



USE CASE

Lumada Edge Intelligence Reduces Equipment Failures and Scrap for Manufacturing Industry Organization

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

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

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

The Challenge

This metallurgical 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 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.

The Solution

With Lumada solutions for digital innovation from Hitachi as well as Hitachi Vantara's Pentaho Data Integration, 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 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.

INDUSTRY

Manufacturing Industry

SOLUTIONS

Digital Transformation, Digital Workplace, Data Management

HARDWARE

Hitachi Advanced Server DS7000

SOFTWARE

Lumada Edge Intelligence
Pentaho Data Integration

APPLICATIONS

Build and operate a data lake with business analytics.

SERVICES

Co-Creation Services From Hitachi Vantara

Outcomes

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

The solution offered the following capabilities:

IoT device management. Deployment and management features in Lumada Edge Intelligence 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. Lumada Edge Intelligence 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 to the IoT gateway through converters. The data in the edge server is further ingested into Lumada in the 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 regions for visualization and analytics. Other structured 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 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 was 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.

The Outcome

Lumada provides drag-and-drop, low-code environments for data management and dashboard building to simplify the condition-based maintenance and process visibility. For example, the company gains the visual layout of the deployed IoT system with regards to OT assets, as well as a live status of various modules running in each IoT gateway and edge deployment.

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 optimize its production line operations.

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