White Paper

Edge Computing and Automation Simplify Path to Green Manufacturing

Combine Edge Computing and Communications for Green Manufacturing Applications

Computer Numerical Control (CNC) machines have a long and rich history, going back close to 75 years, with the first machines on record being developed by MIT's Servomechanisms Laboratory. Essentially, they represent a computerized manufacturing tool that uses pre-programmed instructions to control and operate machinery. They're widely used in various industries for tasks such as cutting, milling, drilling, and additive manufacturing, and can be found in factories, workshops, and laboratories, and they play a crucial role in modern manufacturing processes.

Fast-forwarding to current times, along with the adoption of Industry 4.0 and its emphasis on digitization, automation, and data exchange, including connections to the industrial IoT (IIoT) and the Cloud, CNC machines and associated automation tools are evolving in many areas. With a focus on smart manufacturing, real-time data analytics, and increased connectivity, emerging technologies like artificial intelligence (AI) and machine learning are being explored to optimize automation.

Thanks to use of the latest technologies, CNC automation systems are growing quite rapidly. According to one source, Zion Industry Research, the global CNC automation market was evaluated at $61 billion in 2022 and is slated to hit $133 billion by the end of 2030 with a CAGR of
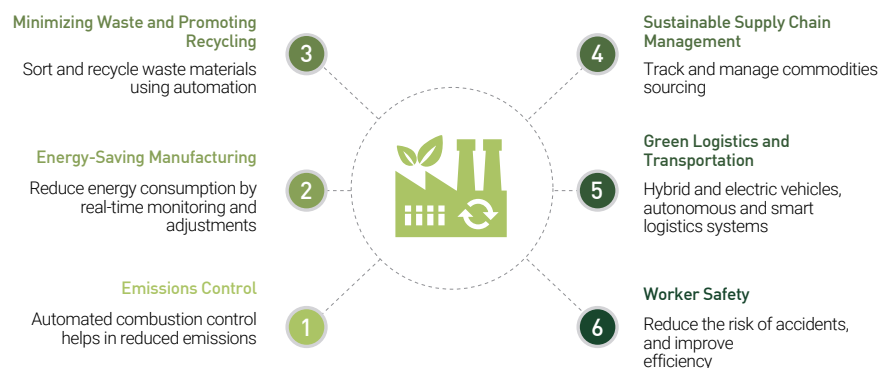
nearly 10.4% between 2023 and 2030.

However, one area that has been slower to evolve is the "greenness" of the machines, or their ability to operate with less power. Manufacturing systems consume substantial power primarily due to their precision motors, spindle systems, and auxiliary components. The high-performance motors responsible for moving the machines various axes demand significant electrical power, especially when rapid and precise movements are needed, particularly at times that require substantial torque and speed. Secondly, CNC machines often incorporate cooling systems to prevent components from overheating during prolonged operations, adding to overall energy usage.

Automation Can Be Great, But Must Be Sustainable

Despite their efficiency and precision benefits, the power-hungry nature of CNC machines and similar automation tools underscores the importance of energy management strategies in industrial settings to optimize performance and minimize operational costs.

Many suppliers to the industrial market segment are trying to put their best foot forward when it comes to being green and consuming less power. This movement is crucial for a host of reasons, encompassing environmental sustainability, economic efficiency, and societal well-being.

Minimizing Waste and Promoting Recycling
3 — Sort and recycle waste materials using automation

Energy-Saving Manufacturing
2 — Reduce energy consumption by real-time monitoring and adjustments

Emissions Control
1 — Automated combustion control helps in reduced emissions

Sustainable Supply Chain Management
4 — Track and manage commodities sourcing

Green Logistics and Transportation
5 — Hybrid and electric vehicles, autonomous and smart logistics systems

Worker Safety
6 — Reduce the risk of accidents, and improve efficiency

First and foremost, reducing power consumption is a fundamental aspect of environmental conservation. Excessive energy use contributes to the depletion of natural resources and increases carbon emissions, leading to climate change and environmental degradation. By adopting greener practices and minimizing power consumption, individuals and industries can mitigate their ecological footprint, preserving ecosystems and biodiversity.

Be a Good Citizen, and Reduce Costs

Economically, reduced power consumption translates to lower utility costs. Investments in green technologies and practices often lead to long-term cost savings through decreased energy bills and operational expenses. Moreover, industries that prioritize sustainability are more likely to appeal to environmentally conscious consumers, potentially enhancing market competitiveness.

For those reasons, suppliers to the industrial and automation industries, including automated smart robots, outdoor mobile robots, smart vehicles, last-mile delivery, and so on, are attempting to make themselves smarter and greener. And they are helping their customers do the same. One example of this movement comes in the form of the NexAIoT **NIFE 210** industrial fieldbus computer, which provides a green solution for CNC and automation applications, as well as other IIoT and industrial applications.

Powered by the latest generation Intel Celeron J6413 quad core (formerly codenamed Elkhart Lake) running at 1.8 GHz, the **NIFE 210** incorporates the capabilities of both an intelligent PC-based controller and an IoT gateway for factory automation applications. It supports up to 32 Gbytes of DDR4L memory and offers a hoist of storage options, including ComboStorage (2.5" SSD + MicroSD), mSATA, SSD/HDD.

The **NIFE 210**, which can operate in temperatures ranging from -10°C to 60°C with typical DC input of 24 V +/-20%. This makes it well suited for the applications described above, including controlling CNC-type machinery in manufacturing and automaton facilities, and M2M intelligent systems. It also includes TPM 2.0 security. In addition, a universal emergency power module can be integrated to operate as an uninterruptible power supply.

NIFE 210-E01
Factory Automation
Fanless System

NIFE 210-E11
Factory Automation Fanless
System with PCIe x4
Expansion Slot

The NexAIoT NIFE 210, with its front-panel I/O access, provides a green solution for CNC and automation applications, as well as other IIoT and industrial applications, and compares favorably against legacy-embedded computers.

Figure 2. NexAIoT next generation automation-PC product line.

The combination of edge computing with CNC automation enables localized decision-making, real-time analytics, and optimized resource usage, aligning with the principles of sustainable manufacturing.

Fitting In

To that end, the industrial fieldbus embedded computer offers easy integration into existing facilities due to its array of I/O options, including an optional Mini-PCIe module and dual RS-232/422/485 ports with isolation, as well as LAN, Wi-Fi, 5G/4G LTE modules. Other options available to the systems integrator include PROFIBUS, ProfINET, DeviceNET, EtherCAT, EtherNet/IP, CANopen, and SERCOSIII master module. For applications that requires even more connectivity, the NIFE 210 can be configured with GPIO, and RS232/422/485.

Obviously, the NIFE 210 compares favorably against competitive systems in terms of its "greenness," as well as the amount of available compute power and I/O. Any systems that are connected to the IIoT and/or running AI and machine-learning algorithms will operate without a flaw. And legacy platforms generally aren't even in the same league when it comes to green solution for CNC and automation applications, as well as IIoT and industrial applications.

Creating the Future of Green Manufacturing with NexAIoT

In addition to providing world-class products, system developers should understand the vendor behind those products, in this case, NexAIoT, a company with a long and rich history in the embedded computing, automation, and industrial IoT segments. In addition, NexAIoT has other products in the NIFE Series that are also aimed at automation. Hence, they aren't trying to shoehorn existing products into this relatively new segment. All NexAIoT products go through strict testing and verification processes before being released.

The NexAIoT NIFE series goes beyond the conventional industrial-grade EMC standard, undergoing far stricter testing that traditional product. The computing line adheres to higher standards and, as a result, is less likely to cause interference

Why NIFE 210 for Factory Automation?

- High computing power and energy-efficient Intel® Celeron® J6413, 1.80 GHz processor for real-time control and precision.
- Fieldbus connectivity PROFINET, PROFIBUS, DeviceNet, EtherNet/IP and EtherCAT.
- Fanless operation minimize the risk of dust and debris entering the system, reducing maintenance requirements and increasing reliability.
- All front access I/O for easy installation and convenient maintenance.
- Support ComboStorage (2.5" SSD & MicroSD) for storage redundancy and capacity expansion.
- Support DIN-rail mounting for easy integration into CNC machinery or control cabinets.
- Tested beyond industrial-grade standard EN61000-6-2, EN61000-6-4.
- Long-term availability (10+ years)

with other nearby electronic devices. This helps reduce the risk of equipment malfunctions, which can lead to accidents, production disruptions, or costly downtime.

Finally, NexAIoT offers longevity support, meaning that in 15 years, or longer in many cases, NexAIoT will still have all the hardware and software (and tech support) that you'll need to keep you application running. And that includes future-proofing as well. Contact NexAIoT for all your green smart manufacturing and automation needs.

Conclusion

NexAIoT offers industrial automation PCs powered by Intel's processors to be used in factory automation that brings unparalleled precision, efficiency, and flexibility to manufacturing processes. The incorporation of edge computing and cloud technologies into manufacturing processes aligns with green manufacturing objectives by promoting resource efficiency, reducing waste, optimizing energy consumption, and enhancing overall sustainability in production operations.

Your Partner in Smart Manufacturing

NexAIoT is a Limited Liability Company, incorporated in Taiwan in 2014 and is a subsidiary of NEXCOM (TWSE: 8234).

NexAIoT has established its position in Asia and China as a market leader in providing I4.0 solutions including Industrial PC, Factory Automation, Robotics, and AIoT. Its mission is to become the global leader in industrial IoT and the preferred partner to accelerate the digital transformation in industry 4.0.

NexAIoT operation is supported by solution engineering, product engineering (R&D, project management, technical support), sales & business development (local, overseas, and ODM), and backend operation (finance, HR, IT, procurement) divisions, with regional business operation in Asia, Europe, and USA.

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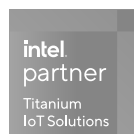
From modular components to market-ready systems, Intel and the 400+ global member companies of the Intel® Internet of Things Solutions Alliance provide scalable, interoperable solutions that accelerate deployment of intelligent devices and end-to-end analytics. Close collaboration with Intel and each other enables Alliance members to innovate with the latest IoT technologies, helping developers deliver first-in-market solutions.

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