



Six Steps to Using Analytics & Augmented Reality to Increase Asset Uptime

Capital intensive industries such as manufacturing, chemical processing, electrical generation and oil production utilize large numbers of capital assets at every stage of the production process. A failure in any one of these assets could cause shutdowns that cost up to tens of thousands of dollars per hour in lost production.

Keeping this valuable equipment running depends upon experienced service technicians tasked with the responsibility of maintaining, diagnosing and fixing it, preferably before it fails. Today's challenge is that the ranks of these experienced technicians are dwindling due to the ongoing retirement of the baby boomer generation along with the fact that many of the most highly qualified potential entrants to the service field prefer more prestigious occupations.

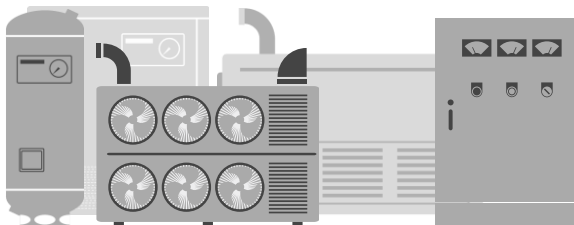
The United States Department of Labor reports that employment of industrial machinery mechanics, machinery maintenance workers, and millwrights is projected to grow 16% from 2014 to 2024, much faster than the average of all occupations. Job postings for highly skilled industrial maintenance technicians have increased 60% in the industrial states of Ohio, Michigan, Indiana, Tennessee and Kentucky in the past year. Yet the total of all recent industrial and maintenance technology graduates would only fill 5.5% of the available jobs.

The Internet of Things (IoT) combined with Augmented Reality (AR) can help address these challenges by transforming the industrial maintenance and field service process. The IoT captures data such as sensor readings and control system states, and instantly converts it to actionable information viewed in real time that can be used to diagnose problems faster than before. Predictive Maintenance (PdM) detects patterns in data collected from sensors embedded in and attached to machinery and knowledge-based systems, and analyzes this data to identify current and upcoming problems. In some cases, problems can be fixed remotely by service technicians armed with diagnostic information and access to machine controls.

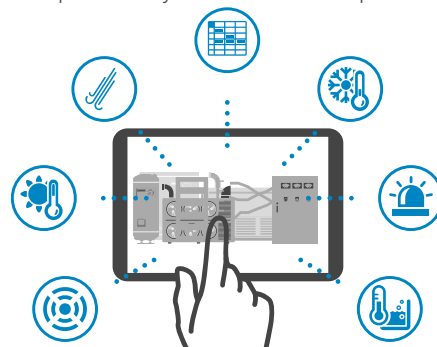
When dispatching a service technician is necessary, AR complements the skill set of field technicians and increases their productivity by overlaying diagnostic information, service instructions, parts catalogs and other information directly over the technician's view of the asset requiring service. For example, a technician wearing smart glasses can see an animation of the repair operation he or she is about to perform overlaid on the area of the machine where the operation is required. The combination of IoT and AR can help ease the shortage of skilled industrial maintenance workers and increase the utilization of valuable capital assets.

Augmented Reality example

Augmented reality (AR) overlays diagnostic information, service instructions and other information directly over the asset requiring service. Using computer vision and object recognition, the computer-generated input overlays the real-world input.



Capital intensive industries depend on asset uptime



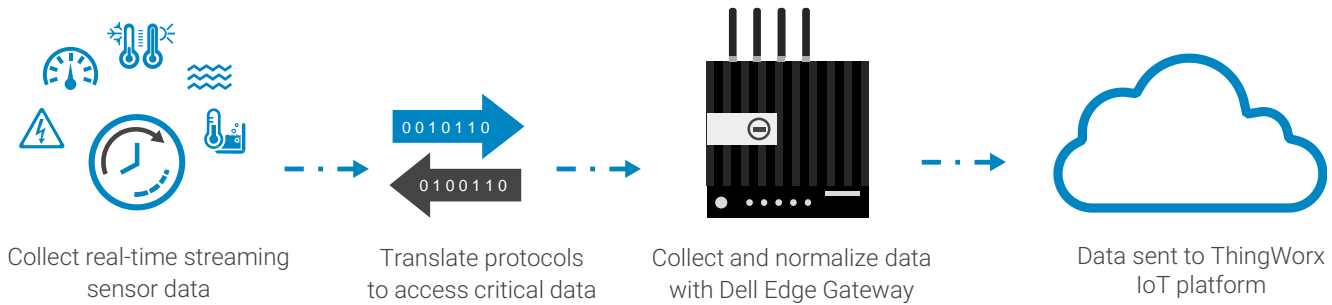
AR enables less-experienced field technicians to do more in less time



Follow these 6 best-practice steps to use AR to increase your asset uptime

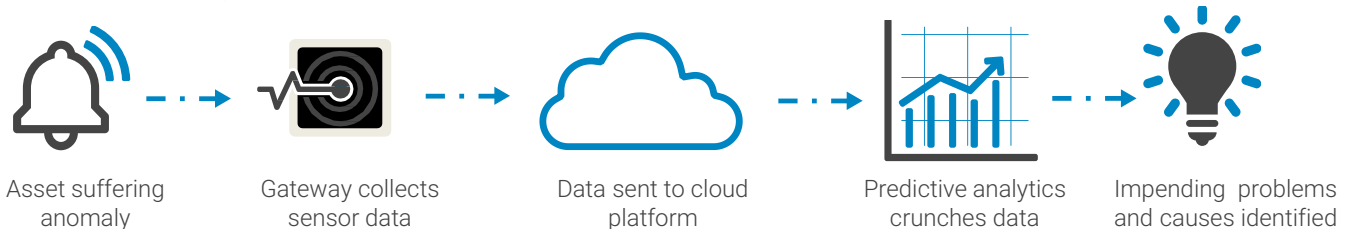
1 | Connect your assets to the IoT

The first step is to equip capital assets with sensors and connect them to the IoT so their performance can be monitored and diagnosed remotely. Many capital assets are already equipped with thousands of sensors that monitor flow, pressure, vibration, voltage, current, speed and many other parameters and transmit data to the control system where it is used to make operating decisions. The control system can be used to capture these sensor readings and send them to a Dell Edge Gateway 5000 series that aggregates this information along with data from other sensors and assets and sends them over the Internet to the PTC ThingWorx IoT platform. The Dell Gateway is capable of aggregating data, performing local analytics, reducing the amount of information that needs to be sent to the next tier, which in turn reduces bandwidth consumption and overall solution latency.



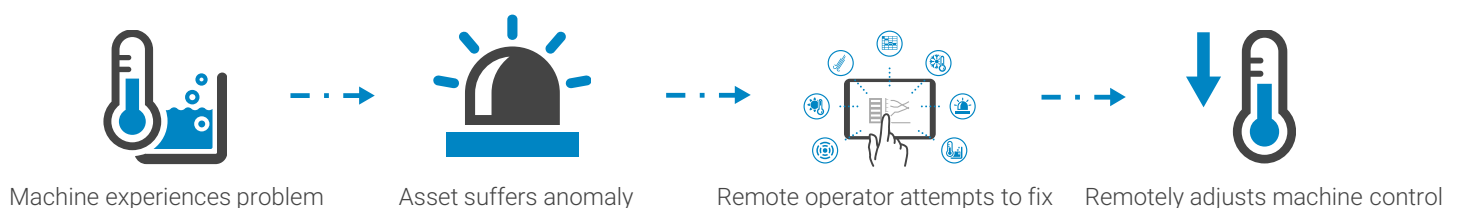
2 | Leverage analytics to detect impending problems

Machine learning systems can analyze the data stream from sensors to understand what's going on deep inside complex machinery. Analysis of previous failures can be used to correlate sensor readings and the condition of critical components that might cause machine failures. Algorithms can predict when specific components might be nearing failure and monitor the condition of in-service equipment to determine when maintenance is required. This approach makes it possible to perform maintenance only when it is actually needed as opposed to traditional time-based preventive maintenance which frequently generates production downtime and ties up skilled maintenance technicians long before maintenance is required.



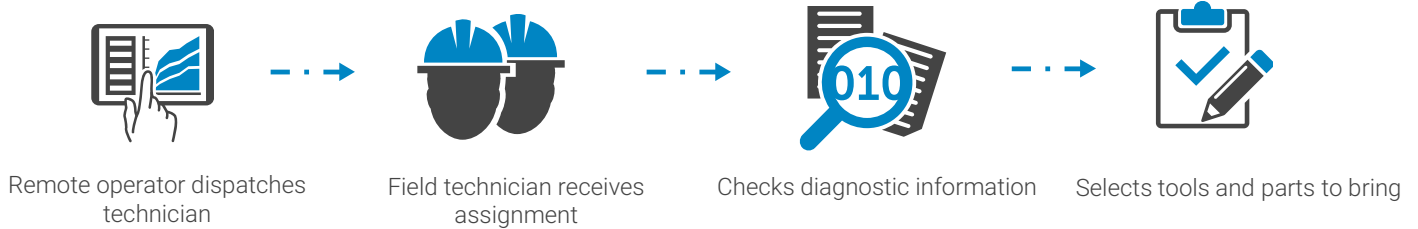
3 | Attempt to solve the problem remotely

Let's suppose that the predictive maintenance system detects an existing or impending problem on the plant floor. Rather than expending the time and expense to send a service technician to the machine, a remote technician can first attempt to diagnose the problem based on the information available from the sensor data. The remote technician may be able to address some or all of these possible causes remotely. For example, the remote technician may be able to recalibrate a sensor to see if that fixes the problem. Workflow can also be established to leverage predictive analytics to analyze the alert and identify possible causes.



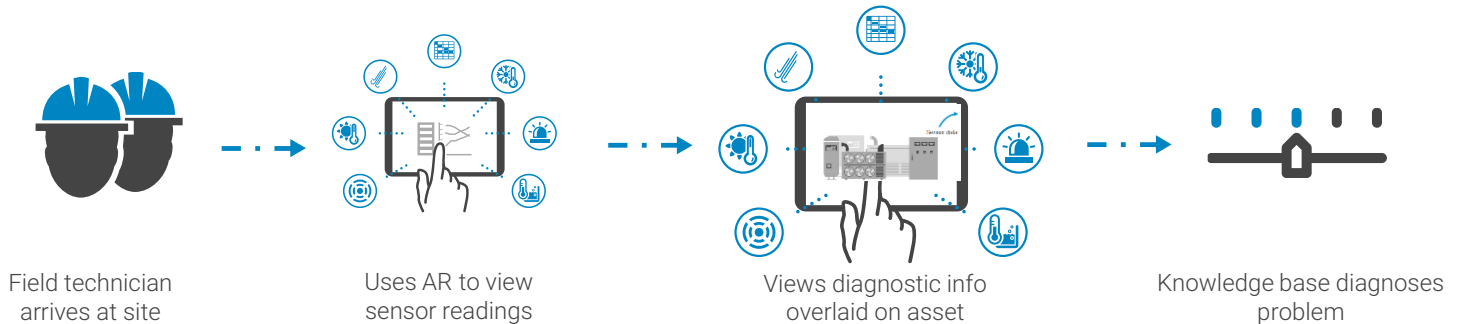
4 | Dispatch a technician

If the problem cannot be solved remotely, the remote technician changes the status to “dispatch required.” The application then automatically generates a work order and sends it to a field technician along with all of the information on the problem generated by the predictive analytics system. The field technician also has access to the same predictive analytics output and real-time sensor data as the remote technician, which can be used to select special tools and parts to bring on the service call to be more fully prepared. The field technician can also check to see whether there are any other issues that can be addressed on this visit, including maintenance on other machines.



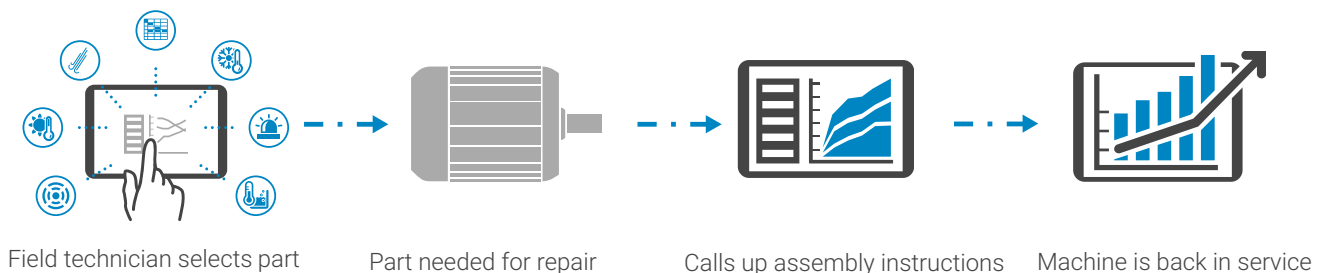
5 | Leverage AR to diagnose the problem on-site

When the field technician arrives at the asset, he or she can use the PTC Vuforia AR application on his or her smartphone, tablet or smart glasses to see sensor readings and other diagnostic information, parts lists, repair instructions and other information superimposed on an image of the asset. In-context access to this detailed information may make it possible to dispatch a less experienced and lower cost field technician. As the field technician’s view moves around the product, real-time diagnostic information provided by sensors for the area that he or she is viewing are visible on the screen. Based on a combination of the real-time data, previous predictive analytics and a knowledge base, the AR application provides likely problem diagnoses along with procedures to correct each one. When necessary the field service technician can call on the help of the remote technician. Using AR, the remote technician can view the problem through the eyes of the field technician, and the field technician can see the remote technician on the screen just like in a video phone call.



6 | Order parts and complete solution

After the field technician determines how to solve the problem, he or she can aim the device with the AR application at the area of the asset where the problem lies and click to call up an exploded view of the assembly. Then the field technician can manipulate the exploded view and select the part needed for the repair. The part is highlighted on the bill of materials, and the technician touches the part to check on its availability and pricing. Finally, he or she drags the part into the shopping cart. The service management application, based on information captured from a range of assets, predicted its future requirements and already performed stock verification. When the technician is ready to replace the part, he or she points at the subassembly and calls up animated instructions for performing the repair procedure superimposed on the actual part.



Augmented Reality for Field Maintenance Solution Example

This AR solution represents a single solution provided by industry leading partners as a reference. Your specific AR application may involve a combination of these and other technology providers within our IoT Partner ecosystem.

Dell has developed a flexible IoT architecture centered around the Edge Gateway 5000 that leverages qualified partners to provide a blueprint for you to develop a complete AR solution. The Dell Edge Gateway 5000 enables you to collect, analyze, relay, and act on real-time data from machine sensors and generate accurate, dynamic predictions. PTC's ThingWorx IoT platform can capture real-time operating information on valuable capital assets that can be used to analyze and diagnose their operation and optimize their performance and maintenance. PTC's ThingWorx Studio AR solution provides field technicians with visual information that enables faster problem diagnosis and faster and more accurate service procedures while also expediting parts ordering. AR is a technology that superimposes computer-generated images, such as parts lists and maintenance instructions, on top of real world objects. ThingWorx Studio is the world's most widely used platform for AR development. With support for leading phones, tablets, and eyewear, more than 30,000 ThingWorx Studio-powered applications have been published on the App Store and Google Play – and have led to more than 275 million app installs. The combination of the IoT and AR can empower the service team to increase uptime of critical assets while maximizing the utilization of scarce skilled technical resources.



Protocol Translation

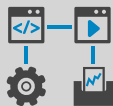
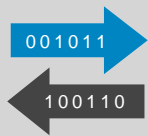
Stream Analytics

Visualization/AR

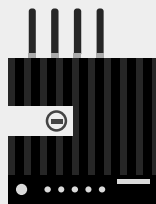
Backend Analytics

Reporting

Big Data Analytics

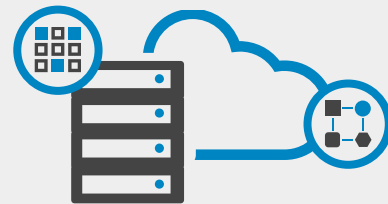
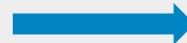
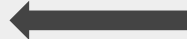


Real-Time
Data



Dell Edge Gateway 5000

Structured
Data



Dell Data Center/Cloud Solutions

Unstructured
Data

Along with our IoT Solutions Partners, we provide technology you can trust to help you get started quickly and efficiently.

Dell takes a pragmatic approach to the Internet of Things (IoT) by building on the equipment and data you already have, and leveraging your current technology investments, to quickly and securely enable analytics-driven action.

The Dell IoT Solutions Partner Program is a multi-tiered partner ecosystem of technology providers and domain experts to complement Dell's broad portfolio of IoT-enabling technologies.

To learn more visit us online at: www.delliotpartners.com

Contact Dell Sales to learn more about the Dell Edge Gateway 5000, our ecosystem of qualified partners, and to deploy this flexible augmented reality-enabled field maintenance solution today.



IoT Solutions
Partner Program

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