DECEMBER 2021

CASE STUDY

MACHINE LEARNING APPLIED IN THE SUGAR FACTORY

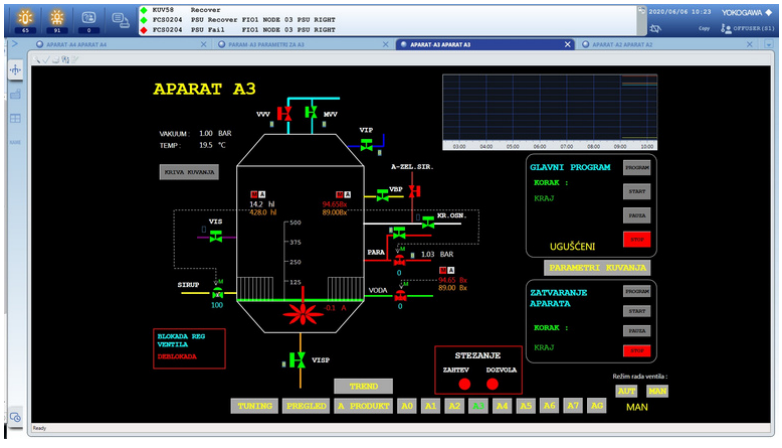
Improving control parameters and optimizing time and energy

The Sugar Factory Crvenka

The sugar factory Crvenka was founded in 1911 by an English-Hungarian joint-stock company, and from 2003 has been in majority ownership of the Greek Sugar Industry (EBZ). Annual production occurs at the surface of 12 to 14,000 acres, where the factories are supplied with approximately 600,000 t of sugar beet which employs its optimal capacity.

Project Objective

*The project objective was **to improve control parameters and optimize the time and energy** needed to crystallize sugar in vacuum apparatuses (A product). Thick juice is fed to the vacuum apparatuses and evaporated until saturated. Seed crystals are added during a strike to grow sugar crystals. The process is continued until a specified crystal size has been reached. The process is executed in batches in multiple apparatuses, time-shifted, with steam supplied from the same source.*



Challenges

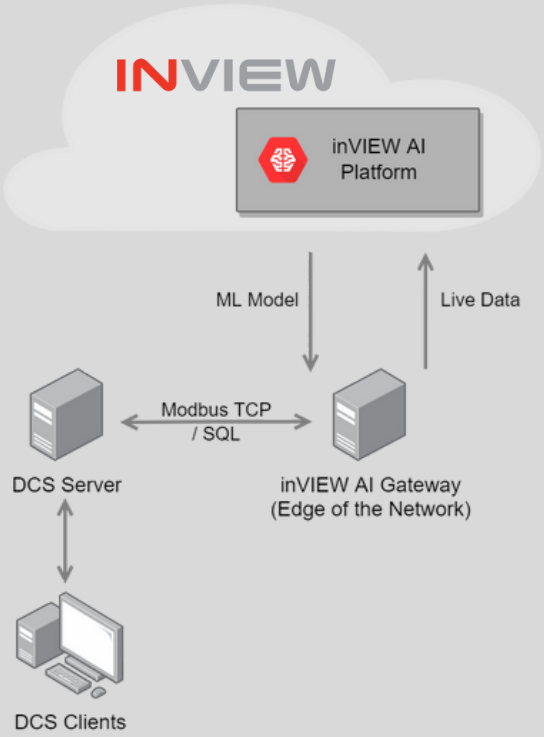
- Vacuum apparatuses have different geometry and characteristics in terms of heat exchange, levels, setpoints, age, efficiency, etc, without the possibility to measure or determine actual apparatus performances
- Classical control method (PID) was inapplicable to maintain levels and densities in apparatus at desired setpoints, due to many other factors which are changing within one batch, over a campaign period, and between campaigns
- The time needed to finish a batch was unpredictable for each apparatus, which led to piling up of apparatus to be discharged
- There was a strong influence of work crew experience on the process outputs and efficiency

Converting raw data into business intelligence

Solution

Existing control logic needed to be enhanced by machine learning to improve process performances in ever-changing process conditions.

The inVIEW IIoT Platform is being used as a tool of choice to create, train and deploy machine learning models into an existing control system (Yokogawa DCS).



The Edge-of-the-Network device was connected to the existing control system, which enabled real-time data acquisition and connectivity to the inVIEW Cloud. Machine learning models were being trained in the Cloud environment and deployed back at the Edge-of-Network device to be consumed by the control system.

Control valves are being operated by the ML model outputs, and the optimal moment to start a new batch is based on ML model recommendations.

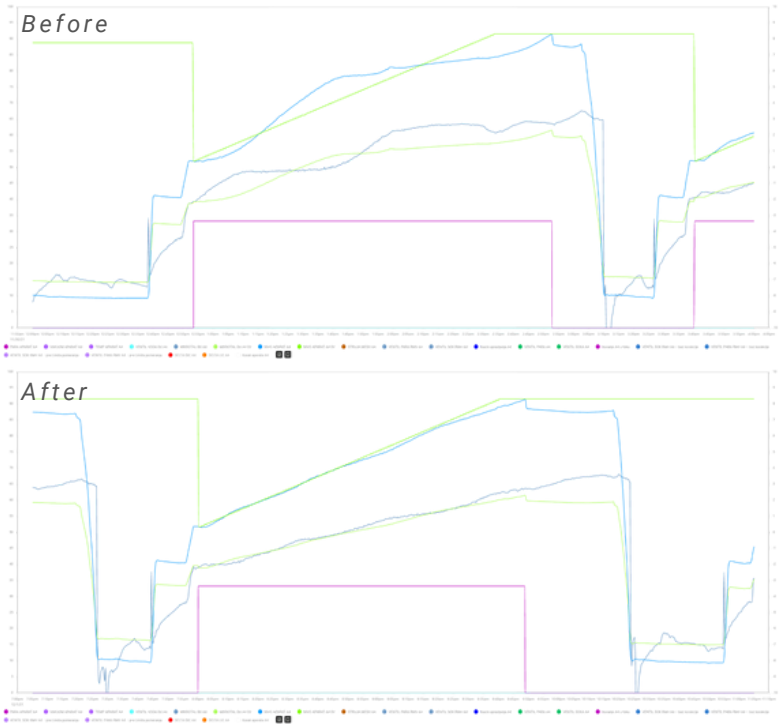
The deployed system has self-adaptive and self-learning features embedded to keep the system performance at its best in each subsequent batch.

Results

Following results are achieved:

- significantly improved control accuracy (up to 67%)
- shortened process time for each batch (8% in average)
- significant energy savings
- performance repeatability in subsequent batches
- independence of workforce experience

Process performances diagrams before and after system implementation are given below.



The user interface was upgraded with improved analytics tools.

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