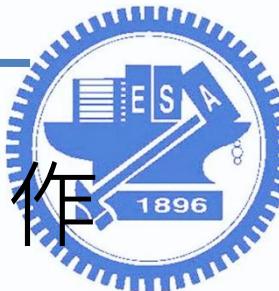


嵌入式系統設計概論與實作

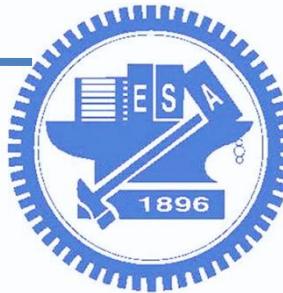
曾煜棋、吳昆儒

National Yang Ming Chiao Tung University



DCP3516嵌入式系統設計概論與實作

- Instructor: 曾煜棋, 吳昆儒
 - Office hours: (reserve by email)
 - 吳昆儒 <wufish@g2.nctu.edu.tw>
- Teaching assistants and office hours:
 - Office hours: (reserve by email)
 - 洪立宇 <harry851025@gmail.com>
 - 郭育麟 <samlong6108@gmail.com>
 - 鍾億錡 <jeki86929@gmail.com>
 - 張育豪 <tim00631@gmail.com>
 - Albert Christian <albert.christian92@gmail.com>



Course Overview

Embedded devices can be used to control, monitor or assist in the operation of equipment, machinery or plant.

嵌入式系統設計概論與實作

應用1: 感測器

應用2: 智慧手環

應用3: 網路攝影機

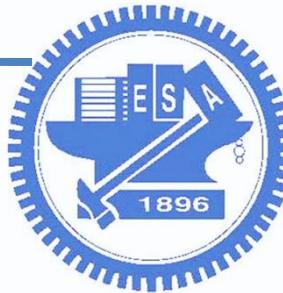
延伸應用3: 機器學習影像辨識

延伸應用3: 影像辨識

應用4: 語音助理

應用5: 網路功能(beacon)

應用X.....



嵌入式系統設計概論與實作



嵌入式應用與原理

電子學/電路學

電阻, 電壓, 電流

網路攝影機

影像傳輸, 影像辨識, AI模型

閱讀規格書

記憶體位置, 設定參數

網路通訊協定

訊號處理

藍牙推播廣告

語音識別

物理, 地球科學

加速度, 角速度, 磁北極, 大氣壓力

微積分, 濾波器

嵌入式開發

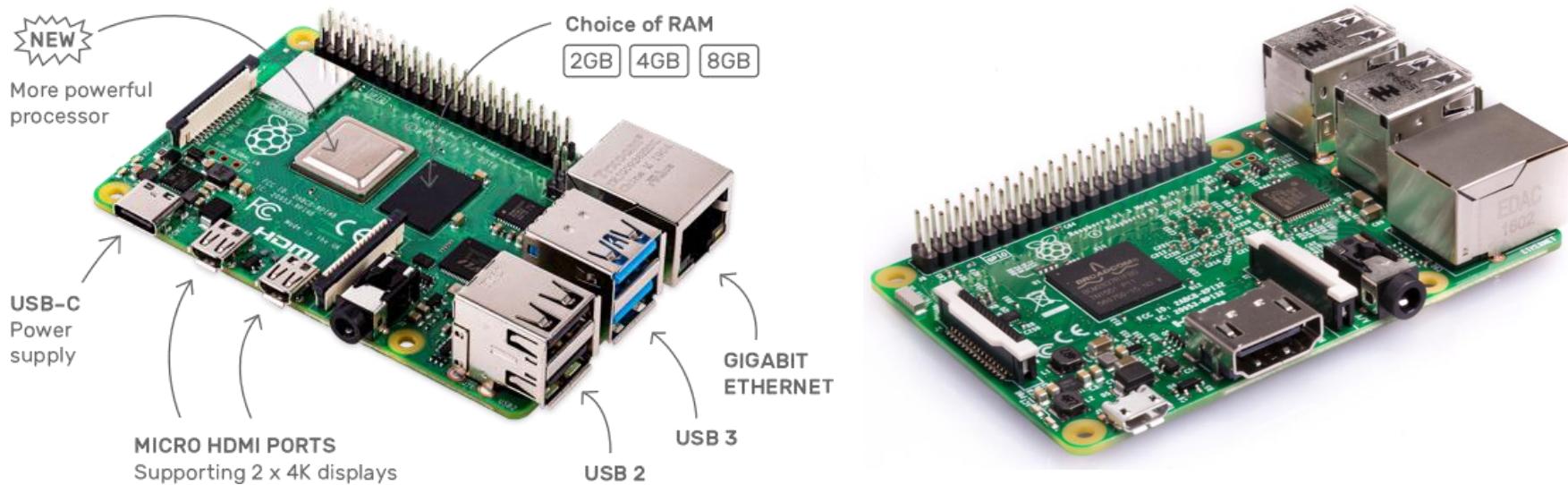
(其他...)

Cross-compile

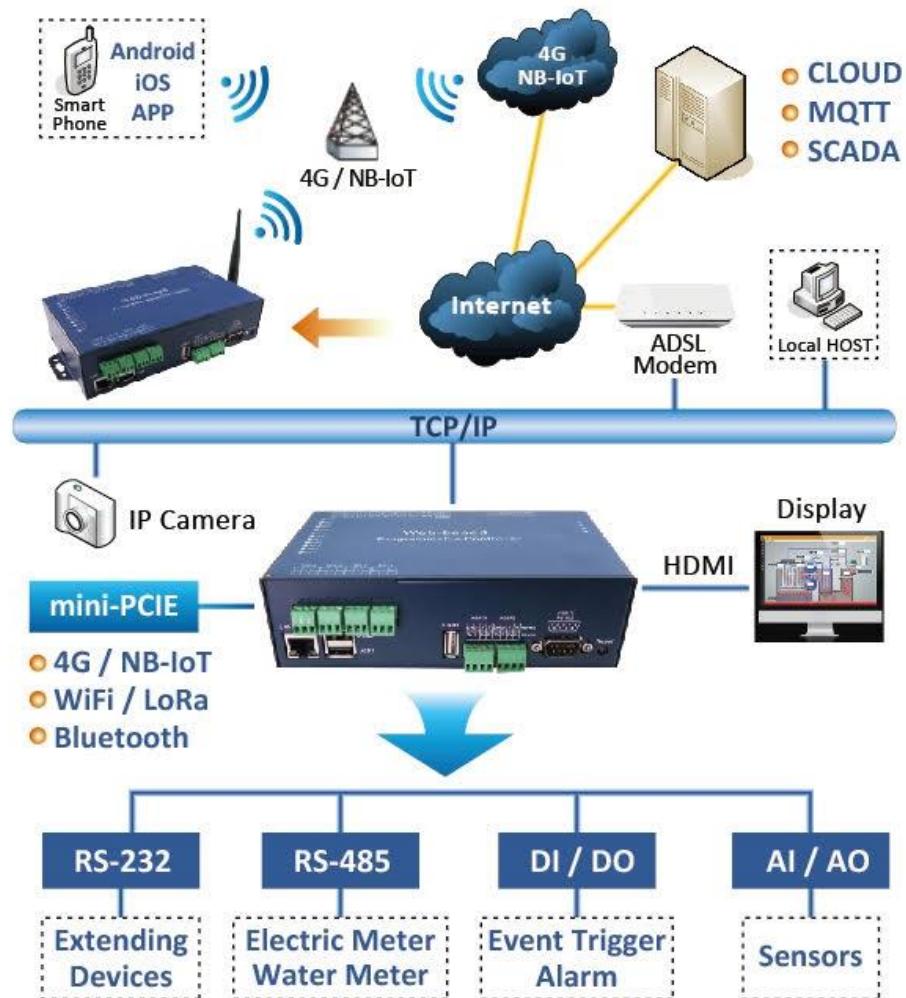
Build Kernel



Use Raspberry PI to create an embedded application



Raspberry Pi CM3+ Industrial IoT Controller

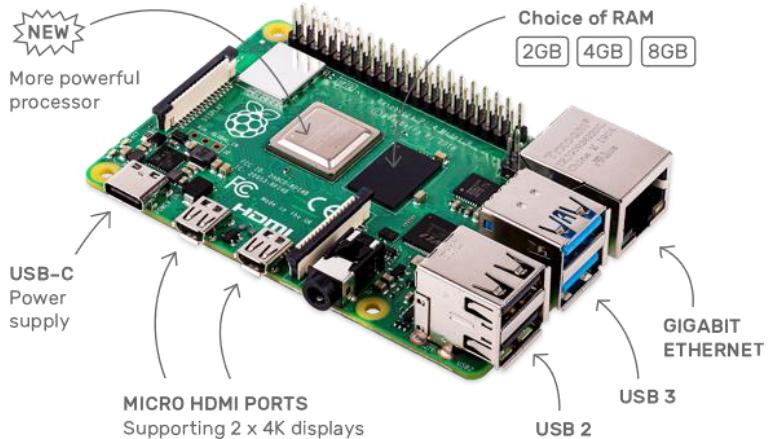


WPC-632-CM3 Raspberry Pi CM3 樹莓派工業級控制器。此機種有嵌入**樹莓派cm3+模組**，提供Raspbian Linux 平台，網路開源豐富，除了已架構的端口，另有mini PCIe可加載4G,NB-IOT,WiFi,Bluetooth,LoRa之無線模組，可快速建構應用系統，另外也有DI/DO機種可選購。

(來自信箱的廣告信)



各種Raspberry Pi



PI4



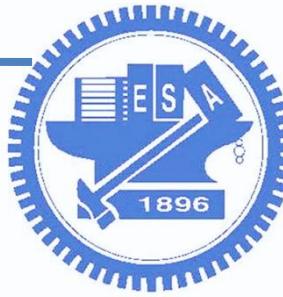
PI zero



PI3



樹莓Pie



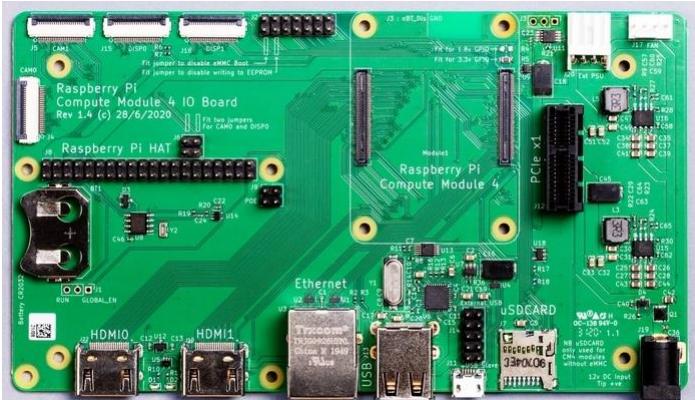
Raspberry Pi for embedded applications



Compute Module 3+ Development Kit



Compute Module 3+



Compute Module 4 IO Board



Compute Module 4



Raspberry PI3 Model B 正面

Display interface

40 GPIO pins

Broadcom chip
(BCM2837)

USB + Ethernet controller

USB 2.0 *4

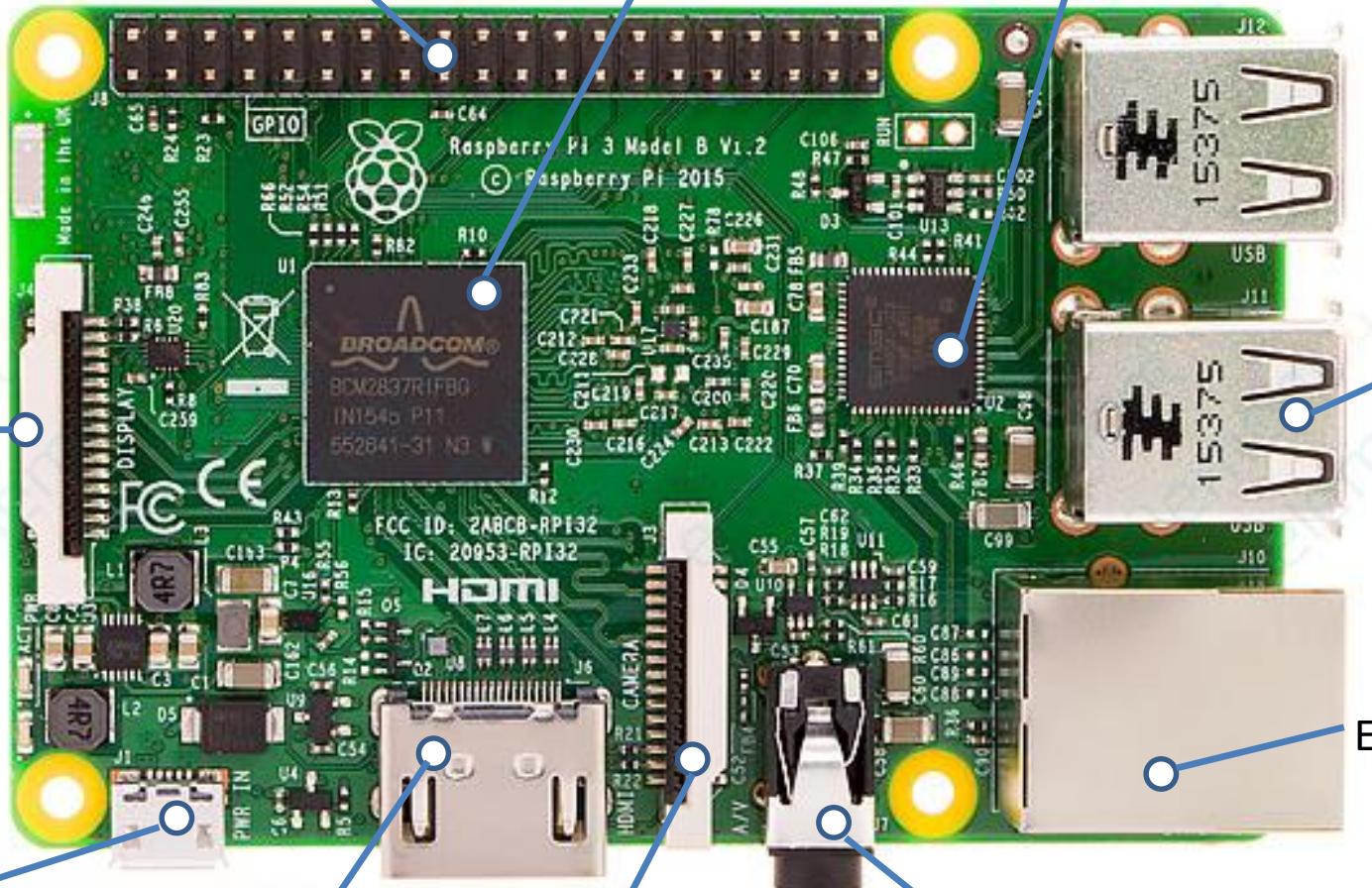
10M/100M
Ethernet port

Power supply
(micro usb)

HDMI

Camera interface
(CSI)

Combined 3.5mm audio jack
and composite video



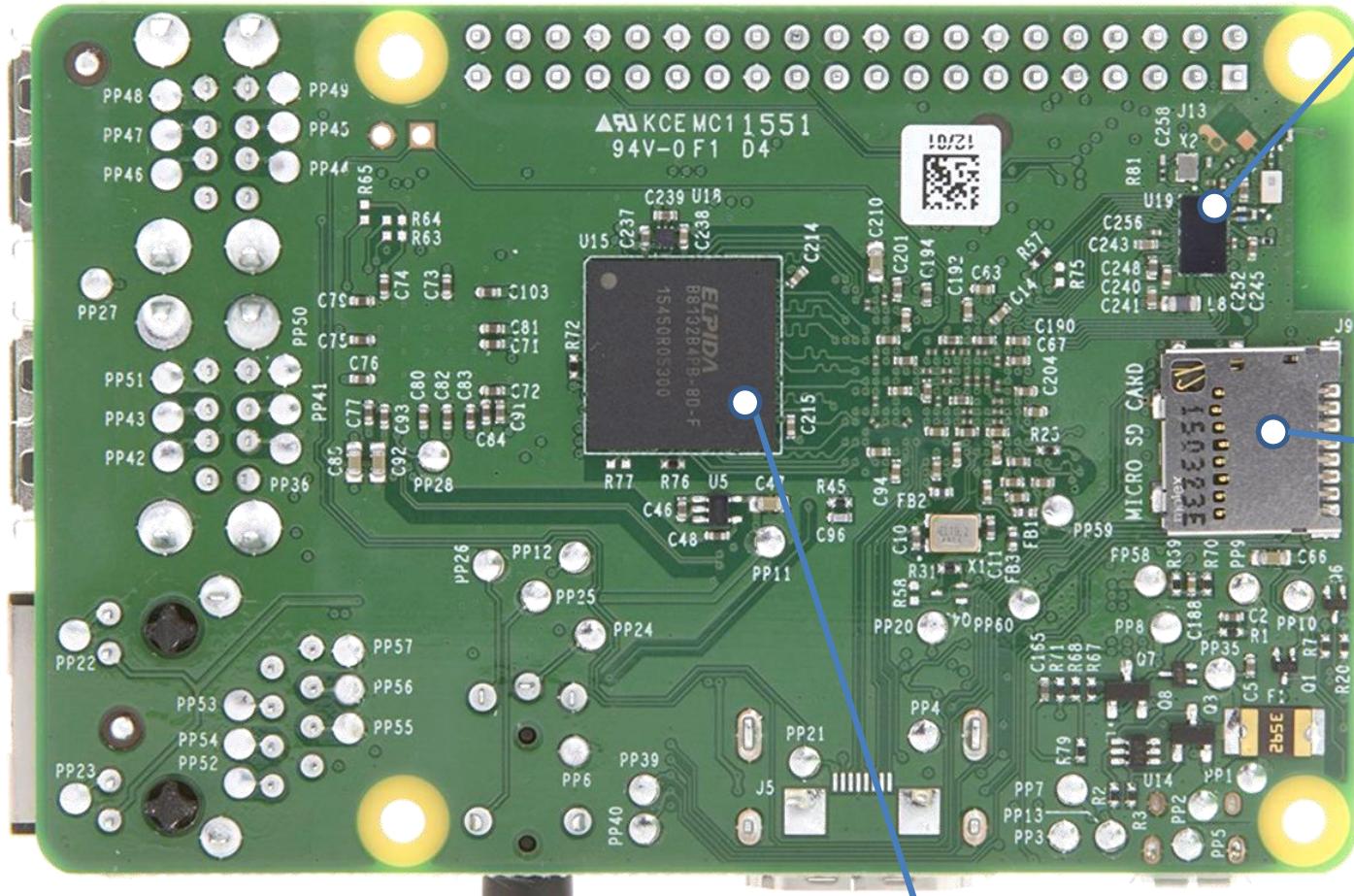
Raspberry PI3 Model B 背面



2.4G WiFi + BT4.1 + BLE

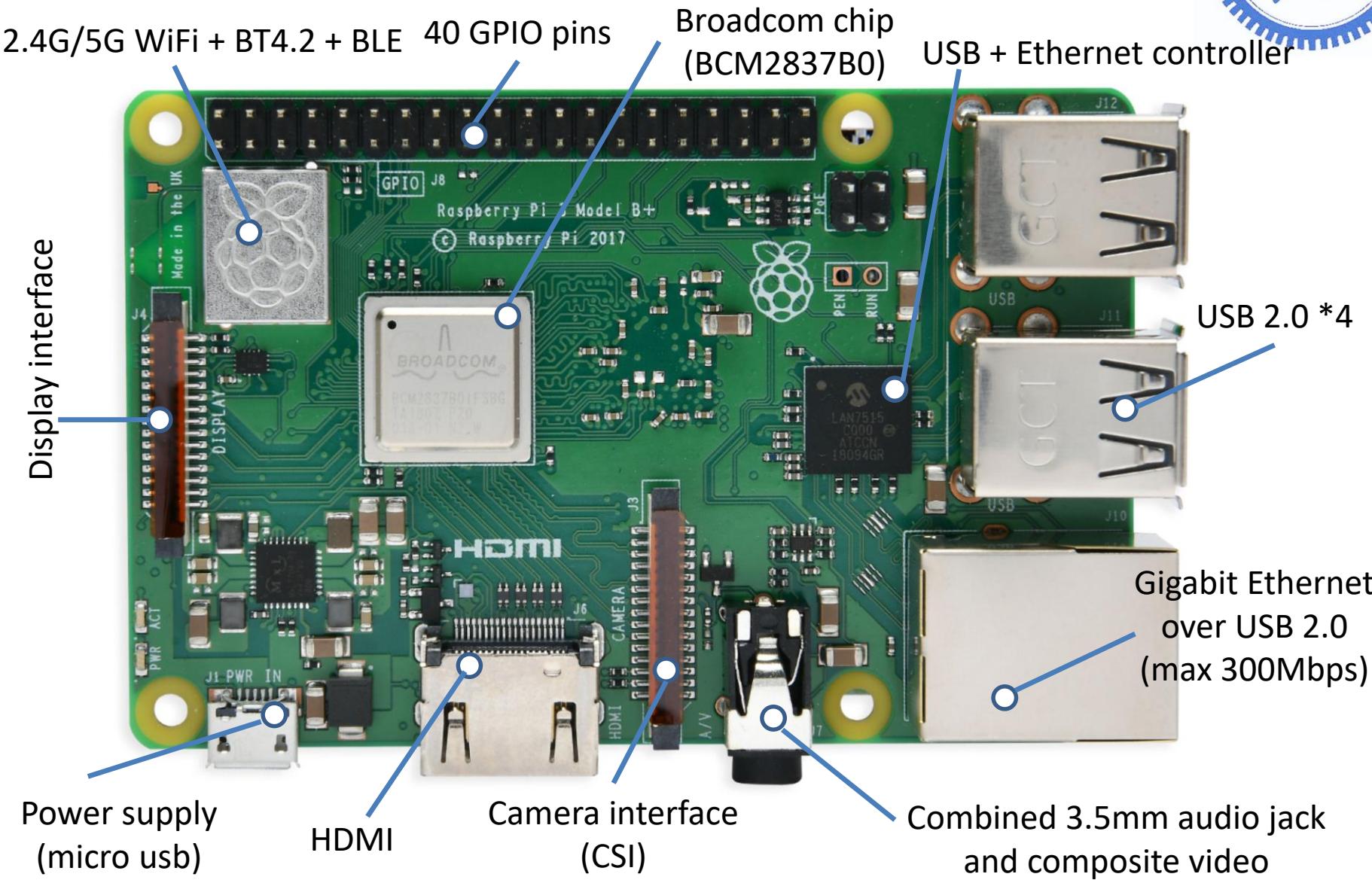
Micro SD

Elpida LPDDR2 (1GB)

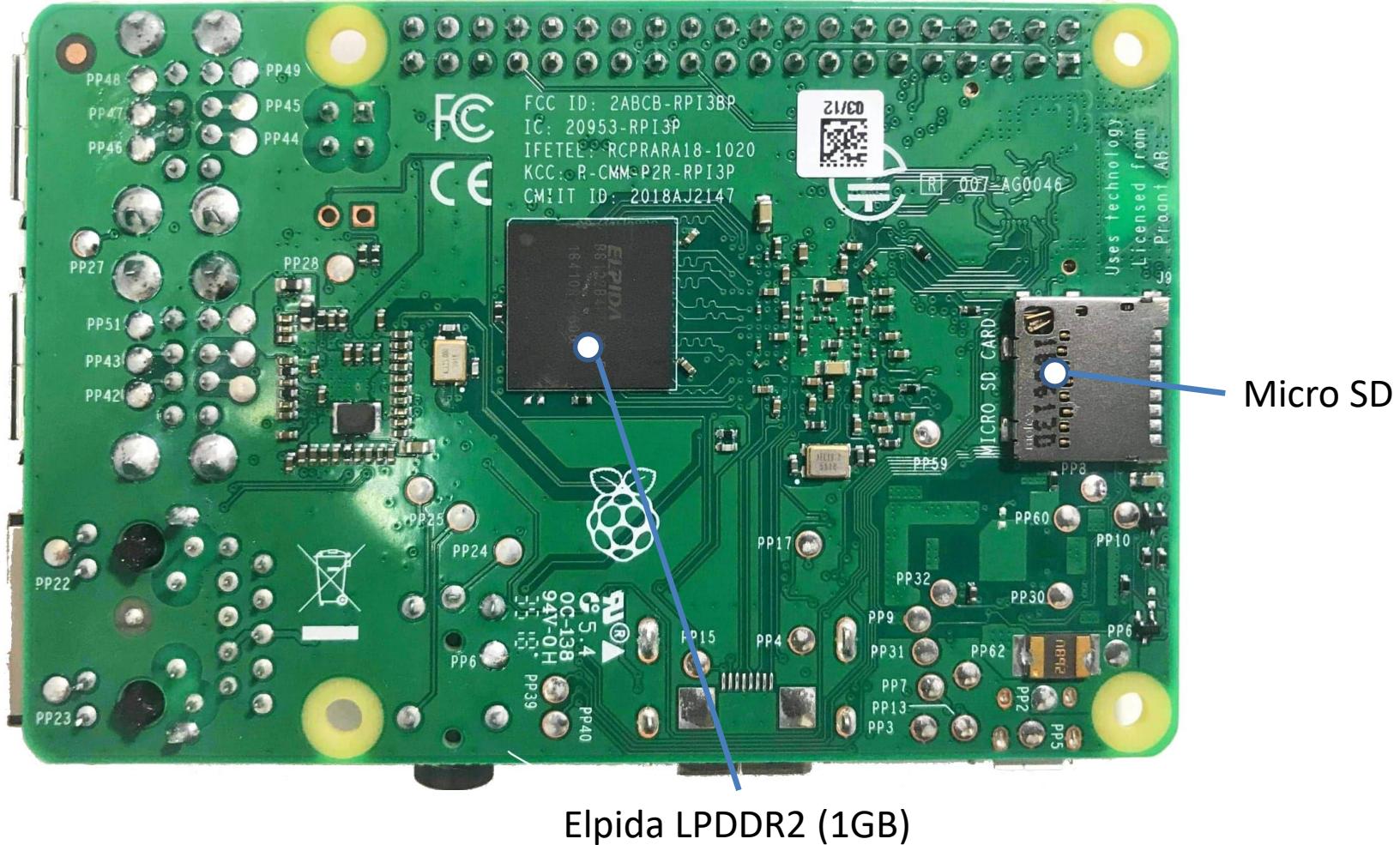
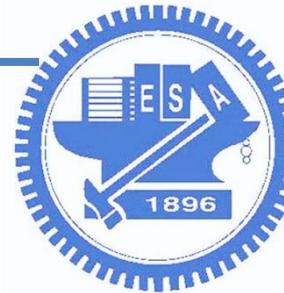




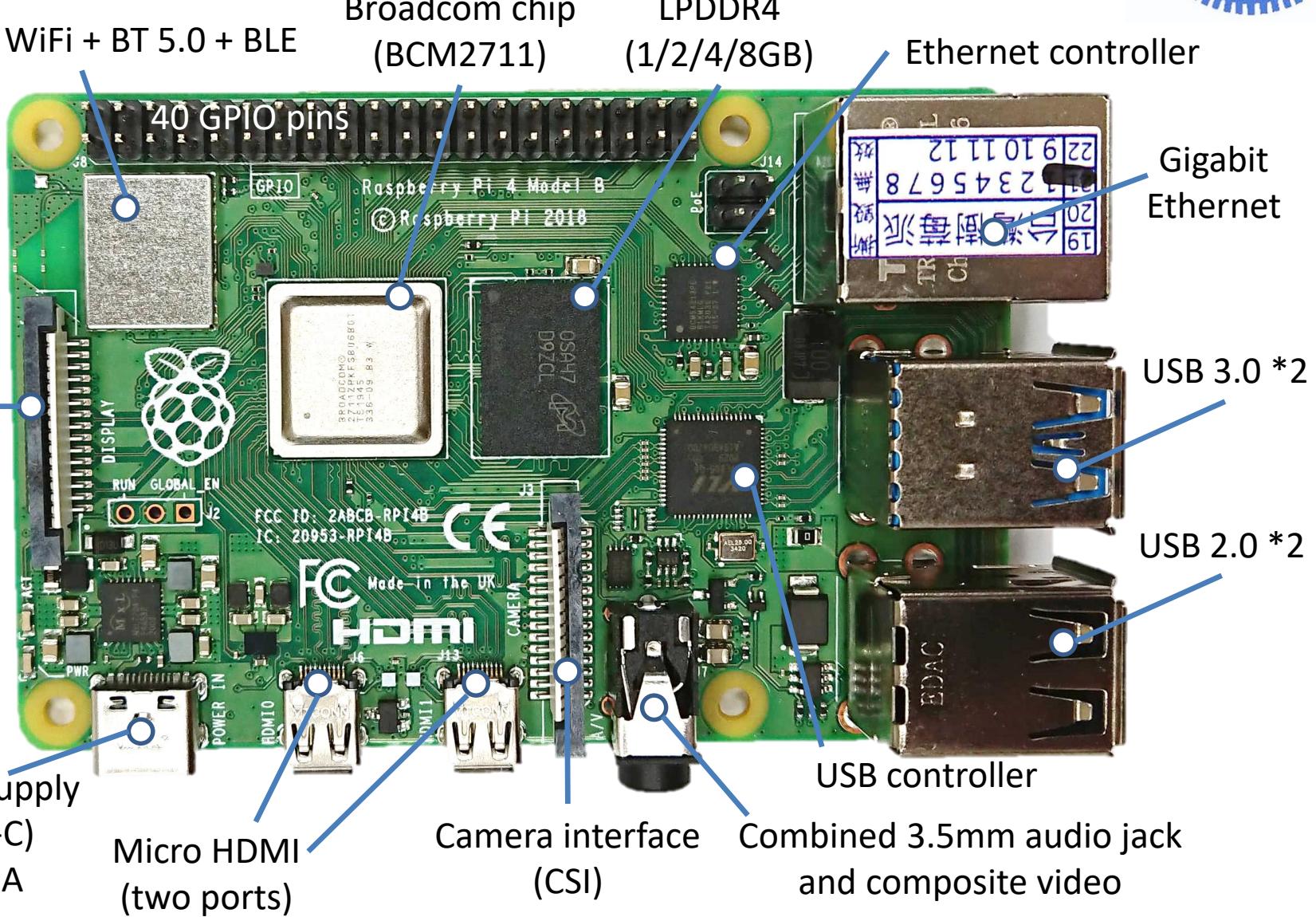
Raspberry PI3 Model B+ 正面

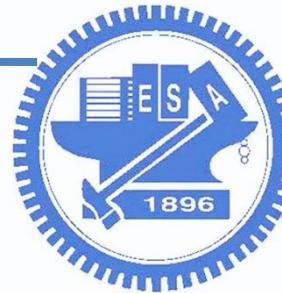


Raspberry PI3 Model B+ 背面

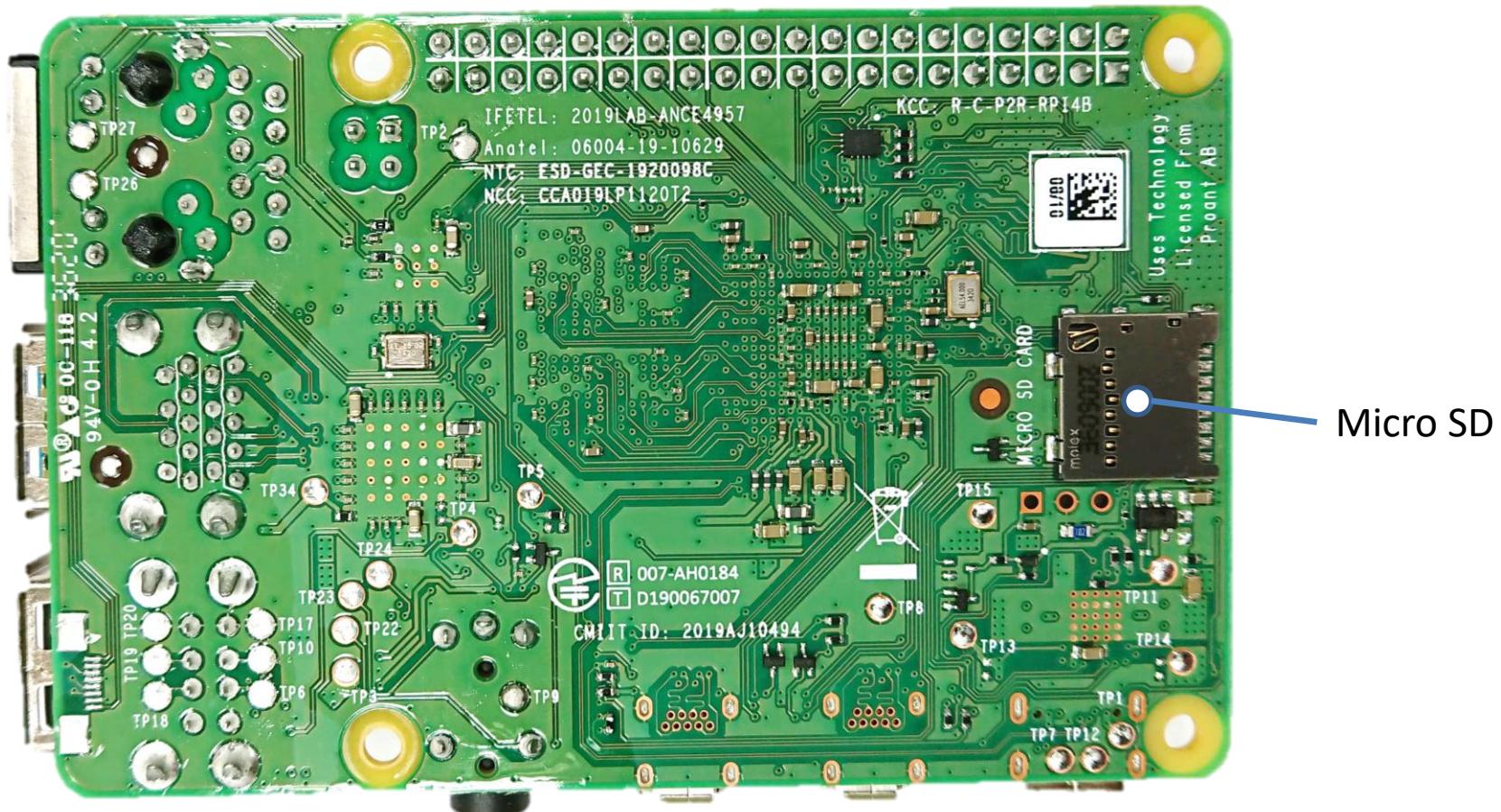


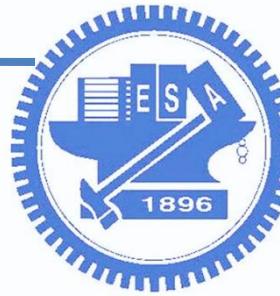
Raspberry PI4 Model B 正面



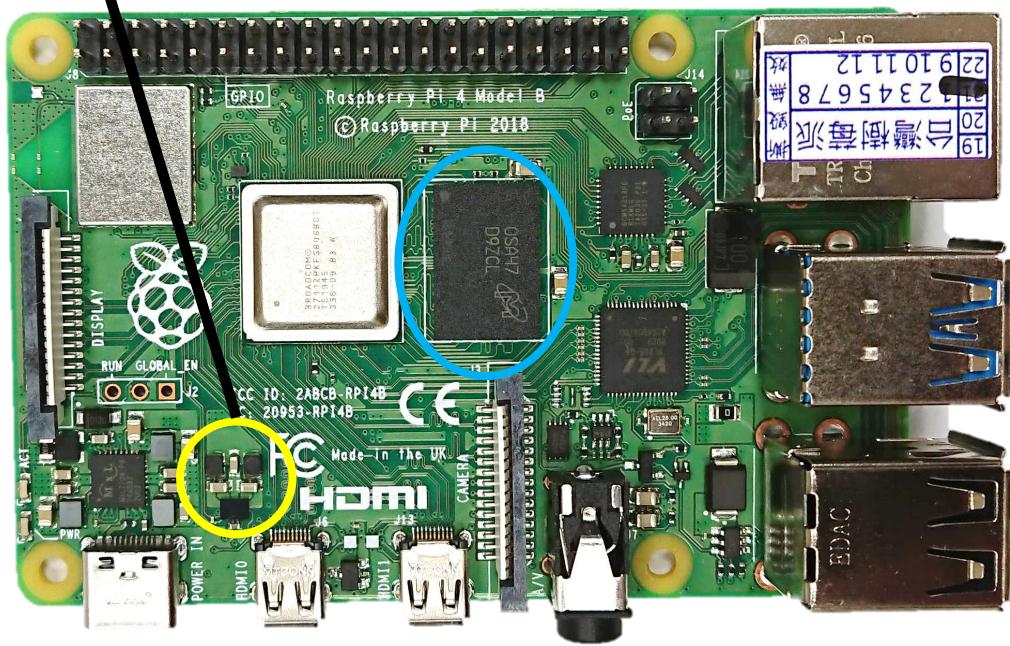
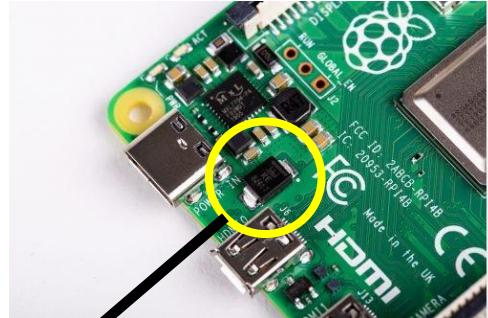


Raspberry PI4 Model B 背面





Raspberry PI4 1/2/4/8 GB?



<https://www.raspberrypi.com.tw/33102/8gb-raspberry-pi-4-on-sale-now>
<https://blog.cavedu.com/2020/03/16/raspberry-pi4-ram/>



Raspberry Pi 可以用在?

- 工業用嵌入式應用
- 感測器控制
 - MudPi water automation system
 - <https://magpi.raspberrypi.org/articles/mudpi-water-automation-system>
 - Bird Feeder Monitor V2.0
 - <https://magpi.raspberrypi.org/articles/bird-feeder-monitor-v2-0>
 - Smart Window Fan
 - <https://magpi.raspberrypi.org/articles/smart-window-fan>
 - Smart Home Herb Garden
 - <https://magpi.raspberrypi.org/articles/smart-home-herb-garden>
- 機器人、自駕車雛形
 - RAPIRO: <http://www.rapiro.com/>
 - Duckietown(self-driving robot): <https://www.duckietown.org/>
 - Formula Pi: <https://www.formulapi.com/>
 - Peto Nybble: <https://www.raspberrypi.org/blog/robotic-cat-peto-nibble/>
 - Peto Bittle: <https://magpi.raspberrypi.org/articles/peto-bittle-robot-dog-has-bite>



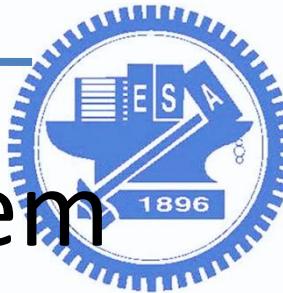
Raspberry Pi 可以用在?

□ 影像與AI應用

- There's Waldo is a robot that finds Waldo
 - <https://www.youtube.com/watch?v=-i7HMPpxB-Y>
- Seeing Wand uses Microsoft AI to describe things
 - <https://magpi.raspberrypi.org/articles/seeing-wand>
- ANPR: Car Spy Raspberry Pi
 - <https://magpi.raspberrypi.org/articles/anpr-car-spy-raspberry-pi>
- Multiple Raspberry PI 3D Scanner
 - <https://www.instructables.com/Multiple-Raspberry-PI-3D-Scanner/>
- Intelligent Drowsiness Monitor: stop falling asleep behind the wheel
 - <https://magpi.raspberrypi.org/articles/intelligent-drowsiness-monitor-stop-falling-asleep-behind-wheel>

□ 其他神奇的應用

- iPourit's Raspberry Pi self-serve beer dispenser:
 - <https://magpi.raspberrypi.org/articles/ipourit>
- FutureHome: IoT smart home built on Compute Module:
 - <https://magpi.raspberrypi.org/articles/futurehome-iot-compute-module>



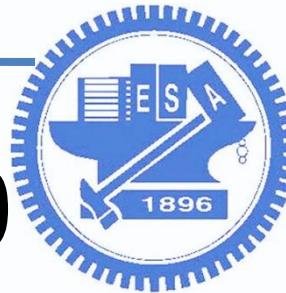
MudPi water automation system



MudPi keeps the garden watered thanks to its Raspberry Pi moisture sensor



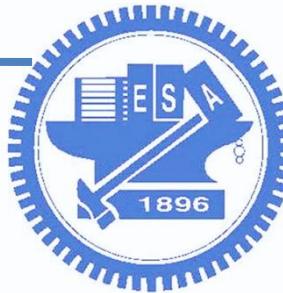
Looked up to the mains – please be careful if you plan to yourself!



Bird Feeder Monitor V2.0



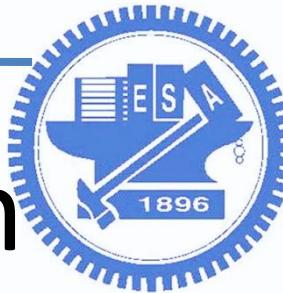
Catching the early bird is much easier when Raspberry Pi computers are involved, as David Crookes discovers



Smart Window Fan



When you need to keep your home cool during the summer months, a smart window fan could be just the thing. Phil King enjoys a breath of fresh air



Smart Home Herb Garden

“We’ve built a [Raspberry Pi-powered], voice-controlled drink mixer and an all-in-one button that starts Netflix, turns off your lights, and orders takeout,” Oscar says.



Growing herbs using Google’s Smart Home API makes for automated flavour in your cooking.



RAPIRO

RAPIRO

The Programmable DIY Robot Kit
with Endless Possibilities

Rapiro is a cute, affordable, and easy to assemble humanoid robot kit. Comes with 12 servo motors and an Arduino compatible Rapiro main board. Designed for Raspberry Pi. Its limitless possibilities all depend on you.

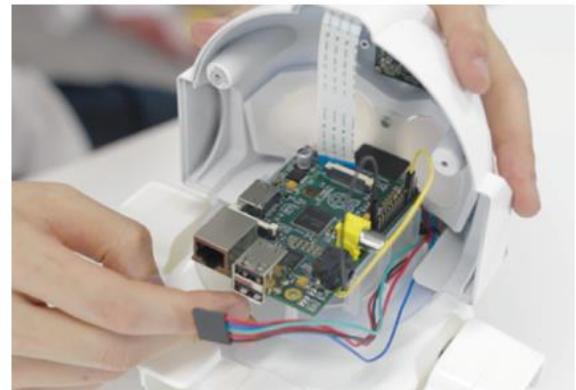
[Buy Rapiro](#)



PLAY VIDEO



You can install Raspberry Pi

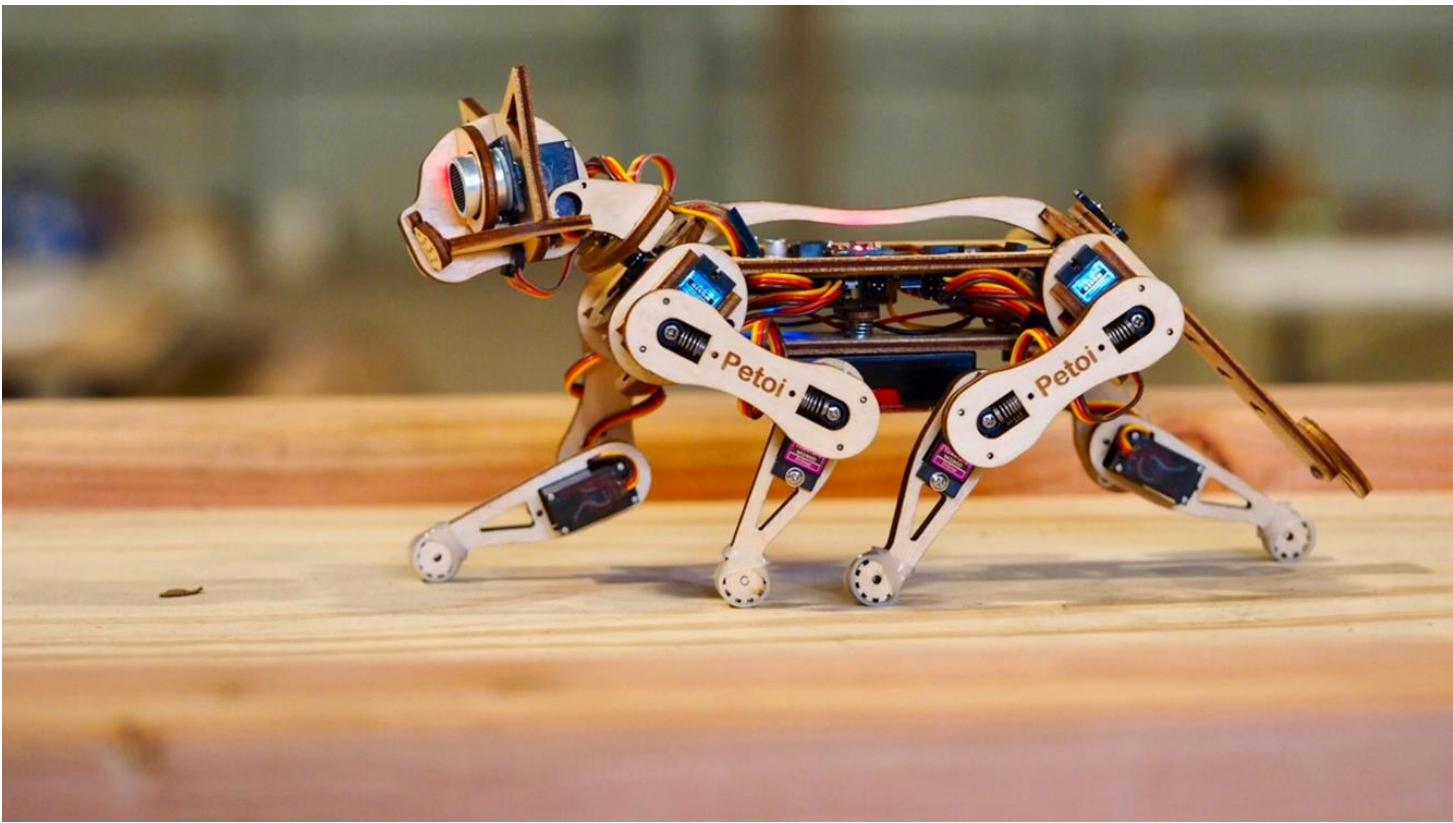


If you want more functions, you could do it by installing a Raspberry Pi (sold separately) inside Rapiro. Raspberry Pi can be programmed with a wide variety of programming languages for Linux. Depending on your programming, your Rapiro could give you message notifications with Wi-Fi enabled or could protect your home as a security robot using a camera module!



Nybble (Pi cat)

- https://www.youtube.com/watch?v=g7_ODr_3DTc

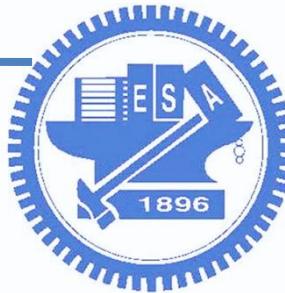




Petoi Bittle



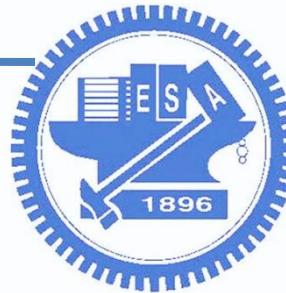
<https://magpi.raspberrypi.org/articles/petoi-bittle-robot-dog-has-bite>



Duckietown

- An Open-Source MIT Class & Computer-Vision Self-Driving Robot for Raspberry Pi



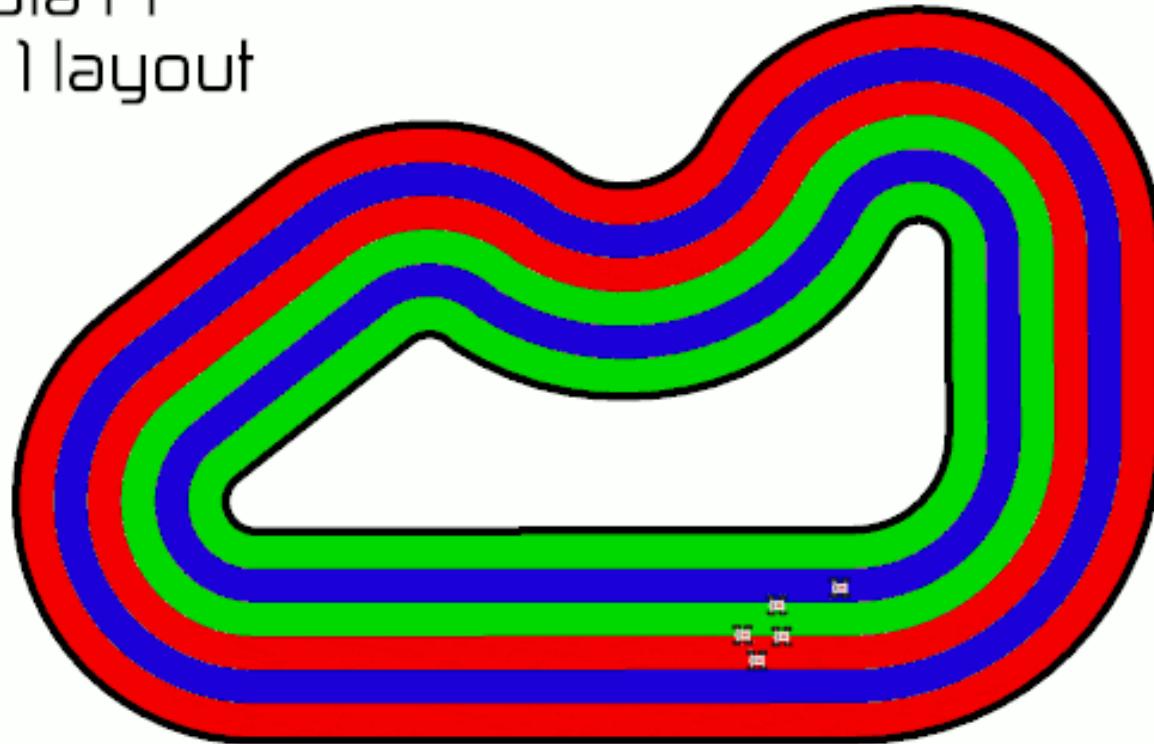


Formula Pi

Self-driving robot racing with the Raspberry Pi

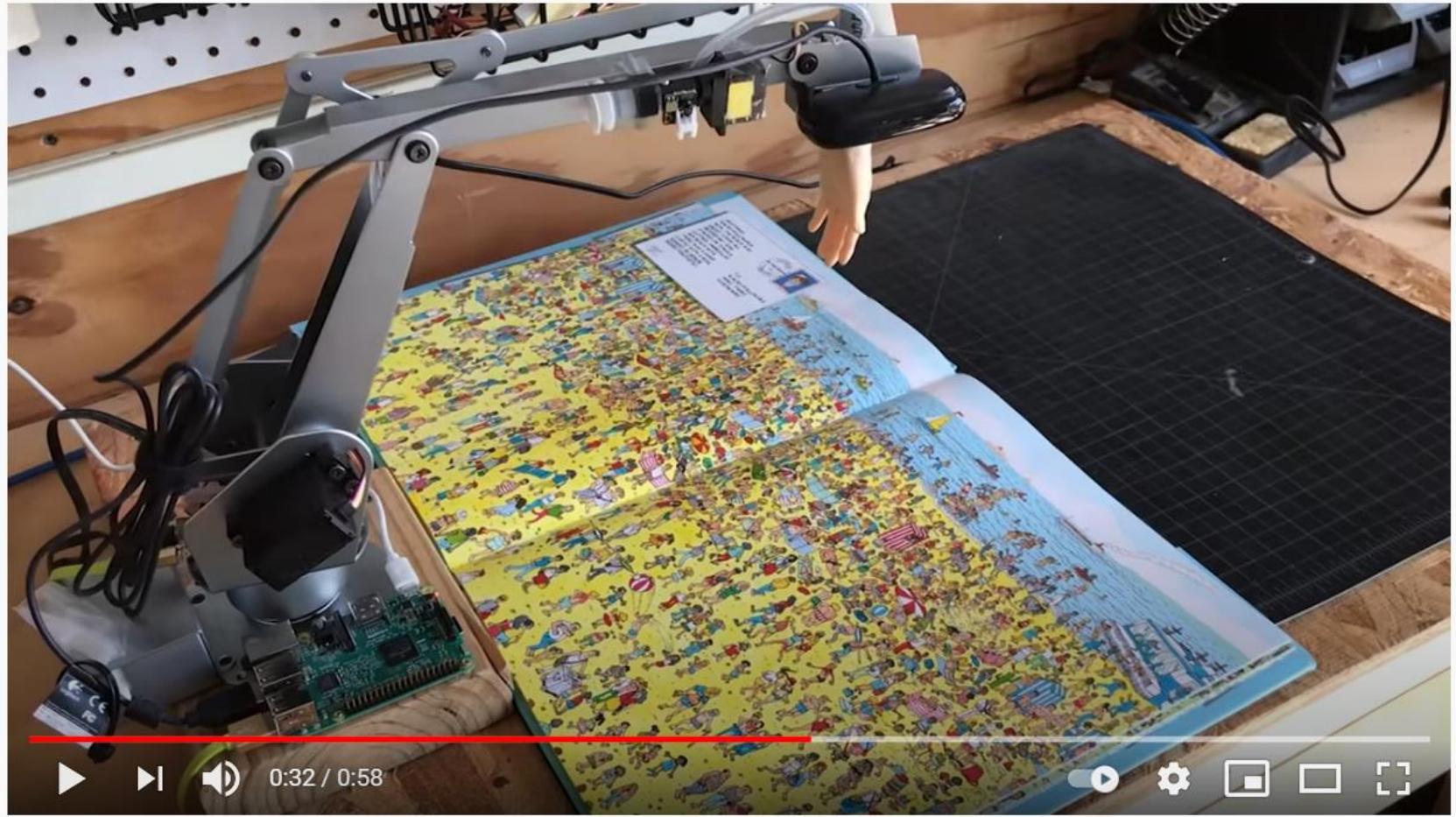
Formula Pi Track 1 layout

Scale:
100cm



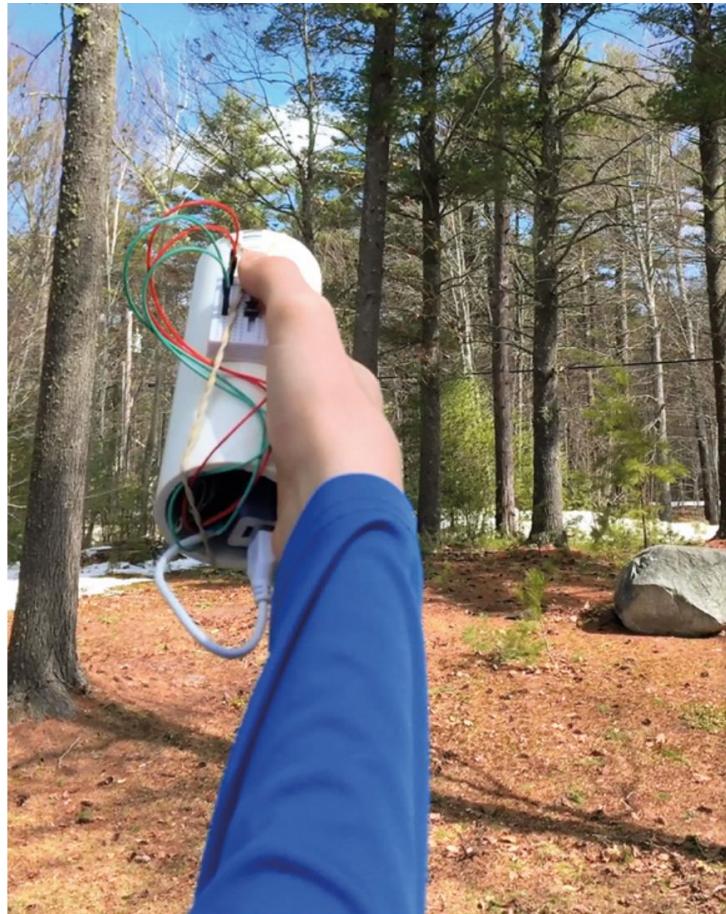
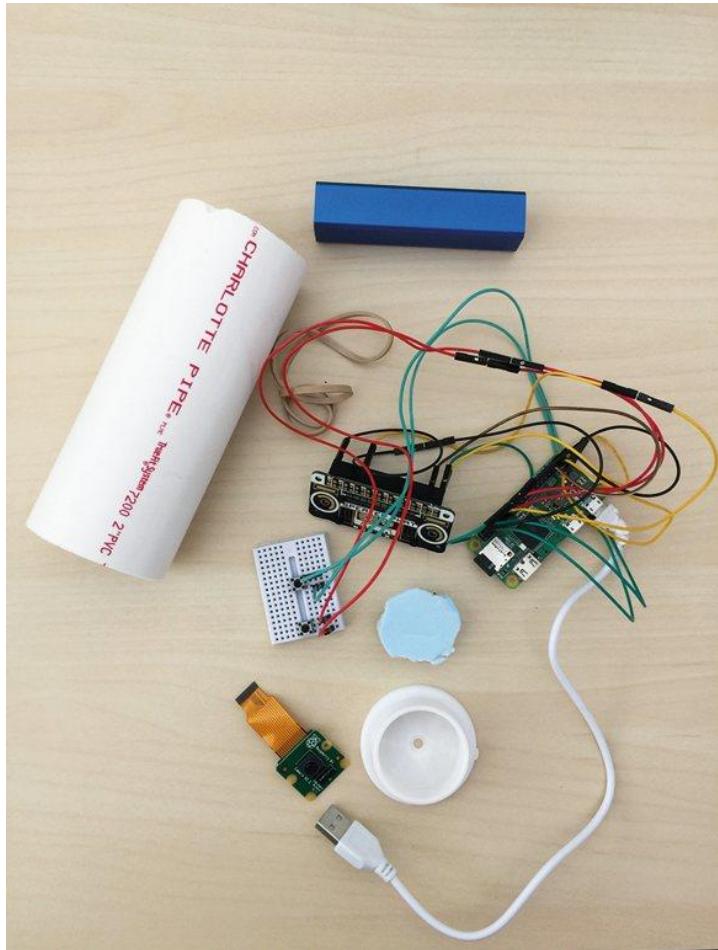


There's Waldo





Seeing Wand

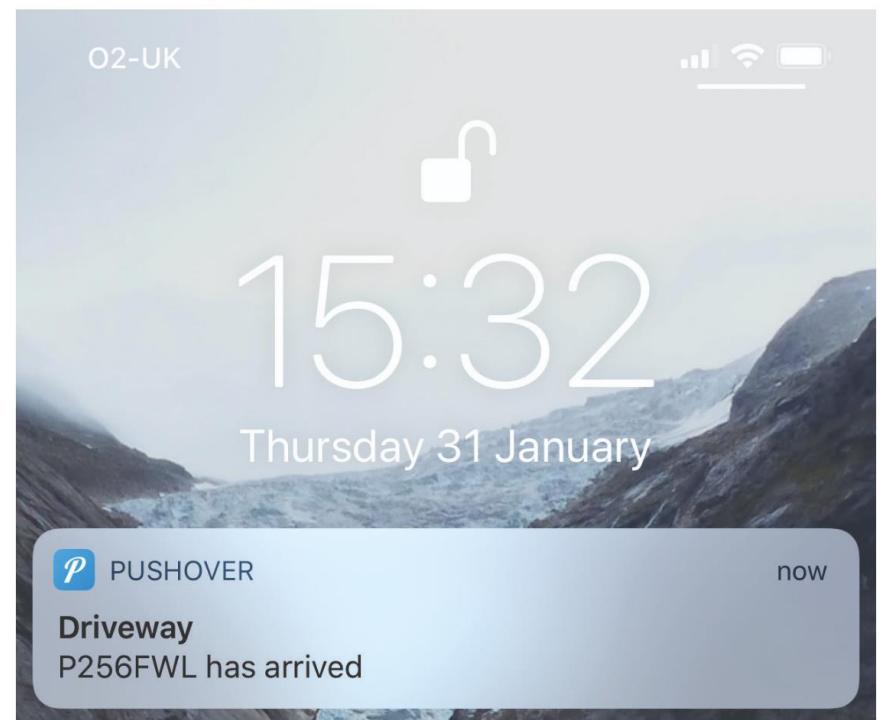


Point the wand at an item, press the button, and its description is spoken



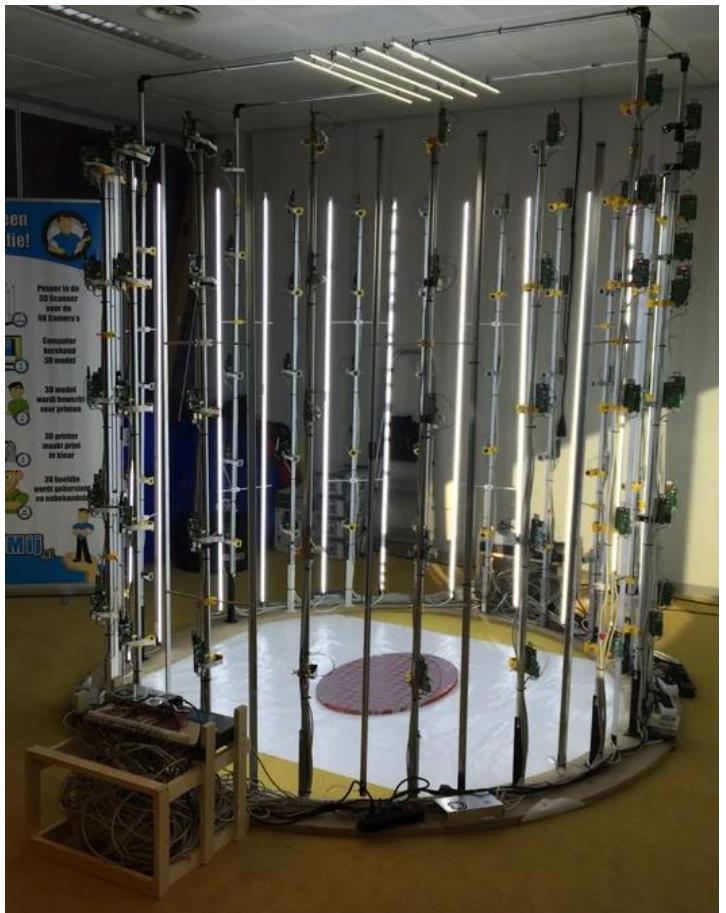
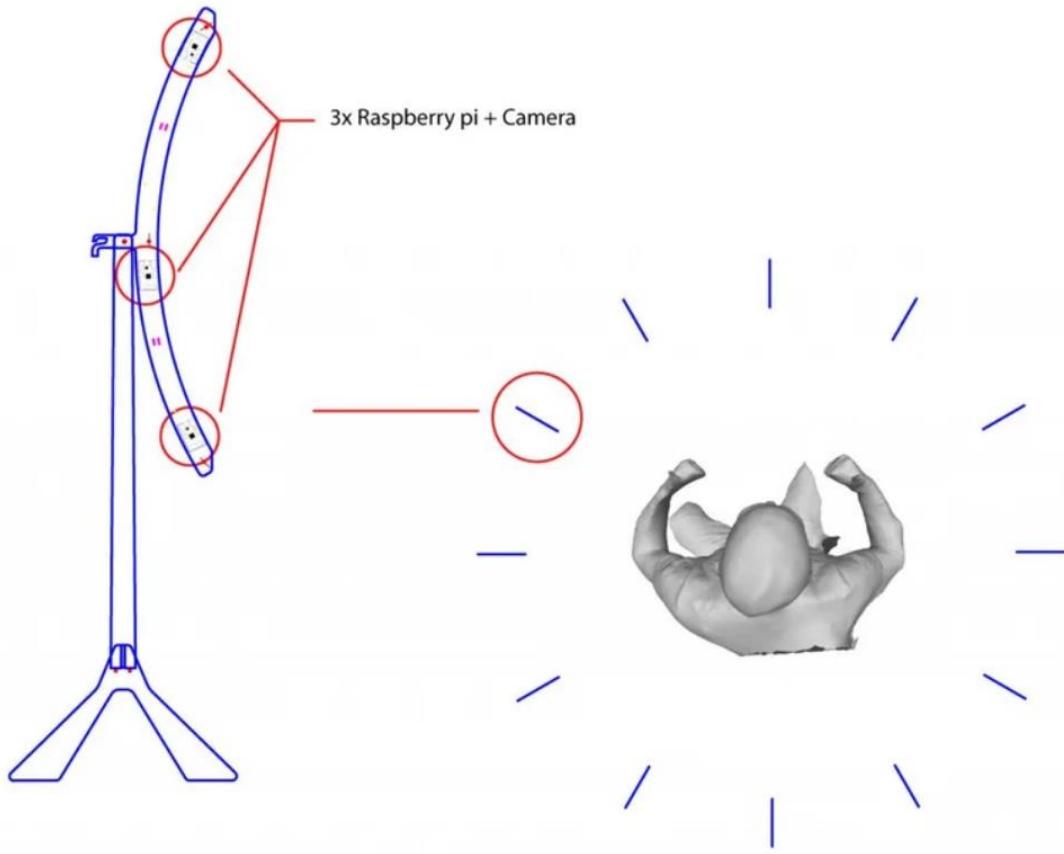
ANPR: Car Spy Raspberry Pi

- Automatic number-plate recognition (ANPR)





3D Scanner





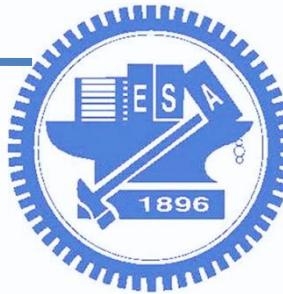
Intelligent Drowsiness Monitor



A clever device that detects if you are sleepy behind the wheel and gives a wake-up call. Nicola King finds out more

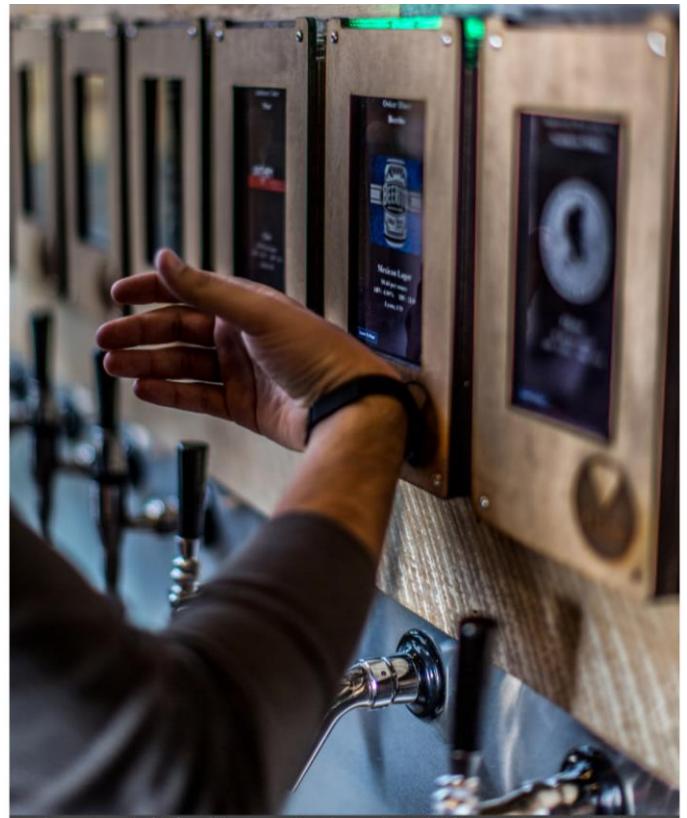


A Raspberry Pi, powered by a battery pack, is connected to the camera, speaker, an accelerometer, and mobile data dongle

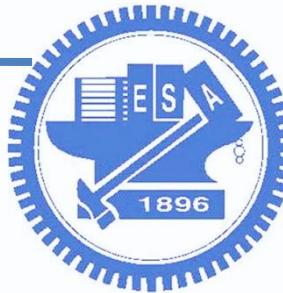


iPourit

- Raspberry Pi self-serve beer dispenser



The customer's drinks tab is set up when they arrive and links to an RFID wristband that activates the dispensers at the beer wall



FutureHome



Norway-based FutureHome is selling home automation systems based on the Raspberry Pi