The industrial IoT can monitor critical machinery

Measurement can change behavior, lead to new business models

By Dan Yarmoluk

For quite some time now, industrial engineers have leveraged connected computing advances to help manufacturing facilities run more efficiently. However, the industri-

al internet of things (IIoT) is expanding manufacturing automation even further by connecting industrial systems to make automation smarter. This will help ensure critical machinery is up and running and is reliable, minimizing costs, maximizing productivity and moving the enterprise toward predictive maintenance.

The main goal of every business is to provide a product or service to a customer. And if you can provide a better product or service, you can provide more value to your customer.

By adding connected capability, you can provide your workforce with alerts that tell employees to service, replace or repair equipment, preventing costly downtime or high maintenance costs for pumps, valves and filters. The internet of things (IoT) is not only up in the cloud, as the power of data and analytics can be delivered right to a smartphone in an operator's or owner's hand, changing how business is done forever.

Think big, start small

It's important to think big but start small. Identify the products or bad actors that are high enough in value or have high enough maintenance costs to warrant the costs of "connecting" them to inform the broader group of requisite people about their health and service schedule.

Consider pumps, water meters and industrial valves. These products may be remote or located on the shop floor or manufacturing plant. It is clear that connected remote products and assets provide optimized route schedules and reduce lengthy downtime, but products in the factory or shop floor can connect beyond the local operator to the supervisor or local maintenance technician.

For example, data could help manag-

ers assign tasks to drivers to ensure that they take the most efficient route. Sensors also allow managers to monitor the location of trucks to reduce congestion in the warehouse and prevent violation of safety rules, such as speed limits.

Focus on improving customer service through measurement or monitoring your product and acting on that data – you want to change behaviors, not conduct a science experiment. For example, sensors can alert you if there's a problem on a piece of equipment, giving you time to address it before it shuts down your entire operations for the day. The timely alert ensures that your customer order is completed on deadline.

Convince your leadership and employees that this is to improve customer retention and differentiation, not to replace field, service or factory employees. When you embrace change, it is not just noise, but exciting and meaningful.

The IoT technology stack historically has come from the global proliferation of smartphones. The billions of units have commoditized all the relevant components of this minicomputer in your hand, from processors to cameras to sensors. These sensors have been repurposed and designed into "connected things."

IoT is further enabled by cheap computing power and storage through what we call cloud infrastructure. It has been stated that today an African chief has more computing power in his pocket than the entire White House during President Bill Clinton's two terms.

Sensors emit data to the cloud, and reporting, data analysis and applications are pulled to produce meaningful information. That information, in turn, should be used to influence human behavior (such as driving route optimization or maintenance scheduling) to optimize business performance. The enabling technology should create specific, measurable action, not conduct a science experiment. Figure 1 details a schematic of the IoT technology stack.

Taking advantage of the IIoT

Many systems within a manufacturing plant are intranet connected. However, much of the data collected from those

FIGURE 1

Building a technology stack

The seven layers of the internet of things



IoT is a futures market

Where there's a technology, there's a market, and *Forbes* rounded up a set of predictions expecting explosive growth in the internet of things market over the next few years.

For example, Bain predicts that annual revenues for IoT vendors could exceed \$470 billion by 2020, while McKinsey estimates the total IoT market size will grow from \$900 million in 2015 to \$3.7 billion in 2020. And General Electric predicts investment in the industrial internet of things will top \$60 trillion in the next 15 years.

This growth reflects an increased number of devices. From 15.4 billion devices in 2015, IHS forecasts 30.7 billion devices in 2020 and 75.4 billion in 2025.

And businesses are using the nascent IoT to create entirely new strategies, *Forbes* reported. For example, Lufthansa created a new business by mining data from its maintenance, repair and overhaul operations. They provide the information to their customers and use real-time aircraft, airport and weather sensor data to improve on-time performance and optimize operations.

It's clear that the IoT and IIoT can deliver value by solving complex logistics, manufacturing, services and supply chain problems.



machines never leaves the plant.

An internet connection allows the critical data to be sent to supporting applications and get analyzed and displayed on one dashboard in any location, available when needed. The transition to IIoT presents manufacturers with many benefits, including visibility, predictive maintenance and improved operations.

The IIoT can bring real-time visibility into the location and status of fixed and moving assets such as critical inventory, parts, equipment and goods in transit.

For example, if a plastic injection molding company houses its polyethylene in a silo, sensors can be added to monitor inventory levels. The connected system can sense when inventory is running low and send an alert to the supplier to schedule a fill, limiting downtime. Data from multiple sites is aggregated on a common platform for centralized management and analysis.

Predictive maintenance also can avoid expensive downtime. From cooling systems to production machinery, manufacturing equipment often requires maintenance on a regular basis. IIoT technology can be used to monitor this equipment remotely, alerting decisionmakers to any changes that indicate impending trouble.

If a motor's temperature increases beyond normal or the vibration of a pump has changed, the trend will show in the data, and the issue can be addressed before it becomes a disaster. The IIoT makes maintenance service proactive, not reactive. Applying analytics to the machine data opens the ability to adopt a use-based maintenance methodology, saving time and money.

The IIoT also will improve operations. The ability to predict potential equipment failures and repairs minimizes the number of service calls necessary. Manufacturers using IoT solutions in 2014 saw an average 28.5 percent increase in revenues between 2013 and 2014, according to a survey from TATA Consultancy.

Industrial use cases

The manufacturing industry is rife with opportunities for a successful IoT deployment. First, many different critical operations can be monitored to reduce downtime on a factory floor. Second, these critical operations generally are so big that the monitoring cannot be done efficiently by visual inspection only. By monitoring several machines all on one dashboard, all parts of a factory can be seen together on one screen.

Pumps are the lifeblood of many industrial processes. Without pumps operating at their peak, valuable production capacity is lost. Continued wear and tear can lead to unexpected downtime. Monitoring industrial pumps or smart pumping systems for cycles completed, unexpected vibration or high temperatures can indicate unusual operating conditions that could foretell a problem. This allows for a service technician to be sent before the operation is shut down completely.

Especially in motors and other manufacturing machinery, measuring vibration can be a strong indicator of an upcoming problem. As the vibration in devices continues to grow stronger, it can mean that a device is dangerously close to failure. Catching this change early enough in the process means that a service technician can be dispatched to the site to fix the problem before a complete breakdown.

Fluid and flow also are important to many industrial processes. A pressure drop across a valve could indicate a ruptured seal, while a pressure increase could signal a blocked filter. A higher temperature could mean a problem somewhere in the production process. Having these data points means that a problem can be solved before there is a loss of quality in your products or a shutdown on your factory floor.

Temperature and humidity can mean many different things for different applications. Perhaps food ingredient supplies will spoil if above a certain temperature. Maybe crops will grow mold if the environment gets too humid. A motor will stop functioning if it gets too hot. Throughout all of these scenarios, IIoT



assets can gather this data and alert your workforce to a problem through preset parameters.

New business models will abound

With the IIoT, there is an extension far greater from being a good partner or vendor to tying business value to measurable-based performance outcomes.

Theodore Levitt, an American economist and former professor at Harvard Business School, captures this concept in his quote, "People don't want a quarterinch drill. They want a quarter-inch hole." As speaker, author and blogger Joseph Barkai wrote in his recent book *The Outcome Economy*, companies create value not just by selling products and services but by delivering complete solutions that produce quantifiable business outcomes for customers.

It's important to note that the value of the IoT does not come from connected devices, but rather from the ability to extract, mine, organize and influence action from the information stemming from connected device data. The rubber will hit the road for all the companies designing expensive technology solutions that don't deliver concrete results. The ones that succeed will create new billion-dollar entities. Organizations will be able to argue their value statistically, offering data to back up previously empty slogans like "I guarantee it."

New business models will emerge because of the outcome-based approach to doing business. We already see the subscription and membership economy becoming a dominant model and the Holy Grail in terms of recurring revenue with companies like Netflix. Software as a service (SaaS) is morphing into things like sensor as a service (SeaS).

For scrappy independent business owners, considering this shifting landscape and embracing it could lead to significant gains and huge disruptions in their industry. \clubsuit

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