Case Study

GE Detects Early Defects and Improves Capacitor Production Yield with Edge Intelligence

The World's Largest Digital Industrial Company

General Electric Company operates as a digital industrial company worldwide. It operates through Power, Renewable Energy, Oil & Gas, Aviation, Healthcare, Transportation, Lighting, and Capital segments. The Power segment offers technologies, solutions, and services related to energy production, including gas and steam turbines, engines, generators, and high voltage equipment; and power generation services and digital solutions. General Electric Company was founded in 1892 and is headquartered in Boston, Massachusetts.

Hard to Detect Capacitor Failure Conditions Reducing Yield, Increasing Scrap

GE was facing multi-million-dollar scrap problems due to limited real-time insights into the entire production process. They believed they could significantly improve the yield and reduce the scrap of their manufacturing operation by analyzing the large amount of RFID sensor data being produced by 30+ machines during the production cycle. This included correlating processing data in real-time from several sources to create an edge intelligence layer with FogHorn for real-time condition monitoring throughout the production process. The goal was to identify defects early, quickly determine root cause, and speed remediation actions to improve yield and reduce scrap costs.

FogHorn Edge Intelligence Senses Defects Early in Production Cycle, Improving Yield, Reducing Scrap

To solve its multi-million-dollar scrap problems, GE asked FogHorn to apply its analytics expertise to help improve manufacturing yields. FogHorn developed a solution using its complex event processor to transform raw, streaming machine data combined with RFID into actionable part and process quality characteristics.

Challenges

- Hard-to-detect failure conditions reducing yield and increasing scrap
- No real-time monitoring of large amounts of sensor data
- No OT-centric analytics for manufacturing team members

FogHorn Solution

- FogHorn VEL™: Real-time analytics on winding machine sensor data
- EdgeML™: ML on normalized data streams for real time failure alerts
- Iterative refinement of VEL analytics and ML models to assist operators

Benefits

- Improved yield, reduced scrap
- Real-time condition analytics delivered to OT staff
- Smart, not scheduled maintenance

The first challenge was to improve pack press monitoring. Traditional statistical process control (SPC) requires an operator to interpret and enter machine force data, very time consuming and error prone. Traditional cloud-based analysis also relied on significant amounts of data transfer. FogHorn was installed to automate the interpretation of the machine data, such as press force, and create a new stream of minimized rich data at the edge that only contains the characteristics of each run. This rich data is sent to the Cloud and pushed directly to back to the edge to create real time process feedback.

The second challenge was related to oil fill. The oil fill equipment allows operators to select from two oil types while filling. The correct oil type depends on the capacitor design. The machine can't look up the correct oil type, making this process prone to mistakes. The FogHorn solution automated this process by serial number discovery, where when a newly loaded serial number is detected, it's sent on a request stream to a responder that replies back with the correct oil type. This prevents operators from using incorrect oil types by writing a value back to the PLC.

The final step is the treat oven, where serial numbers during specific loading events are needed. But RFID antennas were picking up random events throughout the day. The FogHorn solution accepts input streams from both RFID antennas (MQTT) and equipment sensors (OPC-UA). The MQTT stream is filtered by equipment signals in real time, creating a new stream of specific loading events with serial numbers. This stream can provide data for MES, APM and other applications.

Ultimately, the FogHorn solution was applied to 35 machines, 13 individual processes, and 33 RFID readers throughout the plant. With the use of this solution, the plant engineering team discovered and acted on several opportunities for optimization. Yields increased by 8%. Because FogHorn analytics run at the edge, this solution required only a few percentage points of bandwidth vs. a cloud-only architecture.

"FogHorn set the tone early in edge intelligence and machine learning for IIoT by shifting the mindset of "cloud first" to "edge first. Now, you can see it extending its leadership position with "edge to cloud" to deliver the most powerful and cost effective approach to edge AI for industrial organizations."

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