Industrial IoT for predictive maintenance

New levels of insights for industry

aws

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Introduction

More companies in the industrial sector are implementing predictive maintenance solutions so they can know ahead of time when a machine is about to fail and avoid costly breakdowns and lost productivity.

AWS IoT has a network of AWS Partner Network (APN) Partners (ISVs and SIs) that build and deploy predictive maintenance solutions that run on AWS IoT services that are specifically designed for the industrial sector. These predictive maintenance solutions add value to the business by extending asset lifespan and effectiveness, and increasing worker safety. This eBook covers the benefits and challenges of Industrial IoT (IIoT) enabled predictive maintenance, and how AWS and partner solutions for IIoT-enabled predictive maintenance deliver valuable business outcomes to industry.

Preventing asset breakdowns by predicting them—the IoT way

Predictive maintenance helps industries understand the condition of their equipment and identify potential breakdowns before they impact production. IIoT offers new levels of predictive maintenance to industrial enterprises. Using insights from industrial data sources such as the equipment itself, environmental conditions, and human observations, industrial companies can determine the best actions to take—whether it's adjusting machine settings or using different sources of raw materials—to improve the quality of outputs.

With IIoT, industrial enterprises can assess the real-time health of diverse machinery such as wind turbines, blades, solar arrays, electrical power systems, hydroponic greenhouses, autonomous machinery, drones, actuators, and more. Then, they can determine the best fixes for asset issues to prevent costly business and environmental impacts and remove unnecessary maintenance cycles that can lead to excessive downtime and stymied production.

Throughout the industrial sector, performance insights can be used to influence decisions and actions that offer greater environmental and physical safety and security, drive efficiency and improve competitive advantage. Through real-time insights, predictive maintenance solutions are becoming more capable of assessing the state of a machine, anticipating further disrepair, and prescribing maintenance instructions—all while keeping valuable information and assets secure and workers safe.

Why hasn't IIoT-enabled predictive maintenance taken off?

Despite its business and operations to the industrial sector, there has been little enthusiasm for IIoT-enabled predictive maintenance in the past few years. A 2018 Bain and Company survey concluded that the enthusiasm for predictive maintenance enabled by IoT has waned in the two years since their 2016 survey[1]. The reason? Implementing predictive maintenance solutions is more difficult than anticipated for the following reasons:

- Current IT infrastructure lacks the scalability to handle increased data acquisition, processing and storage loads, and sophisticated modelling techniques characteristic of predictive analytics solutions.

- Companies in the industrial sector often take a cumbersome approach to maintaining asset health. This build-it-yourself method of integrating IIoT solutions to wring new value from asset data is difficult, expensive, and introduces risk to existing operations.

- Manufacturers, agribusiness, and other industrial producers are concerned that the machinery and sensor data transmitted, shared, analyzed, and modelled is not secure or could be accessed by unauthorized parties for nefarious purposes. These approaches and fears affect the ability of companies to extract valuable insights from the data.

- A combination of regulatory requirements, rising energy costs, and increasingly environmentally conscious customers create pressure to reduce energy consumption. However, many organizations in industrial sectors lack visibility into the energy they are using, nor do they understand what solutions are available that would enable them to reduce consumption.

Yet, not taking advantage of IIoT-enabled predictive maintenance has serious consequences. A lack of timely insight into processes, equipment, and asset performance and health prevents operations personnel from making the optimal decisions that avoid asset failure and downtimes. By solely relying on scheduled maintenance checks, companies may fail to identify equipment performance anomalies in time to prevent shutdowns that disrupt operations and business or cause a catastrophic environmental event such as a nuclear accident.

Fortunately, solutions from APN Partners that run on AWS IoT can help industrial enterprises overcome these challenges, minimizing the effects of asset failure.

[1]Michael Schallehn, Christopher Schorling, Peter Bowen and Oliver Straehle, "Beyond Proofs of Concept: Scaling the Industrial IoT." Bain and Company, 30 Jan. 2019. https://www.bain.com/insights/beyond-proofs-of-concept-scaling-the-industrial-iot/

How IIoT predictive maintenance partner solutions that run on AWS IoT help industry

Predictive maintenance solutions built on AWS IoT deliver the operational and asset transparency that industrial enterprises need to improve operations, business, and keep costs down. At the same time, they offer data security and protection. They are rooted in AWS IoT and partner IoT solutions that extends from the edge to the cloud.

Edge computing enables devices to sync and communicate with each other while still using the cloud for management, analytics, and durable storage. The gateway consists of the APN Partner and AWS hardware or software components used to design, build, and manage the devices that provide the connection point between the cloud and controllers. At the end of the ecosystem are AWS services and partner platforms, along with SIs who bundle all the hardware, devices, connectivity, platforms, cloud, and SDKs into solutions that provide the desired business outcome.

For the industrial sector, proven expertise and knowledge of the APN IoT Partners, combined with AWS IoT services, deliver desired business outcomes that include minimizing costly maintenance problems and operational expenditures, extending the life of equipment, and maintaining production levels. AWS services are critical to these solutions because they power IoT communications, edge and cloud processing, advance analytics engines that use machine learning, and many other critical tasks. As a result, it is possible to address three key pillars of IIoT-enabled predictive maintenance through cost savings, scaling, and faster innovation.

Reducing equipment costs and prevent downtime

Industrial businesses can get ahead of issues before they occur, then use machine learning to identify exact fixes. AWS enables them to connect their equipment, gather critical data, and better understand the condition of their assets. For example, vibration sensors mounted on critical rotating equipment can monitor for anomalies or drifts in frequencies that indicate that the equipment is likely to fail. If these failure-indicating signals are detected, a maintenance work order can be issued to service the equipment before a catastrophic failure occurs.

Similarly, if the vibration data indicates a healthy operational status, an operations manager could delay regularly scheduled maintenance until the predictive maintenance dashboard detects a decline in equipment health. Both paths drive down factory operational expenses.

Scaling with fully managed services and "pay as you go"

AWS IoT services are built on a pay-per-usage model; therefore, developing prototypes and small-scale pilot projects and scaling up to production deployments is simple. Instance provisioning and managing cloud infrastructure become a thing of the past. IIoT predictive maintenance solutions from AWS and APN Partners deliver cloud elasticity that increases or decreases computing capacity, making it possible to utilize more efficiently the sophisticated analytics and decision optimization that is a cornerstone of predictive maintenance.

For example, when sophisticated modeling of high volumes of sensor data is necessary to identify patterns that could indicate deteriorating equipment health, the solution can scale up, and then scale back down when the modeling is complete. Skilled APN Partners can also build predictive maintenance solutions that deliver visualizations that help manufacturers better understand the root-cause of anomalies, poor performance, and failure.

Innovating faster with the broad set of AWS services and the comprehensive APN Partner community

Companies in each industry sector can see where IoT can take them with the broadest and deepest set of native services amongst cloud providers. Innovation comes faster with access to AWS services and our skilled partners. An example of innovation from the energy sector would be using IIoT predictive maintenance solutions from AWS and APN Partners to facilitate "digital twin technology." This innovative technology uses an advanced digital model created from an existing piece of equipment and IoT sensors attached to the physical unit. The sensors collect data about its performance and send it to the digital twin to support predictive maintenance and virtual troubleshooting from remote locations.

Agribusiness is another a fertile industrial sector ripe for innovating faster. With IIoT predictive maintenance solutions from APN Partners on AWS, agribusinesses can gather transmissions from sensors affixed to livestock housing, smart greenhouses, data-gathering drones, and actuators for spreaders, sprayers, combines, and use them to forecast conditions that could adversely impact crop, dairy, or meat yield before they occur.

Delivering value with IIoT predictive maintenance solutions

As we just demonstrated, AWS and its partners deliver value to organizations by offering the widest range of IIoT predictive maintenance solutions for specific industries and use cases, including the manufacturing, renewable energy, and agritech sectors. They are backed by:

- **AWS IoT:** AWS IoT offers the advanced analytics industrial companies need to easily access and analyze their data for better business insights and decision-making. With AWS IoT, customers can access pre-built machine learning models for predictive maintenance, resulting in faster response times before equipment issues or failures occur.

- **Elasticity of the AWS cloud and pricing structure:** The elasticity of the AWS cloud means it can increase computing power to accommodate peak predictive modeling and maintenance demand and scale down when at rest. This enables customers to model scenarios, increase equipment operations efficiency, and control costs.

- **Comprehensive IoT technology and partner community:** AWS is the only vendor to bring together data management and rich analytics in easy-to-use services designed specifically for noisy IoT data. Combined with our partner community, AWS IoT offers customers a broad and deep set of IoT services, from the edge to the cloud.

Insights derived from using these solutions can influence decisions and actions that drive efficiency and improve competitive advantage. Therefore, this is not a one-size-fits-all approach. Deep expertise in each sector enables deployment of IIoT predictive maintenance solutions and platforms that are a perfect fit, whether they are for an automaker, a solar energy provider, or a hydroponic farm.

Predictive maintenance solutions running on AWS IoT

Predictive maintenance solutions built on AWS IoT deliver the operational and asset insights our customers rely on to increase productivity, speed innovation, and maximize the value of their asset data—all while reducing costs. Here are some examples of predictive maintenance solutions running on AWS IoT that are enabling our industrial customers to address trouble spots before they cause real trouble.
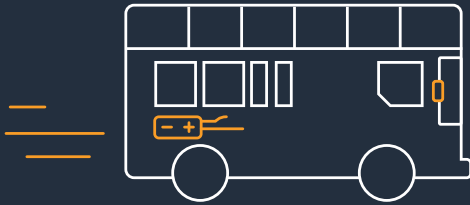
Case study 1
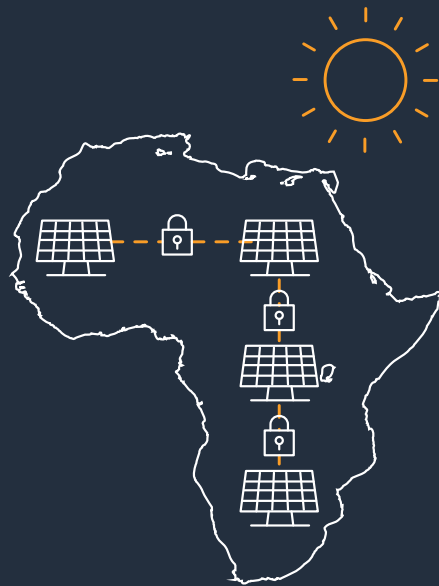
Case study 2

Case study 3

Case study
Vantage Power

Vantage Power, which designs and manufactures technology that can connect and electrify powertrains in heavy-duty vehicles, wanted a vehicle telemetry system that would integrate into the powertrain, vehicle control software, and other existing systems to collect field data the manufacturer could use to see how parts were performing. This included a way to closely monitor their lithium-ion battery systems to help customers detect cell-level defects early and mitigate issues.

An AWS IoT Partner, Luxoft, created an AWS-based telemetry platform that provides Vantage Power customers with a comprehensive technical understanding of powertrain components, including engines, batteries, control systems, electric generators and motors. Luxoft leveraged AWS' IoT services, including AWS IoT Core, AWS Greengrass ML Inference, and AWS IoT Analytics—combined with Amazon Simple Storage Service (Amazon S3) and AWS Lambda— to deliver this predictive maintenance solution built on an IoT architecture.

Using the platform, Vantage derives insights and predictive analytics models that can then be distributed to the vehicles for real-time preventive action. Complex data is transformed into information the company can take action on, and these insights are shown on the platform. For instance, the sensors know when a hybrid vehicle is entering a low emissions zone and ensures its battery is fully charged ahead of time, extending the range and reducing pollution.
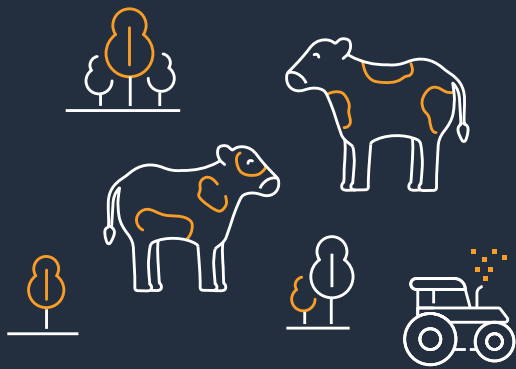
Case study
SolarNow

SolarNow, a Ugandan solar equipment, energy, and services provider, was concerned about disruptive, malicious, and costly service interruptions for remotely deployed solar equipment. SolarNow's devices affect the livelihoods of people in diverse environments and use cases, including household appliances, irrigation pumps, and power supplies to schools and health clinics. Therefore, it is critical that the company maintain its zero-tolerance for controllable service interruptions.

To address those concerns and prevent service interruptions, SolarNow implemented scalable predictive and ongoing security management services provided by AWS IoT and AWS Partner Eseye's AnyNet Secure SIM. The AnyNet solution incorporates AWS IoT Core and Device Defender, so SolarNow can securely manage the delivery of reliable, powerful solar energy to its customers. No costly customized software configuration required.

How does it work? Eseye creates device metrics in real time from the cellular network so that AWS IoT Device Defender can monitor normal behavior of devices. If an anomaly or unusual behavior is detected, the AWS IoT Device Defender Security Profile classifies the severity and publishes it to a configured Amazon Simple Notification Service (Amazon SNS) topic. Amazon SNS invokes an AWS Lambda function that directly updates the IoT Thing Attribute to use the Eseye Marketplace integration to suspend the cellular service. SolarNow also uses Amazon Kinesis and Amazon Machine Learning to collect and process data streaming from its connected devices to identify and analyze patterns of consumption and use. They have also engaged with additional APN Partners to build out its predictive analytics capabilities.

Case study
TINE

TINE, Norway's largest dairy cooperative, was on a mission: drive better predictability of milk production and other key data points related to a cow's health and the quality of milk produced. Historically, TINE has used basic models to attempt to predict milk production and delivery per farm but faced problems with production predictability over different periods of time, which could cause significant problems. For example, in 2011, the entire country experienced a butter shortage because farmers underestimated the fat content that would be needed as a part of that year's production.

IoT devices are installed on TINE dairy farms, including on their robotic milking machines. These devices collect about 2.5 million data points for the cows, including parents, feeding, weight, growth, and other biodata. To make better use of that data and to prepare for an increase of 250 million data points per animal, TINE brought in the experts at Crayon, an APN Advanced Consulting Partner, to identify the technology and platforms that would help improve TINE's insights, predictions, and analysis.

The result is a solution that enables a prediction of milk production and deliveries from each cow, farm, and national level with a 24-month forecast—information that is critical for planning dairy production capacity and logistics. It started with a simple model that demonstrated the use of a convolutional neural network to predict milk production based on the condition of the farm. Based on the finding from the model, the team created a new, refined model to predict the conditions on the farm in the future, which would support better and more accurate forecasting. The model, which uses an ML solution that runs on AWS, predicts cow births and the total number of cows in the herd in addition to milk production.

Ready to get started?

There are several ways to get started, depending on the kind of predictive maintenance solution you want to build. To learn more, visit our website at aws.amazon.com/iot. It details key use cases, AWS IoT services, and our IoT Competency Partners.

If you know what kind of partner you need and want to find the best match, AWS Partner Solutions Finder is an easy way to identify which partner fits the needs of your IIoT predictive maintenance project. You can filter by location, use case, industry, products, and competency expertise.

You can always reach out to an AWS sales associate or directly to your preferred APN Partner. Get started faster with AWS.