

Predictive Maintenance for Power Turbines

Industry: Energy & Utilities

The Problem

A hydro-electric plant needed to monitor turbine bearings. Traditional vibration analysis only detected failure after significant damage occurred. Because turbine signatures change based on water flow and age, a static model became obsolete every few months.

Solution

Klyff implemented an **Unsupervised Anomaly Detection** model that utilizes "Continual Learning." The device creates a "Golden Fingerprint" of the specific turbine's acoustic and vibration profile and adapts that baseline in real-time as the machinery naturally wears.

1. Hardware

- **MCU: STMicroelectronics STM32N6** (with integrated NPU).
- **Sensors:** High-frequency 3-axis industrial Accelerometers + Ultrasonic microphones.

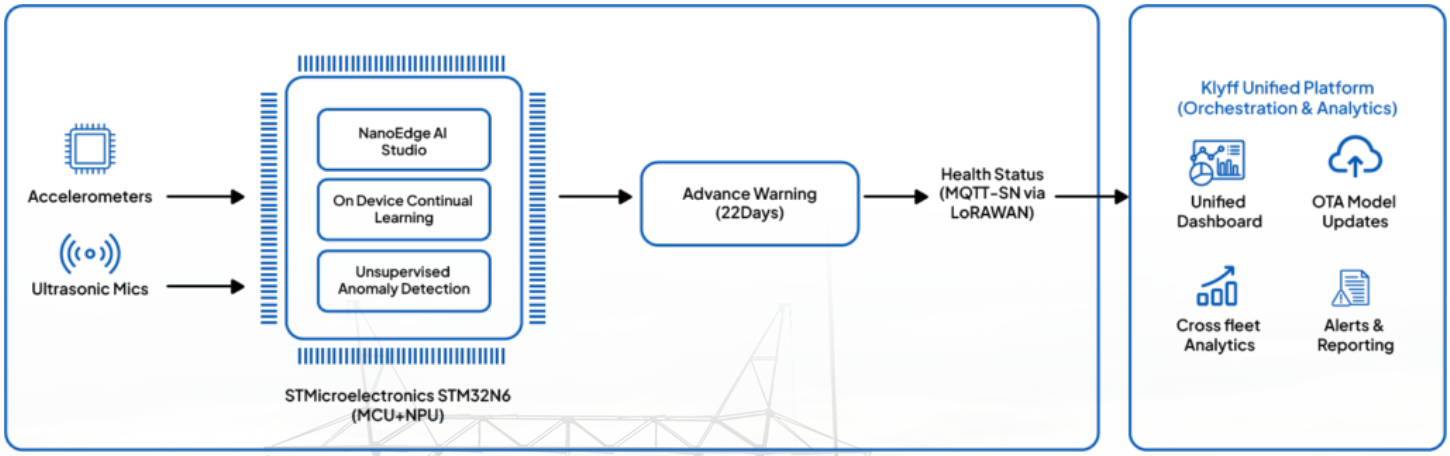
2. Software

- **Inference Engine: NanoEdge AI Studio** integration for on-device training.
- **Protocol: MQTT-SN over LoRaWAN** for ultra-low power status reporting to the Klyff Dashboard.

Results

- Federated Learning learns continuously and updates the fingerprint.
- Lead Time: System now provides 22 days of advanced warning before mechanical failure.
- Operational Savings: Avoided a catastrophic failure in Q3, saving the utility $450,000 in emergency repair costs.

Solution Flow



Klyff gives a significant advantage over traditional Cloud IoT

Feature	Traditional Cloud IoT	Klyff "Hard Tech" (Edge-First)	The Klyff Advantage
Response Latency	**200ms – 2 seconds** (Cloud Round-trip)	**< 10ms – 20ms** (On-Device Inference)	**10–50x Faster.** Essential for high-speed safety stops and robotics.
Data Transmission Costs	**High.** Constant streaming of raw sensor/video data.	**Near-Zero.** Only anomaly "events" are sent to the cloud.	**90% Cost Reduction.** Saves thousands in cloud egress and storage fees.
Data Privacy & Security	**High Risk.** Raw sensitive data travels over the public internet.	**Secure by Design.** Raw data never leaves the device; only insights move.	**GDPR/Union Compliant.** Ideal for worker monitoring and IP-sensitive zones.
Connectivity Reliance	System fails or "freezes" if Wi-Fi/4G drops.	**100% Autonomous.** Decisions continue even during network outages.	**Critical Reliability.** No downtime for remote mines or offshore assets.
Hardware Efficiency	Heavy data logging drains battery and bandwidth.	**Hardware-Optimized.** Uses NPUs/FPGAs to run AI at 10,000x higher efficiency.	**Extended Asset Life.** Models run on ultra-low-power $5–$20 chips.
Failure Detection	**Reactive.** Alerts you after a threshold is crossed.	**Proactive.** Identifies "micro-drifts" in machine behavior weeks earlier.	**True Predictive Maintenance.** Moves from "alerting" to "preventing."

Most IoT platforms are just "pipes" for data. Klyff is the **intelligence** at the end of the pipe. We focus on the **Silicon-to-Model optimization** unlike Cloud Dashboards

Let us help you with predictive maintenance

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