Aircraft component manufacturer introduces predictive maintenance

Intelligent, edge-based predictive asset maintenance solution minimizes production downtime and maximizes ROI

Modern manufacturing is a demanding and resource-intensive industry that regularly requires significant capital investment to obtain specialized equipment to support production processes. When performing optimally, the manufacturing equipment offers a substantial return on investment. However, unexpected downtime due to equipment failure results in lost revenue opportunity.

In the face of very tight revenue and margin pressures, uptime is everything. A mission-critical manufacturing process requires a highly effective monitoring system that not only detects equipment problems in real time, but also has the built-in intelligence to anticipate those failures before they happen.

For these reasons, manufacturing companies increasingly adopt internet of things (IoT) solutions to collect operational data for improved predictive analysis to help mitigate the risk of unplanned and unscheduled maintenance or equipment replacement.

Customer manufacturing challenges

A major European aircraft component supplier encountered this challenge first-hand. A mission-critical, programmable milling machine failed, halting the organization's production process. Despite the customer team's expertise, the problem proved challenging to diagnose. At first, it appeared the downtime resulted from a damaged spindle, the most complicated part of the milling machine. However, a costly and time-consuming spindle replacement did not correct the situation. The team was forced to perform an extensive system evaluation to identify the culprit.

Overview

Customer: Aircraft component manufacturer

Industry: Manufacturing

Location: Europe

Client Challenges / Business Need:

An aircraft component manufacturer wanted to create and implement a robust equipment monitoring and analytics solution to provide proactive, real-time insights

Results:

- Rapid return on investment
- Intelligent insights to maximize equipment life cycle and performance
- Significantly reduced risk of equipment downtime
- Automated alerting should mission-critical components require immediate attention

The two-month investigation ultimately indicated an electrical issue as the source of the problem. Unfortunately, that lengthy period of unexpected downtime proved costly for the company.

This high cost of downtime demonstrated the urgent need for a solution to prevent this type of failure in the future. The manufacturer required better insights to monitor its programmable milling machines, improve the operations process, and enhance system performance. In addition, the organization needed to increase system availability to maximize its revenue potential while minimizing safety risks associated with equipment failures.

Predictive solution requirements

The manufacturer needed an efficient, prediction-based monitoring system that could prevent another catastrophic failure and had several requirements for a practical solution:

- A monitoring system that could capture real-time data related to the health of manufacturing equipment and assets

- Intelligent monitoring of data from production systems, coupled with the ability to identify abnormalities or potential problems in real time

- A mechanism to alert staff proactively, and offer specific actions for resolution should production problems require immediate attention

- The dexterity to improve operational efficiency by identifying condition-based maintenance needs, thereby avoiding unnecessary maintenance intervals

- The ability to detect system inconsistencies and allow maintenance staff to plan scheduled service, repairs, or parts replacement

- Machine learning, fueled by the capture of extensive production data, to enable longer-term process improvement.

Responsive and comprehensive Predictive Asset Maintenance Solution

Capgemini worked with the manufacturer to design an end-to-end predictive asset maintenance solution. By integrating real-time communication between the predictive maintenance application, system management, field service, and end users, Capgemini offered a comprehensive solution that significantly reduced the risk of a milling machine failure.

Capgemini's Predictive Asset Maintenance Solution with Edge Compute runs upon a world-class, security-accredited XIoT platform with Intel® architecture and Intel® IoT Gateways. The IoT gateways at the edge of a corporate network connect sensors and machines via programmable logic controllers (PLCs) to a public cloud solution that hosts the Capgemini Internet of Things (XIoT) platform, asset monitoring capability, and predictive maintenance applications.

The solution features multiple, integrated elements. By incorporating numerous XIoT devices and other monitoring applications alongside the milling machines, the maintenance solution can take a holistic view of the tools it oversees and identify the baseline characteristics for "normal" system operation. While milling machines remain within normal parameters, the system takes no action. However, should the monitoring system detect a deviation from the norm – such as changes in temperature, energy consumption, the number of spindle turns per second, or load on the spindle – its built-in analysis capability can automatically identify an appropriate course of action. Capgemini's solution can then alert and dispatch repair personnel, or send messages to alternate staff depending on the severity of the scenario.

People matter, results count.

The monitoring solution's machine learning capability also tracks accumulated spindle data to estimate the component's time-to-failure. Built-in analytics, reporting, and dashboarding features also help the manufacturer monitor its production assets closely, gain insights to optimize milling machine performance and lifecycle, and plan for future maintenance.

The solution also addresses various networking challenges. First, since the Capgemini monitoring solution uses edge computing for quicker response times and needs less network bandwidth for the back-end, the right information reaches the correct people very quickly. Secondly, the monitoring solution and its IoT devices maintain a consistent, hosted cloud connection to avoid dependence on an internal network. As an added safety measure, the built-in device management application continues its milling machine observations even if the network prevents communication. Finally, the solution is comprised of a modular, scalable, and security-accredited architecture to securely facilitate the addition of new machines.

Immediate solution benefits

After implementation, the holistic Capgemini Predictive Asset Maintenance Solution offered rapid proof of value for the manufacturer thanks to several inherent benefits. Because the solution detects behaviors that deviate from normal operations in real time, needed personnel are quickly notified and can solve problems before they occur. These features reduce the cost of outages and increase system safety.

The predictive capability also helps ensure the highest amount of uptime for the milling machines. The intelligent monitoring system watches for tiny performance deviations that indicate the future need for a planned service interval or new parts. It also ensures proper operation within the optimal efficiency range without over-stressing machines and causing unintended equipment fatigue. Capgemini's solution, therefore, minimizes equipment maintenance that causes expensive downtime, avoids overprovisioning of replacement parts, and extends the life of each milling machine.

Built upon an open IoT platform that connects any device, Capgemini's Predictive Asset Maintenance Solution with Edge Compute enables rapid IoT and as-a-Service model deployments, advanced security, the flexibility to choose a cloud provider, greater scalability to accommodate system growth, and works well with many applications.

For more information about this Intel® Market Ready Solution, please visit:

https://www.capgemini.com/resources/predictive-asset-maintenance-with-edge-compute/

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