Air Quality Measurement Device

A Python and Raspberry Pi Implementation

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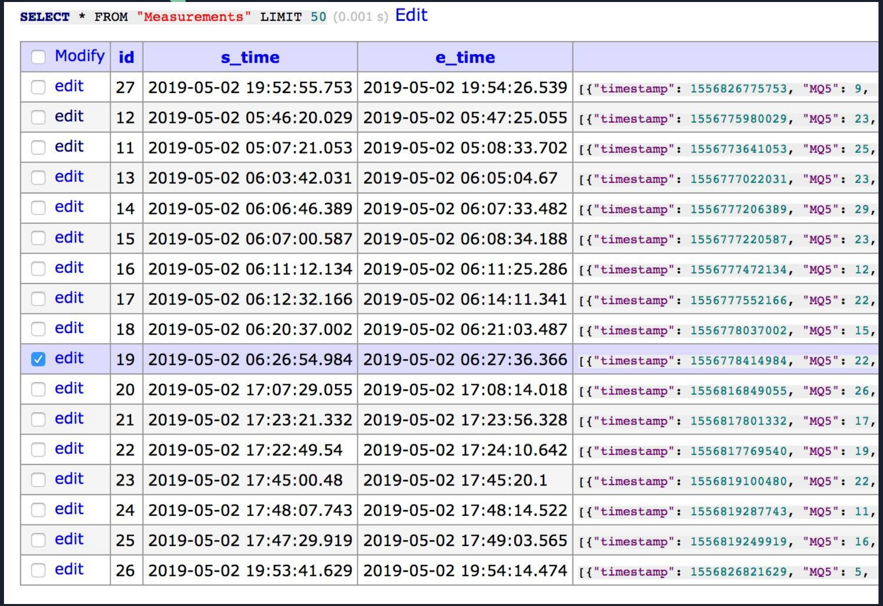
- Problem
  - Analyzing air quality in a particular location is hard work, as one must keep track of temperature, dust particle count, and gas concentrations at many times during the day to understand how ‘good’ the air is.
- Solution
  - Use a Raspberry Pi along with four sensors (temperature, dust concentration, gas concentration, and relative air quality) to record data continuously
  - Send data to a PostgreSQL database on a Flask server
  - Query the server for data observed between two timestamps
  - Retrieve data from server on another device with a display
  - Display and analyze data in a user-friendly and graphical manner
    - Both sensor and display polling times are fully customizable

Backend Data Store



```
SELECT * FROM "Measurements" LIMIT 50 (0.001 s) Edit
```

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☐ edit	27	2019-05-02 19:52:55.753	2019-05-02 19:54:26.539	[{"timestamp": 1556826775753, "MQ5": 9,
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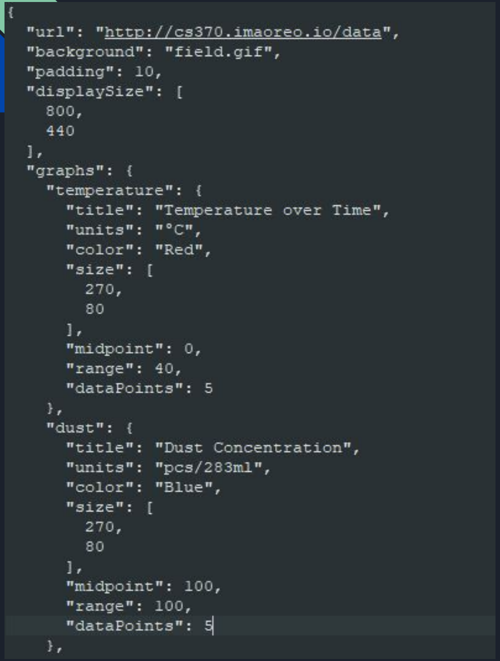
Database Schema with data

The data storage system lives within 2 docker containers:

- PostgreSQL - Database
- Flask/uWSGI
  - Flask handles all the requests and database actions
  - uWSGI orchestrates the flask instances

The Pi and the server interface with each other via a REST API. This prevents unauthorized access to the server and allows for data sanitation.



```
{
  "url": "http://cs370.imaoreo.io/data",
  "background": "field.gif",
  "padding": 10,
  "displaySize": [
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    440
  ],
  "graphs": {
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      "units": "°C",
      "color": "Red",
      "size": [
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      "midpoint": 0,
      "range": 40,
      "dataPoints": 5
    },
    "dust": {
      "title": "Dust Concentration",
      "units": "pcs/283ml",
      "color": "Blue",
      "size": [
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      "range": 100,
      "dataPoints": 5
    },
```
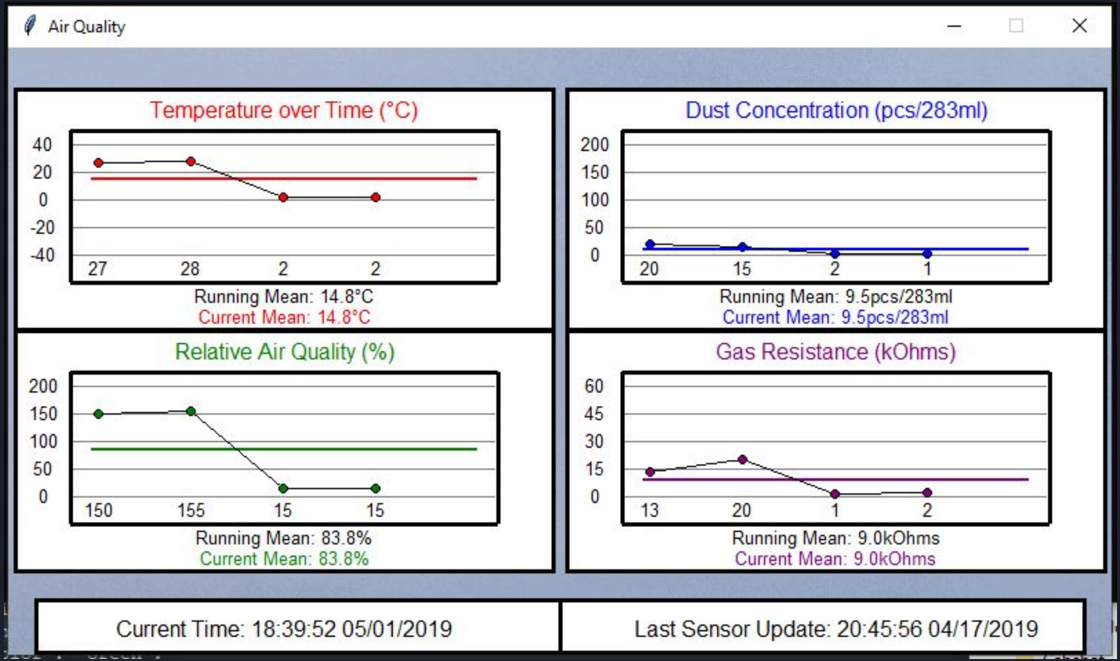

Snippet of display.py's config.json, which is used to change aspects about the graphs and window to be displayed



Temperature over Time (°C)

Running Mean: 14.8°C
Current Mean: 14.8°C

Dust Concentration (pcs/283ml)

Running Mean: 9.5pcs/283ml
Current Mean: 9.5pcs/283ml

Relative Air Quality (%)

Running Mean: 83.8%
Current Mean: 83.8%

Gas Resistance (kOhms)

Running Mean: 9.0kOhms
Current Mean: 9.0kOhms

Current Time: 18:39:52 05/01/2019

Last Sensor Update: 20:45:56 04/17/2019

Example of displayed data after reading in 4 data points from the server. Total number of points to be specified and the expected range of values is specified in the config.json file. The display program can run on any machine with both a display and capabilities to run Python3.