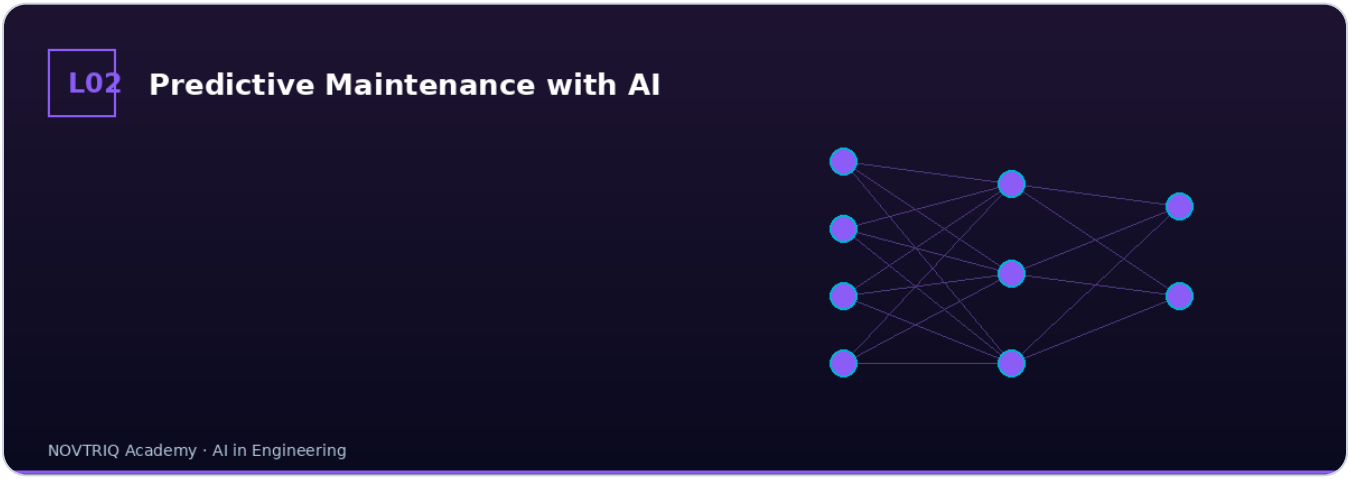
FREE

AI IN ENGINEERING

Predictive Maintenance with AI

Predictive maintenance with AI — vibration, thermal, current signature.



· **AI in Engineering** Lesson 2 of 8

Predictive maintenance is the most mature engineering application of AI. Move from scheduled / reactive to condition-based maintenance using sensor data.

This lesson covers how it works in practice — sensors, data pipelines, models, integration.

Learning objectives

Remember	Key terminology.
Understand	How the technology applies.
Evaluate	Where it works and where it doesn't.
Apply	Plan deployment in practice.

1 · Sensor types

Vibration accelerometers (motors, pumps, fans). Thermal imaging (electrical panels, mechanical wear). Current signature analysis (electrical loads). Acoustic emission (rotating equipment, cracks). Each catches different failure modes.

2 · Data pipeline

Edge gateway — local processing for high-frequency data. Cloud or on-prem analytics platform — long-term storage, model training. BMS integration for actionable alerts.

3 · Models

Anomaly detection (find unusual patterns) — most common starting point. Remaining Useful Life (RUL) estimation — predict time to failure. Both built on time-series data + machine learning (often LSTM, Transformer architectures).

4 · Deployment realism

Data quality dominates outcomes. Many vendor claims overstated. Realistic value: 10–25% maintenance cost reduction, 5–15% downtime reduction. Worth doing on critical equipment with good sensor data.

5 · What this looks like on a real project

UK London Underground HVAC

Vibration + thermal monitoring on critical HVAC + escalator equipment. Reduced unplanned outages 20%+; ROI within 18 months.

EU Manufacturing widespread adoption

EU manufacturing leads on predictive maintenance — Industry 4.0 driver. Building automation lagging but catching up.

UAE Dubai data centre cooling

Major UAE DC operators deploying predictive maintenance on chiller plant; 24/7 critical loads make it economically obvious.

6 · Why this matters

Predictive maintenance is the use case where AI ROI is clearest in the built environment. You now know what data inputs, what models, what failure modes — and what it actually costs to deploy. That puts you in the pilot-leader role, not the spectator role.

Quiz

Your score 0 / 5

1. Predictive maintenance starts most often with:

a) RUL estimation

b) Anomaly detection

c) Failure prediction

d) Lifecycle assessment

2. Vibration accelerometers detect:

a) Temperature changes

b) Mechanical anomalies in rotating equipment

c) Electrical current

d) Light levels

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3. Realistic predictive maintenance ROI:

a) 0% improvement

b) 10–25% maintenance cost reduction

c) 90%+ improvement

d) Worse than scheduled

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4. LSTM is:

a) A sensor type

b) Long Short-Term Memory neural network architecture

c) Hardware standard

d) Maintenance schedule

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5. Edge gateways primarily handle:

a) Cloud storage

b) Local high-frequency data processing near sensors

c) Database backups

d) Email

Answers (for print): 1b · 2b · 3b · 4b · 5b

Resources

PRIMARY SOURCES

- ISO 17359 — Condition monitoring and diagnostics.
- ISO 13374 — Data processing and communication for condition monitoring.

STANDARDS AND GUIDANCE

- NIST SP 800-181 (workforce framework).
- IEC 60812 (FMEA).

INDEPENDENT COMMENTARY

- Vendor whitepapers — Augury, Senseye, Uptake.

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