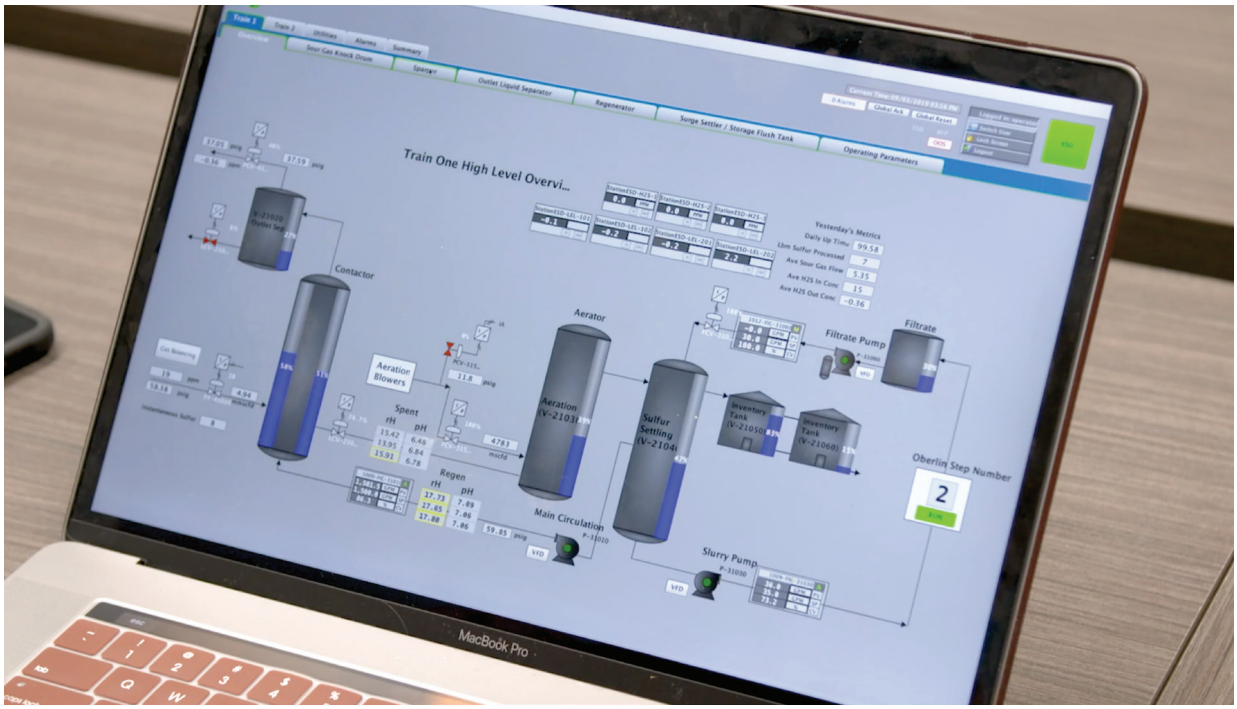
Ignition Firebrand Award-Winning Project

Edge and MQTT Help Convert Toxic Gas to Sulfur



Project Scope

- Tags: 400
- Screens: 20 (Large Systems)
  25 (Mobile Systems)
- Clients: 3
- Alarms: 1200
- Devices used: 1 AB PLC + 1 Moxa + 1 ProSoft per project
- Architectures used: Hub & Spoke
- Databases used: 6 (4 Edge, 2 Cloud) x 2 DB each in PostgresSQL
- Historical data logged: 1800 per project, recorded each second (for most values)

Project Overview

Streamline Innovations operates natural gas treating units in South and West Texas that convert hydrogen sulfide (H2S) into fertilizer-grade sulfur. Hydrogen sulfide is an extremely toxic, explosive chemical found in most natural gas.

Streamline is using Ignition to facilitate the automation of three semi-autonomous, mid-sized units, one large-scale gas treatment facility, and several fully autonomous skids, all with full remote bi-directional control and historian data collection. Ignition will be used at several new locations as well.

H2S is found in about 50 percent of all natural gas wells worldwide. Streamline Innovations has developed a unique chemical technology that converts H2S to elemental sulfur, which in turn

can be used for agricultural applications. This chemical technology has been tried commercially before, but it hasn't been profitable due to operational difficulties.

Streamline has circumvented these issues and has made the Valkyrie Process an attractive solution to H2S removal due to updated chemistry, modern surfactant additives, and a robust but complex control and automation system, which includes the Ignition software platform. Streamline operates at three different scales: 1) unmanned "small" units that treat 200-2,000 pounds of sulfur per day and are roughly the size of a large truck; 2) manned "large" units that treat 20,000 pounds per day or more and are the size of a football field; and 3) completely autonomous "micro" units that are single pieces of equipment in remote locations which perform ancillary tasks.

Problem: Streamline's small units remove H2S from individual wells, typically in remote locations, for which constant human operation would be too costly for commercial operation and travel to the site; simple maintenance issues could take hours. Streamline's first approach with these units employed an automation platform written on a standard PLC, but this did not enable complex calculations to provide model-based controls (and therefore semi-autonomous operation), nor remote control of the unit should a problem arise.

Streamline's larger plant-sized units are complex enough to allow for 24/7 manned operations, but still require real-time analysis of the process, access to the HMI from operators on-site, and remote access to data by office engineers.

Finally, Streamline's micro units require low-cost, basic automation with remote access to data and local access to an HMI without any additional equipment or resources that make traditional PLC-based automation prohibitive.

Solution: For the small units, Streamline employs a classic Ignition hub-and-spoke configuration, wherein Ignition Edge runs locally on a Moxa device, which in turn communicates with the Ignition server in the cloud via MQTT. Streamline has also built a mobile web app to allow operators and employees to access the data from the unit, including all historian data and full bidirectional control, for any authenticated user.

Running in parallel are a number of Python scripts that allow complex calculations — such as fast Fourier transforms on pump vibration and weather forecasts downloaded from the National Weather Service to determine optimal operating temperature — something that would otherwise seem impossible with a PLC. Furthermore, auto-notifications of alerts are sent via Twilio to operators and operations engineers when issues arise.

For the large units, Streamline has further extended Ignition's capabilities by running a full version of Ignition with Perspective locally. This was done because 1) the larger units allowed more budgetary resources to install a full version; 2) the client wished to retain the historian data locally, and; 3) this configuration allowed for the elimination of dedicated HMIs, as any computer or tablet can access Perspective to function as an HMI. To this end, an ad-hoc wi-fi network was installed to allow operators to use an iPad or tablet in the field to function as a handheld HMI. Streamline is in the process of connecting this server to the Cloud Server, which allows integration of the data into a single repository.

For the micro units, Streamline has eliminated the PLC entirely, employing a Moxa box and Ignition Edge to manage the I/O, supplemental Python code to perform any necessary calculations, and MQTT to convey data back to the cloud server.

Results: Streamline found that Ignition, MQTT, and Moxa facilitate its control and automation process, data collection, and remote control for operations.

For the small units, the uptime has reached 99.7 percent, due to the ability to start, stop and restart the unit remotely, monitor issues, and auto-notify via SMS.

The one-second resolution data acquisition has allowed Streamline to develop models to improve the accuracy and performance of the unit, reducing chemistry costs by 15 percent.

Streamline will employ Machine Learning algorithms run on Python on top of Ignition to provide advanced control efficiency and a

self-tuning system, increasing operational efficiency even further.

For the large units, the uptime is more than 99 percent, and the custom HMI screens were designed for local operation at specific areas around the unit, so that operators can have detailed control during maintenance.

During commissioning, the functionality checks were done remarkably faster because the HMI was accessible by the integrator at the instrument, rather than requiring a two-person operation.

For the micro units, intelligent control was deployed without significantly increasing cost, allowing operators to visit the site weekly rather than daily, and reducing downtime from an unknown value to a consistent 98-percent uptime.

Additional Information: The HMI and mobile screens were designed by a recent college graduate. Within six months, he became proficient at building and deploying screens both on the mobile Ignition page and the large plant HMI.

Streamline has also developed "HMI on a Stick," which uses an Amazon Fire Stick or Linux Stick Computer with only an HDMI output to turn any television into a unidirectional HMI. This has been given to clients who have been delighted with its ease-of-use, as well as by operators and management to monitor operations when at home or in a hotel room.

The Ignition interface has allowed remote viewing and access to sites securely, and limits the access to the casual user. Authentication to access the bidirectional control is limited to select employees, and even with that access the remote operator is limited in the ranges and set points he or she can apply. This ensures that only the senior PLC programmer and the programming team has access to the actual HMI and the instruments. This has limited the risk of cybersecurity attacks and makes the system more secure.

Streamline's future goals are to extend the technology to other standard oilfield equipment to create "smart" skids or plants, such as a Smart Amine Plant, a Smart J-T skid, a Smart Glycol Dehydration Unit, and even Smart Compressors and Separators. The larger units will still require a PLC to handle the high number of I/O akin to the small or large Streamline units, but the smaller systems such as a separator or J-T skid can use a configuration similar to the micro units. With a lower price point than a traditional PLC-HMI-SCADA, it now becomes feasible to automate such units. If they are using Machine Learning to tune themselves, they become truly intelligent systems that require minimal human operation.

From there, it becomes possible to have skid-to-skid communication via an Ignition server in the cloud with a stronger, more robust Python AI server managing the entire facility. With auto-recognition and system-wide self-tuning, upstream and midstream surface facilities can operate with maximum efficiency and minimal costs.

Project Created For: Streamline Innovations

Streamline is a technology solutions company focused on water & gas treatment and process improvements in the oil & gas, utility, and industrial markets. Streamline was originally founded to treat produced water and to remove H2S from natural gas in the upstream space. Deploying advanced treating capabilities, differentiated product lines, specialty chemicals, and a solutions-driven team, Streamline now delivers innovative solutions to a variety of problems and operational challenges by leveraging its significant in-house experience and expertise to multiple markets.

www.streamlineinnovations.com

Watch the video case study at:
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