
A.I. BASED MACHINE CONDITION MONITORING SYSTEM

Smart Platform System Connected to **Multiple & Differential Edge Sensors**
Real-Time Analytics with Ai Algorithm running at **Low Power**



Condition-based monitoring in maintenance is focused on preventing machine failures, and downtime by monitoring machine health to determine what maintenance needs to be completed and when. Maintenance should only be performed when certain thresholds are reached, or indicators show signs of decreasing performance or upcoming failure.

Ai-Based Condition Monitoring extends the time between maintenance shutdowns, because maintenance is done on an as-needed basis and as a result, has the potential to decrease maintenance costs and prevent down time for production.

Common types of condition-based monitoring include vibration analysis and monitoring, and temperature tracking. Real-time data is gathered through sensors, providing an ongoing method of testing and tracking machine health.

The goal of condition-based maintenance is to spot upcoming equipment failure so maintenance can be proactively scheduled when it is needed – and not before. This is part of what separates **predictive maintenance** from preventive maintenance.

VIBRATION-BASED CONDITION MONITOR

Presenting an edge Ai-Based Condition Monitoring solution connected to a vibration sensor.

A complex rotating machine with many critical components such as gears, bearings and shafts will generate a mixture of vibrations, which is a combination of vibrations from each components.

It is difficult to use only time-domain waveforms to examine the condition of the critical components such in a rotating machine. Frequency analysis decomposes time waveforms and describes the repetitiveness of vibration patterns, so that the frequency components corresponding to each components can be investigated. Because of its ubiquity, vibration is highly applicable for investigating the operational conditions and status of a rotating machinery.

A vibration-based condition monitoring system is a system that can acquire vibration signals according to pre-determined parameters such as sampling frequency, vibration level, recording length, recording intervals and frequency bandwidths.

The monitoring system can process the recorded vibration and translate the information to intuitive indications for machine operators, and maintenance staff. The system should not interfere with the normal operation of the machines that are being monitored.



Ai-Based Condition Monitoring System connected to a vibration sensor, voyager 3 from Analog Devices.

“Real time edge analytics to prevent downtime and improve productivity”

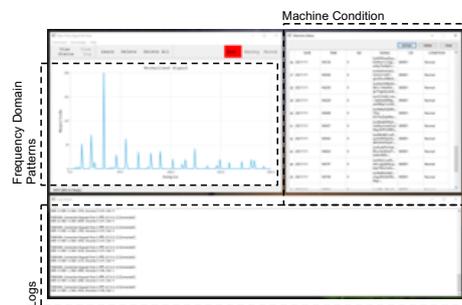
LOW POWER ANALYTICS

LONGWAY AI TECHNOLOGIES and research partner, NYP, have developed an AI-based condition monitoring system that is able to detect machine operating conditions with high accuracy.

By using **Neuromorphic AI** technology in machine vibration analysis, the system can learn and accurately detect various type of machine operating conditions. Monitoring system incorporates a **low power** EDGE-based AI and operates without the need of GPU



Vibration Data Acquisition/Analysis



AI-based Vibration Pattern Recognition



Wireless Battery-powered 3-Axes MemS Accelerometer

TECHNOLOGY FEATURE:

- AI based real-time classification and inference system to detect various machine operating conditions based on trained vibration patterns.
- Neuromorphic AI engine based on 3-layers artificial neural network with Radial Basis Function as activation function to model linear and non-linear vibration patterns.
- Does not requires a large training dataset. Ability to learn-on-the-fly (incremental learning) various vibration patterns while machine is in continuous operation.
- Detection of machine anomaly (report unknown vibration patterns). Able to learn (supervised) on-the-fly, any detected anomaly without the need to bring the system offline.
- Scalable system, ability to support multiple wireless accelerometers (or vibration sensors) across a large area using wireless mesh configuration for monitoring of multiple machines.
- Ability to adapt and use other sensors types such as sound and Acoustic Emission(AE) sensors.