IN FOCUS: MAINTENANCE

The Future of Industrial Maintenance with Artificial Intelligence

In building management, industrial facilities, or the transport sector, every minute of downtime means significant losses. A failed motor, a suddenly stopping pump, or a defective air-conditioning system can trigger a chain reaction that leads to outages, additional costs, and even safety risks.

If the air-conditioning system in a data center fails, the operation of the entire server park can be at risk within minutes. A broken elevator is annoying in everyday life—but in a hospital, it can obstruct vital processes. The failure of the ventilation system in a shopping center even poses a direct safety risk.

In such situations, every minute counts, and every unexpected failure causes high costs. Therefore, maintenance in facility management is not only a technical task but also a strategic factor—a foundation for safety, cost-efficiency, and business continuity.

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Die Digitalisierung und Automatisierung der Industrie erfordern zunehmend Systeme, die nicht nur Daten sammeln, sondern Entscheidern verständliche und nützliche Informationen liefern.

It is therefore no coincidence that for years experts have been searching for a solution that can signal problems in time and prevent costly, unpredictable failures. This is where predictive maintenance comes into play—its goal is to predict impending failures before they occur. PRECOG is a new AI system, optimized specifically for industrial and building infrastructures, that has achieved a breakthrough in this area.

THE EVOLUTION OF MAINTENANCE STRATEGIES: FROM REACTIVE TO PREDICTIVE

Three main approaches have become established:

- Reactive maintenance: Equipment is repaired when it is already defective. At first glance, this seems cost-effective, but the failure of a cooling system in a data center, a heating system in a hotel, or a production line in a factory can cause enormous damage.
- Preventive maintenance: Inspections or replacements take place at scheduled intervals. This reduces the likelihood of unexpected failures but also leads to many unnecessary costs.
- Predictive maintenance: Based on real-time data, defects are predicted and interventions take place only when truly necessary.

While the theory has long been attractive, practice faced difficulties for many years. Most previous predictive solutions have been expensive, slow, or difficult to adapt to changing environments. False alarms often occur, or systems cannot handle the multitude of devices.

THE DEVELOPMENT OF PRECOG AND INTERNATIONAL RECOGNITION

Development began 15 years ago: engineers and mathematicians designed an algorithmic system optimized specifically for predicting failures in electrically driven devices.

As the inventor of the system, I have since perfected the technology on over 2,000 devices, in six industries, and with seven trillion data points—combining it with the latest AI solutions. In 2025, PRECOG won the Silver Medal at the International Exhibition of Inventions in Geneva among 83 entries. This is not only a professional recognition but also proof that the technology represents a genuine breakthrough.

Unlike previous systems, PRECOG does not tie fault detection to pre-defined threshold values—it learns

the individual behavior of each device, which is a key difference.

The Process Steps:
Identification of the most common errors:
For each device type, the six most typical failures are determined, covering 80–85% of all cases.

Monitoring of relevant physical factors for error detection: Energy consumption, current draw, vibration, temperature, or position.

Real-time data analysis: The algorithms learn the behavior of each machine, detect any deviation from normal operation, and immediately forward this to the AI for further evaluation.

AI-based identification: The AI compares the deviation with a database of validated faults.

Simple, clear message for maintenance technicians: Where, when, and what type of fault is expected—with possible repair suggestions.

Technician feedback: The expert can confirm the fault with "Yes/No," allowing the system to learn continuously and become increasingly accurate.

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2025 gewann PRECOG auf der Internationalen Erfindungsmesse in Genf die Silbermedaille unter 83 eingereichten Erfindungen.

This approach ensures that PRECOG does not trigger unnecessary alarms and excludes AI "hallucinations," since it works exclusively with real data.

DIFFERENCES FROM OTHER PREDICTIVE SYSTEMS

The main problems of existing systems:

- Predefined thresholds often cause false alarms, especially with outdoor equipment.

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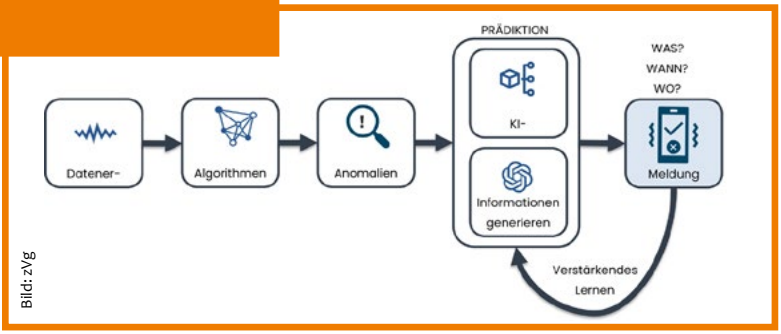
CEO Vida Soft Services.



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PRECOG wählt andere mathematische Ansätze.

- Oversized AI models: large, general-purpose models are slow and resource-intensive, making them unsuitable for real-time analysis.
- General predictive algorithms are unreliable.
- Lack of flexibility: each machine must be trained individually, which is time-consuming and costly.

PRECOG, on the other hand, uses different mathematical approaches:

- It automatically adapts to the operation of each machine.
- Detailed modeling of every device is not necessary—tests per machine class are sufficient.
- It works in real time and involves AI only when needed.
- Within days it achieves over 90% accuracy, which approaches nearly 100% after a few months.
- Reliable in both indoor and outdoor environments.
- Easy integration via an open-source interface, usable both in the cloud and on local servers.
- Compact, optimized models ensure high speed and cost efficiency.

PRECOG is not merely an IT system—it provides a business process that transforms raw measurement data into valuable information wherever such data are available.

WHAT ADVANTAGES DOES PRECOG OFFER?

- Minimization of unplanned outages.
- Cost reduction: elimination of unnecessary preventive replacements and reduced spare parts inventory.
- More efficient work organization: maintenance tasks can be planned in advance, allowing one team to oversee multiple sites.
- User-friendly operation: no engineering-level data analysis required—the system communicates with technicians in simple messages.
- Knowledge sharing: experience gained from one detected fault is automatically transferred to other, similar devices.
- Real-time consumption monitoring.
- Energy optimization: comparison of similar machines and detection of anomalies.
- Analysis of seasonality (revealing causes of varying consumption patterns).
- Calculation of past and future energy consumption by period, in both costs and energy.
- Customizable reports.

PRECOG can be widely used in all areas where systems are powered by electric motors. It functions with both continuous and periodically operating machines, such as:

- HVAC systems (air conditioning, ventilation, cooling, heating),
- Elevators and escalators,
- Data centers, hospitals, shopping centers, hotels,
- Industrial production lines and robots,
- Public transportation (doors, switches), airports,
- Oil and energy industries.

The system can build on existing measurement infrastructures but also provides its own sensors—making it flexible and adaptable to any environment.

THE MAINTENANCE OF THE FUTURE

PRECOG represents a new level in predictive maintenance: it combines real-time operation, reliable forecasts, and user-friendly communication.
Here, artificial intelligence does not appear as a complex computational model, but as a simple, practical tool that directly supports professionals.

The recognition in Geneva is only the first step—PRECOG is opening up major international opportunities.
The digitalization and automation of industry increasingly demand systems that not only collect data but also deliver understandable and useful information to decision-makers.

The operation management of the future will no longer mean repairing failures afterward, but knowing in advance when and where a problem is likely to occur—and being prepared for it.

Furthermore, the technology offers additional development potential.
A medium-term goal is to create an AI assistant that can be freely queried about the current and future state of systems and deliver complex analyses and forecasts—both verbally and in writing.