An introduction to citizen data science with Home-Assistant

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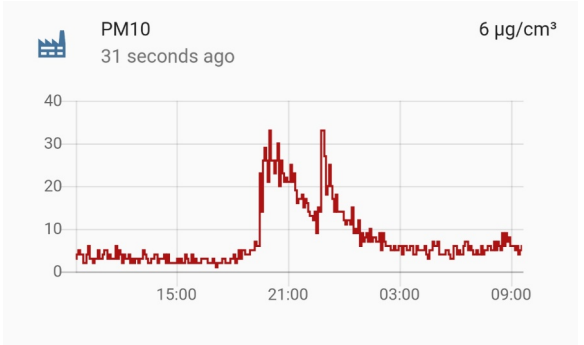
Talk outline

- What are smart-home hubs?
- Introduction to Home-Assistant
- A platform for citizen science
- Case studies:

1. Bird identification
2. Personalized air-quality monitoring (Oliver)



'Smart' home hubs

- All kinds of connected devices entering the home
- A hub centralises control of these devices
- BUT commercial hubs such as Alexa are pretty locked down, not easy to access their data, & privacy concerns

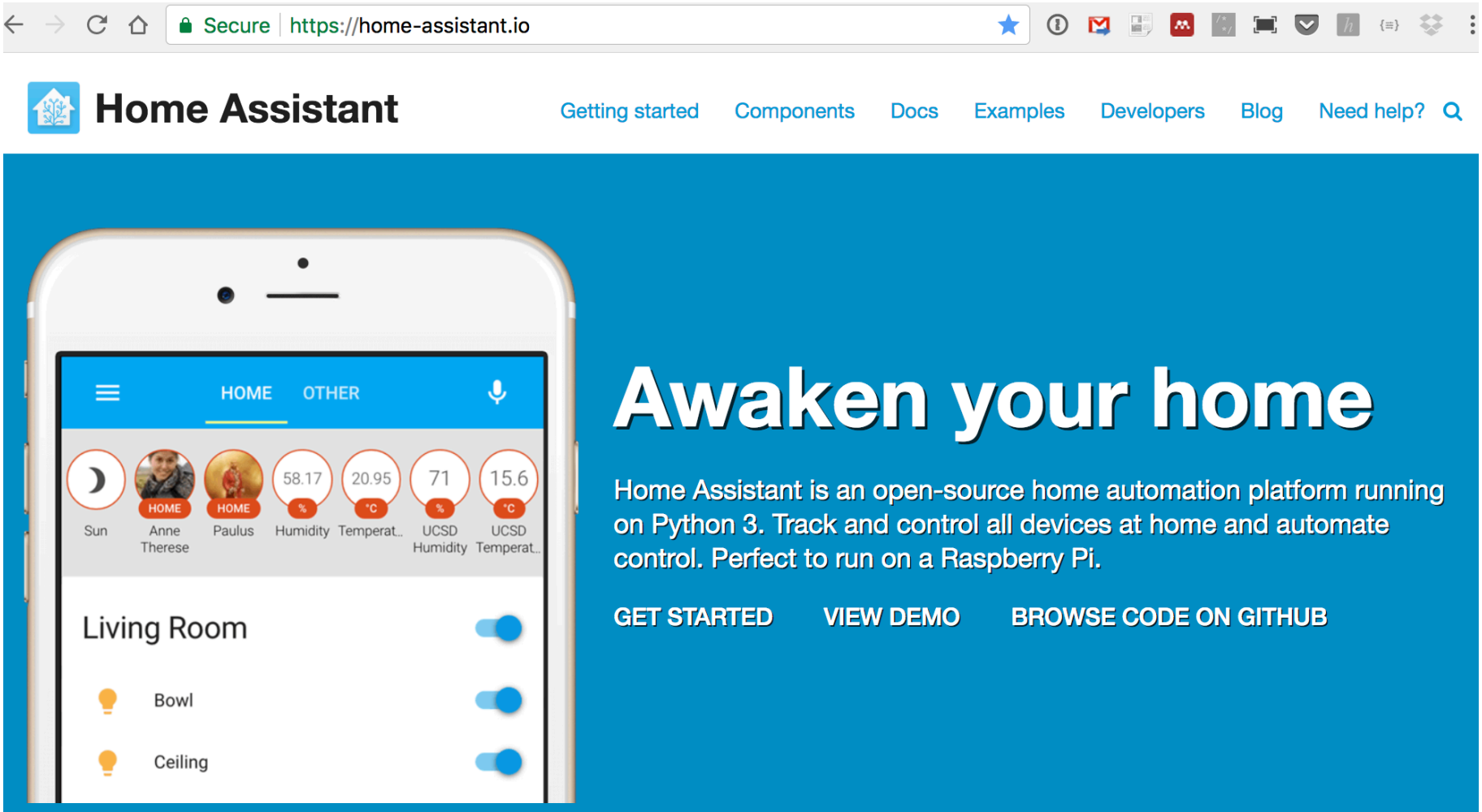
Learning thermostat

The potential of a true smart hub

- Automated routines to save you time/energy/money
- Non invasive monitoring e.g. of elderly
- A home that knows how you like your toast (learning!)
- Your ideas here…
- We require a suitable platform to experiment

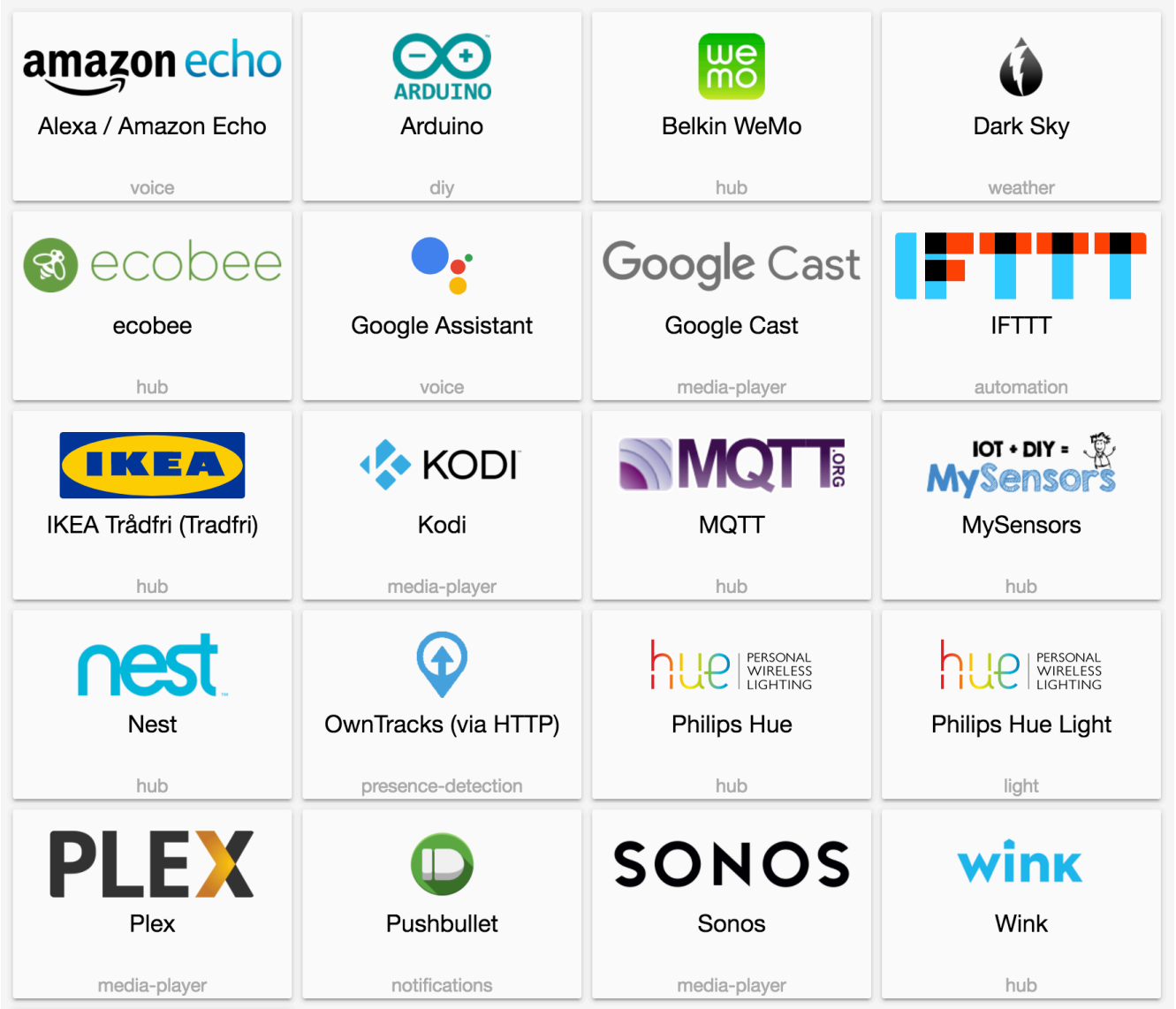
Introducing Home-Assistant

- An open source smart-home hub, python 3, local – typically raspberry pi
- Over 14,600 stars on Github
- Vibrant community ~ 60k active users

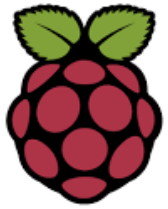


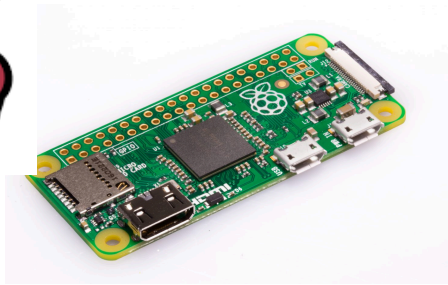
What can Home-Assistant do?

- Connect to over 1000 services & devices
- Control and automate



What do I need to get started?





Your Cart

What a bounty! Make sure that everything in your cart is ship-shape, then click the checkout button to proceed.

	1 Remove	Raspberry Pi Zero W RPI-019	£9.16
	1 Remove	Official Raspberry Pi Zero Case RPI-020	£6

Item Total

£15.16

£12.63 ex. VAT

Shipping is calculated during checkout based on weight, destination, and service selected.

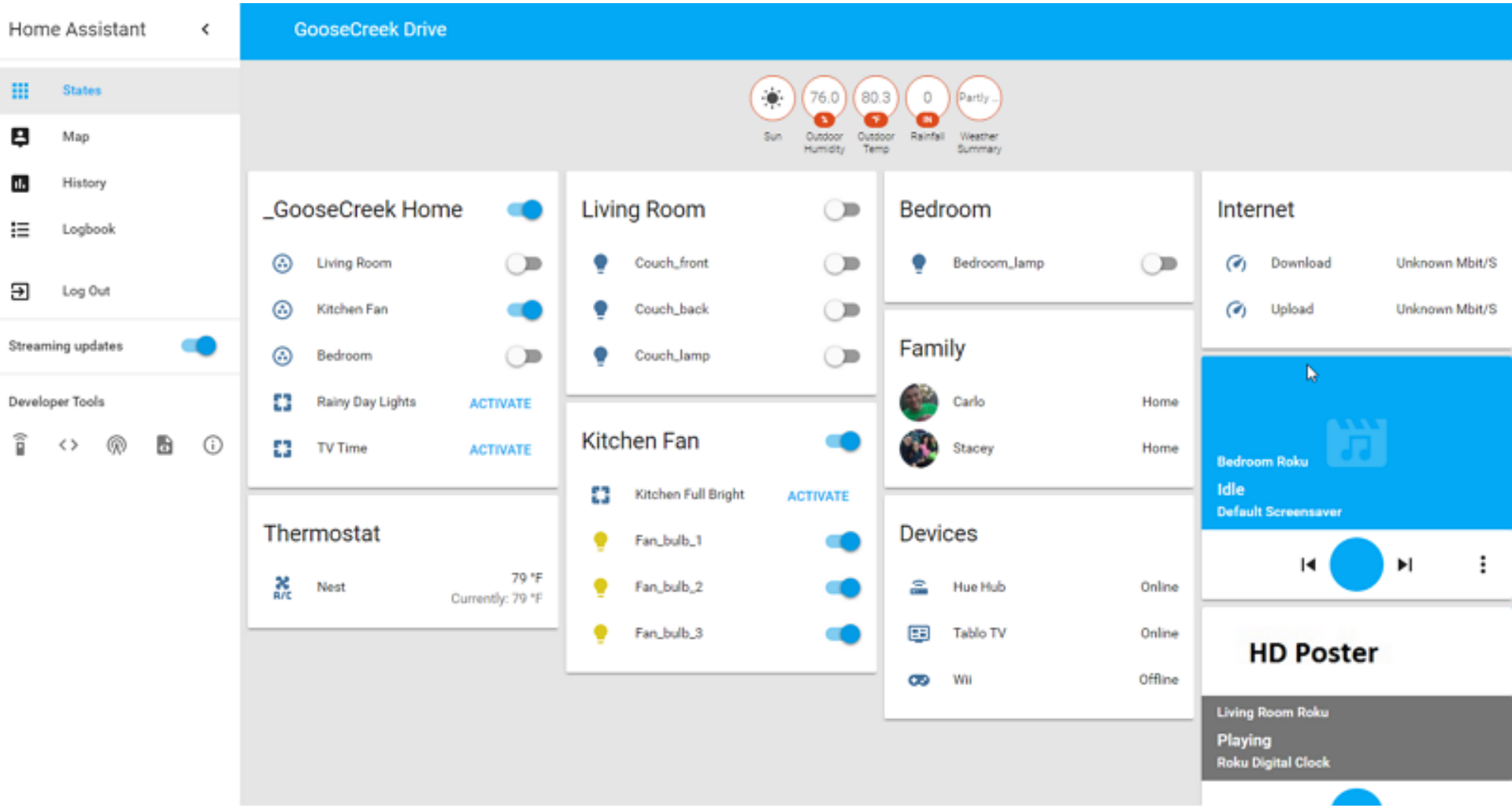
Add your own power supply and SD card.

Setup:

1. Head to https://www.home-assistant.io/hassio/installation/
2. Flash disk image to the SD card
3. Edit text file on the card to add wifi credentials
4. Insert card into pi, wait 20 mins, head to http://hassio.local:8123/
5. Let auto-discovery find your devices
6. Start adding extra services, customizing, automating

What is the UI?

- Browser GUI

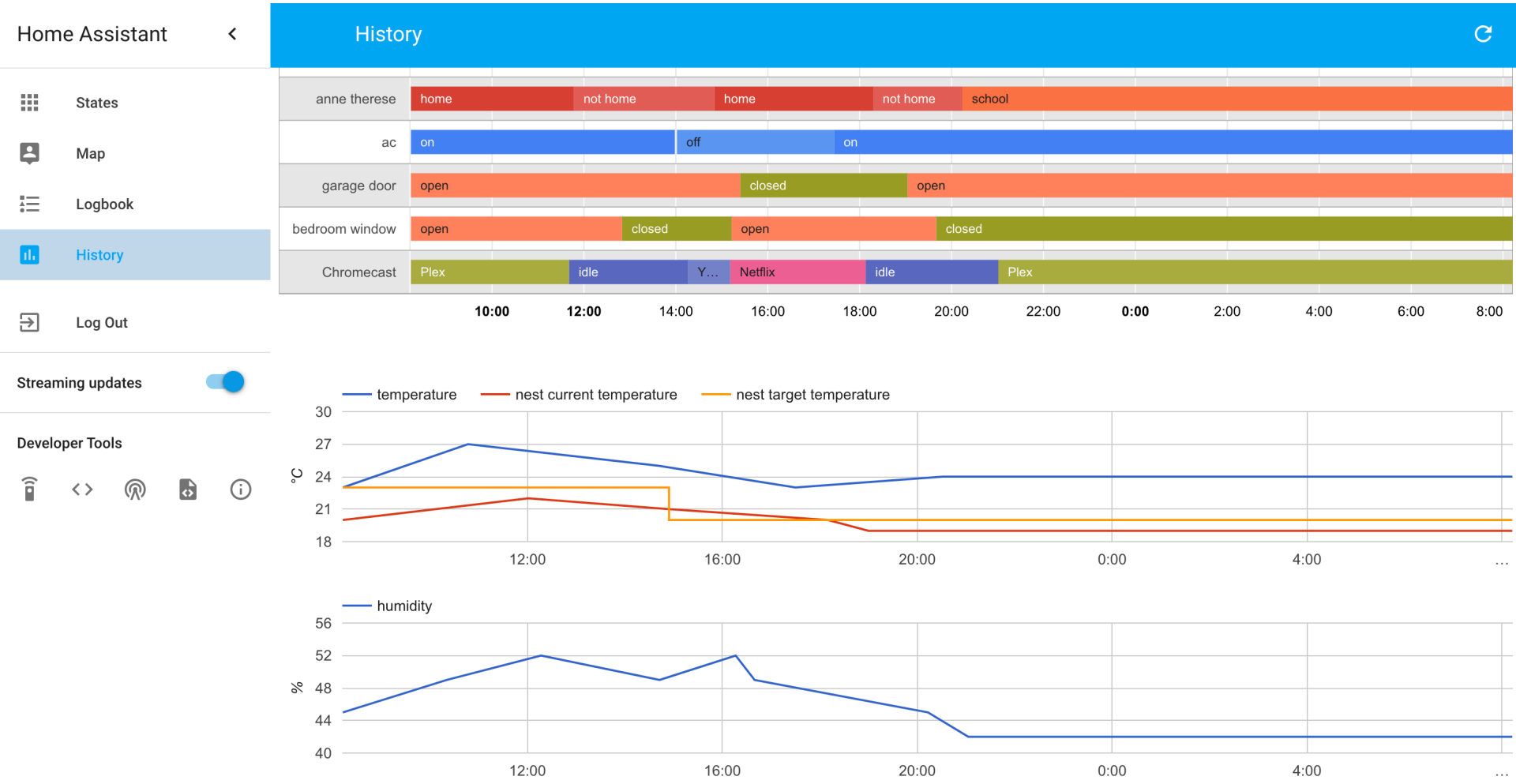


Or create custom UI..!

https://github.com/CCOSTAN/Home-AssistantConfig

How do I view data?

Graphs and charts built in

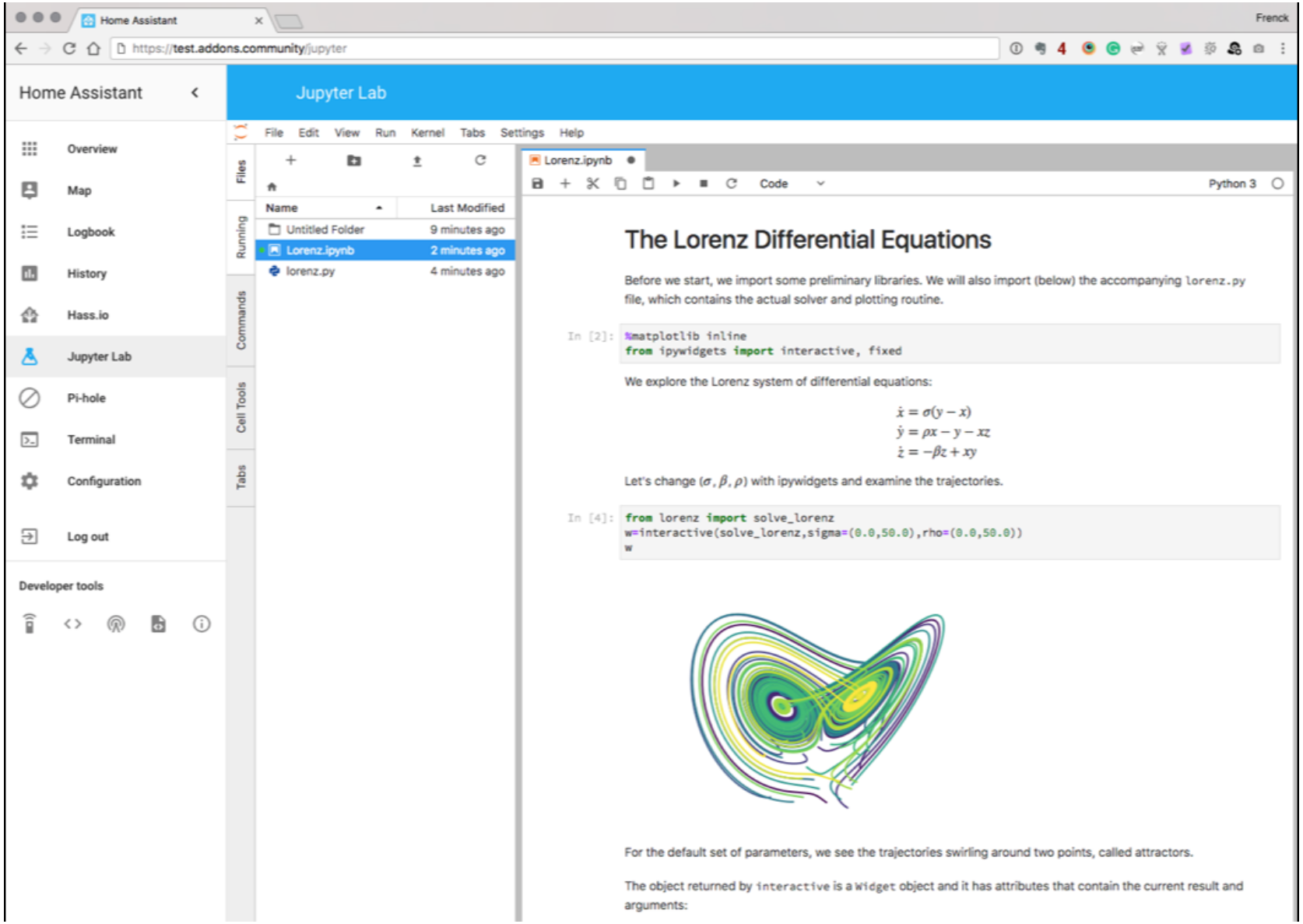


Extend Home-Assistant with 1-click install Addons

Many community add-ons, e.g. influxDB/Grafana https://github.com/hassio-addons

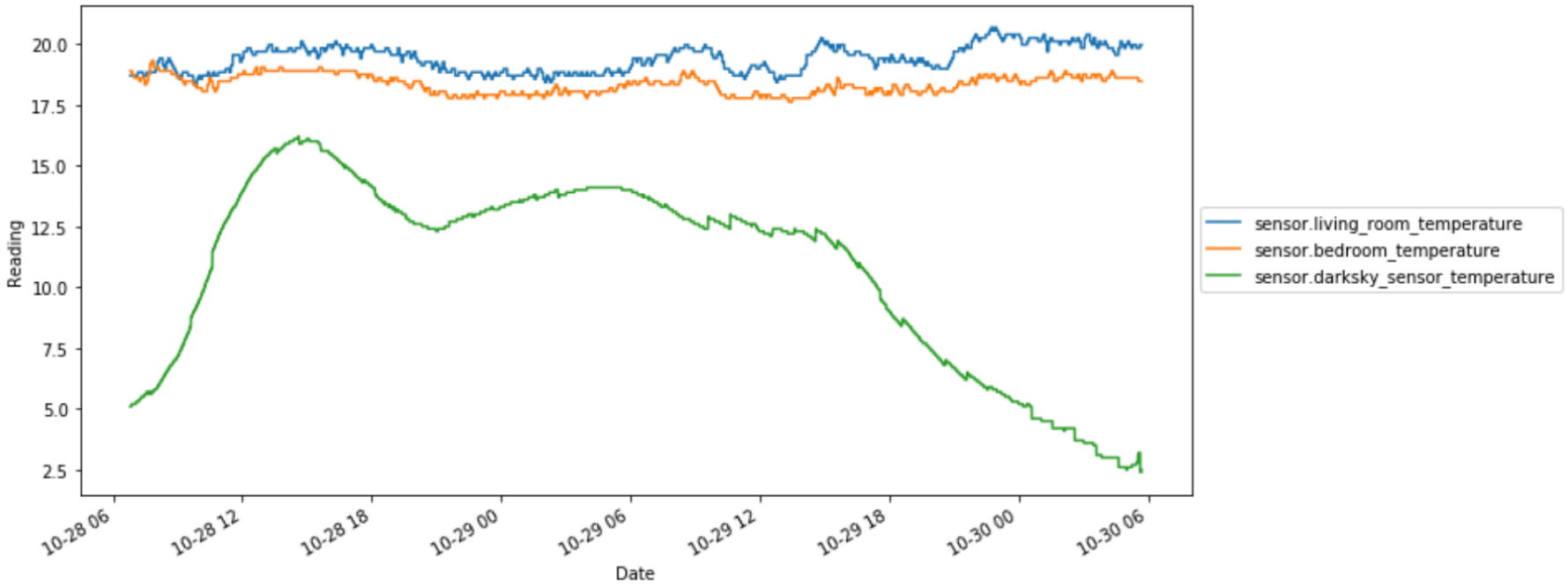
Talking of addons, JupyterLab addon is in development

https://github.com/hassio-addons/addon-jupyter



What is the backend database?

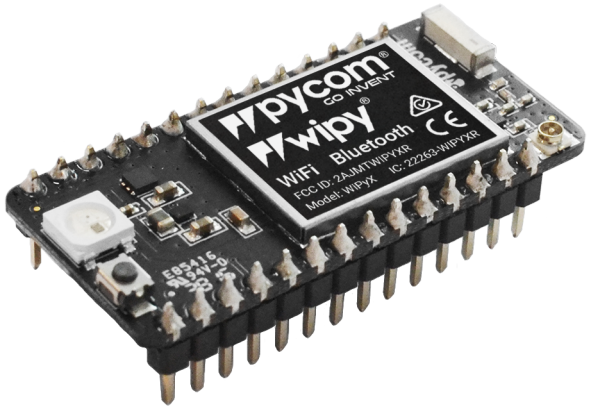
- All state and event data in a single, time series SQL database
- Use standard tools to query your data
- Library for working with data built with Pandas -> Hass-data-detective
- Even upload the sqlite.db file to Google CoLaboratory (online jupyter) for analysis!

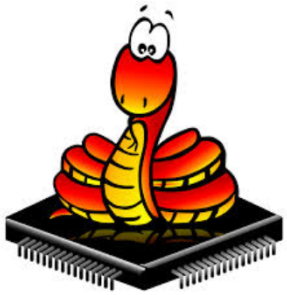


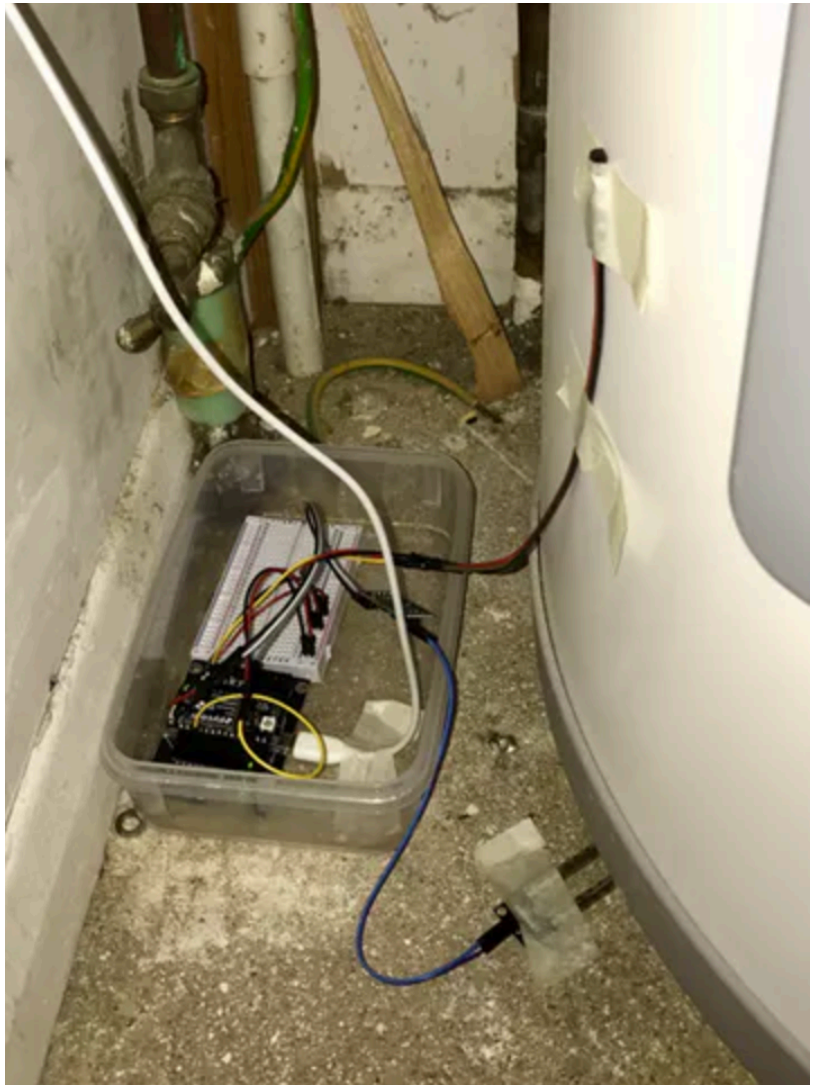
https://github.com/robmarkcole/HASS-data-detective

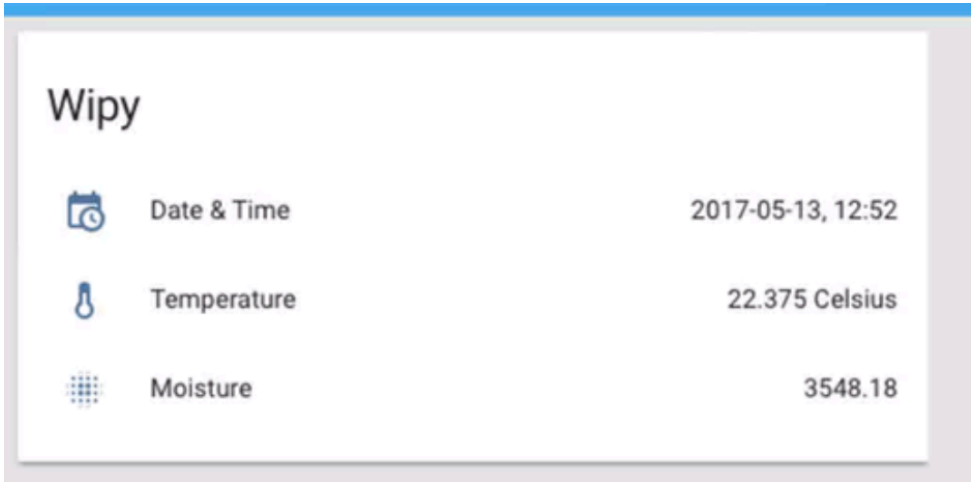
Getting data into Home-Assistant from Micropython

- Physical connection
- Rest API
- MQTT









https://www.hackster.io/robin-cole/micropython-leak-detector

Citizen science case study 1: Bird identification

Project goal: automatically photograph and identify birds visiting my bird feeder, gather data that I can share with birdlife study https://www.rspb.org.uk/..birdwatch

Motion triggered £10 camera & Pi3 Home-Assistant

Task 1: identifying bird/not-bird images

MACHINE BOX

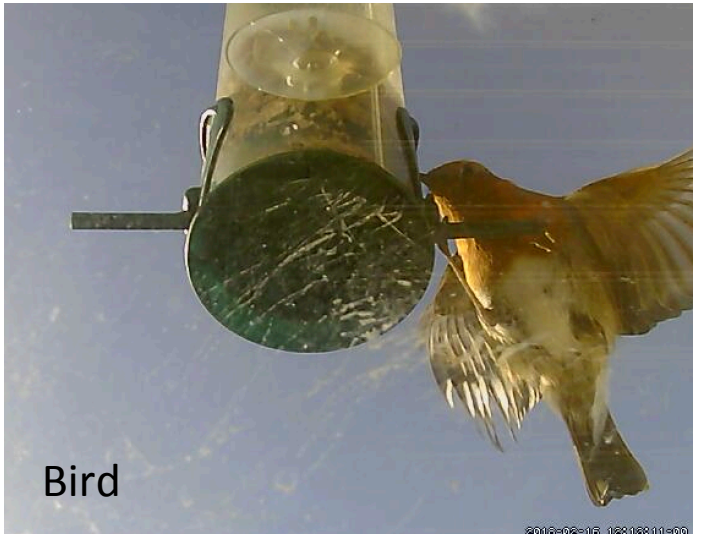
For a simple to use classifier I used https://machinebox.io/docs/classificationbox

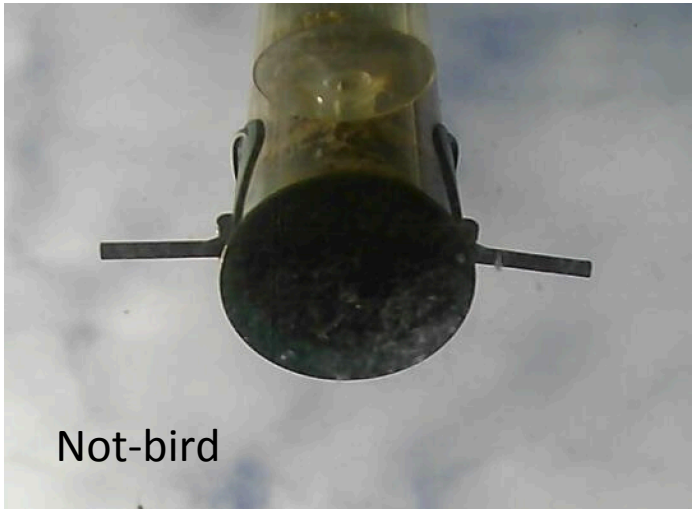
```
Robins-MacBook-Air:birds_vs_not_birds robincole$ imgclass

Classes
-------
birds:  501 image(s)
not_birds:      514 image(s)

Create new model with 2 classes? (y/n): y
new model created: 5b0bfba7cb439f4b
Teach and validate Classificationbox with 812 (80%) random images? (y/n): y
  pass 1 of 1...
 447 / 812 [==========================================================
```

```
Correct:    188
Incorrect:  15
Errors:     0
Accuracy:   92.61083743842364%
```



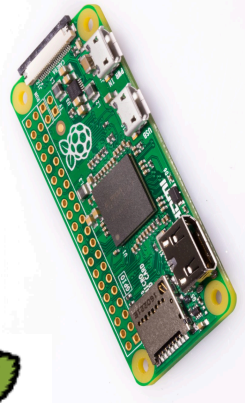


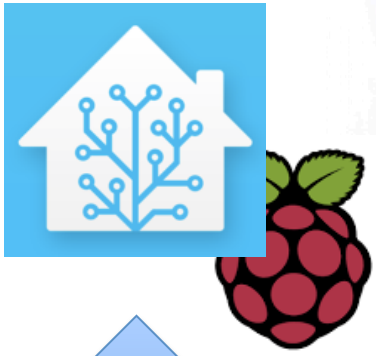
- Trained classifier with 1000 images
- bird/not-bird discrimination with ~ 90% accuracy, beats my expectations!

Task 2: Automating identification

Motion triggered
USB Image capture

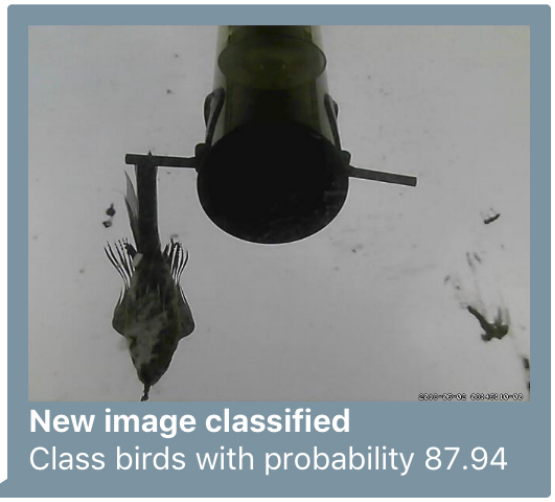
Home-Assistant
on Rpi





If bird

Classificationbox
In Docker on
local server



Notification with image

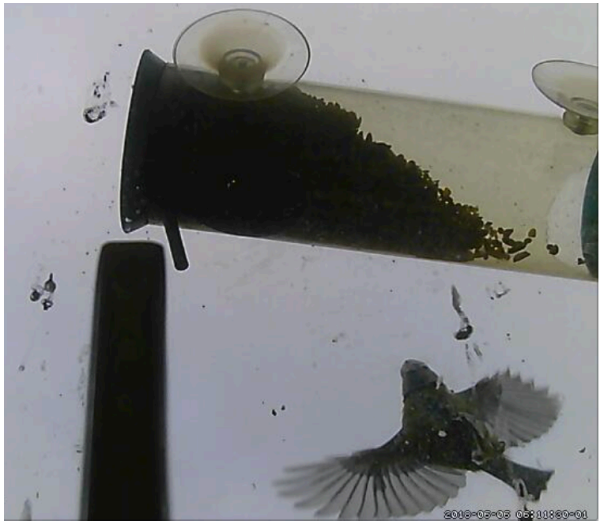
MACHINE BOX

docker

https://github.com/robmarkcole/HASS-Machinebox-Classificationbox

Next steps:

1. Experiment with curating the images used in training to improve accuracy
2. Classify birds by species
3. Contribute data to Birdwatch survey
4. Add Classificationbox to Home-Assistant
5. Share classifiers and know-how with less technical bird-fanciers
6. Make bird-feeder magpie proof!


Thank you!

Now, over to Oliver