

Case Study: CNC Spindle Health Monitoring (Europe)

GIBES INOV – Predictive Maintenance and Industrial Automation

Industry Overview

High-precision manufacturing relies on CNC spindles for consistent quality and uptime. Unexpected spindle failures can:

- Halt production entirely
- Cause significant revenue losses
- Increase maintenance costs due to emergency repairs

Traditional reactive maintenance fails to detect early-stage bearing degradation, leading to catastrophic downtime.

Client Background

A European precision machine shop experienced:

- 3-4 emergency spindle replacements per year
- 120 hours/year of unplanned downtime
- Zero predictive maintenance capability

Key Metrics

Metric	Before GIBES INOV	After GIBES INOV	Result
Emergency Spindle Replacement	3-4 per year	0 per year	100% reduction
Unplanned Downtime (Spindle)	120 Hours/year	0 Hours/year	\$500k+ savings
Maintenance Lead Time	0 Days (Emergency Reaction)	45 Days (Prediction)	Proactive maintenance

Challenges & Constraints

- Sudden, unpredictable bearing failures halted high-speed CNC spindles.
- Lack of early detection tools made maintenance purely reactive.
- Production losses and emergency repair costs were substantial.

GIBES INOV Solution Architecture

Hardware Setup

- High-frequency ultrasonic acoustic sensors installed on spindle housings.
- Industrial accelerometers for vibration monitoring.

Control Logic

- Edge computer running advanced signal processing and machine learning models.
- Early-stage bearing degradation detected through subtle acoustic/vibration signatures.
- Automatic alerts trigger CMMS work orders when thresholds are exceeded.

UI/Data Integration

- Full integration with existing Computerized Maintenance Management System (CMMS) via Modbus/TCP.
- Dashboard provides real-time spindle health monitoring.
- Generates automatic work orders for preventive maintenance.

Deliverables

- Sensor deployment and calibration.
- Trained machine learning model for predictive maintenance.
- CMMS integration and automated alert system.

Implementation Timeline

- **Week 1–6:** Sensor installation and system integration.
- **Week 7–16:** Data collection and machine learning model training.
- **Week 16:** Full predictive maintenance deployment and testing.

Results & Impact

- Eliminated emergency spindle replacements.
- Achieved zero unplanned downtime for spindle-related failures.
- Realized over \$500,000 in annual savings.
- Transitioned maintenance from reactive to predictive, enhancing operational reliability.

About GIBES INOV

GIBES INOV delivers industrial automation, predictive maintenance, and IoT solutions across Europe and Pakistan. We focus on measurable ROI, operational reliability, and scalable automation for manufacturing and R&D sectors.