



UNIMORE

UNIVERSITÀ DEGLI STUDI DI
MODENA E REGGIO EMILIA

WinerIoT

IoT and 3D Intelligent System

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Goals



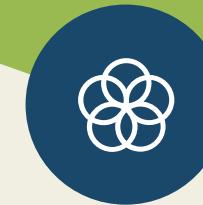
IMPROVE THE PRODUCTION PROCESS

Process analysis and monitoring can help operators in management



INCREASE COLLABORATION BETWEEN PRODUCERS

Thanks to a fully automated system, each producer can ask for help and give availability to other producers



EXPAND THE IOT WORLD

The agricultural sector is a sector still to be explored for IoT areas and thanks to WinerloT we want to lay the foundations of the new agriculture 4.0

* There are still few DBs covering these sectors *

Intelligent management of a winerys system

The idea is based on the production process that transforms grapes into wine. In particular, at the single cellar level, the system will be able to monitor the parameters necessary for the correct success of the fermentation process. Once the process is complete, the new wine will be transferred to the barrels and the evaporation status will be monitored based on the filling of the barrels themselves.

This system will be connected to a network of wineries which in collaboration will store this data and implement any corrective measures.

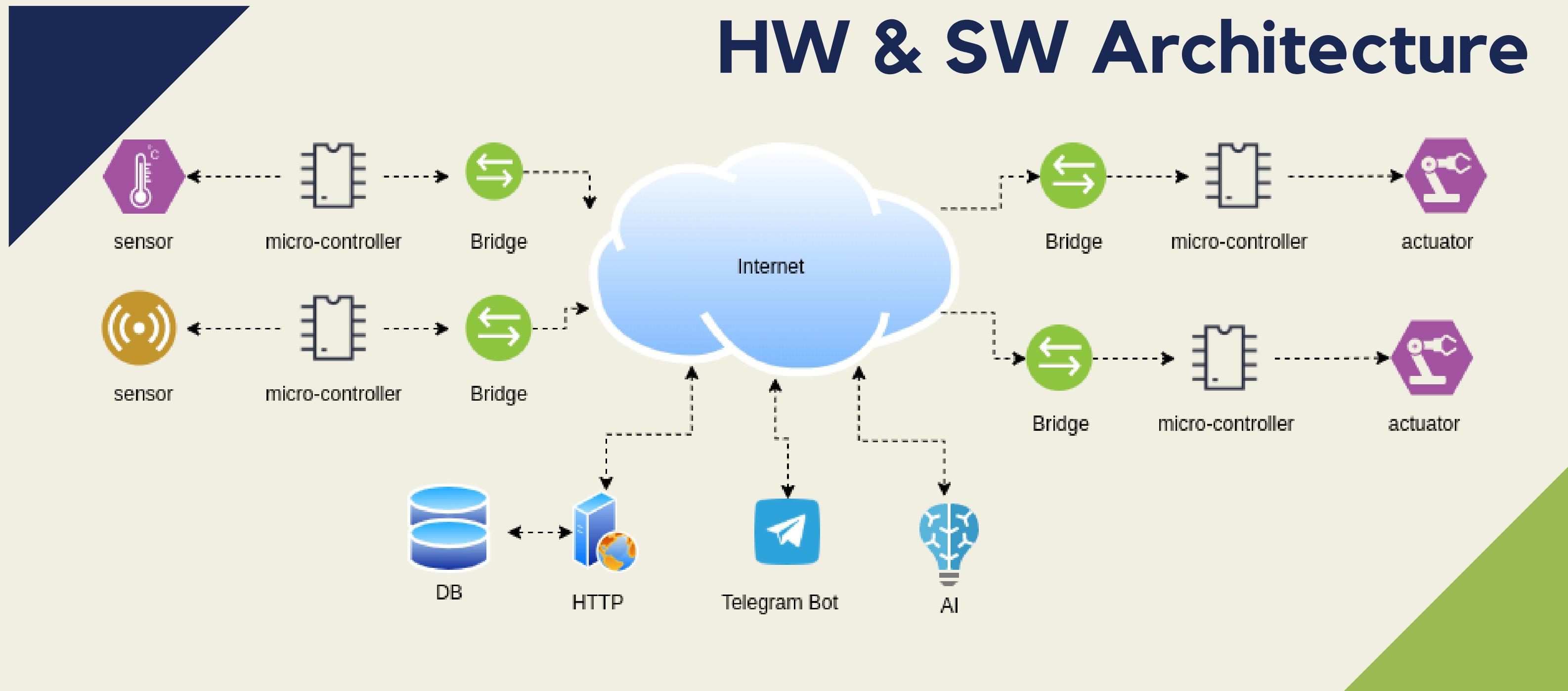
The collected data will be analyzed with AI tools in order to understand a whole series of information such as control of anomalies in the process and production trends.



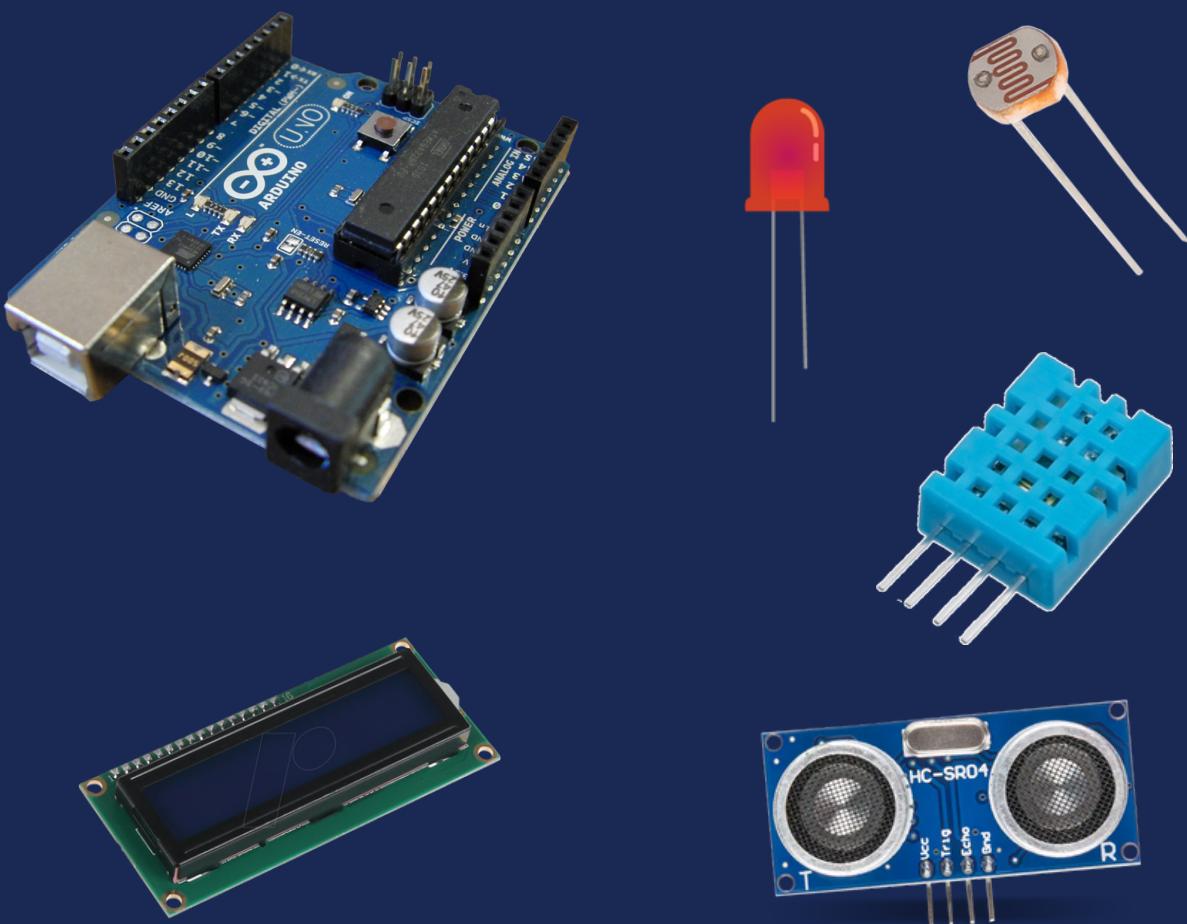
User Centred Design



HW & SW Architecture



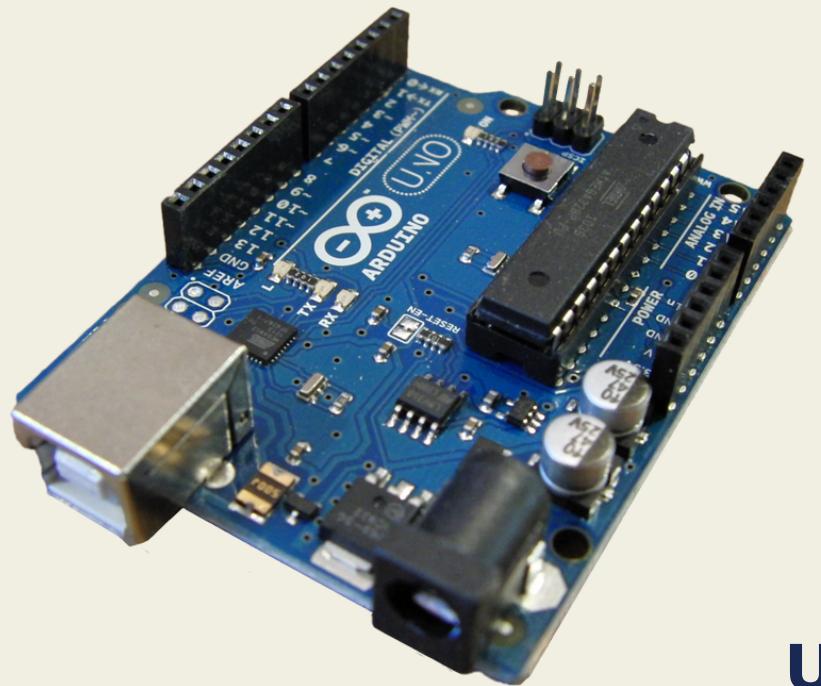
HW Resources



SW Resources



Board: Arduino Uno Rev. 3



FEATURES

- Good for quick prototypes
- Cheap
- Plenty of documentation
- Low power
- VSCode e Arduino IDE

USED FOR

- Take data from sensors
- Elaborate data and decide if to send it
- Communicate reliably to Bridge/Listen for Bridge commands

SPECS

Operating Voltage

5 V

Input Voltage
(recommended)

7 -12 V

Input Voltage (limit)

6 -20 V

Digital I/O Pin

14

Analog Input Pin

6

Flash Memory

32 KB

HARDWARE UTILIZZATO

Circuit Schema

Arduino Uno Rev. 3

1

Breadboard

1

Resistors

1 x 220 Ohm
1 x 1 KOhm

Led

1

Ultrasonic Sensor

1

Photoresistor

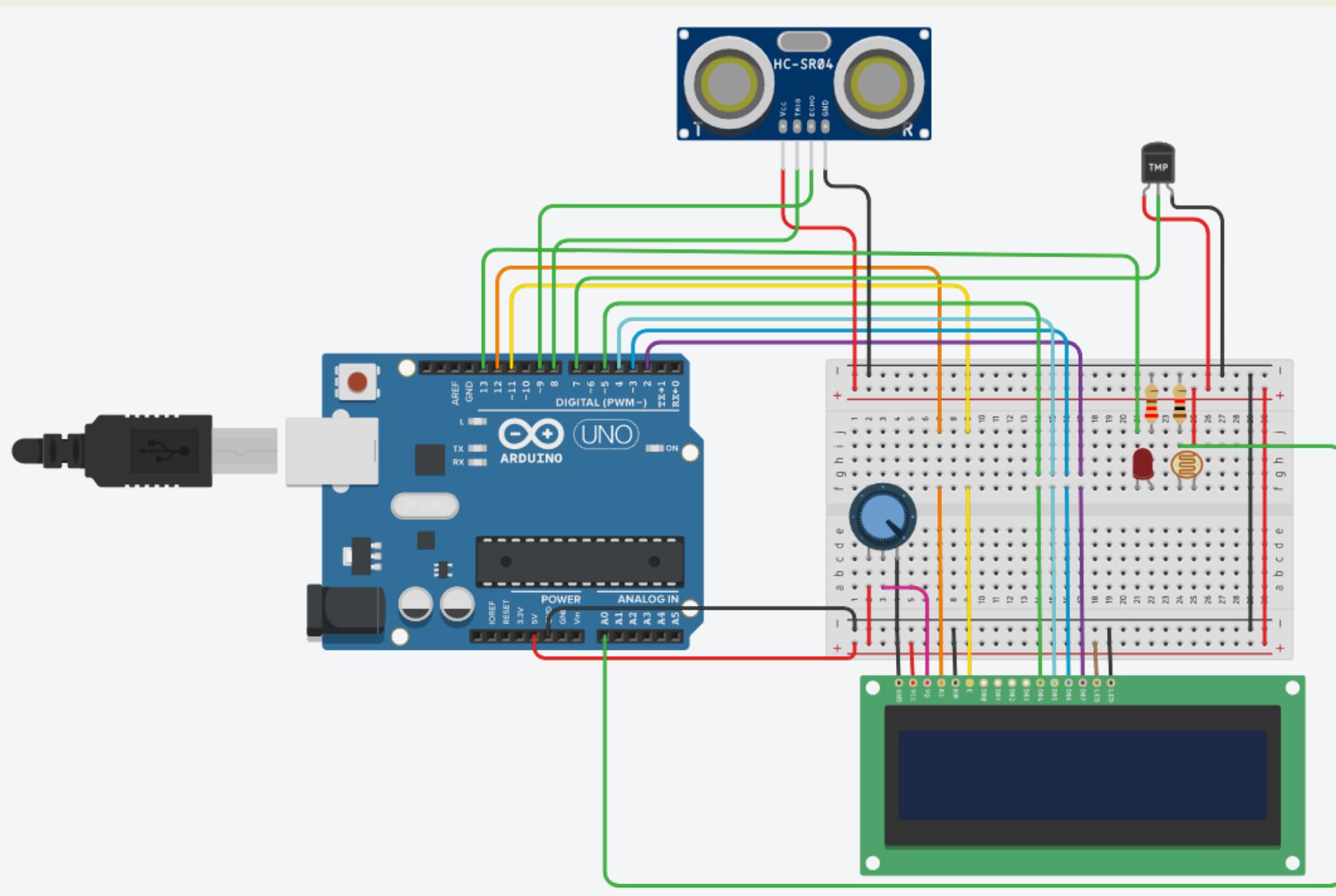
1

Temperature &
Humidity Sensor

1

LCD 16x2

1



System Elements

**1 FINAL STATE MACHINE
MICRO-CONTROLLOR
AND BRIDGE**

2 PACKET PROTOCOL

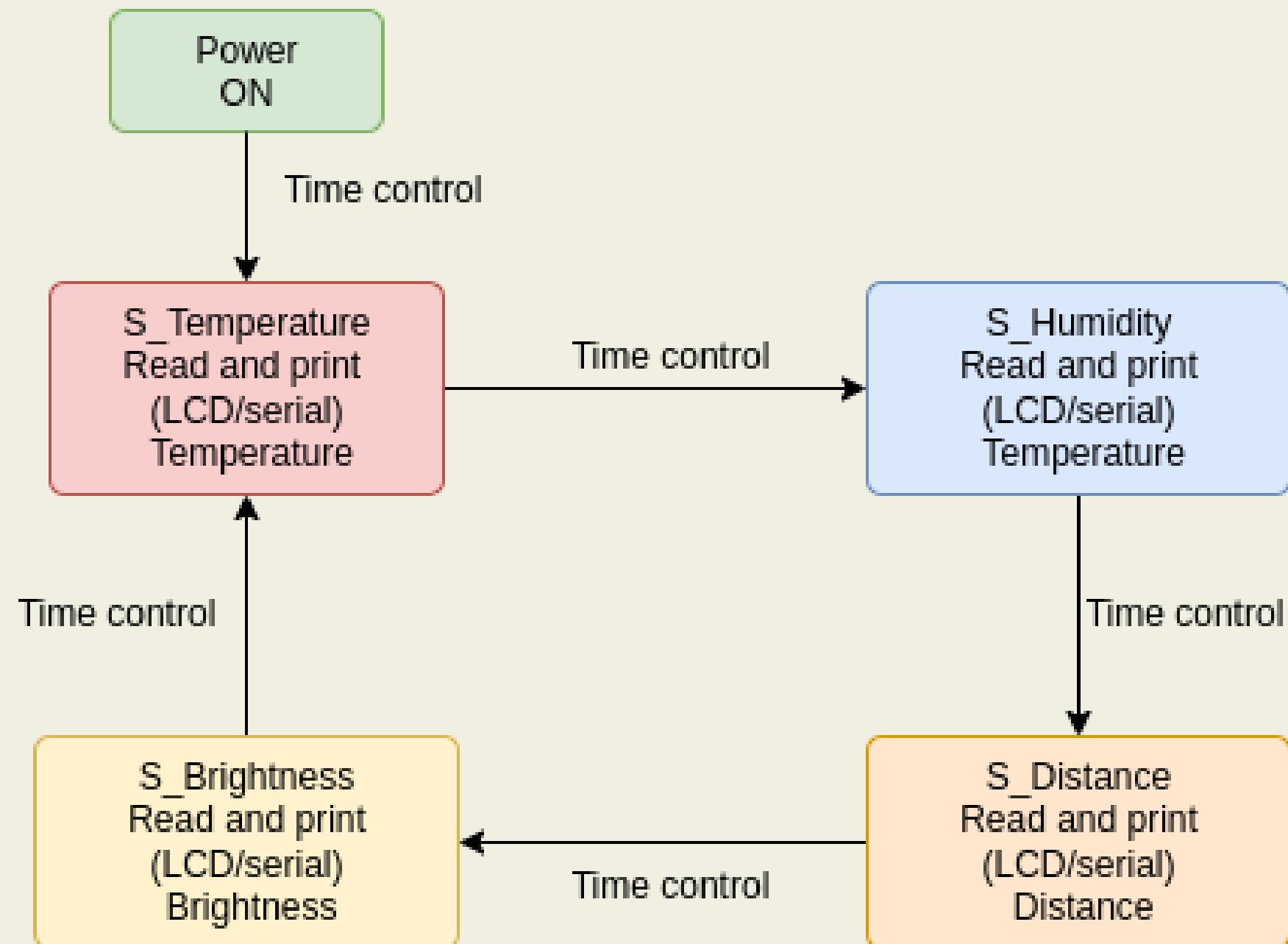
3 DB SCHEMA

4 FLASK API

5 FBPROPHET

6 TELEGRAM BOT

F.S.M. Sensors



LOOP

Each Sensor

Read data from sensor

Print state

Update state

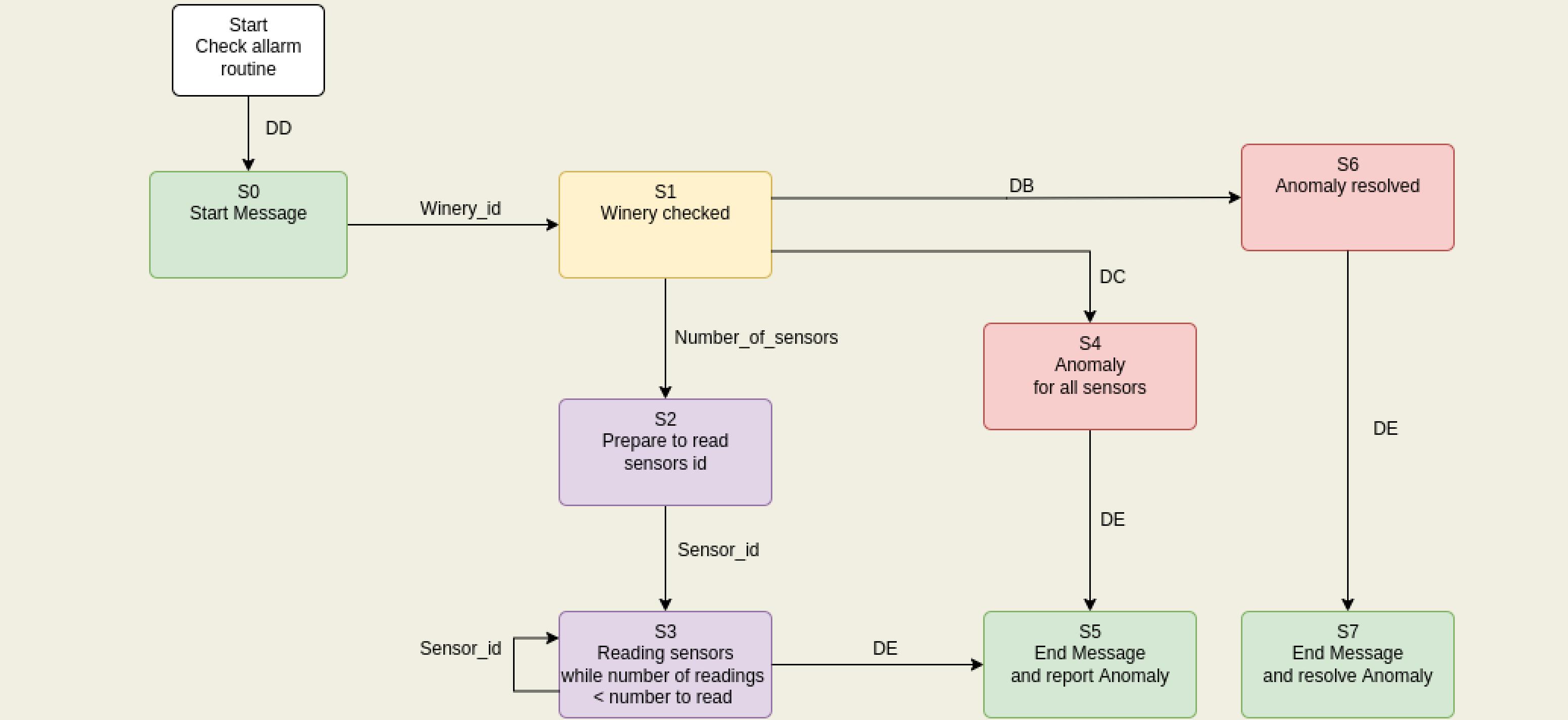
USED FUNCTIONS

Read from sensor

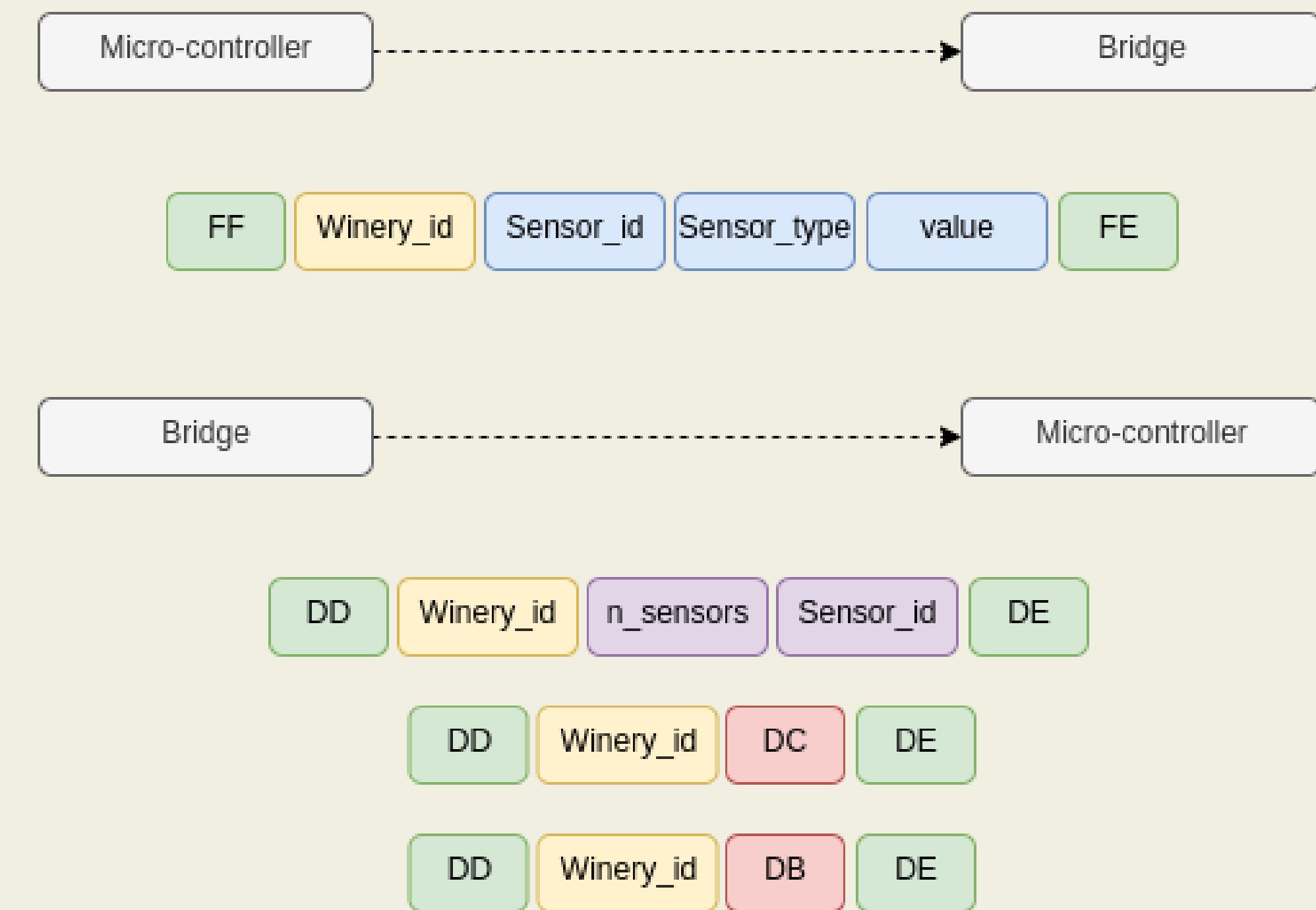
Print on LCD

Print on serial

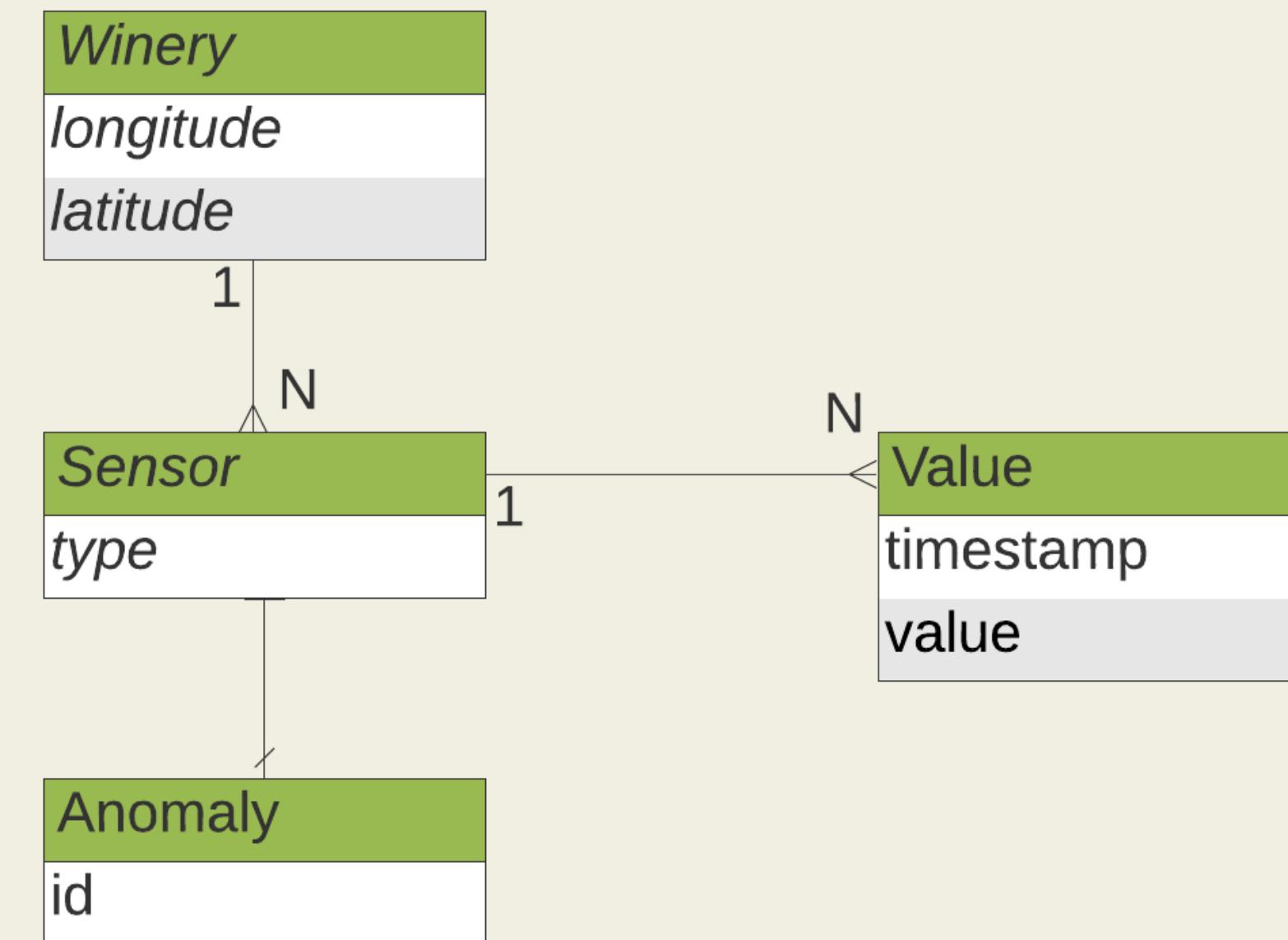
F.S.M. Allarm Monitoring



Packet Protocol used between micro-controller and bridge



ER Schema - SqlAlchemy



Flask Project Structure

ngrok

NAME	FUNCTION
App	Declaration of the FLASK APP with the Config class used to setup the environment. Setup of ngrok to have a tunnel to localhost for test the application online.
Winerys	The manager of the db for support the flask application views using the filter with specific query for the db
Views	The python file containing all the views for the html rendering and apply the management of the all post done by the bridge serial to server.
WinerIoT	

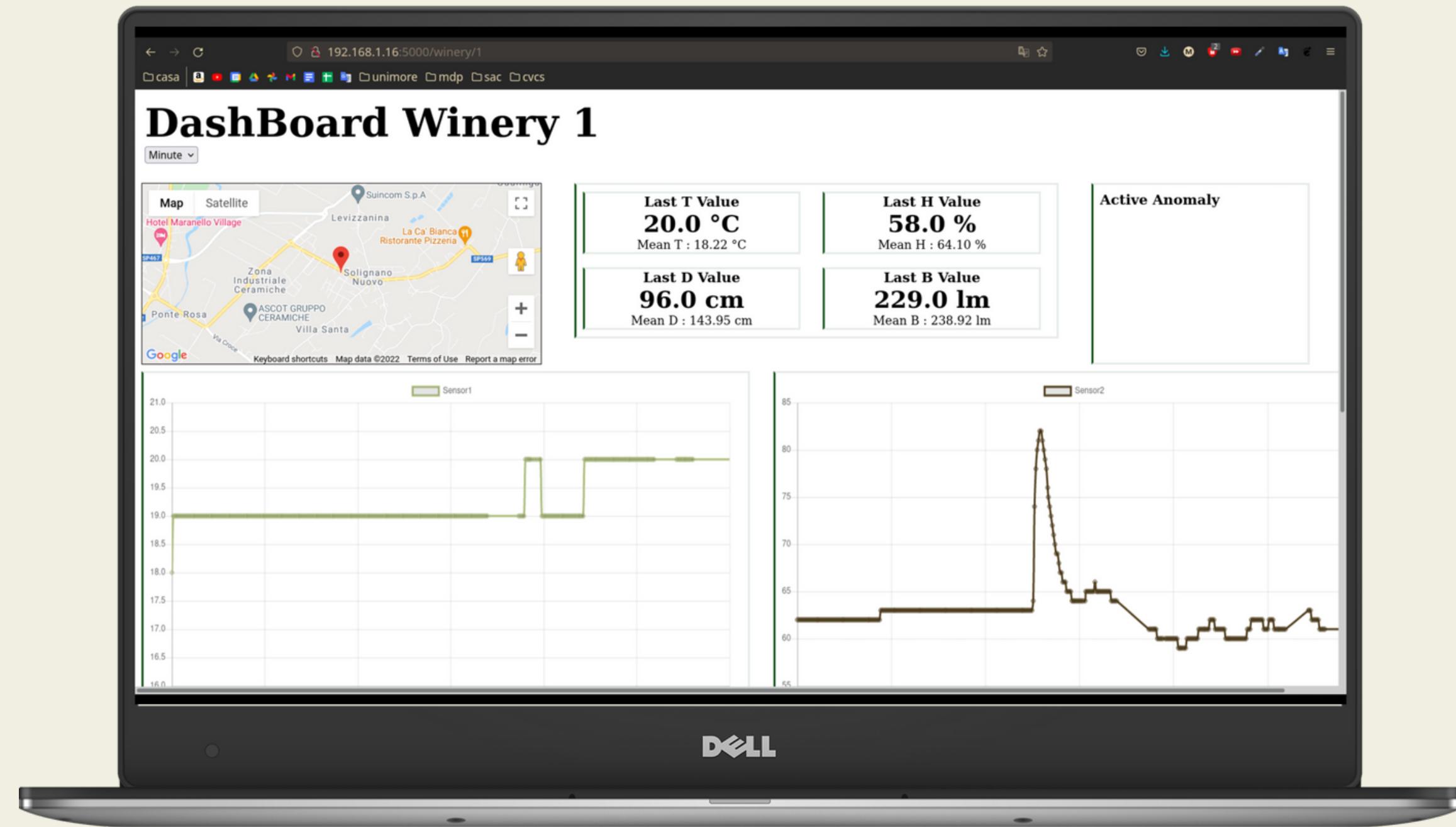
Views Structure - Page API

TYPE OF REQUEST	ROUTE	DESCRIPTION
GET	index	Main page with the button for select the winery and insert fake data for check the anomaly detection.
GET	/winery/<winery_id>	The dashboard of the specific winery that show the position, stats of all sensors and the active anomaly.
GET	/anomaly/<anomaly_id>	Page showing the specific anomaly plot generated from fbprophet
GET/POST	/insert	Insert fake sensor for rise anomaly detection.

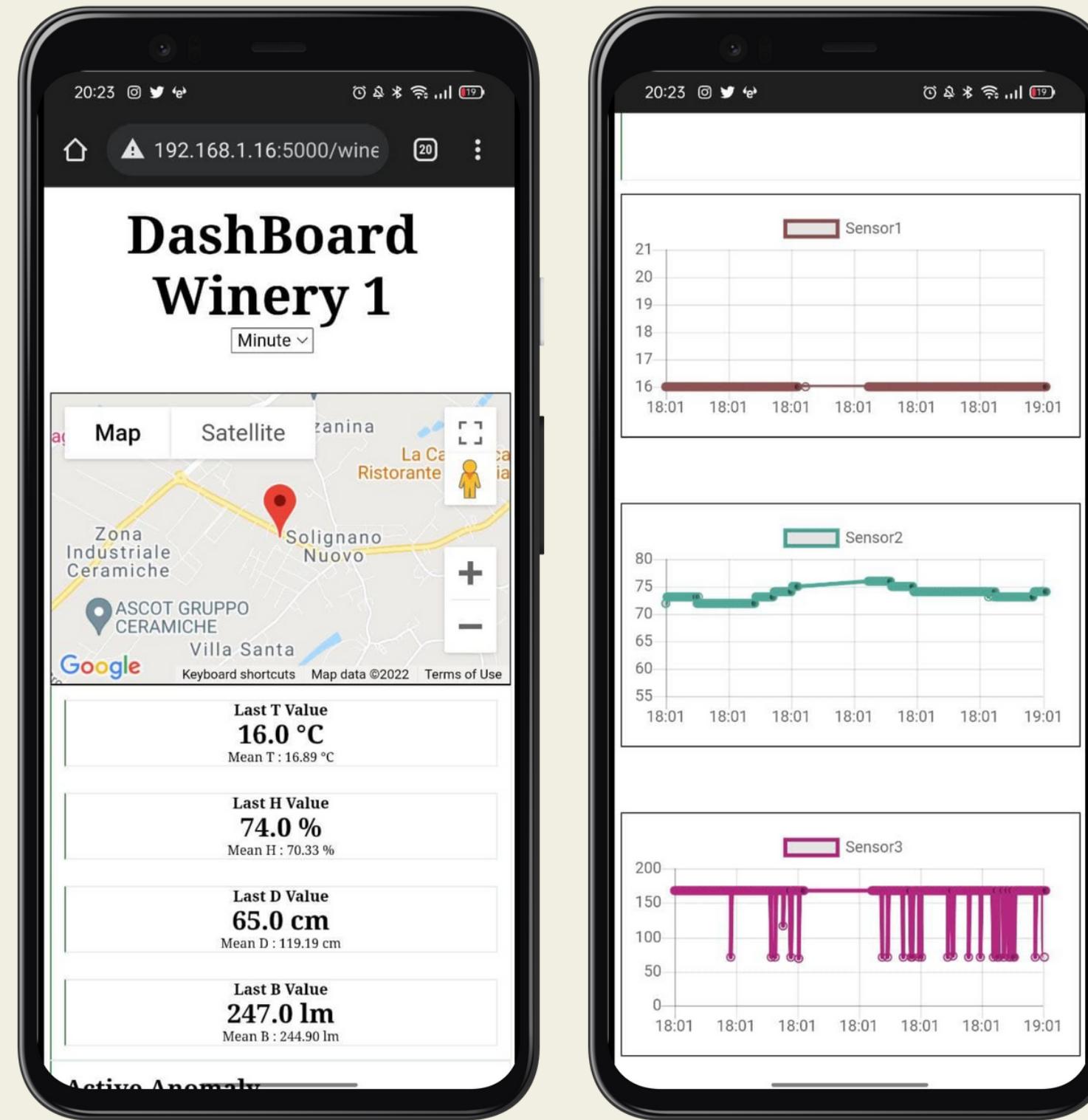
Views Structure - DB API

Type of Request	Route	Description
POST	/add_winery	method for adding the winery
POST	/add_sensor	method for adding the sensor and appending it to the specific winery
POST	/add_value	method for adding the value to the sensor
POST	/add_anomaly	method for adding the anomaly to the sensors
POST	/remove_anomalys	method for remove all the anomalies of the sensor

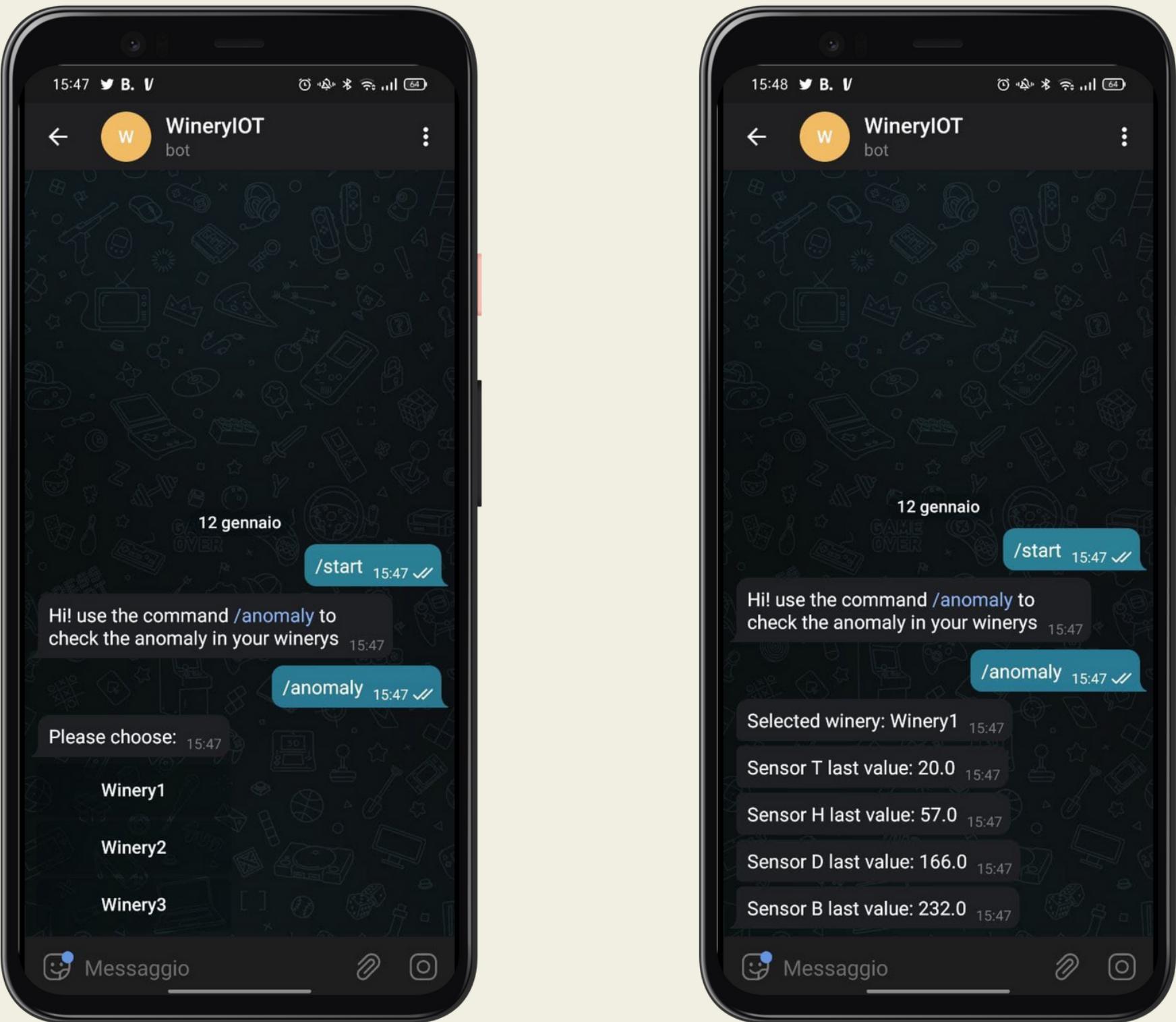
Dashboard



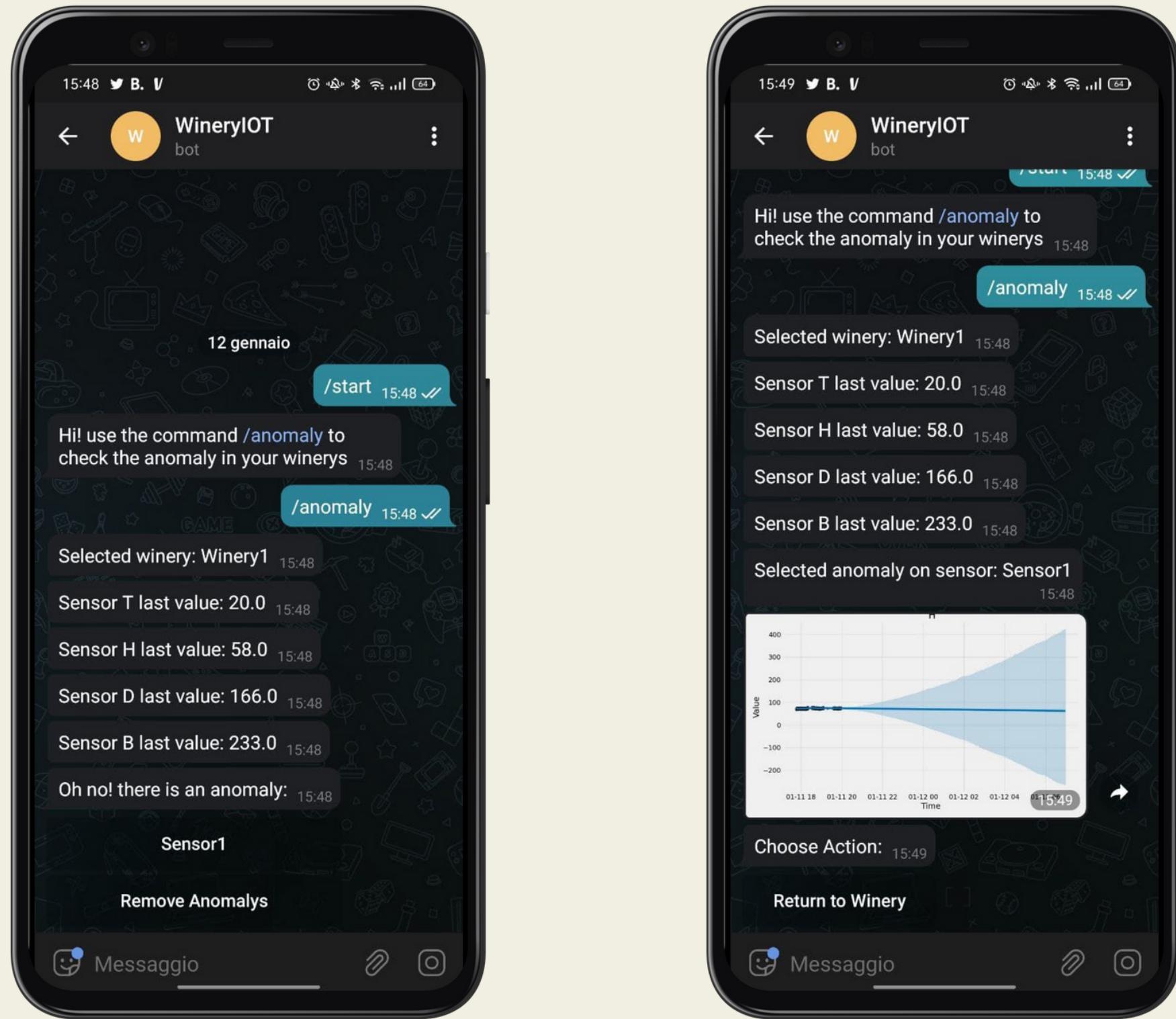
Cross Platform using CSS and JS



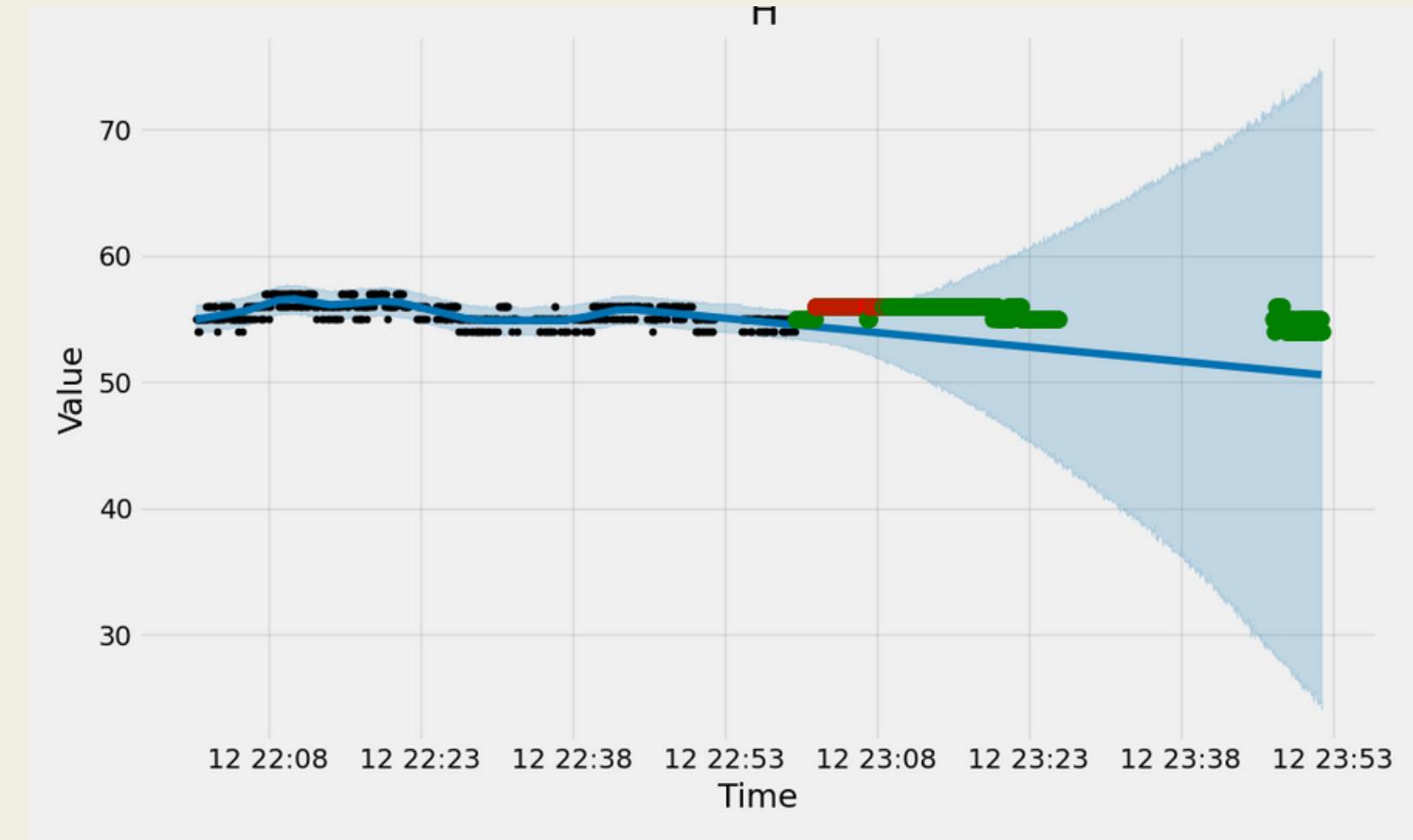
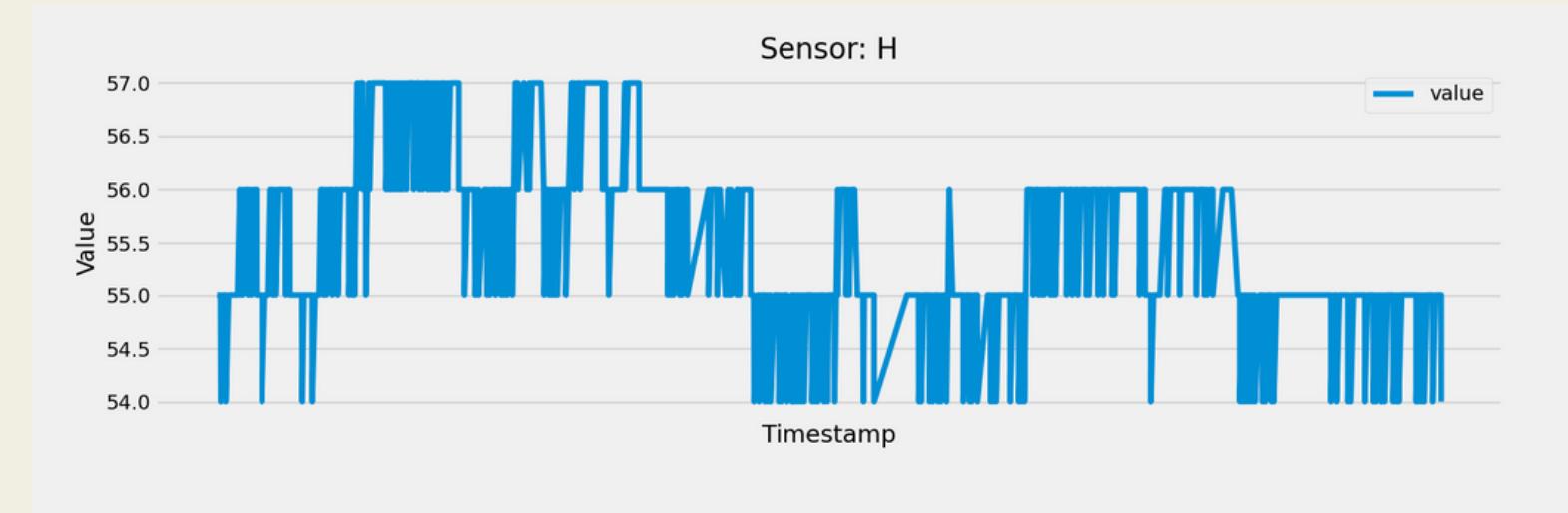
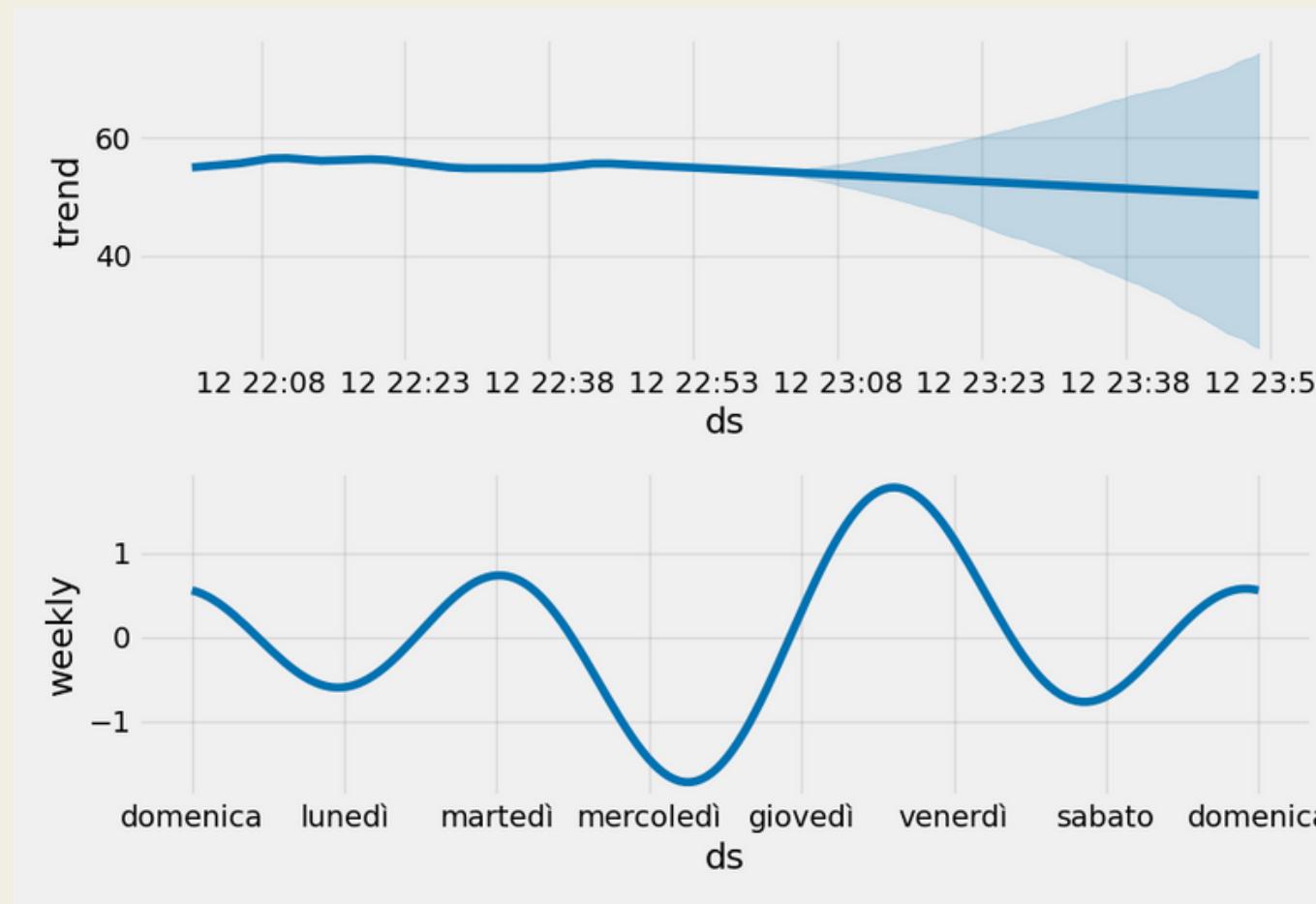
Telegram Bot support on the go Winery Stats



Telegram Bot support on the go Anomaly Management



AI - FbProphet



FbProphet Prediction

	Unnamed: 0	timestamp	value	type	winery_id	sensor_id
0	0	2022-01-12 19:49:11.553422	20.0	T	1	1
1	1	2022-01-12 19:49:27.821020	20.0	T	1	1
2	2	2022-01-12 19:49:43.499093	20.0	T	1	1
3	3	2022-01-12 19:49:58.829670	20.0	T	1	1
4	4	2022-01-12 19:50:15.867656	20.0	T	1	1

	Unnamed: 0	timestamp	value	type	winery_id	sensor_id
0	218	2022-01-12 20:46:31.940304	20.0	T	1	1
1	219	2022-01-12 20:46:45.848826	20.0	T	1	1
2	220	2022-01-12 20:47:00.507537	20.0	T	1	1
3	221	2022-01-12 20:47:14.527697	21.0	T	1	1
4	222	2022-01-12 20:47:33.547740	21.0	T	1	1



Demo

Let's go to the code!



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Grazie per l'attenzione

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