MachineDesign

HOW TO BRING OPERATIONAL TRANSPARENCY TO YOUR MACHINES

A guide to implementing a successful predictive maintenance model.

Predictive maintenance "is often the most efficient maintenance strategy available—a gold standard for which to aim," according to a Deloitte Insights report, "Making Maintenance Smarter."[1]

There is a consensus among manufacturing experts that machine monitoring solutions enable significant transparency into machine performance. Connected machines are less likely to fail because they deliver data that can signal potential maintenance issues, while enabling profound new insight into machine productivity, scrap rates, energy usage, and more.

If you are interested in opening up transparency of your assets, but do not understand how to begin implementing machine-monitoring solutions or know which key performance indicators (KPIs) to monitor, here is a closer look at what to consider:

TOP IMPLEMENTATION CONSIDERATIONS

1 IDENTIFY EQUIPMENT TO MONITOR

The first step is deciding which mechanical components and issues to monitor. Don't feel it's necessary to extend monitoring capabilities to every machine or operation. The Deloitte study recommends beginning with a pilot that includes assets that are critical to operations and are also prone to failing with some frequency. This will help to establish baseline predictive trends. It also allows manufacturers to validate their processes and technologies without incurring significant risk.

2 ENSURE EQUIPMENT DATA IS ACCESSIBLE

Monitoring equipment that is integral to operations won't be effective if the machine does not produce reliable or quality data or can't be retrofitted with data-collection technology. In fact, availability of data is considered the most important success factor for predictive maintenance initiatives, according to companies that responded to a PricewaterhouseCoopers (PwC) survey in 2018.[2]

Manufacturers can use a machine's built-in sensors or add external sensors that monitor variables, such as temperature, vibration and amperage. Remote monitoring will occur over a network, such as Bluetooth or Wi-Fi.

According to PwC, making data accessible requires that manufacturers:

- Consider how their big data infrastructure will collect data from internal and external sources
- Decide on data storage solutions
- Determine how data accessibility will impact the speed, reliability and bandwidth of their communications network
- Plan to adopt an industrial Internet of Things (IoT) infrastructure to connect assets to a central data center. This involves selecting the proper protocols for wireless connectivity, data encryption and security
- Select a data analytics platform, with a single integrated solution the preferred option

TOP MACHINE MONITORING KPIs TO MEASURE

1 OPERATING CONDITIONS

Vibration data "often tops the 'why assets fail' list," according to a Machine Design article from 2019.[3] Typical sources of vibration include rotating components, adjacent machines, turbulent flows, foundations, structural resonances and noise. Other common operating variables include temperature, pressure, energy usage and revolutions per minute. This information helps manufacturers understand time until failure.[4]

2 USAGE RATES/PRODUCTION DATA

IoT sensors can send alerts when thresholds are passed. For instance, a threshold may represent the number of units produced or other usage-based metrics, according to ARC. When an alert is triggered, maintenance needs to be done. This type of program automates manual data collection efforts that are often used in a preventative maintenance program.

3

Finding the right platform and IoT partner is essential to yield the best possible results for your Predictive Maintenance (PdM) 4.0 project. To ensure the best fit, manufacturers should find platforms with the ability to:

- Connect with all types of machines (brands, models)
- Connect with old and new assets (brownfield and greenfield environments)
- Correlate data from multiple plant locations for analysis
- Provide strong analysis (for example: the ability to identify part/machine anomalies in real time)

4 REFINE THE APPROACH

PwC suggests installing feedback loops to refine predictive maintenance processes. Basically, this means allowing the system to set benchmarks based on discovered anomalies so it can learn to identify future failures faster. According to PwC: "Perhaps the PdM 4.0 (predictive maintenance) business case for a particular asset type needs to be re-evaluated: it may be more expensive or yield worse returns than initially thought. Or the criticality of assets may change over time and warrant new feasibility studies."

3 OVERALL EQUIPMENT EFFECTIVENESS (OEE)

OEE offers a complete picture of asset reliability, wrote Jeffrey Nevenhoven, senior consultant for Life Cycle Engineering, IndustryWeek.[5] By pulling in machine availability, performance and quality, this metric provides truly in-depth insight into efficiency and output.

4 MEAN TIME BETWEEN REPAIRS (MTBR)

MTBR is the average time between repairing a failed device and returning it to production. It includes the time required to identify the failure, diagnose the issue and fix it.[6] It's a standard measure of how efficiently an organization can fix a problem.

5 MEAN TIME TO REPAIR (MTTR)

MTTR is an indicator of downtime. It helps manufacturers identify major problems related to the need for out-of-stock parts or repair specialists.[7] It can highlight production weaknesses and areas where contingency plans might be necessary.

6 MACHINE UPTIME

This measurement identifies production stoppages, breakdowns and changeover times. It's typically measured using the following calculation: Uptime = Run-Time (Production) ÷ Total Available Time.[8]

Other factors manufacturers should consider when using an IoT-enabled machine-monitoring strategy include security, skilled talent and the potential for equipment upgrades, according to Deloitte. Solutions should have built-in security features that safeguard the organization against potential cyber threats.

Vendors can often ease the learning curve by providing relevant training and guidance and by recommending whether upgrades or complete equipment replacement is necessary.

HOW MINDSPHERE HELPS

MindSphere, the Siemens cloud-based, open IoT operating system, enables predictive maintenance by seamlessly providing early detection of asset defects and other conditions that can lead to faults. The IoT platform connects to automation and production assets to collect real-time operational data, enabling you to proactively identify when a breakdown or failure may occur. MindSphere helps you build predictive models based on various indicators, including vibration, temperature, cycles, load and pressure.

One of the key advantages MindSphere has over other predictive maintenance programs is the ability to measure factors beyond traditional KPIs, including energy peak times, future workloads and workload impacts. Taking it a step further, MindSphere allows you to do preventative and prescriptive maintenance: not only can it indicate what will fail, but it can also provide remedial actions to take based on financial and operational ramifications. The result is a more comprehensive view of how machine performance impacts the entire organization. To learn more, visit **www.siemens.com/mindsphere.**

1. Deloitte, "Making Maintenance Smarter," 2017. 2. PricewaterhouseCoopers, "Predictive Maintenance 4.0: Predict the Unpredictable," June 2017. 3. Machine Design, "Is Vibration Detection the Canary in the Mines for Manufacturing," Feb. 23, 2019. 4. ARC Advisory Group, "Choose the Right Level of Predictive Maintenance," Sept. 18, 2017. 5. IndustryWeek, "Is Your Maintenance Organization Caught in a Fitbit Trap?" June 21, 2017. 6. Tech Target website, MTTR definition 7. Technology Advice, "The Essential KPIs for CMMS," March 23, 2018. 8. Pyamid Solutions, "Eigth Manufacturing KPIs You Should Track," June 16, 2016.