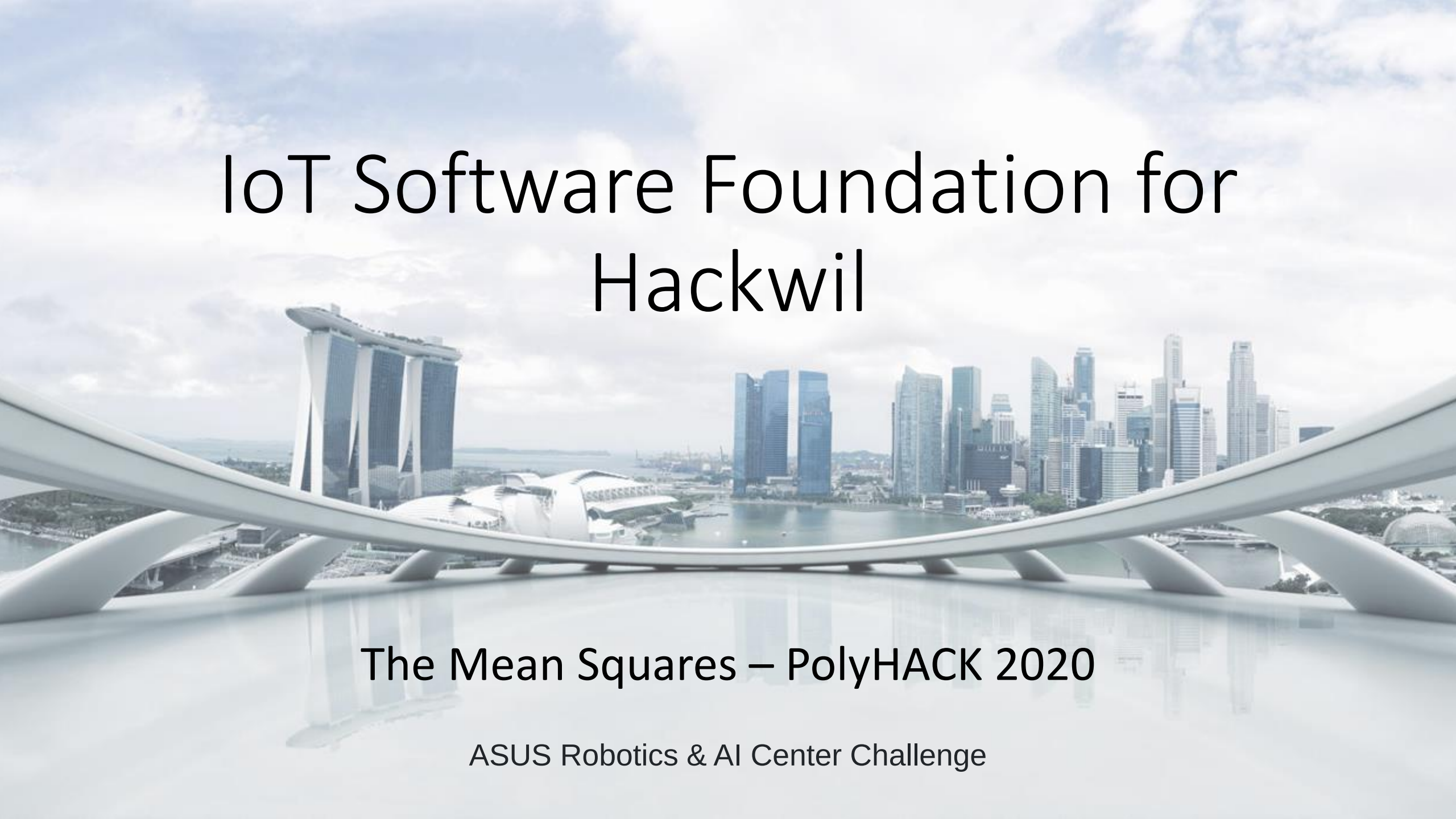


IoT Software Foundation for Hackwil

The Mean Squares – PolyHACK 2020

ASUS Robotics & AI Center Challenge

Our mission

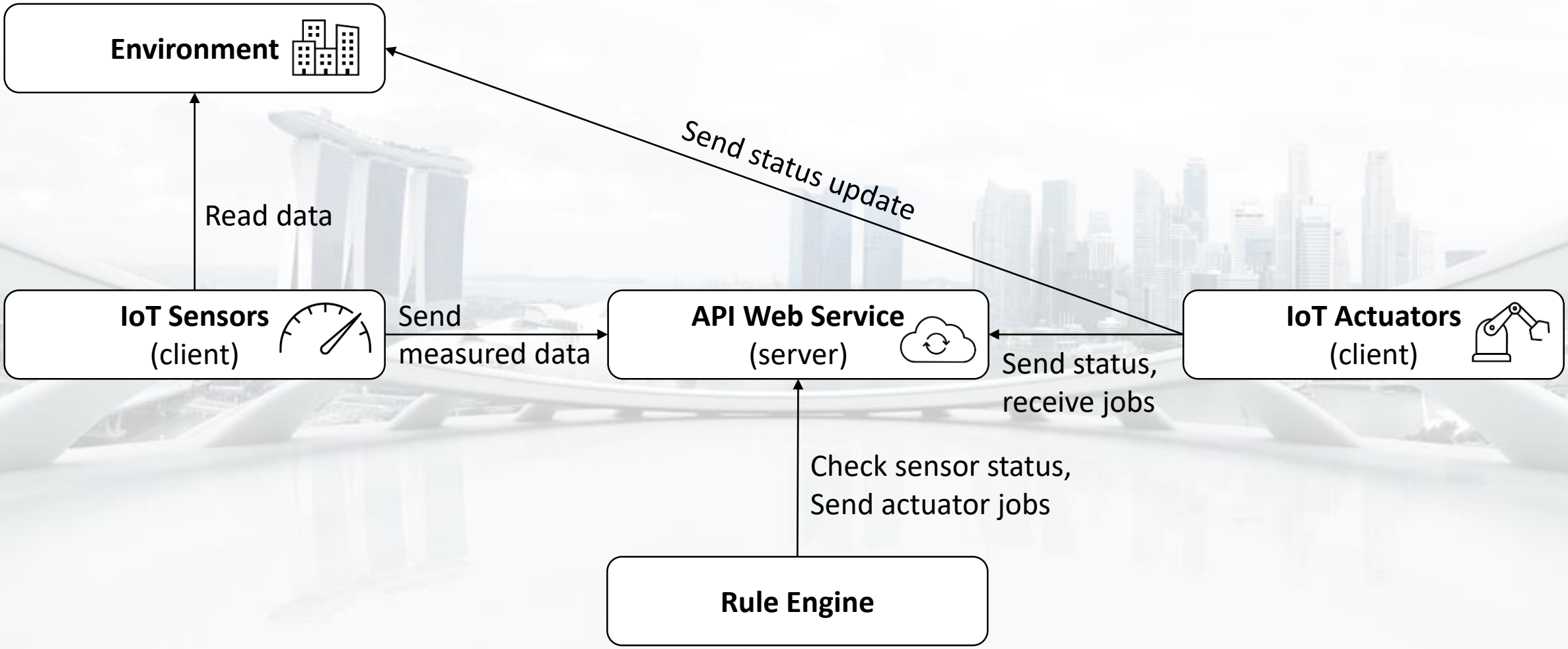
We, *The Mean Squares*, are representatives of the company Polycraft.

Our goal is to provide the software to automate IoT devices throughout Hackwil.

To proof our technical competence we have build an MVP with various types of sensors and actuators communicating via a server that act in a simulated environment.

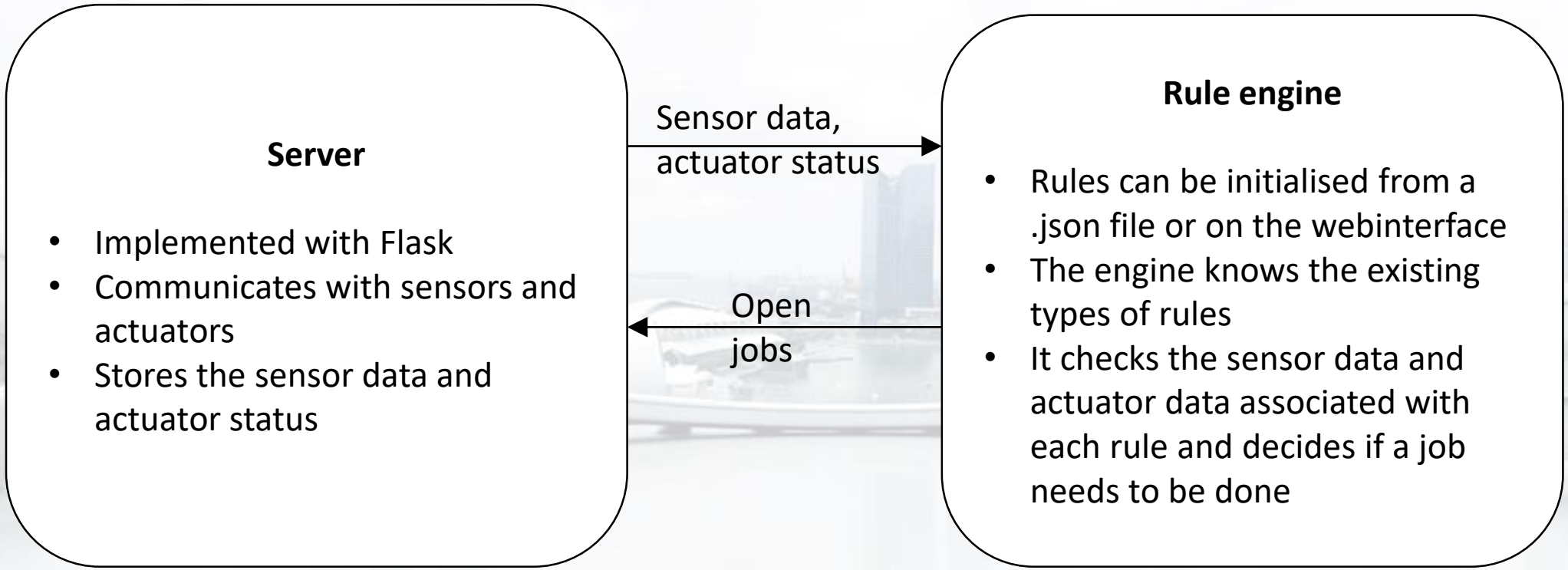
System Overview

Fat server with thin clients implemented using Flask



API Web Service & Rule engine

Fat server containing most of the application‘s logic



Client-Server Communication Protocols

Client side communication

All clients communication must contain the following fields:

- 'id': a unique identifier for the device
- 'ancestors': a list of inheritance of the device in question, in order from youngest to oldest (e.g. ['TemperatureSensor', 'Sensor', 'IOT_Device'])

Clients are Sensor or Actuator.:

- A Sensor has a data entry, which contains a dictionary of measured values
- An actuator instance has a status entry, containing a dictionary describing the state of the device.

Server side communication

The server receives messages from the client, and stores the received data locally.

Sensor:

- The sensor only sends data

Actuator:

- If an actuator needs actuating, the server will wait until the next time the actuator contacts the server, and will return the job to do be executed by the actuator.
- The response from the server is a list of jobs from the rules engine as a dictonary .
- If there is nothing to do, the dictonary is empty. If there is something to do, the dictionary will list what values to change. E.g. if a door should be unlocked, the response will be: {'DoorLocked': False}.

IoT Sensors

Sensors are Thin clients that read from the environment and send their data to the server

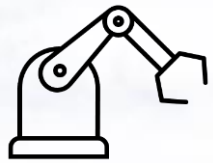
Implemented sensor types:

- Temperature sensor
- Humidity sensor
- Brightness sensor
- Proximity sensor
- Noise sensor
- Motion sensor
- Distance sensor
- Airquality sensor

Initialisation:

- Each sensor has an ID, a type and a position
- The number and type of sensors in Hackwil can by configured in a .json file

IoT Actuators



Actuators are thin clients that sent their status to the server and receive jobs to execute

Implemented actuator types:

- Smart lamp
- Smart door lock
- Motor position
- Smart heating
- Smart sprinkler

Initialisation:

- Each actuator has an ID, a type, a position and a status
- The number and type of sensors in Hackwil can by configured in a .json file

Simulated Environment

- The environment is a class simulating the input data for each sensor
- Each sensor can read a feed of random variables that are scaled according to its type
- The actuators can influence the environment (e.g. a heater inreases the temperature in its surrounding)
- Due to the modular implementation, the environment can easily be replaced by real input data

Try our MVP

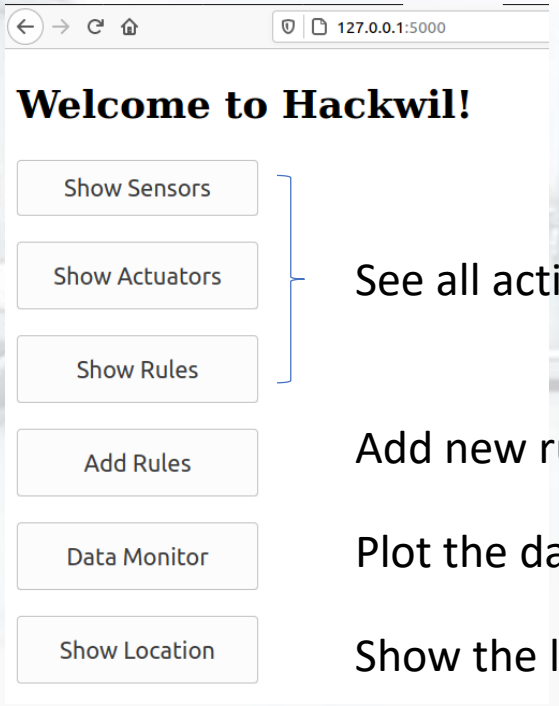
Our sourcecode: https://github.com/Karko93/Polyhack2020-Project.git

Run the code according to the readme.md

Go to the webpage http://127.0.0.1:5000/ to see the simulations of Hackwil

The Webinterface

With our interactive webinterface the state of our IoT system can be monitored.



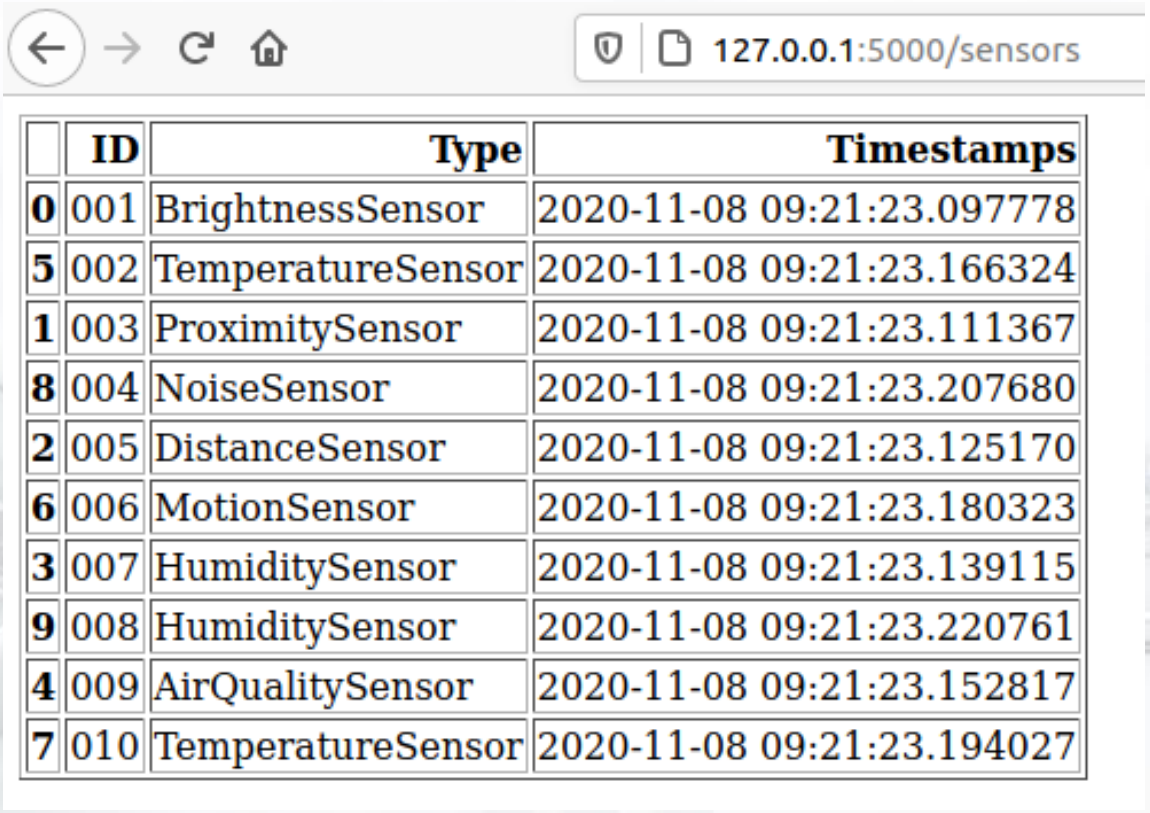
See all active Sensors, Actuators and Rules

Add new rules on the fly

Plot the data of selected sensors simultaneously

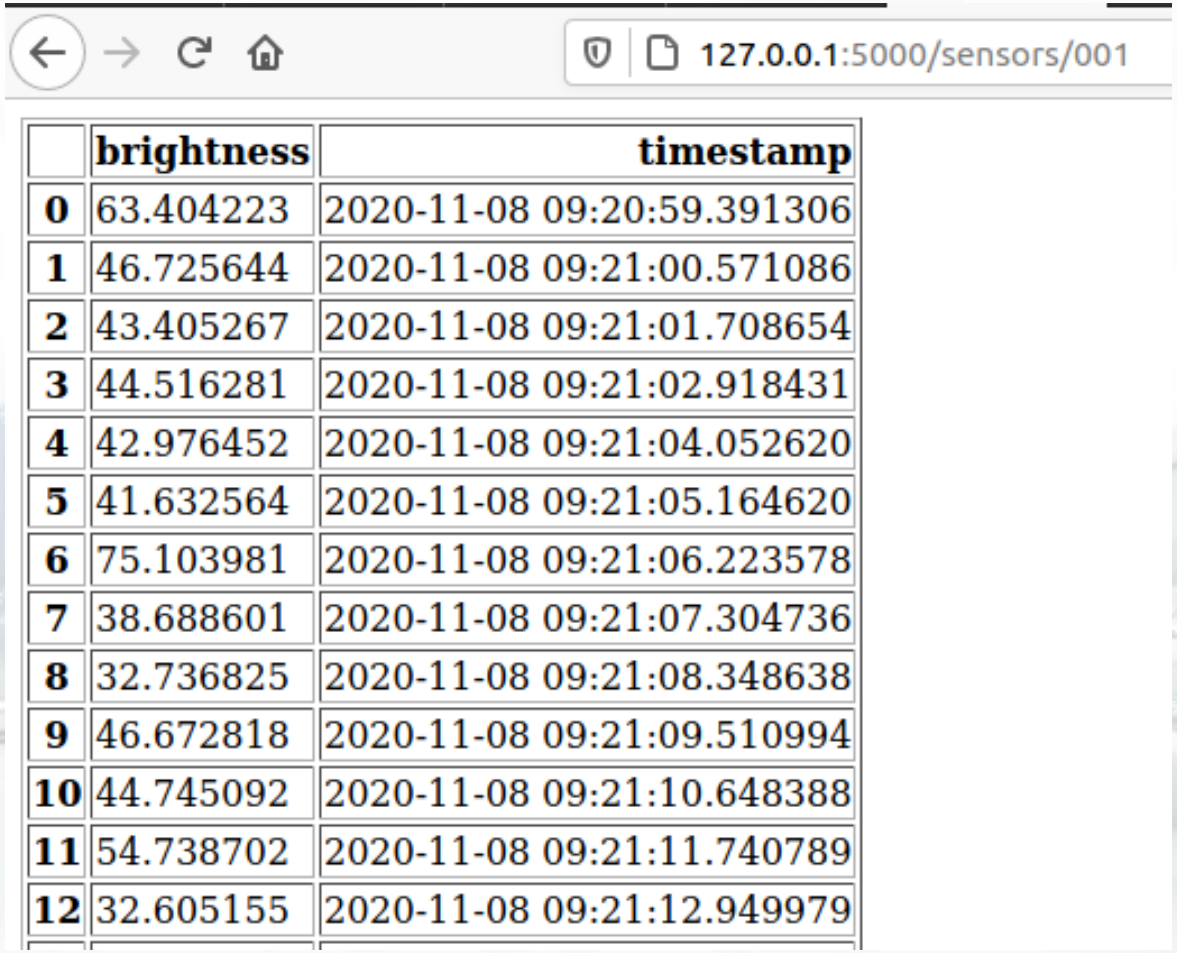
Show the location all IoT devices

The Sensor



	ID	Type	Timestamps
0	001	BrightnessSensor	2020-11-08 09:21:23.097778
5	002	TemperatureSensor	2020-11-08 09:21:23.166324
1	003	ProximitySensor	2020-11-08 09:21:23.111367
8	004	NoiseSensor	2020-11-08 09:21:23.207680
2	005	DistanceSensor	2020-11-08 09:21:23.125170
6	006	MotionSensor	2020-11-08 09:21:23.180323
3	007	HumiditySensor	2020-11-08 09:21:23.139115
9	008	HumiditySensor	2020-11-08 09:21:23.220761
4	009	AirQualitySensor	2020-11-08 09:21:23.152817
7	010	TemperatureSensor	2020-11-08 09:21:23.194027

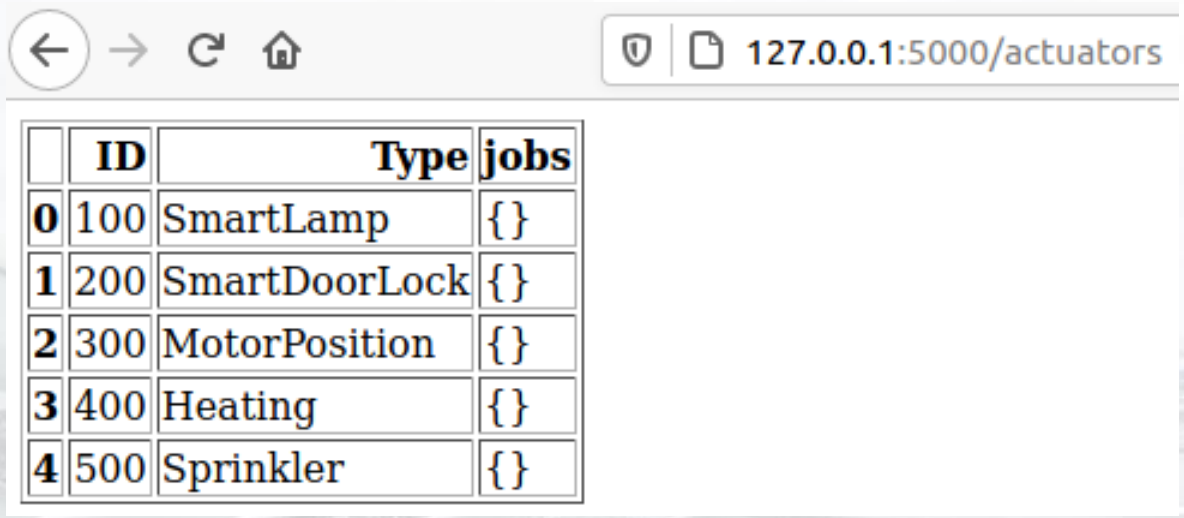
Overview over all connected sensor with last interaction



	brightness	timestamp
0	63.404223	2020-11-08 09:20:59.391306
1	46.725644	2020-11-08 09:21:00.571086
2	43.405267	2020-11-08 09:21:01.708654
3	44.516281	2020-11-08 09:21:02.918431
4	42.976452	2020-11-08 09:21:04.052620
5	41.632564	2020-11-08 09:21:05.164620
6	75.103981	2020-11-08 09:21:06.223578
7	38.688601	2020-11-08 09:21:07.304736
8	32.736825	2020-11-08 09:21:08.348638
9	46.672818	2020-11-08 09:21:09.510994
10	44.745092	2020-11-08 09:21:10.648388
11	54.738702	2020-11-08 09:21:11.740789
12	32.605155	2020-11-08 09:21:12.949979

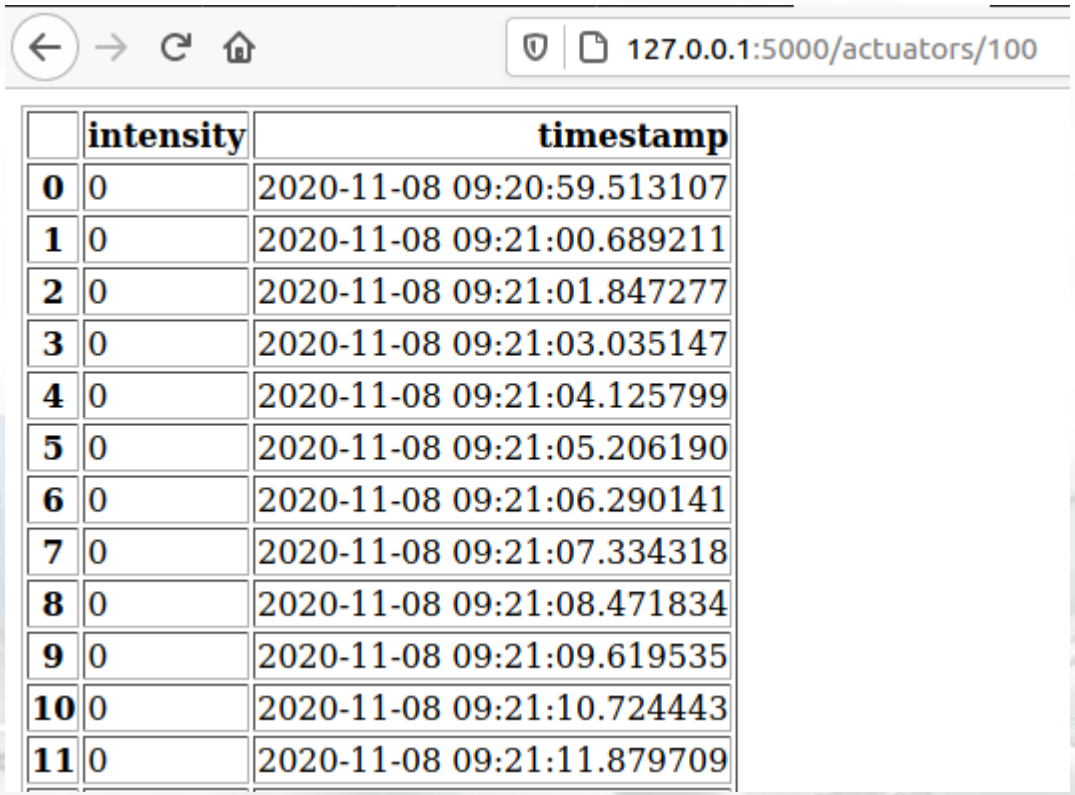
The measurement data for each sensor given an ID

The Actuator



	ID	Type	jobs
0	100	SmartLamp	{}
1	200	SmartDoorLock	{}
2	300	MotorPosition	{}
3	400	Heating	{}
4	500	Sprinkler	{}

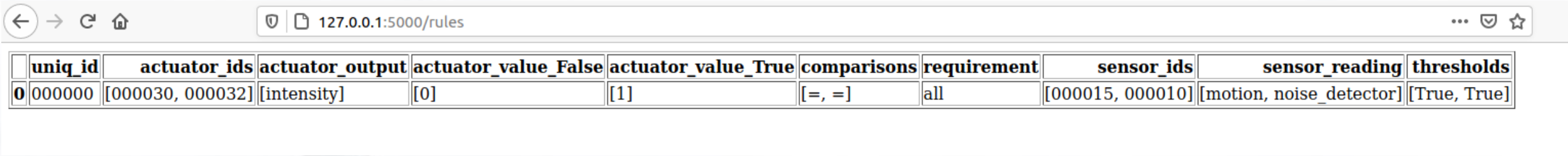
Overview over all connected actuators with assigned jobs



	intensity	timestamp
0	0	2020-11-08 09:20:59.513107
1	0	2020-11-08 09:21:00.689211
2	0	2020-11-08 09:21:01.847277
3	0	2020-11-08 09:21:03.035147
4	0	2020-11-08 09:21:04.125799
5	0	2020-11-08 09:21:05.206190
6	0	2020-11-08 09:21:06.290141
7	0	2020-11-08 09:21:07.334318
8	0	2020-11-08 09:21:08.471834
9	0	2020-11-08 09:21:09.619535
10	0	2020-11-08 09:21:10.724443
11	0	2020-11-08 09:21:11.879709

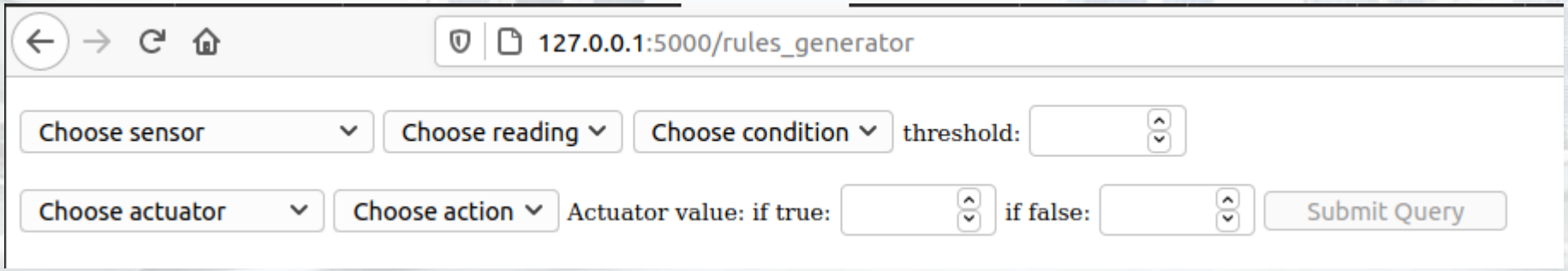
The record of the latest state of each actuator by ID

The Rules



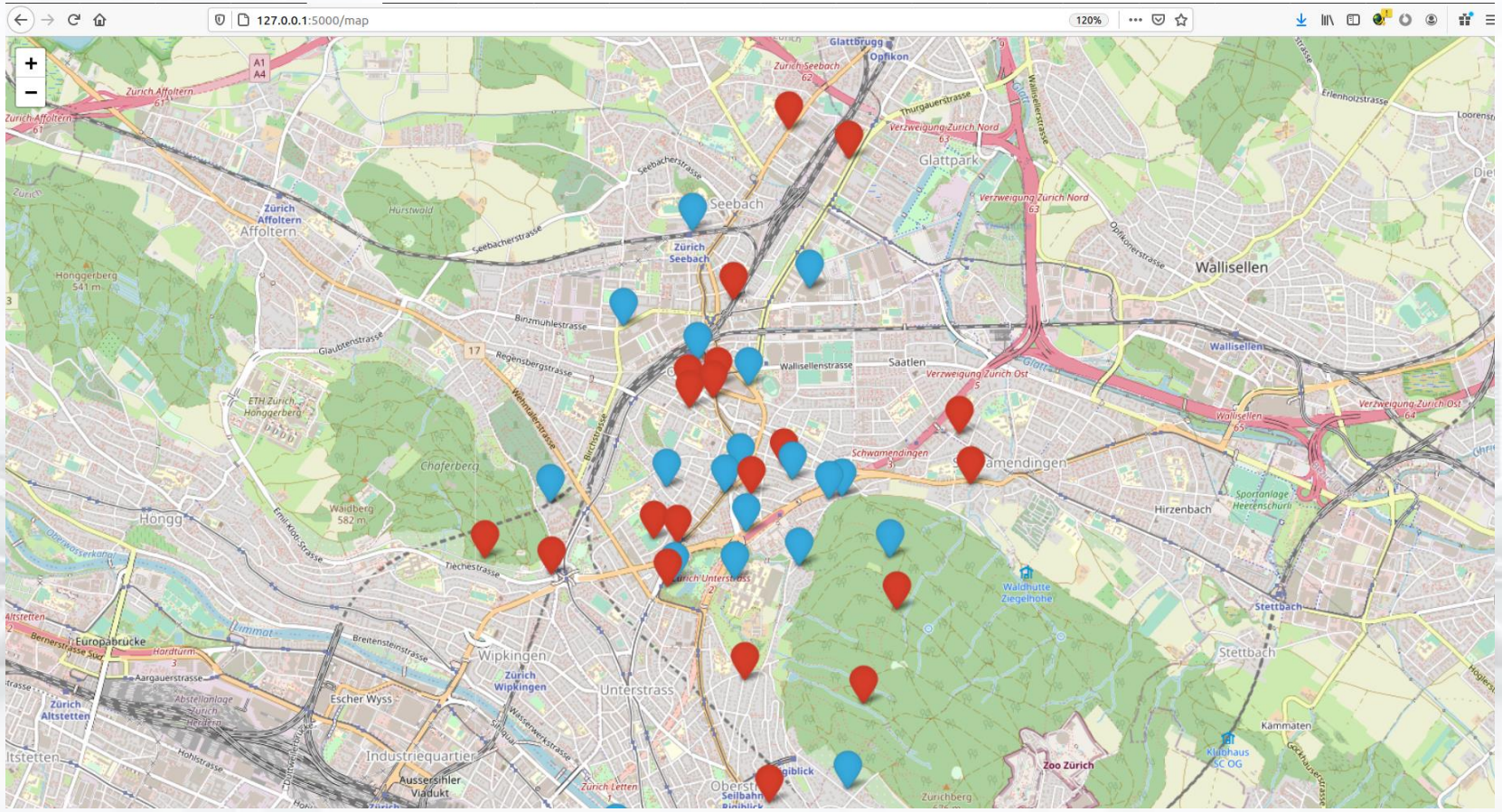
	uniq_id	actuator_ids	actuator_output	actuator_value_False	actuator_value_True	comparisons	requirement	sensor_ids	sensor_reading	thresholds
0	000000	[000030, 000032]	[intensity]	[0]	[1]	[=, =]	all	[000015, 000010]	[motion, noise_detector]	[True, True]

Overview over all assigned rules with the relevant actuator and sensor IDs. Furthermore the type of sensor and rule is shown.



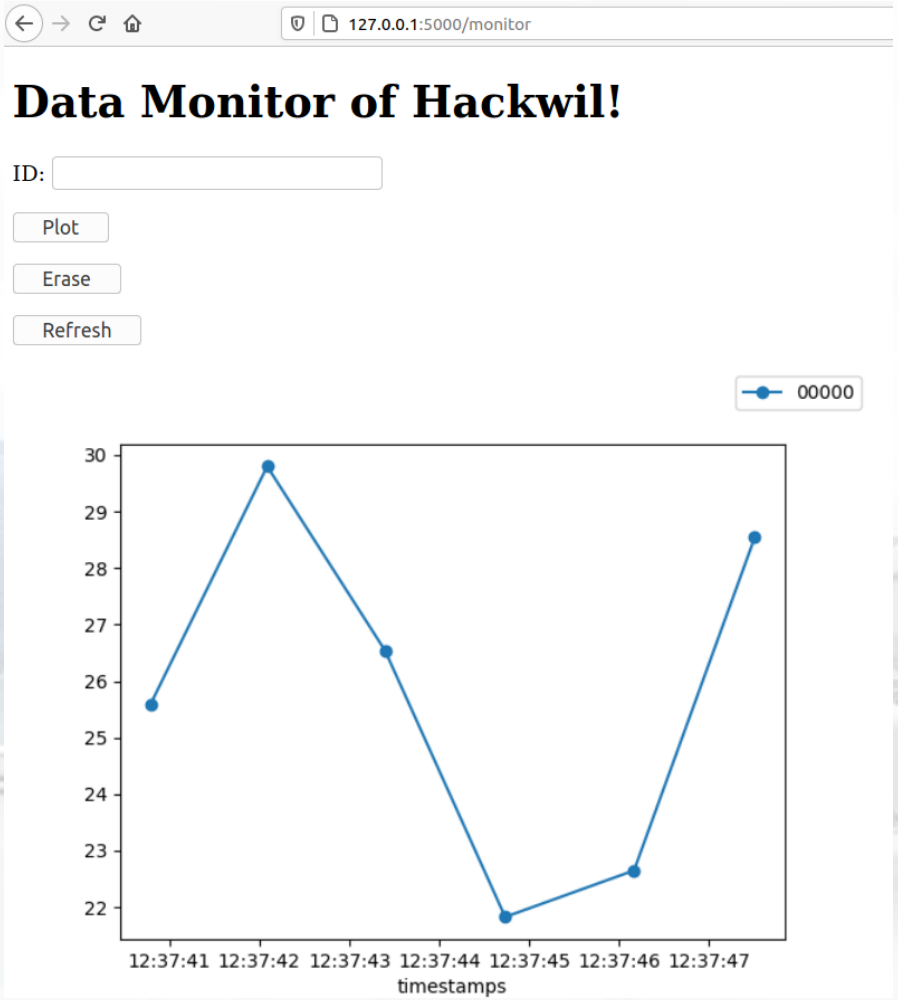
Interface to live add rules to the system. All available sensors and actuators can be selected and a variety of conditions can be applied.

The Location Map



The Data Monitor

Any Sensor can be added to the plot by entering the ID into the prompt.



The Mean Squares

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Remark: The software is most intensively tested on Ubuntu.