WNDRVR

AI ADVANCES MANUFACTURING AND
INDUSTRIAL AUTOMATION SYSTEMS

In the constantly evolving world of manufacturing and automation, the top priorities remain constant: efficiency, quality, flexibility, safety, and cost. Helping to meet those priorities are huge advances in artificial intelligence (AI) and machine learning, which have recently provided this sector with development methods, tools, and services that are propelling advances globally.

MANUFACTURING CHALLENGES

The challenges facing modern manufacturing and industrial automation are numerous and interrelated.

Manufacturing throughput: Factories need to produce more in less time, without compromising quality. As product complexity increases, maintaining high-speed production becomes more challenging, as even minor inefficiencies can lead to significant downtime and cost overruns.

Quality: Customers are demanding higher precision and zero defects, leading manufacturers to adopt advanced quality-control measures. Traditional methods often fall short, leading to waste, rework, and customer dissatisfaction, straining resources and complicating the quest for higher throughput.

Flexibility: As consumer demands shift and product lifecycles shorten, manufacturers must adapt quickly to new products and varying order sizes. This requires switching between products seamlessly — often a struggle for traditional systems.

Safety: With stricter safety regulations and increasingly complex processes, ensuring a safe work environment while maintaining productivity is challenging. Compliance with safety certifications requires continuous monitoring and updating of protocols, complicating operations.

Cost: Manufacturers face constant pressure to reduce costs while improving efficiency. But rising operating expenses (from software licenses to increasing energy costs) can erode profit margins, making it harder to invest in necessary upgrades and innovations.

MEETING CHALLENGES WITH AI

Recent advances in AI have driven innovation and efficiency in manufacturing and industrial automation through a variety of applications.

Robots and cobots: AI-powered factory and warehouse robots navigate complex environments and pick and place items with precision to enhance efficiency. Collaborative robots, or cobots, are designed to work alongside humans. They learn from human actions, improving performance over time and taking on more complex tasks, thus boosting productivity while reducing workplace injuries.

Automated guided vehicles: AGVs are increasingly common and rely on AI to transport materials throughout factories and warehouses. Moving autonomously, they navigate dynamic environments, avoid obstacles, and optimize routes, leading to significant efficiency gains.

Anomaly detection: AI algorithms are revolutionizing quality control in manufacturing. They analyze vast amounts of data from sensors and computer vision cameras in real time, identifying deviations from the norm that may indicate a defect or malfunction. This allows manufacturers to inspect products at a speed and accuracy far beyond human capabilities, address issues before they escalate, reduce downtime, and ensure consistent product quality.

Predictive maintenance: By analyzing machine data, AI predicts failures and supports maintenance before breakdowns occur. This reduces unplanned downtime, extends equipment life, and lowers costs.

Operational flexibility: AI empowers automation in reading and writing data for production lot sizes of one. This means that manufacturers can produce customized products at scale, without lengthy retooling or manual intervention. This enables quick response to both customer demand and market changes. Additionally, AI optimizes the ordering of manufacturing supplies. By analyzing production schedules, inventory levels, and market trends, AI-powered programs ensure that materials are ordered just in time, reducing waste and costs.

CHALLENGES OF IMPLEMENTING AI

While AI has the potential to revolutionize manufacturing, its implementation comes with significant challenges.

Skills shortage: Effective AI algorithms are complex and must be robust, scalable, and capable of operating in real time. The workforce must be proficient in AI, data science, and software engineering, as well as traditional manufacturing processes. The current talent gap makes it difficult for manufacturers to find developers to drive AI initiatives forward. Moreover, those developers then need access to modern software development methods, tools, and services.

Data infrastructure: Manufacturing environments generate vast amounts of data, often siloed and inconsistent. To harness AI's power, manufacturers must build an infrastructure that efficiently collects, stores, and processes data from various sources, including legacy systems not designed for data-driven operations.

Scalable deployment networks: Many manufacturers lack the necessary infrastructure, in both hardware and networking, to deploy AI solutions across multiple sites and different regions. Without this, even advanced AI solutions can be ineffective.

WIND RIVER SOLUTIONS FOR AI AND MANUFACTURING AND INDUSTRIAL AUTOMATION

Wind River® has been delivering safe, secure, and reliable software solutions and services to manufacturing and industrial automation OEMs and their developers for more than 40 years. It supports industrial equipment companies in developing products that utilize the intelligent edge, 5G wireless, AI, and more with:

- A cloud platform that empowers manufacturing and industrial automation systems with robust AI capabilities to speed innovation and improve production and business outcomes
- A developer platform with modern tools and services for designing manufacturing and industrial automation systems
- A Linux operating system that allows flexible containerization and services for AI applications
- The leading real-time operating system (RTOS) with safety certification evidence for rapid operations

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Wind River Studio Cloud Platform

Studio Cloud Platform is an open source, production-grade distributed Kubernetes solution for managing cloud infrastructure that empowers systems with robust AI capabilities. The infrastructure can host AI/ML systems that provide data storage, computational resources, collaboration tools, and security features. This allows industrial manufacturing companies to build AI capabilities into their equipment to support intelligent industrial innovation, intelligent robotics, improved production efficiency and quality control, predictive maintenance, flexible factory production, and safety.

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Wind River Studio Developer

Studio Developer is a modern DevSecOps platform that accelerates development, deployment, and operation of robust mission-critical systems with AI capabilities. It has five main components: Wind River Studio Pipelines, Wind River Studio Virtual Labs, Wind River Studio Test Automation, Wind River Studio Over-the-Air Updates, and Wind River Studio Digital Feedback Loop. Flexible installation options provide control over security and compliance, both in the public cloud and in on-premises infrastructure.

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Wind River Studio Linux Services

Studio Linux Services delivers embedded Linux platform services that developers need to assist and support manufacturing and automation equipment and system design, safety and certification, security, and lifecycle management capabilities.

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Wind River Linux

Wind River Linux is the industry-leading open source operating system. Industrial equipment OEMs can use the comprehensive suite of products, tools, and lifecycle services in the development of complex factory systems.

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VxWorks

VxWorks® is an RTOS that meets hard real-time requirements for precision-based equipment and systems, such as industrial robots and cobots. It provides strict certification standards for safety, security, and performance and is IEC 61508 SIL-3 certified for industrial automation. VxWorks is the first and only RTOS to support application deployment through OCI-compliant containers.

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