

# IoT Infrastructure for the Syngas Platform Vienna with Real-Time KPI Computations

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## Area 2.2 Automation and Control

### Motivation

At the Syngas Platform Vienna large research plants are operated for several weeks within one research campaign. The large data sets, with over 2000 data points, made it very difficult and time consuming to analyze the data manually and locally. Thus, the knowledge gained from data analysis was difficult to use within one research campaign. It significantly slowed down the work of the researchers who had to spend a lot of time on manual repeated calculations.

### New IoT-Infrastructure

To address the limitations of the previous system, data is now stored in a centralized **InfluxDB database**, greatly enhancing accessibility and utility. For **visualization**, **Grafana** dashboards were implemented, providing an intuitive platform accessible to users via any web browser. The visualization offers flexibility by allowing many customization from changing time ranges to colour schemes, and automatic calculation of key performance indicators (KPIs), effectively functioning as a "soft sensor."

As the success of the new system increased demand for more complex calculations, limitations in Grafana's ability to handle such tasks became evident, including slower load times and challenges in implementation and maintenance.

To overcome these limitations, **real-time computations were integrated using the Julia** programming language via a custom InfluxDB API, enabling more advanced and efficient data processing. The new infrastructure is designed to collect, process, and visualize plant data in real time with improved performance and scalability.

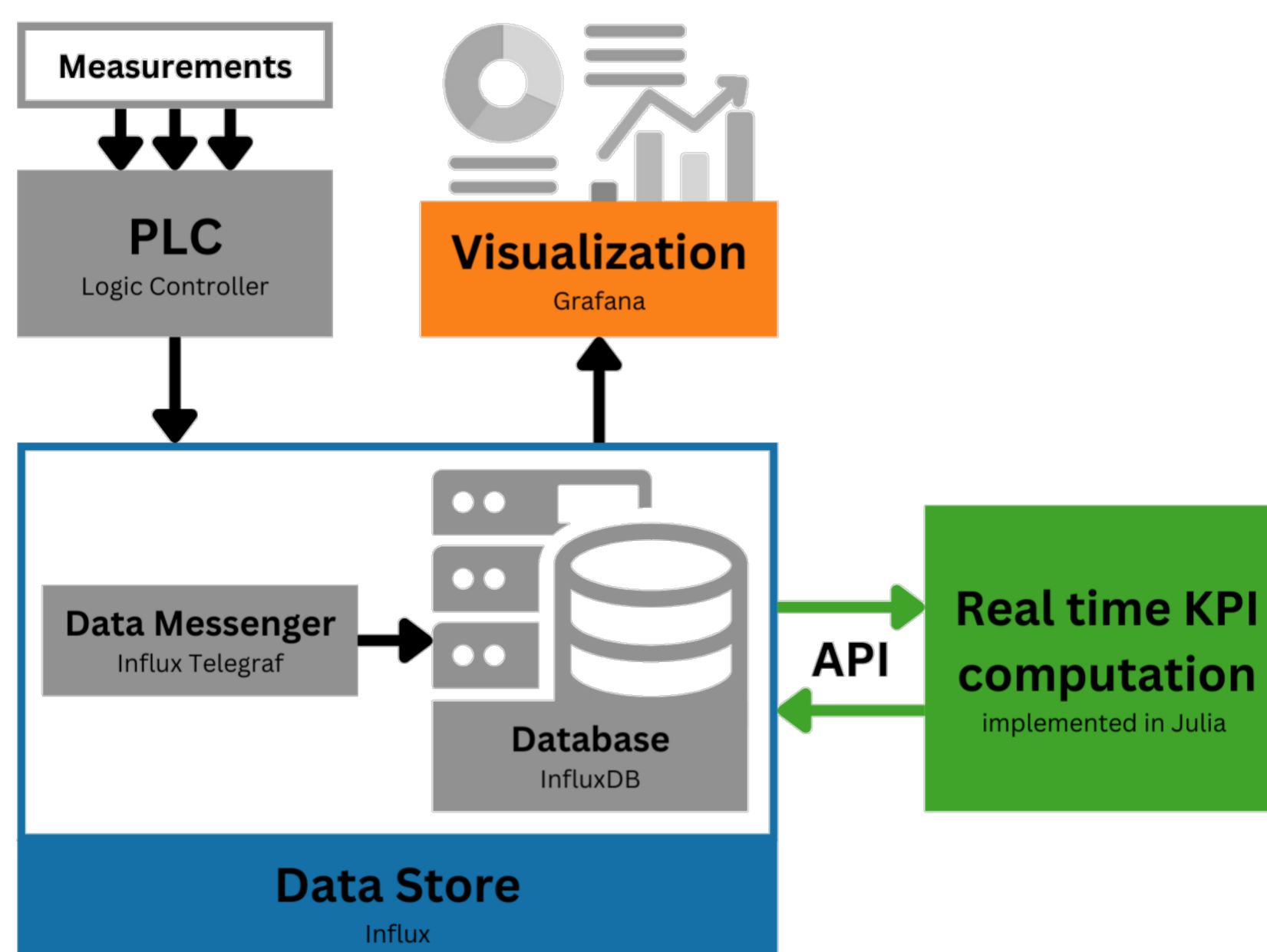


Figure 1 – Visualization of the implemented IoT infrastructure for the control and analysis of plant data

### Data Storing

Data collected from the plant via Programmable Logic Controllers (PLCs), including measurements like temperature, pressure, and flow rates, are collected and stored in our **InfluxDB** time-series database via **Telegraf**. This setup ensures that all data is centralized, highly

accessible, and ready for real-time analysis and visualization, streamlining monitoring and decision-making processes.

### Data Processing

Once the data is stored in **InfluxDB**, it can be accessed via the **Julia API** to perform complex calculations. This allows not only insights from historical data but also the **online calculation of KPIs**. Additionally, it opens up possibilities for more advanced applications, such as using machine learning models for predictive analytics and anomaly detection, as well as creating digital twins — virtual models that mirror real-time plant operations. These capabilities provide deeper insights, enhancing predictive maintenance and process optimization in real time. The new IoT infrastructure moves us beyond basic visualizations to proactive, data-driven decision-making.

### Data Visualization

The processed and raw data is then visualized using **Grafana**, a powerful, user-friendly visualization tool. Grafana pulls data directly from the InfluxDB database and displays it in real-time graphs, allowing easy monitoring and control of the plant. It also enables users to customize dashboards and track key performance metrics effortlessly.

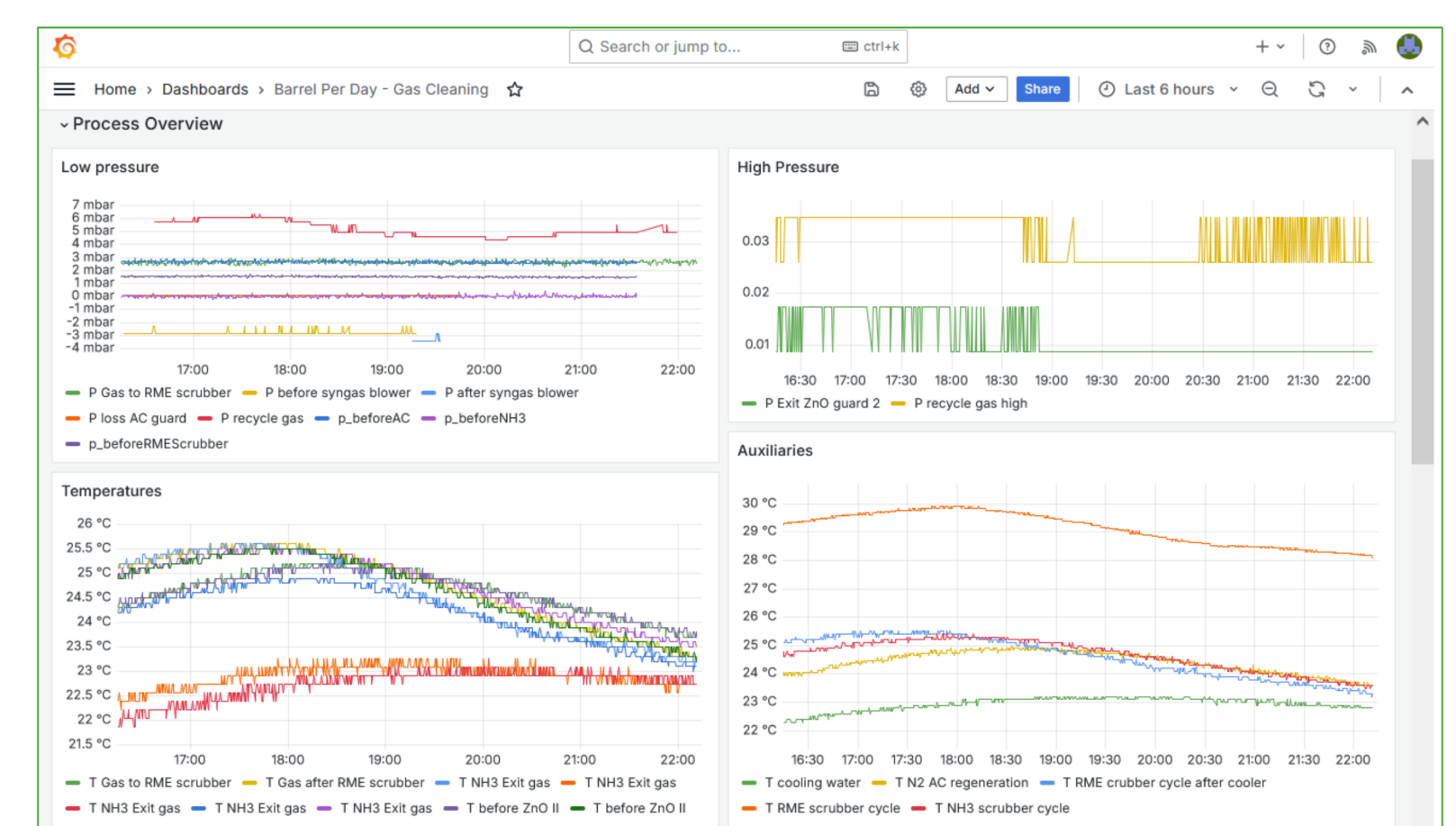


Figure 2 - Example of real-time graphs for the syngas platform in Grafana dashboard. Access it with your BEST credentials with PC here:

<https://sigrafana.bioenergy.local/d/adw9osfnk0pa8c/barrel-per-day-gas-cleaning?orgId=1>

### Conclusion

- Manual data analysis was replaced with an automated, flexible, and accessible **system for real-time monitoring and visualization**.
- A **Julia-based API** was developed to perform complex calculations, enhancing advanced data analytics capabilities, providing a foundation for future scalability and research.
- **Data is now easily accessible** through Grafana, which offers customizable settings and intuitive usability.
- The overall **IoT infrastructure** enables the researchers at the Syngas Platform Vienna to use the knowledge gained from data analysis within one research campaign. This speeds up the work of the researchers, finally leading to more targeted research.

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