



Digital maintenance for sustainable and flexible  
operation of HYDROpower plant

# The Di-Hydro Visualization Tool & The Web Dashboard with Analytics

ETIP Hydropower Day 8<sup>th</sup> September 2026

Mihai Iovea

ACCENT PRO 2000 S.R.L. (AP2K)

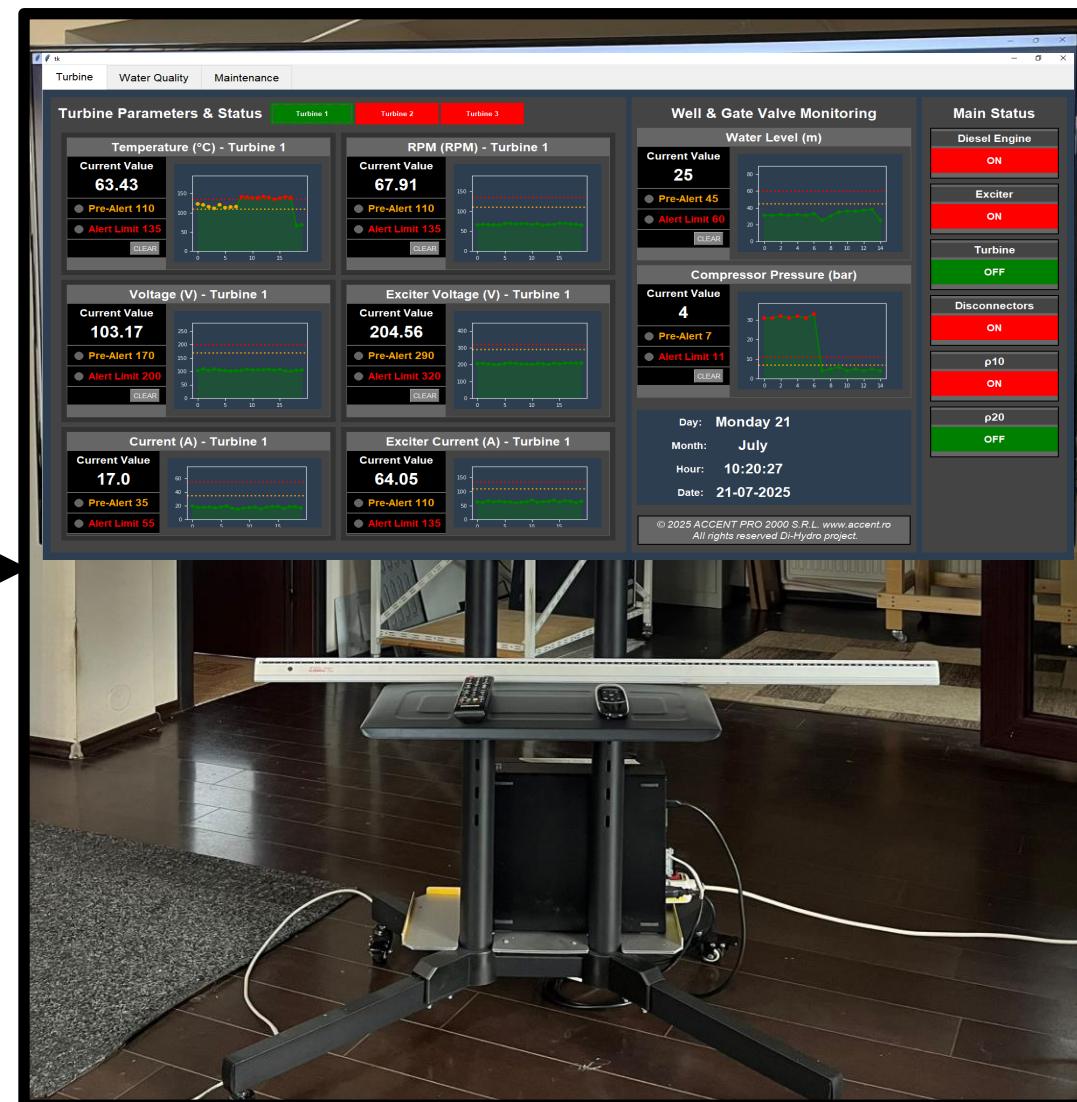
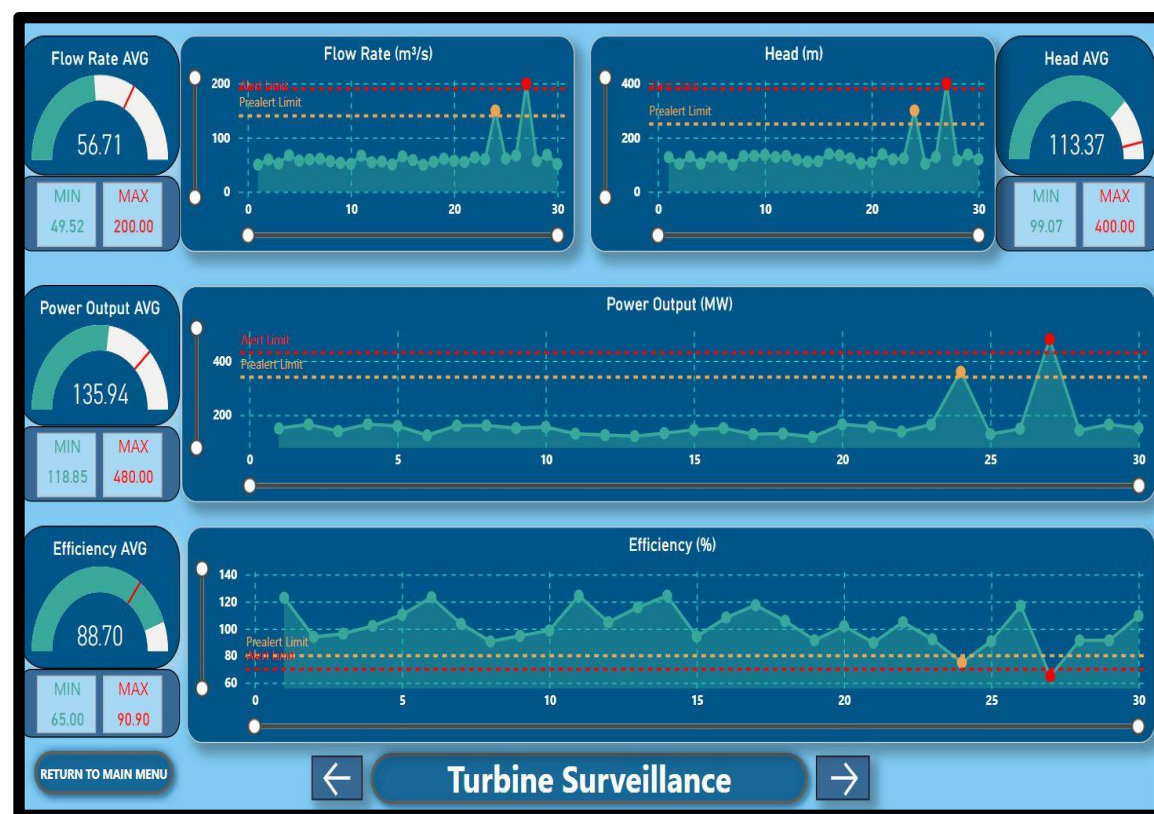


This project has received funding by the European Union's Horizon Europe  
research and innovation programme under Grant Agreement N° 101122311

## First Prototype with simulated data

## First Version with simulated data

## Final VT Version with real data



## Made with PowerBI

### Disadvantages:

- Not interactive
- Generates costs

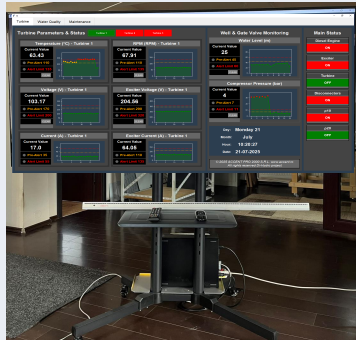
## Made with Python

- Very interactive
- No costs

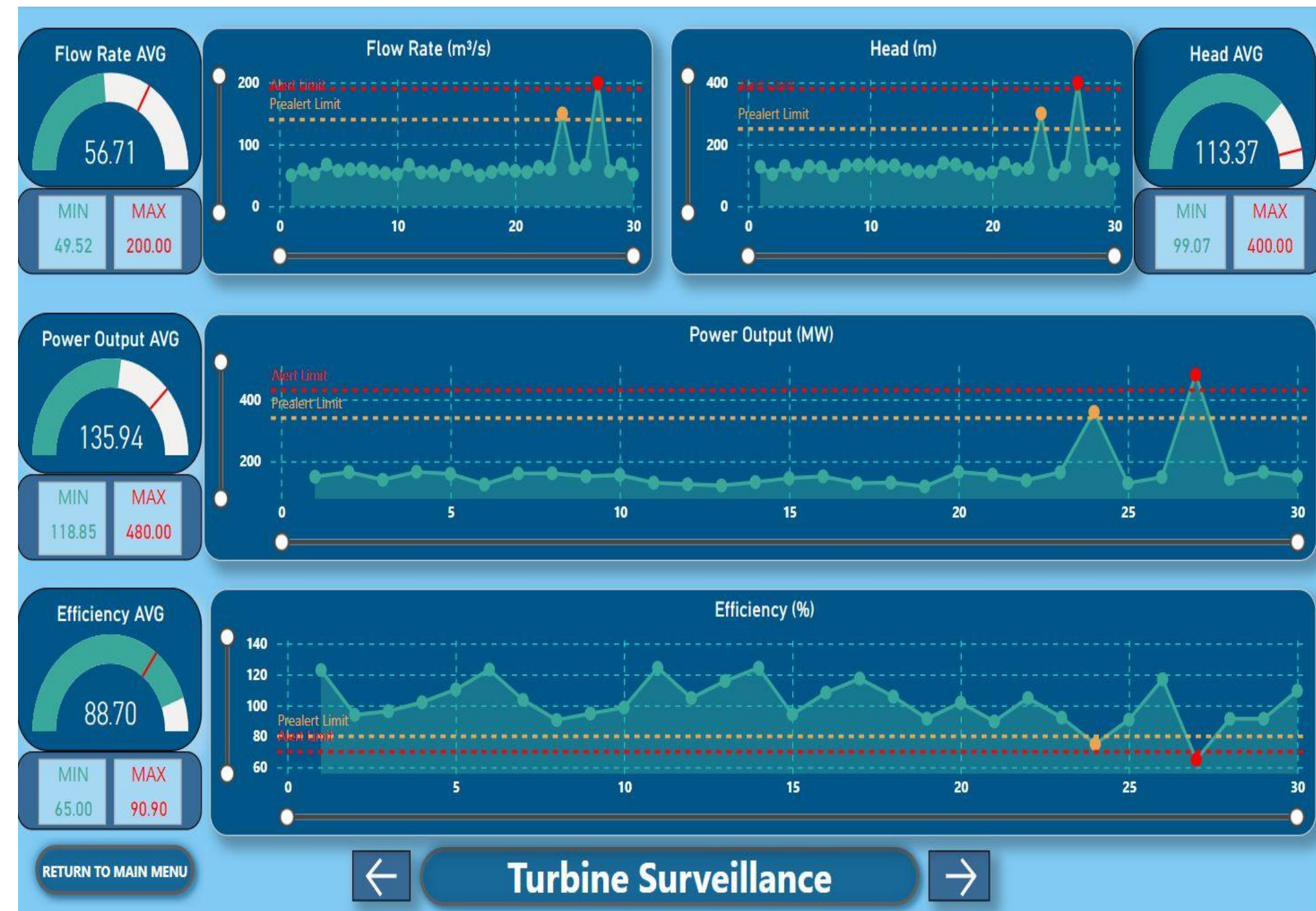
## DT Web Dashboard



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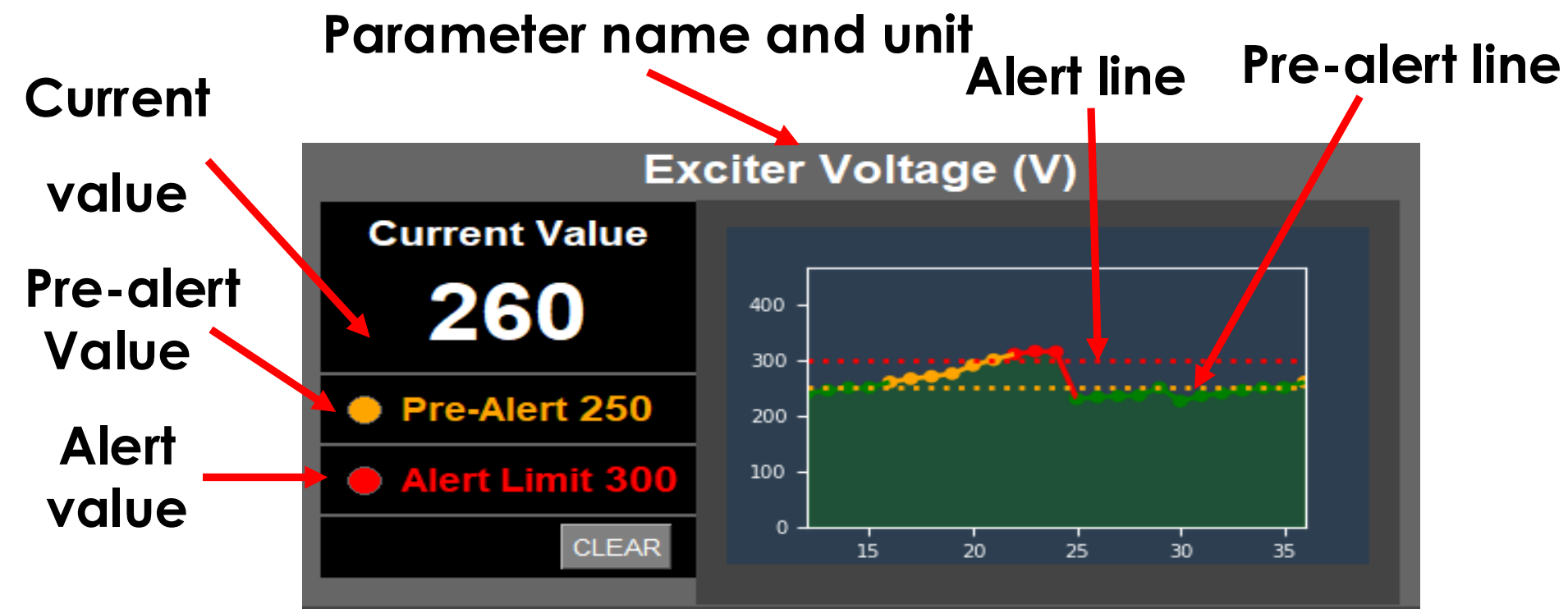
| Visualization Tool Old Version                                                                      | Visualization Tool Final Version                                  | Web Dashboard with Analytics        |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------|
| Parameter Display Section                                                                           | Parameter Display Section                                         | Digital Twin Online Interface       |
| Workflow                                                                                            | Generator Section                                                 | Parameter load & select             |
| HPP Maintenance Section                                                                             | Turbine Section                                                   | Digital Twin Parameter Graphs       |
| Hardware Setup  | Augmented Reality (parameter surveillance over camera livestream) | AI Prediction display               |
| Augmented Reality                                                                                   | Digital Twin & AE Sensors Parameter Display                       | Multiple Parameter Graphs with zoom |
| * Data simulated by AP2K                                                                            | * Data provided by PPC, ACCELIGENCE & CERTH                       | * Data provided by ACCELIGENCE      |

For this version the main problem was the lack of data interactivity. The plots cannot do surveillance in real-time or continuous surveillance over historical data.





The first version was displaying simulated numeric HPP data and non-numeric parameters in the first tab, tables in the second and maintenance schedule in the third.



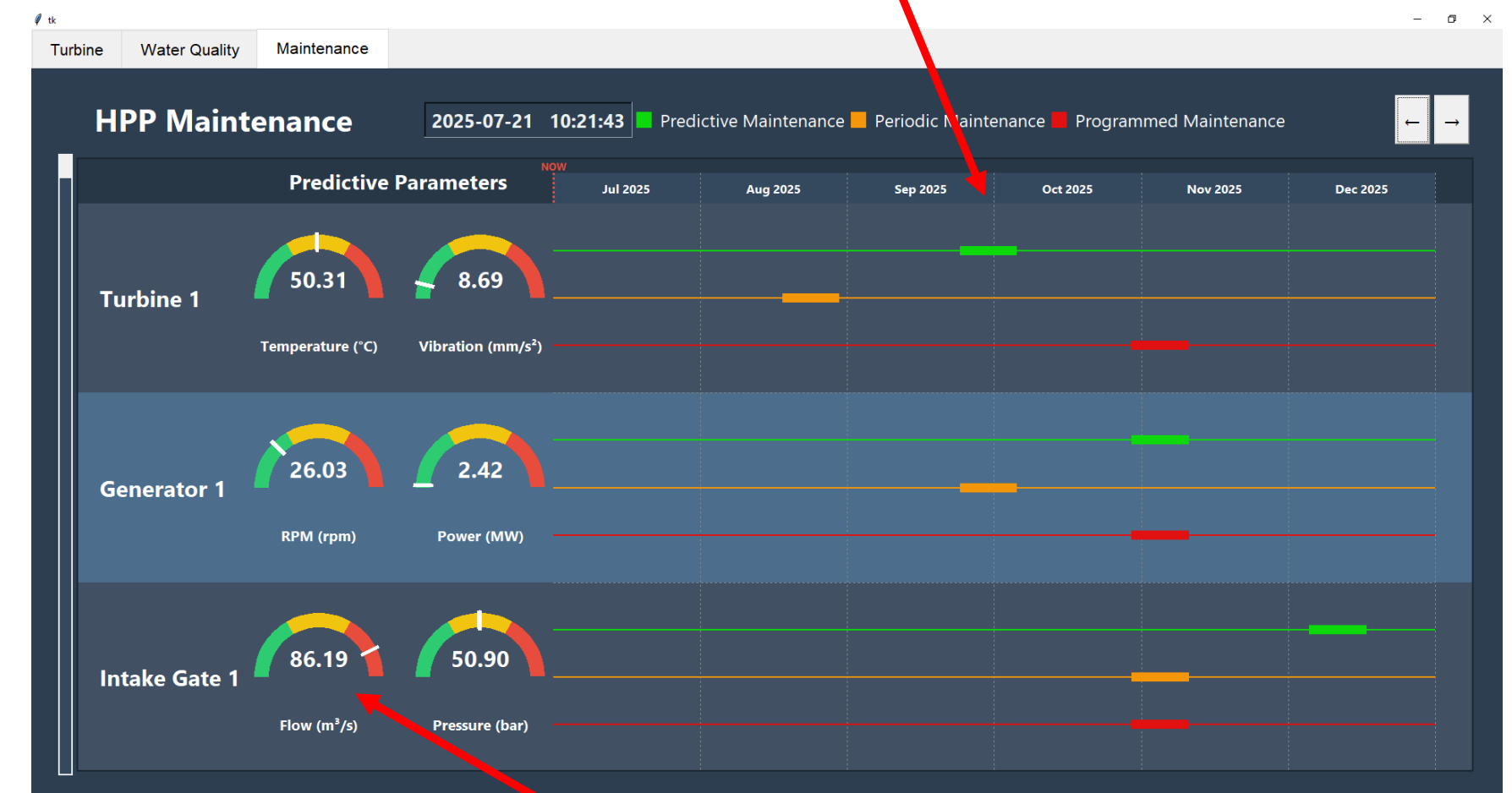
Parameter Name

| Input Data                          |      |   |
|-------------------------------------|------|---|
| Head (m)                            | 121  | ● |
| Power Output (MW)                   | 160  | ● |
| Reservoir Level (m)                 | 211  | ● |
| River Flow Rate (m <sup>3</sup> /s) | 320  | ● |
| Sediment Load (mg/L)                | 0.6  | ● |
| Turbine Efficiency (%)              | 92   | ● |
| Water Temperature (Celsius)         | 21   | ● |
| Water Volume (m <sup>3</sup> )      | 5200 | ● |

Modified Value

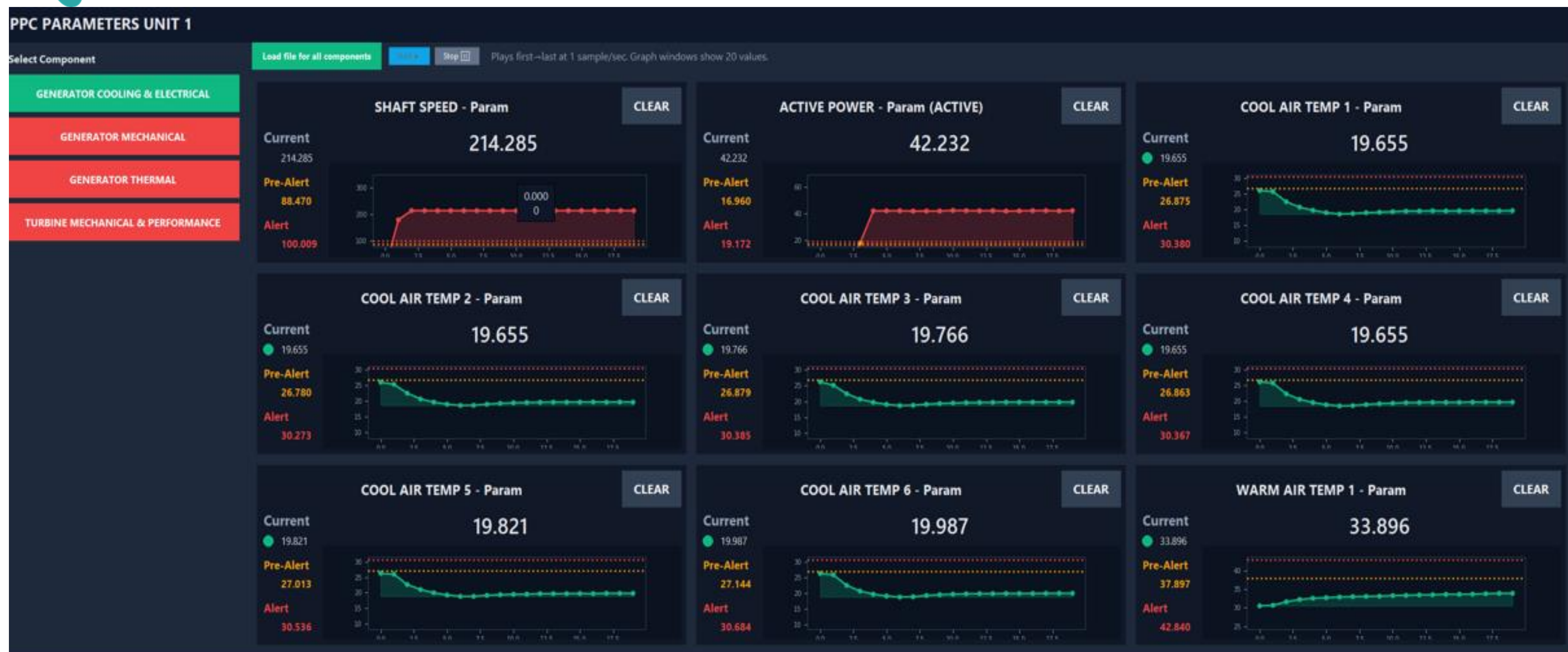
Original Value

## Maintenance duration section



Graph Indicator with parameter values

# Final Version of The Visualization Tool (VT) Window (Tab 1)



## Parameter name

Current  
value

Pre-  
alert  
Value

Alert  
value



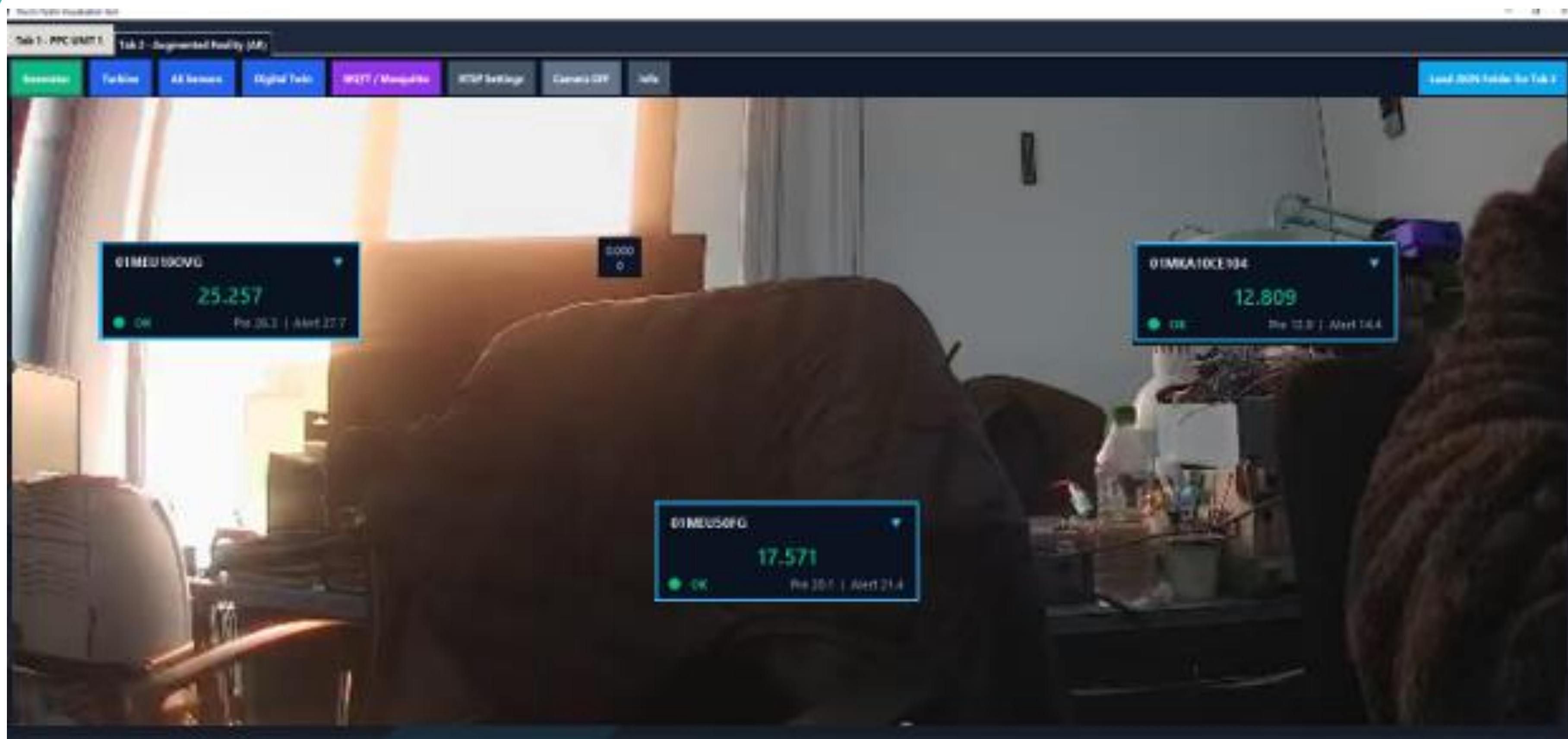
Alert line

Pre-alert  
line

For the HPP data display the end-users need to load the data (.xlsx, .csv or .json).  
The other action needed is the navigation through buttons for each data category.

The rest of the execution is automated by the VT.

## Final Version of The Visualization Tool (VT) Window (Tab 2)



**The camera stream of the hardware component runs in the background of the window, while in front, there are 3 core parameters monitored for each data category.**

**The data (.json) is loaded through the LOAD button in the right side.**

**The camera stream can be turned on and off by using the Camera ON/OFF button.**

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**Camera stream configuration can be changed based on IPs and hardware through the RTSP Settings button.**

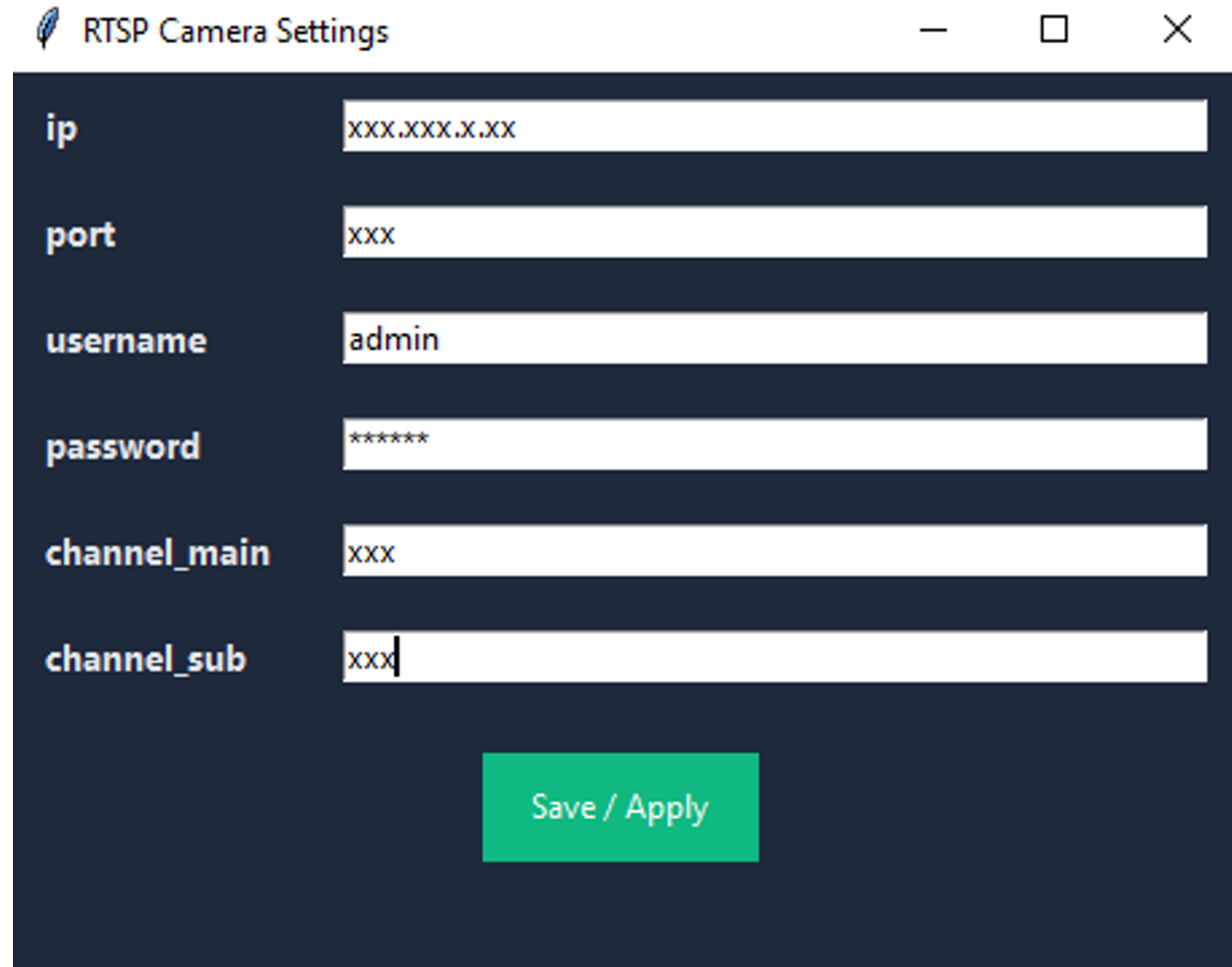
**In the next slide, this concept will be detailed.**

**This AR surveillance is developed for HPP hardware components system parameters and can be used for any preferred device.**

## What is the RTSP Settings button & what it does?

**RTSP (Real-Time Streaming Protocol)** is a network communication protocol used to establish, control, and manage real-time audio and video streams over IP networks. It enables functions such as starting, stopping, pausing, and monitoring live video feeds from compatible devices.

**Shortly**, the user needs to set the credentials in the config for the camera stream to work in the VT.

A screenshot of a web-based configuration window titled "RTSP Camera Settings". The window has a dark blue background and contains several input fields for configuration. The fields are labeled "ip", "port", "username", "password", "channel\_main", and "channel\_sub". The "ip" field contains "xxx.xxx.x.xx", "port" contains "xxx", "username" contains "admin", "password" contains "\*\*\*\*\*", "channel\_main" contains "xxx", and "channel\_sub" contains "xxx". A green button labeled "Save / Apply" is located at the bottom right of the form.

| Field        | Value        |
|--------------|--------------|
| ip           | xxx.xxx.x.xx |
| port         | xxx          |
| username     | admin        |
| password     | *****        |
| channel_main | xxx          |
| channel_sub  | xxx          |

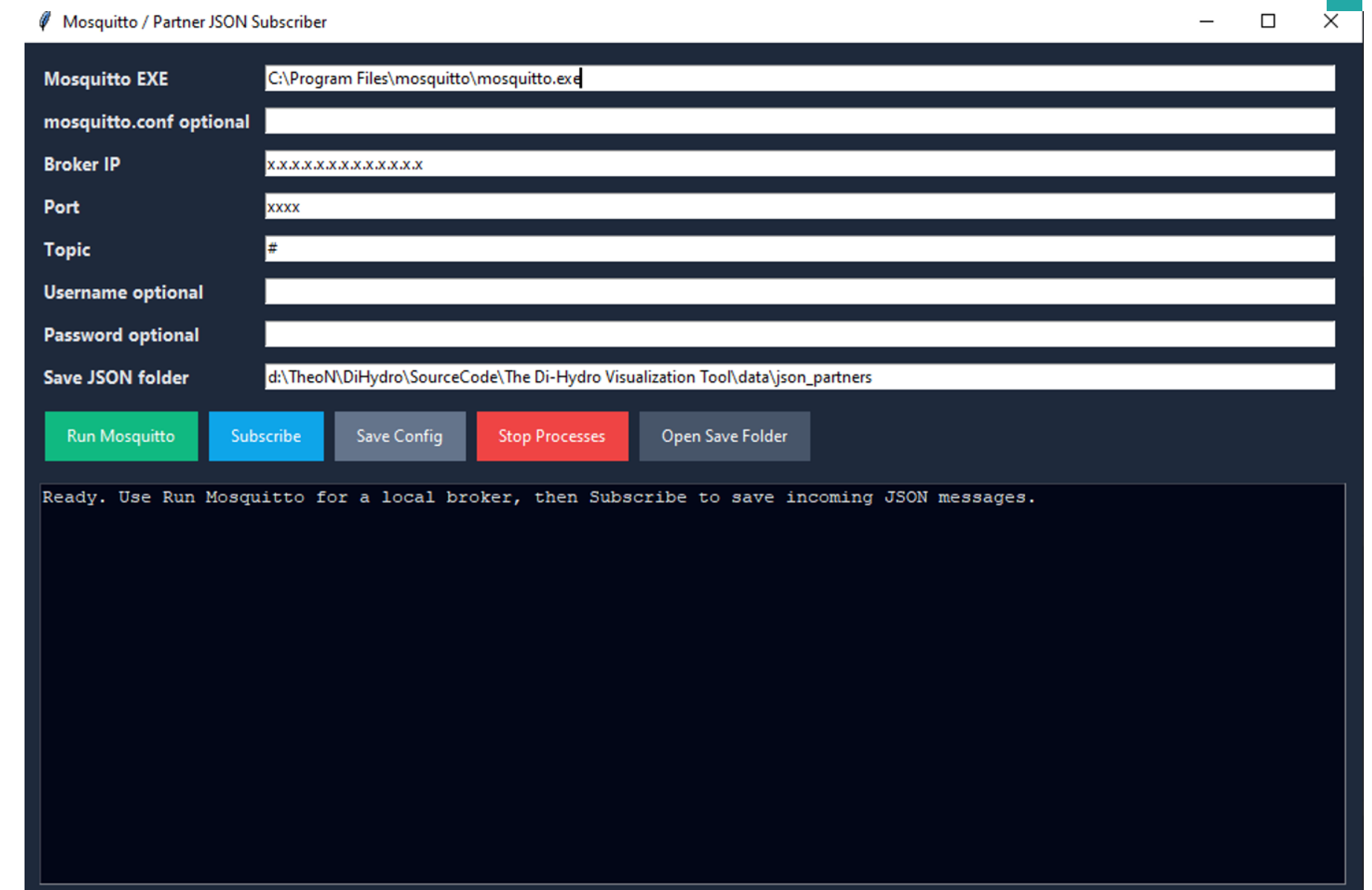
Save / Apply

## What is the MQTT/Mosquitto button & what it does?

The MQTT Configuration Window provides a graphical interface for managing MQTT broker connections and subscriptions.

Using this interface, operators can:

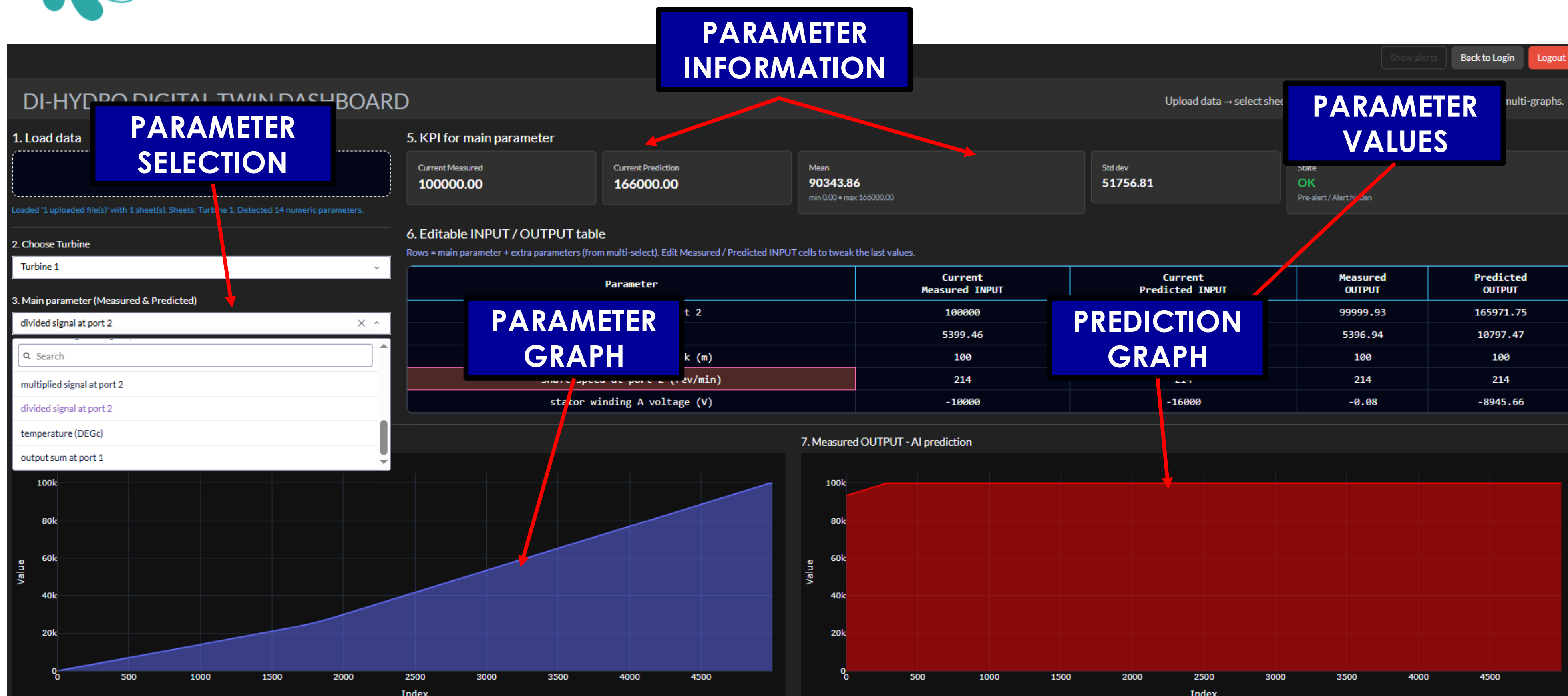
- Connect to and start communication with the MQTT broker.
  - Subscribe to the required MQTT topics.
- Save broker credentials and configuration settings.
  - Store and manage received data.



The screenshot shows a configuration window titled "Mosquitto / Partner JSON Subscriber". It contains several input fields for configuration: "Mosquitto EXE" (C:\Program Files\mosquitto\mosquitto.exe), "mosquitto.conf optional", "Broker IP" (x.x.x.x.x.x.x.x.x.x), "Port" (xxxx), "Topic" (#), "Username optional", "Password optional", and "Save JSON folder" (d:\TheoN\DiHydro\SourceCode\The Di-Hydro Visualization Tool\data\json\_partners). Below these fields are five buttons: "Run Mosquitto" (green), "Subscribe" (blue), "Save Config" (grey), "Stop Processes" (red), and "Open Save Folder" (grey). At the bottom, a status bar reads: "Ready. Use Run Mosquitto for a local broker, then Subscribe to save incoming JSON messages."

The user needs only to press the Run Mosquitto button, subscribe and save buttons, in this order. After these steps, users can load the saved data.

For more details for understanding the MQTT functionality, please check IMT's Data exchange platform from the link below!



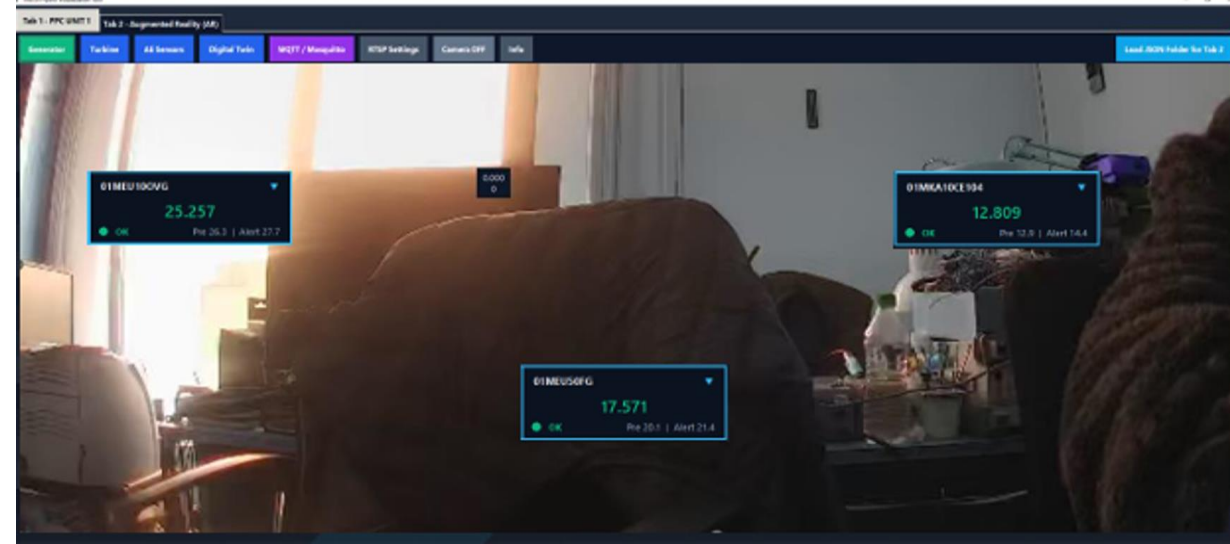
**The Web Dashboard has the same functionalities as The Visualization Tool, but with AI prediction forecast for Digital Twin parameters.**

**The design is a little different, it includes tables and status for the parameters beside the graph sections.**

**The Web Dashboard can work at the same time with the Visualization Tool.**

**The Visualization Tool provides universal display, maintaining most of the functionalities automated for an easy experience for every type of end-user.**

**The final product is an .exe file that runs everything at the click of a mouse.**



### HPP LOCAL SURVEILLANCE HW & SW SOLUTION

- ✓ Scalable
- ✓ Built with Python
- ✓ Data Server Interrogation
- ✓ Forecast Visualization
- ✓ Digital Twin
- ✓ Database Compatible (Azure, SQL, .csv file)
- ✓ Flashing Warnings
- ✓ Big Size Screens
- ✓ Data Auto Refresh

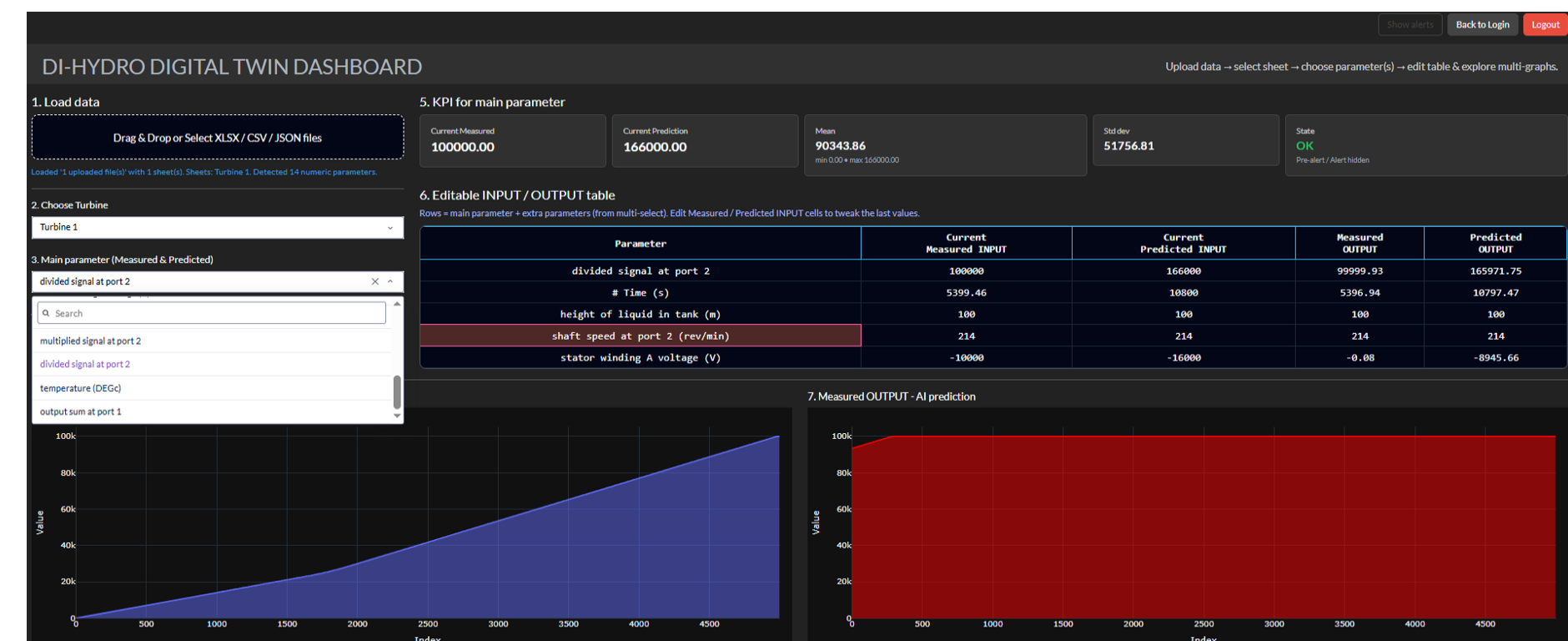


## OPERATOR VISUALIZATION TOOL EXAMPLES

### HPP FEDERATED DATA VISUALIZATION WINDOW



### DIGITAL TWIN FEDERATED DATA VISUALIZATION WINDOW



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Check out the  
**Di-Hydro Innovation Handbook**,  
featuring the main results from  
the project!



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# Thank you.

Mihai lovea  
[office@accent.ro](mailto:office@accent.ro)

Theo Netculescu  
[theo.netculescu@accent.ro](mailto:theo.netculescu@accent.ro)

**The Di-Hydro Visualization Tool Repository:**

<https://github.com/TheoN03/The-Di-Hydro-Visualization-Tool>



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