

Arduino

Class 1

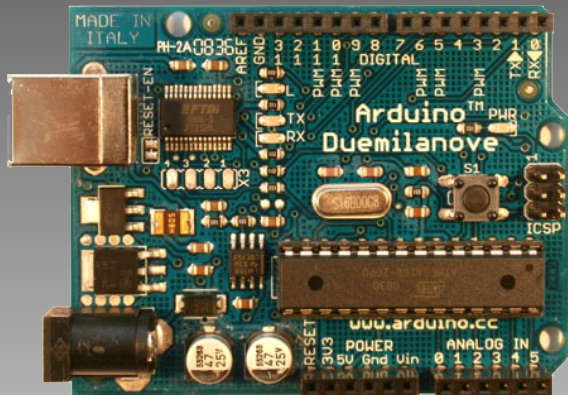
Outline

What is arduino

How to set up

What is Arduino

Arduino hardware + Arduino software + Open Source platform / forum

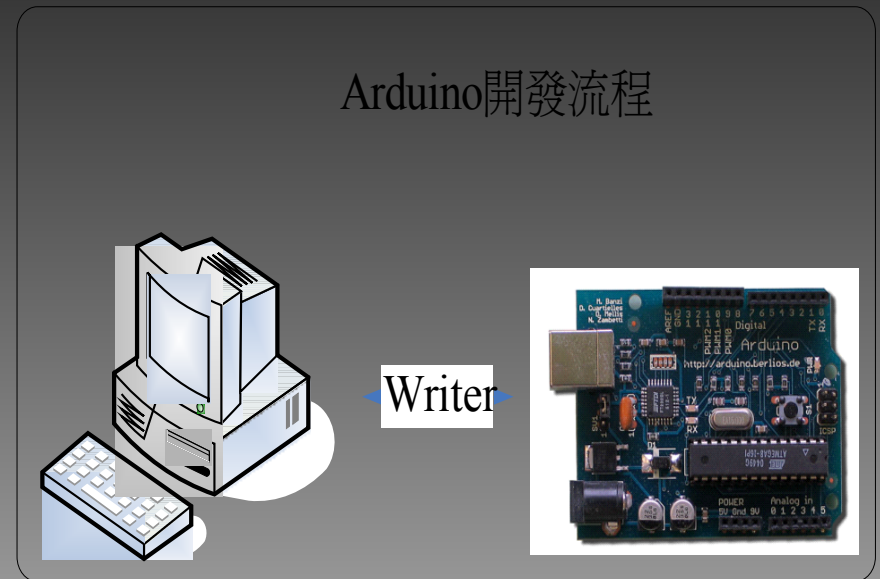
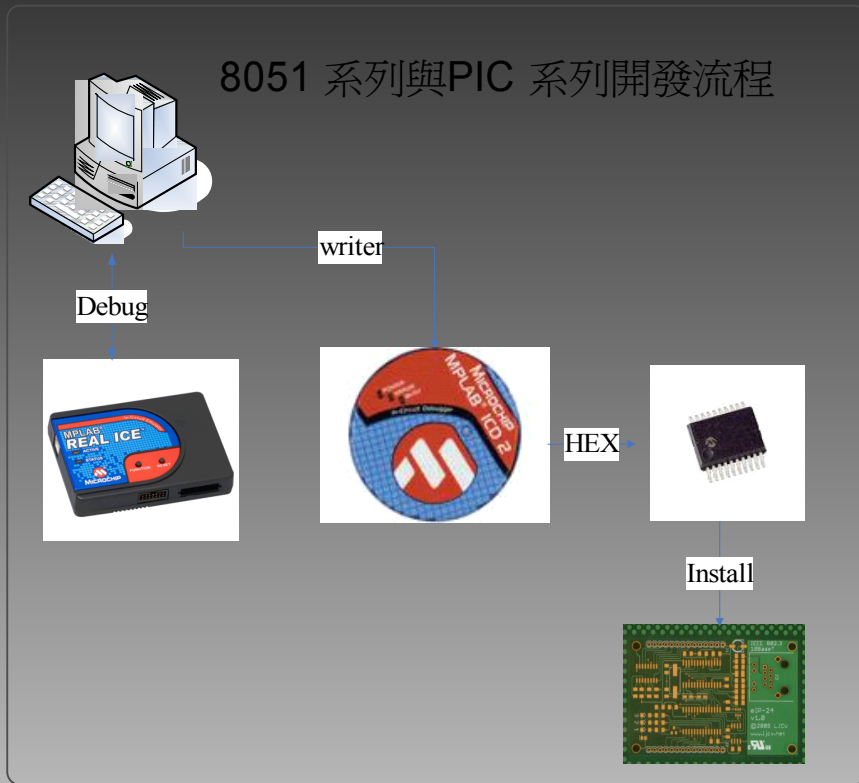


```
example_8_2_Xbee_ClientB_broadcast_16key | Ard...
File Edit Sketch Tools Help
example_8_2_Xbee_ClientB_broadcast_16key
/*
 * Client 從廣播接收訊號，[node][val]
 * B1 : 當 B node 收到後，會閃 LED 燈 1 次並回傳 1
 * B2 : 當 B node 收到後，會閃 LED 燈 2 次並回傳 2
 * C1 : 當 C node 收到後，會閃 LED 燈 1 次並回傳 1
 */
#include <NewSoftSerial.h>
#define node_A_sh 13A200
#define node_A_sl 403D0190
#define node_B_sl 403D018A
#define node_C_sl 403D01D0

// set pin 9 as RX
uint8_t sSPY = 0;
1
```



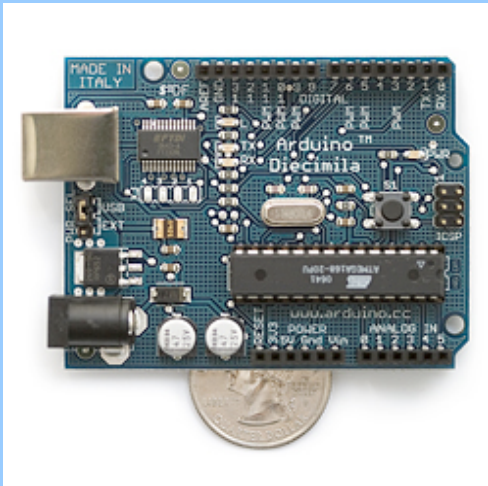
Arduino 與傳統 MCU 開發差別



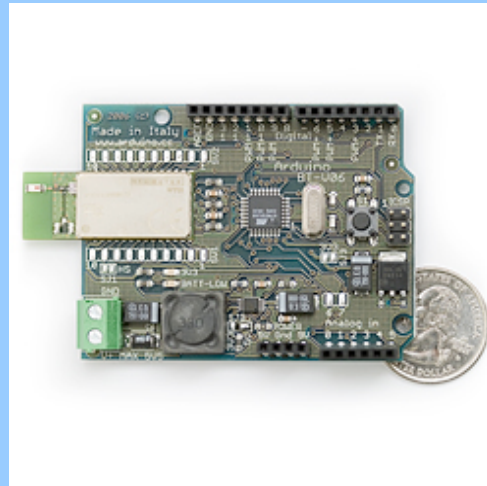
	傳統開發	Arduino
開發時程	長	短
所需設備	多且貴	便宜 (just USB)
語言難度	難	易
Debug tool	強大	無

Arduino Duemilanove Board

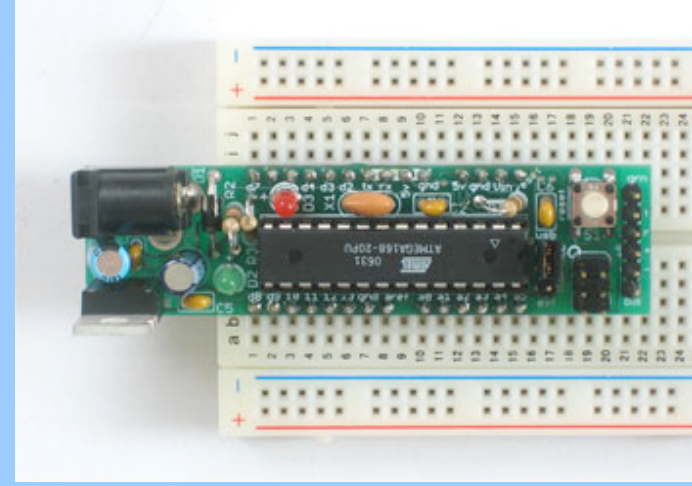
Diecimila



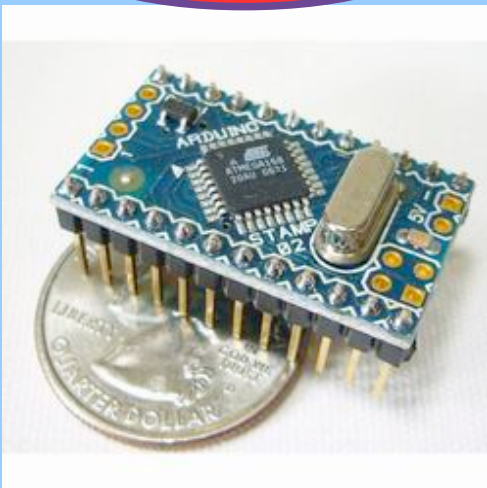
BT



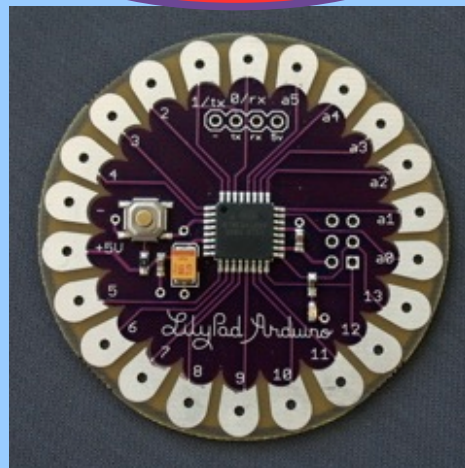
Boduino



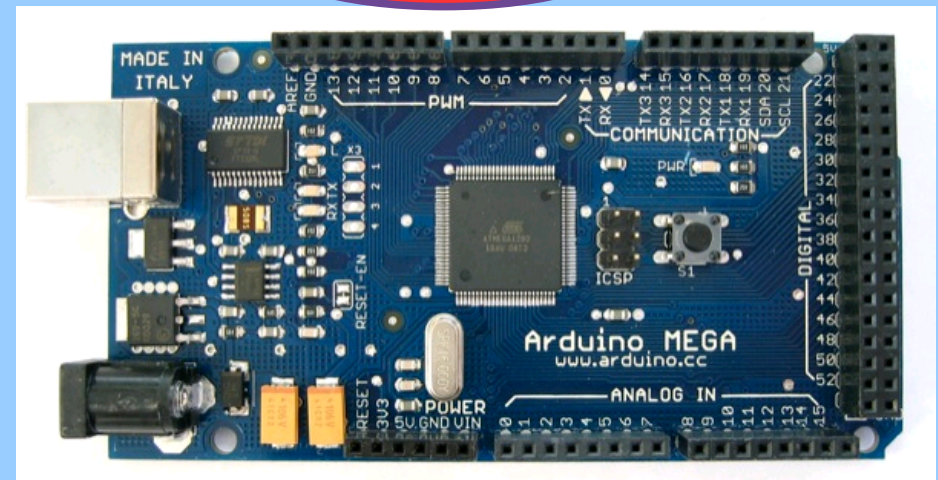
Mini



Lily Pad



Mega



Arduino Duemilanove

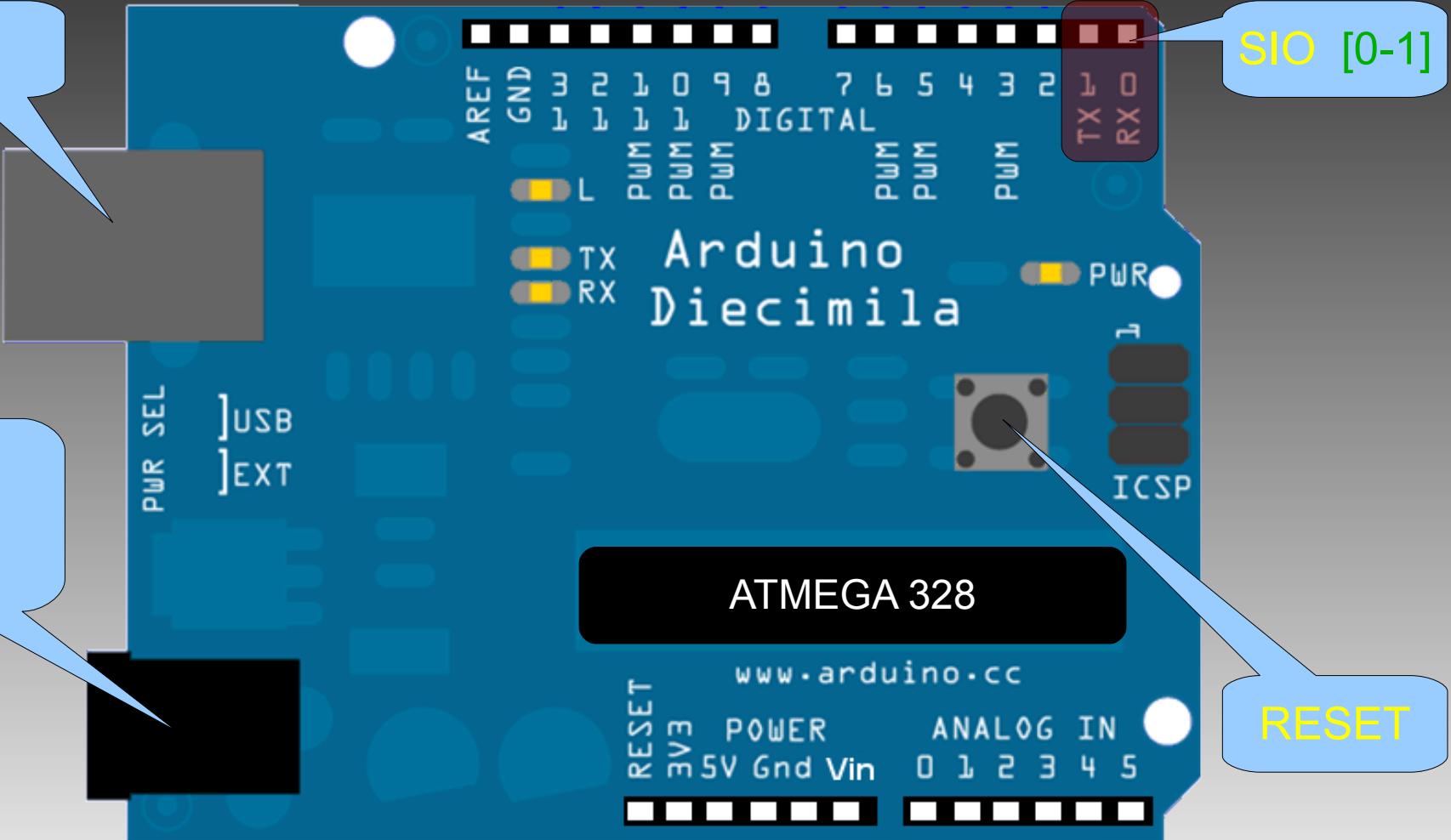
Digital I / O [0-13]

USB

SIO [0-1]

DC
[7-12]
[6-20]

RESET



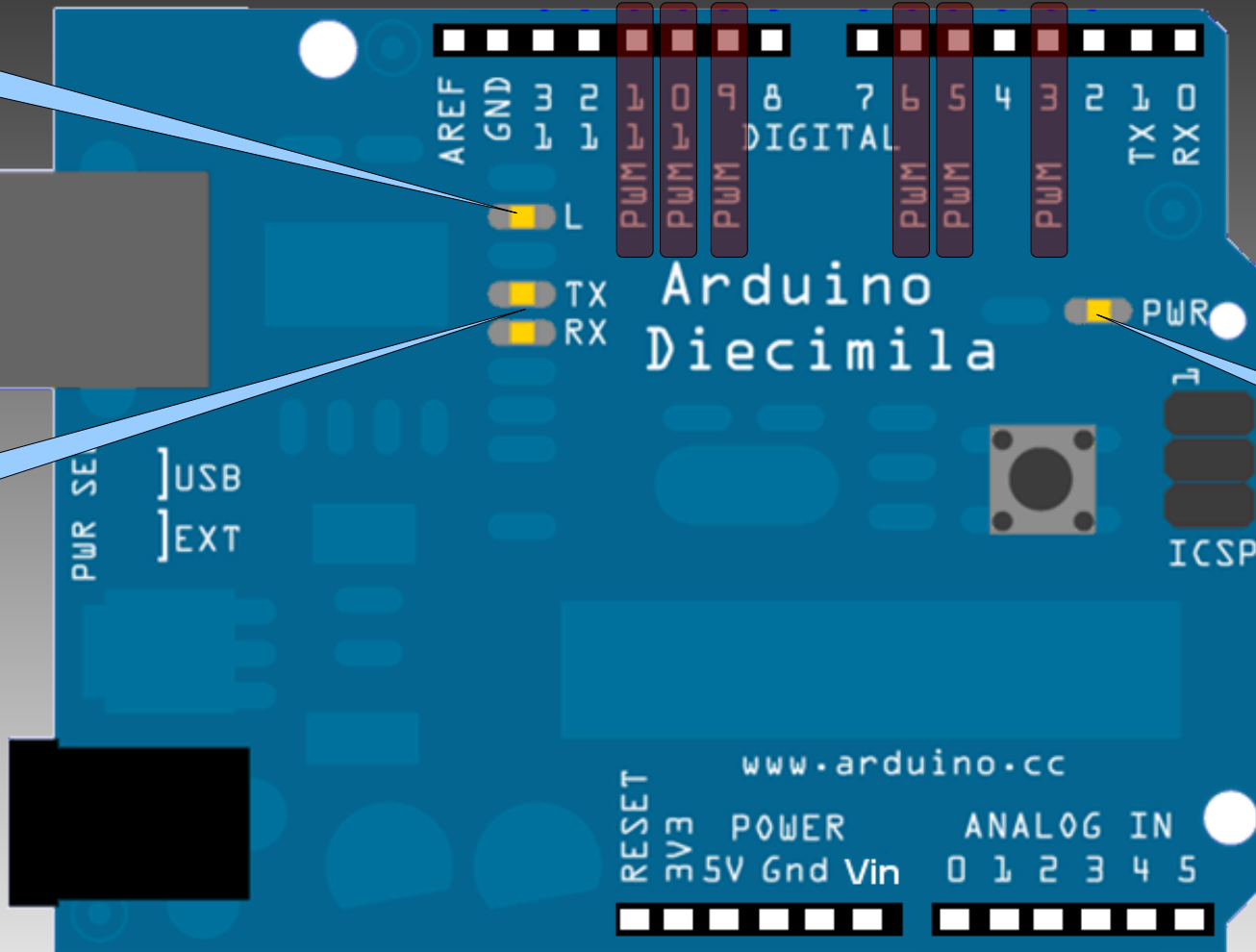
Arduino Duemilanove

Analog output [3,5,6,9,10,11]

Pin 13 LED

TX/RX LED

TX/RX LED



Analog input [0-5]

Arduino Duemilanove

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	16 KB (ATmega168) or 32 KB (ATmega328) of which 2 KB used by bootloader
SRAM	1 KB (ATmega168) or 2 KB (ATmega328)
EEPROM	512 bytes (ATmega168) or 1 KB (ATmega328)
Clock Speed	16 MHz

Sensor

光電轉換：光敏電組、紅外線。

壓電、磁力轉換：壓電元件、麥克風。

氣體偵測元件：CO₂/CO 氣體感測器。

溫度轉換：熱敏電組。

位移轉換：水銀開關、3G sensor。

How to set up

Step 1 : 取得 Arduino 。

Step 2 : 下載 Arduino software 並解壓縮。

<http://arduino.googlecode.com/files/arduino-0018.zip>

Step 3 : 插入 USB B-type plug 。

Step 4 : 安裝 FTDI USB driver

`\arduino-0018\drivers\FTDI USB Drivers`

Step 5 : 重開機。

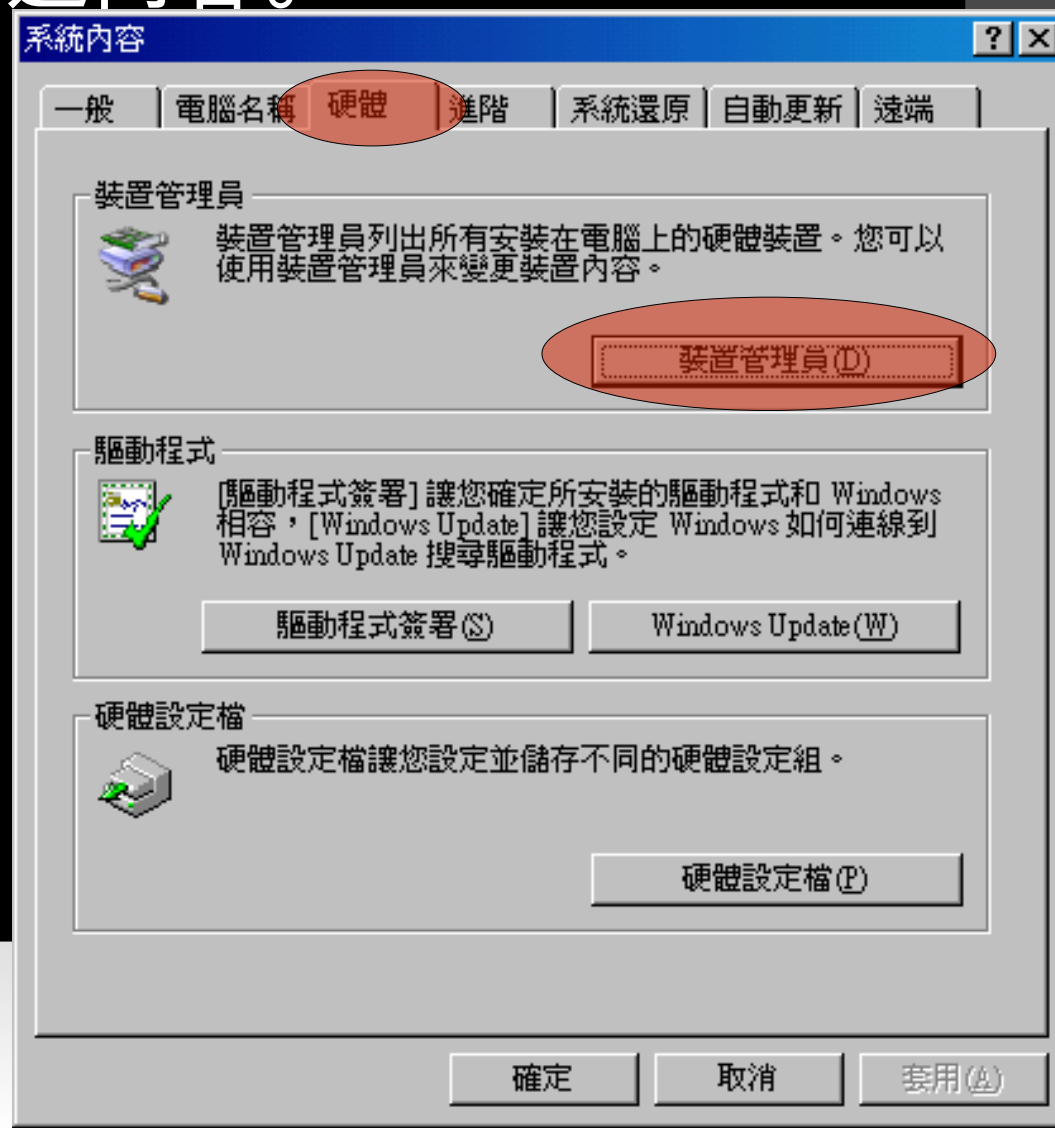


查出 Arduino 使用的 port

「我的電腦」按右鍵，選內容。

選「硬體」標籤。

選「裝置管理員」。



查出 Arduino 使用的 port

點開「連接埠 (COM 和 LPT)」。

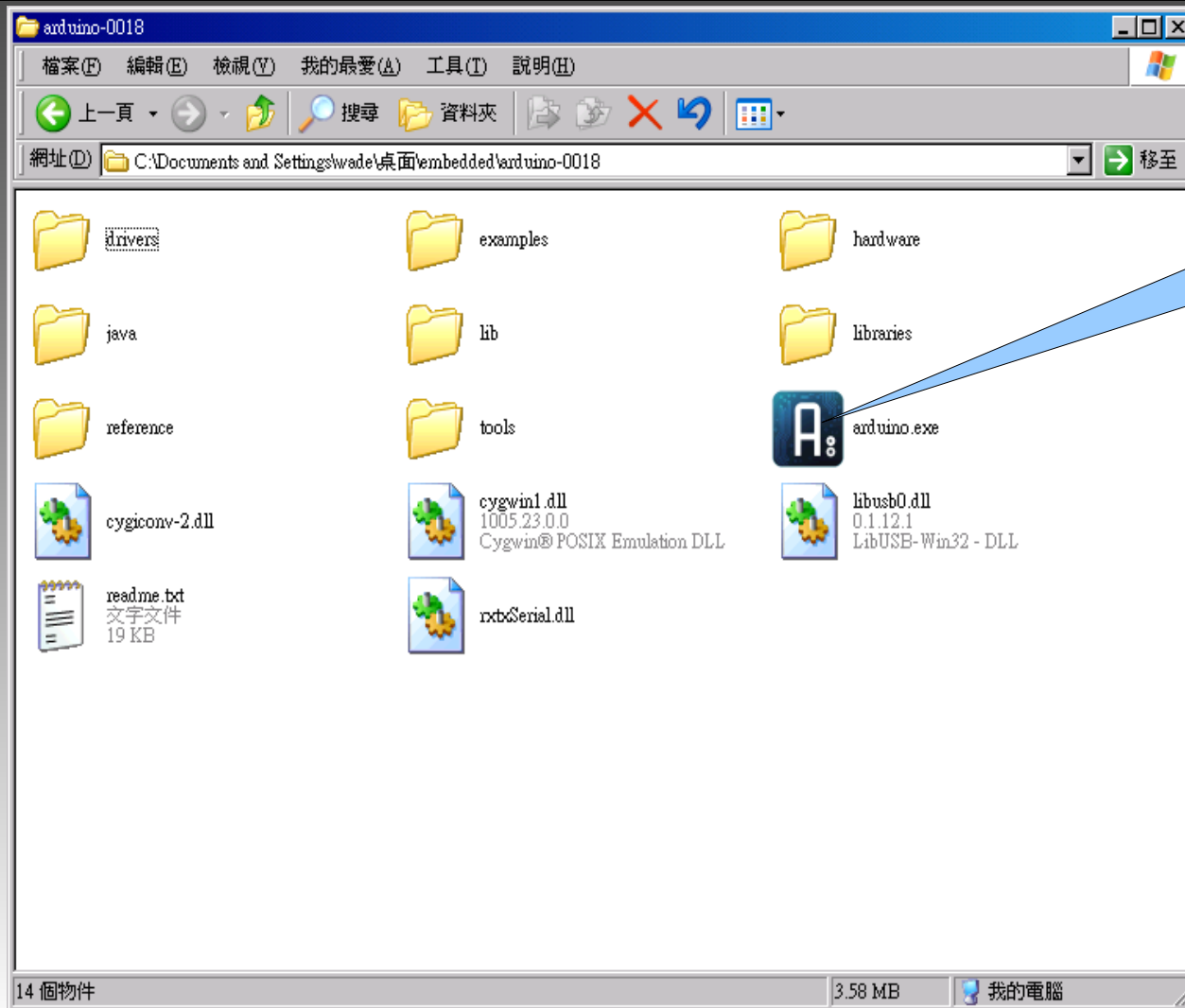
尋找「USB Serial Port (COMXX)」。

此次範例為 COM17



執行 Arduino software

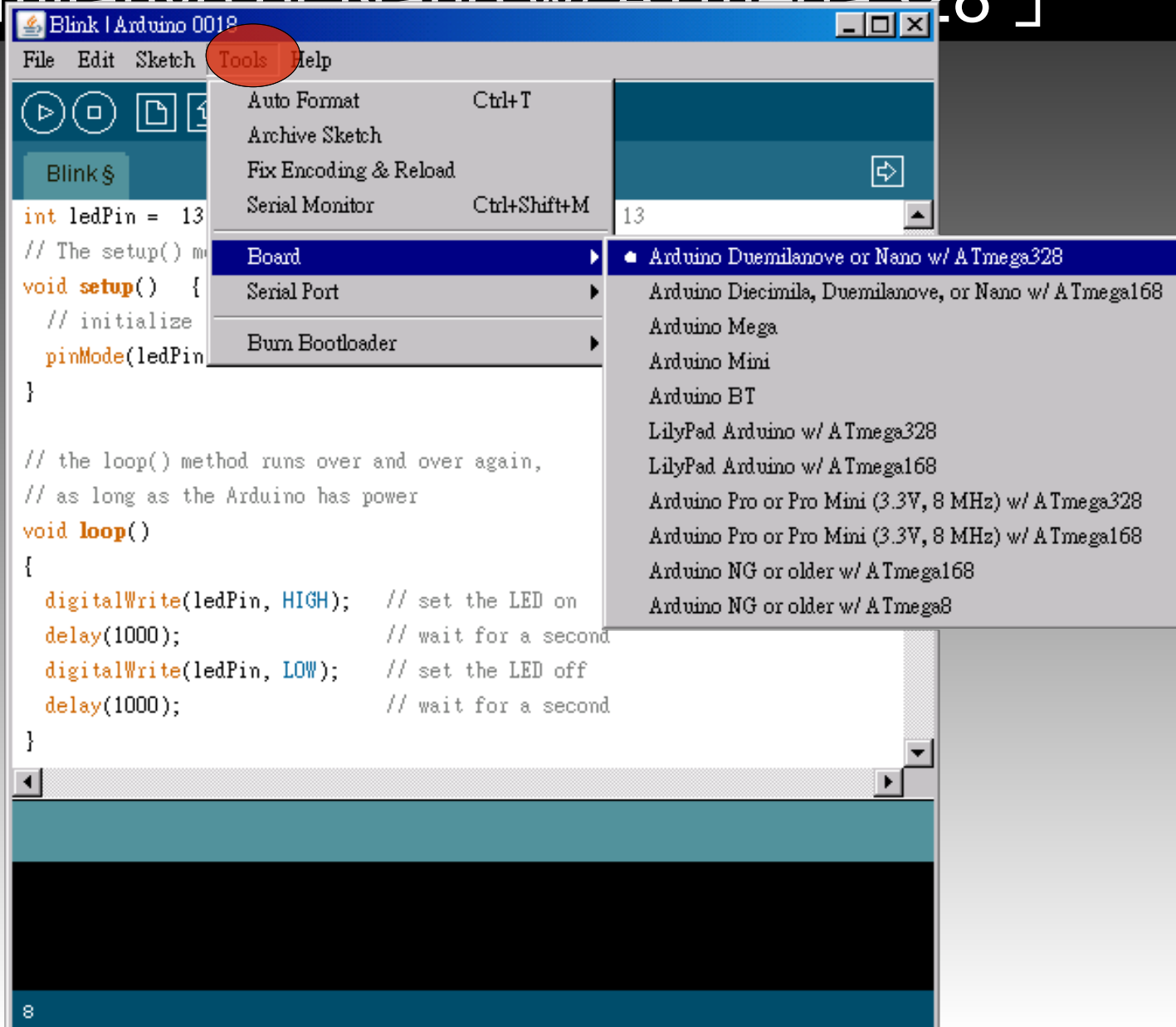
執行 arduino.exe 。



點兩下

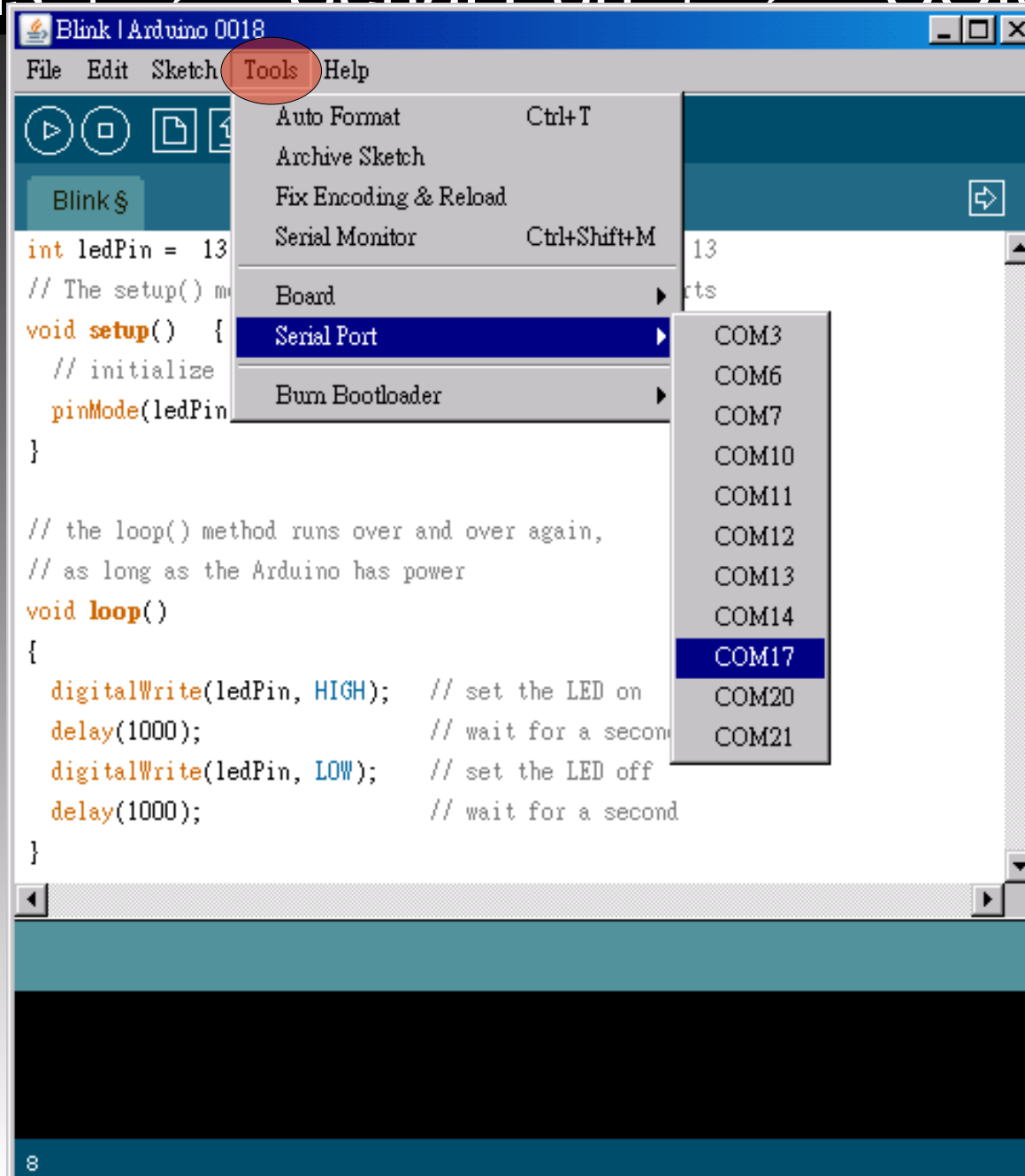
選擇你所使用的板子：

「 Tools 」 → 「 Board 」 → 「 Arduino Duemilanove or Nano w/ ATmega328 」



選擇你所使用的 Port :

「 Tools 」 → 「 Serial Port 」 → 「 COM17 」



Arduino software 介面

Verify
驗證程式碼
有無錯誤

Stop
停止驗證或
燒錄程式碼

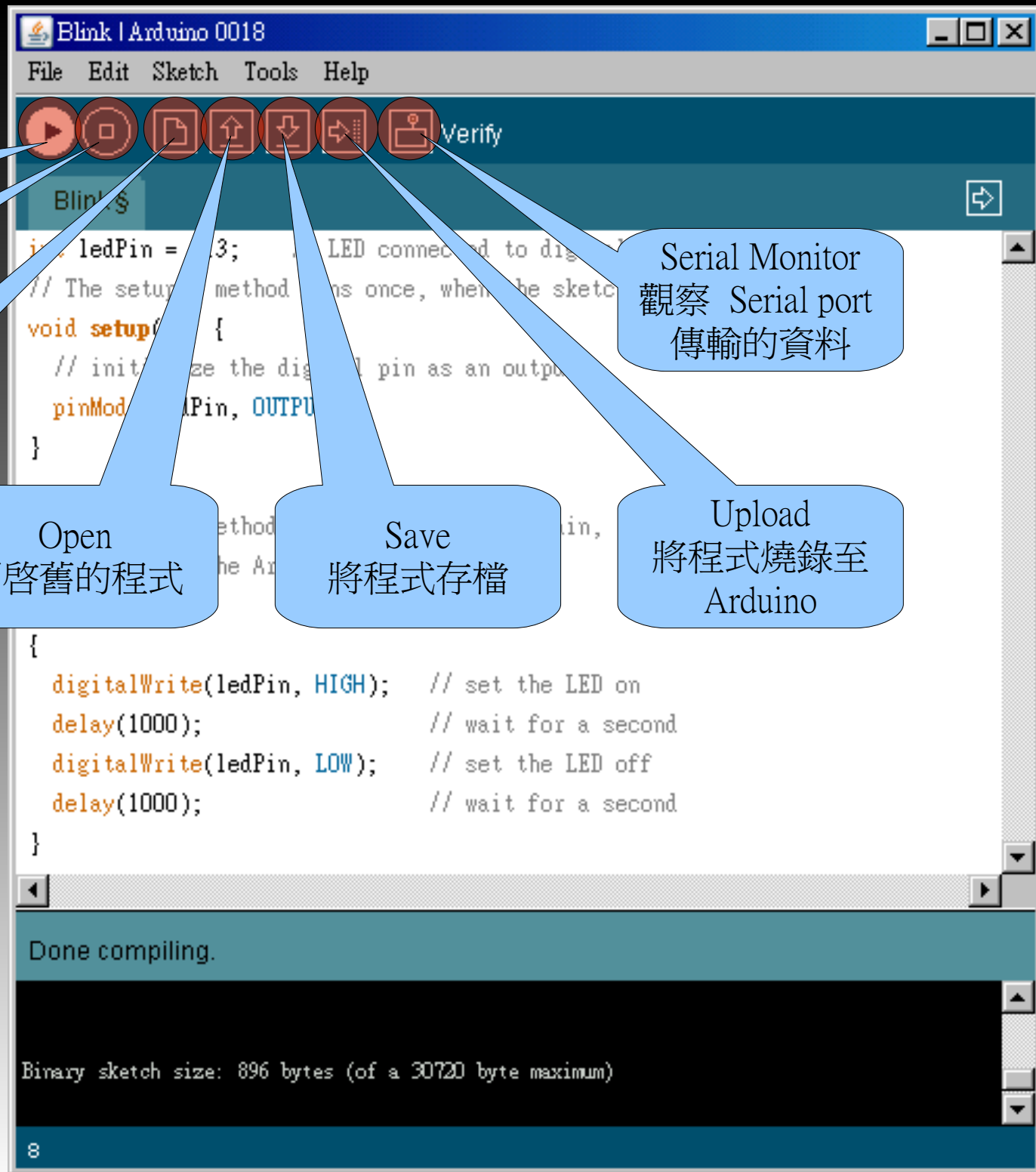
New
開啓新的程式

Open
開啓舊的程式

Save
將程式存檔

Serial Monitor
觀察 Serial port
傳輸的資料

Upload
將程式燒錄至
Arduino

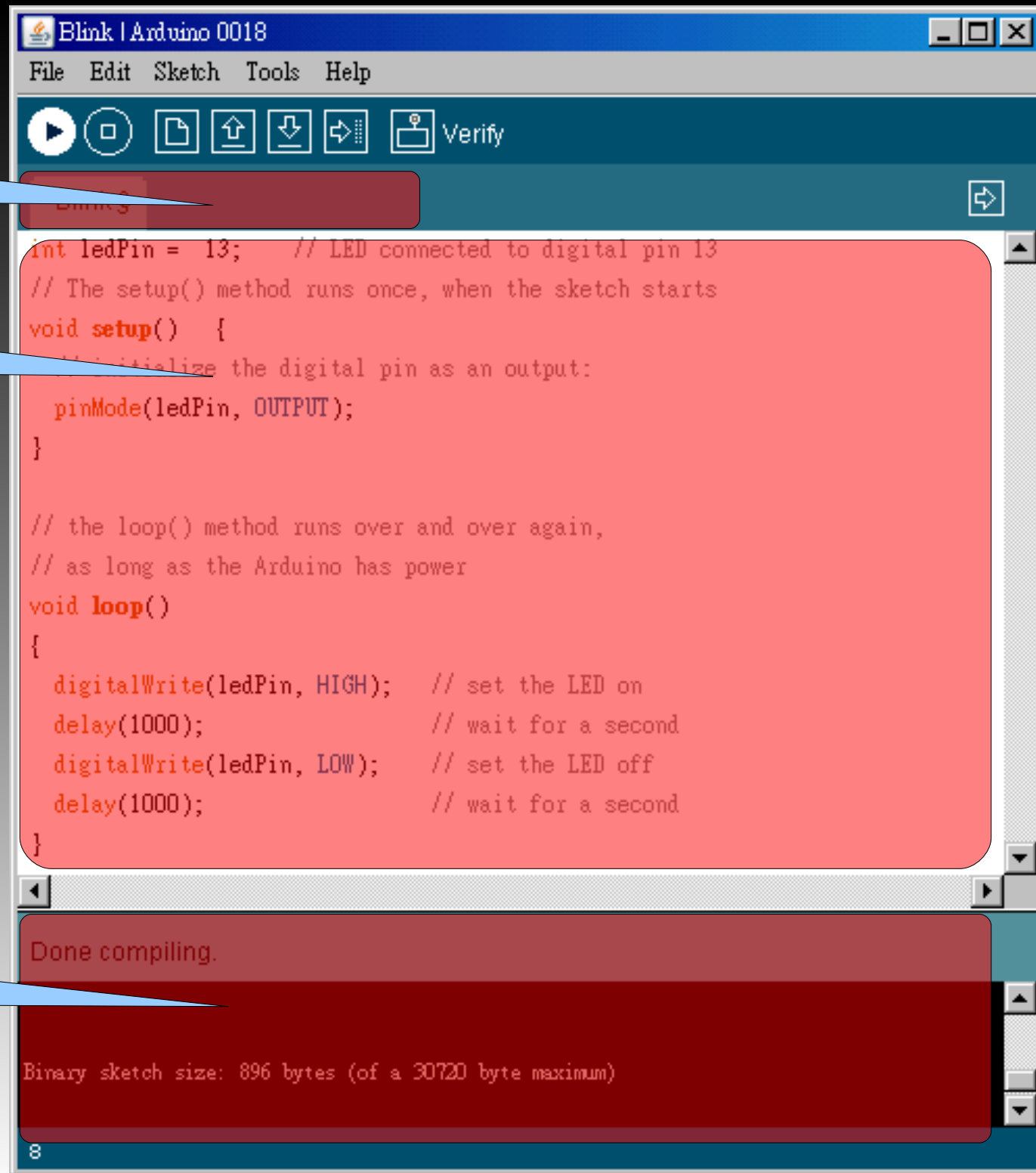


Arduino software 介面

編輯的檔名
及
引入的函式庫

程式編輯區

狀態回報
顯示編譯情形
及錯誤訊息



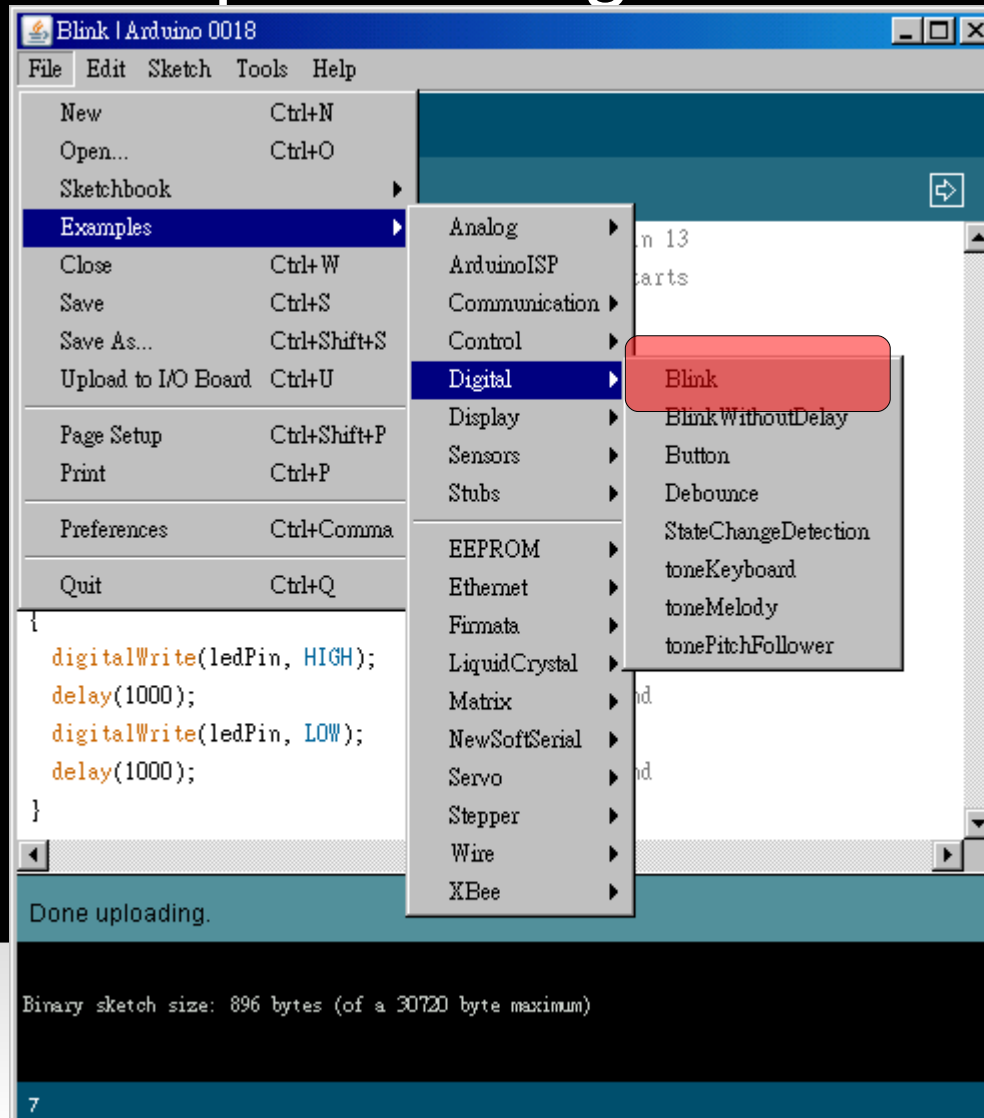
第一個程式

讓 PIN 13 的 LED 一閃一閃亮晶晶。

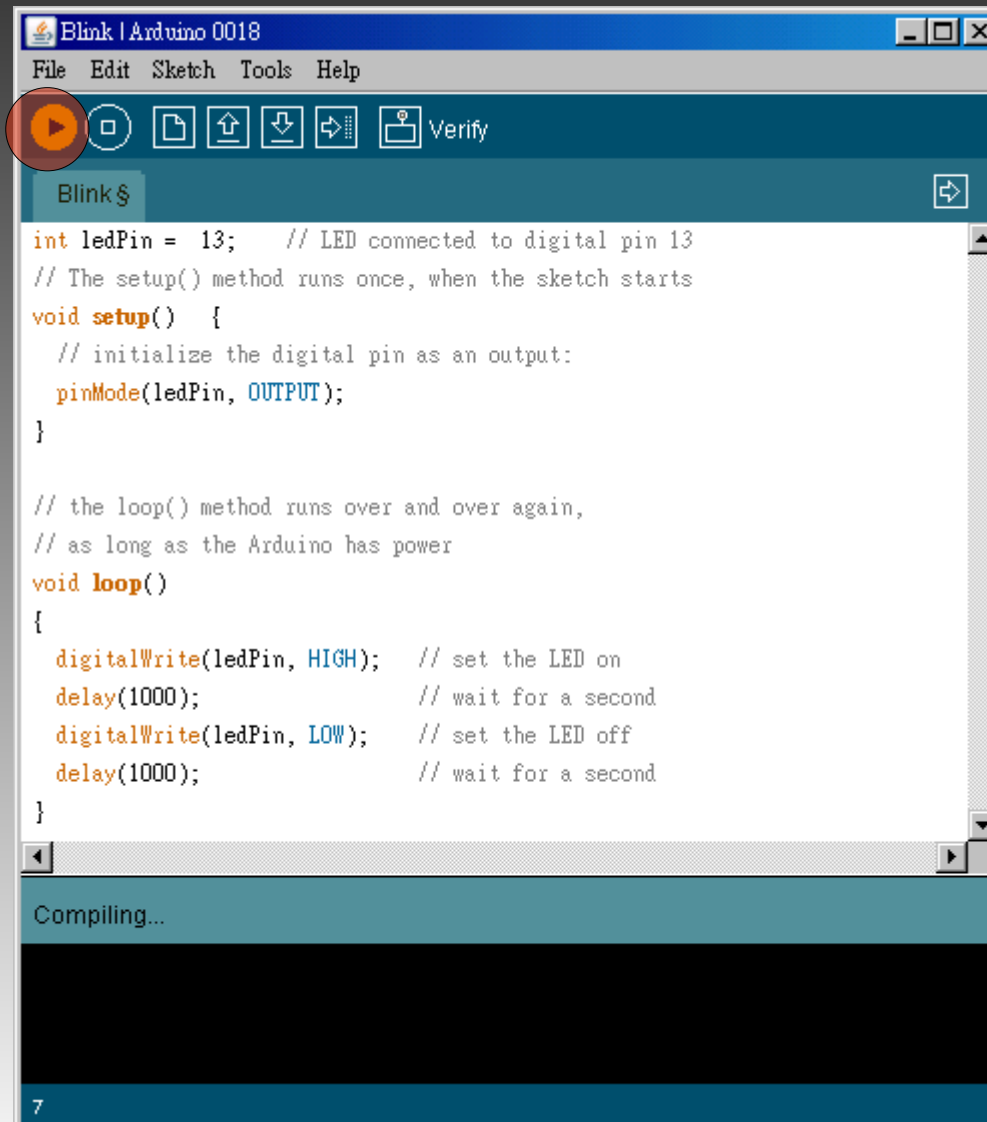


載入程式碼

File → Examples → Digital → Blink



Verify

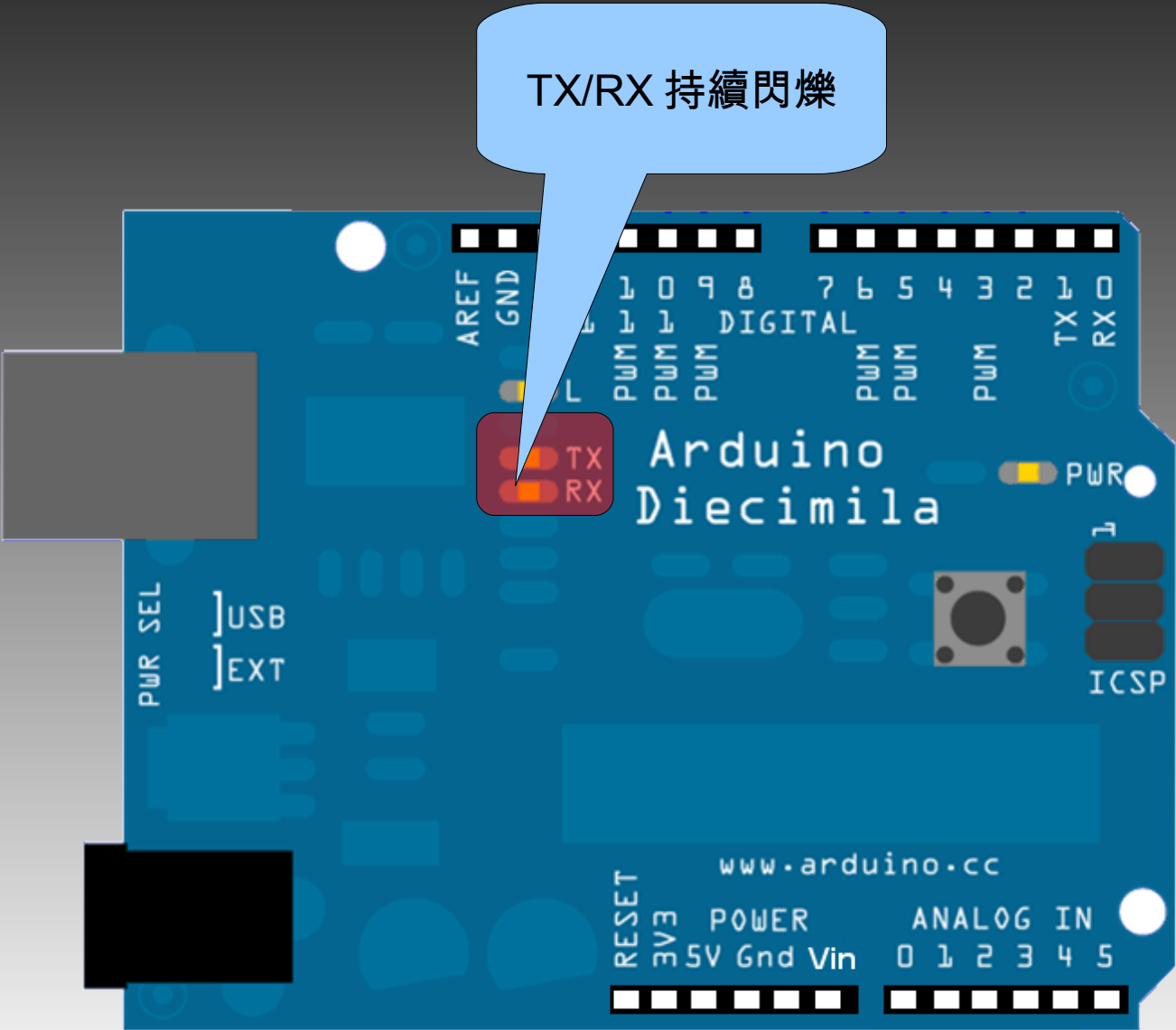


Upload



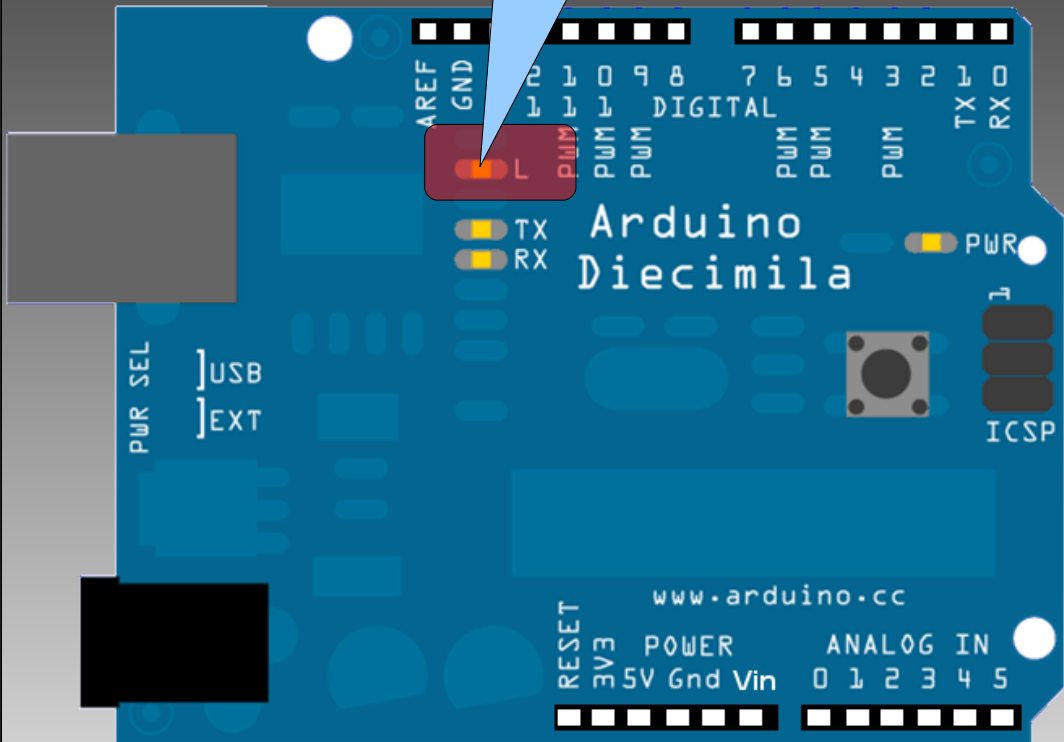
Uploading

TX/RX 持續閃爍



Uploading 完成

LED 持續閃爍



```
Blink | Arduino 0018
File Edit Sketch Tools Help

Blink $

int ledPin = 13; // LED connected to digital pin 13
// The setup() method runs once, when the sketch starts
void setup() {
  // initialize the digital pin as an output:
  pinMode(ledPin, OUTPUT);
}

// the loop() method runs over and over again,
// as long as the Arduino has power
void loop()
{
  digitalWrite(ledPin, HIGH); // set the LED on
  delay(1000);                // wait for a second
  digitalWrite(ledPin, LOW);  // set the LED off
  delay(1000);                // wait for a second
}

Done compiling.

Binary sketch size: 896 bytes (of a 30720 byte maximum)

7
```

程式解說

```
int ledPin = 13;           // LED connected to digital pin 13
```

```
void setup() {
```

```
  pinMode(ledPin, OUTPUT);
```

```
}
```

只執行一次，初始化

```
void loop()
```

```
{
```

```
  digitalWrite(ledPin, HIGH); // set the LED on
```

```
  delay(1000);                // wait for a second
```

```
  digitalWrite(ledPin, LOW); // set the LED off
```

```
  delay(1000);                // wait for a second
```

```
}
```

重複執行

數位信號輸 (出) 入

`pinMode(pin, mode)`

`digitalWrite(pin, value)`

`digitalRead(pin)`

數位信號輸（出）入

`pinMode(pin, mode)` : 設定 `pin` 腳的數位輸出
`mode` 為 (`OUTPUT`) 或數位輸入 (`INPUT`)。

Example :

```
pinMode(2, OUTPUT);
```

```
pinMode(4, INPUT);
```

數位信號輸（出）入

`digitalWrite(pin, value)` : 設定 `pin` 腳的 `value` 為 `HIGH` 或 `LOW`。

Example :

```
digitalWrite(2, HIGH);
```

```
digitalWrite(4, LOW);
```

數位信號輸（出）入 - 練習

用最少的指令寫出霹靂車前面的掃描燈。

●●○○○○、 ○●●○○○、 ○○●●○○、 ○○○●●○、
○○○○●●、 ○○○●●○、 ○○●●○○、 ○●●○○○、
●●○○○○

數位信號輸（出）入

`digitalRead(pin)` : 讀取 `pin` 腳的 `value` 為 `HIGH` 或 `LOW` 。

Example :

```
int val = digitalRead(2);
```

類比信號輸（出）入

```
analogWrite(pin, value)
```

```
int analogRead(pin)
```

類比信號輸（出）入

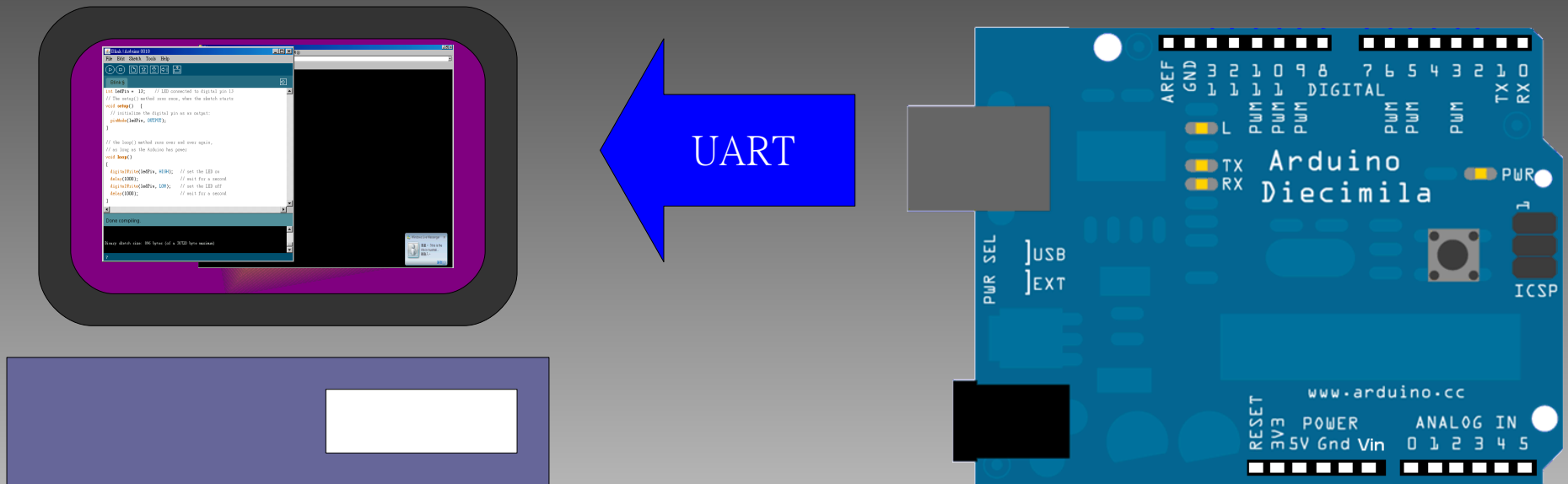
`analogWrite(pin, value)` : 設定
`pin(3,5,6,9,10,11)` 腳的 `value` 為 `0 ~ 255`。

Example :

```
analogWrite(2, HIGH);
```

```
analogWrite(4, LOW);
```

透過 UART 傳送資料




```
void setup()
{
  Serial.begin(9600);      // open serial port, set data rate to 9600
}

void loop()
{
  Serial.println( analogRead(0) );// print analog pin 0 as ASCII DEC
  delay(200);
}
```

讀取 Serial port
資料

The screenshot shows the Arduino IDE interface. The main window is titled "sketch_mar25a | Arduino 0018" and contains a code editor with the following code:

```
void setup()  
{  
  Serial.begin(9600);  
}  
  
void loop()  
{  
  Serial.println(417);  
  delay(539);  
  Serial.println(483);  
  delay(333);  
  Serial.println(392);  
  delay(528);  
  Serial.println(496);  
  delay(357);  
  Serial.println(375);  
  delay(495);  
  Serial.println(492);  
  delay(367);  
  Serial.println(347);  
  delay(510);  
  Serial.println(480);  
}
```

The Serial Monitor window is open, showing a list of numbers: 417, 539, 483, 333, 392, 528, 496, 357, 375, 495, 492, 367, 347, 510, 480. The baud rate is set to 9600 baud. The window title is "COM17".

設定 Serial port
Baud rate

9600 baud

透過 UART 接收資料

```
int led = 13;
int val;
void setup()
{
  Serial.begin(9600);
}
void loop()
{
  if (Serial.available() )           // if UART buffer is availabled
  {
    val = Serial.read();             // read from UART buffer
    Serial.println(val);
  }
}
```

以 Arduino software 透過 UART 送資料

The image shows a screenshot of the Arduino IDE's Serial Monitor window. The window title is "sketch_mar25a | Arduino 0018". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". The toolbar contains icons for running, stopping, saving, and other actions, along with the "Serial Monitor" icon. The main area shows a text input field with "sketch_mar25a \$" and a "Send" button. A blue callout bubble on the left points to the input field with the text "輸入資料". A blue callout bubble on the right points to the "Send" button with the text "傳送資料". The bottom of the window shows a baud rate dropdown set to "9600 baud".

輸入資料

傳送資料

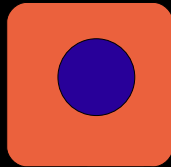
IR 紅外線傳輸

Infrared transfer : 產生 700nm 以上的紅外線波長。

IR 紅外線傳輸

Infrared Receiver : Input 37.5KHz ~ 38.5KHz
紅外線脈衝。

10K Ω



5V
GND
SINGL

練習產生 38KHz 脈衝

```
byte pin = 12;

void setup()
{
  pinMode(pin, OUTPUT);
}

void loop()
{
  digitalWrite(pin, HIGH);
  // 填入程式碼

  digitalWrite(pin, LOW);
  // 填入程式碼
}
```

練習接收紅外線訊號

提示：Infrared Receiver 會將收到的紅外線轉為數位訊號由 single 傳回。

練習

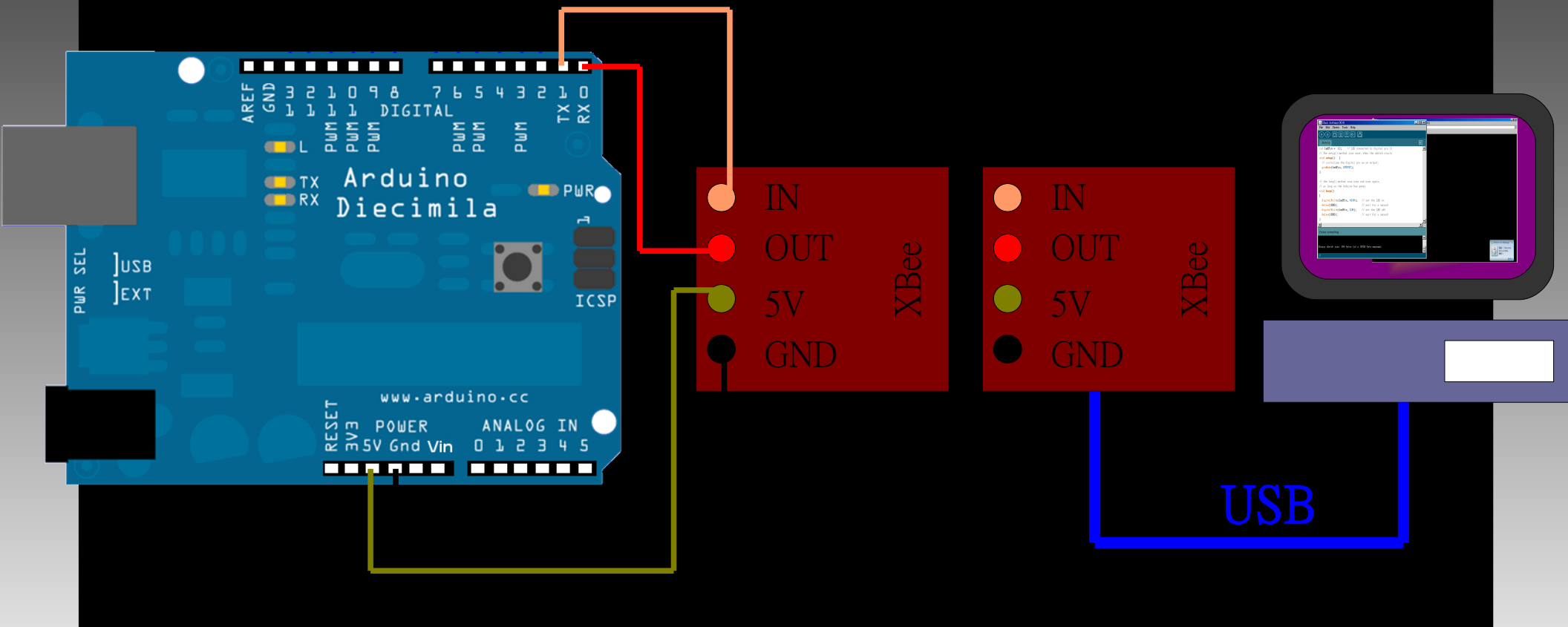
如何使用現有的東西控制 LED 開關。

透過 Arduino 本身的 I/O pin。

透過 PC 控制。

透過 Xbee 傳送資料

透過 UART 傳輸



Reference

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