



SUPERMICRO PARTNERS WITH MICROAI TO DELIVER A DIGITAL FACTORY PLATFORM

Empowering Next-Generation Manufacturing with Artificial Intelligence



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Executive Summary

Traditionally, manufacturing maintenance strategies have relied on two main approaches: scheduled and reactive maintenance. For several decades these approaches were sufficient to maintain average levels of overall equipment efficiency (OEE); however, this is no longer the case, as costly limitations often accompany these approaches. On one end, equipment would either be over or under-maintained when relying on scheduled maintenance. While on the other end, reactive maintenance significantly increases the chance of unplanned downtime and safety risks. Both scenarios result in the inefficient use of resources while negatively impacting overall operational efficiency. To overcome these costly limitations, the industry has started shifting towards a predictive maintenance approach, which leverages artificial intelligence (AI) and machine learning (ML) algorithms to optimize OEE. The goal is to utilize real-time data and performance indicators to proactively identify potential

equipment failures and prioritize maintenance activities to optimize resource allocation. Although AI and ML-based predictive maintenance technologies show great promise, it is not always easy to implement as they require certain prerequisites.

Challenges of AI Application Deployment in Manufacturing

Deploying AI-based predictive maintenance in this industry presents specific challenges that must be overcome to ensure successful implementation. Some of these include:

- **Limited Historical Data:** AI models typically rely on substantial amounts of historical data for training. Usually, a subject matter expert and data scientist would be needed to analyze and develop an algorithm to train the AI model based on available historical data.
- **Data Complexity & Interpretability:** In some cases, critical machine information may not have been captured in the past due to equipment or process changes, making it difficult to establish reliable patterns for accurate predictions.
- **Real-time Processing & Latency:** Significant computational power and time are likely required, which can introduce latency that can impact other performances.
- **Complex System Integration:** Manufacturing operations have a complex ecosystem of interconnected systems. This will require careful planning and implementation to ensure compatibility and seamless data exchanges between new applications and existing infrastructure.
- **Appropriate Edge Hardware Requirements:** Edge devices with sufficient processing power to execute AI workloads while being robust in design to withstand rugged environments.

Although these challenges prove to be burdensome, AI based predictive maintenance can provide many benefits in manufacturing.

Supermicro & MicroAI Solution

Realizing these challenges, Supermicro has partnered with MicroAI to develop a turnkey plug & play AI and ML factory platform. This Digital Factory combines Supermicro's ultra-reliable Intelligent Edge Systems with MicroAI's innovative technology to enable an AI based predictive solution that can be trained within a few days without needing preexisting historical data or data scientists.

Features:

Machine-Centric Intelligence

Embedding and training AI and ML algorithms directly onto the MCU or MPU of the manufacturing device or machine. Customizes AI algorithms based on the asset's specific operational and/or environmental parameters to provide breakthrough predictive insights into maintenance requirements.

Self-Learning

AI and ML algorithms learn the standard behavior patterns of the asset under various operational conditions. This self-learning occurs without human intervention requirements and provides performance baselines based on actual performance vs. static specifications.

Predictive Analytics

Real-time, asset-specific performance data is automatically collected and analyzed to produce predictive maintenance intelligence based on current and projected asset health and performance. Maintenance is performed when needed eliminating unnecessary machine downtimes and reducing maintenance costs.

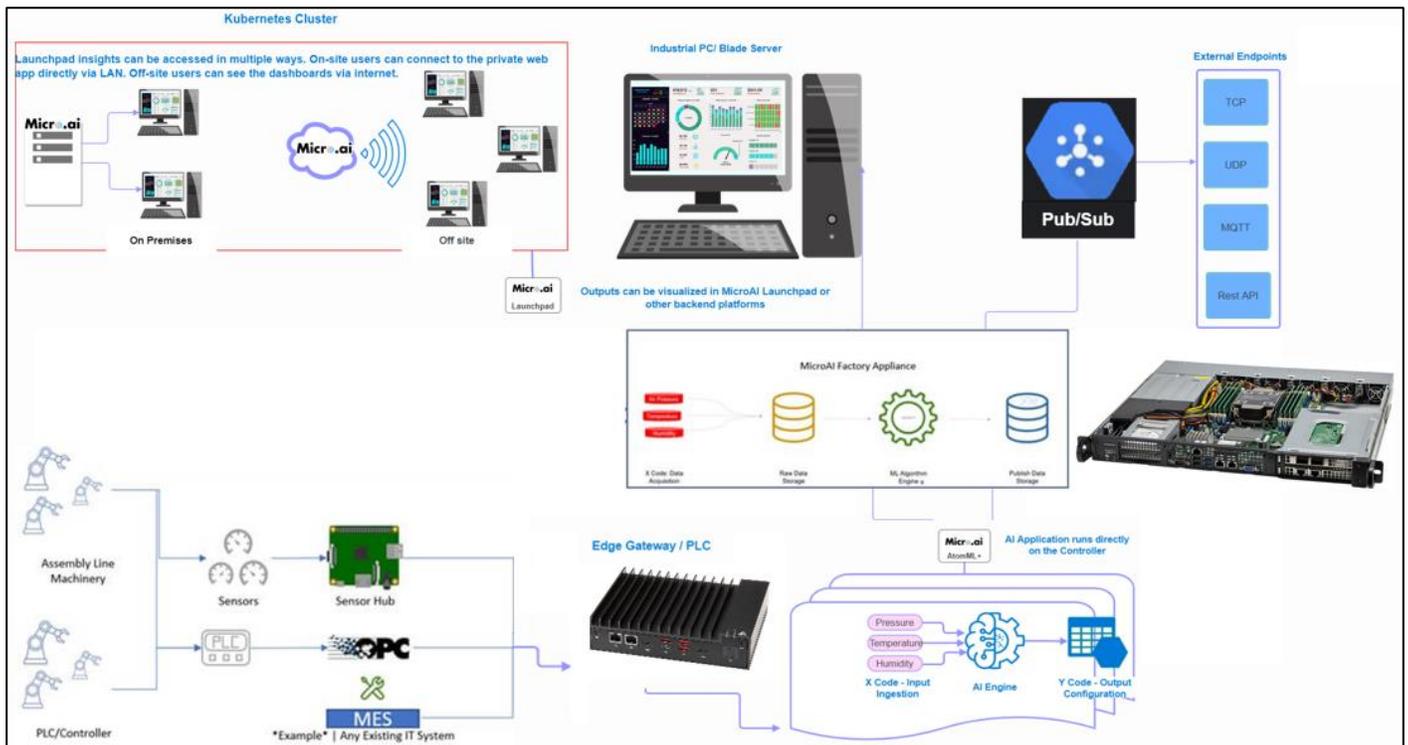
Catastrophic Failure Prevention

Local, real-time, predictive analytics that detect and alert the possibility of device or machine failure. Intelligent, automated workflows provide rapid alerts to ensure prompt response and fault mitigation to extend asset lifespans and improve factory floor safety.

Robust and Reliable Hardware

Built to withstand harsh environments while still delivering high compute performance capabilities. Fanless design offers reduced energy consumption and ultra reliability.

Deployment Architecture



The deployment architecture consists of multiple components working together to ensure seamless data acquisition, analysis, and actionable insights.

Overview:

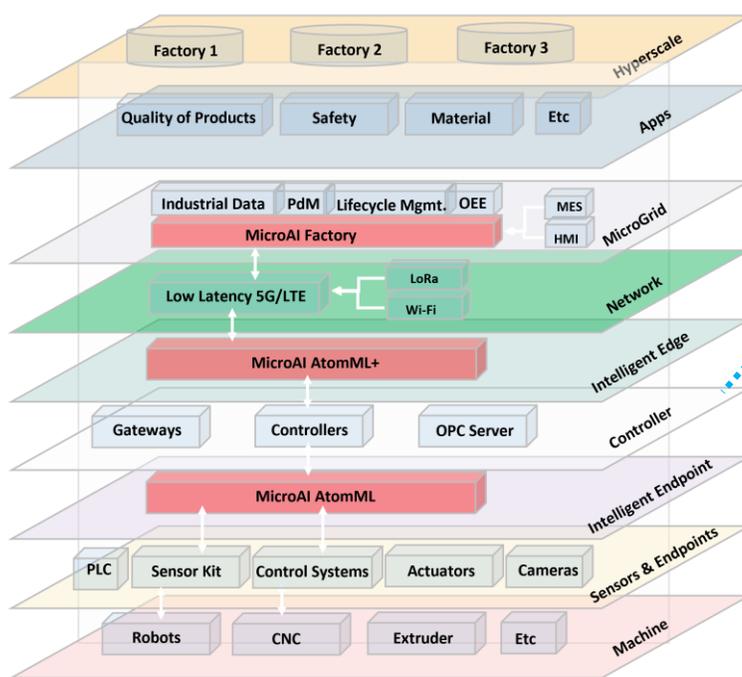
- 1. Supermicro Edge Device:** At the heart of the architecture, these edge devices are deployed throughout the manufacturing facility to capture sensor data from various machinery and equipment to perform real-time data processing, AI model inference, and local analytics.
- 2. Data Acquisition and Integration:** This layer ensures seamless integration of all sensors with the edge devices. It utilizes communication protocols such as Modbus, OPC-UA, or MQTT to capture data from these sources. The acquired data is then preprocessed, filtered, and integrated to ensure compatibility and consistency.
- 3. Analytics Engine:** Responsible for processing and analyzing sensor data collected by edge devices. It includes the AI models specifically trained for factory use cases, such as anomaly detection, fault prediction, and performance optimization. These

models are compact and optimized for edge computing, allowing real-time analysis directly on edge devices without relying heavily on cloud connectivity.

4. **Central Management System:** Allows administrators to monitor the health and performance of the edge devices, track analytics results, and configure the system settings in a user-friendly dashboard.

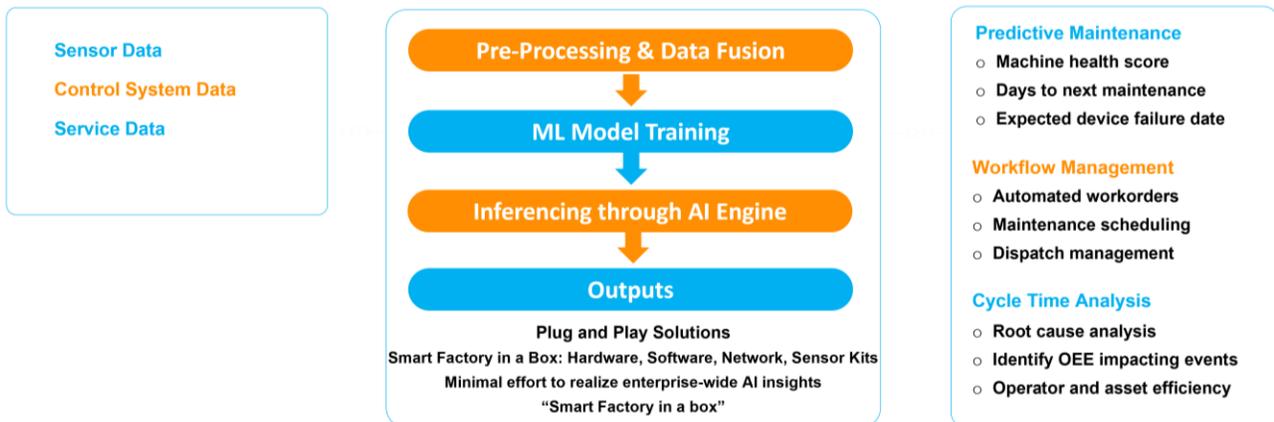
5. **Connectivity & Communication:** This includes wired and wireless connectivity options or industrial protocols like MQTT or OPC-UA.

Supermicro SYS-E100-12T Series Specification:



Supermicro SYS-E100-12T Series
Compact Fanless Form Factor
11 th Gen Intel Core i7/i5/i3/Celeron Processors
Up to 64GB DDR4 3200MHz SODIMM
Dual 2.5GbE LAN w/ Intel I22T-IT
Dual HDMI (2.0b and 1.4b) supports 4K
Expansion Slots: M.2 B-Key, M-Key, and E-Key
-30°C to 50°C Operating Temperature

Next Generation Factory Management & Process Optimization



Features:

Time-series data & insights from MicroAI AtomML & AtomML+ are hyper-converged within MicroAI Factory to deliver next generation On Premise Automation

Asset Monitoring & Self-Reporting: Enables real-time monitoring capabilities through collecting and analyzing sensor data. It continuously tracks asset conditions such as temperature, vibration, pressure, and other performance metrics to identify anomalies or deviations from normal operating parameters.

OEE Analysis: Provides the ability to develop real-time AI/ML based insight into OEE performance of any manufacturing line and shift. The ability to view which equipment is performing below the expected rate immediately allows operations to make informed decisions.

Cycle Time Analysis: This can predict the number of jobs that will be completed throughout a cycle. Displays a full line view that shows the occurrence of starved or blocked conditions and predicts the root cause of these conditions. This will allow management to see which assets or operators are underperforming.

Performance Monitoring: AI/ML based Machine Health Scores are generated for each asset by ingesting control systems and sensor data. It's configured to optimize the days to the next maintenance based on the current performance and health of the machine. It will also generate alarms based on the events happening to the device or environment.

Causality Analysis & Feedback Loop: Identifies root causes of problems or inefficiencies and establishes a feedback loop by providing insights into the causal relationships between variables. It will then facilitate the integration of these actions into the operational processes to continuously monitor and adjust performance.

Key Benefits:



Density Package Selection

Features	Standard	Advanced	Enterprise
Basic Performance Insights (Cycle Time, JPH, OEE)	✓	✓	✓
Predictive Maintenance Insights (alarms, health score)	✓	✓	✓
Causality Assignment	✓	✓	✓
Standardized Dashboards/Reporting	✓	✓	✓
ML Performance Insights (Predicted Cycle Time, Predicted JPH, Predicted OEE, Starved / Blocked Conditions)	✗	✓	✓
Advanced Predictive Maintenance Insights (Duty Rate, Predicted Days to Next Maintenance)	✗	✓	✓
MicroAI's Fully Integrated Work Order system	✗	✓	✓
APIs integration to Work Order systems	✗	✓	✓
Custom Dashboards	✗	✓	✓
ML Root Cause Analysis Insights (Classification and Reinforcement Learning)	✗	✗	✓
Federated Learning	✗	✗	✓

Supermicro Servers

Features	xSmall	Small	Medium	Large
CPU	1.4GHz 64-bit quad-core ARM Cortex-A53 CPU	Intel® Atom® processor E3940 (9.5W, 4C) 1.60 GHz to 1.80 GHz; Single socket FCBGA 1296	8th Gen. Intel® Core™ i5-8365UE Processor 1.60 GHz to 4.10GHz; Single Socket FCBGA-1528	Intel® Ice Lake Xeon D-1736NT 15MB 8 Cores 2.7GHz QAT 20G, 67W
Memory GB	1GB LPDDR2 SDRAM	Up to 8GB 1866MHz DDR3L Non-ECC SO-DIMM in 1 socket	Up to 64GB Unbuffered Non-ECC SO-DIMM DDR4 2400MHz; 2 DIMM slots	Up to 4 DDR4 2933MHz 256GB RDIMM or 128GB UDIMM
Storage	Micro SD format for loading operating system and data storage	1 SATA 3.0 for 7mm 2.5" SATA SSD, 1 M.2 B-Key 2242/3042 for SATA SSD	M.2: B-Key 2242/3042/2280, E-Key 2230, M-Key 2242/2280	1x M.2 B-Key (3042/3052/2280)&Nano SIM Slot 1x M.2 M-Key(2280) 1x M.2 E-Key (2230) or 1x 2.5" SATA/PCIe drive bays
Network Connectivity	2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE Gigabit Ethernet over USB 2.0 (maximum throughput 300Mbps) 4 x USB 2.0 ports	Dual LAN with Intel® Ethernet Controller I210-JT	Single LAN with Intel® I210T Single LAN with Intel® PHY I219LM	1 Dedicated IPMI LAN 6 Networking Interface (2 x25G SFP28, 4 x 1GbE)
Instruction Set	64-bit	64-bit	64-bit	64-bit
Operating System	Linux and Unix	Windows/Linux	Linux	Linux

Small:
SYS-E50-9AP



Medium:
SYS-E100-12T-E



Large:
SYS-E302-12D-8C



Features	Standard	Advanced	Enterprise
Node Size	Small	Medium	Large
No of Nodes(minimum required)	1	1	1
CPU Cores/Threads	32/64	32/64	32/64
Memory GB	128 GB	256 GB	512 GB
Storage SSD (After RAID Configuration)	6 TB	10 TB	10 TB
Network Controller	10G	10G	10G
Power Supply	Dual	Dual	Dual
Server Type	Rackmount	Rackmount	Rackmount
Operating System	Windows 2019	Windows 2019	Windows 2019
GPU Card	N/A	A4000	A4000
RAID	Yes	Yes	Yes

SYS-110P-FRN2T



Conclusion

AI driven predictive solutions have provided clear advantages for manufacturers, especially those that do not rely on the need for historical data. Supermicro and MicroAI's partnership creates a robust and comprehensive predictive maintenance solution combining AI, Edge Computing, and robust hardware. This powerful combination enables real-time anomaly detection, proactive maintenance, scalability, and security, ultimately optimizing OEE, reducing cost, and ensuring uninterrupted production in industrial manufacturing environments. By implementing Supermicro & MicroAI Digital Factory Platform, manufacturers unlock their manufacturing processes' full potential while maintaining their advantage in the dynamic manufacturing landscape.

Further Information

[Supermicro 5G, Edge, IoT, & Embedded Brochure 2023](#)

[Supermicro Fanless Edge Systems](#)

[Supermicro Compact Edge Systems](#)

[Supermicro 1U Edge Systems](#)

[MicroAI Predictive Manufacturing](#)

[MicroAI Digital Factory](#)

[MicroAI Digital Intelligent Manufacturing WhitePaper](#)

MICRO.AI

MicroAI™ is the pioneer in edge-native artificial intelligence (AI) and machine learning (ML). The company's mission is to automate the management of machines, enable them to self-monitor and self-report, and provide the most accurate information on machine health. The company's software is deployed within edge appliances aggregating data from multiple machines, as well as embedded on microcontrollers (MCUs) and microprocessors (MPUs) within an individual machine themselves. MicroAI's software is used by manufacturing and industrial processing companies, original equipment manufacturers, and asset owners to predict failures, identify security issues, and improve life-cycle management and overall equipment effectiveness (OEE). For more information visit www.micro.ai.

SUPERMICRO

As a global leader in high performance, high efficiency server technology and innovation, we develop and provide end-to-end green computing solutions to the data center, cloud computing, enterprise IT, big data, HPC, and embedded markets. Our Building Block Solutions® approach allows us to provide a broad range of SKUs, and enables us to build and deliver application-optimized solutions based upon your requirements.

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