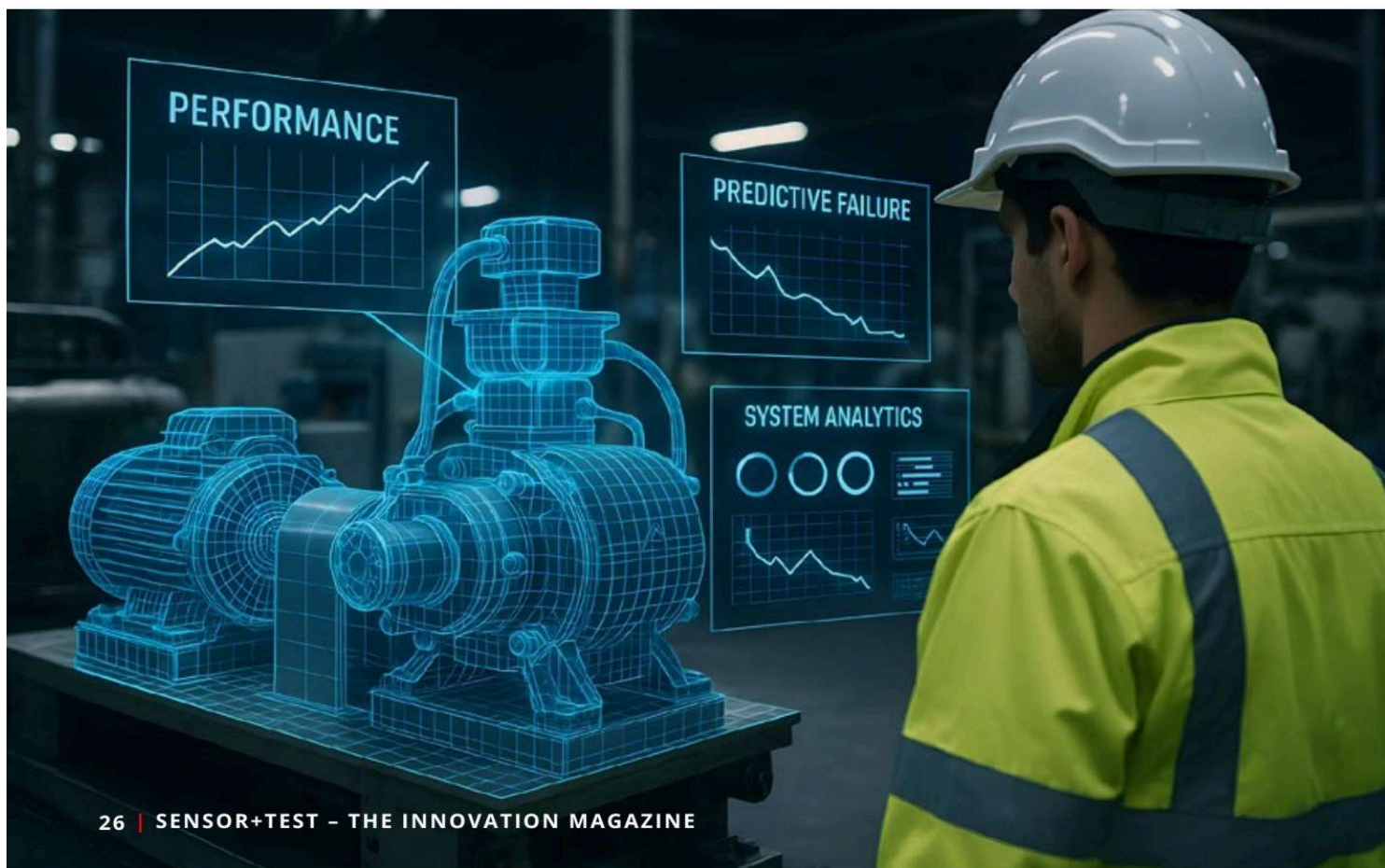


Monitoring rotating machines with AI

CONDITION MONITORING – Manual monitoring of measuring points in industrial plants is time-consuming and expensive. Sensors in IIoT networks automatically collect status data such as vibration and temperature. Digital platforms with AI analyze this data, enabling predictive maintenance and fewer breakdowns.





01 Asystem multisensor from Wika

Industrial plants contain numerous rotating machines, such as pumps, turbines, compressors, fans, motors, centrifuges, converters, and agitators. Efficient and stable operation of these machines is crucial for reducing energy losses and maximizing performance. With wireless sensors and an energy-efficient network, the infrastructure for smart condition monitoring can now be implemented with minimal installation effort – even in sprawling facilities, hilly terrain, or potentially explosive areas. Compact sensors are used to monitor the machines, recording vibration, ultrasound, and temperature values every minute or hour. The sensors transmit this data securely and efficiently to a gateway via a low-power wide-area network (LPWAN) such as LoRaWAN, a radio technology designed for long distances and low energy consumption. The gateway sends the measured values to a central network server. This is where the raw data from all end devices is collected – depending on the plant, this can be tens of thousands of sensors. The network also includes an application server with a digital platform, including an AI tool that analyzes the measured values..

Automatically detect and classify deviations

Abnormal values, for example in vibration, reveal at an early stage when something is not running properly. An algorithm identifies faults long before the machine would actually fail. Machine learning plays an essential role in this smart monitoring. Once the sensors are installed, they

first measure for two to three weeks during normal operation. Based on this data, the AI tool creates an individual model for each pump, motor, and so on. The model maps which measured values are normal and which indicate a fault. From then on, the tool compares all new sensor data with the model and generates an anomaly score. It is not just a matter of exceeding a defined threshold value, for example, but the score is calculated from a set of measured values in different process phases. An anomaly score of 0 to 100 % indicates the extent to which the data corresponds to expectations in a given period.

Depending on how the data deviates from the reference model, the tool also classifies anomalies according to specific error categories. This means that the software recognizes a pattern in deviating values and uses this to determine the probable cause of the error. Until now, specialists have often been tasked with checking raw data for potential errors and their causes based on empirical values. This time-consuming process can be greatly simplified through automation, as an AI tool can identify the relevant information and draw conclusions from it in a very short time. In times of skilled labor shortages, this is an important support for teams of experts who have to monitor numerous machines. In addition, an intelligent algorithm detects deviations in the data at a very early stage – as in the following practical example from the chemical industry.

Prevent unplanned shutdowns

In spring 2025, a plastics manufacturer implemented Wika's condition monitoring solution in one of its plants. At



In the past, maintenance work was carried out at regular intervals and when workers noticed unusual noises, for example. In many cases, maintenance was not actually necessary. The key figures used by the mining company to evaluate the success of the condition monitoring platform have shown that, thanks to AI-supported predictive monitoring, this now rarely happens.

that time, no one expected that the tool would soon prevent a failure. Sensors had been installed at several points on a stirred tank reactor: at the motor output, at one output of the gearbox, and at the seal on the tank bottom. After the solution had been in operation for a few weeks, the software registered a slight increase in the anomaly score. The data showed elevated ultrasonic values, initially only minimally higher than expected. About two weeks later, the curve rose more sharply. In the high-frequency range, the ultrasonic level remained significantly elevated for several days. Shortly thereafter, conspicuous vibration values were also recorded. When the operator shut down the stirred tank reactor the following weekend, the maintenance team did not have to search long for the cause. The balls in the ball bearing in the upper part of the reactor had broken. The condition monitoring software had detected the fault in the measurement data more than a month earlier. Otherwise, the operator would have been surprised by the reactor failure and would have had to interrupt operation unplanned. Instead, he was warned early and was able to coordinate the repair of the fault at a convenient time.

Increased efficiency at a mining company

A global mining group initially introduced the solution at seven locations as part of a digitalization initiative, with a clear focus on process optimization and cost reduction. Wika installed the sensors on a wide variety of equipment, from ventilation systems and pump compressors to crushers. These machines break down rock or coal for further processing and are powered by very large motors.

The proportion of maintenance orders that actually required manual intervention has tripled compared to the past. Not only is the company using its resources much more effectively, it has also reduced the failure rate to a minimum. Depending on the application, the seven locations recorded 40 to 60% fewer machine failures – corresponding to total savings of €100,000 to €300,000 per month. The company has thus achieved its goal of realizing a return on investment for the solution in less than six months.

Efficient condition monitoring

Thanks to LPWAN wireless technologies such as LoRaWAN, operators of industrial plants can now implement an IIoT network with minimal effort. Smart, wireless sensors record temperature, vibration, and ultrasonic values on all types of rotating machines. An intelligent analysis tool uses the data to derive reliable information about the condition of the machines. Operators not only learn early on where a fault is occurring, but also its probable cause. Smart condition monitoring thus makes it possible to optimize maintenance processes, avoid downtime, and reduce costs. Experience from companies in various industries underscores the benefits and rapid return on investment of IIoT-based, AI-supported predictive maintenance.

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