Case Study

FOGHORN

Schindler Optimizes Elevator Performance with On-board Edge Computing

Schindler is Moving the World

Schindler moves over 1 billion people per day. They are one of the world's leading providers of elevators, escalators and moving walks. The #1 priority of Schindler is to ensure the safe and smooth movement of their passengers throughout the decades their products are in service. Schindler is investing in advanced digital solutions for elevators and escalators, that enables higher uptime, thorough insights, and greater convenience.

Schindler recognized the value in analyzing the 2.5 GB of sensor data each elevator produced daily to anticipate maintenance needs, avoid downtime, minimize expensive repair and replacement costs, and ensure a high level of customer satisfaction.

Constrained Computing Environment and Costly Communications to the Cloud Presented Challenges

One of the first realities was that cloud-based solutions would not scale to address Schindler's challenges. The simple cost to move 2.5 GB of data a day over a 4G cellular connection for over a million elevators would be untenable. Not to mention the costs of cloud storage for all of this data. And given the number of elevators in service, no new equipment could be cost-effectively added.

The solution required adding edge intelligence to each elevator's core motion sensor kit (MSK,) a small ARM-based gateway with 200-300 MB of available memory that monitors temperature, humidity, 3-axis accelerometers, braking and other data.

Challenges

- Monitor 1.5M+ elevators / escalators deployed globally
- Limited communications / compute resources
- Mine sensor information for actionable insights
- Reduce inspection / repair fees of ~ $2K/event

FogHorn Solution

- FogHorn installed on existing motion sensor kits, <1 Gb footprint
- CEP time-aligns state and activity data in <20 lines of code
- Support for 40+ ML models to generate predictive alerts

Benefits

- Smart, not scheduled, maintenance
- Reduce costly repair and servicing
- New managed service revenue
- Reduced bandwidth costs transporting data to the cloud

Delivering Powerful Data Enrichment and Machine Learning in a Small Footprint

After deploying the FogHorn Lighting Platform in the MSKs, the first step was to rapidly ingest elevator sensor data, including accelerometers (x, y, z,) cabin pressure and door status. This data was then fed into FogHorn's real-time streaming complex event processing (CEP) engine to align, up-sample, interpolate, populate missing data and pre-process data for downstream machine learning.

This was implemented 100% in Vel, Foghorn's Pythonic, SQL-ish, English reading-like language and platform written specifically for low-footprint, low- latency (milliseconds) advanced edge IIoT analytics. Vel was designed from the ground up to enable not only powerful and highly complex analytic expressions to be executed on streaming data (like a turbo charged dynamically programmable rules engine), but VEL also cleans, filters, normalizes and aligns streaming data to allow any machine learning or AI models to be executed on the real-time processed metadata.

Next, the aligned real-time data was fed into a door event detection algorithm. The data would be processed and run against a Hidden Markov model (HMM) to detect various door states and duration. Vel was used along with FogHorn's Lightning EdgeML™ machine learning software.

Finally, with the door event data ascertained, business rules could be implemented in Vel to detect door state anomalies and raise service alerts as necessary.

The new insights into elevator activity from FogHorn's edge intelligence platform will enable predictive and pre-emptive maintenance for Schindler and their customers, improving elevator uptime and decreasing service disruption and inspection and repair fees of ~ $2,000 an event.

Additionally, the Schindler data science team can cut down their development time drastically. What once took multiple days or weeks to develop in Python code (2,500 lines) can be done in hours with FogHorn's Vel (65 lines,) significantly increasing the speed of development and regression testing.

This drastic simplification in development is perhaps the most significant benefit from the FogHorn Lightning Platform. New levels of iterative learning and improvement are now possible allowing OT experts to apply their domain expertise and impact the business in real-time.

By using an edge solution and analyzing real-time data at the point of origination, only the most meaningful insights – aggregated, summarized, and characterized – would be sent to the cloud for further analysis.

"Using innovative technologies such as the Internet of Things, Edge computing and advanced analytics, we can offer customers and passengers real-time data, insights, enhanced reliability and convenience."

Michael Nilles, Chief Digital Officer of Schindler