Leveraging Connectivity and Predictive Analytics to Proactively Service Products in the Field

Introduction

The pandemic brought to the forefront issues that have plagued companies that develop and support products in the field. Namely, the costs and inefficiencies of sending someone to every site to service those field-based products. This approach had long been impractical, and with the pandemic locking down site access, it often became impossible. If they have not done so already, companies must transition from reactive to proactive remote maintenance and service to stay competitive, rein in operating costs, and better enable expansion and growth.

Fortunately, enabling technologies through the Internet of Things (IoT) and Augmented Reality (AR), as well as new services (e.g., 5G, LP-WAN, Wi-Fi 6, and more) now enable companies to easily incorporate connectivity and data collection of machine status into their products, for seamless, predictive remote maintenance.

Organizations can use predictive analytics and artificial intelligence (AI) on various data sources from machines in the field to modernize their maintenance and repair operations, reap the benefits of predictive maintenance, and offer enhanced services.

Predictive analytics also allows a company to deliver more insightful intelligence and become more deeply embedded into customer operations. These are strategic moves that can develop more profitable long-term customer relationships. Such capabilities can also help companies transition to new business strategies, such as moving to recurring revenue or pay-per-use models (versus a one-time purchase).

Improve maintenance, repair, and operational efficiency

With travel restrictions and lack of access to customer facilities, companies that support products in the field found they had to reduce their reliance on field-deployed technicians.

The pandemic simply gave companies looking to transition to remote monitoring and predictive maintenance another incentive to do so. Connectivity to the products in the field is essential. The cost of including/adding connectivity can be justified based on the ability to make more efficient use of technicians. Cost savings are realized in a couple of ways: Technicians do not lose time traveling and a company can have fewer technicians working centrally. The net result is fewer technicians can support more products in the field.

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Predictive analytics applied to the collected data offers even more savings and improvements. Insights derived from real-time product status data can help shift from schedule-based maintenance to condition-based and predictive maintenance. Efficiencies abound by virtue of servicing products only when needed and not based on a day on the calendar. There also are opportunities to combine procedures in a single call if you can predict other issues ahead of time. Using predictive analytics to spot problems in the making and address them before they happen reduces downtime and the cost of emergency service calls.

Howden Group Ltd. has had experience applying these approaches. In a recent interview, Dr. Billy Milligan, Solutions Development Lead, Howden Group Ltd., points out the difference in these approaches. He notes that when a device's temperature exceeded a threshold in the past, an alert was sent. Now, an equipment manufacturer can spot temperature anomalies that are precursors to problems in the making and take action before they have an impact.

Predictive analytics helps in other ways. A company might use information that predicts an issue that needs remediation and take the opportunity to combine procedures or fix two problems on a single trip. The information could also provide an advanced warning to ensure long lead-time parts are ordered and on hand.

Reduce downtime, cut costs

The combination of connectivity plus predictive analytics allows for a proactive approach to maintenance that lets companies cut costs, get more life out of installed equipment, and reduce downtime.

In the past, companies would routinely replace a part based on scheduled maintenance. Such schedules use historical vendor data related to the mean time to failure. With performance insights, a company can see whether a device is experiencing a performance degradation or not. If it is not, the device can be used an additional week, month, or months. Getting extended life out of a part that is in service spreads parts replacement costs out over longer times. That reduces overall annual spending for spare and replacement parts.

Conversely, predictive capabilities that detect potential problems in the making allows companies to fix the problems before an outage and deliver additional cost savings.

First, from the customer's perspective, downtime directly impacts their business. Production lines shut down, wells are not pumped, wind energy is not generated — business stops, no matter what the business is. Those losses are not directly passed on to the company that provides or maintains the equipment, but repeated problems will result in them switching to a new product provider or service organization.
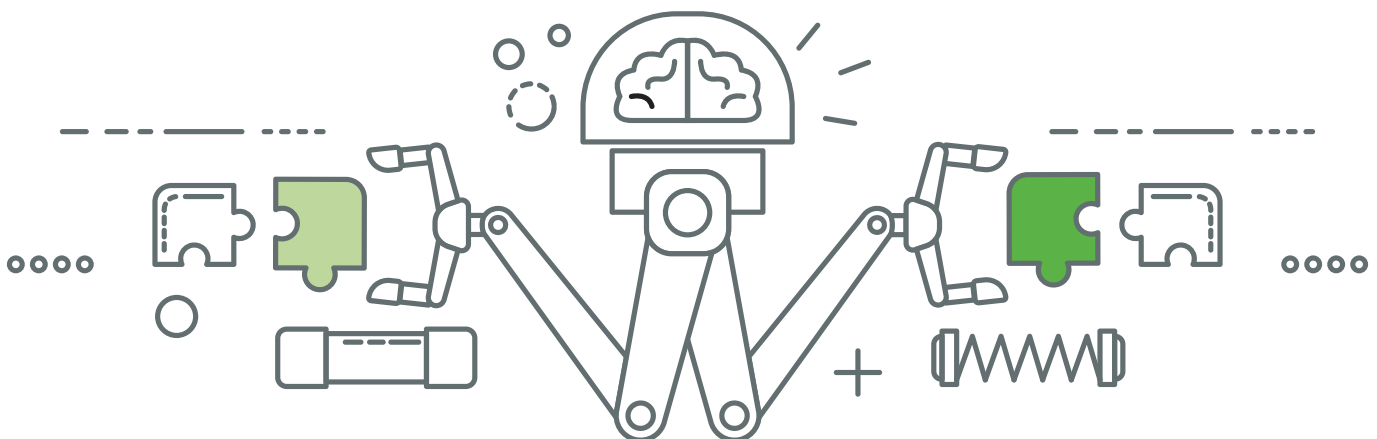
Second, a more direct cost that can be avoided is the expense of conducting emergency repairs. Companies that dispatch technicians with no notice incur high travel costs. This break/fix model of implementing repairs also requires expediting parts to the site, which results in high shipping and delivery fees.

> A predictive analytics solution along with connectivity offers:
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> · Cost savings
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> · Decreased downtime
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> · Increased technician efficiency
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> · Less travel time

If a problem is detected that requires an on-site visit, the predictive analytics of status data can provide deeper insight into the problem's possible root causes. That information can ensure the technician brings the right tools and parts when making the site visit. In turn, this helps increase the likelihood of problem resolution on the first trip.

Even when there is no emergency, the combination of a predictive analytics solution that detects problems in the making with connectivity that enables remote repairs offers additional cost efficiencies. Rather than send a technician to a site to install new firmware or reboot/restart a device remotely, this onsite work can also be carried out remotely. That saves travel time and expenses, and it again allows fewer technicians to manage more products in the field.

Enhanced applications are made possible

Once a company has connectivity to devices in the field and predictive analytics capabilities to derive insights from the device data, it can transform its operations and business model in several ways. Some potential leading-edge applications that can be employed include:

Simulation: In some situations, gathering historical data about an expensive piece of equipment's performance in the field may not be acceptable. Replacement or service may be impractical. Simulations can provide insights that remedy the problem. Specifically, a company can use multiple device data streams and Artificial Intelligence (AI) or Machine Learning (ML) modeling to infer the performance of another device or process. For example, the traditional use of predictive analytics would focus on the performance of a single device. Insights derived by analyzing data about a single device's operating conditions might find that when there is a temperature spike of a certain magnitude, that is a precursor to a device failure in three days.

In contrast, virtual sensors could use a mathematical model to learn every detail of a given process based on many stored historical measurements. After a training process, a virtual sensor approach could take the impact analysis to a higher level. It could correlate that insight with a performance indicator of an entire production line or facility.

Automated operations: Rather than just keeping equipment running, the insights derived from predictive analytics of device data could be used to offer an innovative service. Most production lines examine products for defects after they've been produced. Predictive analytics could make a correlation: When temperatures of this device on the line exceed this amount, there is an X percent higher chance of a defect in the finished product. If such conditions are detected in real time, an automated adjustment could be made rather than just issuing an alert. Thus, the problem is mitigated, increasing the number of parts that come off the line without defects. Such applications would incorporate AI and elements of prescriptive analytics to identify problems in the making and decide what actions should be taken to allay them.

Digital twin: A digital twin is a digital representation of a physical device in the field. It can provide insights into how a customer is using the device. Digital twins are often used by manufacturers to better understand and predict physical product performance and provide continuous monitoring and predictive maintenance insights to improve product efficiency, reduce unplanned downtime, and enable service-based models.

Enabling the Industry 4.0 journey: Companies that manufacture and support devices in the field are transitioning to data-driven operations. They seek to make greater use of the data at hand. Such information and insights could be shared with the customer to help them along their path to Industry 4.0, which is the application of technology to digitally transform how industrial companies operate. These technologies include industrial IoT, automation, simulation, and analytics. One specific Industry 4.0 opportunity is predictive maintenance. By using predictive analytics on device data, it is possible to identify patterns of behavior that more accurately predict when the device is about to break. This enables maintenance schedules to be planned accordingly.

Teaming with a technology partner

Assembling the technology to move to predictive and predictive maintenance and to enable new business models can be a daunting task. It requires expertise in connectivity and analytics. One way to speed adoption of such technologies and get to value faster is to work with a technology provider that brings the solutions, real-world experience, and technology expertise.

Industrial equipment used in manufacturing, energy production, processing, or healthcare, can benefit from solutions that aid in the transition to proactive operations. Technology partners that can help must offer more than just IoT connectivity and predictive analytics capabilities. They must complement their technology offerings with market expertise gained from having a strong manufacturing customer base.

Any solution selected must include the essential functionality many companies require today. A solution must provide the connectivity needed to access status and performance data of devices deployed in the field. It must analyze that data to deliver real-time insights, predictions, and recommendations for the next steps or actions. Having such connectivity and insights together in a single solution lets companies remotely monitor and manage the systems in the field. If real-time data shows an unfavorable trend (e.g., a device's temperature is rising unexpectedly) or the predictive analytics capabilities spot a potential problem in the making, corrective actions can be initiated.

Solutions with connectivity offer additional advantages. If a software update is needed, solutions should be able to carry this out without a site visit. If a visit is necessary, the predictive analytics insights will narrow down the scope of the problem, ensuring that the service team brings the right spare parts and equipment. Knowing more about the situation, a company could be sure to send properly-trained staff capable of performing the particular service or repair.

Given that most companies do not have unlimited numbers of experts to send to every site for every problem, a suitable solution lets companies build augmented reality (AR) experiences that enable remote expert guidance. Such an application provides a "see what I see" experience, with live, on-screen annotations. Such capabilities provide visual clues to help the technician on site.

There are all areas where the right solution can help companies get up and running faster. A prime example of its use in the field is the work being done by Howden Group Ltd. Howden uses PTC´s ThingWorx in its Uptime solution, a remote equipment health and performance monitoring application used for its rotating equipment (fans, turbines, etc.) running in customer facilities all over the world.

Their solution can proactively monitor and manage devices running in remote locations, some of which are in the North Sea and other remote locations. It built a health scoring system for its deployed turbo compressors. "They're very hard to get to. It normally involves planes and helicopters," said Billy Milligan, Solutions Development Lead at Howden. With the ThingWorx technology in their platform, "We are watching customer machines as though we're standing beside them on the vessel."

One of the things Howden is trying to do is leverage the analytics in different areas. For example, a normal SCADA system will let companies set alarms if a condition exceeds a high value or goes below a low value. Howden is using anomaly detection to get indicators that something is heading towards a high alarm. If this information can be gleaned early, adjustments can be made, and the alarm is avoided.

Beyond operational uses, Uptime is a vehicle for monetizing after-sales growth. Howden envisions applications where, for example, air quality can be monitored, and fan speeds can be dynamically adjusted to maintain a certain level of air quality.

Takeaways

Companies that develop or support products in the field need to transition from reactive to predictive maintenance and service. Such a transition is possible using ubiquitous connectivity and predictive analytics on machine data. As Howden demonstrates, solutions like ThingWorx can help with this transition. Beyond enabling the move to enhanced operations, the same technologies can enable new business models.

To learn more about transitioning to proactive operations and more, visit: www.ptc.com/predictive-analytics

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