Use Cases

General Atomics

Fledge in Manufacturing
Situation Awareness – Aircraft Paint Booths

A large defense and technologies company with more than 15,000 employees worldwide. They are a leading manufacturer of unmanned aerial vehicles (UAVs). These UAVs can be remotely piloted from anywhere in the world and are capable of very long duration, high altitude flights while carrying significant payloads. They are widely used by world militaries for intelligence, surveillance and offensive operations as well as by civilian organizations for border enforcement, firefighting and scientific applications.

The Need: UAVs are crafted from composite materials in an exacting process that demands high degrees of precision. If any step is executed under improper conditions, the entire aircraft may need to be reworked or even scrapped. The client wants to instrument every aspect of the manufacturing process to ensure that it is performed correctly and efficiently. By doing this, they expect to increase quality while reducing expenses from rework and scrappage. To completely monitor the production process, the client expects to deploy hundreds of sensors across multiple manufacturing stages. Data from these sensors must be available to personnel on the production floor, to supervisory personnel and for historic review.

The Solution: The key requirement for the project was a data management solution that could collect readings from hundreds of heterogeneous sensors and reliably transmit information to the multiple information systems that require it. To accomplish this, the client selected Fledge supported by Dianomic Systems. Fledge is an LF Edge Open Source project for industrial IoT that collects data from sensors, processes it at the edge, alerts and delivers it to data systems or the cloud. The client integrated Fledge with their existing operational systems to provide central monitoring and historical archiving. The initial stage of the project was to monitor the UAV painting process. UAVs are painted with multiple layers of primer and topcoat. These must be applied within strict ranges of temperature and humidity to ensure proper drying and curing. The client instrumented each paint booth with 4 temperature and humidity sensors one set in each corner. These sensors are attached to A/D converters and then to Fledge software running on Advantech Embedded IoT Gateways.

Fledge software converts the sensor readings to JSON format and reliably delivers the data to OSIsoft PI. In addition, Fledge connects with local displays at each paint booth to display temperature and humidity information on the factory floor. The display is green/red color coded to alert production personnel when environmental conditions are appropriate to begin the painting process.

The Results: Fledge-based monitoring has enabled the client to optimize the UAV painting process. Production now immediately begins when environmental conditions are met, eliminating the delays caused by manual measurement and communication. Supervisory personnel are alerted when conditions move outside specifications and can immediately rectify the situation. Further, manufacturing engineering now use historical data on temperature to better plan cycle times and to identify cost saving opportunities such as insulation and cooling devices. With the pilot project complete, the client is now moving towards their vision of complete visibility into the entire production process. Fledge’s open architecture will enable them to easily integrate the large numbers of varied sensors needed to ensure their operations are highly reliable and productive.

The next stage is to monitor autoclaves as they press and cure composite materials into UAV components. The client wants to review autoclave operations to ensure they have precisely executed the series of temperature/pressure/time stages necessary to eliminate bubbles and create structurally sound components. With the Fledge and PI infrastructures already in place, deploying monitoring for this process will be as simple as attaching additional pressure and temperature sensors to the Fledge gateways.

Link to Recording (Disclaimer: Foglamp instead of Fledge is used since it predates Fledge 1.8).

Jacksonville Energy Authority - A Leading Electrical Utility
This Fledge client is one of the largest community-owned electric utility companies in the United States, servicing nearly 500,000 customers in the United States. It operates five generating plants, about 750 circuit miles of transmission lines and nearly 7,000 miles of distribution lines. It also purchases energy from several solar sites located across its service territory, including one producer with more than 200,000 solar panels.

Reducing Reactive Repairs

The electrical utility spends millions of dollars on transformer maintenance each year. Much of this expense results from emergency responses to restore service due to failures in the field. They wanted to reduce these reactionary expenses and move to a proactive model where they could forecast systems requiring maintenance before failures actually occur. This will allow them to decrease outages while saving money by using their maintenance crews more effectively. Proactive maintenance requires a great deal of instrumentation and trend data on each transformer. This information needs to be available to multiple organizations across the enterprise for planning, analytics, monitoring and scheduling.

Fledge Enables Predictive Maintenance

The company decided that IIoT technology offered the best solution for this project. While they considered leveraging existing SCADA systems, they determined the cost to scale the hardware and licenses for these systems would be excessive. Further, security and NERC CIP regulatory concerns made it challenging to provide broad access to data residing in SCADA. Because of this, they decided to focus their SCADA systems on operation and controls and to use IIoT for condition-based monitoring and maintenance.

The company deployed Dynamic Ratings B100 Electronic Temperature Monitors at their substations. These measure power transformer top oil temperature and LTC temperatures and calculate winding temperatures. In addition, they made use of existing fan sensors to monitor ambient temperature.

To manage the edge data, the utility deployed Fledge, the Linux Foundation’s industrial IoT edge project supported by Dianomic Systems. Fledge is an open, industry-wide solution for monitoring the Internet of Things that collects data from sensors, processes it at the edge, alerts and delivers it to data systems or the cloud. Fledge’s open-source architecture provides a rapid, low-cost way to achieve complete visibility into information needed by businesses to operate more reliably and productively.

Fledge collects data from multiple B100s at the substation. It reliably delivers the data to OSIsoft PI for long-term trending, visualization, advanced analytics and event detection.

Because of Fledge’s open nature, the company was able to deploy it on their existing Cisco 4000 integrated services routers, saving the expense of additional ruggedized hardware.

Lower Costs and Fewer Outages

Fledge-based monitoring has enabled the utility to move to a much more proactive maintenance strategy. From OSIsoft PI, they can now detect the warning signs of transformer core, coil and LTC switch failures. Further, PI analytics can calculate cumulative thermal aging of the transformer to forecast life expectancy. Crews can be scheduled to perform maintenance before a failure occurs, resulting in much lower costs and less downtime.

The implementation has proven to be highly cost effective. Fledge’s flexibility enabled the company to leverage all its existing edge and back-end systems. Other than sensors, no new hardware was required for the deployment.
The utility plans to leverage Fledge’s flexibility to support additional IIoT use cases for field data management, integrating additional sensors and edge-based analytics to identify service requirements. Using Apache Kafka, Fledge will integrate with Oracle ERP to automatically generate maintenance work orders.

**Google and Honda GT3 Racing** - See LF Edge Blog Post

**Fledge and Digital Twins w/ML**

**Breaking GT4 Track Records**