ENGINEERS
NEVER STOP LEARNING

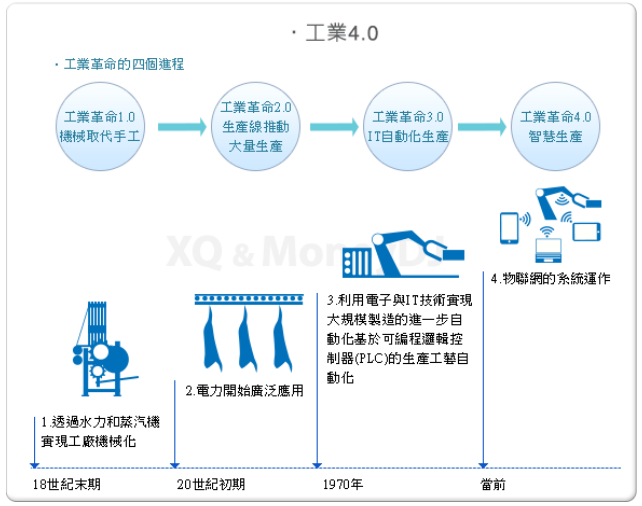

# AI Robotic Car Racing

*是德科技專案經理*

*Keven Chang*

# IOT , Industry 4.0 , AI (Cloud)

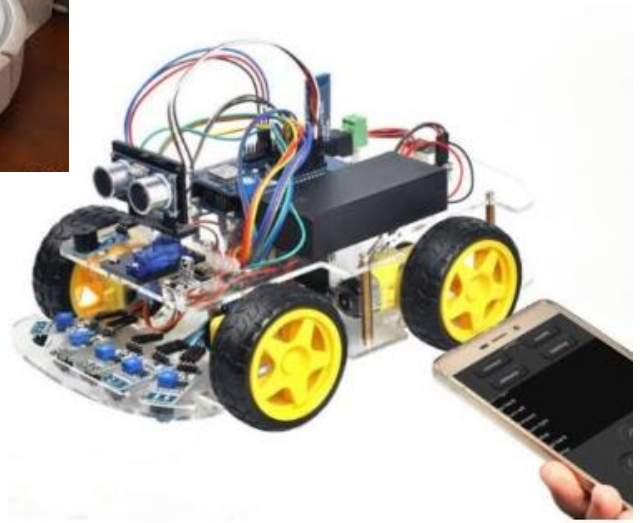
- Sensor
- Processor
- IO , Data Link
- AI (Cloud)






# IOT , Industry 4.0 , AI (Cloud)

KEYSIGHT TECHNOLOGIES



- Mixed Signal Analyzer

- Arb Function Gen

- Current waveform Analyzer

- Source Measurement Unit

- Digital Multi-Meter

- RF Signal Analyzer

# Robot Car Introduction

## ➢ERLK (Electronics Robot Learning Kits) Vendor

http://osoyoo.com/


OSOYOO 机器人智能汽车 Arduino DIY 学习套装，带教程 Android/ iOS APP WiFi 蓝牙 IR 模块和线路跟踪超声波传感器科学公平

OSOYOO

57 消費者評論 | 59 個問題已回覆

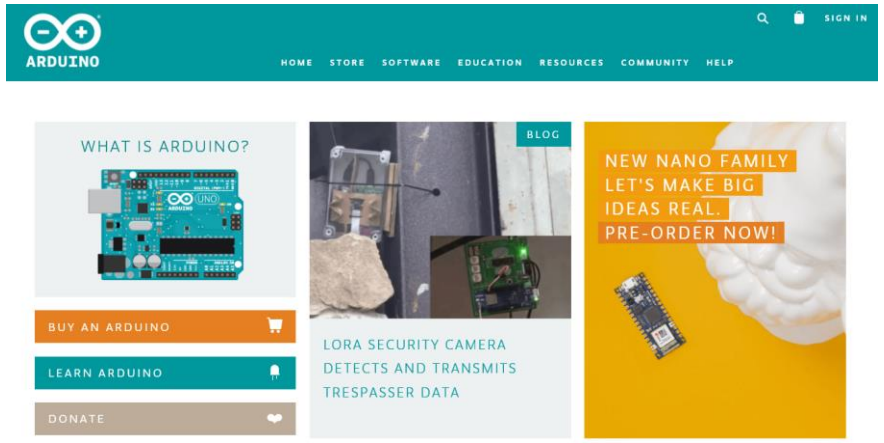
價格： US$66.99 + 至 日本 的 USD10.46 運費與進口費用押金 詳細資料

- OSOYOO 機器人車用學習套組專為初學者 Arduino 編程而設計，並獲得機器人設計和組裝方面的實踐經驗
- 该套装配有分步教程 从简单的汽车，基本动作，到多功能机器人汽车控制的移动 APP 。 本指南包含 5 個課程，其中包含詳細的樣本代碼及評論、電路圖、組裝說明和影片。 即使您沒有編程体验，您也可以按照分步说明操作，逐步成为 master。
- 此套件包含模塊零件包括：超音波感測器模塊、跟蹤模塊、紅外遙控器、藍牙模塊和 WiFi 擴展板等。 有了这些模块，机器人汽车可以采用多种模式，例如 autoto-go、红外线控制、 障碍、 line 跟踪。 您可以使用我們的 Android/iOS APP 通過 Wifi 或藍牙更改工作模式。 我們最近開發了 iOS 應用程式，我們暫時提供線上教學，請訪問：http://t.cn/RkA4iu
- 我們的機器人車是 100% 開放源碼。 如果您是一名中級球員，並且有時間閱讀我們的代碼評論，您可以輕鬆訂製這款機器人車，打造您專屬的科學展覽、大學、居家工作，甚至商業用途的項目。
- 人性化設計方便組裝和客製化：OSOYOO Model X Motor Driver 模組是改良的模組，具有新設計的接線插座，可大大簡化組裝過程和線纜連接穩定。 该汽车套装还有一个电压计，可以实时监控电池状态。


https://www.amazon.com/OSOYOO-Learning-Tutorial-Bluetooth-Ultrasonic/dp/B074Z6DMYP

# Robot Car Introduction

https://www.arduino.cc/



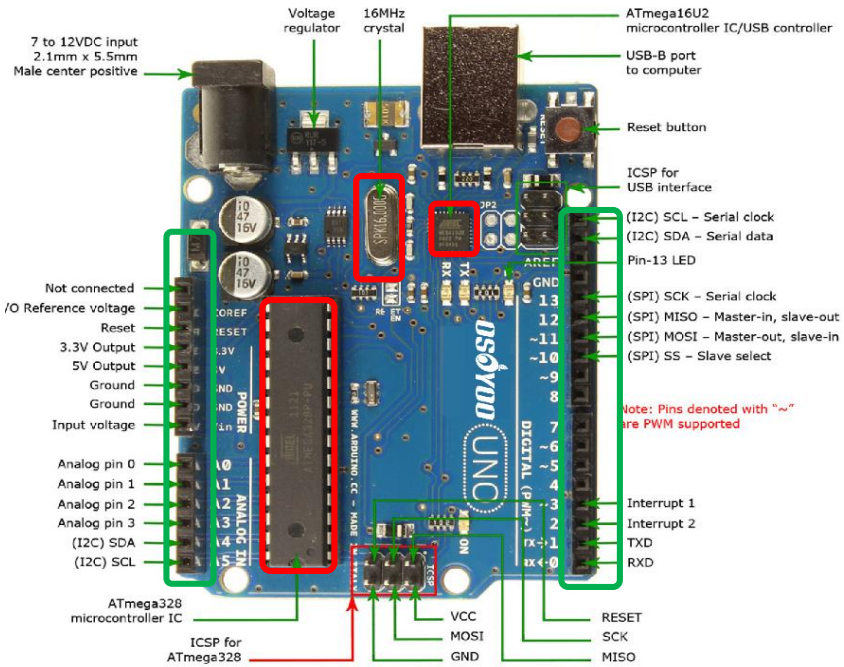

## ➢ Arduino Base Board

## Uno R3 board : Base Board

- ➢ Processor
- ➢ Crystal (16MHz)
- ➢ USB IO Controller

### ➢ Core Microcontroller (ATmega328p)

- •Microcontroller: ATmega328P-PU
- •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: 32 KB of which 0.5 KB used by bootloader
- •SRAM: 2 KB (ATmega328)
- •EEPROM: 1 KB (ATmega328)
- •Clock Speed: 16 MHz

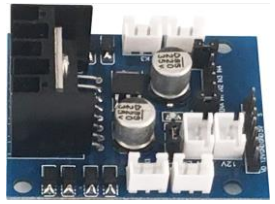



| | |
|---|---|
| Microcontroller | ATmega328P |
| Operating Voltage | 5V |
| Input Voltage (recommended) | 7-12V |
| Input Voltage (limit) | 6-20V |
| Digital I/O Pins | 14 (of which 6 provide PWM output) |
| PWM Digital I/O Pins | 6 |
| Analog Input Pins | 6 |
| DC Current per I/O Pin | 20 mA |
| DC Current for 3.3V Pin | 50 mA |
| Flash Memory | 32 KB (ATmega328P) of which 0.5 KB used by bootloader |
| SRAM | 2 KB (ATmega328P) |
| EEPROM | 1 KB (ATmega328P) |
| Clock Speed | 16 MHz |
| LED_BUILTIN | 13 |
| Length | 68.6 mm |
| Width | 53.4 mm |
| Weight | 25 g |

### Pins Description

# ➢ Peripheral accessories

## ➢ DC Motor Driver Package



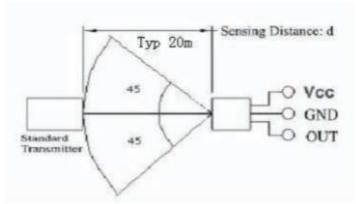
| ENA | IN1 | IN2 | The State of DC Motor A |
|---|---|---|---|
| 0 | X | X | Stop |
| 1 | 0 | 0 | Brake |
| 1 | 0 | 1 | Rotate Clockwise |
| 1 | 1 | 0 | Rotate Counterclockwise |
| 1 | 1 | 1 | Brake |

-Drive voltage: 5-35V; logic voltage: 5V
-PCB size: 4.2 x 4.2 cm

## ➢ Voltage Meter

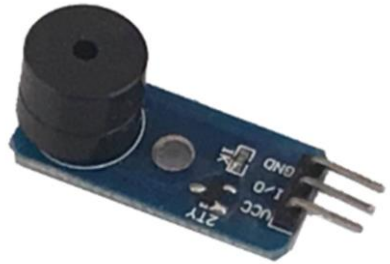
•Display : 3-Digit LED
•Display Color : Red;
•Measuring Range : DC0-100V;
•Input Voltage : DC3-30V
•Total Size :
33 x 15 x 10mm/ 1.3” x 0.6” x 0.4”(LWH);
•Mount Hole Dia. : 2mm/ 0.08”
•Main Material : Plastic, Iron, PCB;
•Pin : 3Pins
•Weight : 6g

## ➢ IR Remoter




**Specification:**
Dimension: 6.4 x 7.4 x 5.1mm
Receiving angle: 90 °
Working voltage: 3 ~ 5V
Frequency: 38KHz
Receiving range: Min 18m, Typ 20m

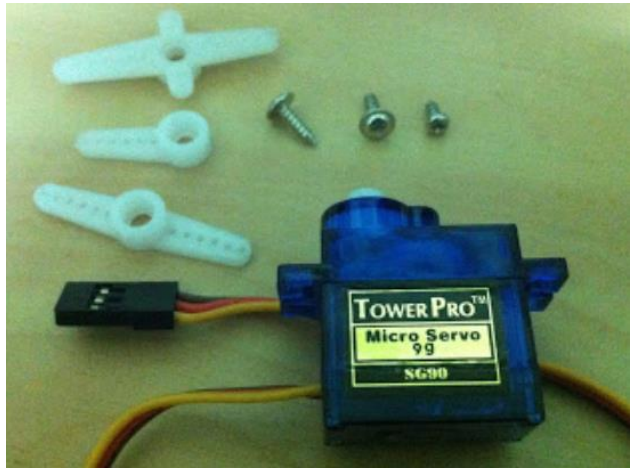
## ➢ Buzzer




**Specifications:**
Material: ABS
Color: Blue
Work Voltage: 3.3-5V .
PCB Dimension: 3.1cm*1.3cm.
Color: Blue
**Pin Definitions :**
VCC : 3.3V-5V
GND : The Ground
I/O : I/O Interface of SCM

# ➢ Peripheral accessories

## ➢ Servo 伺服馬達




- 重量：9g
- 尺寸：23*12.2*29mm
- 工作電壓：4.8V
- 轉矩：1.8kg-cm，當工作電壓為4.8V時
- 運轉速度：0.1秒/60度 ，當工作電壓為4.8V時
- 脈衝寬度範圍：500~2400μs
- 死頻帶寬度（dead band width）：10μs

電源　　（紅色）
接地　　（黑色）
訊號線　（橘色）

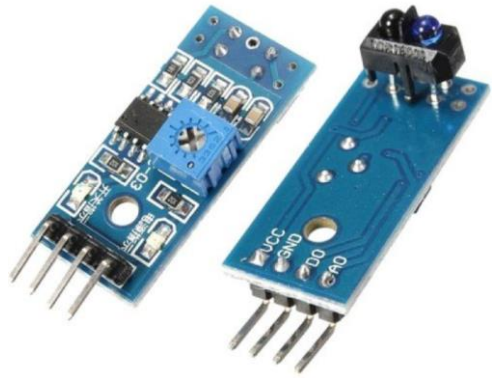
PWM:訊號脈波
必須每秒重複50次(也就是50Hz,PRI: 20ms)
而脈衝持續時間長短便代表了馬達該將軸柄轉到什麼位置
範圍從1.0ms到2.0ms. 置中則是1.5ms.

PW:1.0ms當做角度0度
PW:1.5ms會是90度
PW:2.0ms則是轉到底180度
(注意,也有可能反過來)

Angle Rotate Speed: 100ms/60 度 ,
(= 300ms/180度),
(= 1.6ms /1度)

```
#include <Servo.h>
Servo myservo;
myservo.attach(9)
myservo.attach(9, 500, 2400);
// 修正脈衝寬度範圍, User PWM Low / High Edge(1ms/2ms)
myservo.write(i);
// i=% , Default 1ms~2ms, 0~100%
myservo.writeMicroseconds(i);
// i=us , Pulse ON time.
myservo.detach() ;
```

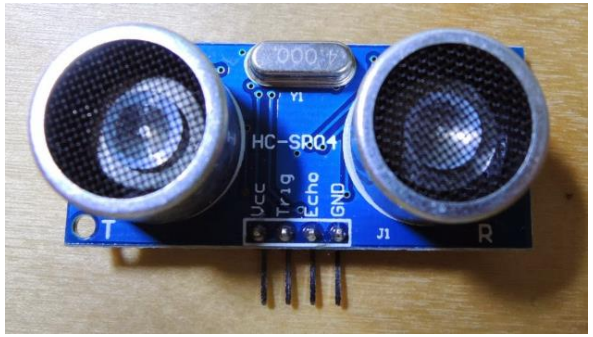
## ➢ Black White Sensor

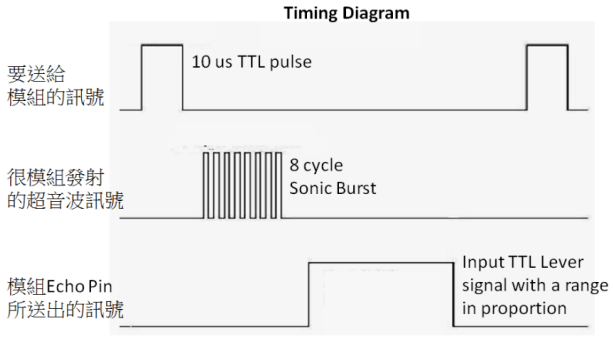


- •Product model : TCRT5000;
- •working Voltage : DC 3.3-5V
- •Output channel : 0/1;
- •detect distance : 1-25mm;
- •focal distance : 2.5mm
- •Chip set : LM393;
- •PCB Size : 32 x 14mm/1.3” x 0.55” (low)
- •material : electric part
- •Total Size :
  38 x 14 x 18mm/1.5” x 0.55” x 0.7”(L*w*h);
- •Net weight : 3g;

# ➢ Peripheral accessories

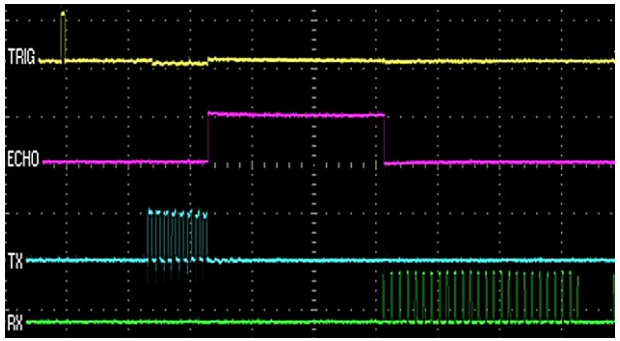
## ➢ Ultrasonic Distance Sensor (HC-SR04)




- 超聲波測距模塊HC-SR04提供　2cm　-　400cm)非接觸式測量功能，
  測距精度可達3mm。 模塊包括超聲波發射器，接收器和控制電路。

- 工作的基本原則：
- 使用IO觸發器至少 10us 高電平信號
- 模塊自動發送8個40 kHz並檢測是否有脈衝信號。
- 如果信號返回，通過高電平，高輸出IO持續時間的時間是從發送超聲波到返回的時間。
- 測試距離 Measure Distance =（高水平時間 * 聲速（340M / S）/2. ）
  聲速:340M/s , Measure Distance :
  cm =（高水平時間 ms）* 0.0294 / 2 ）=（高水平時間 ms）* 0.0147 ）
  聲速:302M/s , Measure Distance :
  cm =（高水平時間 ms）* 0.0332 / 2 ）=（高水平時間 ms）* 0.0166 ）
- 測試對象時，面積範圍不小於0.5平方米，平面要求盡可能平滑，否則會影響測量結果。
- 建議使用超過60ms的測量週期，以防止觸發信號到回波信號。




Picture Left is a scope screen shot showing the external and internal signals for this process, where -

•TRIG (Yellow) and ECHO (Magenta) are the signals between unit and micro,

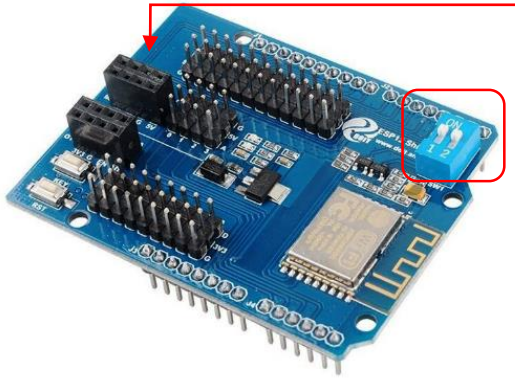
•TX (Cyan) and TX- (Green) are the internal signals of the burst being sent.

**Note** The Echo pulse does not start till 202 µs after the start of sending.

The start of sending is our measurement reference point.

# ➢ Peripheral accessories

## ➢ ESP8266 UART WIFI Shield use guide

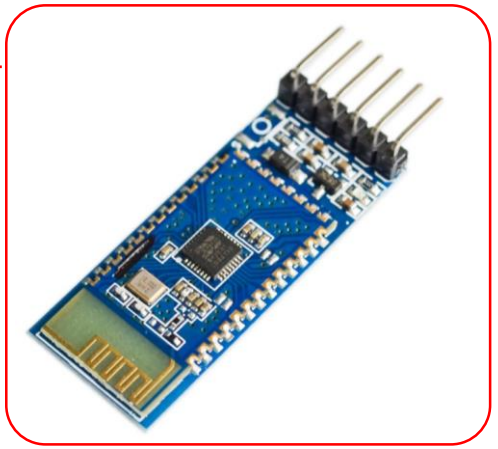


- Set the two switch positions to OFF position (1 2) (Low Position) , this will disconnect wifi module from Arduino serial port. (Download Program)
- Set Wifi modue two switches to ON position (ON) (High Position) , which will connect wifi module to Arduino serial port. (Wifi Connection)

http://192.168.4.1

•Wifi protocol 802.11 b/g/n ；
•STA/AP work mode；
•integrated TCP/IP stack， support one socket；
•work as TCP/UDP Serve or Client mode；
•serial port baud rate： 1200/2400/4800/9600/19200/38400/57600/74800/ 115200 bps；
•serial port width：5/6/7/8 bits； ；
•Extended Arduino Pin D2/3/4/5/6/7/8/9/10/11/12/13；
•Extended ESP8266 GPIO Pin 0/2/4/5/9/10/12/13/14/15/16/ADC/EN/UART TX/UART RX；
•RESET；
•KEY reset；
•WiFi current：working：≈70mA（200mA MAX），sleep：<200uA；
•wifi speed：110-460800bps；
•working temp：-40℃～＋125℃
•weight：20g

## ➢ SPP-C Bluetooth Module



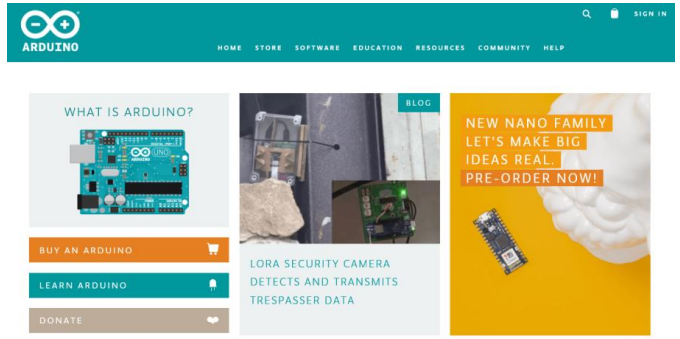
### Physical Feature

| | |
|---|---|
| Operating Frequency Band | 2.4GHz -2.48GHz unlicensed ISM band |
| Bluetooth Specification | V2.1+EDR |
| Output Power Class | Class 2 |
| Operating Voltage | 3.3V |
| Host Interface | UART |
| Dimension | 27mm (L) x 13 (W) mm x 2mm (H) |

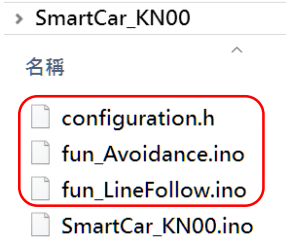
- Set the two switch positions to OFF position (1 2) (Low Position) , this will disconnect wifi module from Arduino serial port. (Enabled Bluetooth)

# ➢Arduino IDE

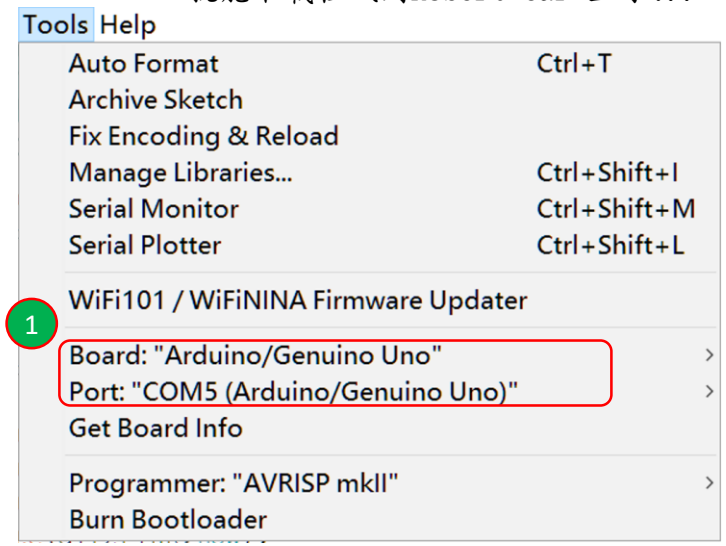
https://www.arduino.cc/en/Main/Software?setlang=en

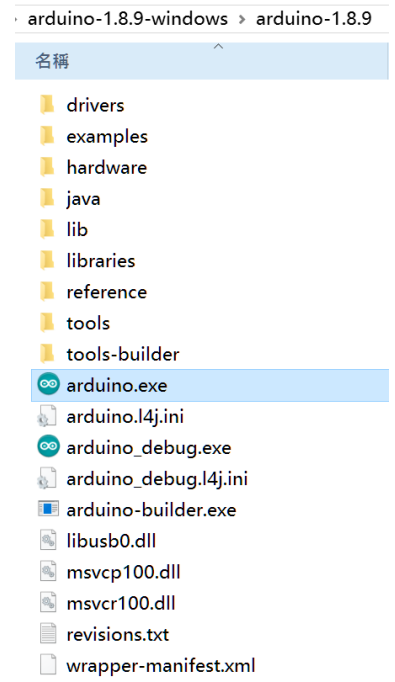



<Arduino Robot Car Example 程試專案> 開啟專案目錄.
*主程式檔名(*.ino) 需與目錄同名
*該目錄下的(*.ino & *.h), 會被一同載入



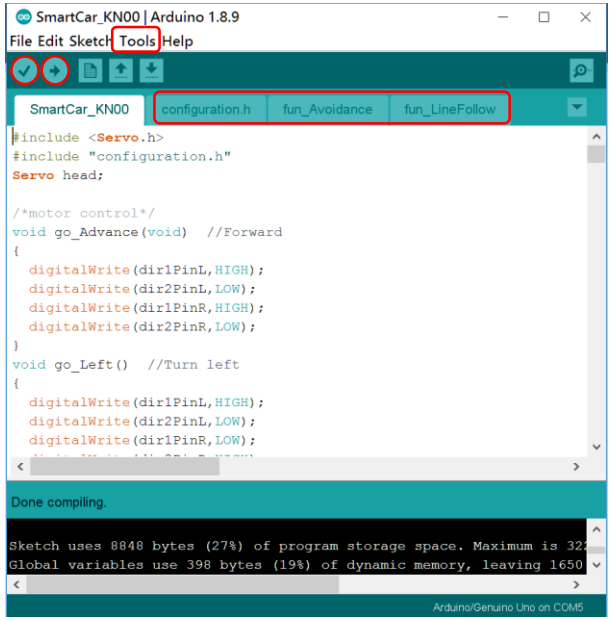

* 選對板卡(Arduino/Genuino UNO R3)
* 與USB-RS232 COM Port,連接介面設定
就能下載程試到Robert Car 上了!..




2

* Complier
* Upload Code



KEYSIGHT TECHNOLOGIES

# Reference Evaluation Lessons (參考範例)

OSOYOO

- smartcar-lesson1
- smartcar-lesson2
- smartcar-lesson3
- smartcar-lesson4
- smartcar-lesson5

Lesson 1: Motor Control (馬達)

Move Actions (FF,BK,TR,TL)

Lesson 2: IR Receiver (紅外線搖控器)

IR Remote Move Actions

Lesson 3: Buzzer / Ultrasonic / Servo (蜂鳴器,超聲波,伺服轉向馬達)

Sound Alarm , Distance Detect , Angle Rotate

Lesson 4: Black White Sensor (黑白感應器)

Black Line follower

Lesson 5: + Wi-Fi (Bluetooth ) Remoter (WiFi/藍芽 遠端搖控)

Cmd Receiver/Customize Parameter

# ➢ *Robotic Car Racing*



車道布局範本 | 8 英呎 x 8 英呎

KEYSIGHT TECHNOLOGIES

# Q/A ?