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Benefits of Reliable and Repeatable Data for Predictive Maintenance and Asset Performance Management

Mobile sensors are taking steps to increase flexibility, ease of use, and cost savings

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Artificial intelligence (AI)–powered predictive maintenance and Asset Performance Management (APM) programs are rapidly becoming a key component of sector-leading industrial operators. A recent survey from Deloitte found that 34% of respondents had already begun implementing AI systems to support intelligent automation, while 52% plan to implement these systems in the next three years. But implementing and operationalizing AI is often easier said than done, especially without access to regular, reliable data about your operations. In fact, respondents to a National Association of Manufacturers survey say that they spend more than 80% of their data management efforts simply trying to capture and organize data rather than finding competitive insights by analyzing that data.

Autonomous robots not only save people from dirty, dangerous, and difficult tasks, but their ability to collect regular, reliable, and repeatable asset performance data can make successful AI-driven predictive maintenance (PdM) a reality for a fraction of the cost of fixed, IIoT sensor networks.

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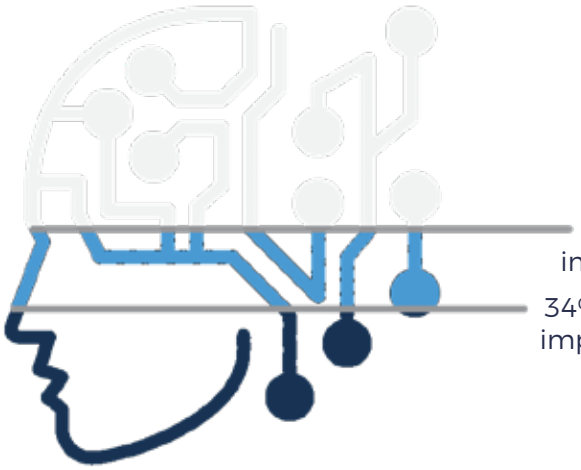
Today's leading Fortune 500 companies realize that successful advanced analytics systems such as AI-powered PdM are data-centric. AI and machine learning (ML) systems depend on data to deliver results. For organizations with large facilities, remote sites, or hundreds or even thousands of assets, regularly and repeatedly collecting reliable data is a challenge on the road to using an AI-PdM model to predict potential failures and increase productivity.

But what does reliable data actually mean in an industrial setting? First, it needs to be the right data — signals gathered from the assets and locations that matter most to ensure productivity or reliable uptime. Second, the data needs to be accurate — noise in equals noise out. And maybe most importantly, the data needs to be regular, dependable, and ready for AI-PdM software consumption. An example of problematic data would be infrared scans of electric motors at a pump station during periods of low demand; such data would reduce the quality of a trend analysis because it doesn't fully reflect the state of the equipment under full power and maximum stress loads. In addition, depending on human operators to collect data — people with constantly changing job demands — can lead to inconsistencies, delays, and missing data. Pandemics also mean workers are having to shift jobs more often, inserting more uncertainty into data collection. And without the adequate and consistent data, AI-PdM systems may not spot key warning signs such as leaks and mechanical or electrical anomalies until it's too late.



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Thermal imaging payloads mounted to Boston Dynamics' legged robot platforms can reveal high-low temperature conditions indicative of early equipment failure or inadequate heating for material process applications, among many other industrial use cases.

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Today, industrial companies have another way to improve data collection beyond the cost-prohibitive solutions of hiring more operators to conduct more rounds or installing dozens, hundreds, or thousands of machine sensors, not withstanding the power, data networks, cloud storage, and maintenance costs needed to keep these sensor networks operational. This new option involves the use of agile mobile robots — an approach designed to overcome the current obstacles to collecting regular, reliable, and repeatable data.

Acquire the Data You Need Through Dynamic Sensing

Traditionally, capturing regular, reliable data — information that is accurate, consistent, and frequent — has been a challenge.

Manual-scan operator rounds (ORs) are resource intensive, so they're typically done less frequently, often are not fed into a PdM analysis, and instead rely on the individual to identify conditions indicative of future equipment failures. Even more problematic, preventive and predictive inspections are always susceptible to being eclipsed by whatever problem is at hand on any given day. As a result, ORs don't deliver data with the frequency or consistency needed to maximize the benefits of an AI system. On the other hand, fixed IIoT sensors can offer frequent, structured data, but they are expensive — costing up to $1,000 or more per inspection node — have limited perspective, require additional power requirements and data connections, can open industrial networks to data security concerns, and are difficult to adapt when circumstances change.

Building information modeling (BIM) systems require regular spatial measurements to verify that a building is constructed according to the architect's design. Carrying gimbal-mounted 3D laser scanning payloads, Boston Dynamics' robotic platforms enable quick verification of physical structures against BIM designs.

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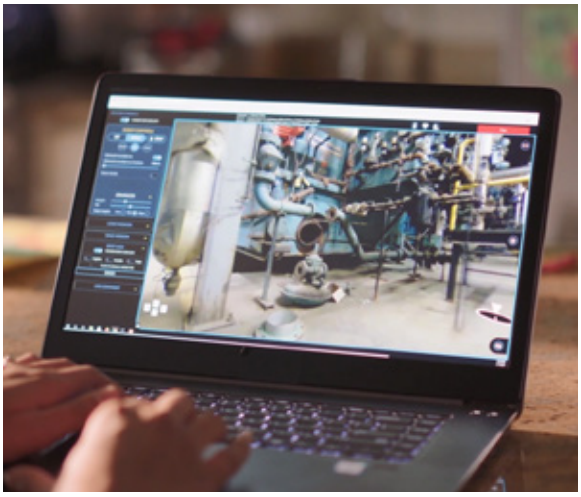


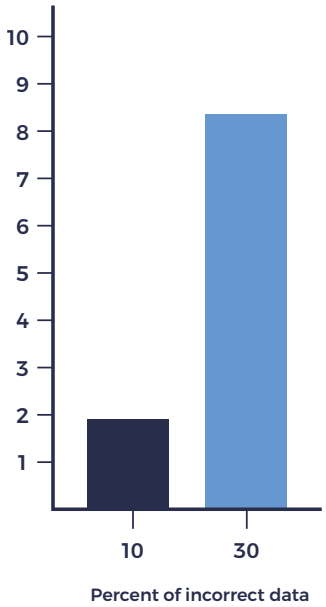
Many "dull, dangerous, and dirty" routines can be fulfilled using legged robots for sensing, data capture, and vision inspection.

Dynamic sensing is an alternative approach that offers the best of both worlds: flexible, accurate data collected when and where you need it. Agile mobile robots capable of autonomous operator rounds (AORs) and equipped with custom payloads can autonomously capture the data that matters most for your operations. They interface directly with your existing software solutions to process data on the edge. Today, these systems have sensors that allow them to read gauges — even from a considerable distance; inspect equipment for visual defects and thermal anomalies; provide high-precision 3D scans to validate infrastructure specifications; and even find steam leaks before they become a danger to human workers and nearby equipment.

Quality Data + Quality Modeling = Quality Production

All AI models, whether they are sales predictions, manufacturing quality assurance systems, or asset management maintenance systems, are only as good as the data used to create them. AI models are "data-centric," meaning the model will only perform as well as the quality of the data used to "train" the AI model. With this in mind, the need for regular, reliable, and repeatable data cannot be overstated when it comes to creating an AI-PdM model that will help boost productivity, cut costs, and prevent downtime. Now, consider this: if only 10% of input data is mislabeled or otherwise inaccurate, it takes 1.88 times the entire data set to correct for that 10%. If 30% of the data is incorrect, it will take 8.4 times the entire data set to correct it.

AI software used to enhance APM systems is only as good as the data fed into the AI model. As this graph shows, if only 10% of a data set is inaccurate, or unreliable, it takes nearly twice the original data set to correct the AI model. If the unreliable data accounts for 30% of the training data set, it takes 8× more data to correct the original AI model.



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With AOR solutions, data collection is predictable and reliable. For example, imagine using an agile mobile robot equipped with a camera to read equipment gauges. Operators can simply plan a route through the facility, commanding the robot to take a picture of each gauge. The robot can repeat this mission as frequently as needed to collect a representative data set, capturing the photos from the same location and at the same angle every time. This dynamic approach to data collection speeds up the process and provides the dependable, regular, and accurate data your AI-PdM or APM system needs to keep you running at top productivity.

Generate More Reliable Insights

Whether you build your own AI-PdM or APM model or integrate one off the shelf, you still need to feed frequent, high-quality data into the system to optimize production. Variations in the data captured (resulting from, for example, a person trying to take a photo from the exact same spot and angle every day), missing data, or a lack of coverage from fixed sensors can reduce the overall reliability of the AI-powered system.

Deploying a robot on regular autonomous operator rounds in your facility — gathering data on equipment and assets routinely and reliably — helps ensure that your AI-PdM or APM system is capable of identifying problematic equipment and processes before they halt operations. Additionally, mission scheduling enables you to collect at the best possible moment to maximize productivity during core hours while ensuring data quality.

Boston Dynamics' robotic platforms can be guided using a handheld device, or our web-based navigation software. After training, the robots can perform many routines autonomously.

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Make Better Decisions

More data — and more accurate data — will make it possible for your enterprise to make data-driven decisions, minimizing the risk of unplanned delays or downtime and maximizing productivity. At the same time, dynamic sensing frees up your teams from tedious, time-consuming scans, which can also be dangerous to operators during leaks or other hazardous conditions. In short, people shouldn't be feeding data into the system; they should be at the top of that chain, making decisions in response to data and turning insights into action.

A continuous stream of accurate data feeding into your existing software systems makes it easy to identify issues before they escalate. You can automate alerts and work orders to act on the insights that surface, ensuring that operators and maintenance teams can easily prioritize their responses and make decisions based on details. You can perform maintenance when needed, minimize downtime, and maximize the efficiency of your site and team.
To learn how you can capture continuous data on your sites, visit the asset performance management section for more details, resources, and contacts.

Armed with accurate, reliable data, APM systems can help avoid unplanned downtime while protecting workers from dangerous conditions.