Lumada Industrial DataOps Reduces Equipment Failures and Scrap for Manufacturing Organization

Challenge: The company was experiencing frequent equipment downtime caused by machine failures.

Solution: Plant-floor solution deployed sensors, PLCs and video analytics to gather information needed for monitoring.

Outcome: Deeper visibility enables early detection of machine failures, efficient material movement and improved worker productivity.

Challenge

This metals industry manufacturer deals with the production of powder-formed solid metal components, such as valves, pulleys, sprockets and other products for a wide range of industries, from automotive to recreational. The company had a classic brownfield environment with various types of equipment from multiple automation vendors, which were not connected or lacked open interfaces. This situation led to some operational issues that critically impacted productivity of the manufacturing plant.

The company was experiencing frequent equipment downtime caused by machine failures. Since supervisors had poor real-time visibility into the production line operations, machines would often break down unexpectedly for a significant duration of time without triggering any corrective action. Shop-floor visibility was a key requirement to address this issue.

Furthermore, the plant was experiencing excess waste from scrap metal due to quality issues that were detected too late. From a system perspective, integration of IT and OT systems was nonexistent. Systems operating in silos led to a disconnect between manufacturing applications; for example, production scheduling could not reflect the shop floor conditions, such as machine availability.

Outcomes

- Minimizes equipment downtime.
- Moves material more efficiently.
- Improves worker productivity.
- Reduces scrap metal by 3%.
Solution

The company was able to transform its work and operations, reducing cost and risk. The overall IoT solution connects multivendor devices and processes multiple types of data, including video, vibration and acoustic. The solution also integrates Information Technology (IT) and operational technology (OT) systems, including enterprise resource planning (ERP) and programmable logic controllers (PLCs), and runs advanced analytics on the edge and in the cloud. It enables the manufacturer to predict the remaining useful life (RUL) of assets and to detect early potential machine failures.

The Solution Offered the Following Capabilities

IoT Device Management

Deployment and management features in IIoT Core Software allow provisioning and life-cycle management of deployed devices. All edge devices, including the gateways and appliances, can be managed remotely.

Integration Tools and Management

IIoT Core Software collects the sensor, PLC and video camera data and allows it to be ingested into the edge server through the Ethernet or IP network. PLCs are connected through a SCADA API as well as OPC-DA with a converter to OPC-UA. Sensors are connected through an IoT gateway through converters. The data in the edge server is further ingested into the Lumada platform via MQTT. Raw data is stored both at the edge and in the platform tier.

IoT Data Management

Lumada is used for storing both edge- and cloud-sourced structured and unstructured data and analytics results. Data storage is distributed across six IoT gateways, edge deployment and Amazon Web Services (AWS) cloud-based platform tiers running Lumada and is made available on an as-needed basis to applications.

High-speed, high-volume data (such as video, vibration and sound) mostly resides at the edge. All unstructured data, such as video, resides in and is analyzed 100% at the edge in real time. Results from unstructured data analytics are also made available at remote locations.

Structured data, such as production information from a manufacturing execution system (MES) or ERP systems and machine production statistics from PLCs are streamed into the platform as well. This approach makes the data available to a large group of stakeholders from different departments for visualization and analytics. Other structured and unstructured data, such as sensor data from vibration and acoustics sensors, where volumes are large, are analyzed predominantly at the edge in real time, and analytical results are made available to the cloud-based platform tier.

At the Edge Tier, the System Uses

- Shop-floor monitoring via video and the PLC data: This application monitors machine, material and worker behaviors and raises an alert when an abnormality is detected. It helps with mean time to detect (MTTD) and mean time to repair (MTTR) analysis of unscheduled machine downtime. It also provides results on worker flow analysis, worker productivity analysis and material movement monitoring (for example, raising alerts when the robotic arm makes incorrect material placement).
- Machine monitoring using vibration and PLC data: This application is for predicting the RUL for lathe machining tools.
- Production line monitoring using the acoustic and the PLC Hitachi Vantara data: This application detects anomalies in production line operations by observing noise generated by different components during a given production cycle. It uses acoustic signals with PLC data and then uses artificial intelligence (AI) to learn acoustic patterns corresponding to normal and anomalous situations.

At the Platform Tier

The application analyzes production data coming from ERP (IT data) and PLCs (OT data). Lumada performs cross-linking of shop-floor activities and ERP system data for production monitoring and forecasting of the delivery time to the customers. This approach helps to break the silo between the IT and OT systems and provide the single source of truth, improving the integrity of manufacturing applications.

Application Enabling and Management

Using Lumada, data-driven insights are shared and consumed through multiple means:

- Developing dashboards that show the performance against various process key performance indicators (KPIs), based on the collected data.
- Setting up alarms when the KPI is violated.
- Creating the user interface (UI) for operators and supervisors to enter a reason for the delay and downtime.
- Developing and publishing mobile apps for the stakeholders to receive real-time alerts. The company is also looking to use Lumada to build, package, deploy and maintain microservices applications.

Security

Sensor-layer security solution analyzes various KPIs on network behavior (delay, jitter, route followed) as well as payload characteristics, to determine when a potential breach occurs. Role-based access control (RBAC) is provided against data, dashboards and configuration for all Lumada platform services. Encryption is provided through SSL/TLS for data in transit.
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Outcome
Deeper visibility enables early detection of machine failure, resulting in minimal equipment downtime, efficient material movement, and improved worker productivity. The waste from scrap metal was reduced from 6% to less than 3%. Overall, the deployed data-driven approach helps to predict RUL of the company’s machines and optimizes its production line operations.

Learn More
See how Lumada Industrial DataOps can unlock operations capacity.

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