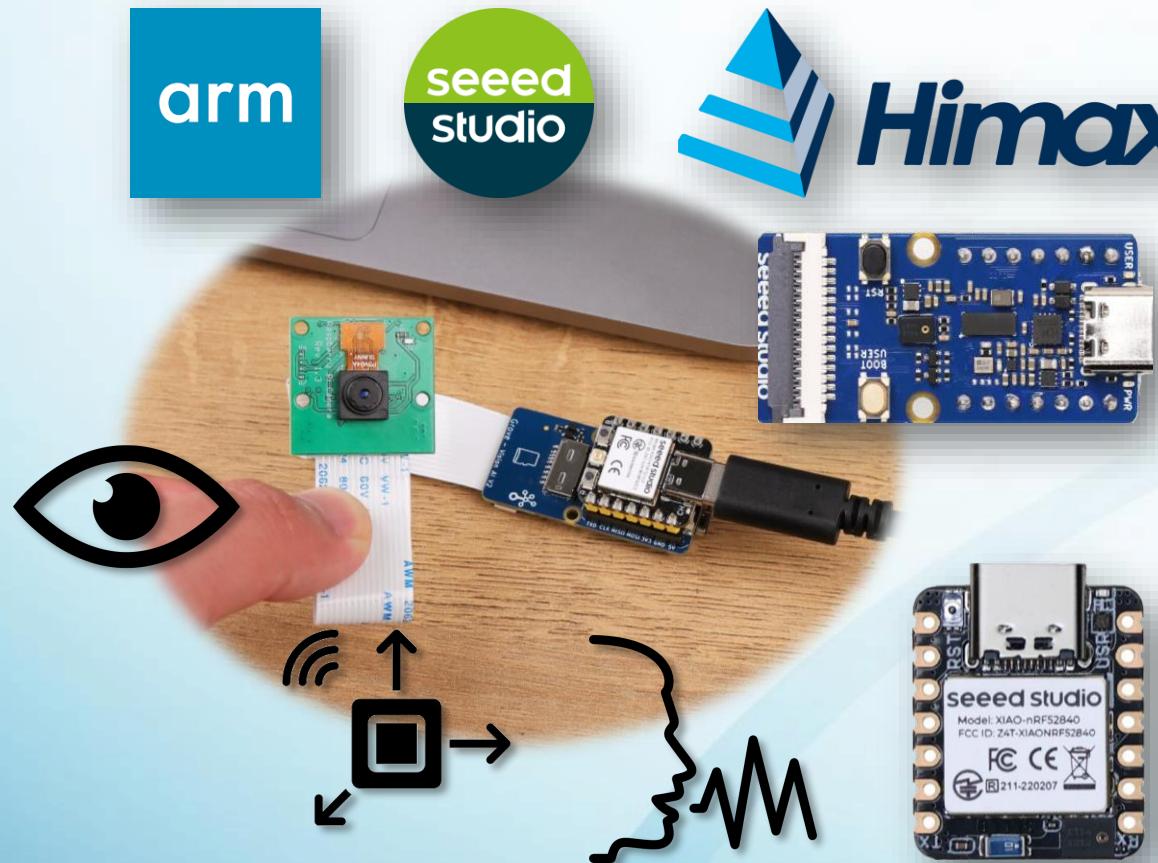


OmniXRI TinyML 小學堂 2025



Cortex-M
Processor

Ethos-U
MicroNPU

【第 7 講】 實驗開發板介紹



歐尼克斯實境互動工作室 (OmniXRI Studio)
許哲豪 (Jack Hsu)

簡報大綱



- 7.1. Arduino Nano 33 BLE Sense
- 7.2. Seeed Xiao nRF52840 Sense
- 7.3. Seeed Grove Vision AI Module V2 Kit
- 7.4. Seeed SenseCAP Watcher
- 7.5. Seeed SenseCraft AI 簡介

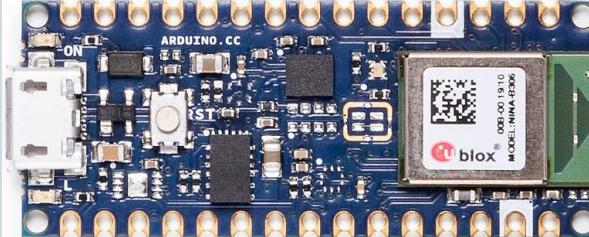
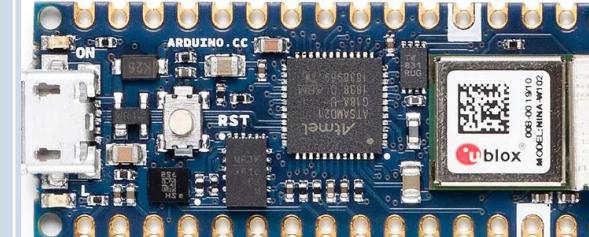
本課程完全免費，請勿移作商業用途！
歡迎留言、訂閱、點讚、轉發，讓更多需要的朋友也能一起學習。

完整課程大綱：<https://omnixri.blogspot.com/2025/03/omnixri-tinyml-2025-0.html>
課程直播清單：<https://www.youtube.com/@omnixri1784streams>

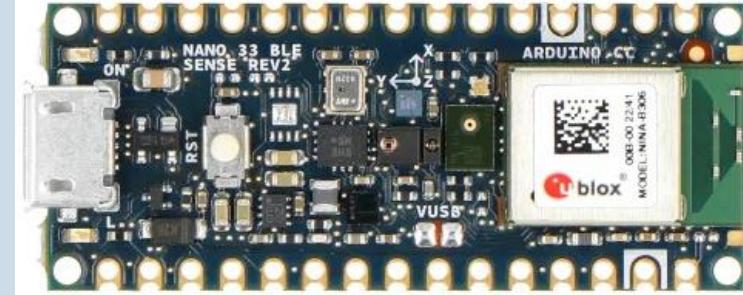


7.1. Arduino Nano 33 BLE Sense

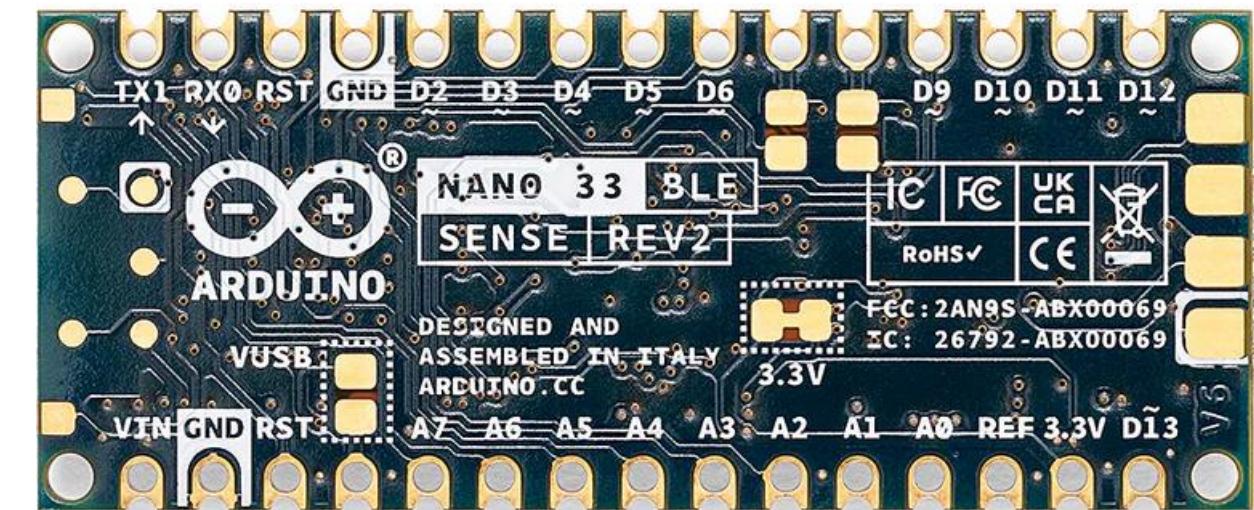
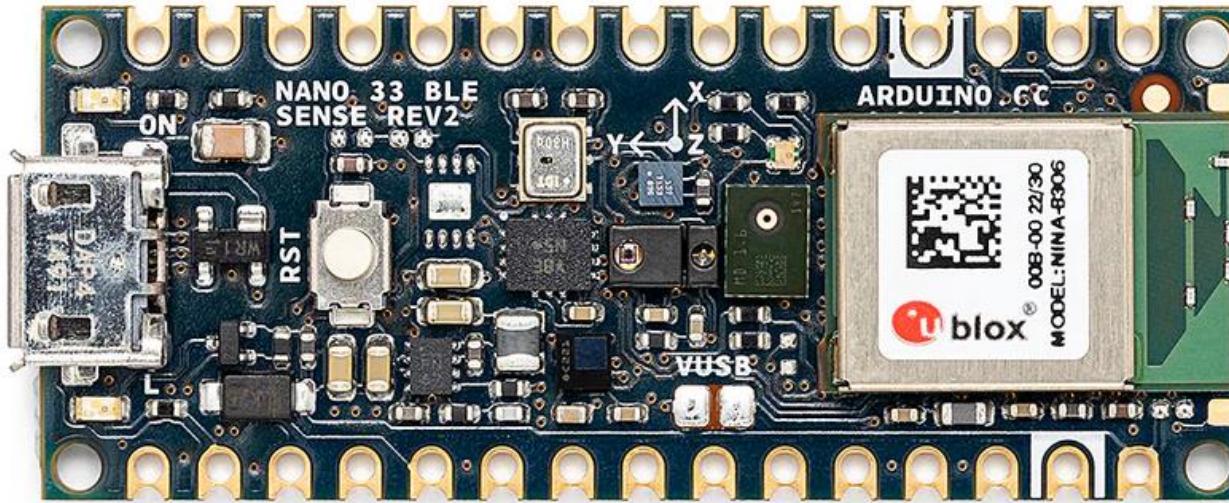
Arduino Nano 33 家族

	BLE	BLE Sense (rev. 1)	IoT
Arduino Nano 33			
MCU	Nordic nRF52840		SAMD21
arm core	Cortex-M4F @64MHz		Cortex-M0+ @48MHz
Flash / SRAM	1MByte / 256KB		256KByte / 32KB
Wireless	Bluetooth 5		WIFI 802.11b/g/n+BT4.2
Sensor	IMU(9 axis)	IMU(9 axis), 溫濕度、氣壓、麥克風、手勢(光照、接近、色彩)	IMU(6 axis)
DAC	PWMx14		PWMx11, 10bit ADC x1
GPIO	DIOx14, AIx8, UARTx1, SPIx1, I2Cx1		DIOx14, AIx8, UARTx1, SPIx1, I2Cx1

Arduino Nano 33 BLE Sense 一、二代比較

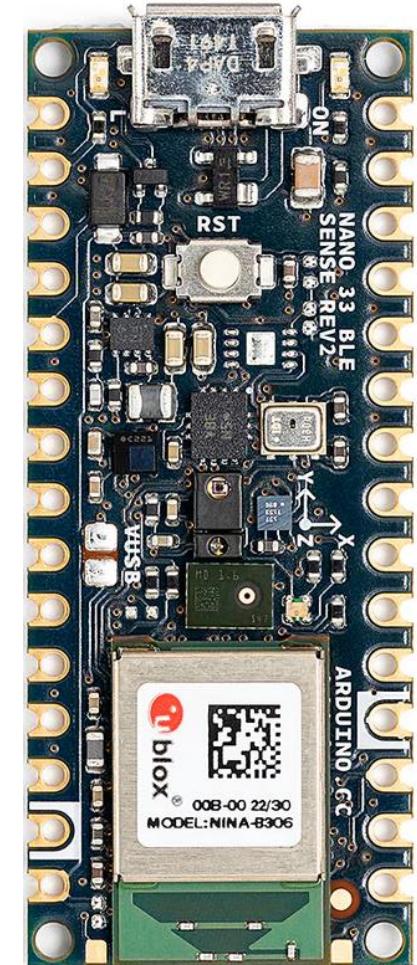
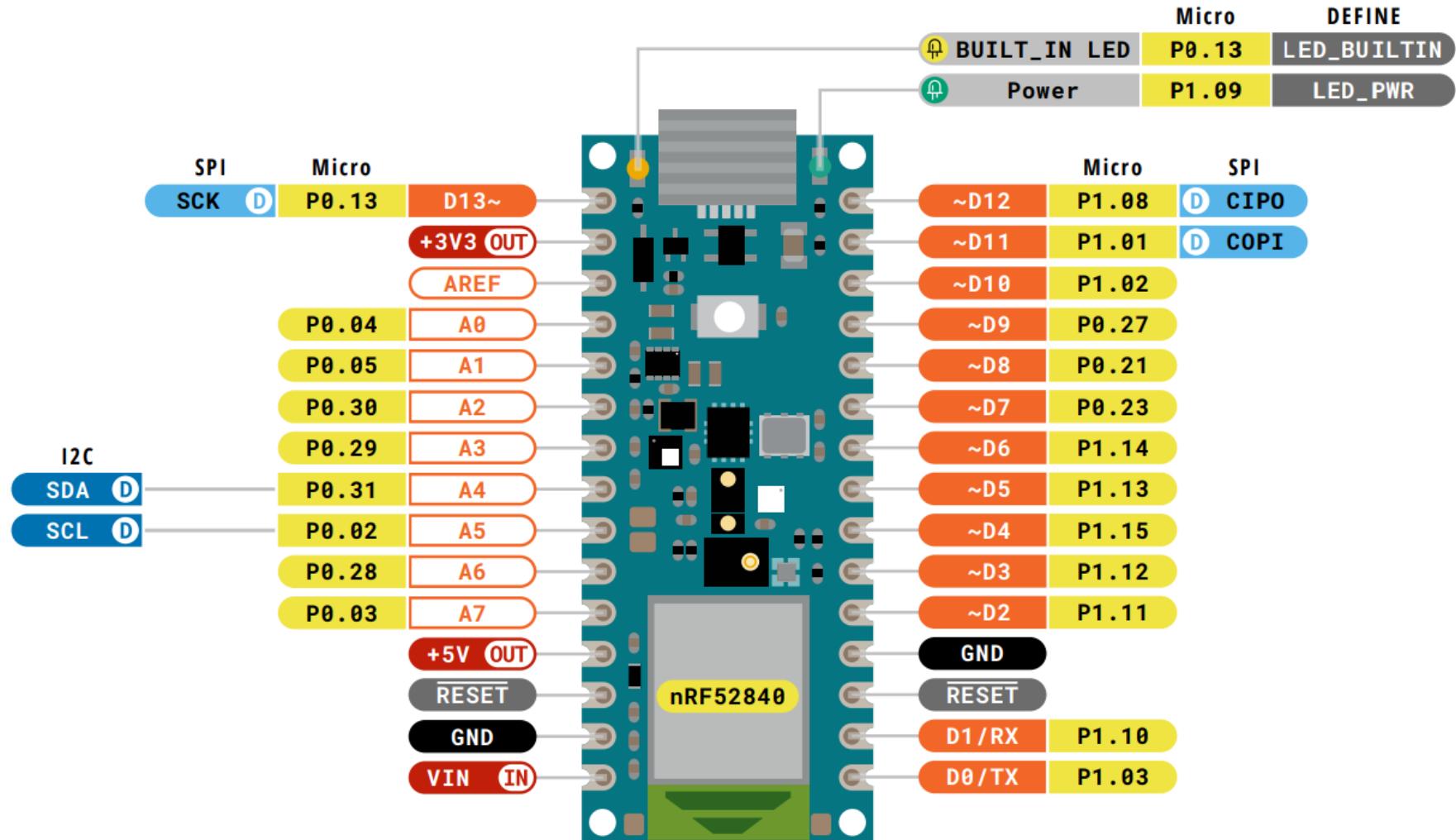
	Rev. 1	Rev. 2
Arduino Nano 33 BLE Sense		
MCU	Nordic nRF52840 (arm Cortex-M4F @64MHz, 1MB Flash / 256KB SRAM)	
慣性測量單元 (IMU)	LSM9DS1 (九軸IMU，包含加速度計、陀螺儀、磁力計)	BMI270 (六軸IMU，包含速度計、陀螺儀) 另加 BMM150 (三軸磁力計)
溫濕度感測器	HTS221	HS3003
麥克風	MP34DT05	MP34DT06JTR
手勢、接近、光照、 RGB感測器	APDS9960	APDS9960
電源管理	MPM3610	MP2322

Arduino Nano 33 BLE Sense Rev.2 規格



- 微處理器 : Nordic nRF52840 (arm Cortex-M4F)
- 工作電壓/頻率 : 3.3V / 64MHz
- Flash / SRAM : 1MB / 256KB
- 外觀尺寸 : 45mm x 18mm
- 數位 IO : x14 (+板上LED)
- 類比輸入 : 12bit, 200KHz x8
- 類比輸出 : PWM x14
- 感測器 :
 - 運動感測器 (BMI270 + BMM150)
 - 數位麥克風(MP34DT06JTR)
 - 手勢/照度/近接/色彩(APDS9960)
 - 氣壓(LPS22HB)
 - 溫濕度(HS3003)

Arduino Nano 33 BLE Sense Rev.2 接腳圖



資料來源：<https://docs.arduino.cc/hardware/nano-33-ble-sense-rev2/>

Arduino Nano 33 BLE Sense Rev.2 感測器

加速度計/陀螺儀

BMI270 Inertial Motion Unit 6 axis		
P0.22	VDD	
P0.22	VDDIO	
SDA1 D	P0.14	SDx
SCL1 D	P0.15	SCx
P0.22	CSB	
P0.11	INT1	
P0.20	INT2	
GND	SDO	

LPS22HBTR Pressure sensor		
P0.22	VCC	
P0.22	VCCIO	
SDA1 D	P0.14	SDA
SCL1 D	P0.15	SCL
P0.22	CS	
P0.12	INT1	
GND	SDO	

氣壓感測器

The sensors BMI270, BMM150, LPS22HBTR and HS3003 are powered by P0.22, that can be set to zero to turn them off

接近、照度、手勢、色彩感測器

APDS-9960
Digital proximity, Ambient light, RGBa and Gesture sensor

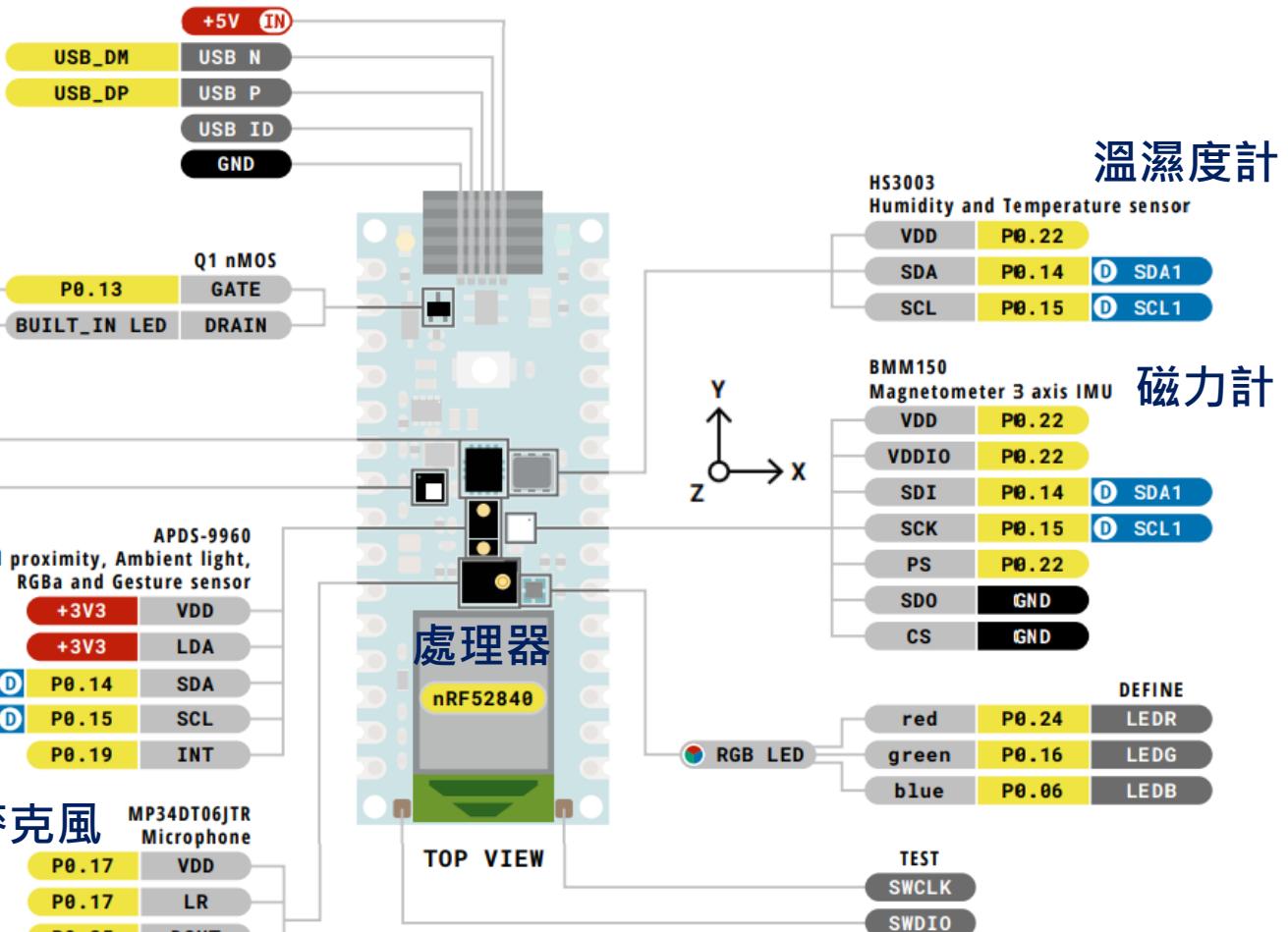
+3V3	VDD	
+3V3	LDA	
SDA1 D	P0.14	SDA
SCL1 D	P0.15	SCL
P0.19	INT	

數位麥克風

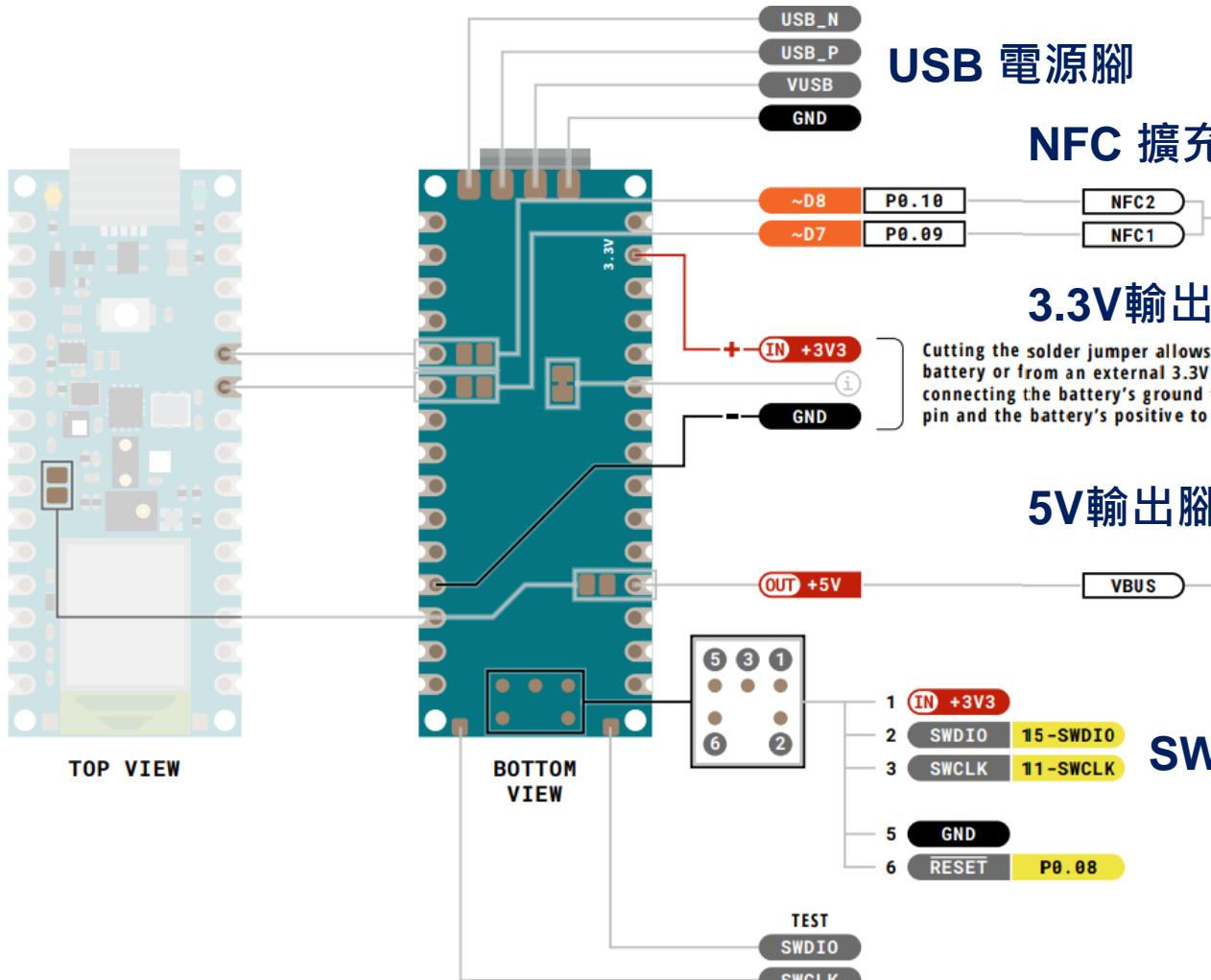
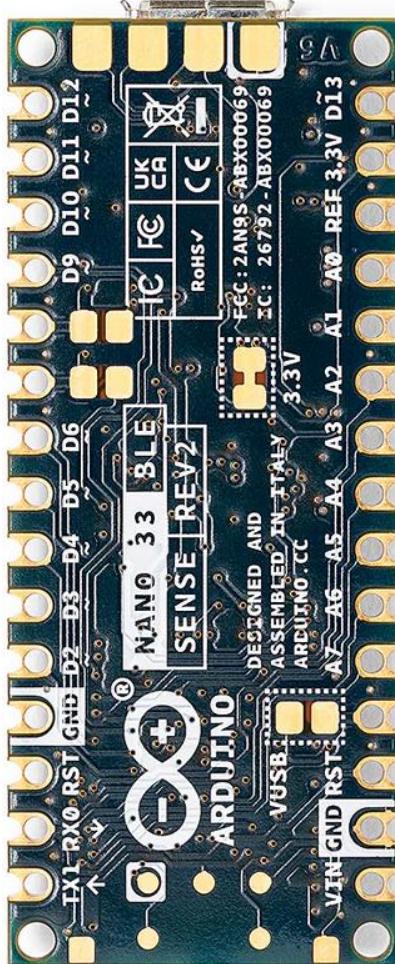
MP34DT06JTR
Microphone

P0.17	VDD
P0.17	LR
P0.25	DOUT
P0.26	CLK

資料來源：<https://docs.arduino.cc/hardware/nano-33-ble-sense-rev2/>



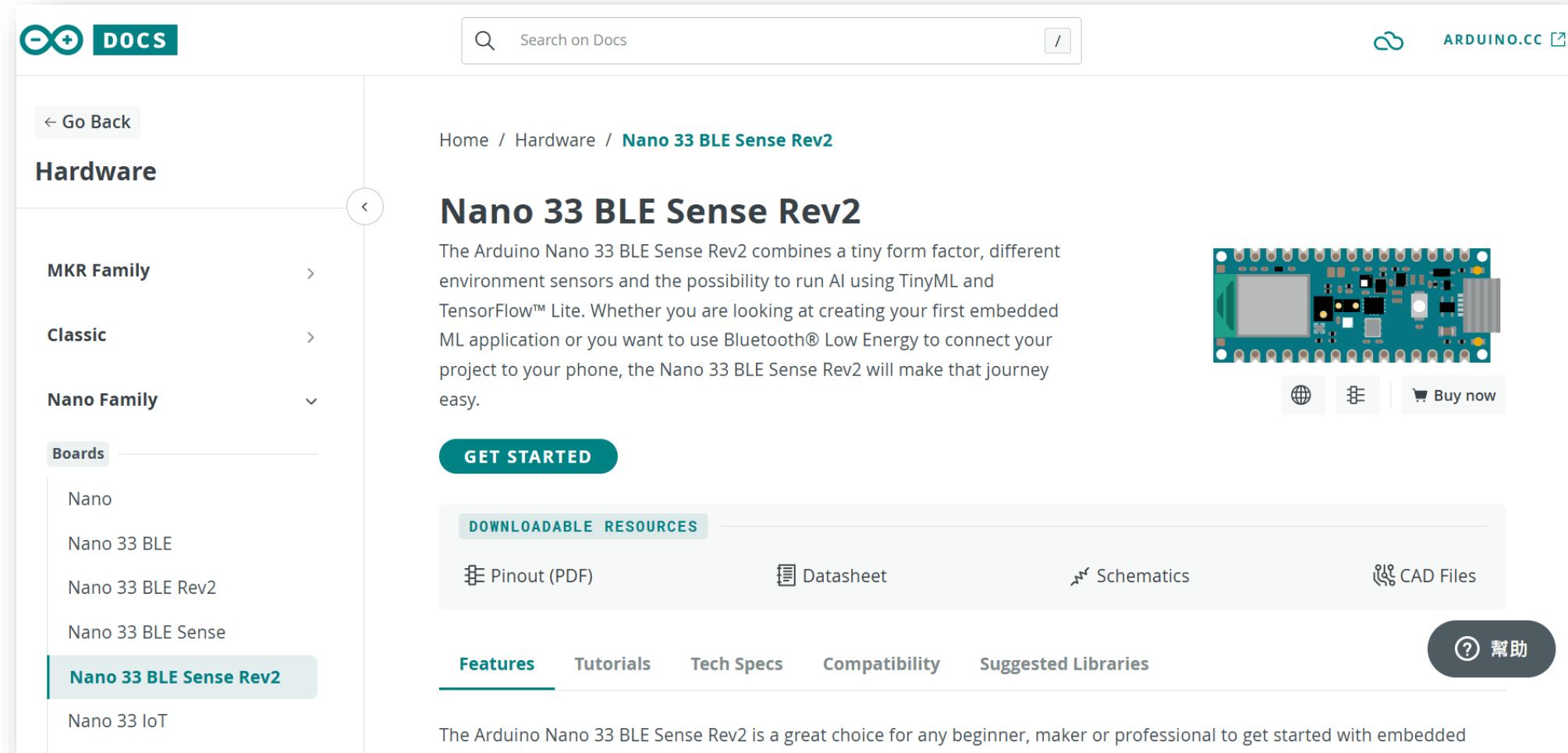
Arduino Nano 33 BLE Sense Rev.2 電源



沒有提供鋰電池充
放電IC要自行增加

資料來源：<https://docs.arduino.cc/hardware/nano-33-ble-sense-rev2/>

Arduino Nano 33 BLE Sense Rev.2 技術文件



The screenshot shows the Arduino Docs page for the Nano 33 BLE Sense Rev2. The page includes a sidebar with navigation links for MKR Family, Classic, and Nano Family boards, and a detailed description of the Nano 33 BLE Sense Rev2 board. The main content area features a large image of the board, a "GET STARTED" button, and a "DOWNLOADABLE RESOURCES" section with links to Pinout (PDF), Datasheet, Schematics, and CAD Files. A footer note states that the board is suitable for beginners, makers, and professionals.

Docs Search on Docs / ARDUINO.CC

← Go Back Home / Hardware / **Nano 33 BLE Sense Rev2**

Hardware

- MKR Family >
- Classic >
- Nano Family < v

Boards

- Nano
- Nano 33 BLE
- Nano 33 BLE Rev2
- Nano 33 BLE Sense
- Nano 33 BLE Sense Rev2**
- Nano 33 IoT

Nano 33 BLE Sense Rev2

The Arduino Nano 33 BLE Sense Rev2 combines a tiny form factor, different environment sensors and the possibility to run AI using TinyML and TensorFlow™ Lite. Whether you are looking at creating your first embedded ML application or you want to use Bluetooth® Low Energy to connect your project to your phone, the Nano 33 BLE Sense Rev2 will make that journey easy.

GET STARTED

DOWNLOADABLE RESOURCES

- Pinout (PDF)
- Datasheet
- Schematics
- CAD Files

Features Tutorials Tech Specs Compatibility Suggested Libraries

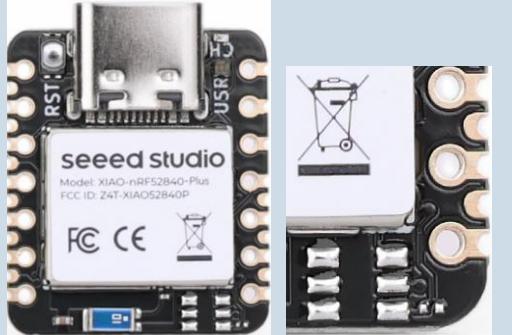
The Arduino Nano 33 BLE Sense Rev2 is a great choice for any beginner, maker or professional to get started with embedded

<https://docs.arduino.cc/hardware/nano-33-ble-sense-rev2/>



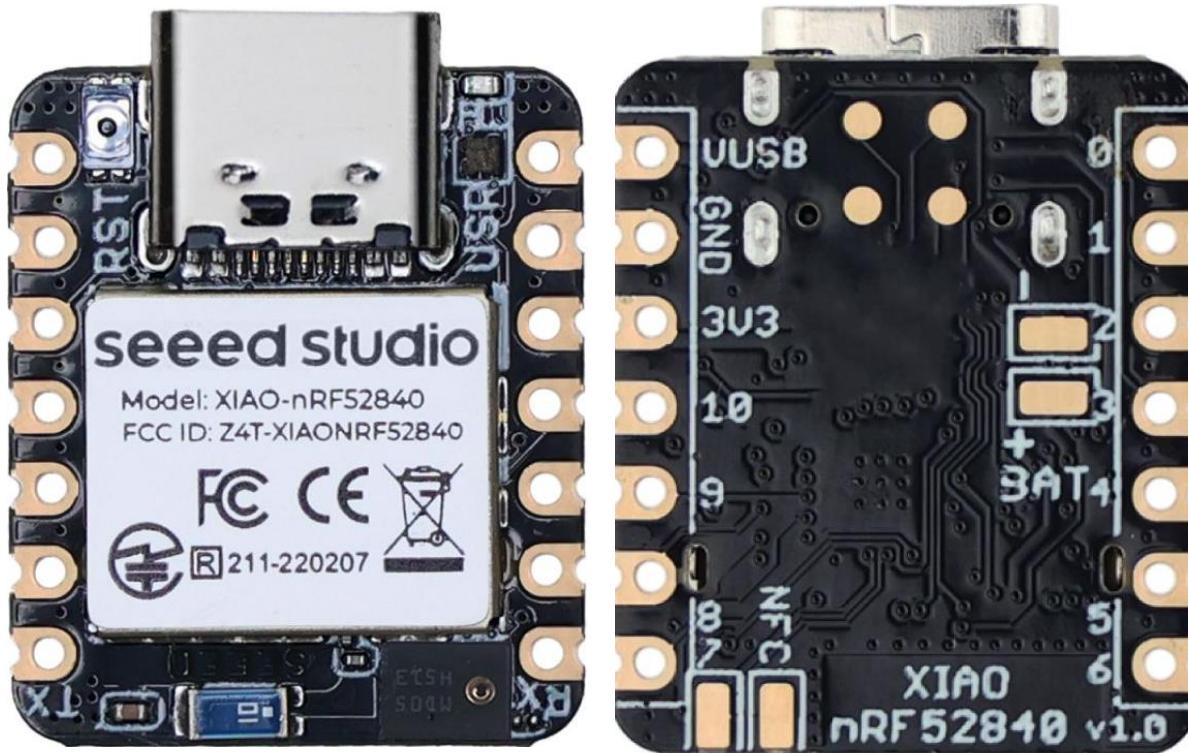
7.2. Seeed Xiao nRF52840 Sense

Seeed Xiao nRF52840 家族

	nRF52840	nRF52840 Sense	nRF52840 Sense Plus		
Xiao					
MCU	Nordic nRF52840 (arm Cortex-M4F @64MHz)				
Flash / SRAM / QSPI	1MB / 256KB / 2MB				
GPIO & Interface	11xGPIO(PWM), 6xADC, UART, I2C, SPI, NFC, SWD		20xGPIO(PWM), 6xADC, 2xUART, I2C, I2S, 2xSPI, NFC, SWD		
感測器	--	6 DOF IMU(LSM6DS3TR-C), PDM Microphone			
電源管理	BQ25101 (充電電流50 / 100 mA)				
外觀尺寸	21mm x 17.8mm				

資料來源：https://wiki.seeedstudio.com/XIAO_BLE/

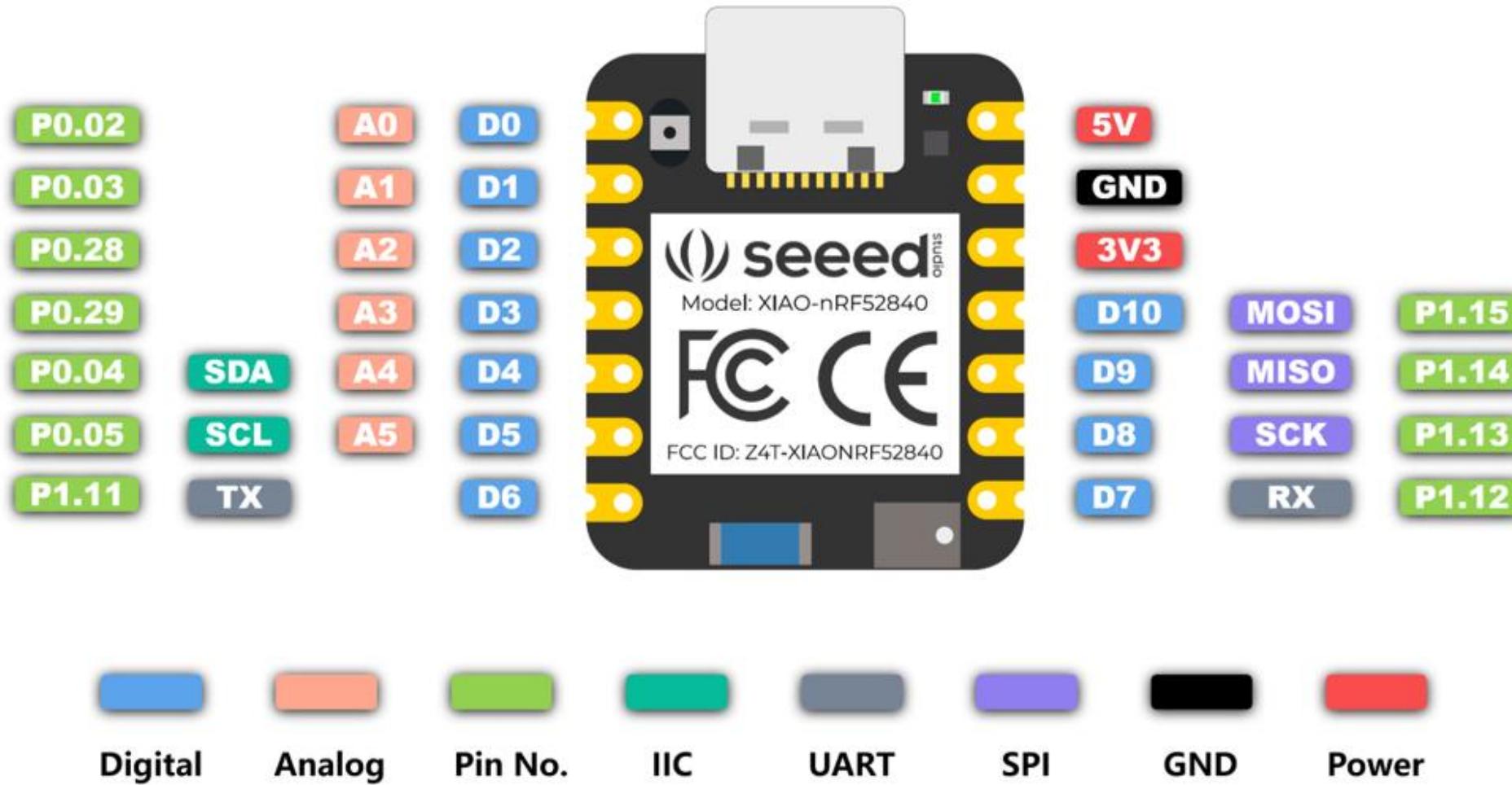
Seeed Xiao nRF52840 (Sense) 規格



資料來源：https://wiki.seeedstudio.com/XIAO_BLE/

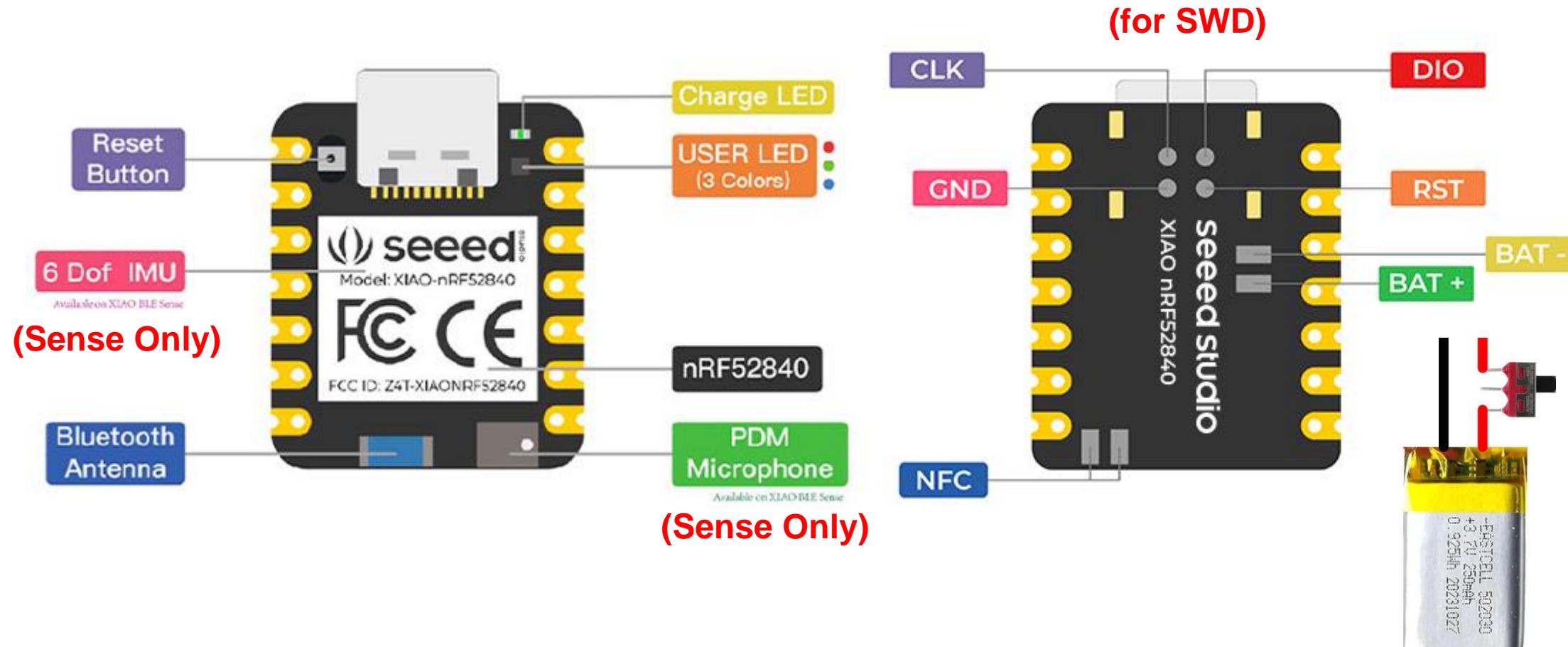
- 微處理器：
 - Nordic nRF52840 (arm Cortex-M4F)
- 工作電壓/頻率：3.3V / 64MHz
- Flash / SRAM：1MB / 256KB
- 外部Flash：QSPI 2MB
- 外觀尺寸：21mm x 17.8mm
- 數位 IO：x11 (+板上RGBLED)
- 類比輸入 / 輸出：x6 / PWM x11
- 感測器：**(Sense Only)**
 - 運動感測器 (LSM6DS3TR-C)
 - 數位麥克風
- 無線：Bluetooth 5.0 / BLE / NFC
- 開發工具：
 - Arduino / MicroPython / CircuitPython

Seeed Xiao nRF52840 (Sense) 接腳圖



資料來源：https://wiki.seeedstudio.com/XIAO_BLE/

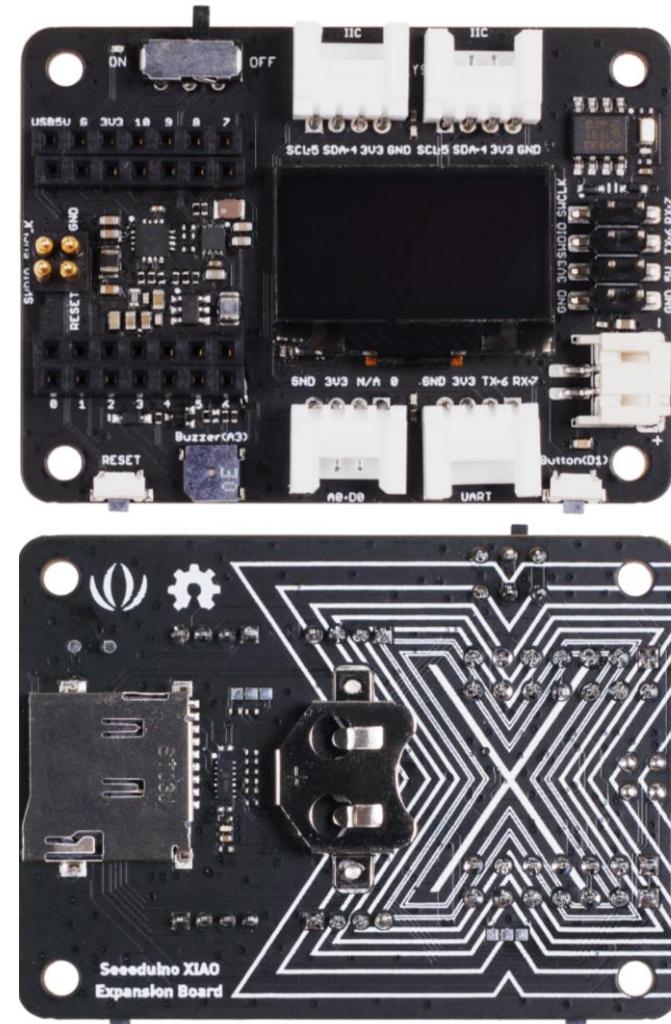
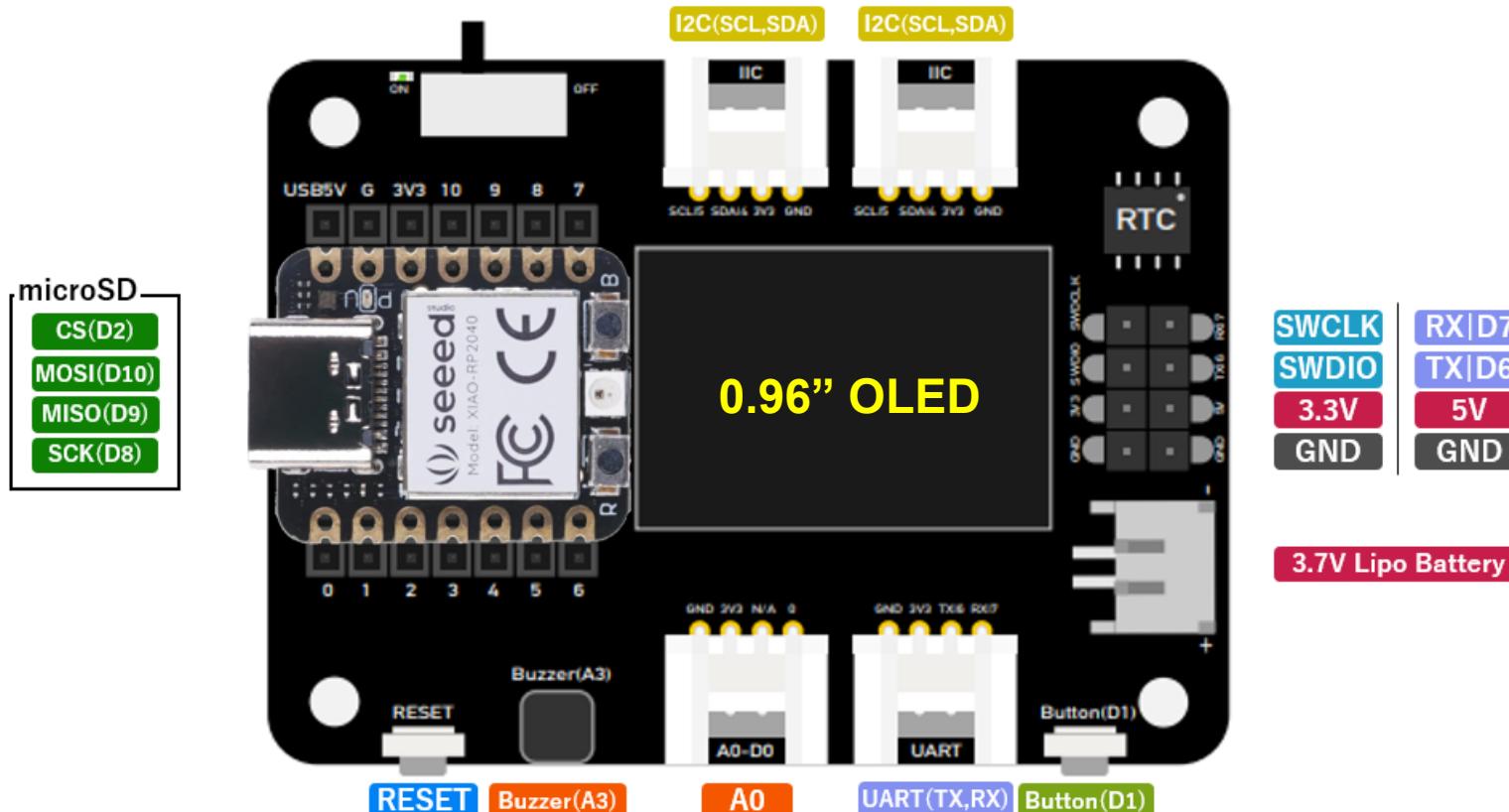
Seeed Xiao nRF52840 (Sense) 元件圖



資料來源：https://wiki.seeedstudio.com/XIAO_BLE/

Seeed Xiao 擴充底板

可支援 Xiao SAMD21, RP2040, nRF52840(Sense), ESP32C3, ESP32S3(Sense), ESP32C6, RP2350, RA4M1, MG24(Sense)



資料來源：<https://wiki.seeedstudio.com/Seeeduino-XIAO-Expansion-Board/>

Seeed Xiao nRF52840 (Sense) 技術文件

seeed studio Quick Links ▾ Explore with Topics ▾ FAQs ▾ Rangers ▾ Bazaar 🛍️ AI Bot 🤖 SenseCraft AI 🤖 ⚡ Search CTRL K

Exhibition for XIAO Series

- XIAO SAMD21 >
- XIAO RA4M1 >
- XIAO MG24 >
- XIAO RP2040 >
- XIAO RP2350 >
- XIAO nRF52840 Series** > **Getting Started with Seeed Studio XIAO nRF52840 Series**
- RTOS >
- Programming Language >
- Platform >
- Hardware Usage >
- IMU Usage for XIAO nRF52840 Sense

Getting Started with Seeed Studio XIAO nRF52840 Series

Getting Started with Seeed Studio XIAO nRF52840 Series

XIAO nRF52840	XIAO nRF52840 Sense	XIAO nRF52840 Plu
		
Get One Now	Get One Now	Get One Now

Features

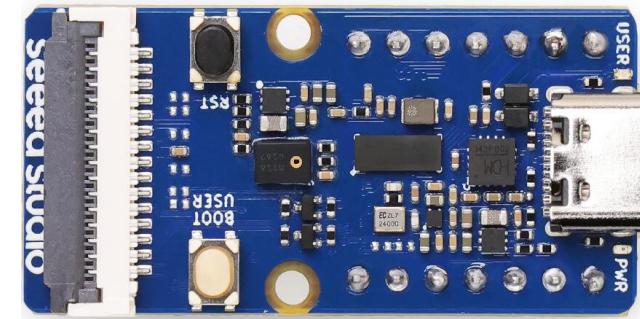
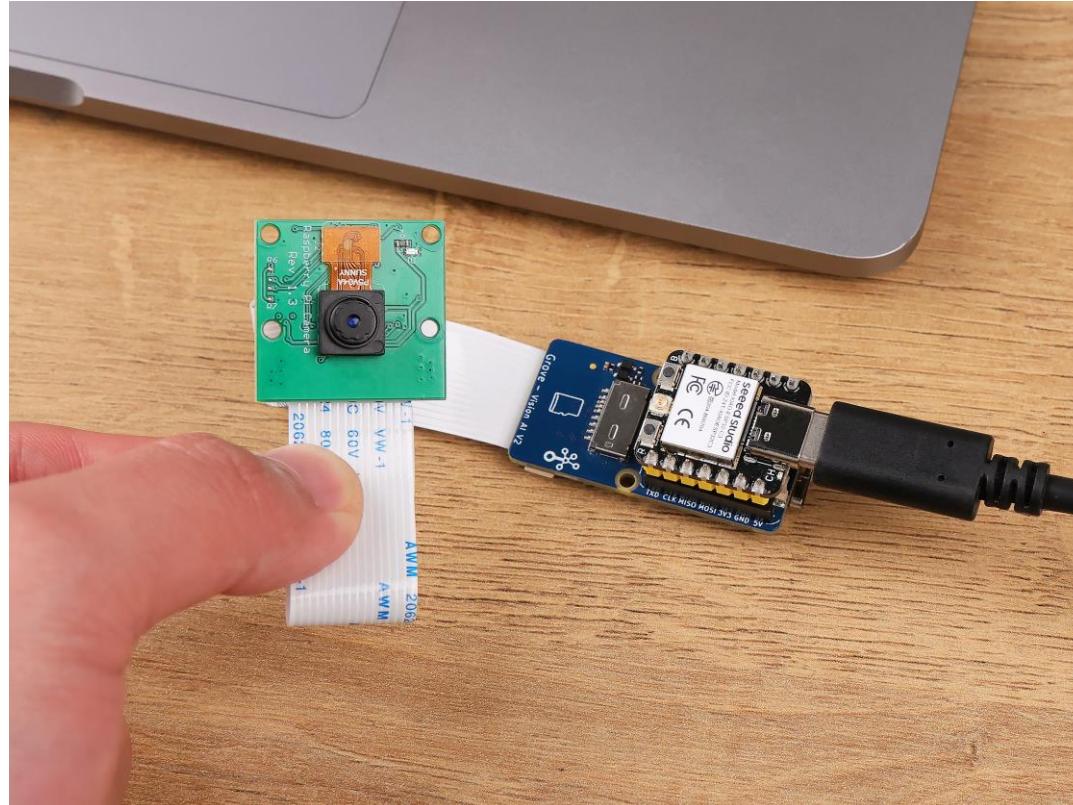
- Specifications comparison
- Hardware overview
- Two Arduino Libraries
- Getting started
- Hardware setup
- Software setup
- Playing with the built-in 3-in-one LED
- Power Consumption Verification
- Battery Charging current
- Access the SWD Pins for Debugging and Reflashing Bootloader
- FAQ
- Q1: My Arduino IDE is stuck when uploading code to the board

https://wiki.seeedstudio.com/XIAO_BLE/

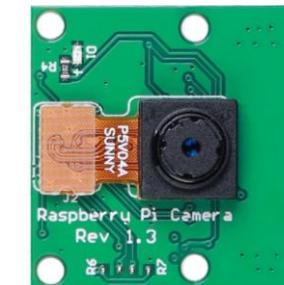


7.3. Seeed Grove Vision AI Module V2 Kit

Seeed Grove Vision AI V2 Kit



**Grove Vision AI
Module V2
(Himax WiseEye2
HX6538)**



**OV5647-62
Camera Module
for Pi3B+4B
(含軟排)**

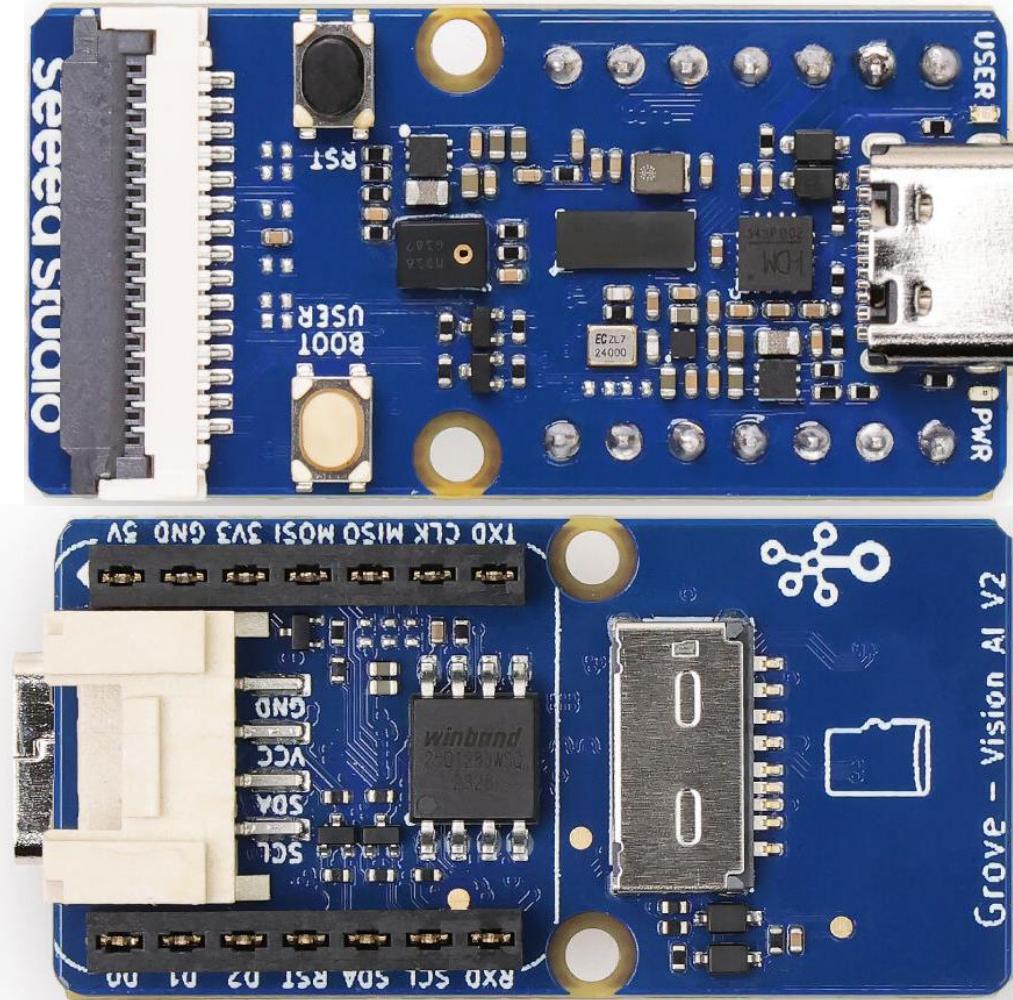
2529 x 1944 (5MP)

**Xiao ESP32C3
(WIFI / BT5)
(無線通訊用，選配)**



資料來源：https://wiki.seeedstudio.com/grove_vision_ai_v2/

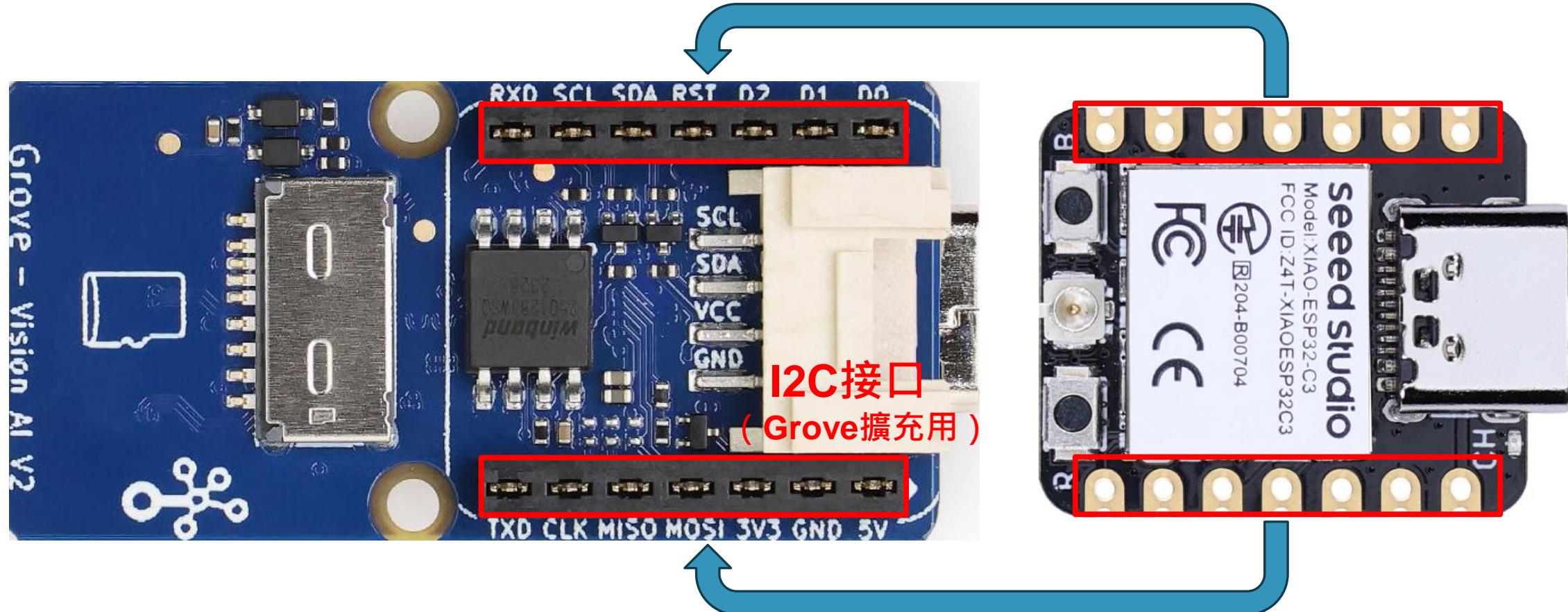
Grove Vision AI Module V2 規格



資料來源：https://wiki.seeedstudio.com/grove_vision_ai_v2/

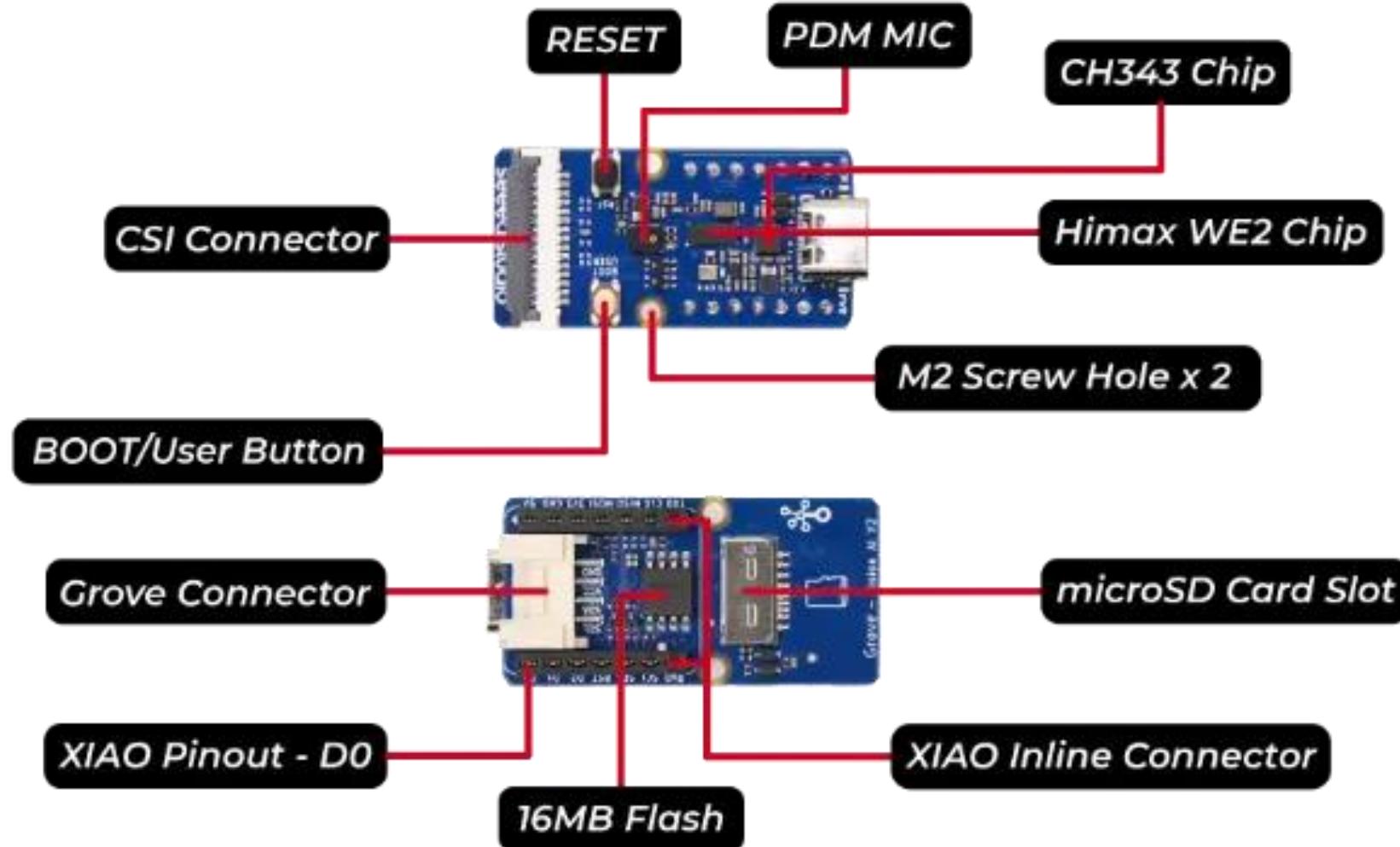
- **處理器**：Himax WiseEyes 2 HX6538
 - Arm Cortex-M55 (1x @400MHz, 1x @160MHz)
 - Arm Micro NPU Ethos-U55 (256MAC @400MHz)
 - 4K Boot ROM, 2432KB SRAM
- **GPIO**：User LED x1, CSI, IIC, UART, SPI, USB
- **尺寸**：13.6mm x 8.6mm
- **感測器**：PDM Micphone
- **外部記憶體**：miniSD Slot, 16MByte QSPI Flash
- **開發工具**：
 - Arduino, Seeed SenseCraft AI, Edge Impulse, GCC, arm Vela Compiler

Grove Vision AI Module V2 接腳圖



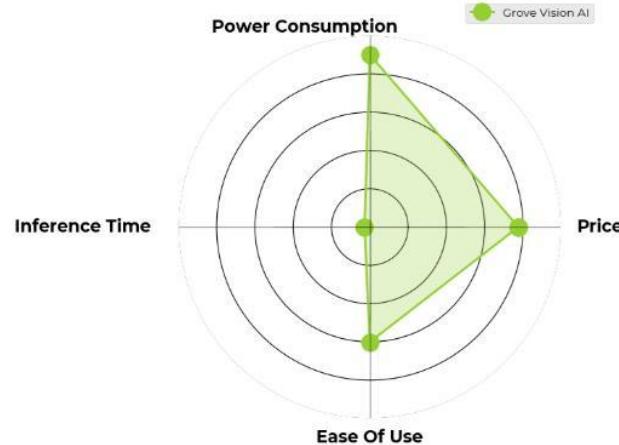
資料來源：https://wiki.seeedstudio.com/grove_vision_ai_v2/

Grove Vision AI Module V2 元件圖



資料來源：https://wiki.seeedstudio.com/grove_vision_ai_v2/

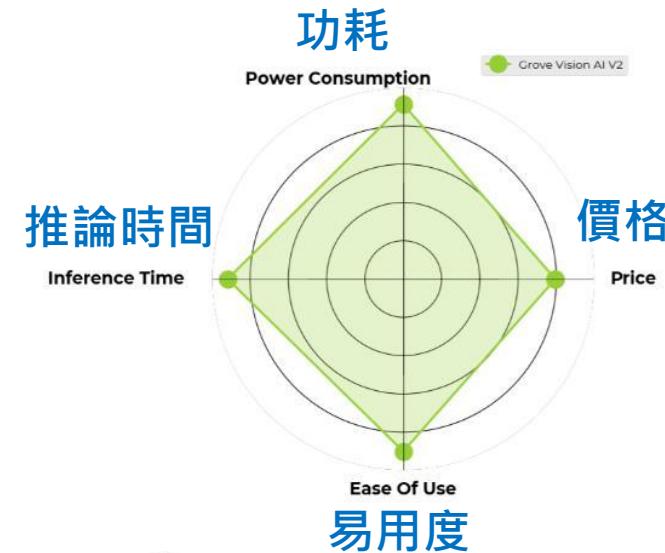
常見視覺AI模組性能比較 (1/2)



Power Consumption: 0.40W
Inference Time: 389.0ms
Frame Rate: 2.57FPS
Ease of Use: 6.0
Price: \$25.99

Grove Vision AI

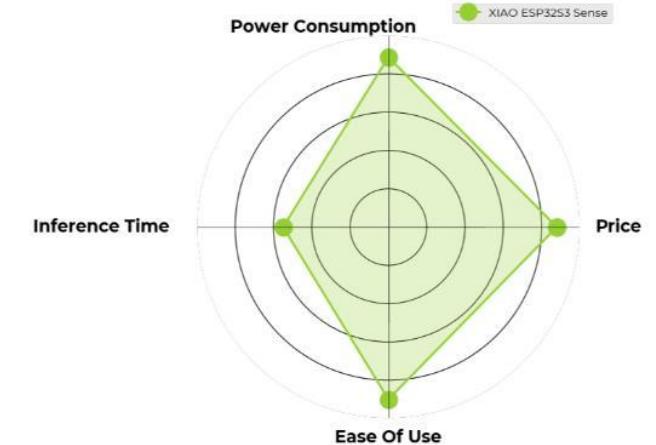
Himax HX6537-A (ARC EM9D DSP) 400 MHz



Power Consumption: 0.35W 
Inference Time: 33.0ms
Frame Rate: 30.30FPS
Ease of Use: 9.0
Price: \$23.89

Grove Vision AI V2

Himax WiseEye2 HX6538 (Cortex®-M55 + Ethos-U55)
400 MHz + 150MHz (M55) + 400MHz (U55)



Power Consumption: 0.45W
Inference Time: 180.0ms
Frame Rate: 5.55FPS
Ease of Use: 9.0
Price: \$13.99

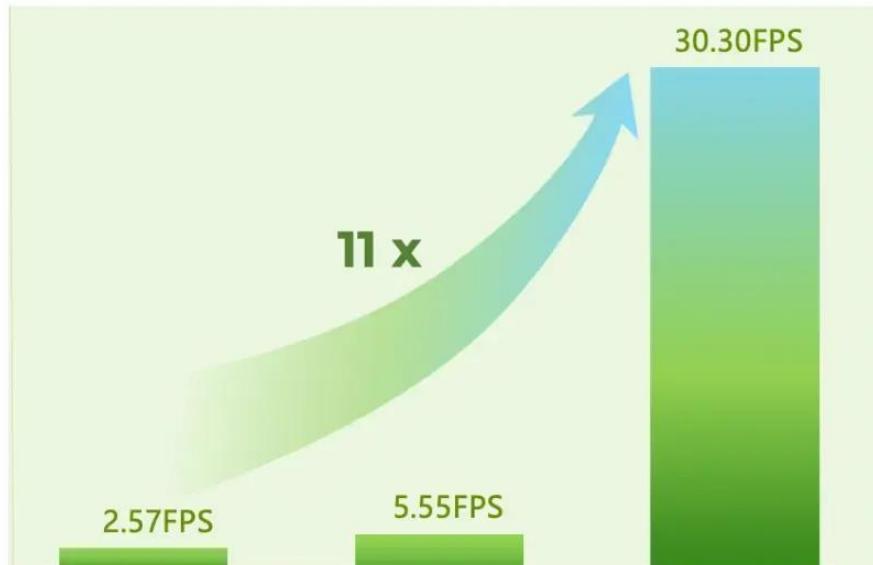
XIAO ESP32S3 Sense

ESP32S3 (Dual-Core Tensilica LX6) 240 MHz

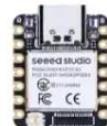
資料來源：https://wiki.seeedstudio.com/grove_vision_ai_v2/

常見視覺AI模組性能比較 (2/2)

Refresh Rate



Grove Vision AI v1

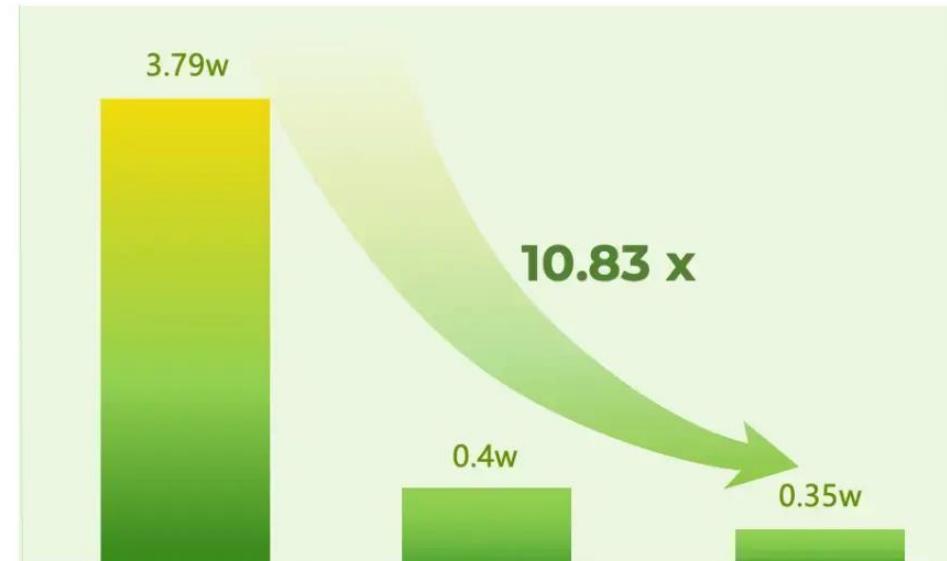


XIAO ESP32S3



Grove Vision AI v2
(M55 + U55 AI addon)

Energy Efficiency



Grove Vision AI v1
(M55 + U55 AI addon)



Grove Vision AI v2
(M55 + U55 AI addon)

資料來源：https://wiki.seeedstudio.com/grove_vision_ai_v2/

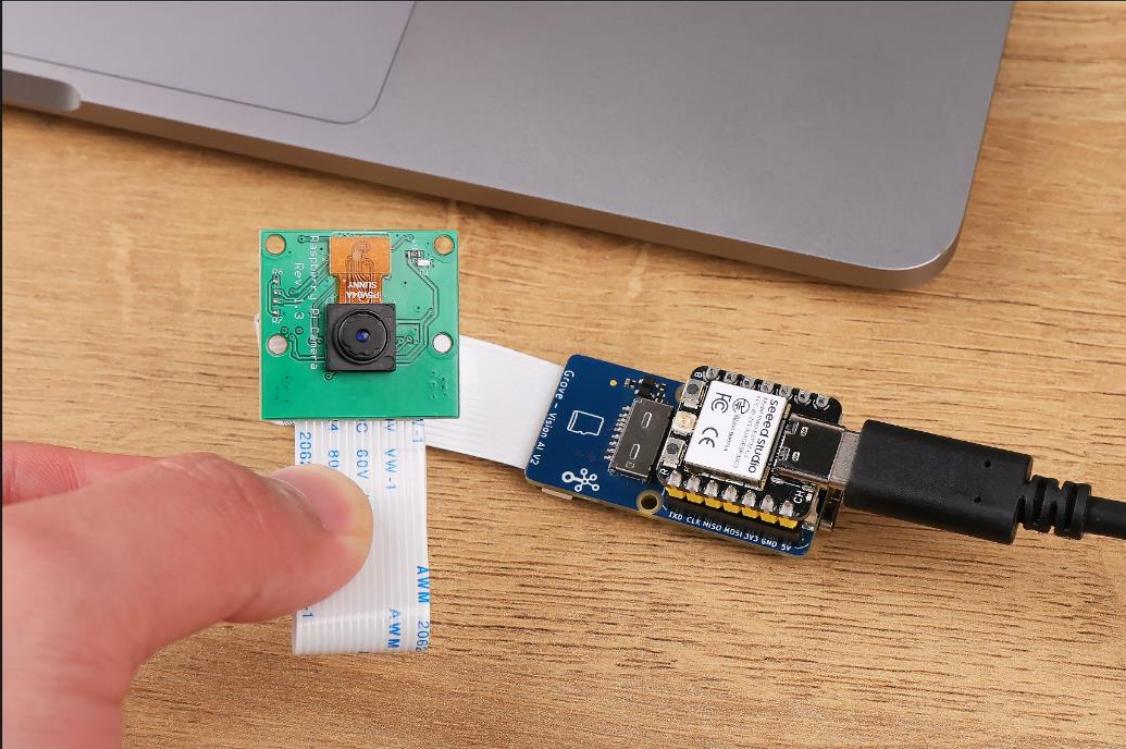
Grove Vision AI Module V2 技術文件

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Grove Sensor

- Multiple in one
- AI-powered
- Grove Vision AI
- Grove Vision AI V2**
- Software Support
- External Camera supported
- Deploying Models from Datasets to Grove Vision AI V2
- RS45 transmission of Vision AI V2 data
- Development
- Application
- Grove Smart IR Gesture Sensor (PAJ7660)

Grove Vision AI Module V2



Introduction

Features

Application

Hardware Overview

Connecting to a CSI interface camera

Boot / Reset / Flashed Driver

- Boot
- Reset
- Driver
- Bootloader Recovery
- Tool Manual
- Prerequisites
- Software Installation
- Hardware Connection
- Usage

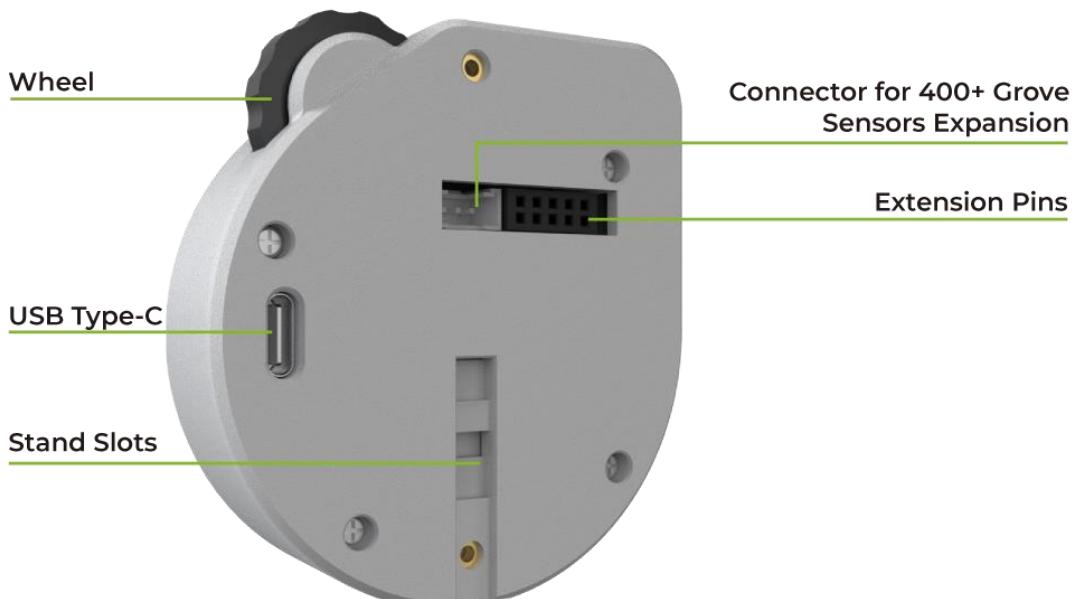
Getting Started

https://wiki.seeedstudio.com/grove_vision_ai_v2/



7.4. Seeed SenseCAP Watcher

Seeed SenseCAP Watcher



資料來源：<https://wiki.seeedstudio.com/watcher/>

Seeed SenseCAP Watcher 規格



資料來源：<https://wiki.seeedstudio.com/watcher/>

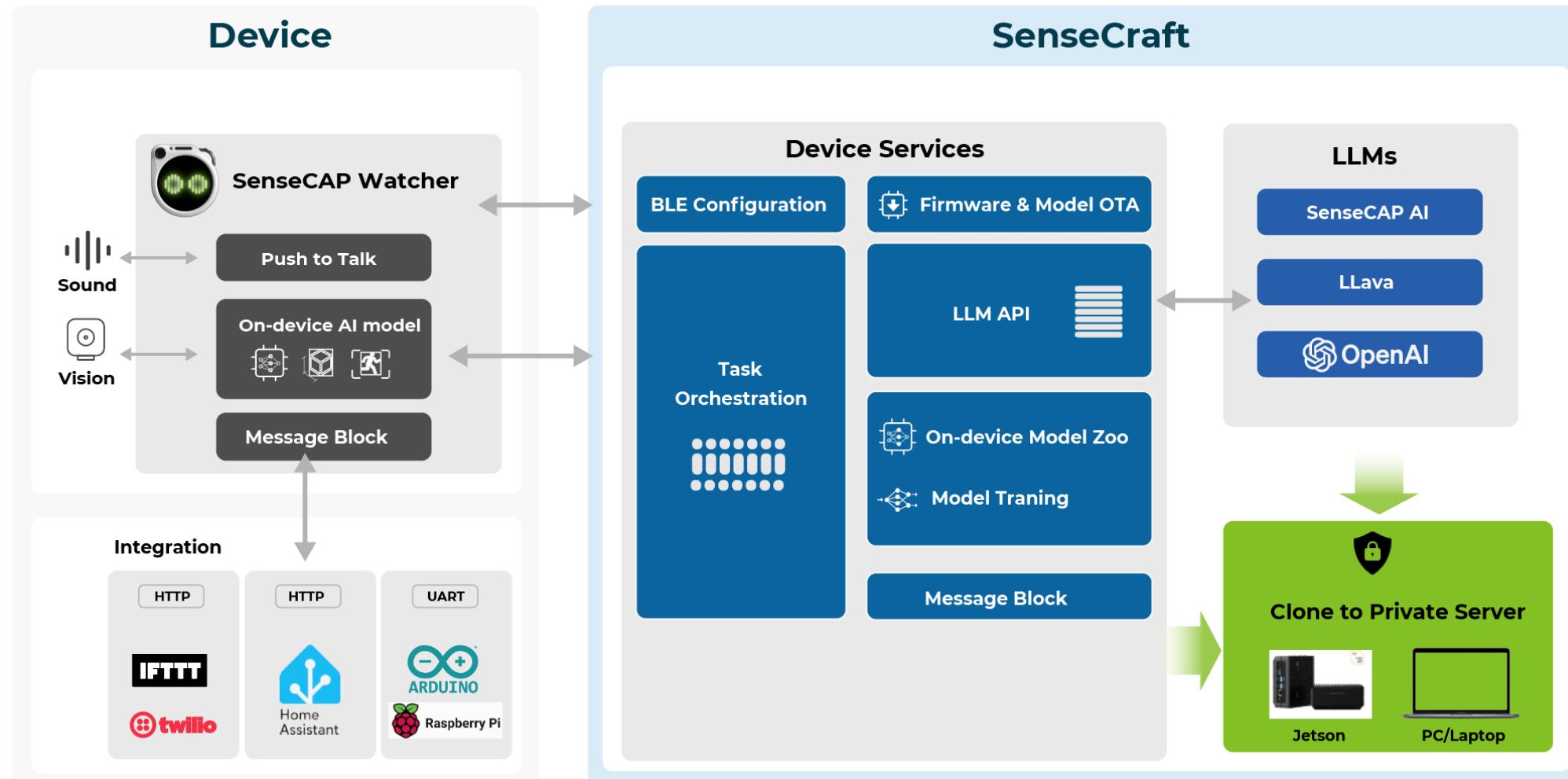
- **主要處理器：**
 - ESP32S3 @ 240MHz, 8MB PSRAM + 32MB 外接Flash
- **AI 處理器：**
 - Himax HX6538 (WE2), Cortex-M55 x2 (160/400MHz) + Ethos-U55 256MAC (400MHz), 4K ROM, 2432KB SRAM, 16MB QSPI Flash
- **攝影機模組：** OV5647 120° FOV (5MP)
- **顯示器：** 觸控1.45吋圓形螢幕 412x412 pixel
- **週邊：** 麥克風、1W喇叭、RGB LED、SD卡槽、滾輪按鍵
- **擴充介面：** Grove(IIC)、2xUSB-C、2x4接口(IIC, 2xGPIO, 3.3/5.0/Gnd)
- **電池：** 3.7V 400mAh 鋰電池
- **尺寸：** 69 x 69 x 20 mm

Seeed SenseCAP Watcher Grove擴充



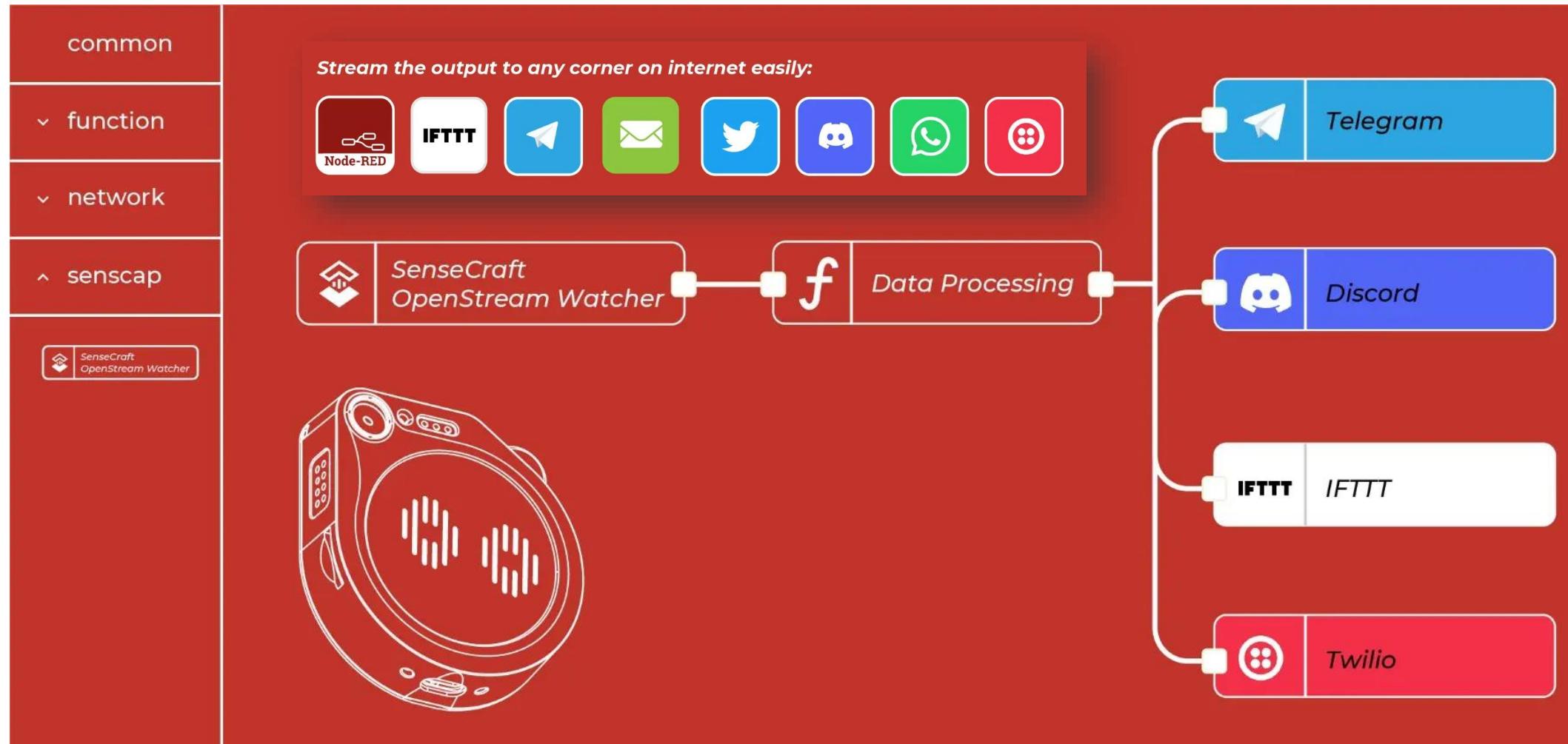
資料來源：<https://www.seeedstudio.com/SenseCAP-Watcher-W1-A-p-5979.html>

Seeed SenseCAP Watcher 系統架構



資料來源：<https://wiki.seeedstudio.com/watcher/>

Seeed SenseCAP Watcher Node-RED



資料來源：<https://www.seeedstudio.com/SenseCAP-Watcher-W1-A-p-5979.html>

Seeed SenseCAP Watcher 使用案例



People Detector
By Jeremy Ellis



Custom Animations
By Roni Bandini



Exercise Monitoring Assistant
By Jaime Arango



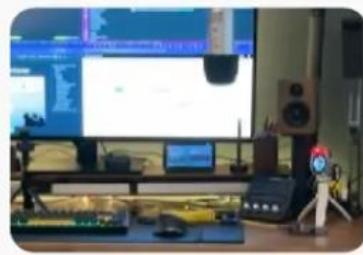
Cat Detector
By Becky Stern



Mug Detector
By Marcelo Rovai



People + Wearing Dress Detector
By Tim Lovett



Automated Lighting Controller
By Mithun Das



People + Calling Detector
By Hardware.ai



People + Smoking Detector
By Techiesms



Smart Doorman
By Hendra Kusumah



Workstation Protector
By Betty Fan



Gestures Detector
By Matt Mets



3D Printing Protector
By Nada que Hacer



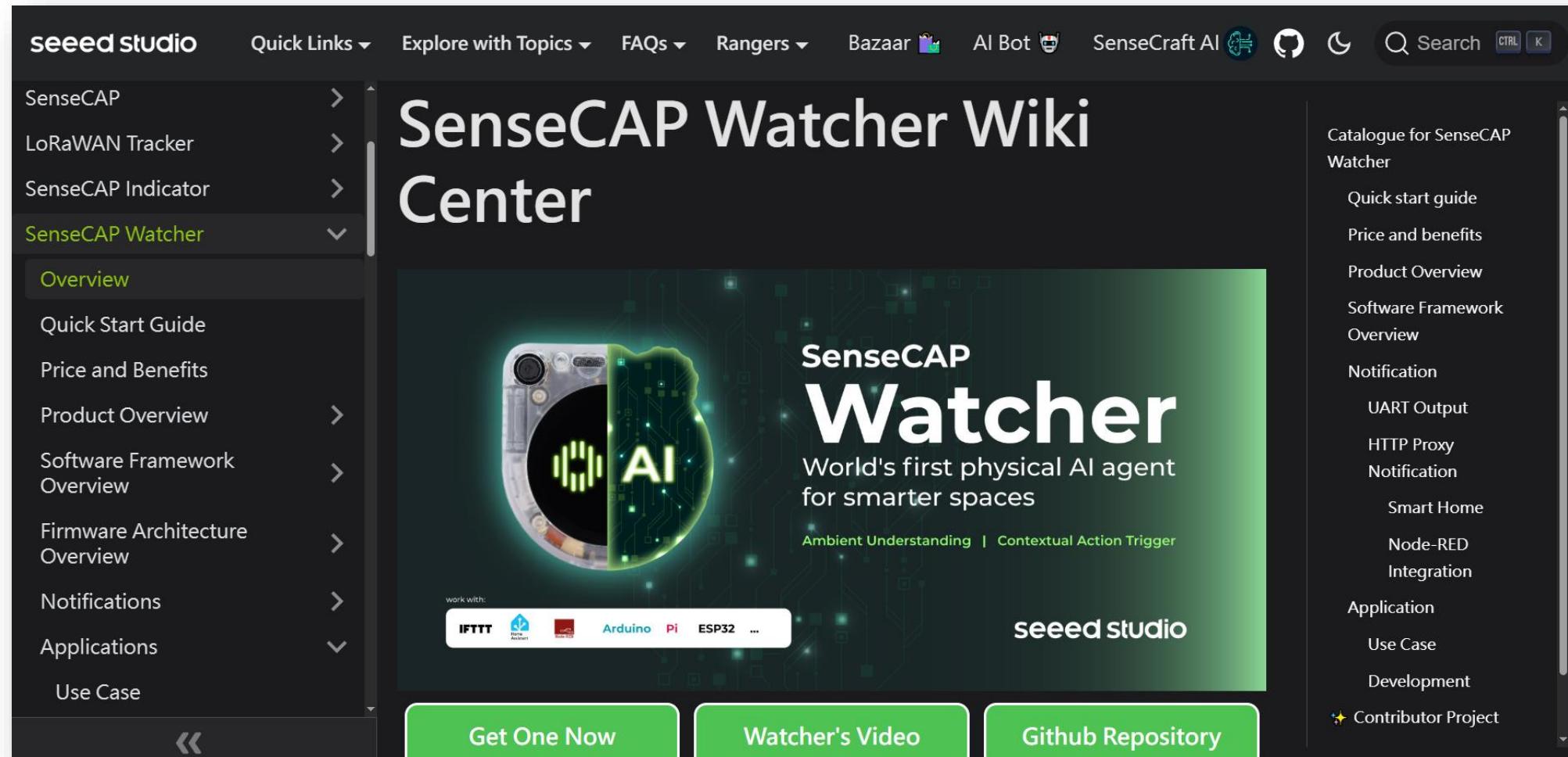
Robot Puppy
By Gianpaolo Macari



Animals Detector
By Rifqi Abdillah

資料來源：<https://www.seeedstudio.com/SenseCAP-Watcher-W1-A-p-5979.html>

Seeed SenseCAP Watcher 技術文件



SenseCAP Watcher Wiki Center

Catalogue for SenseCAP Watcher

Quick start guide

Price and benefits

Product Overview

Software Framework Overview

Notification

UART Output

HTTP Proxy

Smart Home

Node-RED Integration

Application

Use Case

Development

Contributor Project

<https://wiki.seeedstudio.com/watcher/>



7.5. Seeed SenseCraft AI 簡介

Seeed SenseCraft AI 功能概述



The screenshot displays the SenseCraft AI platform interface across three main sections:

- Top Navigation Bar:** Includes links for "主页" (Home), "预训练模型" (Pre-trained Models), "模型训练" (Model Training), "视觉工作空间" (Visual Workspace), "关于SenseCraft AI" (About SenseCraft AI), and a "登录" (Login) button.
- Left Sidebar:** Features a large green banner with the text "三步构建视觉AI传感器" (Three steps to build a visual AI sensor). Below it are sections for "排序方式" (Sorting Method) with buttons for "上传时间" (Upload Time), "最多点赞" (Most Likes), "最多点击" (Most Clicks), and "最多收藏" (Most Favorites); "模型任务" (Model Tasks) with categories like "目标检测" (Object Detection), "分类检测" (Classification Detection), "图像分割" (Image Segmentation), "姿态检测" (Pose Detection), and "生成式模型" (Generative Model); and a "公共AI模型" (Public AI Models) section showing a thumbnail of a person's face labeled "面条检测" (Noodle Detection).
- Center Content Area:**
 - Pre-trained Models:** Shows a search bar and a list of 401 models.
 - Model Training:** A detailed view for "生成AI分类识别模型" (Generate AI Classification Model). It shows "第一步: 分类数" (Step 1: Number of Classes) with "Class 1" selected (Grove Vision AI V2) and "Class 2" (SenseCraft). It includes sections for "设备信息" (Device Information) and "数据输出" (Data Output).
 - Right Sidebar:** Includes sections for "设备" (Devices), "WIFI & MQTT", and "设备日志" (Device Log).

<https://sensecraft.seeed.cc/ai/>

模型任務：目標檢測、分類檢測、圖像分割、姿態檢測、生成式模型

支持設備：reComputer Jetson (Orin), XIAO ESP32S3 Sense, Grove Vision AI V2, SenseCAP Watcher, SenseCAP A1102, reCamera

**建議使用 Chrome 或 Edge
瀏覽器，不要開啟隱私模式**

Seeed SenseCraft AI — 註冊與登錄

已註冊登錄

登錄

* 邮件

请输入正确的邮箱地址

* 密码

忘记密码?

登录 3

注册

2  我已阅读并同意 [隐私政策](#)

1 

進行註冊

注册

* 用户名

* 邮件

* 验证码   1 

从電郵中取得驗證碼並輸入

* 密码

* 确认密码

* 职业

工作地点

国家

区域

详细地址

官网地址

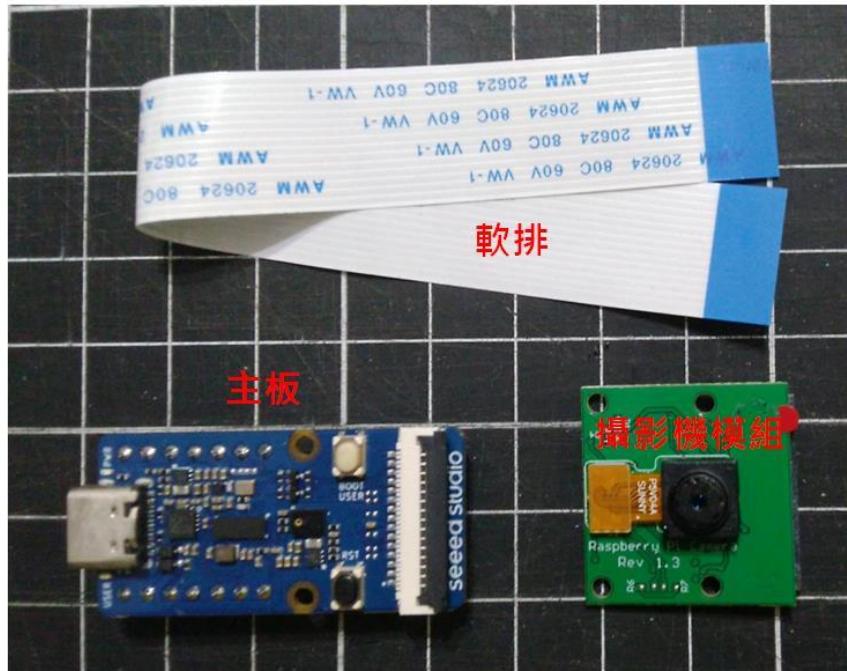
手机号 0/11

注册 3

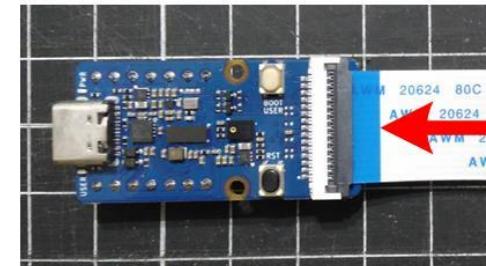
* 隐私政策  我已阅读并同意 [隐私政策](#)

開發板組裝 – 連接攝影機

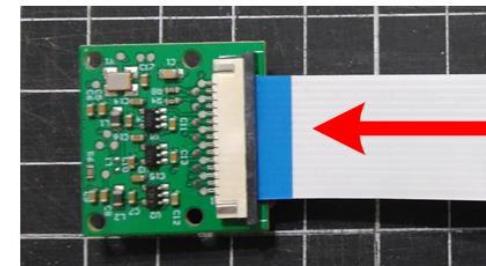
Seeed Grove Vision AI Module V2 & Camera



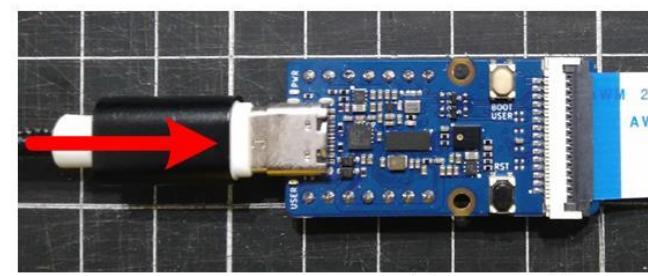
註：插入軟排時請注意正反面



1. 軟排插入
主板



2. 軟排插入
攝影機模組

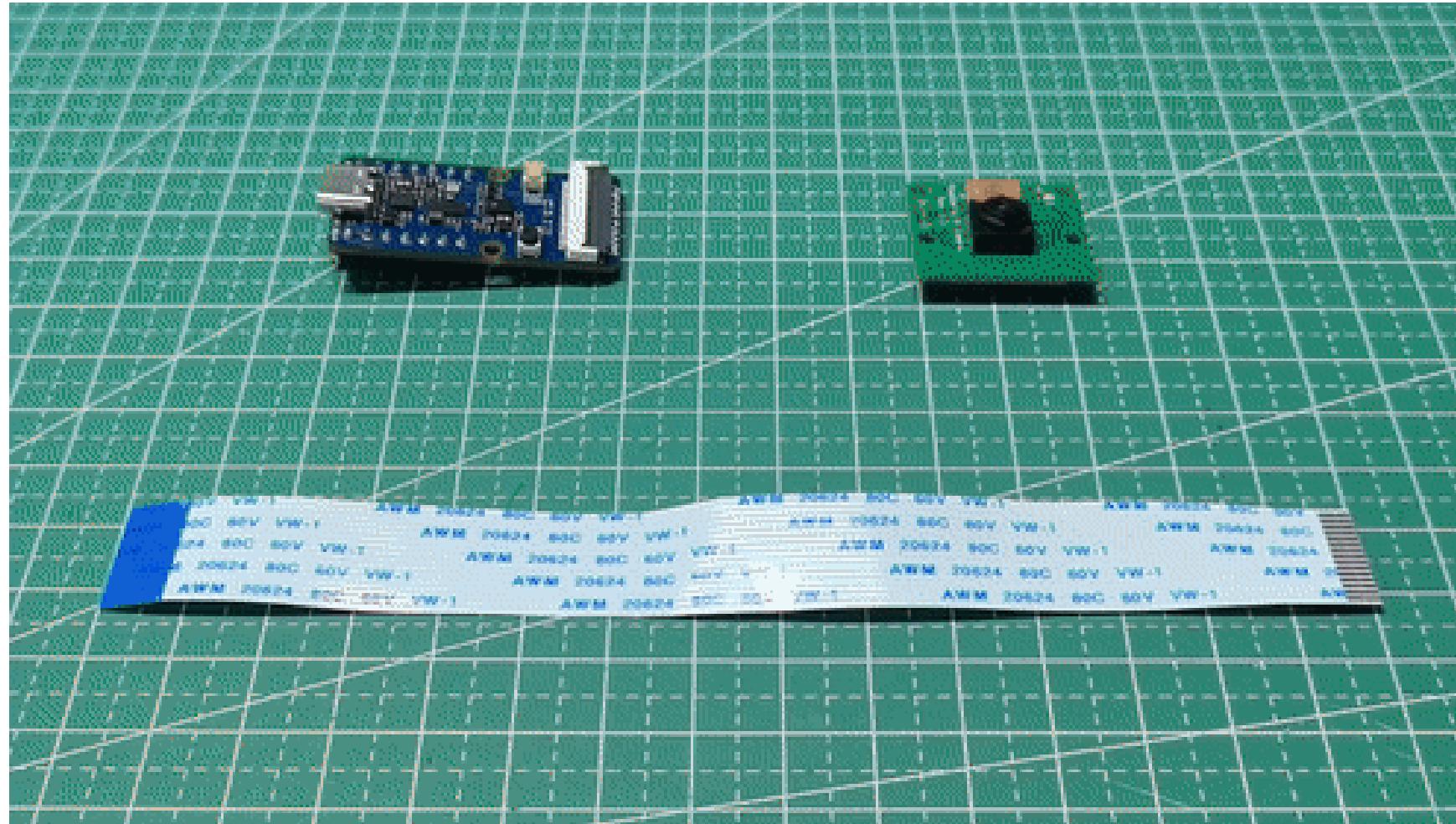


3. USB插入
主板

OmniXRI 整理製作, 2024/07/15

資料來源：<https://omnixri.blogspot.com/2024/07/vmaker-edge-ai-19-mcunpu.html>

開發板組裝 – 連接攝影機（動畫）



注意板端連接器
很脆弱要小力操作

AI模組板端
翻蓋插入後再蓋回

攝影機模組端
拉出插入後再壓入

注意軟排正反面

裸板操作手濕勿碰

請勿接觸到金屬
以免造成電路短路

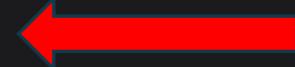
資料來源：https://wiki.seeedstudio.com/grove_vision_ai_v2/

安裝驅動程式 (USB – COM)

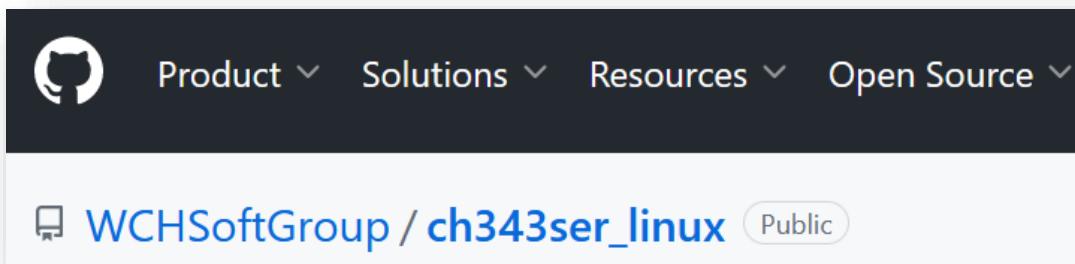
Driver

If you find that the Grove Vision AI V2 is not recognised after connecting it to your computer. Then you may need to install the CH343 driver on your computer. Here are some links to download and install the CH343 driver.

- Windows Vendor VCP Driver One-Click Installer: [CH343SER.EXE](#)
- Windows Vendor VCP Driver: [CH343SER.ZIP](#)
- Windows CDC driver one-click installer: [CH343CDC.EXE](#)
- Windows CDC driver: [CH343CDC.ZIP](#)
- macOS Vendor VCP Driver: [CH34xSER_MAC.ZIP](#)



Windows 環境 https://wiki.seeedstudio.com/grove_vision_ai_v2/

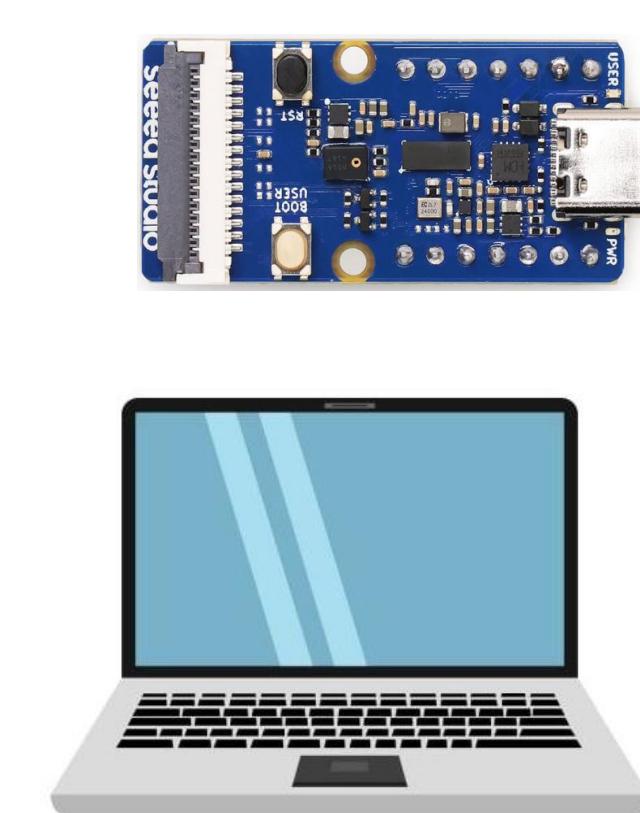


The screenshot shows the Seeed Studio website's header with a navigation bar featuring 'Product', 'Solutions', 'Resources', and 'Open Source' dropdown menus. Below the header, there is a GitHub repository card for 'WCHSoftGroup / ch343ser_linux' with the status 'Public'.

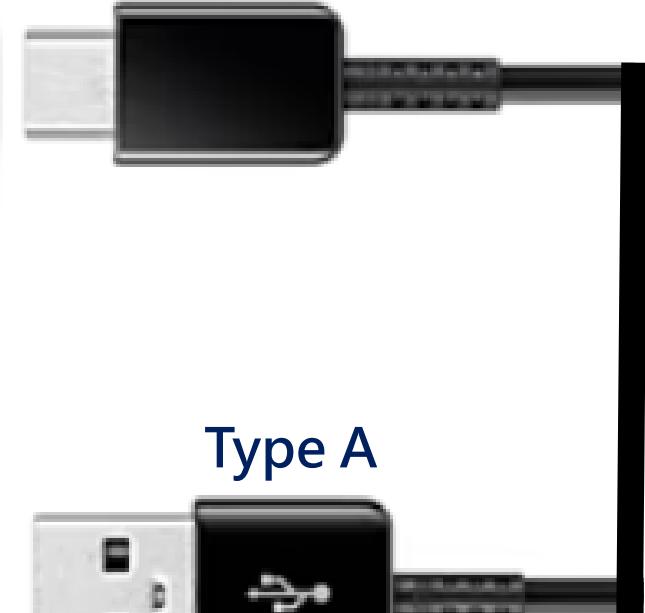
Ubuntu (Linux) 環境

https://github.com/WCHSoftGroup/ch343ser_linux

開發板組裝 – 連接USB



Type C



Type A

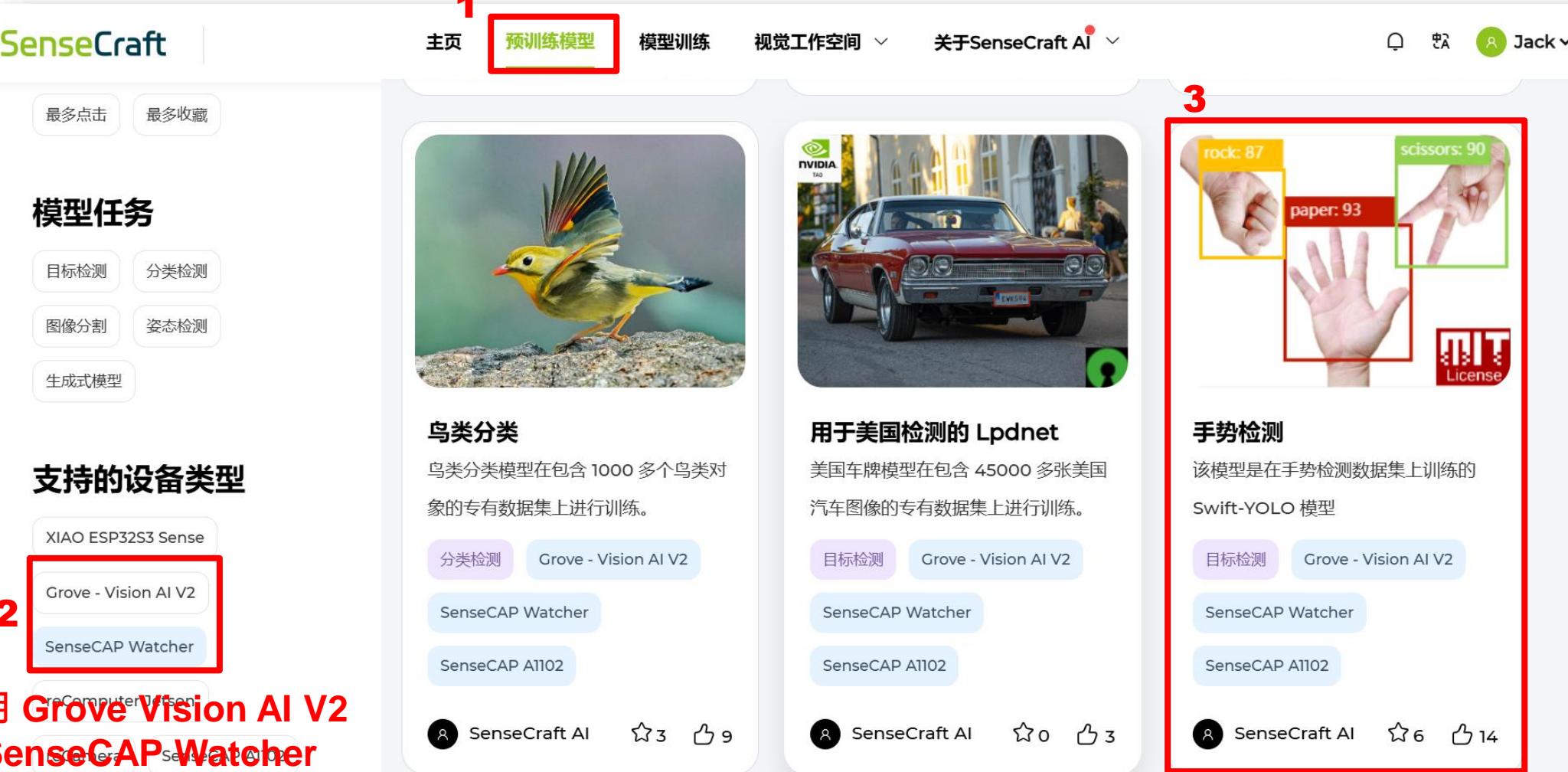
COM 埠號會變
請依自己電腦上埠號為準

Seeed SenseCraft AI – 預訓練模型

1 預訓練模型

2 可選用 Grove Vision AI V2 或 SenseCAP Watcher

3



The screenshot displays the SenseCraft AI platform interface. At the top, there's a navigation bar with tabs: '主页' (Home), '预训练模型' (Pre-trained Models) which is highlighted with a red box and has a red number '1' above it, '模型训练' (Model Training), '视觉工作空间' (Visual Workspace), and '关于SenseCraft AI' (About SenseCraft AI). On the right, there's a user profile for 'Jack'.

1. Pre-trained Models: This section shows three examples of pre-trained models. The first is '鸟类分类' (Bird Classification) featuring a colorful bird in flight. The second is '用于美国检测的 Lpdnet' (Lpdnet for US Detection) featuring a red classic car. The third is '手势检测' (Hand Gesture Detection) showing hands making rock, paper, and scissors gestures. Each example includes a small image, a brief description, and a list of compatible devices.

2. Supported Device Types: This section lists supported device types. A red box highlights 'Grove - Vision AI V2' and 'SenseCAP Watcher', with a red number '2' to its left. Other listed devices include 'XIAO ESP32S3 Sense' and 'SenseCAP A1102'.

3. Hand Gesture Detection Model: This section provides details for the hand gesture detection model. It shows three hand gestures with confidence scores: 'rock: 87', 'paper: 93', and 'scissors: 90'. It also includes an 'MIT License' badge.

Seeed SenseCraft AI – 部署模型

SenseCraft | SenseCraft AI

手势检测

该模型是在手势检测数据集上训练的 Swift-YOLO 模型。

模型任务: 目标检测 支持的设备类型: Grove - Vision AI V2 支持的设备类型: SenseCAP Watcher 发布商: SenseCraft AI

模型精度: INT8 模型格式: TF Lite

模型详情

手势检测模型基于 Swift YOLO 框架，可用于识别图像中的不同手势。该模型结合了 Swift 编程语言和 YOLO 目标检测算法的优点，具有高效的实际识别和准确的定位。您可以将此模型部署到 Grove Vision AI (V2) 中，以便快速识别图像中的手势，这种模式为教育、医疗、游戏、无障碍交互和其他应用提供了新的可能性。

此手势检测模型可用于许多不同的场景，包括但不限于：

- 教育：在线教育平台上，教师可以通过手势识别技术实现对学生的远程控制，提高教学效果。
- 医疗：医生可以用手势识别技术进行手部模型训练，提高手术技能。
- 游戏：在虚拟现实 (VR) 和增强现实 (AR) 游戏中，玩家可以通过手势识别技术更自然地进行交互。

模型推理示例图片



类别

- Paper
- Rock
- Scissors

推荐参数

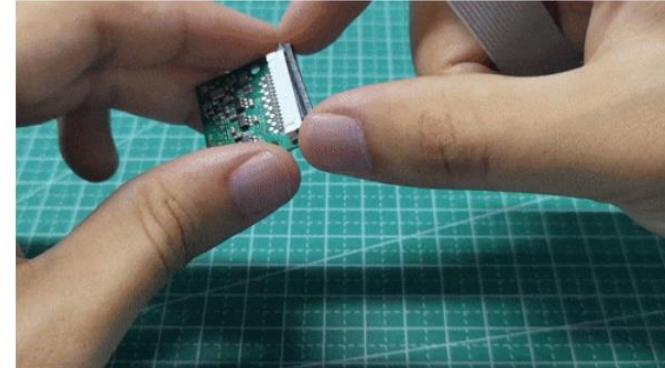
高精度(0~100) : 60
IOU阀值(0~100) : 45

支持的设备类型

该模型可以部署在以下设备上，若您没有此类型的设备，可以点击下面的链接购买。

Grove - Vision AI V2 SenseCAP Watcher

连接设备

- 连接 Grove - Vision AI V2 通过 CSI 连接线连接到摄像机
- 通过USB将 Grove - Vision AI V2 连接到电脑
- 选择USB Single/serial 调试器进行连接

2 **连接设备**

确认要部署这个模型吗？

模型名称: 手势检测 Model ID: 60111

3 **取消** **确认**

sensecraft.seeed.cc 想要连接到序列埠

USB Single Serial (COM5) - 已配對 **4**

5 **連線** 取消

已烧录20.00%

燒錄至100%後自動重啟

建議燒錄及測試時不要插ESP32-C3以免容易失敗。

Seeed SenseCraft AI — 執行推論



感測器資訊

即時影像

**測試時不要插
ESP32-C3以免
容易失敗。**

輸出結果 (設備日志) :

- **Preprocess** 前處理時間
- **Inference** 推論時間
- **Postprocess** 後處理時間
- **Box** 物件框
 - 左上 x,y 、右下 x,y 、
 - 置信度、物件編號
- 置信度高時較不易檢出
- 重疊區(IOU)高時
容易誤判為多個物件

設置

置信度(0 ~ 100) ①

IOU閾值(0 ~ 100) ②

Seeed SenseCraft AI — 數據輸出

SenseCraft | SenseCraft AI 模型列表 雷達圖 單元檢視 索引 關於 SenseCraft AI Jack_OmniXRI

Grove Vision AI(V2) 斷開連接

設備信息 網絡配置 數據輸出 (選中) 訓練模型

條件

對象	條件	置信度	操作
			1 滿足事件條件時觸發操作

觸發操作

3

● 啟動LED燈
 ■ 保存圖片到SD卡

刪除 發送

● 啟動LED燈
 ■ 保存圖片到SD卡

如果設備檢測到Paper 並且置信度為大於50, 則點亮設備的黃色LED燈
 如果設備檢測到Paper 並且置信度為大於50, 然後將圖片保存到SD卡

只能設定一組條件

觸發操作

2

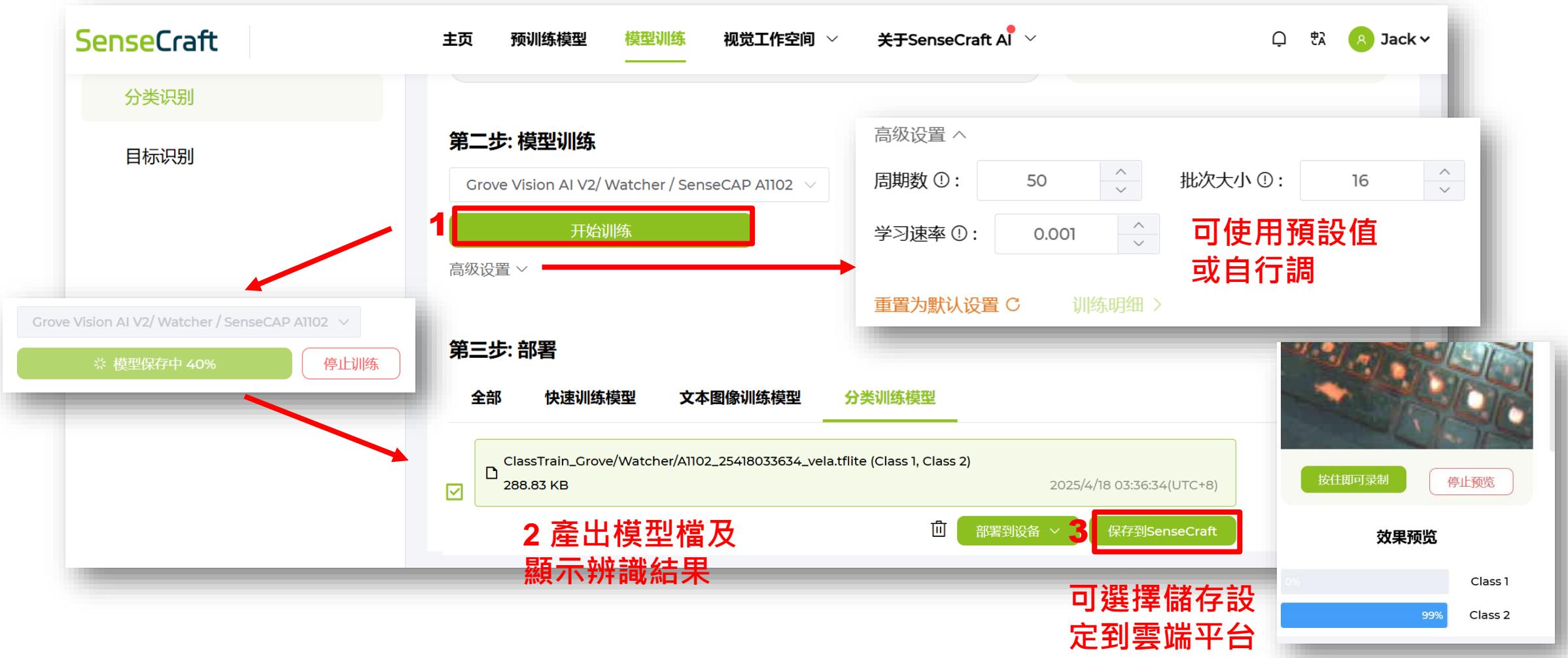
取消 確認

對象: Paper
 條件: 大於
 置信度: 50

資料集建置 - 分類識別 - 數據採集



資料集建置 – 分類識別 – 模型訓練部署



The screenshot illustrates the SenseCraft AI platform interface for building datasets, performing classification recognition, and managing model training and deployment.

Top Navigation Bar:

- SenseCraft
- 主页
- 预训练模型
- 模型训练** (highlighted)
- 视觉工作空间
- 关于SenseCraft AI
- Jack

Left Sidebar:

- 分类识别
- 目标识别

Model Training Section (第二步: 模型训练):

- Model Selection: Grove Vision AI V2/ Watcher / SenseCAP A1102
- Training Status: 1. **开始训练** (Start Training) button highlighted with a red box and arrow.
- Advanced Settings: 周期数 (Epochs): 50, 批次大小 (Batch Size): 16, 学习速率 (Learning Rate): 0.001. A note on the right says: 可使用預設值或自行調 (Can use default values or manually adjust).
- Buttons: 重置为默认设置 (Reset to Default), 训练明细 (Training Details).

Deployment Section (第三步: 部署):

- Model Type: 分类训练模型 (Classification Training Model) selected.
- Model Preview: Shows a camera feed of a keyboard with a yellow bounding box highlighting a key.
- Buttons: 按住即可录制 (Press to Record), 停止预览 (Stop Preview).
- Deployment Options: 部署到设备 (Deploy to Device), 保存到SenseCraft (Save to SenseCraft) highlighted with a red box and arrow.
- Model File: ClassTrain_Grove/Watcher/A1102_25418033634_vela.tflite (Class 1, Class 2), 288.83 KB, 2025/4/18 03:36:34 (UTC+8).
- Effect Preview: Shows a bar chart with 0% for Class 1 and 99% for Class 2.

Annotations:

- 指向“开始训练”按钮的红色箭头。
- 指向“分类训练模型”选项卡的红色箭头。
- 指向“保存到SenseCraft”按钮的红色箭头。

Text Labels:

- 可使用預設值或自行調 (Can use default values or manually adjust)
- 2 產出模型檔及顯示辨識結果 (2. Generate model file and display recognition results)
- 可選擇儲存設定到雲端平台 (Can choose to save settings to the cloud platform)

資料集建置 – 目標識別 – 快速訓練



The screenshot shows the SenseCraft AI web interface. On the left, a sidebar titled "训练类型" (Training Type) has two options: "分类识别" (Classification Recognition) and "目标识别" (Object Recognition), with "目标识别" highlighted. The main content area is titled "生成AI检测模型" (Generate AI Detection Model). It features three steps: 1. "第一步: 输入对象名称" (Step 1: Enter object name) with a placeholder "请输入对象名称" (Please enter object name). A red annotation text "輸入待辨識物件名稱，AI自動生資資料集。" (Enter the name of the object to be identified, AI automatically generates data set.) is overlaid on this step. 2. "第二步: 模型训练" (Step 2: Model Training) with a green "开始训练" (Start Training) button. A red annotation text "開始訓練模型" (Start training model) is overlaid on this button. 3. "第三步: 部署" (Step 3: Deployment) with tabs for "全部" (All), "快速训练模型" (Fast Training Model) which is selected and highlighted in green, "文本图像训练模型" (Text Image Training Model), and "分类训练模型" (Classification Training Model). A dropdown menu "支持的设备类型" (Supported Device Types) is also visible.

資料集建置 - 目標識別 - 採集圖像訓練

生成AI检测模型

快速训练 采集图像训练 ⓘ

第一步: 输入对象名称
Mouse 编辑

第二步: 选择采集方式
Grove Vision AI V2 / SenseCAP A1102 断开连接


按住即可录制 停止预览

第三步: 采集训练数据 (至少选择10张)

未标注(1) 已标注(0)

 → 

请在图片上拖动鼠标来标记图片

重置 确认

第四步: 模型训练
✿ 训练中 20% 停止训练

第五步: 部署

全部 快速训练模型 文本图像训练模型 分类训练模型

支持的设备类型

暂无模型

訓練時間要很久，
通常結果不好要增
加更多影像內容。

**拖拉左上右下，
框選物件。**

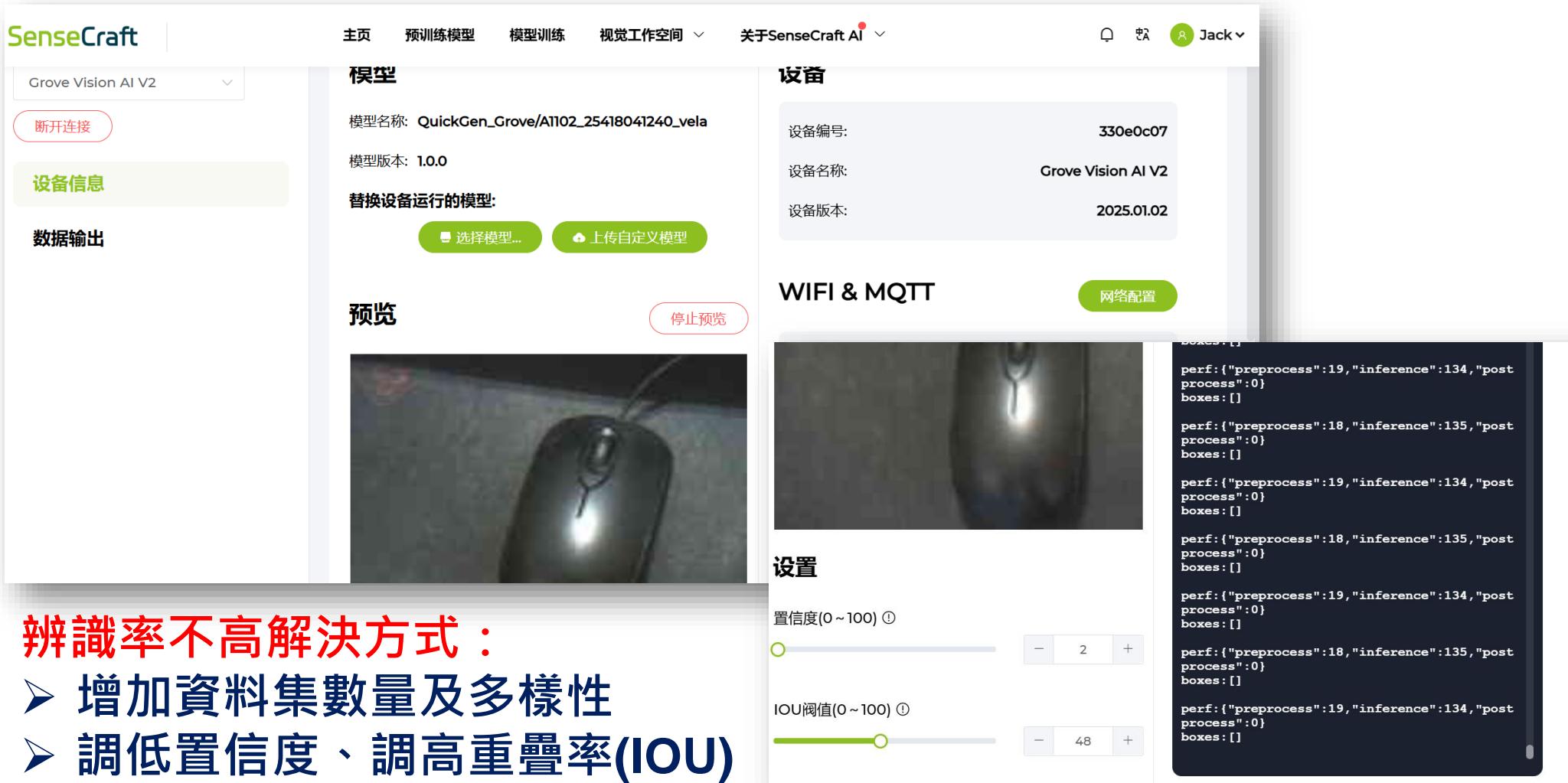
**資料集至少10張
才能開始訓練。**

2025/04/23

OmniXRI TinyML 小學堂 2025_【第 7 講】實驗開發板介紹_OmniXRI_JackHsu

48

資料集建置 - 目標識別 - 驗證模型



The screenshot displays the SenseCraft AI web interface. At the top, there's a navigation bar with links for '主页' (Home), '预训练模型' (Pre-trained Models), '模型训练' (Model Training), '视觉工作空间' (Visual Workspace), '关于SenseCraft AI' (About SenseCraft AI), and a user profile for 'Jack'. Below the navigation is a sidebar with tabs for '设备信息' (Device Information) and '数据输出' (Data Output). The main content area is divided into several sections:

- 模型 (Model):** Shows the model name as 'QuickGen_Grove/AI102_25418041240_vela' and version '1.0.0'. It includes a dropdown for selecting a different model and a button to upload a custom model.
- 设备 (Device):** Displays the device ID '330e0c07', name 'Grove Vision AI V2', and version '2025.01.02'.
- WIFI & MQTT:** Shows a live video feed from the camera and a log of inference results on the right side. The log entries are as follows:


```

perf: {"preprocess":19,"inference":134,"postprocess":0}
boxes: []

perf: {"preprocess":18,"inference":135,"postprocess":0}
boxes: []

perf: {"preprocess":19,"inference":134,"postprocess":0}
boxes: []

perf: {"preprocess":18,"inference":135,"postprocess":0}
boxes: []

perf: {"preprocess":19,"inference":134,"postprocess":0}
boxes: []

perf: {"preprocess":18,"inference":135,"postprocess":0}
boxes: []

perf: {"preprocess":19,"inference":134,"postprocess":0}
boxes: []
      
```
- 设置 (Settings):** Includes sliders for '置信度 (0 ~ 100)' set at 2 and 'IOU阀值 (0 ~ 100)' set at 48.

辨識率不高解決方式：

- 增加資料集數量及多樣性
- 調低置信度、調高重疊率(IOU)

進階補充 – 更多自定義模型訓練方式

seeed studio

- Getting Started ▾
- Technology ▾
- FAQs ▾
- Rangers ▾
- Bazaar 🎁
- AI Bot 🤖
- SenseCraft AI 🌱

- Home Assistant >
- TinyML >
- TinyML Workshop >
- ModelAssistant >
- Introduction >
- SenseCraft AI Model Assistant Overview
- Quick Start**
- Installation
- Tutorials >
- Config
- Datasets
- Training >
- Export >
- Development >

Object Detection

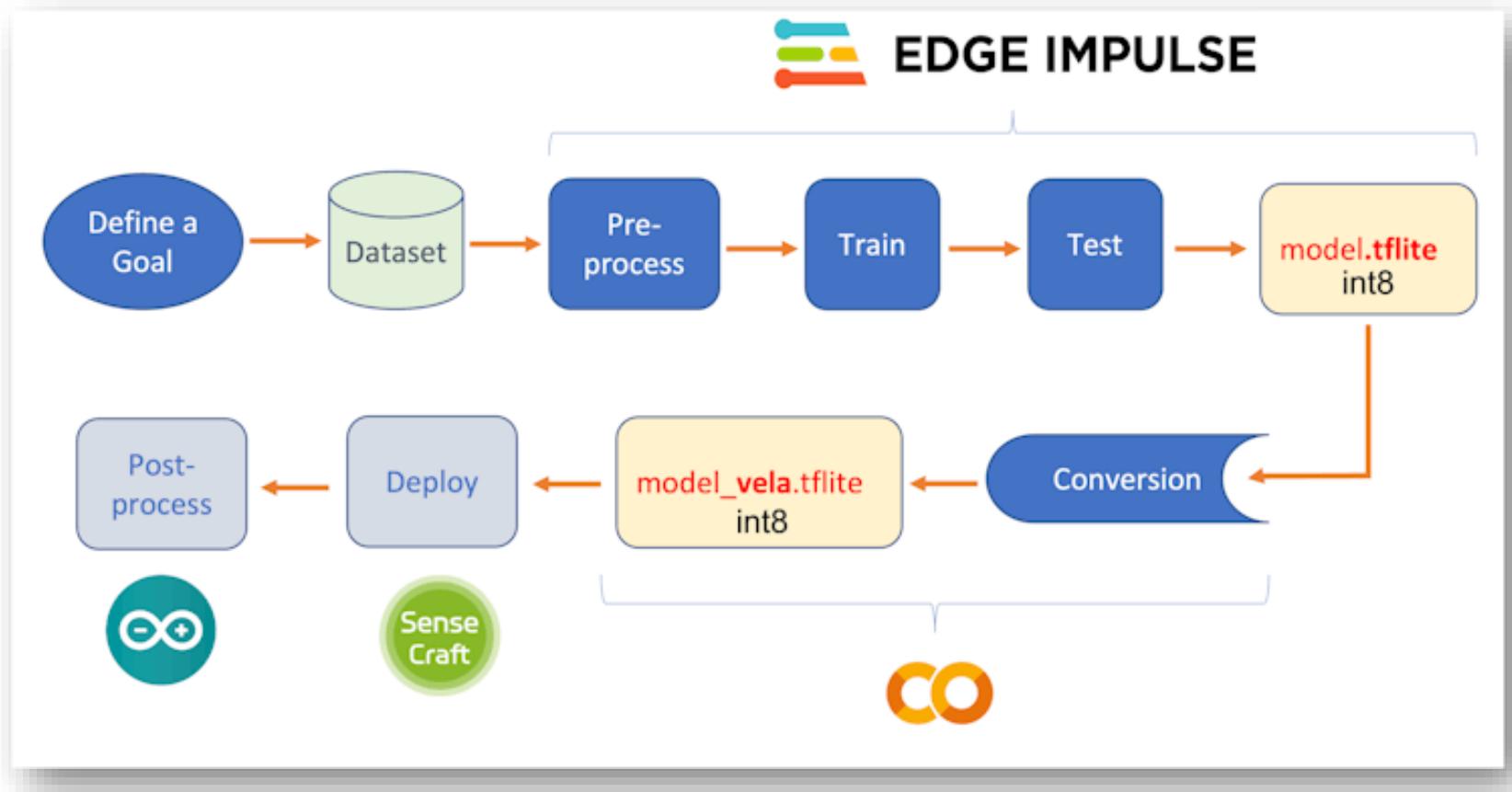
Model	Colab
Gender_Detection_Swift-YOLO_192	 Open in Colab
Digital_Meter_Water_Swift-YOLO_192	 Open in Colab
Apple_Detection_Swift-YOLO_192	 Open in Colab
person_Detection_Swift-YOLO_192	 Open in Colab
Face_Detection_Swift-YOLO_96	 Open in Colab
COCO_Detection_Swift-YOLO_320	 Open in Colab
Gesture_Detection_Swift-YOLO_192	 Open in Colab
Digital_Meter_Electricity_Swift-YOLO_192	 Open in Colab

Image Classification

Model	Colab
MNIST_Classification_MobileNetV2_0.5_Rep_32	 Open in Colab
Gender_Classification_MobileNetV2_0.35_Rep_64	 Open in Colab
Person_Classification_MobileNetV2_0.35_Rep_64	 Open in Colab
Person_Classification_MobileNetV2_0.35_Rep_96	 Open in Colab
Person_Classification_MobileNetV2_0.35_Rep_32	 Open in Colab
CIFAR-10_Classification_MobileNetV2_0.35_Rep_32	 Open in Colab

https://wiki.seeedstudio.com/ModelAssistant_Introduce_Quick_Start/#model-training

進階補充 – 採用Edge Impulse訓練轉換



Grove Vision AI Module V2 & Xiao ESP32C3 & Xiao ESP32S3
非 Edge Impulse 標準支援開發板，暫需採模型訓練完成後轉檔方式提供其它軟體使用。

<https://www.hackster.io/mjrobot/computer-vision-at-the-edge-with-grove-vision-ai-module-v2-0003c7>

參考文獻

-
- 許哲豪，臺灣科技大學資訊工程系「人工智慧與邊緣運算實務」(2021~2023)
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延伸閱讀

- Arduino nano 33 BLE Sense Rev. 2

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- Seeed Studio Xiao nRF52840 (Series)

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- Seeed Studio Grove Vision AI Module V2

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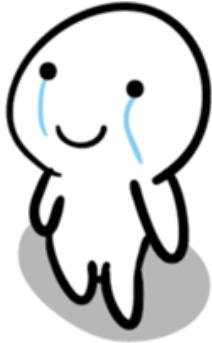
- Seeed Studio SenseCAP Watcher

<https://wiki.seeedstudio.com/watcher/>

- Seeed SenseCraft AI

<https://sensecraft.seeed.cc/ai/home>

沒有最邊



只有更邊



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YOUTUBE 直播 : <https://www.youtube.com/@omnixri1784streams>



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[開 源 : https://github.com/OmniXRI](#)