Regendruppels Tellen met Python: IoT Pluviometer Project

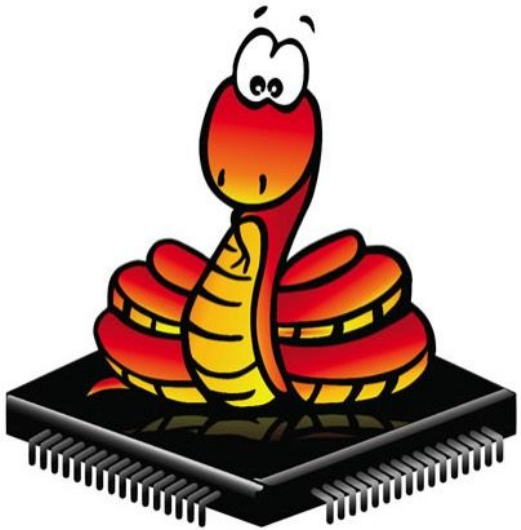
Jelle Victoor - Fri3d camp 2024

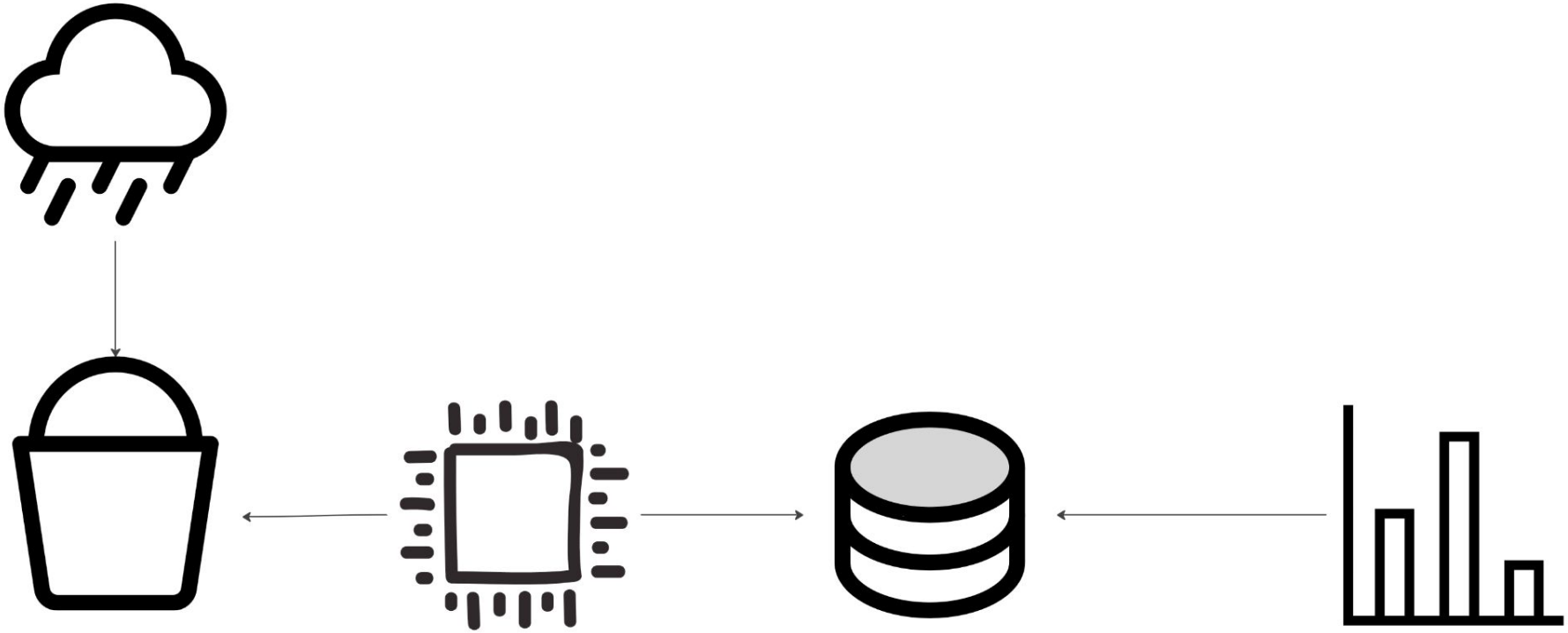
WAAROM TOCH OOK?

- Kunnen vragen aan je buur hoeveel liter hij heeft gehad.
- Ken jezelf. Notoir slecht in een pluviometer dagelijks checken.
- Interesse in elektronica
- data logging op lange termijn
- Veel follow up projecten mogelijk!

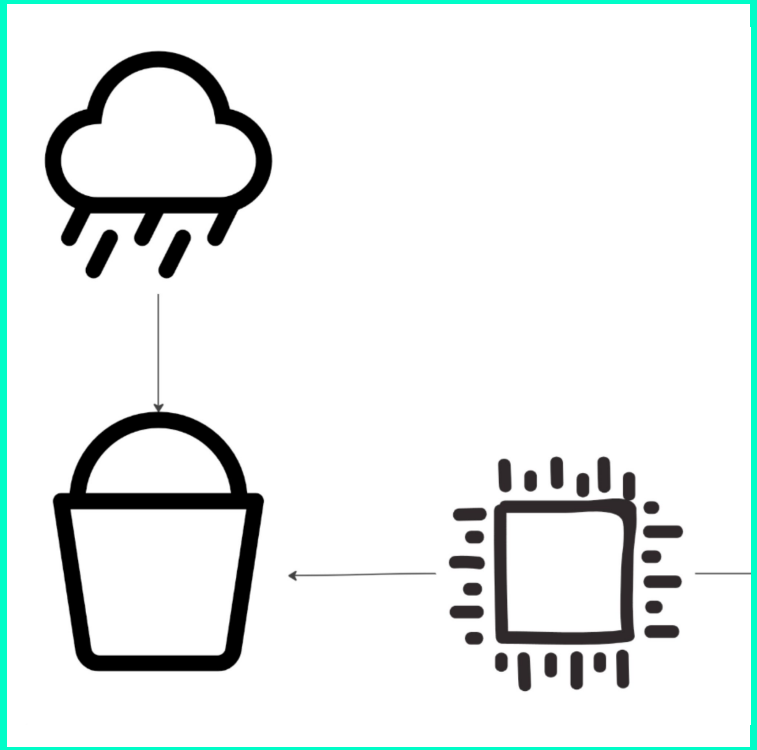
Elektronica + 3d printing + weers info

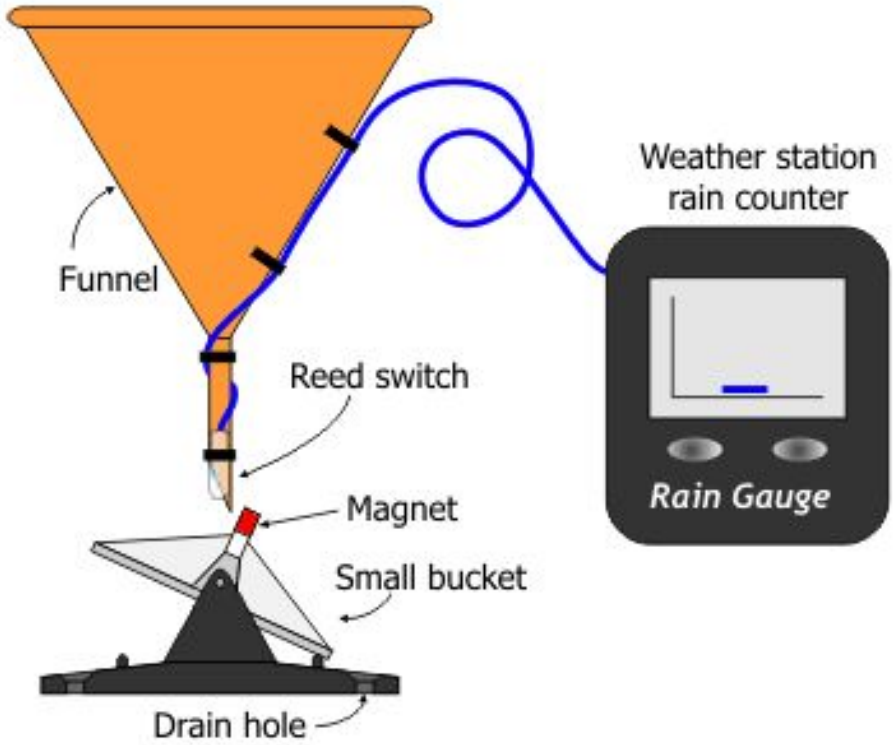
- Haalbaar elektronica project
- Raspberry pi pico werkt op micropython
- Integratie in Home Assistant





Hoofdstuk 1: Druppels tellen

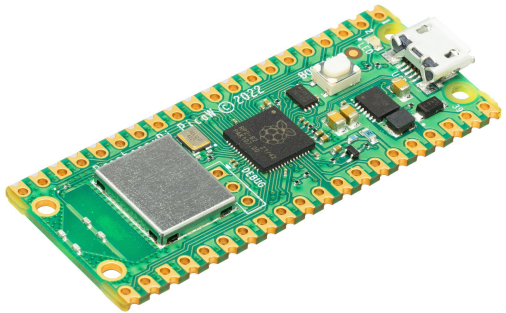




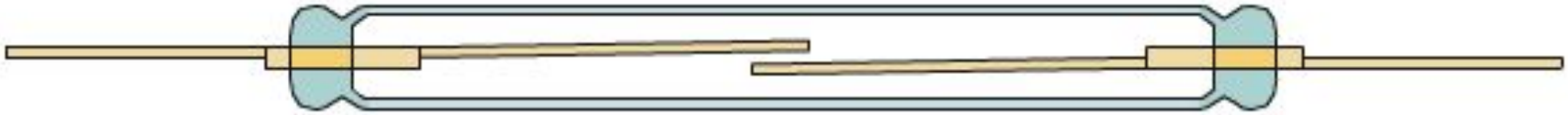
bron: https://www.kifissiameteo.gr/Lesson08_Instrument_RainGauge.html

BOM (Bill of Materials)

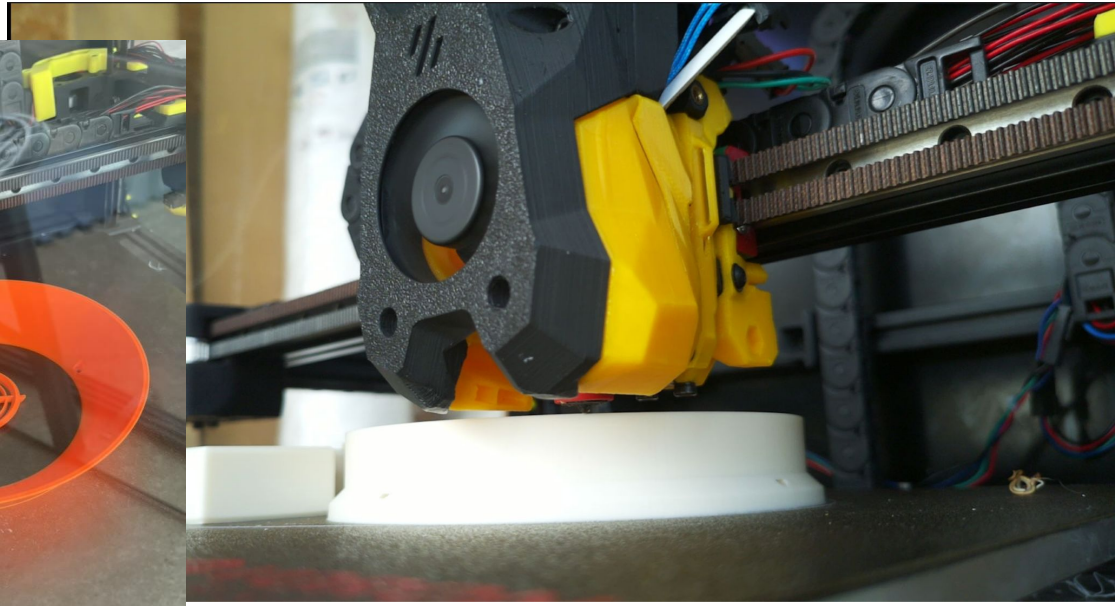
- raspberry pi pico w (w for wifi)
  - microcontroller, hart van het toestel
  - ondersteunt micropython



BOM - Reed contact & magneet



BOM - 3D PRINTS



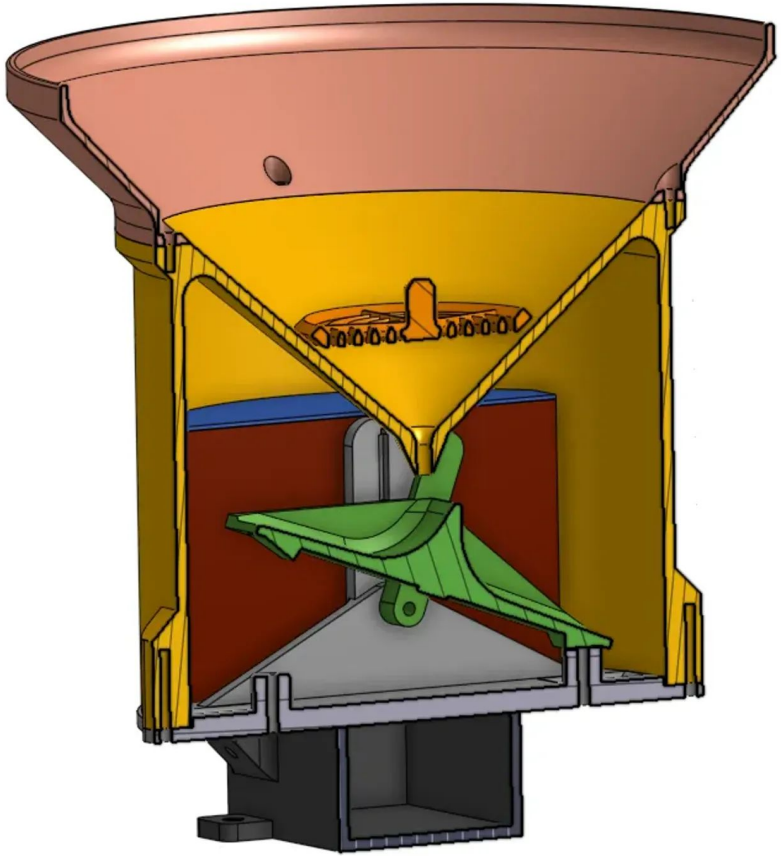
BOM - 3D PRINTS

- h

Hoofdstuk 1.1:
3D printing

3D MODEL

- Veel modellen beschikbaar
- 3d printing friendly model
- model ge-remixed
  - andere magneet
  - threaded inserts

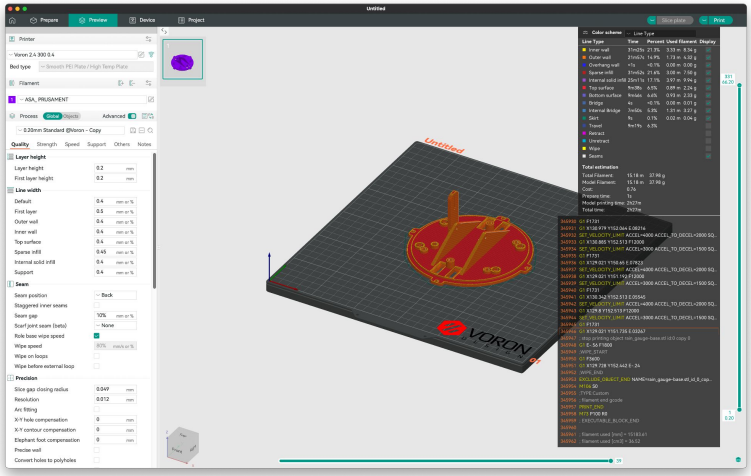


https://www.printables.com/model/967217-rain-guage/comments/1973317

Printerinstellingen

Materiaal keuze: ASA (Prusament - natural & Prusa Orange)

- 3 top layers
- 4 bottom layers
- layer height 0.2
- layer width 0.4
- 15% infill

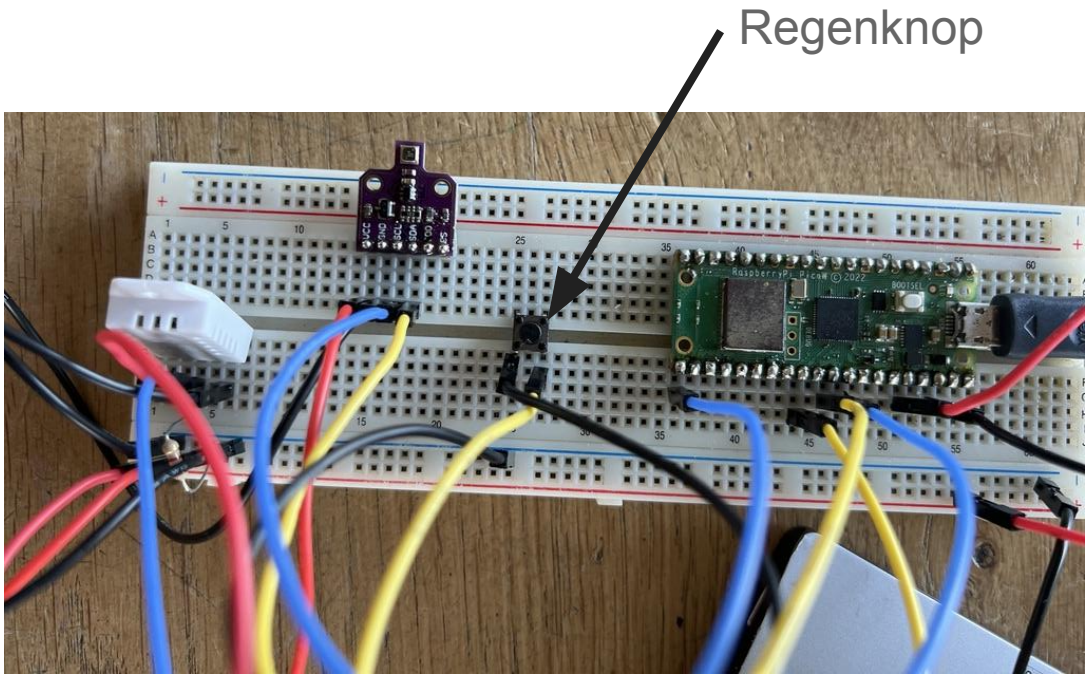


Hoofdstuk 1.2: The Build

The build

Hoofdstuk 1.3: Neerslag meten

ONTWIKKEL OMGEVING

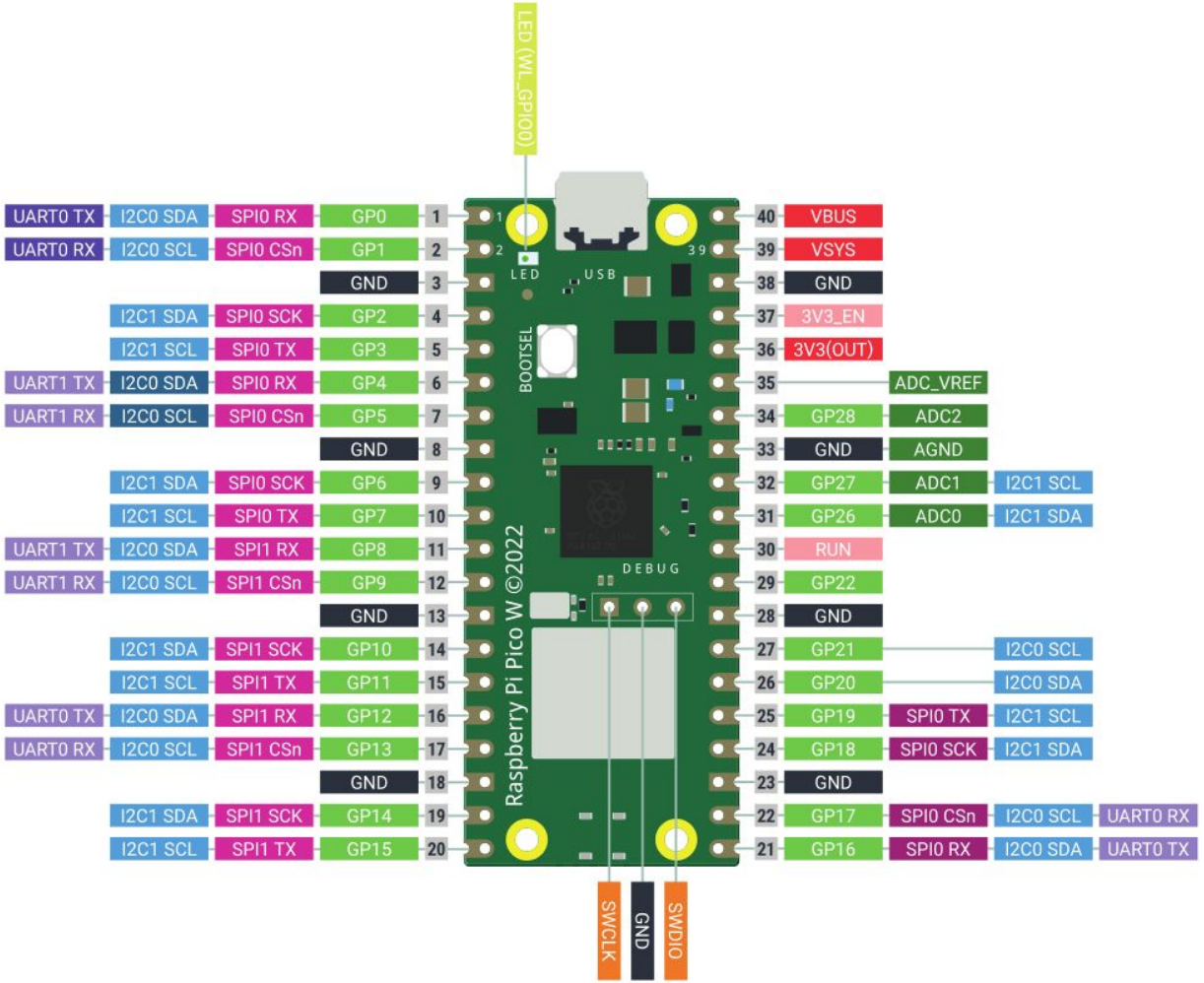


RP2040

- Power
- Ground
- UART / UART (default)
- GPIO, PIO, and PWM
- ADC
- SPI / SPI (default)
- I2C / I2C (default)
- System Control
- Debugging

Infineon 43439

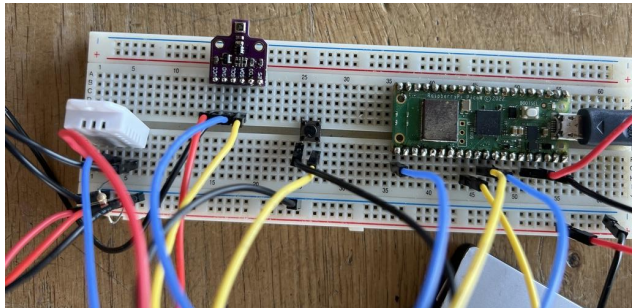
- GPIO



HOE NEERSLAG DETECTEREN

hiervoor kan je 2 manieren gebruiken.

- while(true) loop
  - simpele implementatie
  - kan op het missen van activering van de switch
- IRQ (Interrupt request)
  - op hardware wordt er een signaal gedetecteerd en dit stopt de CPU om een speciale handler methode uit te voeren
  - Dit is ondersteund op de RP2040 microcontroller van de PICO



Neerslag meten

```
number_of_times_bucket_tipped =  0

def tipped(pin):
  global number of times bucket tipped
  number_of_times_bucket_tipped +=  1

rocker = Pin(15, Pin.IN, Pin.PULL_UP)
rocker.irq(tipped,  trigger=Pin.IRQ_FALLING)
```

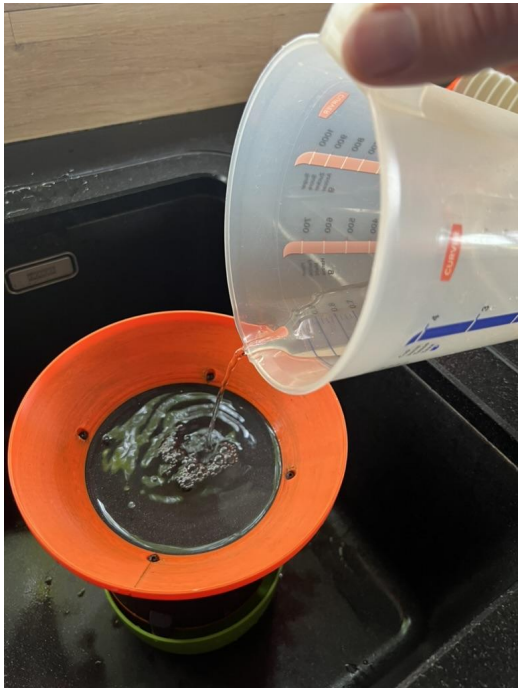
initiële staat van de teller

callback om het aantal bij te houden

de pin van het reed contact de irq registreren

Hoofdstuk 1.4: De Kalibratie

Kalibratie

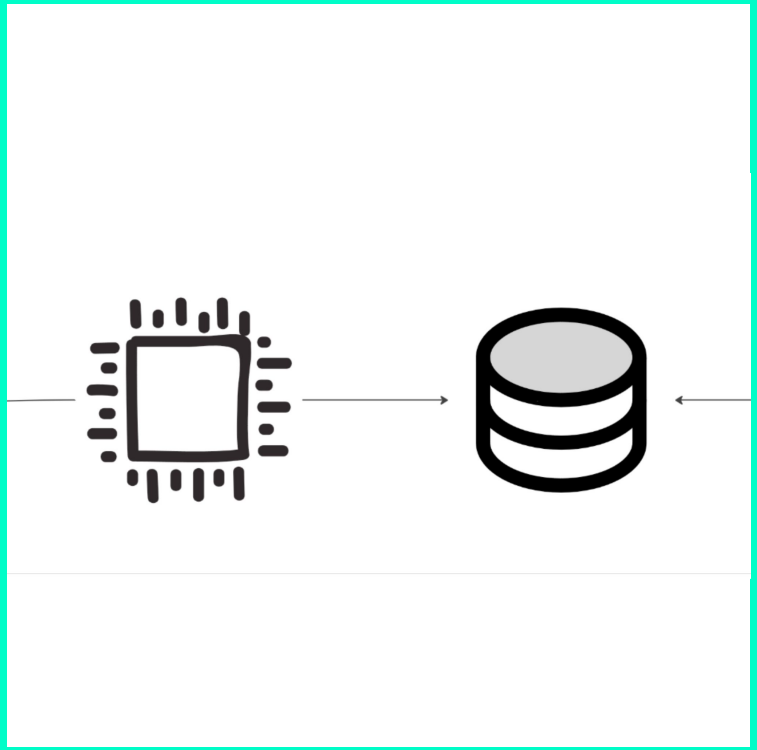


```
37    rocker.irq(tipped, trigger=Pin.IRQ_FALLING
38
39    while True:
40        pass
```

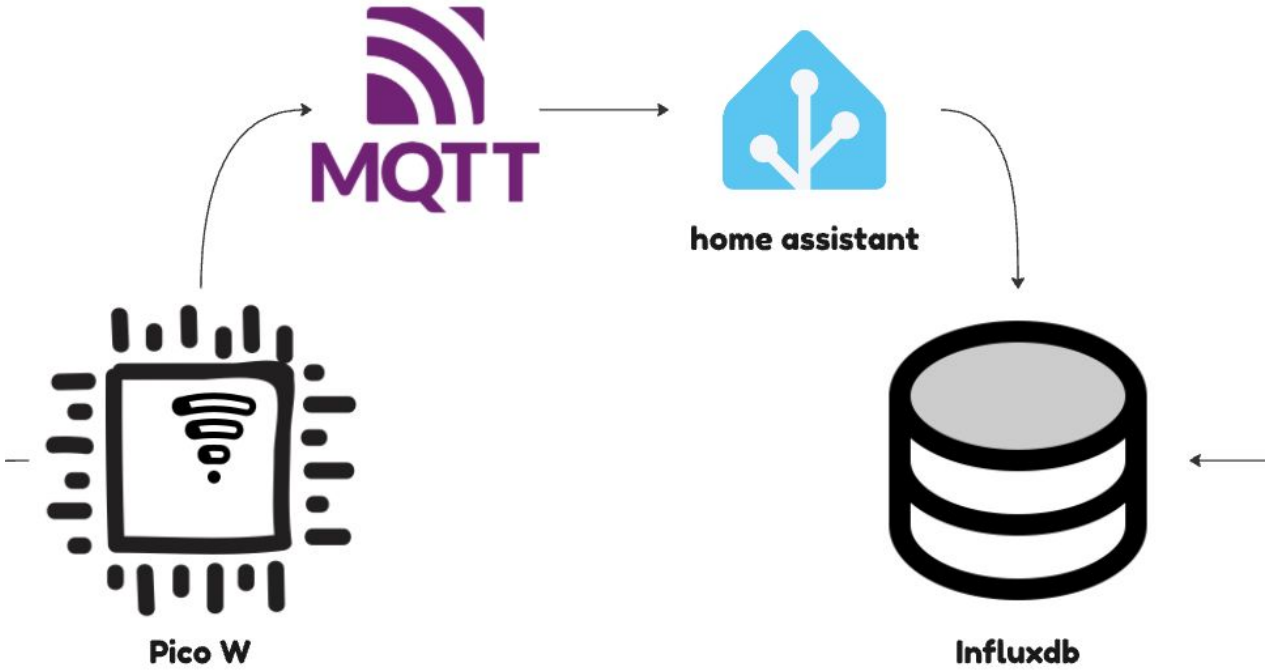
Shell

```
the single rock volume is:  1.964876
the single rock volume is:  1.684179
the single rock volume is:  1.473657
the single rock volume is:  1.309917
the single rock volume is:  1.178926
the single rock volume is:  1.071751
the single rock volume is:  0.9824379
the single rock volume is:  0.9068658
the single rock volume is:  0.8420897
the single rock volume is:  0.7859504
the single rock volume is:  0.7368284
the single rock volume is:  0.6934856
the single rock volume is:  0.6549586
the single rock volume is:  0.6204871
the single rock volume is:  0.5894628
the single rock volume is:  0.5613931
the single rock volume is:  0.5358753
the single rock volume is:  0.5125763
the single rock volume is:  0.4912189
the single rock volume is:  0.4715702
the single rock volume is:  0.4534329
the single rock volume is:  0.4366391
the single rock volume is:  0.4210448
the single rock volume is:  0.406526
the single rock volume is:  0.3929752
the single rock volume is:  0.3802986
the single rock volume is:  0.3684142
the single rock volume is:  0.3572502
the single rock volume is:  0.3467428
the single rock volume is:  0.3368359
the single rock volume is:  0.3274793
the single rock volume is:  0.3186285
the single rock volume is:  0.3102436
the single rock volume is:  0.3022886
the single rock volume is:  0.2947314
the single rock volume is:  0.2875428
```

Hoofdstuk 2: Opslaan



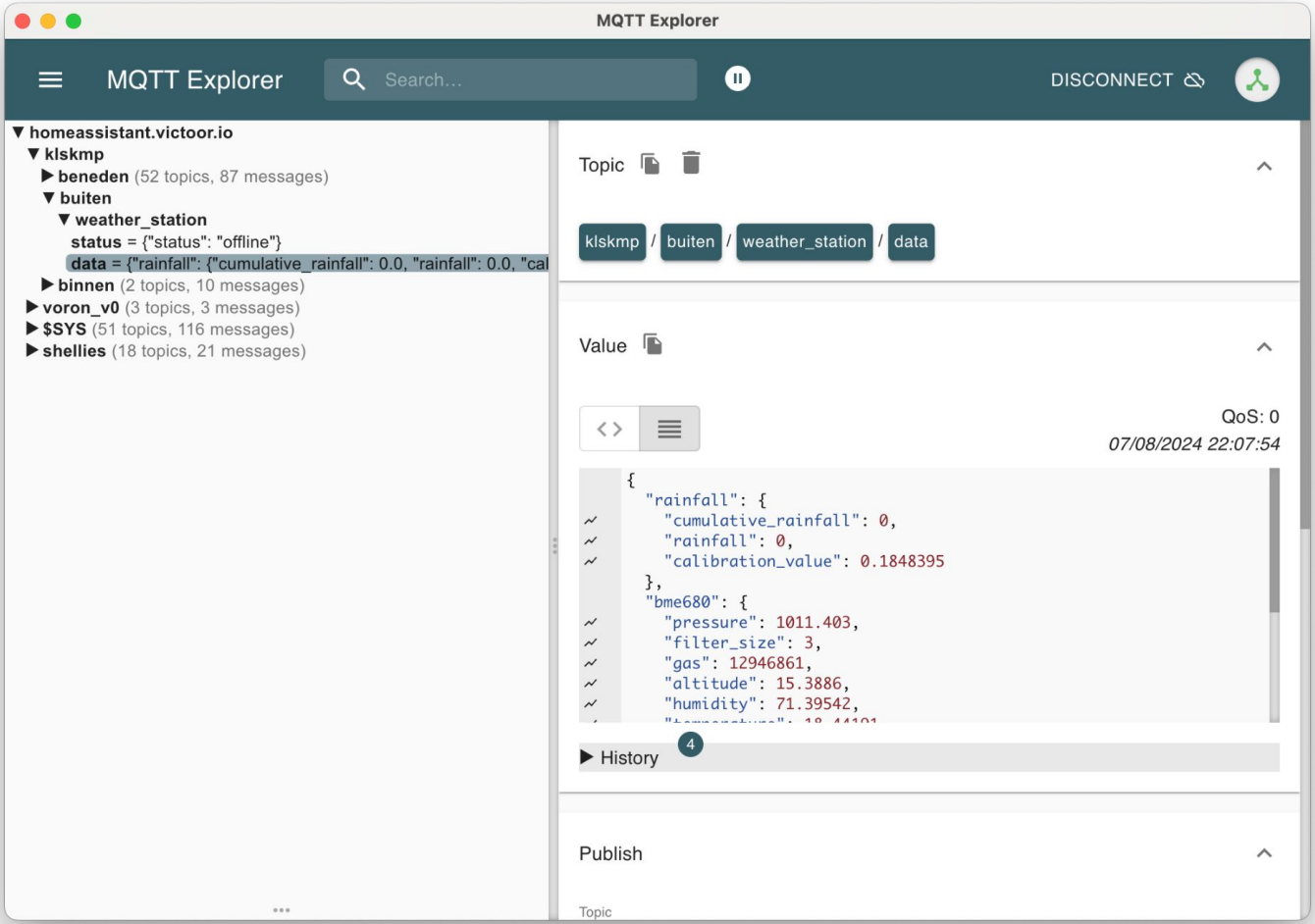
DATA VERSTUREN EN OPSLAAN



Mqtt Connectie

```
from umqtt.simple import MQTTClient
import json

client = MQTTClient("weatherstation", "mqqt.victoor.io")

try:
    client.connect()

    topic = "klskmp/buiten/weatherstation"
    data = {"rain": 0.21}
    client.publish(topic, json.dumps(data))

    client.disconnect()
except OSError as e:
    print("Failed to publish", e)
    raise
```

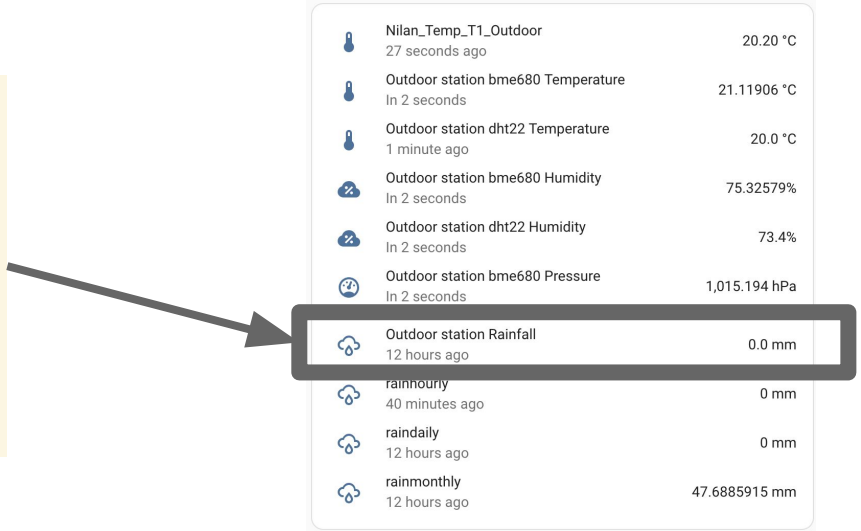
```
hoeveelheid regen =
Rocker *
kalibratie_waarde
```


MQTT Explorer
MQTT Explorer
Search...
DISCONNECT
homeassistant.victoor.io
klskmp
beneden (52 topics, 87 messages)
buiten
weather_station
status = {"status": "offline"}
data = {"rainfall": {"cumulative_rainfall": 0.0, "rainfall": 0.0, "cal
binnen (2 topics, 10 messages)
voron_v0 (3 topics, 3 messages)
$SYS (51 topics, 116 messages)
shellies (18 topics, 21 messages)
Topic
klskmp / buiten / weather_station / data
Value
QoS: 0
07/08/2024 22:07:54
{
"rainfall": {
"cumulative_rainfall": 0,
"rainfall": 0,
"calibration_value": 0.1848395
},
"bme680": {
"pressure": 1011.403,
"filter_size": 3,
"gas": 12946861,
"altitude": 15.3886,
"humidity": 71.39542,
4
History
Publish
Topic

Home assistant Plugins

MQTT is een standaard plugin

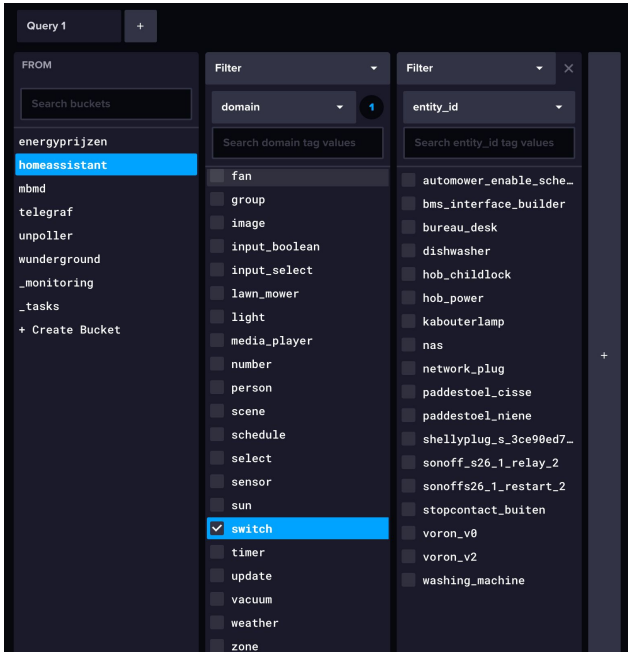
```yaml
mqtt:
 sensor:
   - name: "Outdoor station Rainfall"
     unique_id: "weather_station_rain_sensor"
     unit_of_measurement: "mm"
     object_id: rainfall
     state_topic: "klskmp/buiten/weatherstation"
     value_template: "{{ value_json.rain }}"
```



https://www.home-assistant.io/integrations/mqtt/

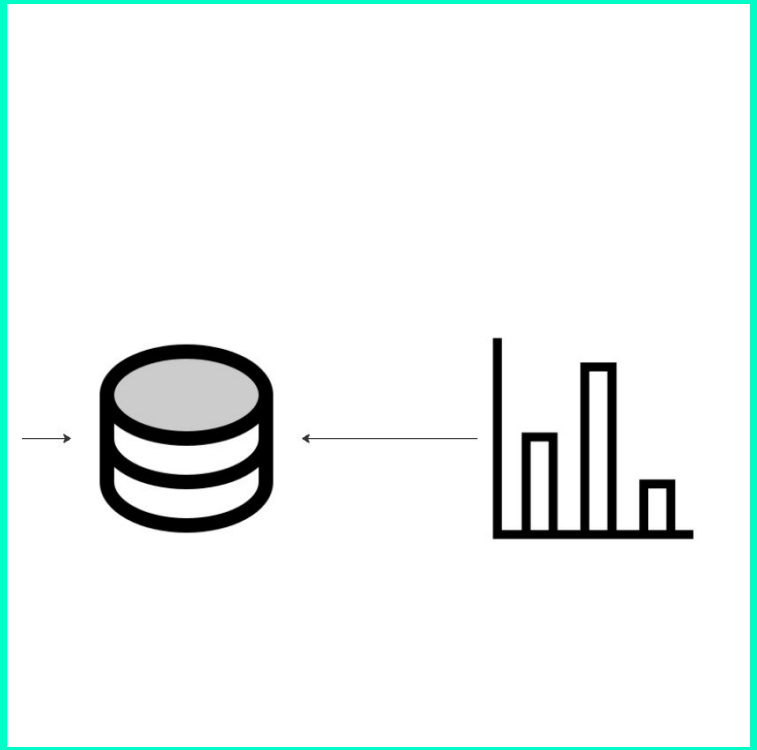
Home assistant Plugins

*The `influxdb` integration makes it possible to transfer **all** state changes to an external InfluxDB database*

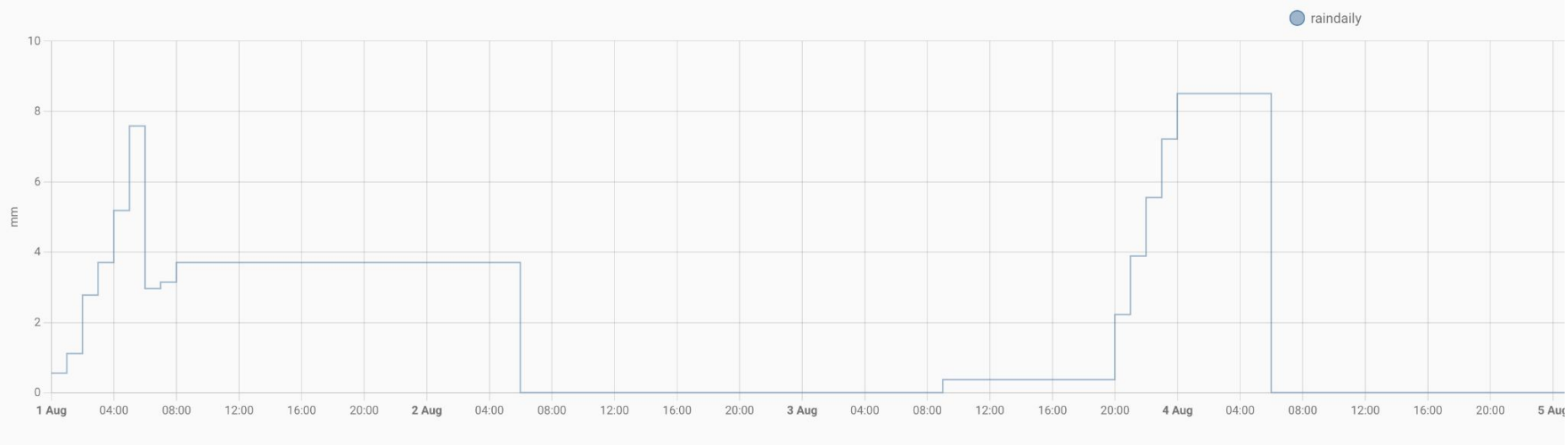


https://www.home-assistant.io/integrations/influxdb/

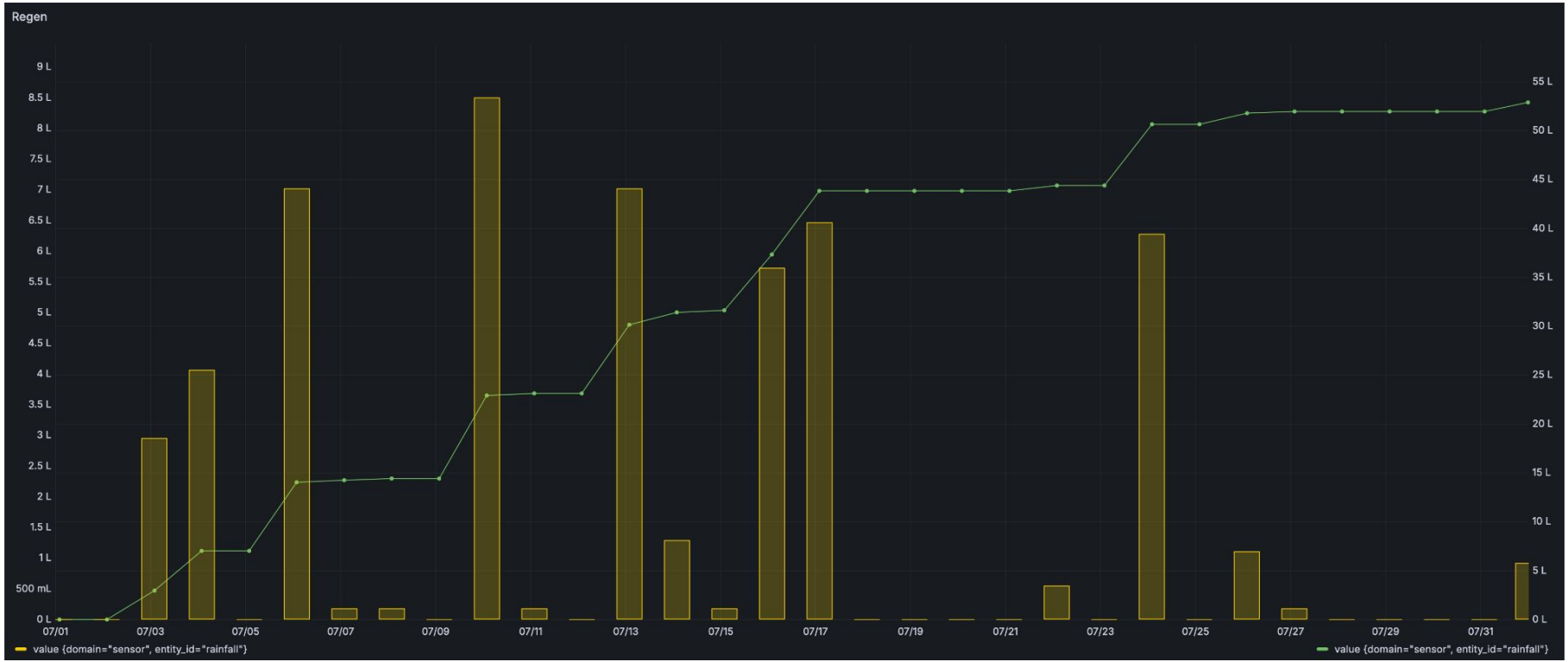
Hoofdstuk 3: Visualiseren



Home assistant



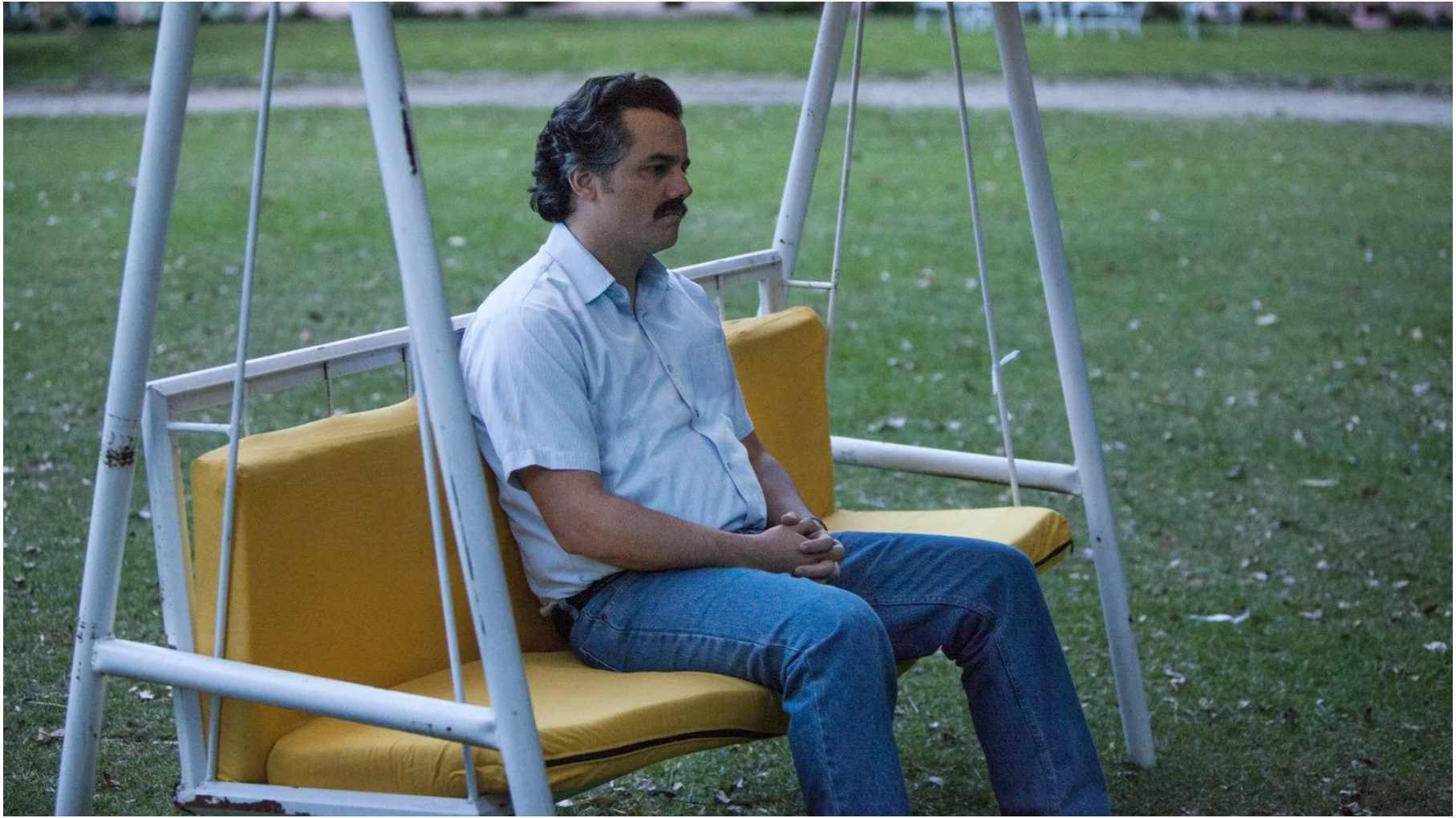
Grafana


Regen
9 L
8.5 L
8 L
7.5 L
7 L
6.5 L
6 L
5.5 L
5 L
4.5 L
4 L
3.5 L
3 L
2.5 L
2 L
1.5 L
1 L
500 mL
0 L
55 L
50 L
45 L
40 L
35 L
30 L
25 L
20 L
15 L
10 L
5 L
0 L
07/01
07/03
07/05
07/07
07/09
07/11
07/13
07/15
07/17
07/19
07/21
07/23
07/25
07/27
07/29
07/31
value {domain="sensor", entity_id="rainfall"}
value {domain="sensor", entity_id="rainfall"}

Grafana

Weer
Outside Temperature
30 °C
20 °C
10 °C
0 °C
07/01 07/04 07/07 07/10 07/13 07/16 07/19 07/22 07/25 07/28 07/31
value {domain="sensor"}
value {domain="sensor", entity_id="nilan_temp_t3_extract"}
value {domain="sensor", entity_id="nilan_temp_t1_outdoor"}
Pressure
1020 hPa
1010 hPa
1000 hPa
07/01 07/04 07/07 07/10 07/13 07/16 07/19 07/22 07/25 07/28 07/31
value {domain="sensor", entity_id="outdoor_station_bme680_pressure"}
humidity
100%
80%
60%
40%
20%
0%
07/01 07/04 07/07 07/10 07/13 07/16 07/19 07/22 07/25 07/28 07/31
value sensor
Regen
8 L
6 L
4 L
2 L
0 L
50 L
40 L
30 L
20 L
10 L
0 L
07/01 07/04 07/07 07/10 07/13 07/16 07/19 07/22 07/25 07/28 07/31
value {domain="sensor", entity_id="rainfall"}
value {domain="sensor", entity_id="rainfall"}

Wachten



IT JUST RAINED
DADS CHECKING ON THEIR RAIN GAUGE
imgflip.com

Problemen

VERSTOPPINGEN

Bugs (vooral spinnen)

Protecting Your Instruments from Spiders, Wasps and Other Pests

When making measurements and carrying out experiments, scientists tend to spend a great deal of time and care in selecting the right instruments, calculating uncertainty, and making sure conditions are acceptable. One of the last things on the minds of most people (and rightfully so) is that a pest, like a spider, could find a way to sabotage an experiment or measurement campaign. As spring approaches, many pests (including our 8-legged friends) will just see the aperture of an infrared radiometer (IRR) as their new comfortable home. There are some simple steps to prevent IRRs from looking like the photo below.

« previous next »

PRINT

are when trying to spider-proof the WS-2902 (for dummies like me) (Read 1953 times)

he unit. As an extra layer of
ed to see a temp reading of
pped reading! Worried that I
and thankfully, everything went

edit.

Logged

Spiders in Rain Gauge

Post Reply | Search this topic...

5 posts • Page 1 of 1

Spiders in Rain Gauge

by **fcook36** » Tue 13 May 2014 4:00 am

Any ideas on how to keep spider nests out of the rain gauge?

Floyd
fcook36@windstream.net
http://home.windstream.net/fcook36/

fcook36

Posts: 4
Joined: Wed 07 Aug 2013 4:02 pm
Weather Station: ProWeather / Fine Offset
Operating System: XP SP3
Location: Kaw City, OK. USA
Contact:

Re: Spiders in Rain Gauge

by **tumutbound** » Tue 13 May 2014 4:57 am

tumutbound

Posts: 154

Valideren

Hoe weet ik nu of mijn pluviometer correct meet

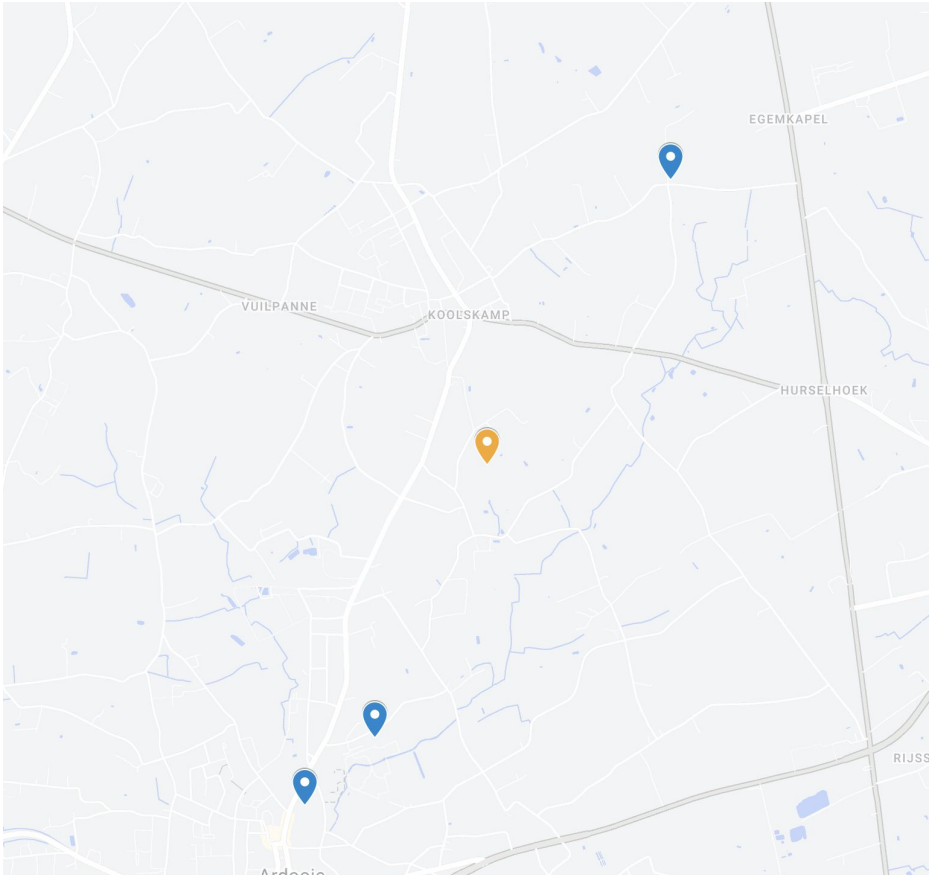
Weather underground hub voor weerstations

Geen API, maar de website kan je wel scrapen met bv Beautiful soup in python.

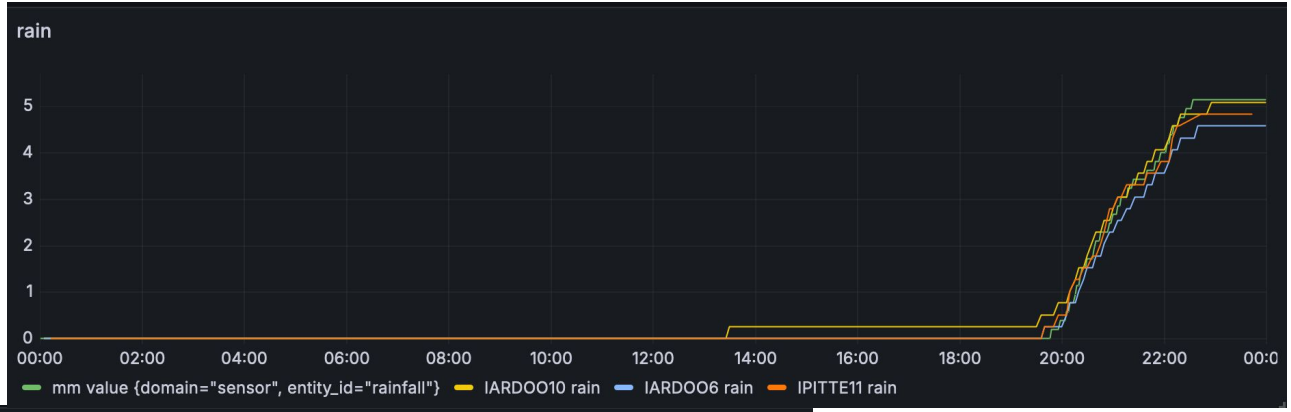
Data van 3 nabije weerstations

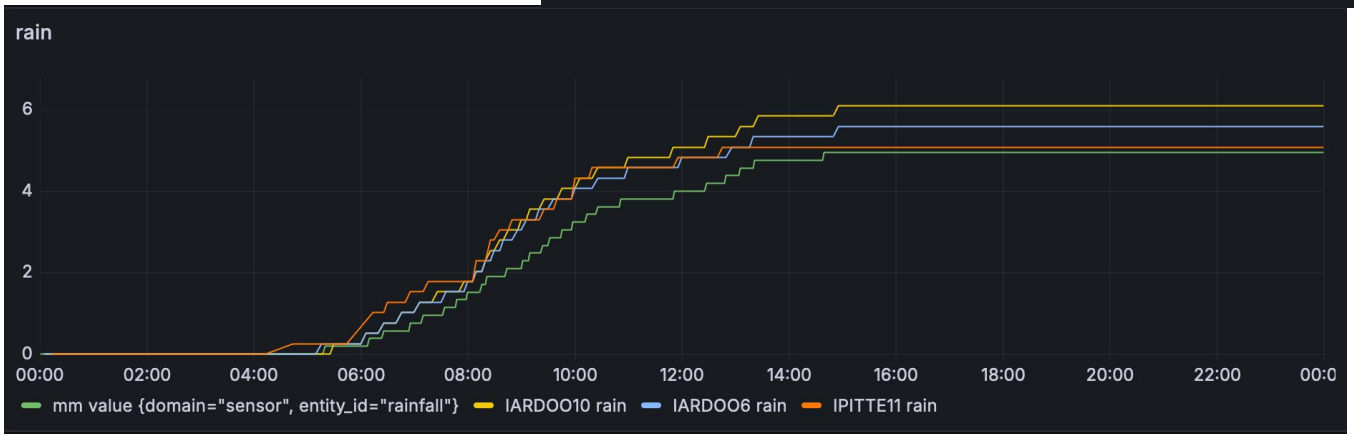
`IARDOO6 IARDOO10 IPITTE11`

Hoe weet ik nu of mijn pluviometer correct meet



Hoe weet ik nu of mijn pluviometer correct meet





https://github.com/jellevictoor/wunderground2influxdb

Conclusie

Github micropython repository

https://github.com/jellevictoor/weatherstation

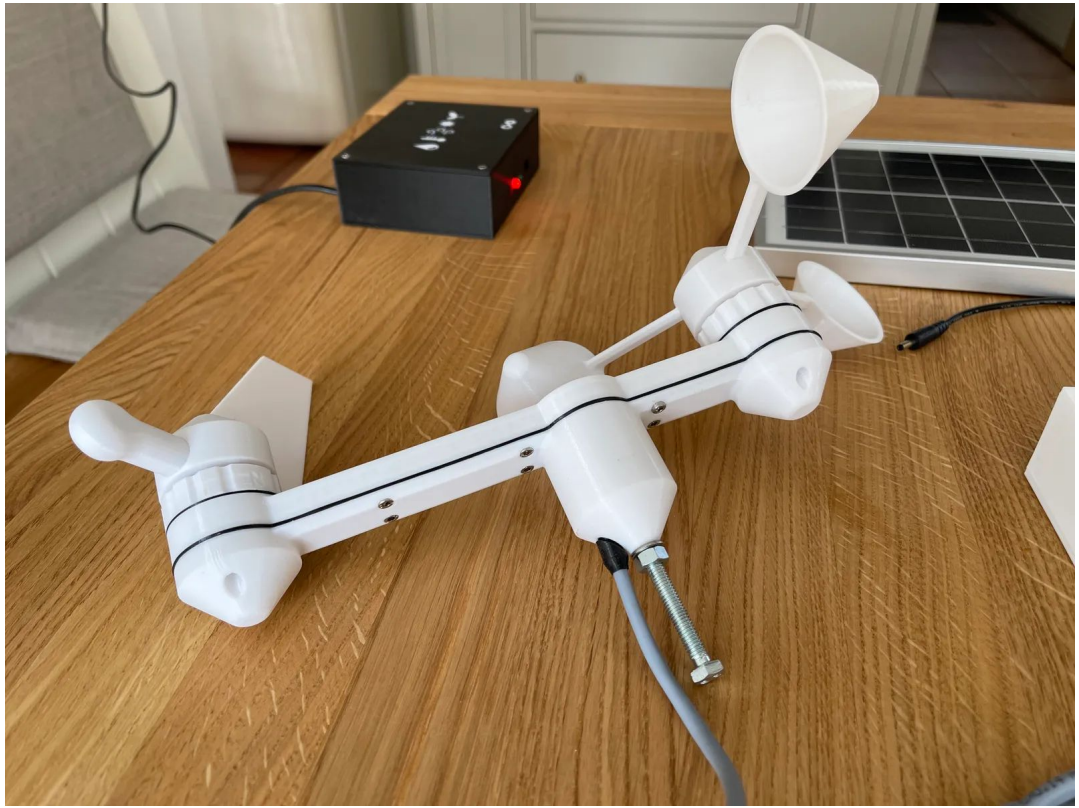
Remixed 3d print

https://www.printables.com/model/967217-rain-guage

FOLLOW UP PROJECTEN

Follow up projecten

E-paper display

Follow up projecten

full blown weerstation