Oide

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Supporting the Professional Learning of School Leaders and Teachers

Raspberry Pi and Astro Pi

Day 2 Session 1

Skills Workshop

OIDE and ESERO

Overview

Session 1 10:00 - 11:30	Introduction to Astro Pi Mission Space Lab
Tea/Coffee 11:30 – 12:00	
Session 2 12:00 - 13:30	Raspberry Jam/Project
Lunch 13:30 - 14:30	
Session 3 14:30 - 16:30	Showcase

Session Overview

PART 1. Introduction to Astro Pi Mission Space Lab

PART 2. Choosing the right platform (Danny's helper program)

PART 3. More on sensors …

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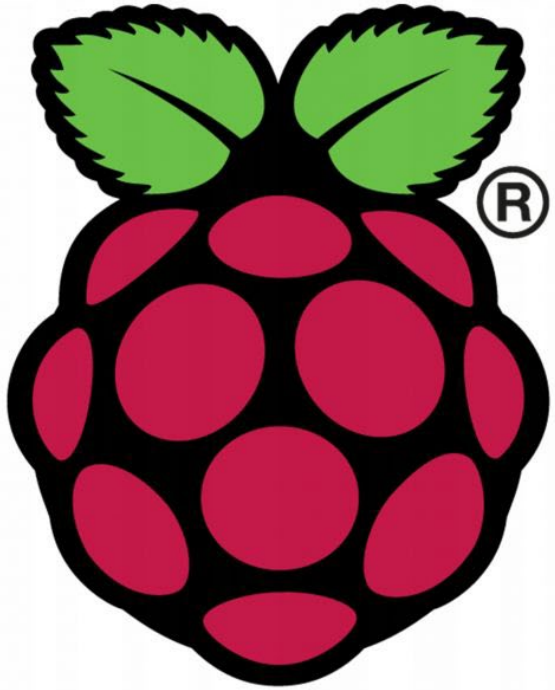
Supporting the Professional Learning of School Leaders and Teachers

The Raspberry Pi and Astro Pi

PART 1

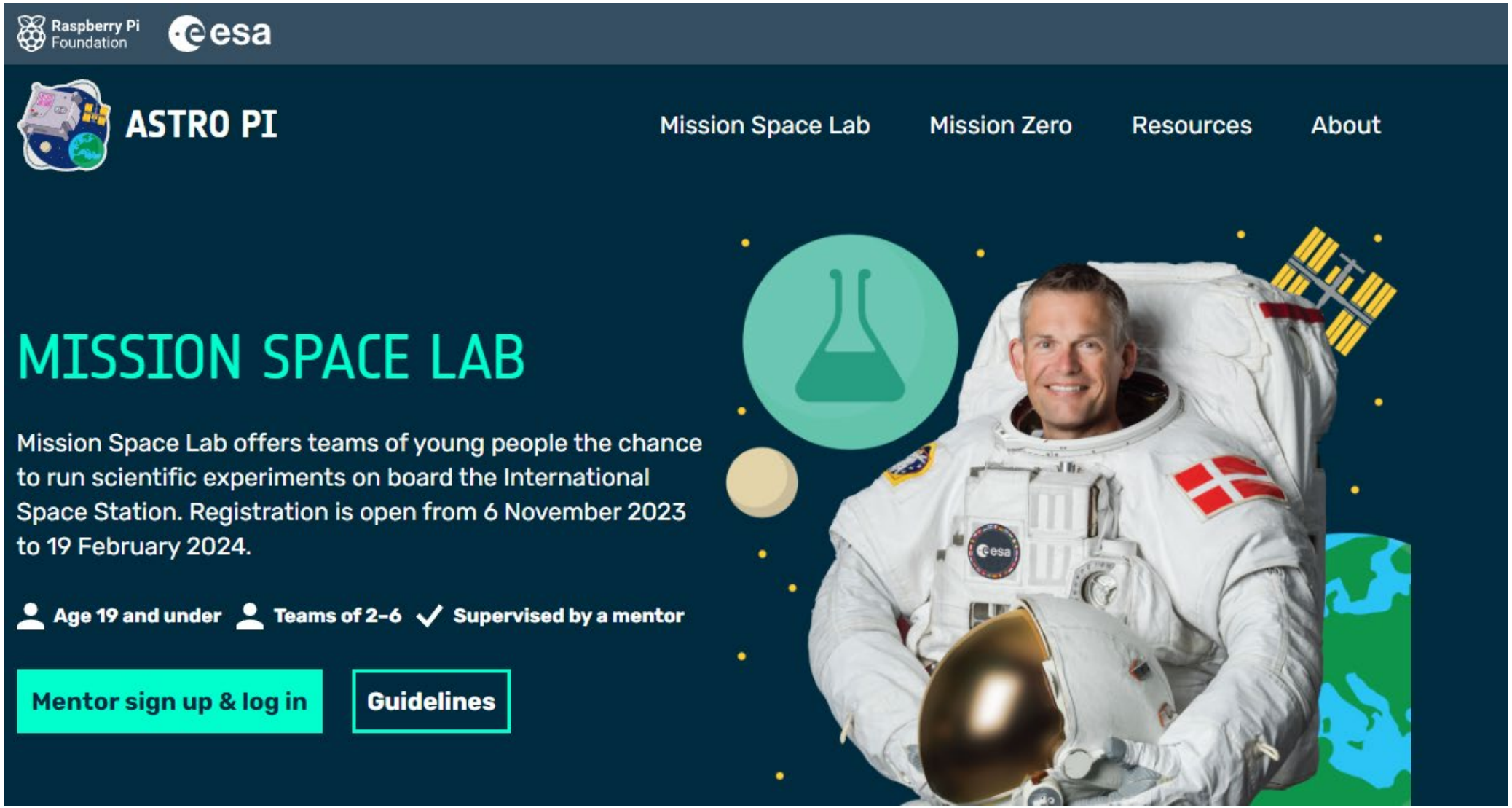
Introduction to Raspberry Pi Mission Space Lab



Raspberry Pi

What is Astro Pi?

The European Astro Pi Challenge offers young people the amazing opportunity to conduct scientific investigations in space by writing computer programs that run on Raspberry Pi computers aboard the International Space Station (ISS).



https://astro-pi.org/mission-space-lab/

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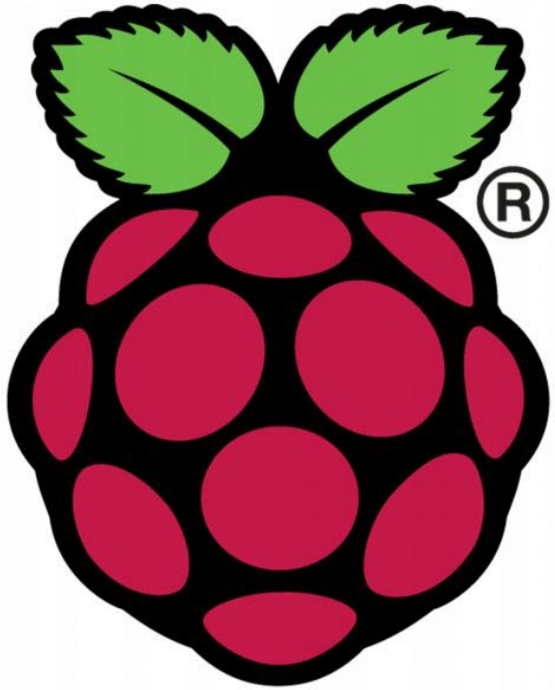
The Raspberry Pi and Astro Pi

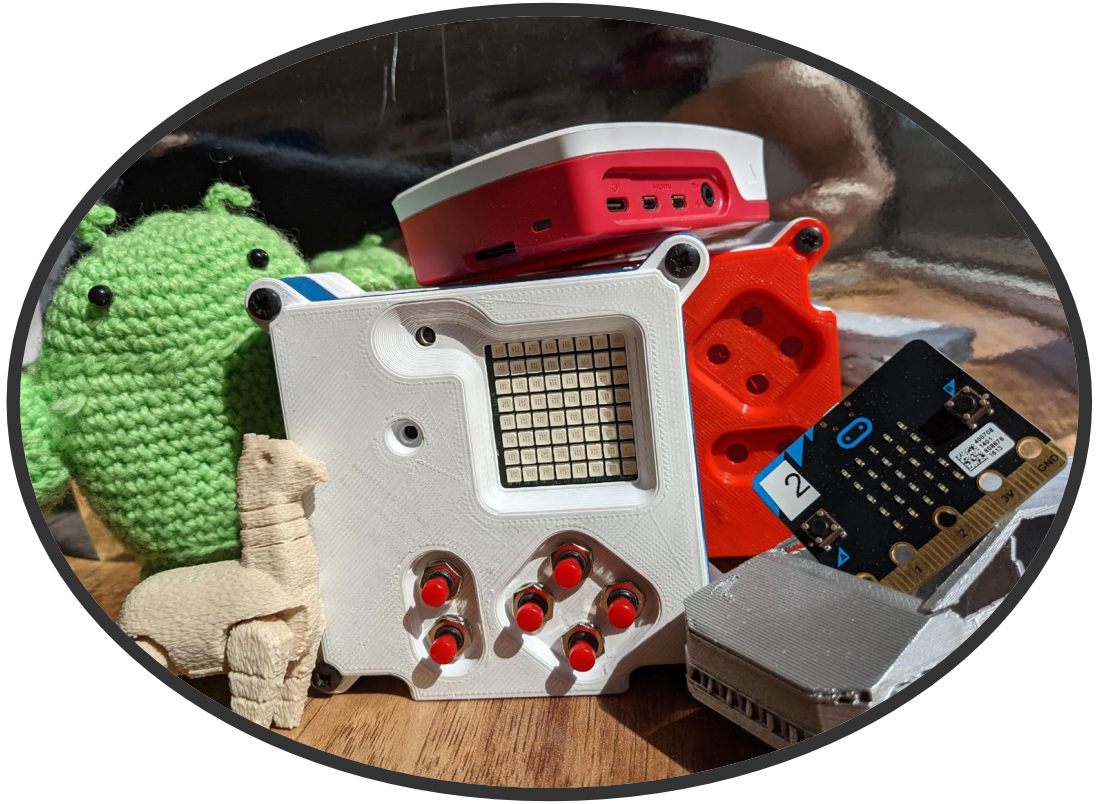
PART 2

Choosing the right platform



Raspberry Pi

Which system is the best system for your students?

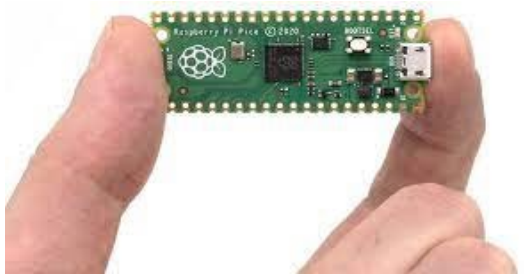


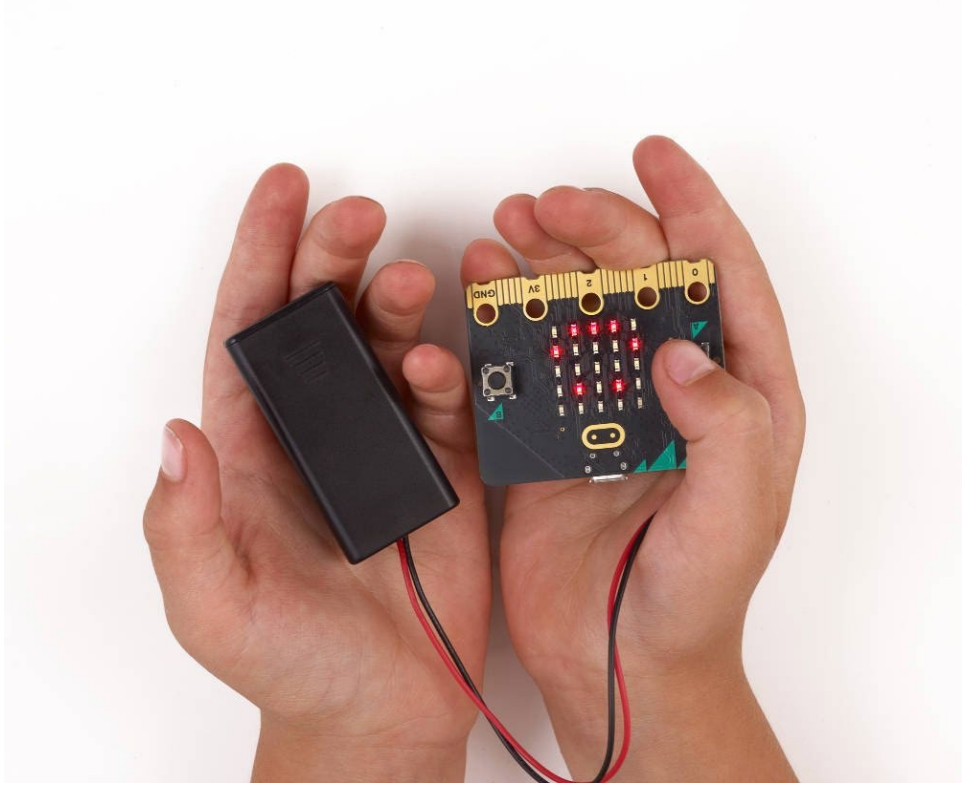
The correct answers is always “It depends…”

Using a Raspberry Pi 1.0 for Image Processing while technically possible…

These are just tools that make students ideas into reality!

A tool is something that amplifies human capability.





The right tool for the right job" – Montgomery Scott (Star Trek)

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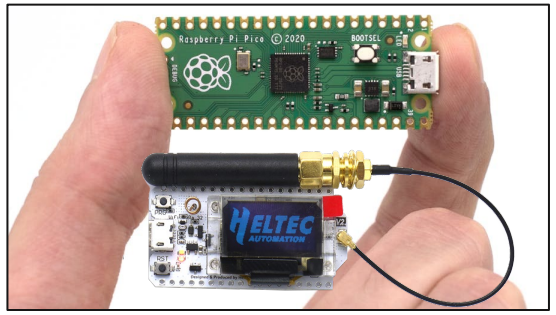

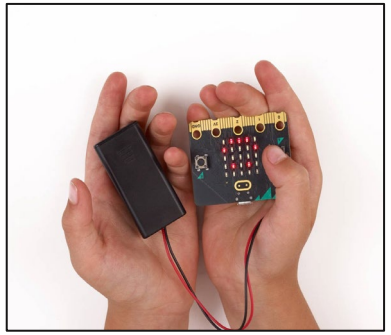

Raspi Pico or Arduino ESP32

- C, JS, mPython
- Thumb Sized
- Battery can last months
- No built in Display
- Radio/Bluetooth
- GPIO Analogue/Digital

BBC Micro:bit

- Block, JS, mPython
- Badge Sized
- 3V Watch Battery
- Built in LED display
- Radio/Bluetooth
- GPIO Analogue/Digital
- Ringtone Audio on V2

Raspberry Pi

- Block, JS, Python
- Wallet Sized
- 5V Power Pack
- HDMI Out to 2 Displays
- WiFi/BT
- GPIO Digital Only
- Camera
- Full audio out

Desktop Computer

- All languages
- Usually large
- Mains Voltage
- Many large displays
- WiFi/BT
- Usually no GPIO for sensors
- Camera + fast processor
- Audio

*** Key features that might fit a particular job**

Be as “Device Agnostic” as you can. The idea determines the device.

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If unsure, these 8 questions will help you decide on the correct system:

- **Does it need GPIO? (or can this be browser based?)**
- **Does it need a direct internet connection? (databases, weather etc.)**

- **Does it need an onboard camera?**
- **Does it use Analogue inputs?**

- **Does it use i2C? (how complex are the sensors?)**
- **How small does it need to be? (Wearable? Mobile? 3V? 5V? 230V?)**

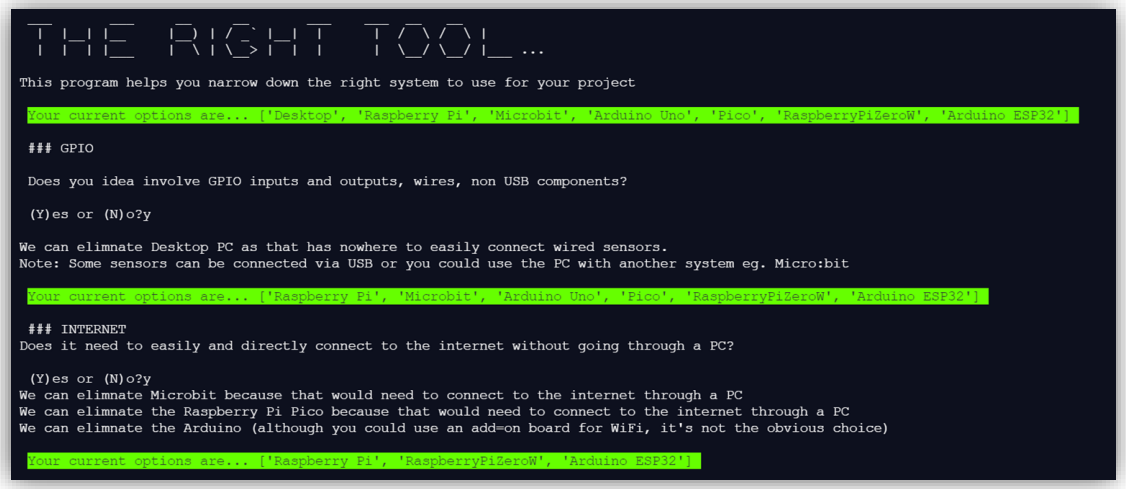
- **What programing languages are you familiar with? (Python or C?)**
- **What kind of digital media output is needed? (.mp3 sound? .mp4 Video?)**

Individual Activity using Python: A student asks you:

*"My idea is an alarm that **senses** if a cookie is still there or not. If the cookies is removed, a sensor picks this up and **a camera** take a picture of the bandit. What should I use for this?"*

Go to the link below. This is a series of questions (written in python with a *list* and *if else*) to help your students decide what system might be best for their project idea. Let's see if you all get the same answer for the Cookie Alarm scenario above!

https://replit.com/@MrDMurraySTJ/whichSystem



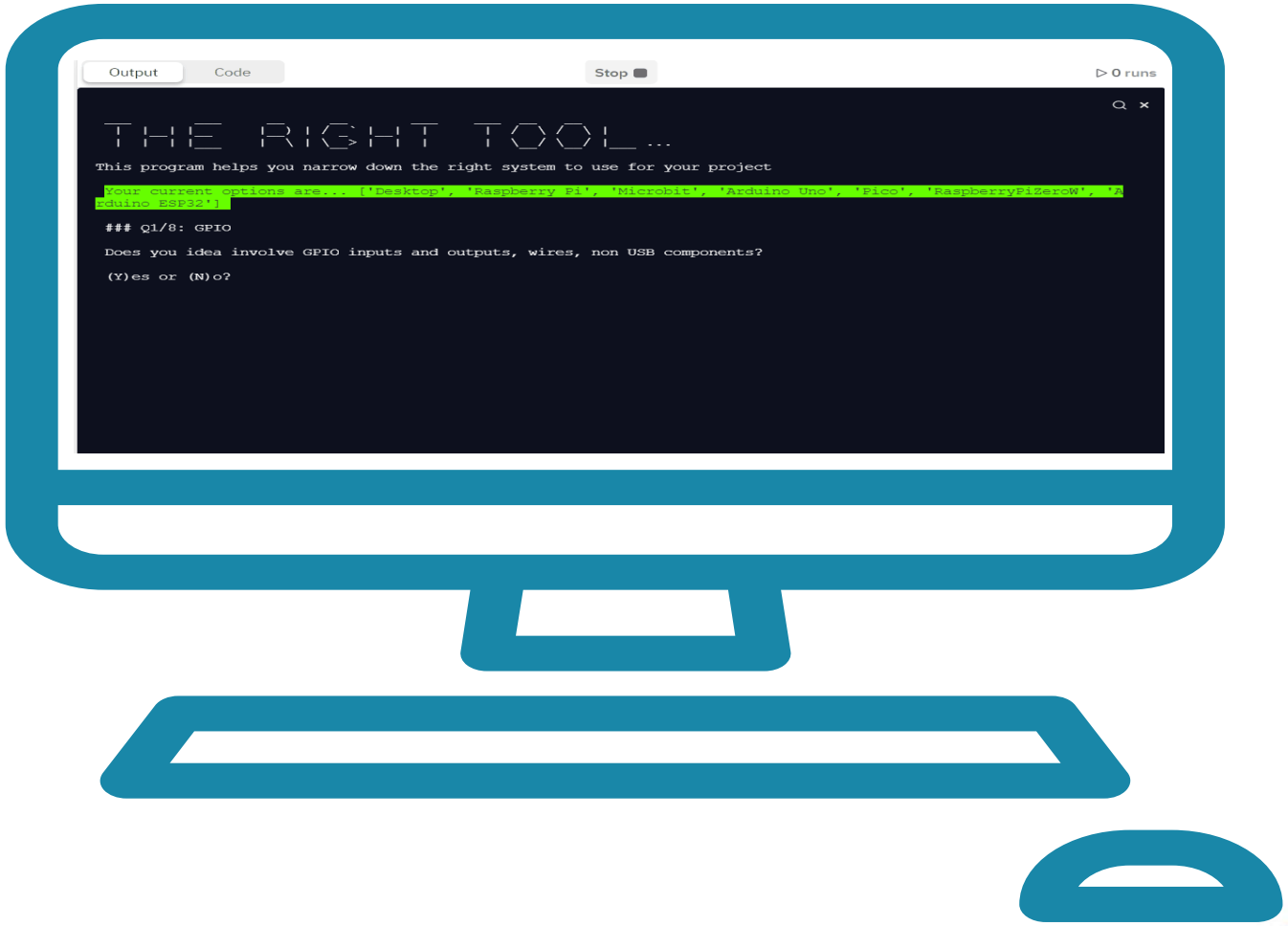

```
# Q1: Does it General Inputs and Outputs?
print(" ### Q1/8: GPIO")
print("\n Does you idea involve GPIO inputs and outputs, wires, non USB
components?")
answer = input("\n (Y)es or (N)o?")

if answer.upper() == "Y" or answer.upper() == "YES":
  print("")
  print("We can elimnate Desktop PC as that has nowhere to easily connect wired
  sensors.")
  print("Note: Some sensors can be connected via USB or you could use the PC
  with another system eg. Micro:bit")

  if "Desktop" in listOfSystems:
    listOfSystems.remove("Desktop")
```

Did everyone get "*Raspberry Pi*" as the outcome for the Cookie Project?

Is that *really* the only option?



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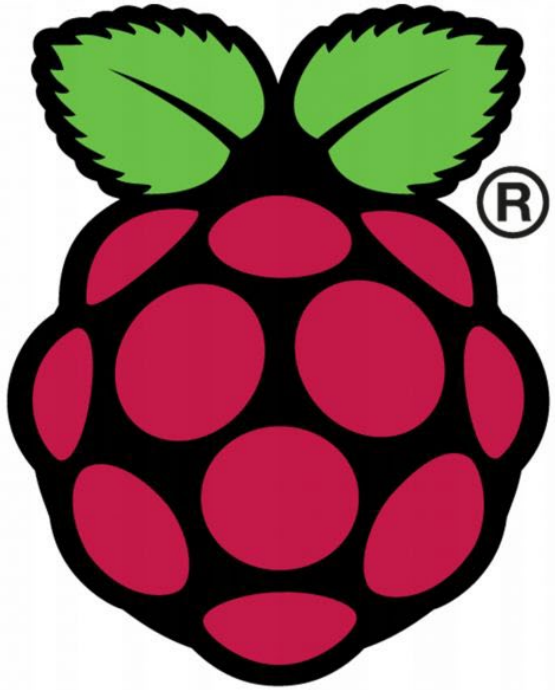
PART 3

More on sensors …



Raspberry Pi

This is a 17 euro 37 Sensor Kit for Arduino

What do most of these sensors have in common?

They have 3 pins.

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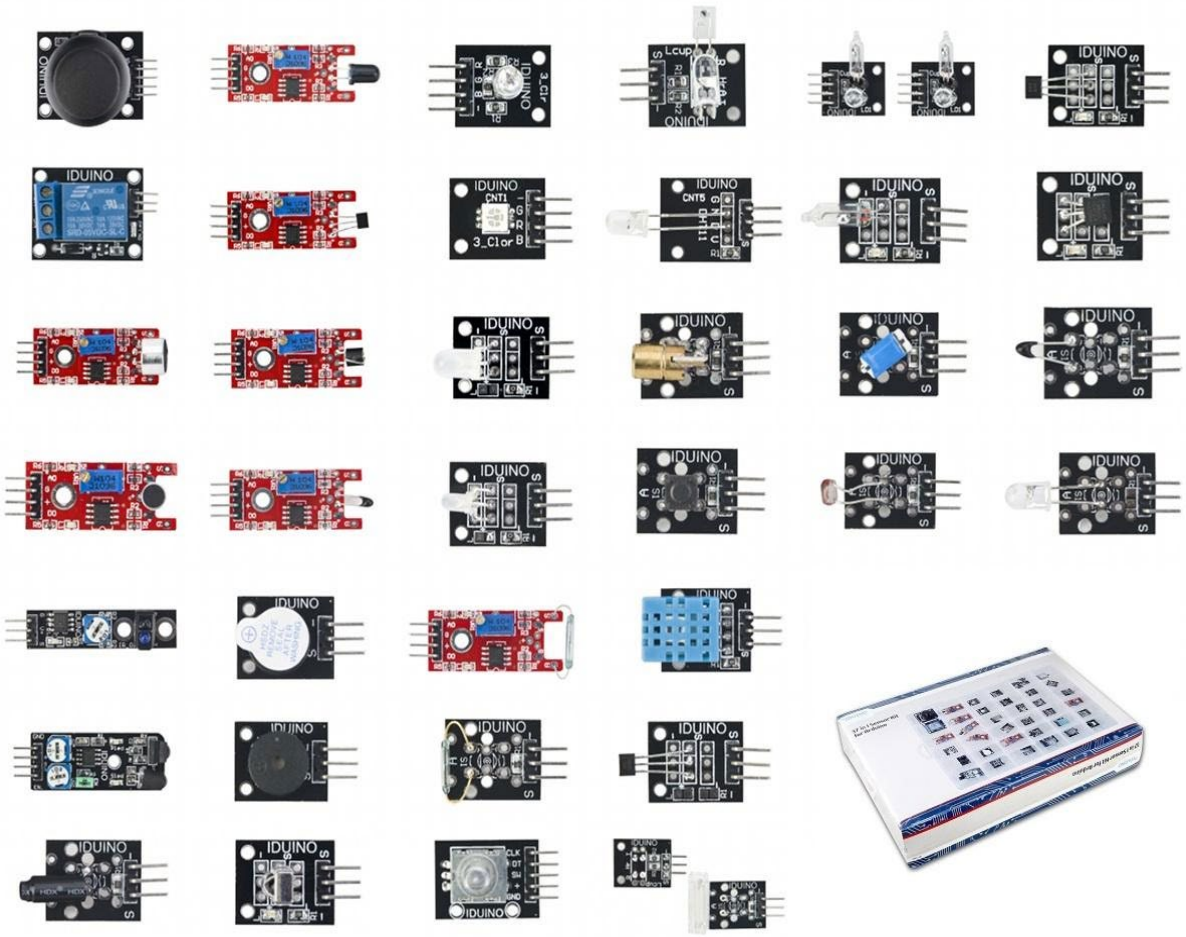
Even the 4 Pin sensors are really 3 Pin sensors!
(I'll explain that later)

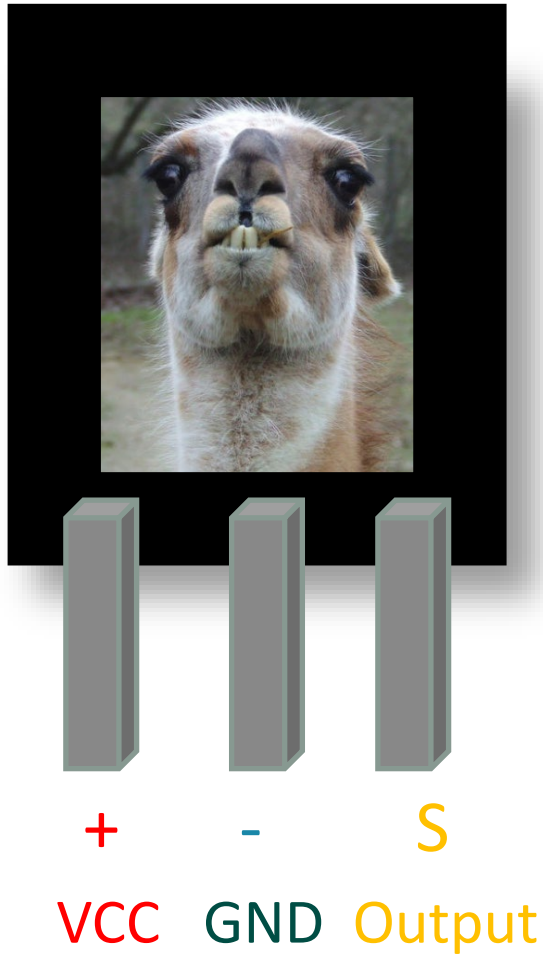


There's no such thing as a 3 Pin Llama sensor but… you would know how to use it!

Connect the + to the 3V pin, 5V pin, or the positive end of a battery.

Connect the – to the GND pin or the negative end of a battery.

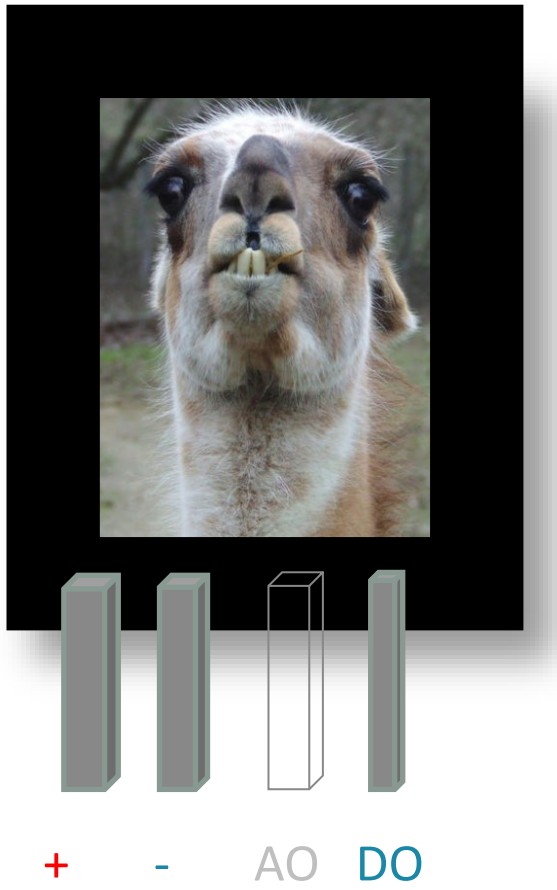
Connect the other pin (usually labelled S for signal output) to your favourite GPIO pin on your Raspberry Pi, Micro:bit or Arduino.



4-pin Llama sensors have two options for the output signal.

Just leave one disconnected. So, it's still really a 3- pin!

Digital Llama Detector



SIGNAL TYPE:

DO (Digital Output)

This detects:

- YES LLAMA (TRUE)

- NO LLAMA (FALSE)*

SIGNAL TYPE:

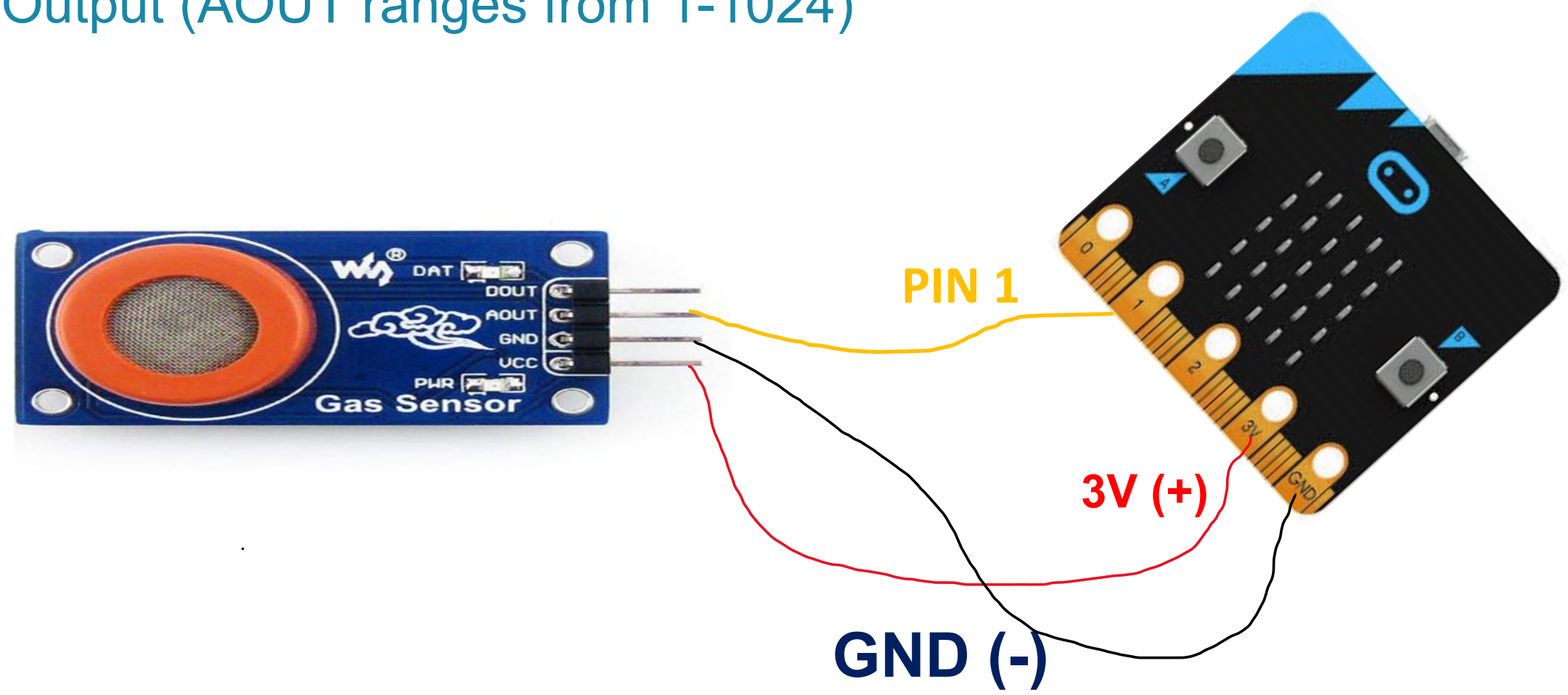
AO (Analogue Output)

Pin returns a number from 1-1024 or 1-255 which describes the intensity of smell of Llama right now.

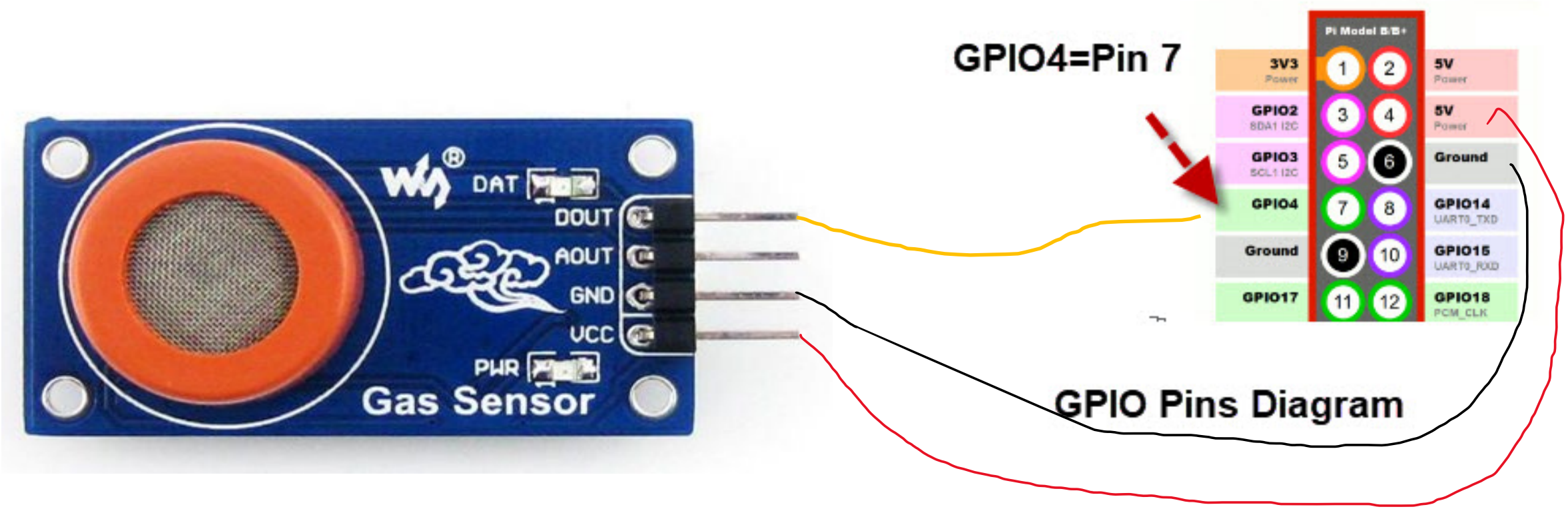
May need some calibration.

Analogue Llama Detector

Example: An MQ-2 Gas Sensor setup to Analogue Output (AOUT ranges from 1-1024)



Example: An MQ-2 Gas Sensor setup to Digital Output (Yes deadly gas, No deadly gas)



Raspberry Pi's have Digital Inputs only

If you can do one Gas sensor, you can do them all!

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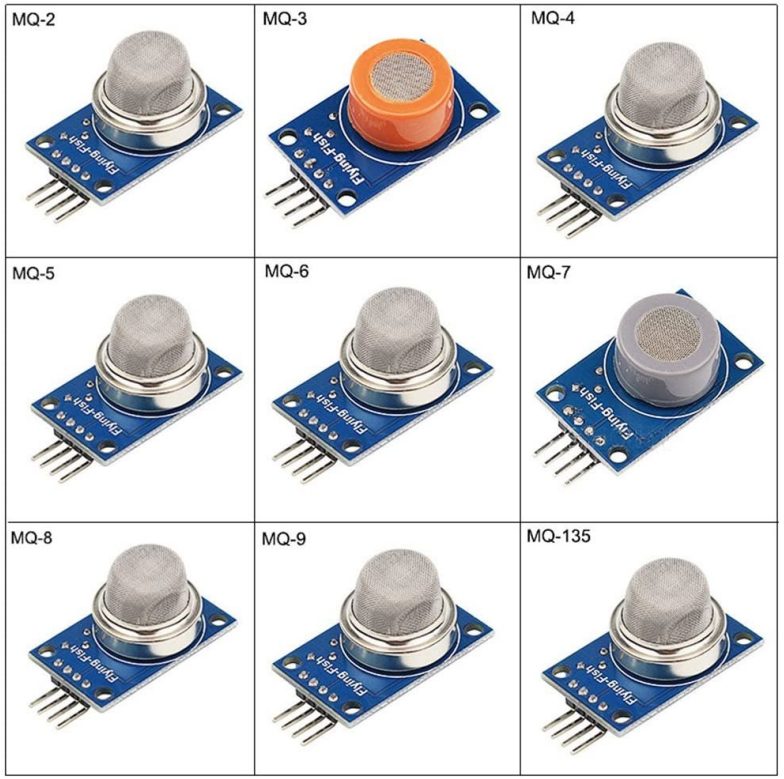
Look how similar the other gas sensors are. Literally identical ☺

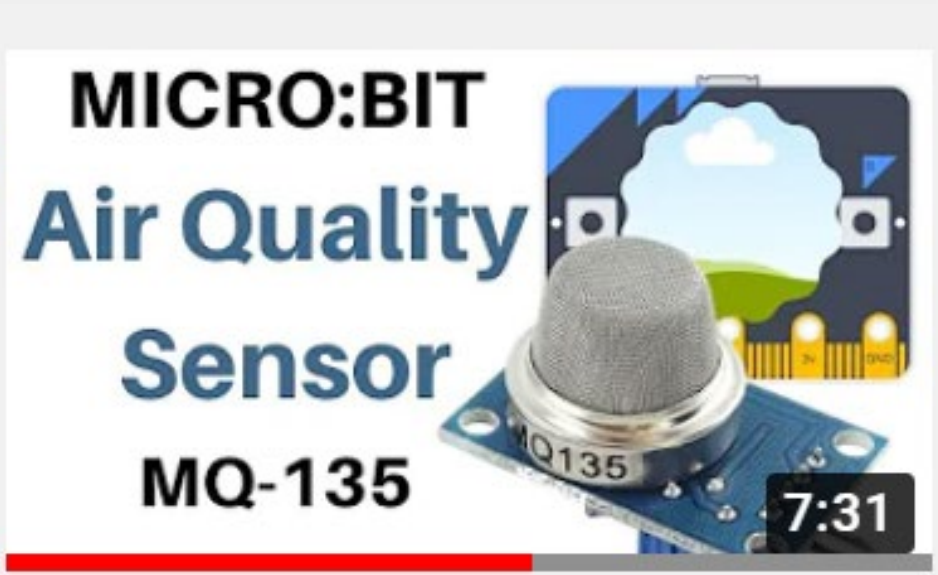
Number	Model	Nominal Test Target Gas
S1	MQ-8	hydrogen, coal, gas, etc.
S2	MQ-9B	carbon monoxide, etc.
S3	MQ-2	flammable gas, smoke, etc
S4	MQ-5	liquefied petroleum gas, methane, coal gas, etc
S5	MQ-135	ammonia, sulfides, etc.
S6	MQ-3B	alcohol, etc
S7	MQ-7B	carbon monoxide, etc.
S8	MQ-4	natural gas, methane, etc.
S9	MQ-2	flammable gas, smoke, etc.
S10	MQ-6	liquefied petroleum gas, isobutane, propane, etc.
S11	MQ-5	liquefied petroleum gas, methane, coal gas ,etc
S12	MQ-7	carbon monoxide, etc.



There are full tutorials with wiring and code in the videos below:

MQ-135 Air Quality Sensor with a Raspberry Pi

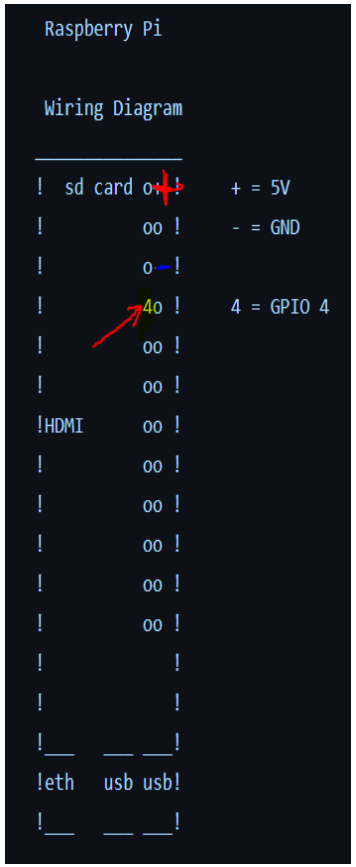
https://youtu.be/ZdvzQpFzne8



MQ-135 Air Quality Sensor with a Micro:bit

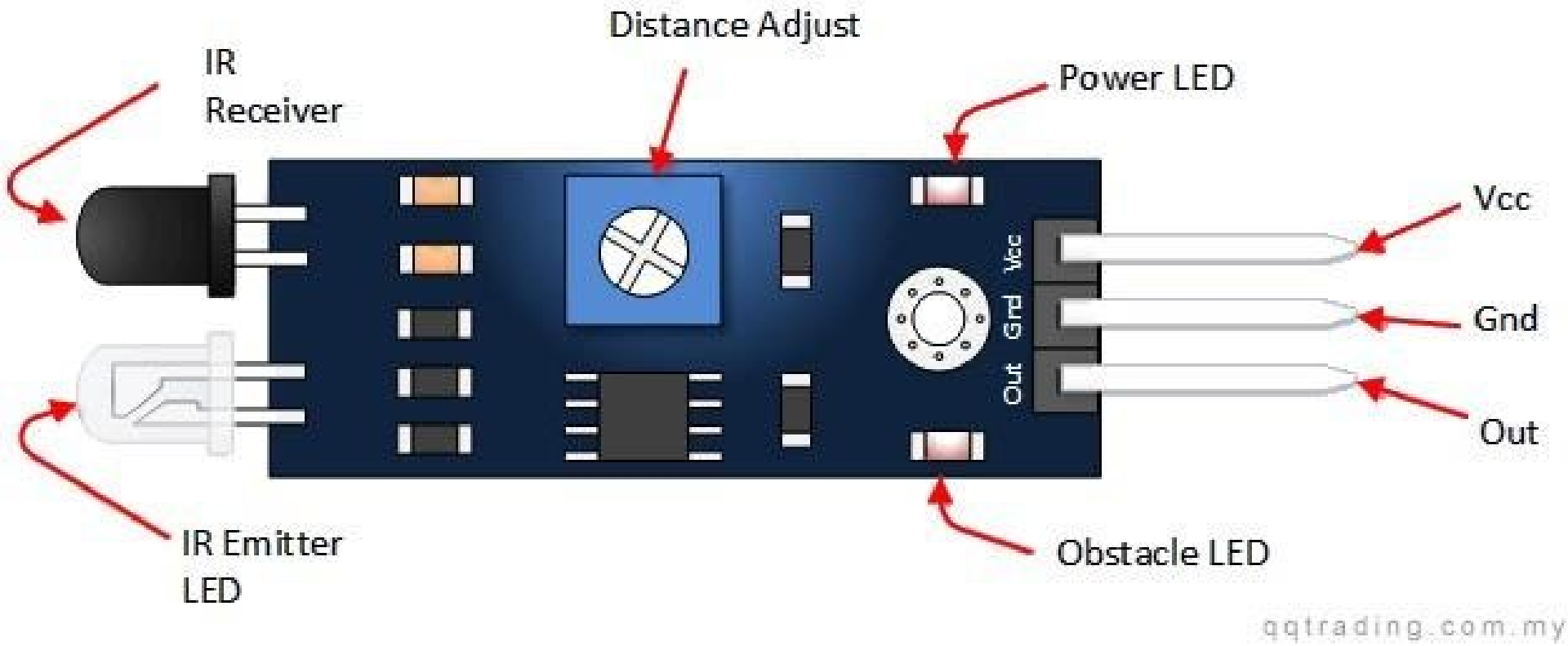
https://youtu.be/x6HCeG9BCzA

Pick NEARLY ANY sensor with a Digital Output and use it with this code and GPIO4 on your Raspberry Pi.




```python
import RPi.GPIO as GPIO
from time import sleep     # For pausing
GPIO.setmode(GPIO.BCM)     # BCM numbering, not BOARD
GPIO.setup(4, GPIO.IN)     # Sets pin4 to an input


try:                       # Doesn't kill the program on an error, goes to finally instead
    while True:            # MASH CTRL+C to stop the program

        if GPIO.input(4): # Checks what's up with Pin 4, if it's TRUE or FALSE
            print("I'm reading TRUE on GPIO 4")

        else:
            print("I'm reading FALSE on GPIO 4")

        sleep(1)           # Wait 1 second before the next reading

finally:                   # When you CTL+C out of the try block, you end up here

    print("Cleaning up...")
    GPIO.cleanup()         # Turns off all pins that are still on so the next program runs cleanly
```

Here's an infrared distance sensor. Same 3 pins!



VCC GND Output

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Break

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Department of Education