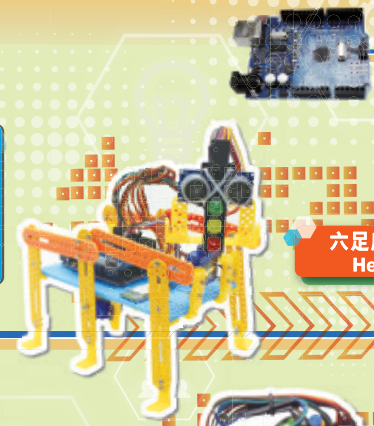
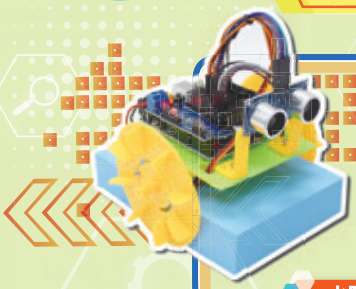
S Science T Technology E Engineering M Maths

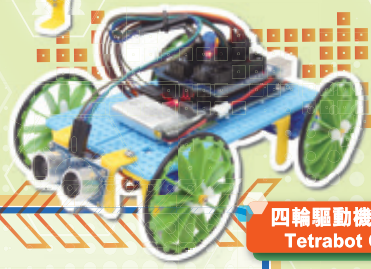
智能機械系列 1
SmartBot Series 1
教學套件 Teaching Kit



六足爬行機械
Hexabot



水陸兩用機械
Amphibot



四輪驅動機械車
Tetrabot Car

- 本教學套件可作為《Arduino 智能遙控爬行機械教學套件》的延伸學習及活動
  This Teaching Kit may serve as a learning and activity enrichment to Arduino Smart RC Climbot Teaching Kit
- 清晰簡易的零部件裝嵌步驟說明
  Clear and neat instructions on how to assemble the parts
- 學習及應用常見的機械模型硬件
  Hands-on experience on some common robot hardware
- 多元化的零部件配搭組合
  Versatile part combinations for assembly
- 採用 mBlock + Arduino + Bluetooth RC app (Android) 實作的方式
  Practical implementation of mBlock, Arduino & Bluetooth RC app (Android)
- 教師可配合設計與科技科課程自訂教學內容及 STEM 教學活動
  The teaching content and STEM learning activities can be customized to cater for the Design & Technology curriculum

雅博資訊科技有限公司
Apricot Information Technology Limited

編著：劉偉成 (Lau Wai Shing)

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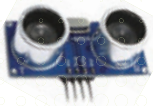
Arduino Uno R3 Compatible Board

Arduino Uno R3 感應器擴展板 v5.0 /
Arduino Uno R3 Sensor Shield v5.0

SG90 伺服電動機 (180 及 360 度連續轉動) /
SG90 Servo Motor (180 and 360-degree Continuous Rotation)

鋰聚合物電池 (3.7V 650mAh) /
Lithium-ion Polymer Battery (3.7V 650mAh)



HC-SR04 超聲波感應器 /
HC-SR04 Ultrasonic Sensor

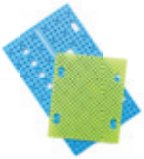
HC-05 藍牙模組 /
HC-05 Bluetooth Module

LED 紅黃綠燈模組 /
LED Traffic Light Module

八葉塑膠螺旋槳 /
8-blade Plastic Screw Propeller

水陸兩用橡膠輪 /
Amphibious Rubber Wheel

多孔塑膠連桿 /
Perforated Plastic Connecting Strip



多孔固定膠板 /
Perforated Plastic Panel

多孔塑膠角碼 /
Perforated Plastic Angle Bracket

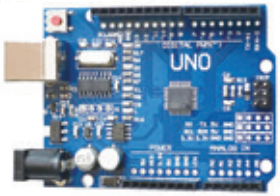
USB 線 /
USB Cable

10cm 杜邦線 (公對母，母對母) /
10cm Jumper Wires (M/F, F/F)

鋰聚合物電池充電器 /
Lithium-ion Polymer Battery Charger

重要零件介紹 Introduction to Major Parts

Arduino Uno R3 兼容主板
Arduino Uno R3 Compatible Board



Arduino Uno R3 是 Arduino Uno 的第三代改進版，是一款易用型開放源碼微控制器開發板。其運作原理主要是運用按鈕、感應器或手機等等把訊息輸入 UNO 板，透過執行所燒載的程式而作出反應，輸出的零部件可以是直流電動機、伺服電動機、LED 等等。

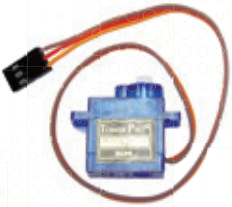
Arduino Uno R3 is the third revision of Arduino Uno, a user-friendly microcontroller board which operates by receiving input signals through buttons, sensors, mobile phones, etc. and responding through executing the loaded program. The output devices can be DC motors, servo motors, LEDs, etc.

Arduino Uno R3 感應器擴展板 v5.0
Arduino Uno R3 Sensor Shield v5.0

這款感應器擴展板不單將 Arduino Uno R3 板上全部數位與模擬針腳擴展出來，還提供不同模組的專門接口，實際上是將電路簡化，能夠很容易地將常用感應器連接起來，一款感應器僅需要一種通用（兼容數位 / 類比）的 3 針連接線。

This type of sensor expansion board not only extends out all digital and analog pins on Arduino Uno R3, but also provides a variety of ports for specific modules, which practically simplifies the circuit by easily connecting up those commonly used sensors. It works with any sensor using a universal (digital/analog compatible) 3-pin connector.

伺服電動機
Servo motor



伺服電動機又被稱為 RC 伺服機或伺服馬達舵機，並分為直流和交流電動機兩種。它由電動機、齒輪箱、輸出軸和控制電路板所組成。各型號的伺服電動機的輸出軸轉動範圍由 0 至 360 度不等。用家可以設定不同的訊號，控制伺服電動機轉動的速度和扭力。

A servo motor is also called as RC servo. It can be divided into two types, DC and AC motors. A servo motor consists of a motor, a set of gears, a shaft and a control circuit board. The angular range of servo shaft rotation varies with models, from 0 to 360 degrees. Users can control the speed and torque of a servo moto by setting different signals.

鋰聚合物電池
Lithium-ion Polymer Battery

鋰聚合物電池是一款高能量密度，無記憶性的電池，能夠在未放空電的情況下充電。它利用鋰離子經過電解液往返正負兩極時，所產生的能量變化來進行充或放電。它的自放電率低而壽命長，因此被廣泛應用於小型電子產品上。

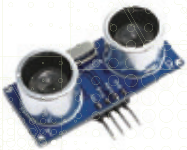
Lithium-ion Polymer battery has a high energy density and no memory effect which means it can be charged even it is not in a low capacity. It is charged or discharged by the principle that energy changes when lithium-ions move between the positive electrode and the negative electrode through the electrolyte. It has a low self-discharge rate and a long life span, so it is commonly used on small electronic gadgets.

LED 紅黃綠燈模組
LED Traffic Light Module

LED 紅黃綠燈模組包含 4 支針腳及紅色、黃色和綠色 LED 燈泡各一顆，需要配合 5V 電壓使用。3 顆 LED 燈泡可按編程單獨控制開關。

LED traffic light module consists of 4 pins, a red LED, a yellow LED and a green LED. It operates on 5V. Each LED can be switched on or off independently based on the program setting.

超聲波感應器
Ultrasonic Sensor



超聲波感應器由超聲波發射器、接收器和控制電路板所組成。它把超聲波由發射器發射的時間與反彈回來的時間作運算，並把超聲波信號轉換成電信號，測量感應器與附近物體之間的距離。

The ultrasonic sensor consists of a transmitter, a receiver and a control circuit board. It calculates the duration of the ultrasonic's travel to and back and then converts the ultrasonic signal into an electrical signal, thus to measure its distance from nearby objects.

HC-05 藍牙模組
HC-05 Bluetooth Module

HC-05 藍牙模組支援電子設備與 Android 應用程式以藍牙無線形式在 10 米範圍內通訊。用家只要把藍牙模組與流動設備配對，即可便兩者連接並傳送資料。

HC-05 Bluetooth Module allows wireless communication between digital device and an Android app through Bluetooth within a 10m range. To enable data transmission between a mobile device and the module, users just need to pair them up.

程式語言 Programming Language

Scratch 程式語言是由 MIT 開發的免費教學用程式語言，特別為中小學生而設計。Scratch 使用圖形化的積木編程界面，簡單易用。

參考書目：① PA01 Scratch 初階；② PA02 Scratch 進階

Scratch is a free educational programming language that was developed by MIT and geared towards kids ages 8-16. Scratch's drag-and-drop programming blocks can fit into one another like jigsaw puzzle pieces.

Reference Books: ① PA01 Scratch: Basic Skills；② PA02 Scratch: Advance Skills

產品特色 Product Features

1. 詳盡自學教程 Detailed Self-Learning Tutorial

- 教學內容詳盡，鼓勵同學自學。
  Detailed teaching and learning materials are provided to facilitate student's self-learning.
- 充足及清晰指引以提升學生學習效率。
  Adequate and clear instructions are given to hence student's learning efficiency.
- 零部件裝嵌步驟影片簡潔易明，學生可按需要重播內容。
  Concise videos on assembly steps are provided which enable students to repeat content when needed.
- 教程支援電腦、平板及智能手機，方便易用。
  Tutorial supports different devices including computers, tablets and smart phones.

2. Scratch 語言教學 Scratch Programming Language

- 採用流行、簡易並免費的 Scratch 程式語言來進行教學，學與教更簡便。
  Scratch, a popular, simple and free programming language is used, which makes learning and teaching easy.
- 特別加入與硬件相關的編程技巧。
  Hardware-related programming skills are covered.

3. 開放源碼的軟硬件 Open-Source Software & Hardware

- Arduino 和 mBlock 都是開放源碼的，教師可以按校本需要調整內容。
  Arduino and mBlock are open-sourced, teachers can adjust the teaching content according to school needs.

教材和學材 Teaching and Learning Materials

1. 基礎知識 Basic Knowledge

- 附多本基礎知識教程，讓學生能輕鬆學習組裝和控制智能機械。

  User-friendly basic knowledge tutorials of Smartbot assembly and control are provided for beginners.

2. 自學教材 Self-Learning Guide

- 每個專案都有詳盡的自學教材，鼓勵自主學習。

  Each project contains detailed self-study materials which encourage self-study.

- 每個專案具獨立性，可靈活調動學習次序。

  Each project is a stand-alone one for greater flexibility on learning sequence.

3. 資源檔案及建議答案 Resource Files & Suggested Answers

- 全部與編程有關的作業均配備相關的資源檔案及建議答案。

  All assignments related to programming are provided with relevant resource files and suggested answers.

4. 互動光碟及專用網站 Interactive CD-ROM & Companion Website

- 光碟和網站均提供完整的教材和學材，方便備課、教學或自學。

  A CD-ROM and a website with full teaching and learning materials are provided.

  (網址 Website：http://www.apricot.com.hk/stemkit/)

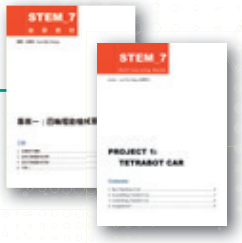
專案一：四輪驅動機械車
Project 1: Tetrabot Car

同學會學習運用四個 360 度伺服電動機為四輪驅動機械車提供動力，並運用同時控制四個伺服電動機運作的程式。

Students will learn to use four 360-degree servo motors to provide power to a Tetrabot Car and to use a program to control four servo motors simultaneously.

專案資源 Project Resources

自學教材
Self-Learning Guide



資源檔案
Resource Files

建議答案
Suggested Answers

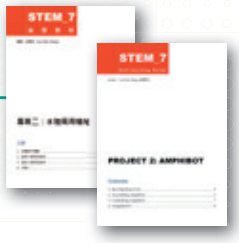
專案二：水陸兩用機械
Project 2: Amphibot

同學會運用塑膠螺旋槳和伺服電動機等電子零件，組裝一隻水陸兩用機械，並利用 mBlock 程式控制機械在水面或陸地上移動及避開障礙。

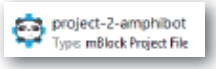
Students will use plastic screw propellers and other electronic components to assemble an Amphibot, and use mBlock programs to instruct the robot to move and avoid obstacles on water and land.

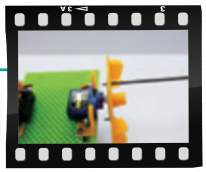
專案資源 Project Resources

自學教材
Self-Learning Guide



資源檔案
Resource Files





建議答案
Suggested Answers

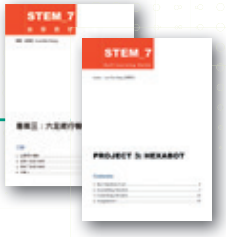
專案三：六足爬行機械
Project 3: Hexabot

本專案除了讓同學組裝六足爬行機械和控制機械移動外，亦讓他們接觸數學軌跡及物理元素，例如調節機械關節的距離，改變機械步幅等。

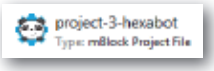
In this project, students will assemble and control a Hexabot. Also, they will touch on the concept of locus and physical elements, like changing the stride length of a Hexabot by modifying the distance between its joints.

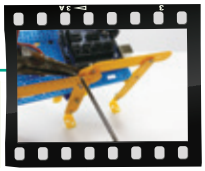
專案資源 Project Resources

自學教材
Self-Learning Guide



資源檔案
Resource Files





建議答案
Suggested Answers

本教學套件為配合教育局推行的STEM教學而設計，適合中小學生使用，學與教材料齊備，方便作課堂教學、專題研習或自主學習之用。

產品特色 Product Features

- 開放源碼的軟硬件 Open-Source Software & Hardware
- 詳盡教學課程 Well-Organised Teaching Materials
- 採用 Scratch 語言教學 Scratch Programming Language is Adopted
- 提供活動相關的基礎知識 Relevant Basic Knowledge is Provided
- 提供清楚的零部件裝嵌步驟影片 Clear Part Assembly Steps in Video Provided
- 資源檔案及建議答案 Resource Files & Suggested Answers
- 互動光碟及專用網站 Interactive CD-ROM & Companion Website

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- 曾應教育局邀請分享學校 STEM 發展及 Arduino 工作坊
- 現於《兒童快報》STEM 專欄分享 STEM 習作
- 編著《Arduino 智能遙控爬行機械教學套件》及《智能機械系列教學套件》

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