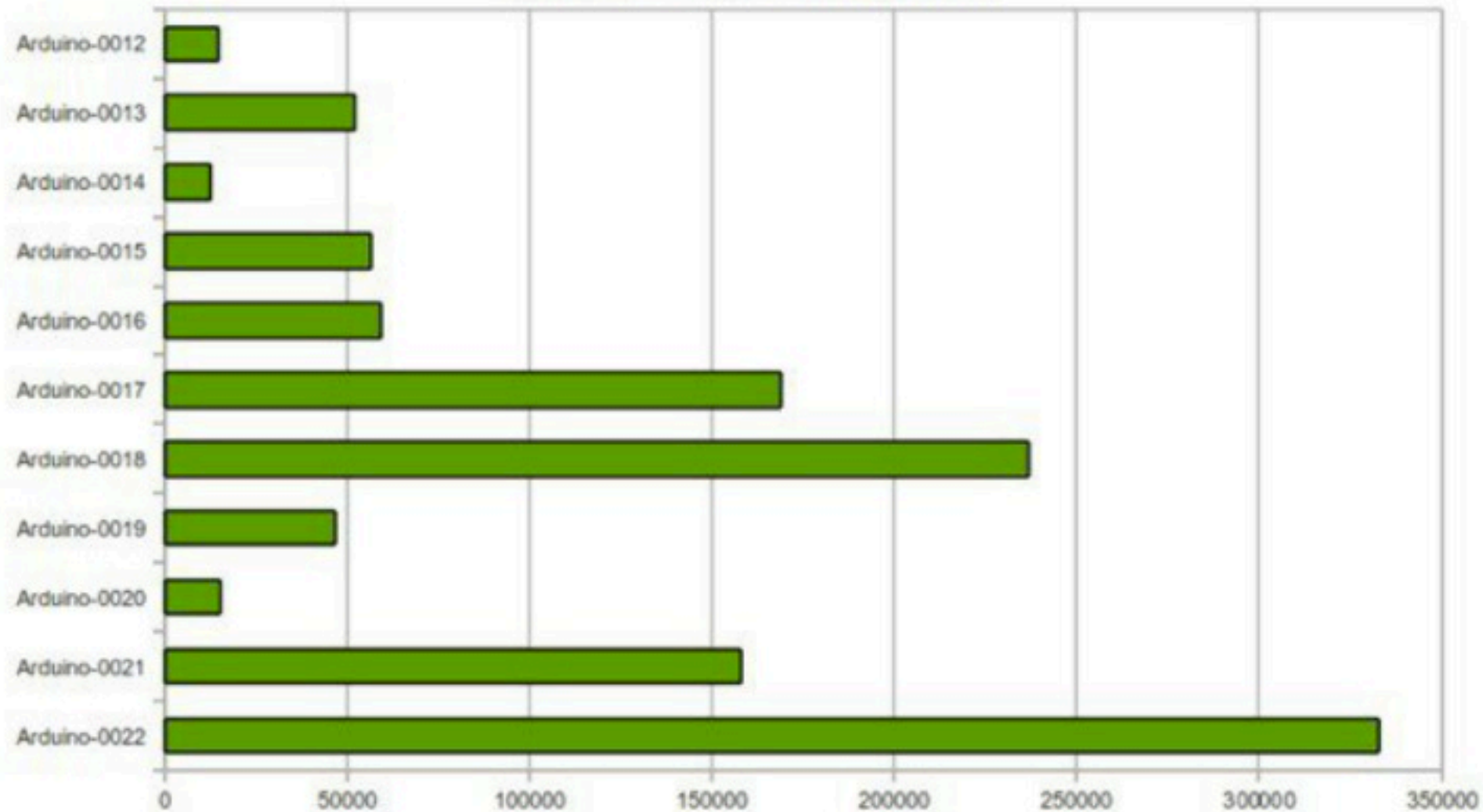
52979 Users

533405 Posts

71411 Topics

3.4M Pageviews/Month

Downloads by IDE version
arduino.cc - Google code - 2008-2011



IDE Downloads



CC BY-SA

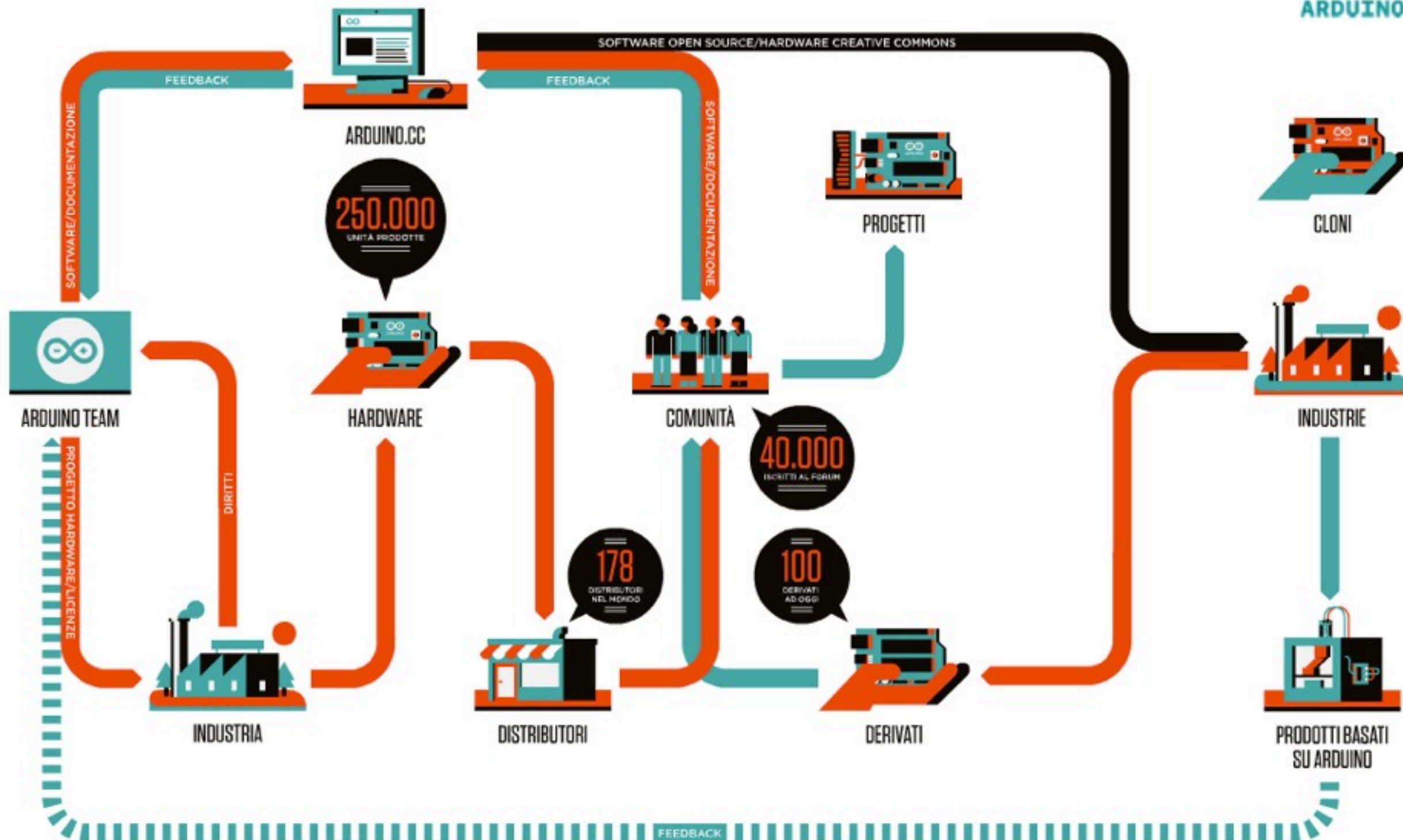


Illustration: Francesco Muzzi for Comitato Italia 150

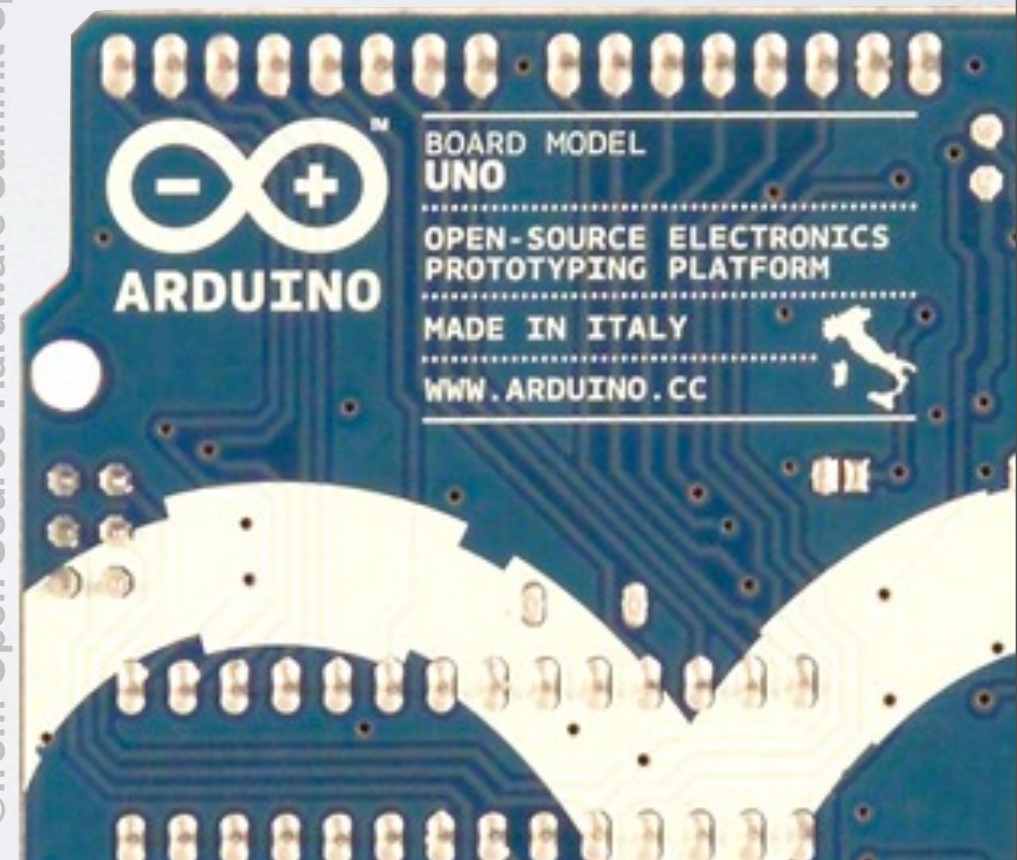
Business Model

@from Open Source Hardware Summit Speech 2011

認識ARDUINO的誕生

- Processing.org
- Wiring.org.co
- Arduino.cc

@from Open Source Hardware Summit Speech



PROCESSING.ORG

- 起源於2001年
- 以Java程式語言為基礎的視覺藝術軟體
- OpenSource
- MIT Media Lab
- Windows 、 Mac OS 、 Linux
- Coding is Art

Explode | Processing 1.5.1

STANDARD

Explode

```
/**
 * Explode
 * by Daniel Shiffman.
 *
 * Mouse horizontal location controls breaking apart of image and
 * Maps pixels from a 2D image into 3D space. Pixel brightness controls
 * translation along z axis.
 */

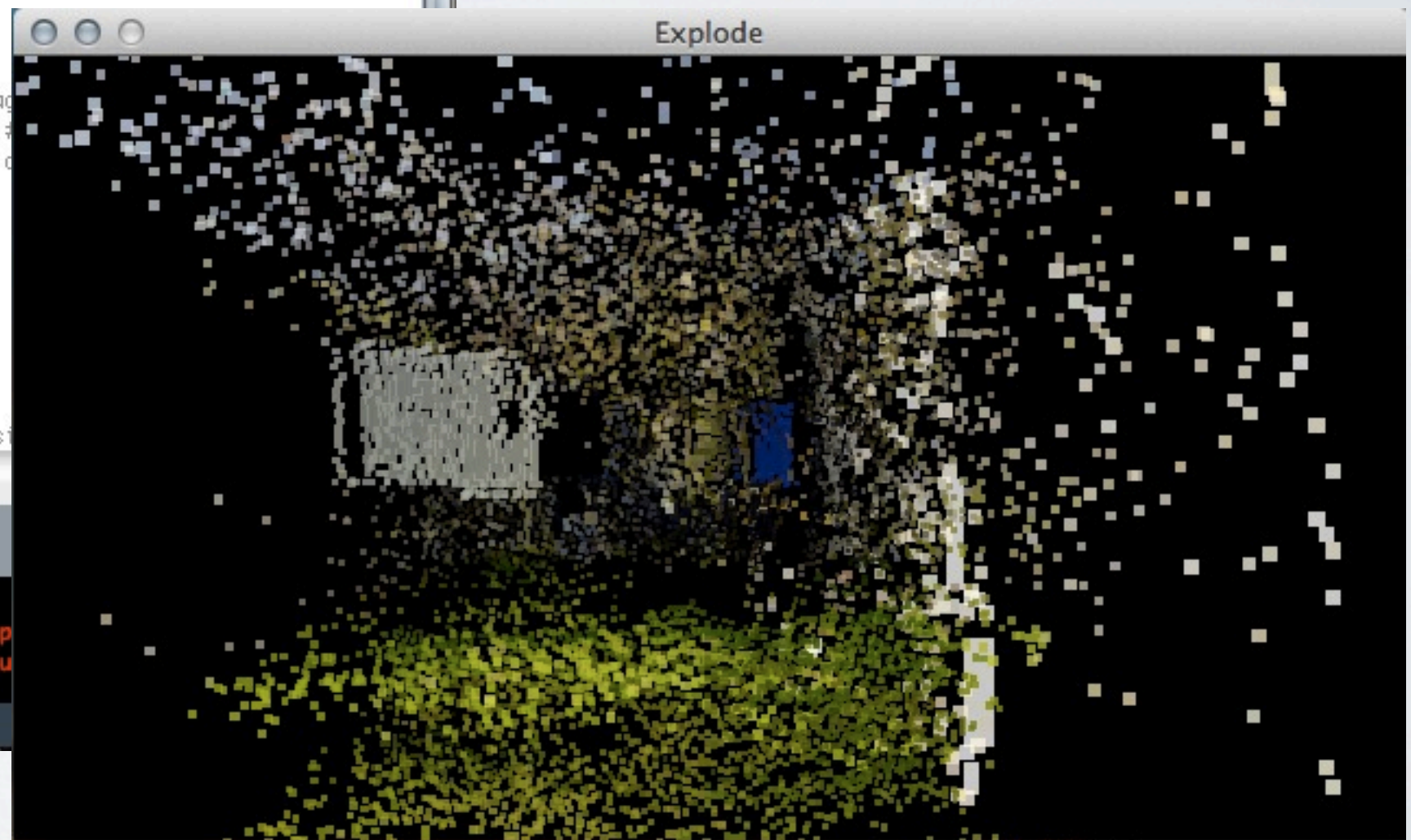
PImage img; // The source image
int cellsize = 2; // Dimensions of each cell in the grid
int columns, rows; // Number of columns and rows in our system

void setup() {
  size(640, 360, P3D);
  img = loadImage("eames.jpg"); // Load the image
  columns = img.width / cellsize; // Calculate # of columns
  rows = img.height / cellsize; // Calculate # of rows
}

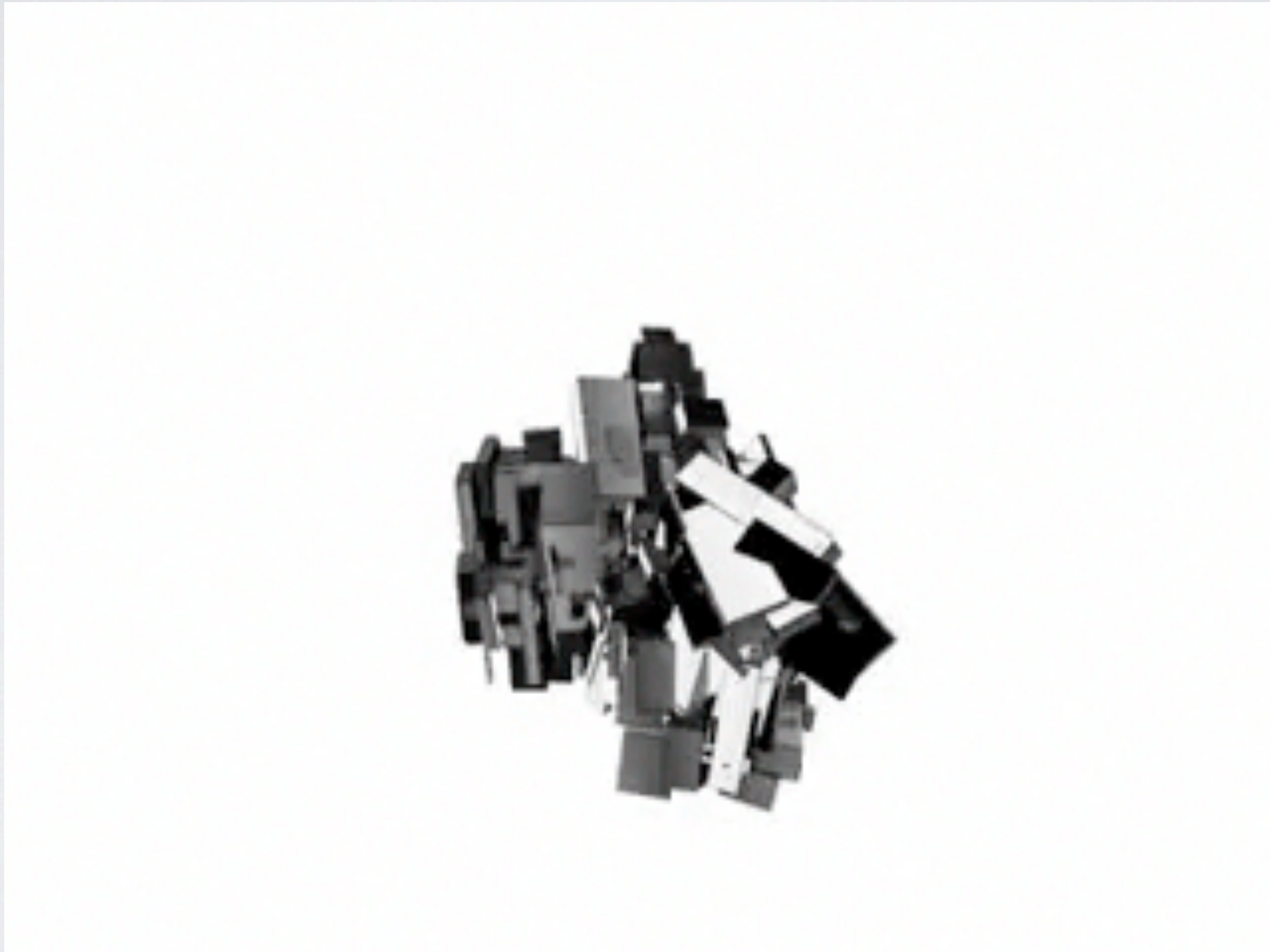
void draw() {
  background(0);
  // Begin loop for columns
  for (int i = 0; i < columns; i++) {
    // Begin loop for rows
    for (int j = 0; j < rows; j++) {
      int x = i*cellsize + cellsize/2; // x position
```

2011-12-06 01:03:49.189 java[21291:5913] Can't open /Library/InputManagers/MultiClutchInputManager.bundle

1



PROCESSING VISUALS



<http://www.youtube.com/watch?v=AQr0tIQy9CI>

WIRING.ORG.CO

- 起源於2003年
- Arduino的前身
- 首創OpenSource電路原型開發平台
- 使用Processing IDE作為程式開發環境
- 公開bootloader、電路設計、編譯器、燒錄器軟體、IDE介面原始碼、眾多感測器連接範例



What will *YOU* do with the **W**?

Wiring
get on board.

- » Download Wiring
- » Getting the Wiring hardware
- » Browse Tutorials
- » Play with Examples

sketch_dec06a | Wiring 0100

sketch_dec06a

```
void setup()
{

}

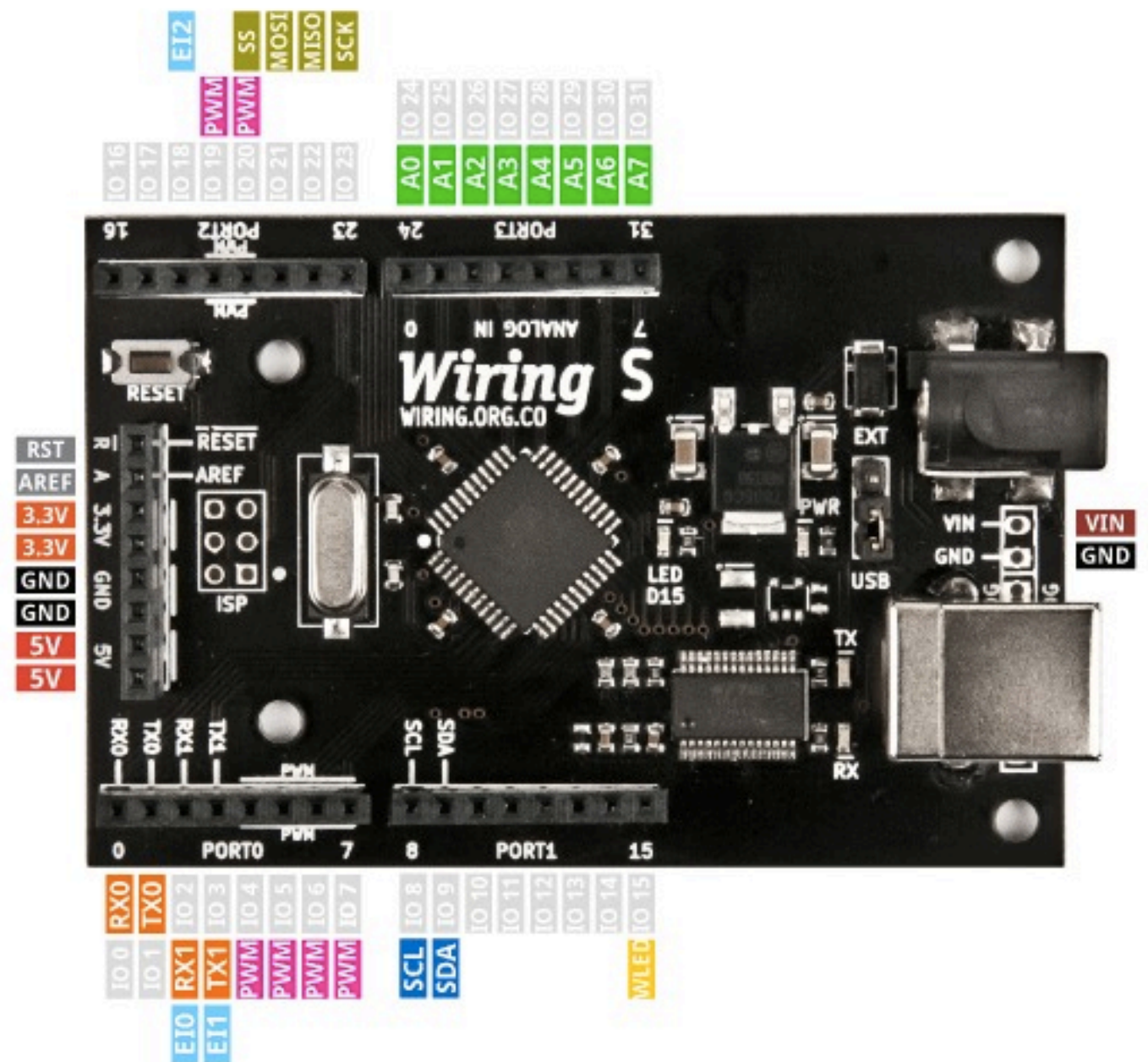
void loop()
{

}
```

Done Uploading.

Binary sketch size: 1922 bytes (of a 30720 byte maximum) - 6%
Serial monitor started after upload (Wiring -> Preferences)

6board: Arduino Duemilanove or Nano w/ ATmega328 @ 16 MHz on /dev/ttyUSB0



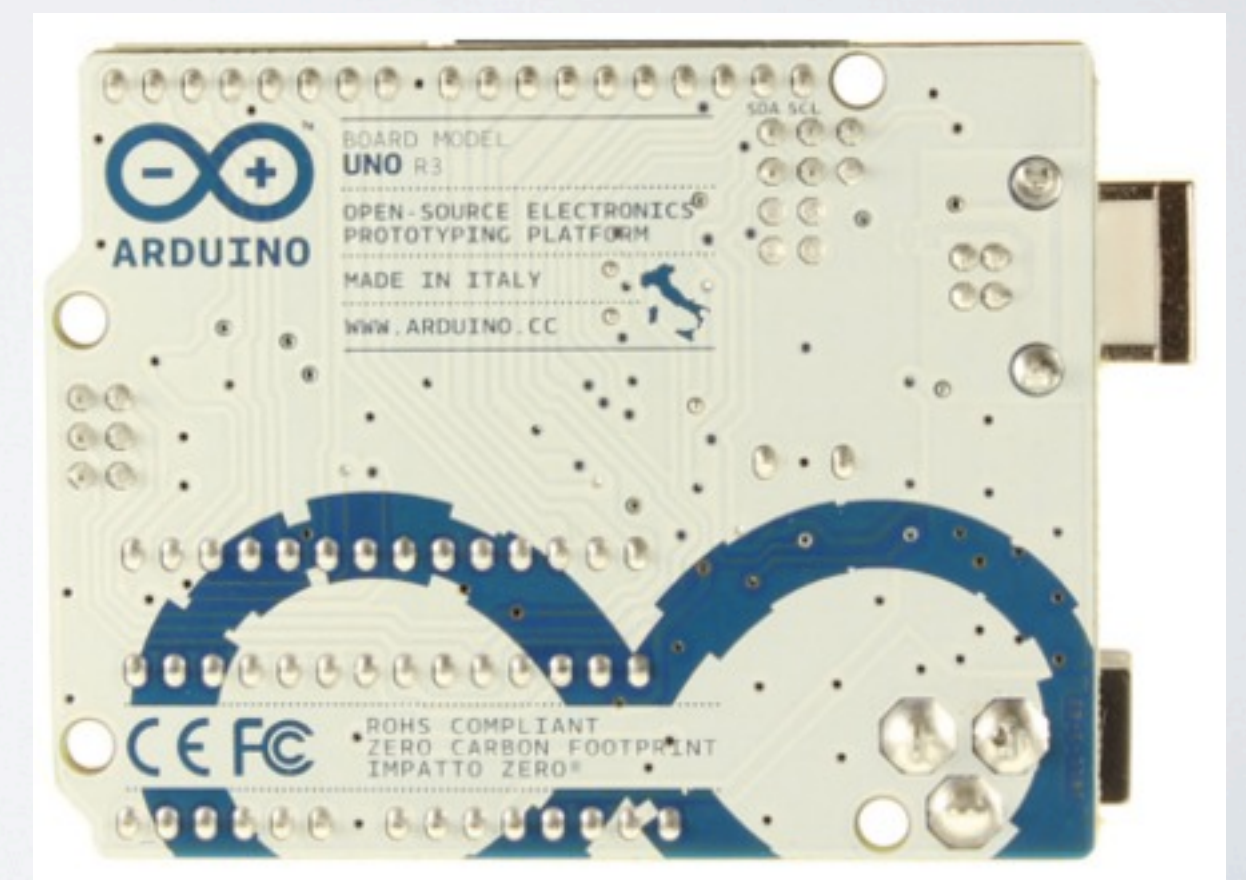
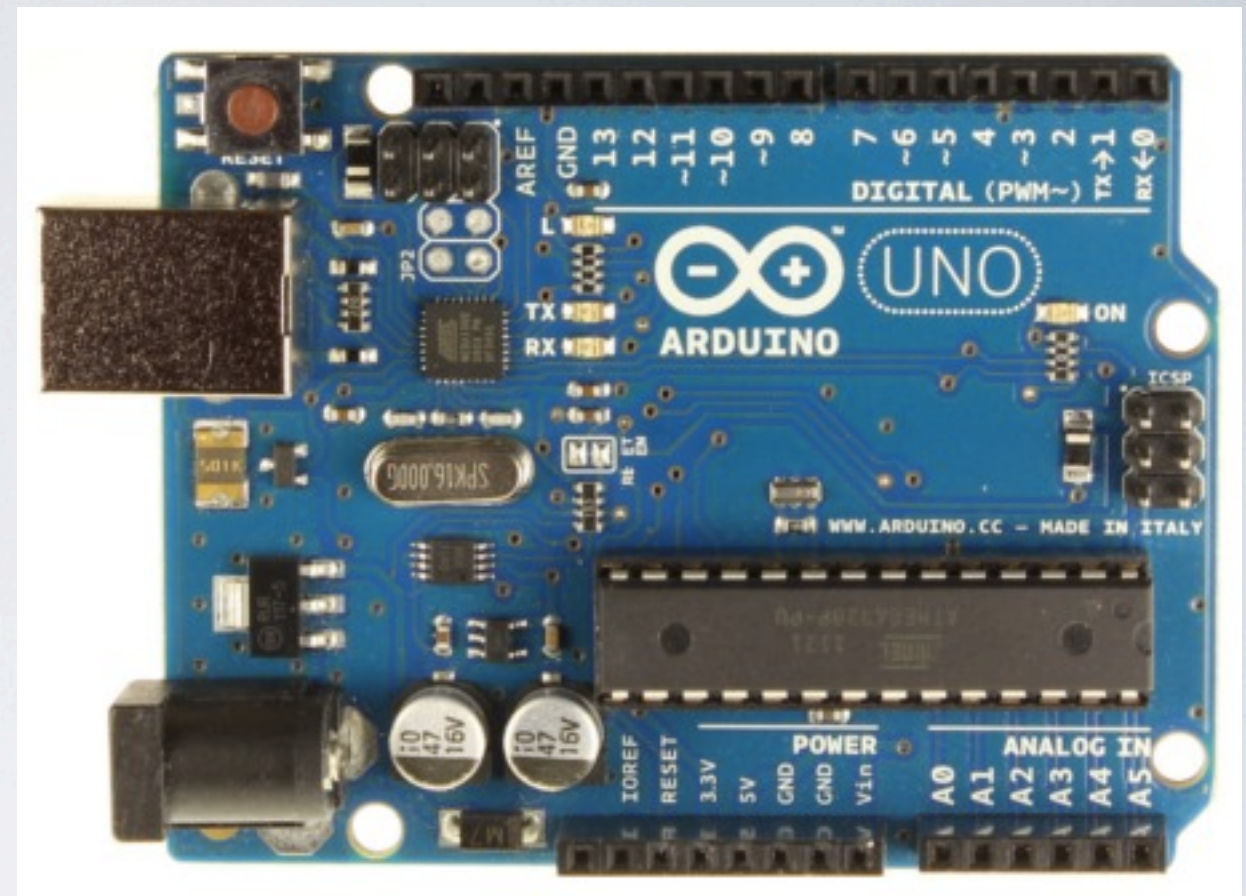
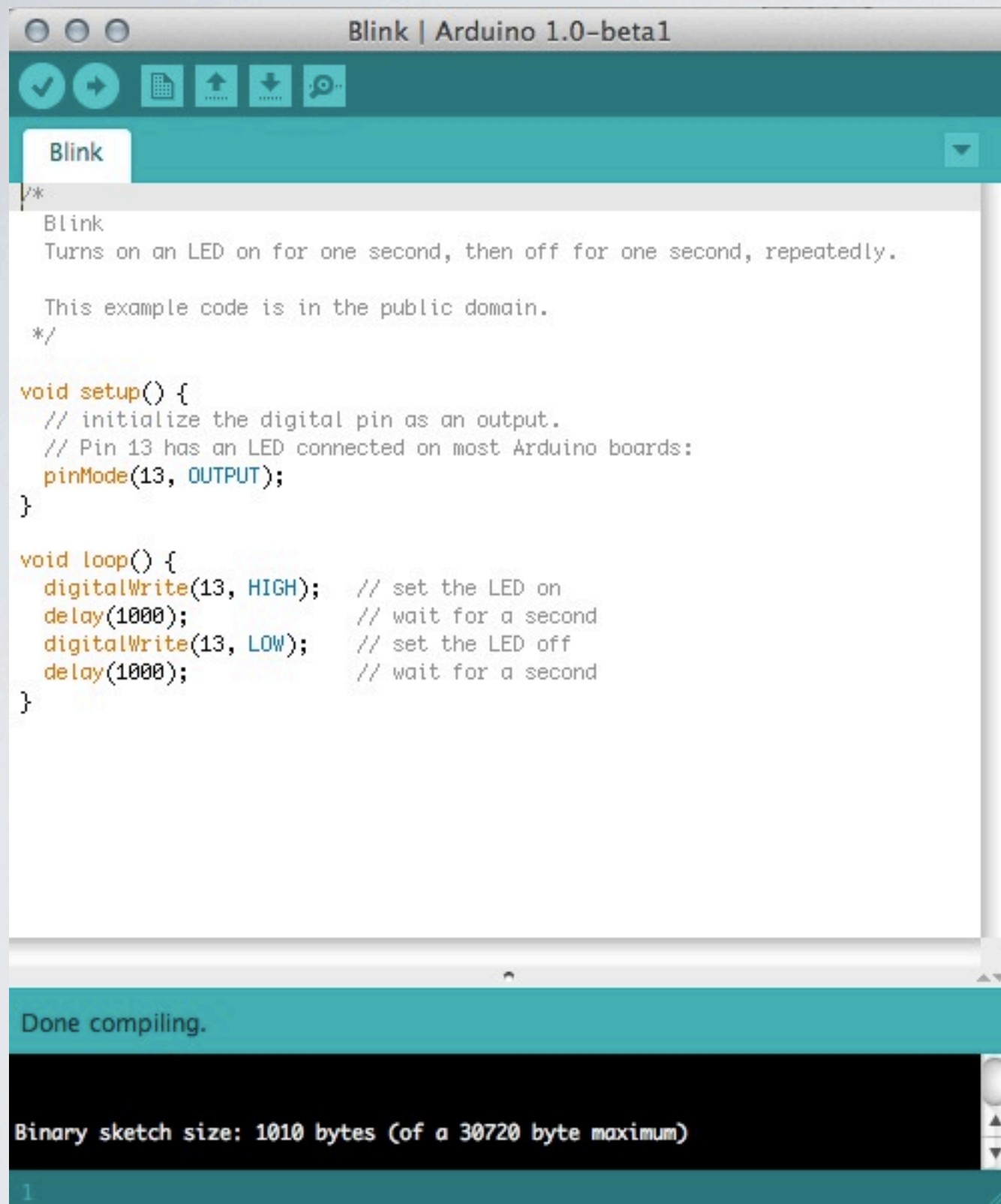
LEGO HELLO WORLD



<http://www.youtube.com/watch?v=zX09WnGU6ZY>

ARDUINO.CC

- 創立於2004年
- 結合Processing與Wiring的優點，採用更便宜的架構
- 當時的主要對手為BasicStamp
- 採用Atmel AVR的相關OpenSource軟體
- 簡單使用、零件成本便宜、上手速度快、討論區完整、容易複製

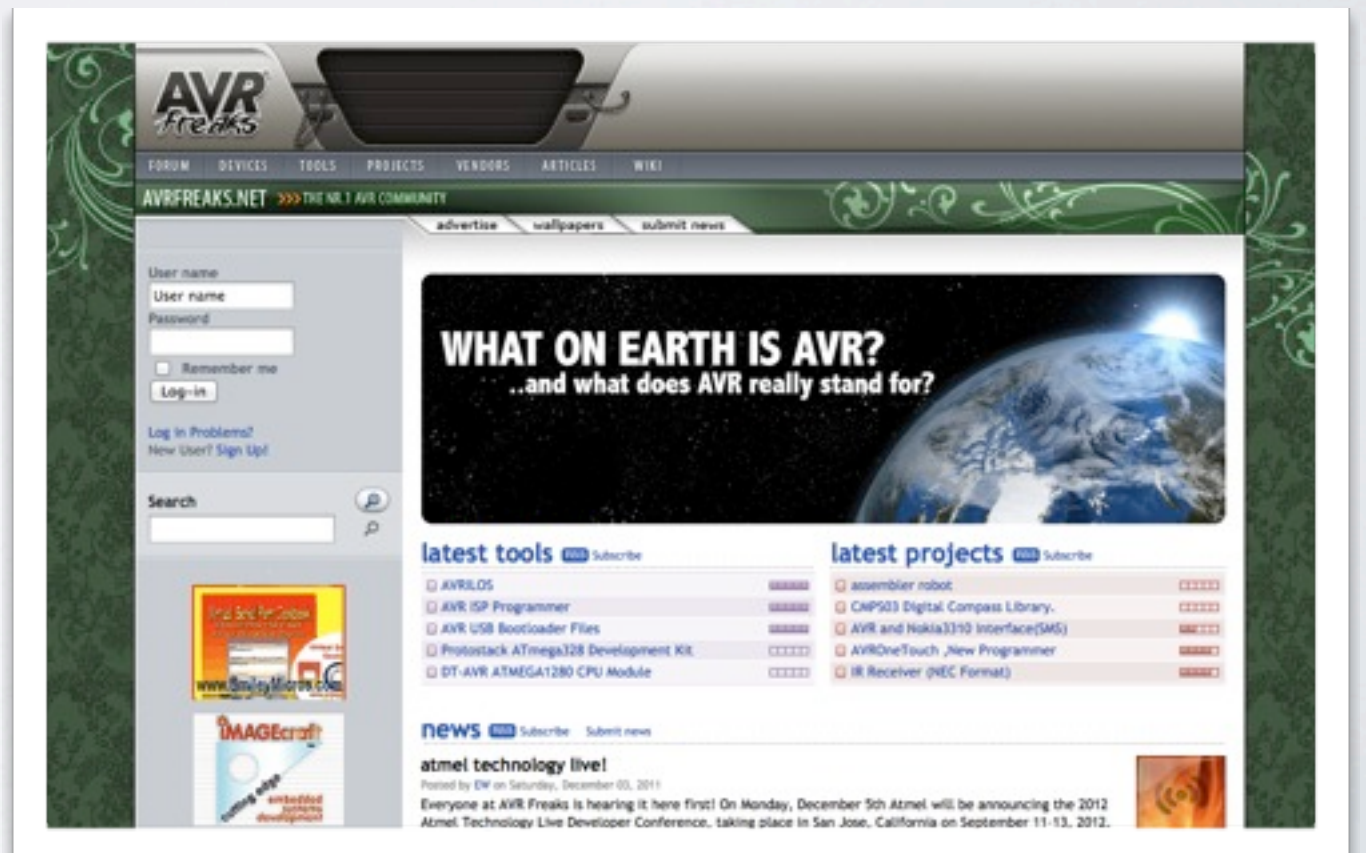


ARDUINO社群的形成

- AVR Freaks 大量的DIY玩家討論AVR
- Avrdude , avrgcc, avr-g++, Java 開源軟體為基礎
- Arduino 軟硬體完全開放，不留任何機密
- MakeMagaize, Instructables.com DIY教學網站大量分享應用範例，破解心得
- Sparkfun.com, seeedstudio.com, adafruit.com 提供完整的DIY套件、零件、電路板、模組、擴充板，甚至提供範例程式碼、

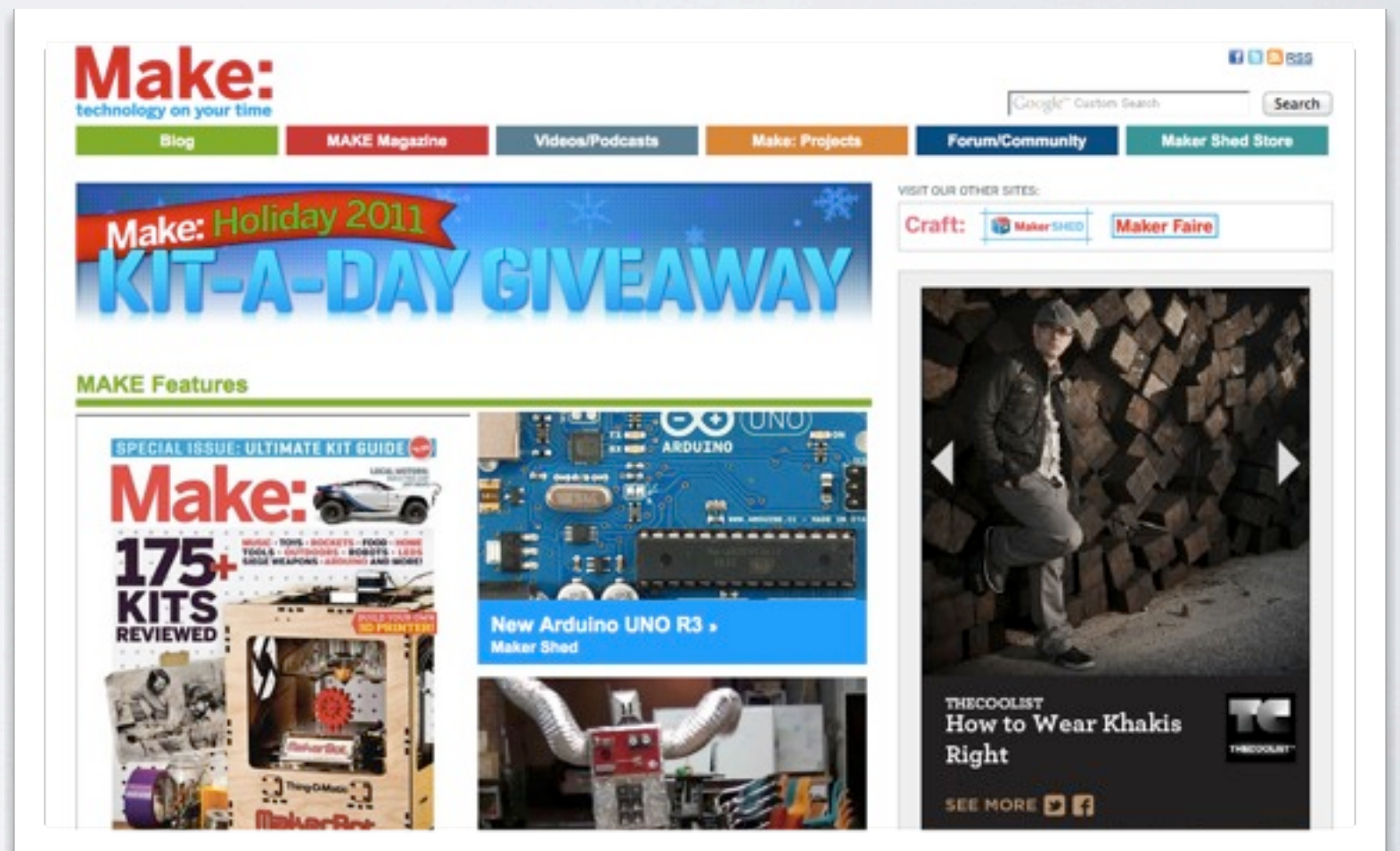
AVR FREAKS

- 眾多AVR DIY玩家資訊匯集地
- 唯一獲得原廠支援的論壇
- 提供破解、複製教學資料
- 販賣各式AVR工具
- 加入完全免費



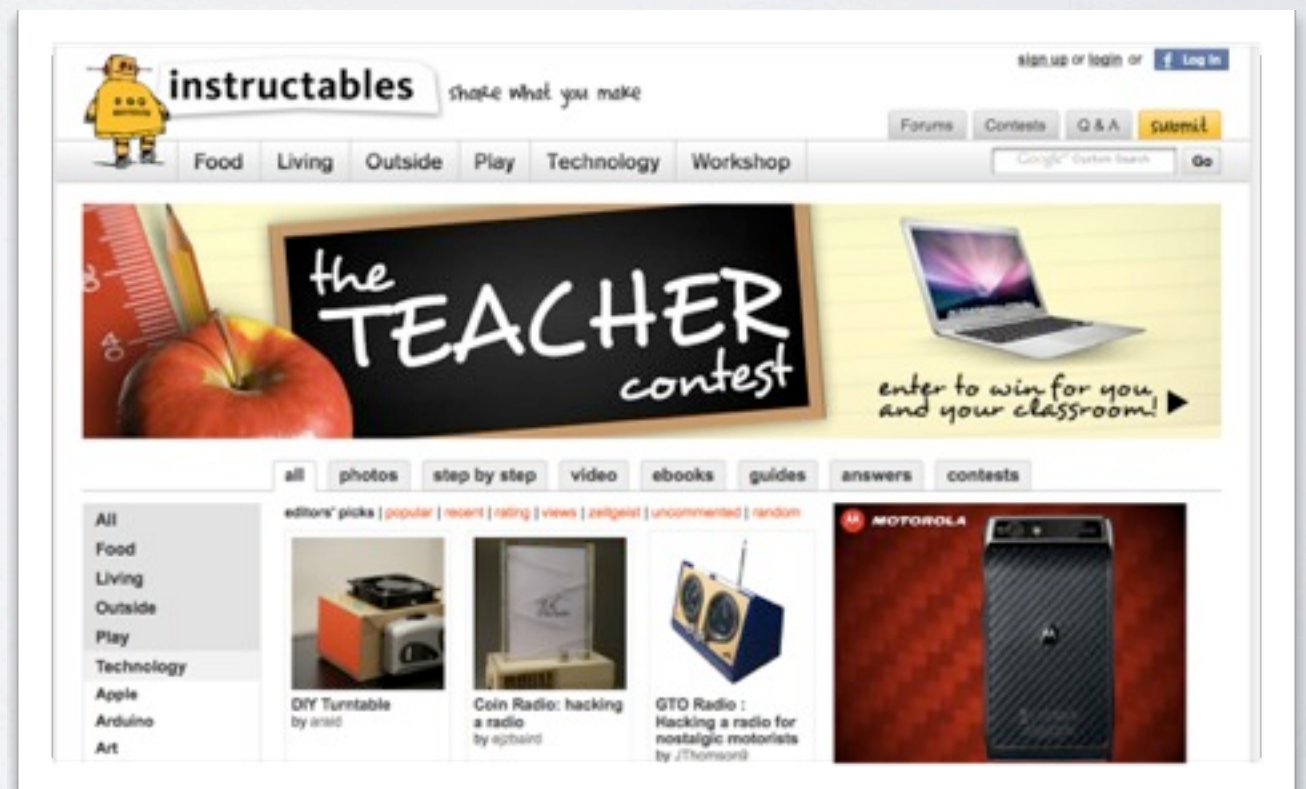
MAKE:MAGAZINE

- DIY月刊/線上討論/教學/影片
- 每期都有電子DIY的專題報導
- 專案製作教學與材料販賣相連
- 提供高畫質教學影片
- 熱絡的DIY討論區
- 定期舉辦工作坊
- 年度DIY創意競賽



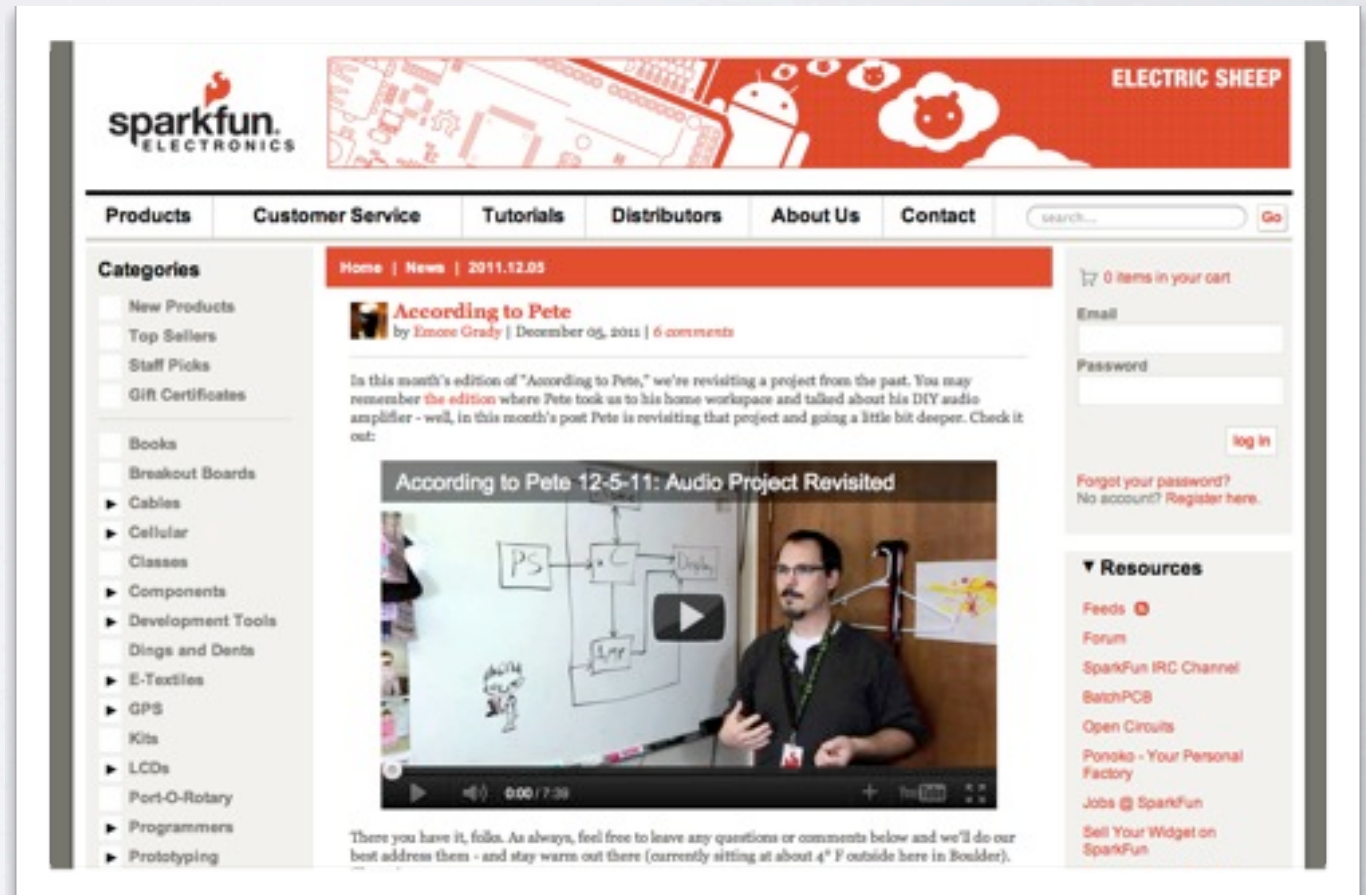
INSTRUCTABLES.COM

- DIY製作分享平台
- 會員可下載完整製作過程與材料清單[pdf]
- DIY範圍廣：美食、生活、戶外、科技、玩樂
- 適合樂於分享創意的作者
- 上萬篇DIY創意
- 分類清楚
- 入會兩年只需\$40美元



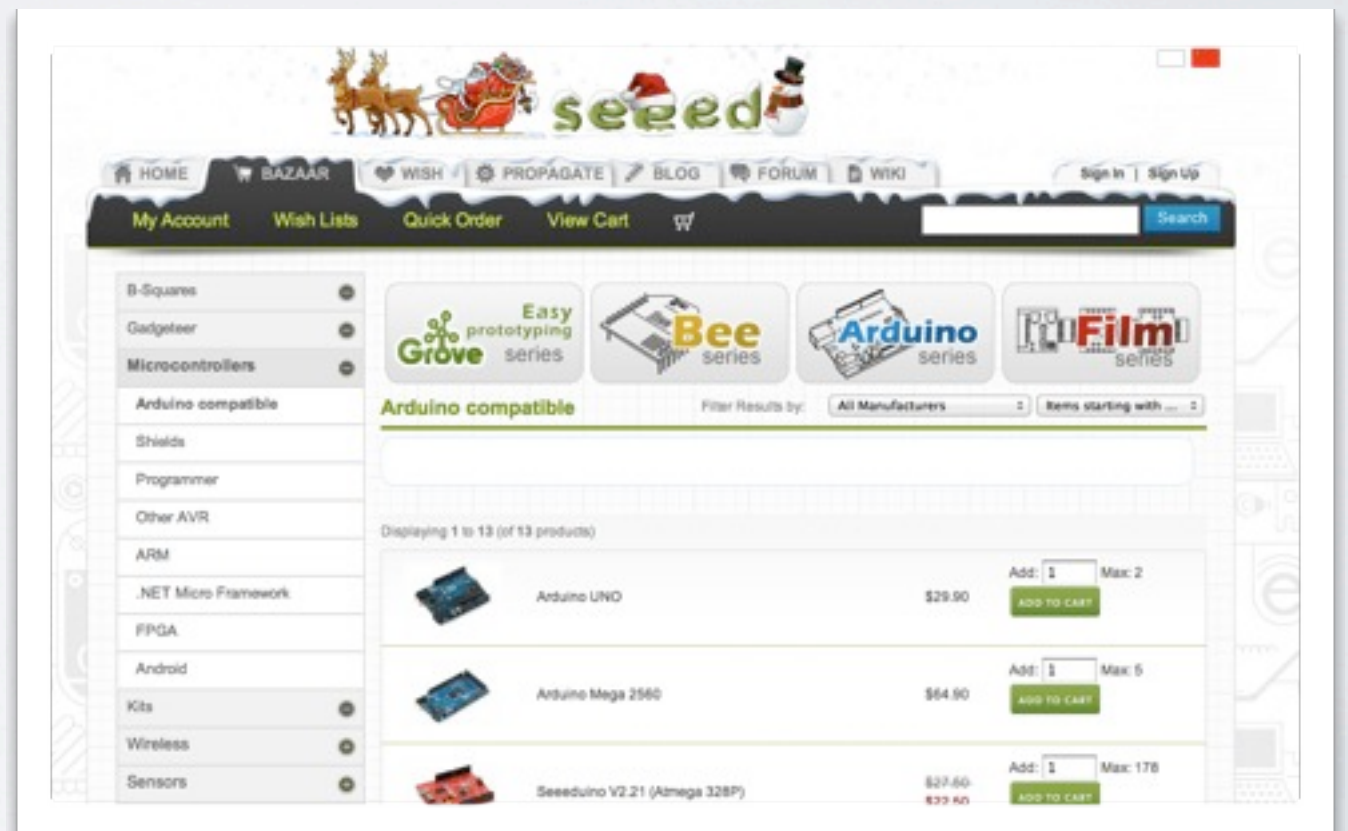
SPARKFUN.COM

- 最完整的DIY套件、模組、開發板、零件販賣商
- 套件、模組都有相關教學、範例程式碼
- 自行研發DIY模組與PCB板設計
- 每項產品都有豐富的討論串
- 發貨速度快，配合國際貨運最快2天到貨
- 即時上架最新的開發模組



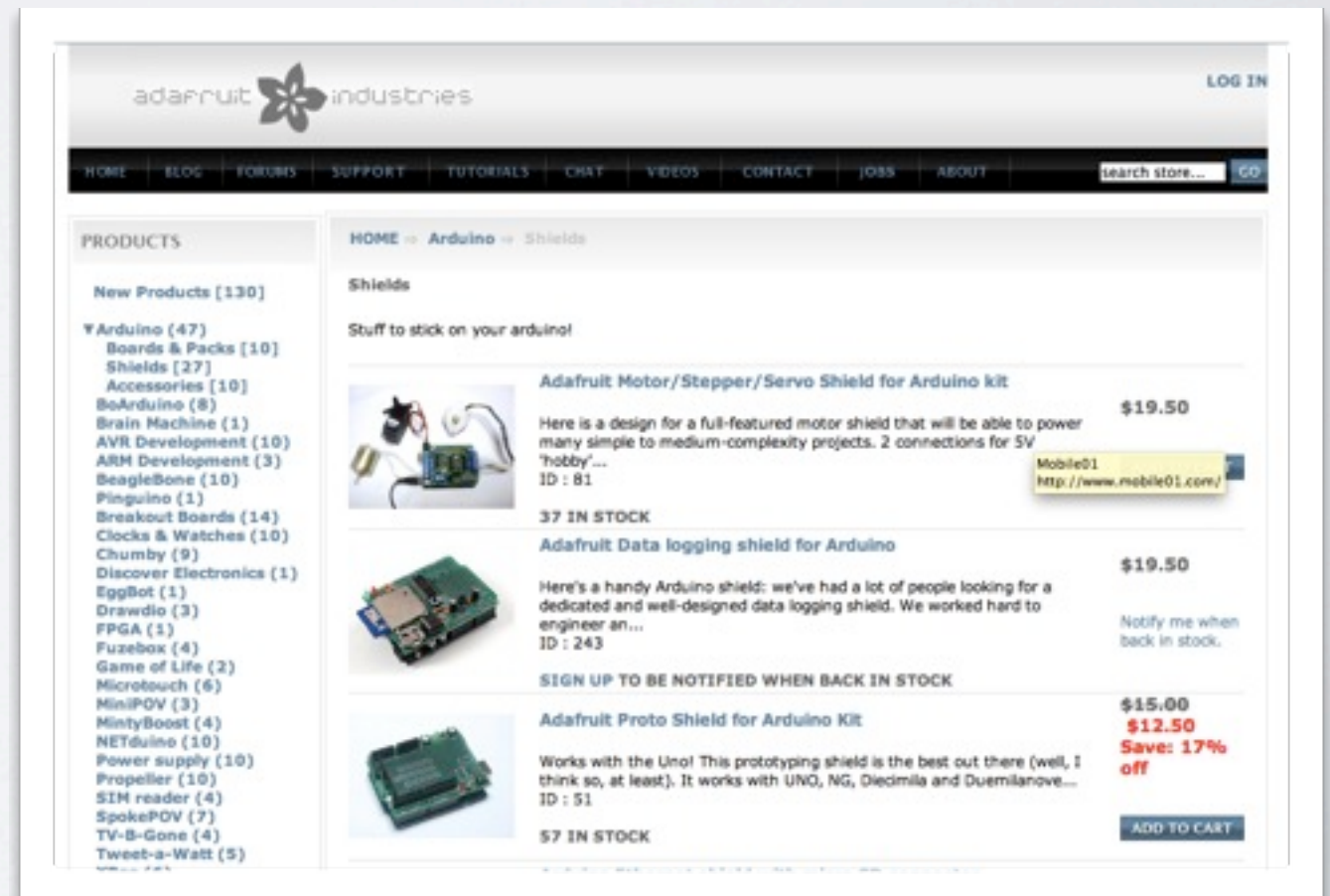
SEEEDSTUDIO.COM

- Hacker最愛，最多的特殊模組套件
- Arduino延伸版本匯集地
- 眾多的擴充板套件
- 自行研發的PCB板設計
- 機器人套件較多
- 可代為設計電路原型



ADAFRUIT.COM

- 以OpenSource Hardware為主的套件與元件銷售
- 自行設計Open Source Hardware擴充板
- 豐富的教學與影片
- 價格最為合理便宜
- 工作坊教學套件居多

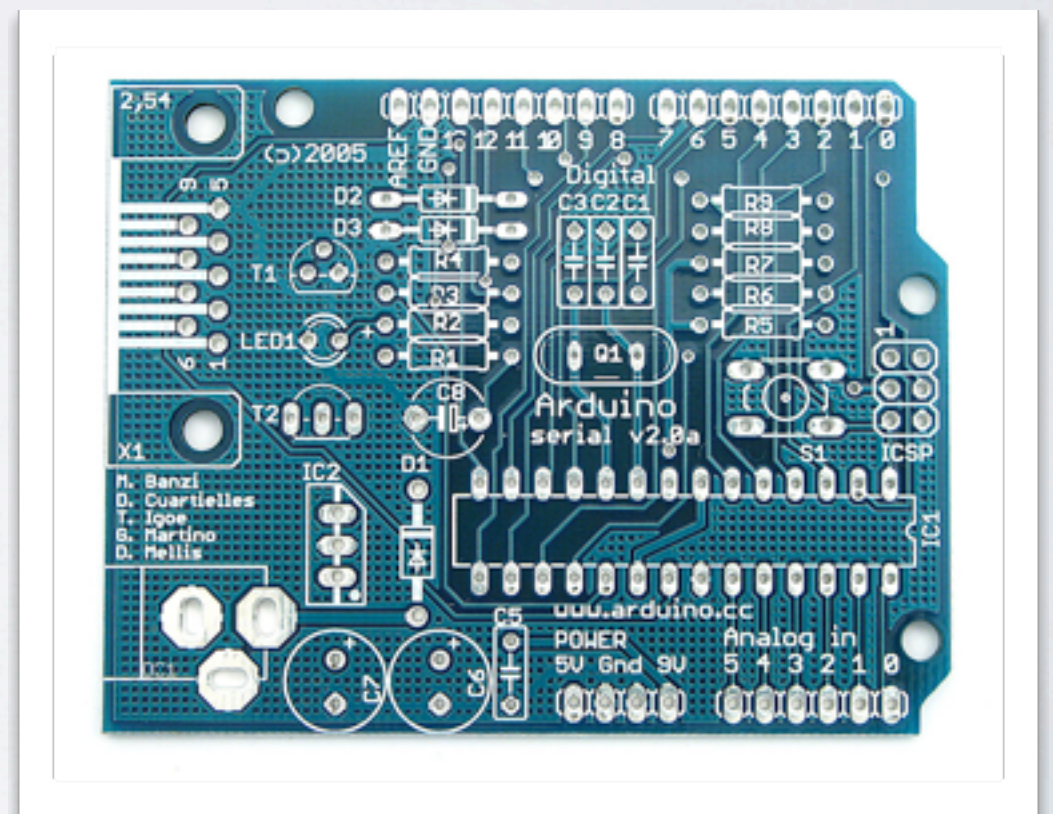


ARDUINO書籍

- 入門：Getting Started with Arduino/**踏進互動科技世界-使用 Arduino**
- **超圖解Arduino互動設計入門**
- 範例：Making Things Talk
- 秘技：Arduino CookBook
- 核心：Arduino Internals 或 Introduction to Embedded Systems: Using ANSI C and Arduino Development Environment
- 無線：Building Wireless Sensor Networks/ **建置無線感測網路**
- 機器人：Make:Arduino Bots and Gadgets
- 語法：Beginning Ardino Programming
- ADK：Beginning Android ADK with Arduino [2012/3/26]
- iOS：iOS Sensor Apps with Arduino
- 互動概念：Programming Interactivity

PCB LAYOUT軟體

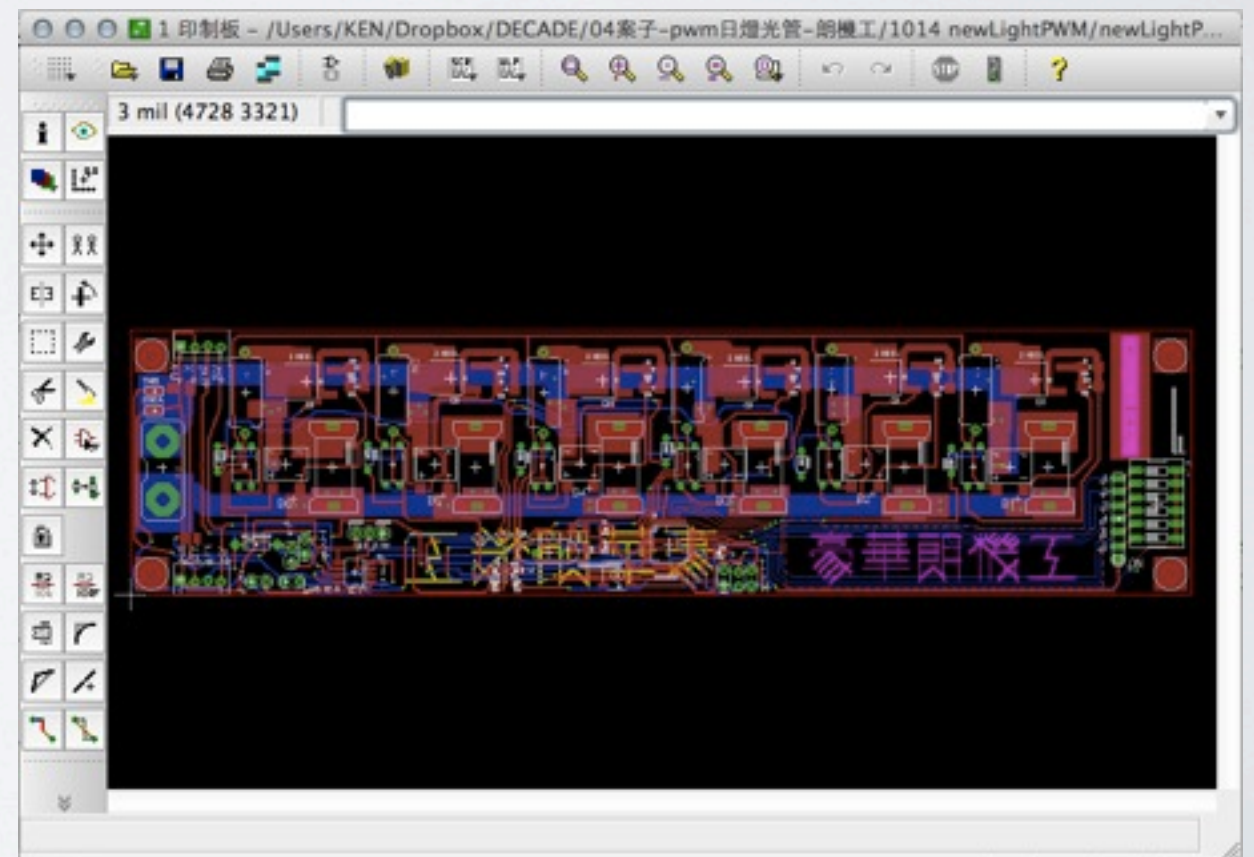
- PCB Layout難度降低，DIY玩家自行複製容易
- Protel 99 SE / Altium Designer 10
- Eagle PCB Design 初學者免費首選
- PADS PCB Design
- OrCAD
- AutoCAD



EAGLE PCB

- 跨平台：Windows、Mac OS、Linux
- 設計10cm x 15cm 以內免費使用
- 元件豐富、可自定元件
- Sparkfun, Seeedstudio, adafruit 所設計的模組與Footprint皆公開於網路上
- 容易上手

參考網址：<http://www.cadsoftusa.com>



其他開放硬體平台

- Raspberry Pi
- TI
 - BeagleBoard[OMAP 3530]
 - PandaBoard[OMAP4430]
 - LaunchPad[MSP430Gxxxx]
 - eZ430 [cc430F6137]
- Atmel - ARM7 - Netduino
[AT91SAM7S12][.Net Micro Framework]
- Parallax - BasicStamp



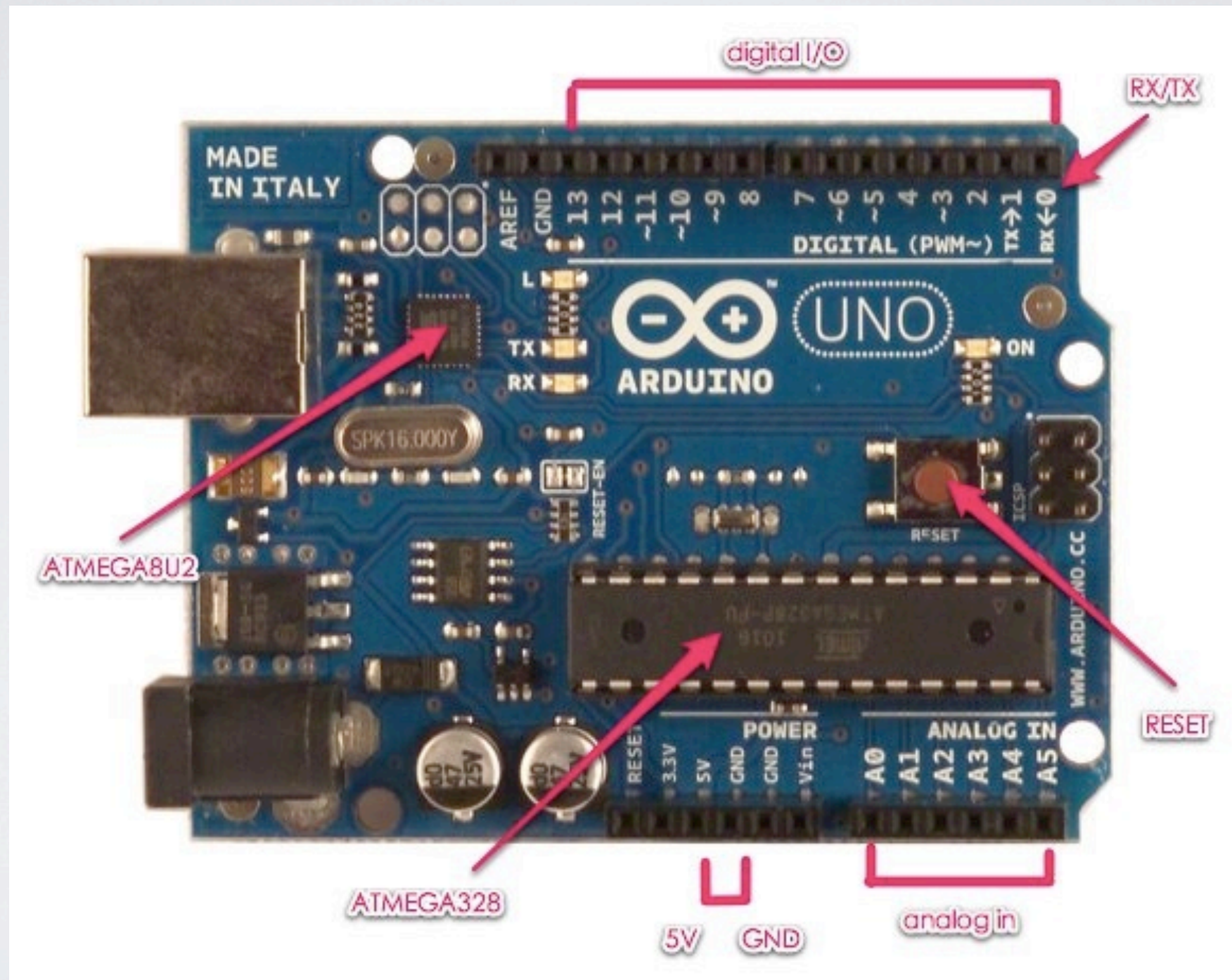


ARDUINO FEATURE

- Source 電路圖設計 + 程式開發介面
- 免費下載，也可依需求自己修改!!
- Arduino 可使用ISCP線上燒入器，自我將新的IC晶片燒入bootloader
- 可依據官方電路圖，簡化Arduino模組，完成獨立運作的微處理控制
- 可簡單地與感測器，各式各樣的電子元件連接(EX：紅外線,超音波,熱敏電阻,光敏電阻,伺服馬達,...等)
- 支援多樣的互動程式 ex: Flash,Max/Msp,VVVV,PD,C,Processing... 等
- 使用低價格的微處理控制器(ATMEGA8/168/328) NT\$120~NT\$180
- USB介面，不需外接電源。另外有提供9VDC輸入

ARDUINO BOARD

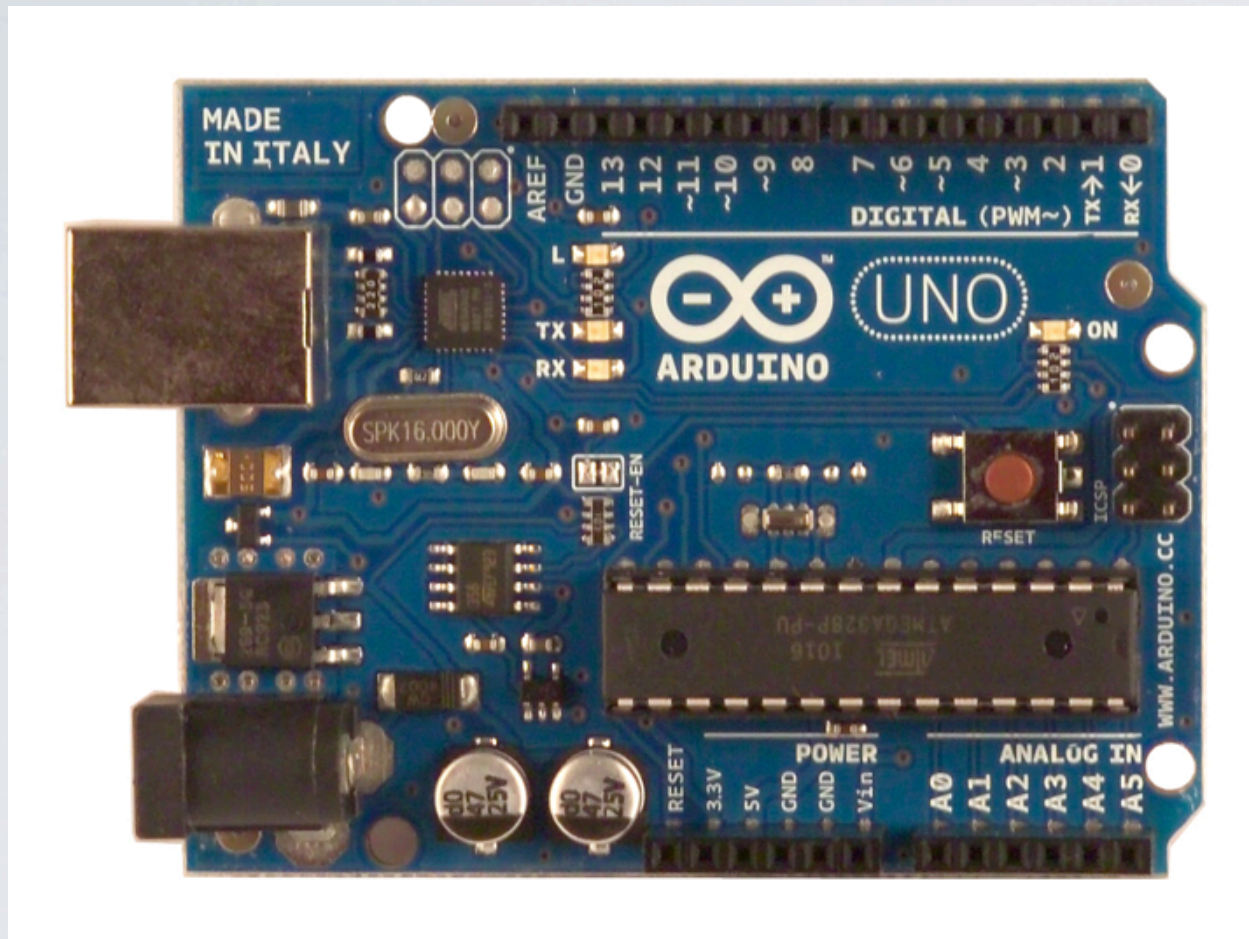
\$29.5



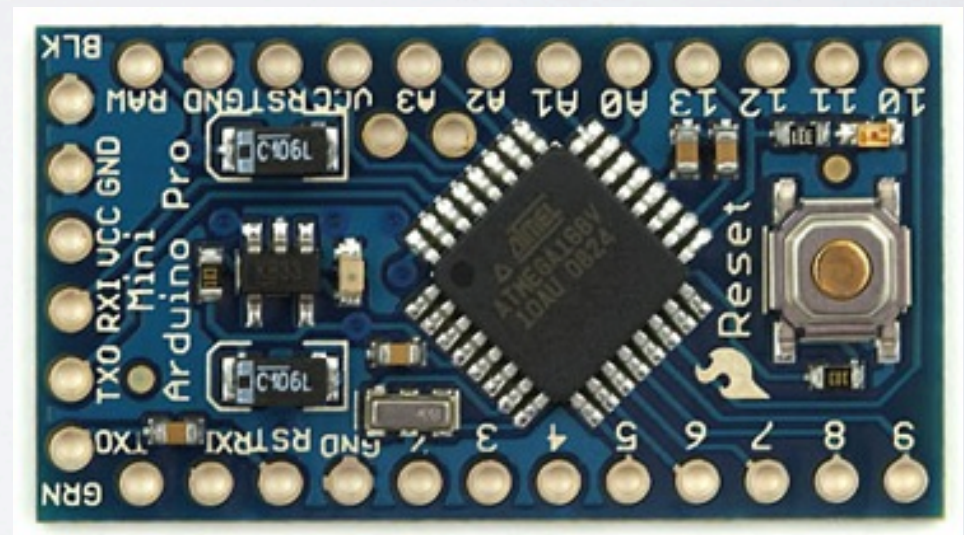
ARDUINO SPECIFICATION

- **Digital I/O** 數位式輸入/輸出端共 1~13
- Analog I/O 類比式輸入/輸出端共 0~5
- 支援USB接頭傳輸資料及供電(不需額外電源)
- 支援ICSP線上燒錄功能
- 支援TX/RX端子
- 支援AREF端子
- 支援3~6組PWM端子
- 輸入電壓：接上USB時無須供電，5V~12V DC輸入
- 輸出電壓：5V DC輸出

Arduino UNO



Arduino Pro Mini

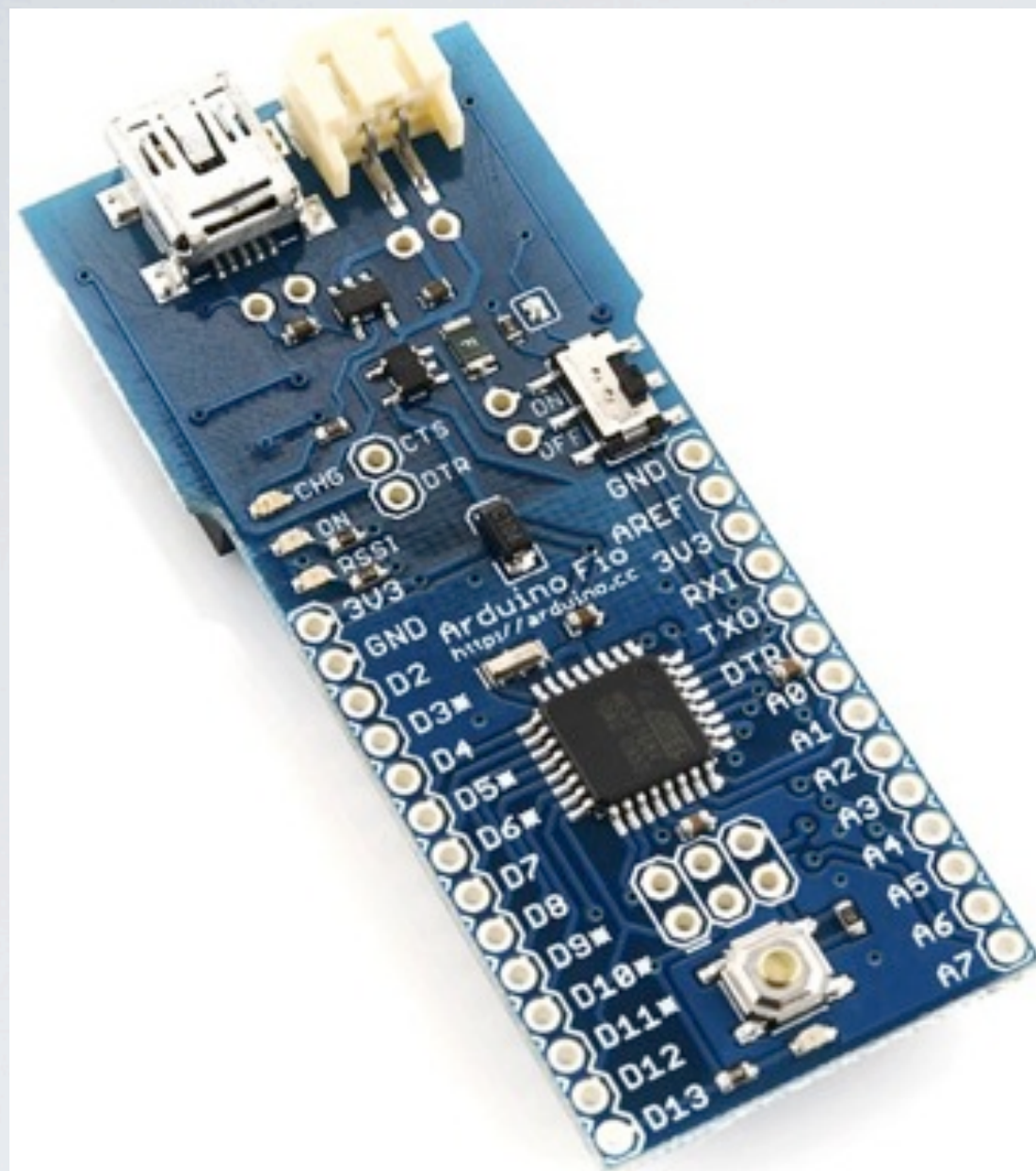


33mm x 18mm

ArduinoBT

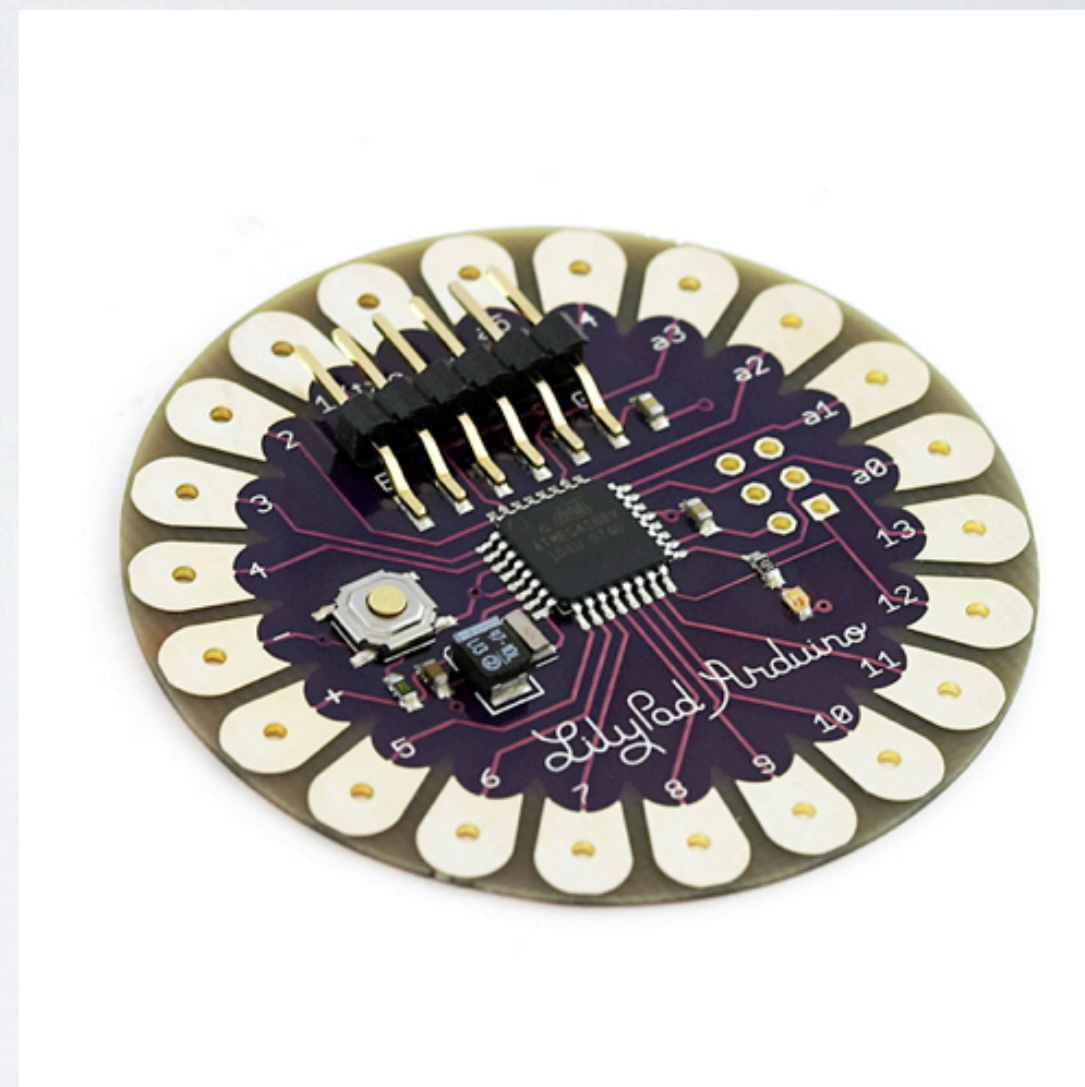
Arduino MEGA 2560





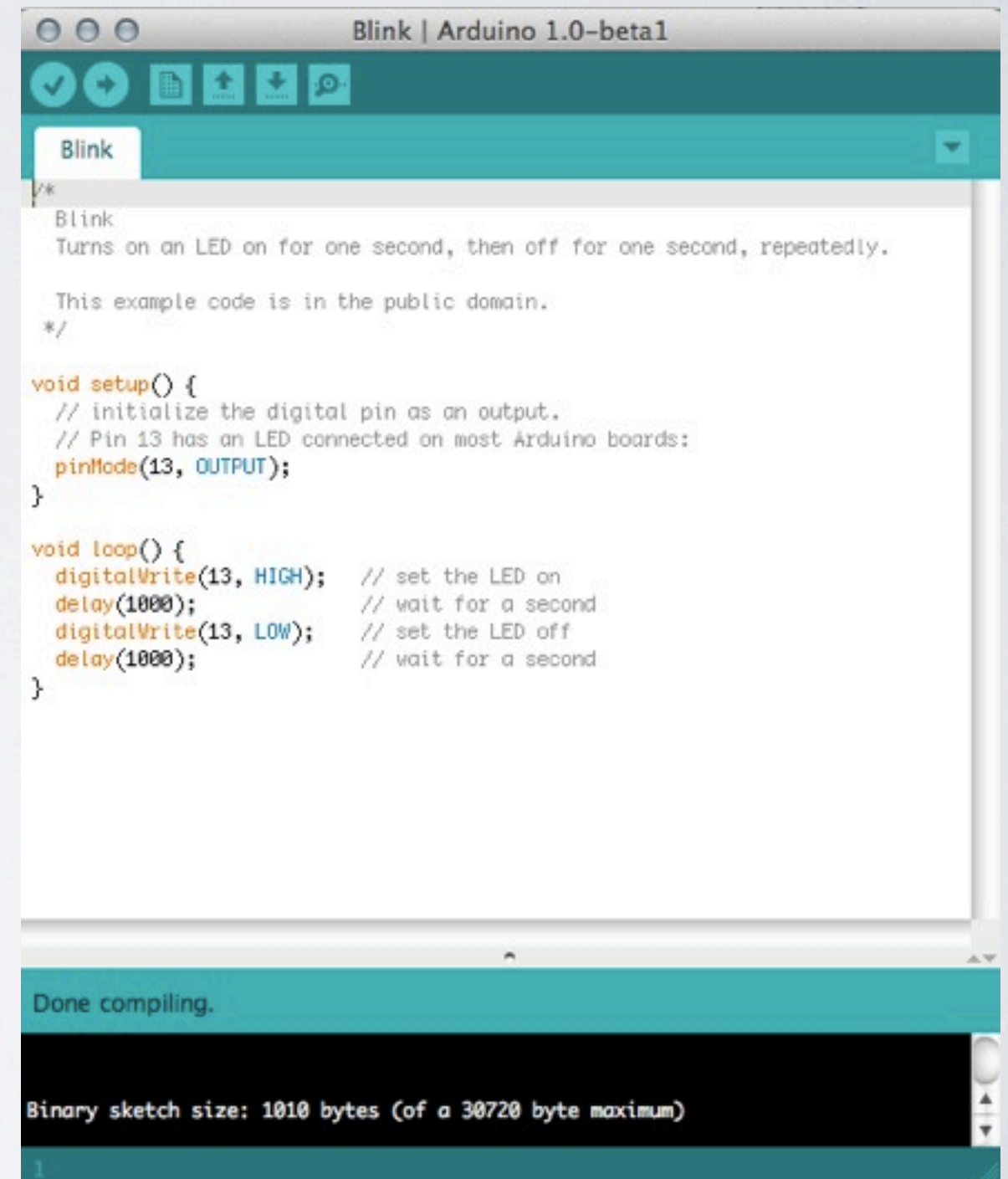
Arduino FIO

LilyPad



ARDUINO SOFTWARE

- Last Version: Arduino 1.0
- Windows
 - Xp, vista32/64, win7
- Mac
 - PPC, intel (MAC OS 10.7 Lion)
- Linux



The screenshot shows the Arduino IDE interface. The title bar reads "Blink | Arduino 1.0-beta1". The menu bar includes icons for check, add, file, upload, download, and help. The "Blink" menu item is selected. The main text area contains the following code:

```
/*  
  Blink  
  Turns on an LED on for one second, then off for one second, repeatedly.  
  
  This example code is in the public domain.  
  */  
  
void setup() {  
  // initialize the digital pin as an output.  
  // Pin 13 has an LED connected on most Arduino boards:  
  pinMode(13, OUTPUT);  
}  
  
void loop() {  
  digitalWrite(13, HIGH); // set the LED on  
  delay(1000);             // wait for a second  
  digitalWrite(13, LOW);  // set the LED off  
  delay(1000);             // wait for a second  
}
```

At the bottom, a status bar indicates "Done compiling." and "Binary sketch size: 1010 bytes (of a 30720 byte maximum)".

ARDUINO CODE

```
int ledPin = 13;
```

```
void setup()
```

```
{
```

```
    pinMode(ledPin, OUTPUT);  設定腳位輸出狀態
```

```
}
```

```
void loop()
```

```
{
```

```
    digitalWrite(ledPin, HIGH);
```

```
    delay(1000);
```

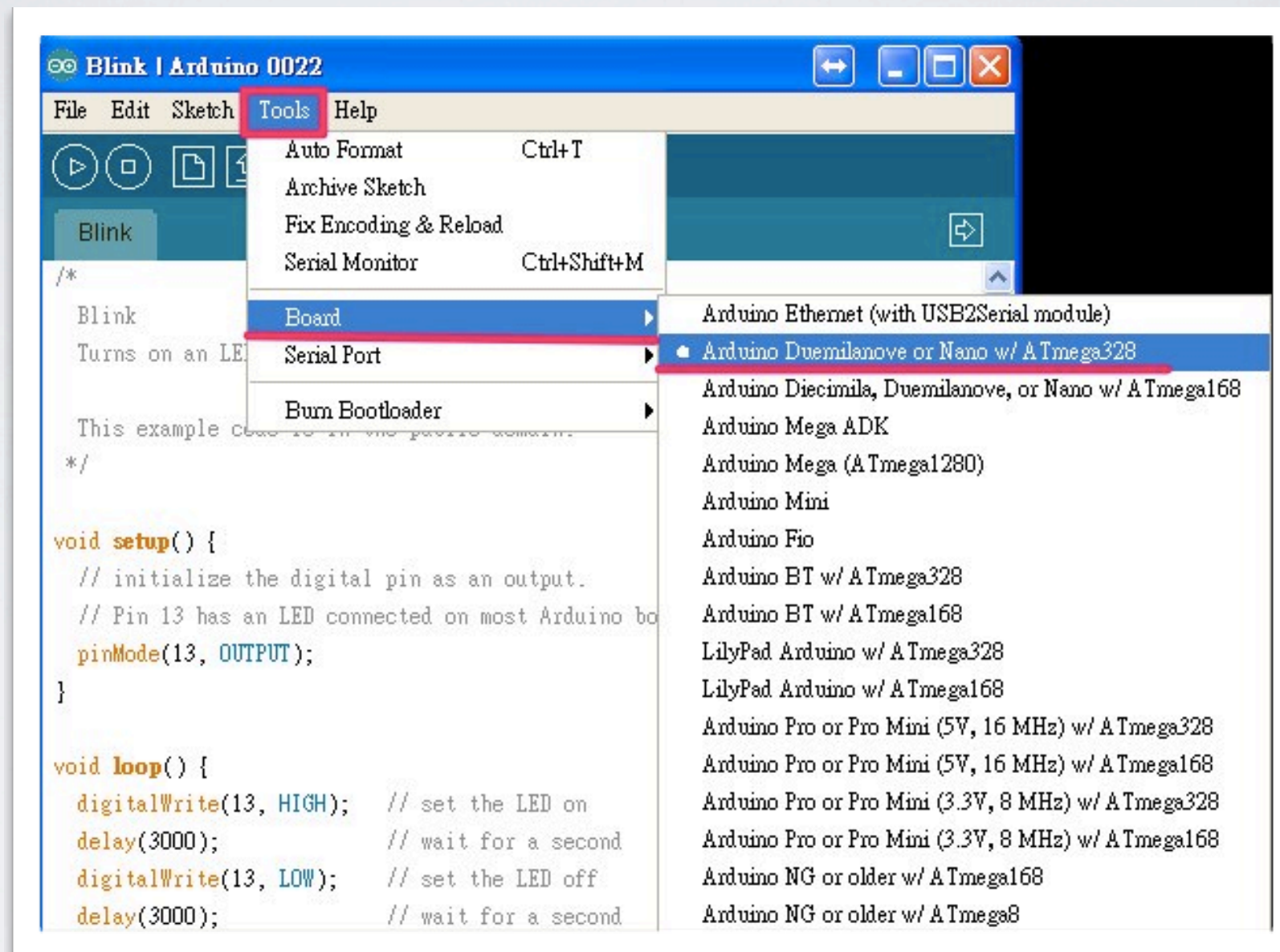
```
    digitalWrite(ledPin, LOW);
```

```
    delay(1000);
```

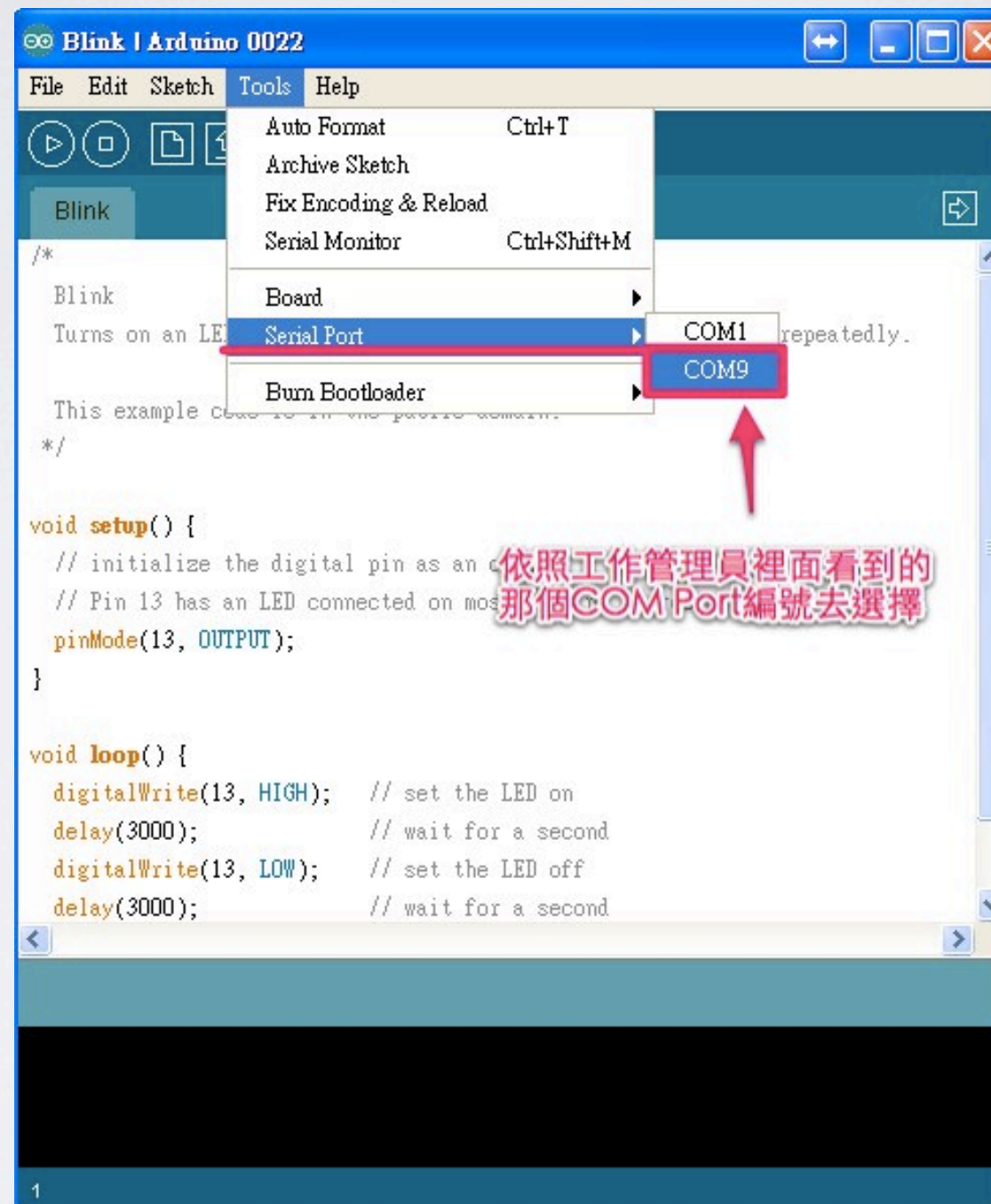
```
}
```

設定PIN13腳位為低電位 = 0V 滅!!
延遲

SELECT BOARD

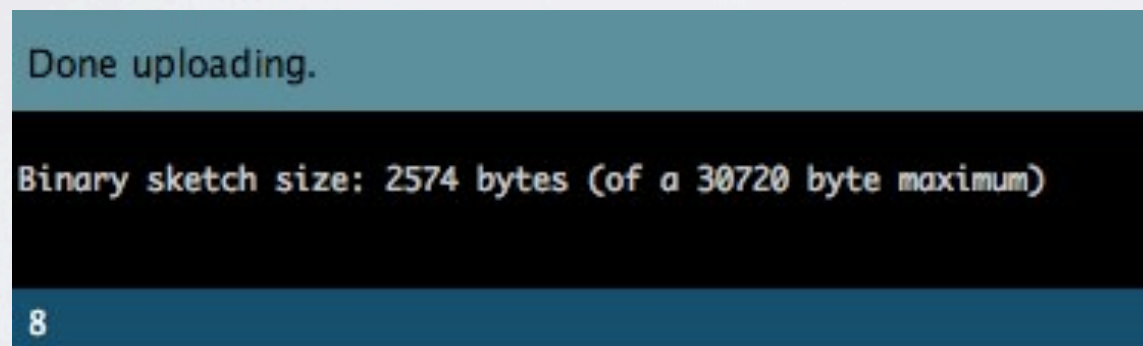


SELECT PORT



UPLOAD

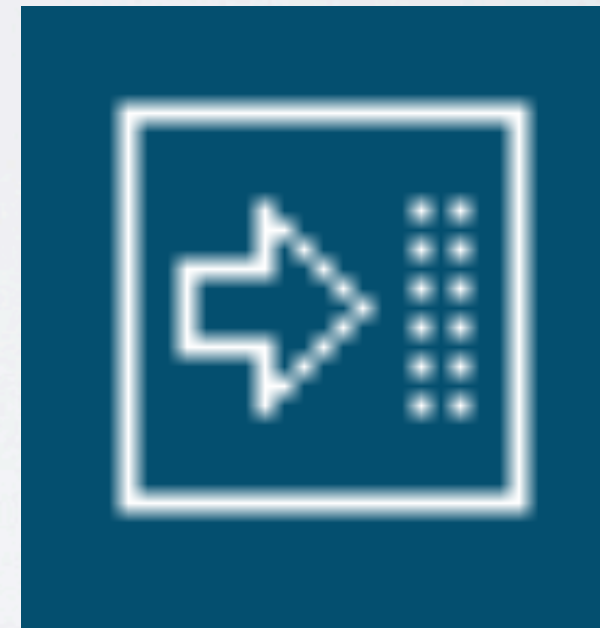
- 按下軟體上面的Upload to I/O Board，等待幾秒鐘，板子上面的RX/TX燈號會連續閃爍，等閃爍之後，軟體上面的下面會出現：



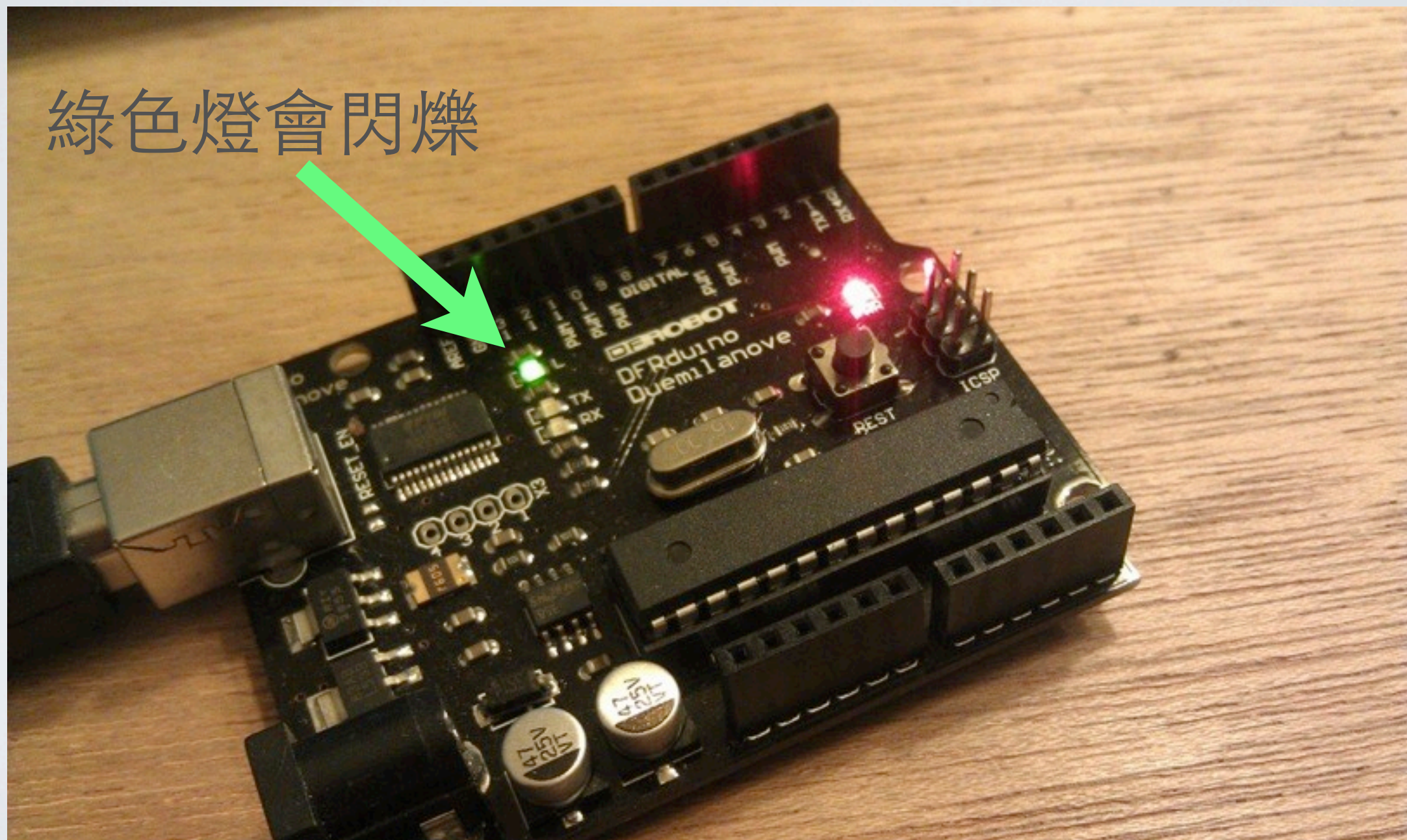
Done uploading.

Binary sketch size: 2574 bytes (of a 30720 byte maximum)

8



COMPLETE



下週進度

Arduino與電子電路概論、Arduino與LED控制、開關控制

今天的keynote在
<http://arduino.tw>