Component-Level Revolution: Expert Perspectives on AI's New Role in Automotive Manufacturing

Six Expert Perspectives

With 75% of advanced manufacturing companies now prioritizing artificial intelligence implementation as a primary engineering and R&D goal, a significant shift is taking place on factory floors. While cloud computing promised a revolution in smart manufacturing, a more pragmatic transformation is now emerging: component-level intelligence is proving to be a game-changer in automotive manufacturing.

This approach, where individual manufacturing machines provide advanced real-time monitoring and early warning capabilities, delivers the precision and speed crucial for modern production. In modern manufacturing facilities, every second of downtime translates to lost production and revenue. In high-stakes industries such as automotive manufacturing, the cost can exceed $50,000 per minute, which translates to about $3 million per hour Rapid data processing and predictive analytics are more essential than ever for maintaining a competitive advantage.

Understanding Component-Level Intelligence

Component-level intelligence represents an innovative approach to machine diagnostics and monitoring, enabling manufacturers of all sizes to leverage artificial intelligence with limited initial investment. While serving as an advanced monitoring and early warning system, this technology is designed to support—not replace—specialists, engineers, and operators. It provides crucial real-time data and alerts, but all production decisions remain firmly in the hands of human operators and maintenance teams.

"Component-level intelligence represents a fundamental shift in manufacturing automation," explains Lucas Majewski, Global Director of Automotive/EV Industry. "Individual components, such as servo drives,

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inverters, and robots, act as intelligent monitoring agents. They perform self-diagnostics and provide early warnings of potential issues. For instance, our servo drives now monitor their condition and detect potential problems in surrounding machine parts, such as belt wear, alerting maintenance teams before failures occur."

Component-Level Intelligence vs. Cloud Platforms

The fundamental difference between component-level intelligence and traditional cloud platforms lies in their data processing and analysis approach. Cloud-based solutions require data from manufacturing equipment to be transferred to centralized platforms and back. This process introduces latency and potential security risks. Component-level intelligence processes data locally at the point of generation, enabling immediate analysis and faster response times.

Cloud platforms require significant initial investments in data storage, backup systems, security measures, and hardware. In contrast, component-level intelligence allows for gradual implementation, starting with the most critical areas. This bottom-up approach enables manufacturers to expand their intelligent monitoring capabilities at their own pace without large upfront expenditures.

Frederik Kok, Senior Cyber Security Expert, emphasizes: "Processing data at the component level enables rapid detection of equipment anomalies. This local processing eliminates delays associated with cloud data transfer while maintaining maximum security of sensitive manufacturing data."

Practical Benefits

A practical example of component-level intelligence can be seen in MELFA robots equipped with MELFA Smart Plus diagnostic cards, which enable continuous performance monitoring. Another case involves the

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MELSERVO-J5 servo series, which demonstrates how servo systems contribute to the intelligent ecosystem by analyzing mechanical components throughout the production line. These systems monitor critical parameters such as friction and vibration patterns, creating a comprehensive network of diagnostics that enhances overall production reliability.

In the smart factory environment, components communicate automatically within the Industrial Internet of Things framework. They independently report repair needs, signal maintenance requirements, or cleaning requests. Such systems provide immediate alerts based on those signals, enabling rapid response from maintenance teams and resulting in more efficient factory operation and significant savings. "From what we observe across manufacturing facilities of all sizes, components equipped with AI-driven intelligence consistently help reduce unplanned downtime. The beauty of this solution lies in its automation - the analytics happen in the background without requiring any data science expertise," adds Piotr Siwek, Digital Director EMEA at Mitsubishi Electric Factory Automation.

Scalable Manufacturing Intelligence

Giuseppe Polimeni, Director of Global Key Accounts, responsible for Mitsubishi Electric activities in EU countries and in the Japanese market, outlines the evolution: "Starting with component-level intelligence allows manufacturers to build digital competencies gradually. We're transitioning from basic predictive maintenance to prospective maintenance, where systems anticipate issues and actively guide optimization. This progression naturally leads to more comprehensive automation as organizations grow more sophisticated in AI usage."

The key to success lies in starting small and scaling intelligently. "In one European factory, we began with AI implementation in welding applications," shares Siwek. "Edge-level data analytics performed with MaiLab software achieved nearly 100% accuracy for failure predictions. The quality results encouraged the client to expand the project across the entire production line."

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Omar Esparza emphasizes the importance of demonstrating value: "It's imperative to demonstrate the competitive advantages that automation brings to each customer. The rapid flow of information enabled by AI tools demands adaptability and delivers exceptional value and an improved customer experience."

Albert Ganz, General Manager of Sales and Quality, emphasizes the importance of flexibility: "OEMs are increasingly creating digital models and simulating manufacturing environments in parallel with actual implementations. This approach saves time and money while enhancing adaptability. While most manufacturers now design for multiple scenarios, they still need flexible automation strategies that respond quickly to changing market conditions, without costly line overhauls."

Hybrid Future

While component-level intelligence forms the foundation, industry experts predict the growing importance of hybrid AI solutions. "The future belongs to hybrid solutions," explains Frederik Kok. "Our bottom-up strategy allows clients to build solid digital foundations and consciously choose which processes require cloud support." This approach enables manufacturers to progress while managing risk, which is particularly valuable in market uncertainty.

The emergence of component-level intelligence marks a significant evolution in automotive manufacturing that perfectly aligns with the industry's need for flexible, scalable solutions. Manufacturers can create robust, adaptable production environments by starting with intelligent components and gradually building towards comprehensive automation systems. This approach addresses immediate efficiency needs and paves the way for future hybrid AI implementations. Component-level intelligence comes as a navigator on the path to advanced manufacturing automation.

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About the Report: "Drive the EVolution! Automotive Industry Factory Automation Expert Round-up Report 2025" combines insights from industry experts across Europe, Asia, and the Americas with real-world case studies and actionable recommendations for manufacturers aiming to stay ahead in a rapidly evolving industry.

About Mitsubishi Electric Corporation

With more than 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 6503) is a recognized world leader in the manufacture, marketing, and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation, and building equipment. Mitsubishi Electric enriches society with technology in the spirit of its "Changes for the Better." The company recorded a revenue of 5,521.7 billion yen (U.S.$ 36.8 billion*) in the fiscal year ended March 31, 2025.
For more information, please visit www.MitsubishiElectric.com.

**U.S. dollar amounts are translated from yen at the rate of ¥150=U.S.$1, the approximate rate on the Tokyo Foreign Exchange Market on March 31, 2025.*

About Mitsubishi Electric Factory Automation Business Group

Offering a vast range of automation and processing technologies, including controllers, drive products, power distribution and control products, electrical discharge machines, electron beam machines, laser processing machines, computerized numerical controllers, and industrial robots, Mitsubishi Electric helps bring higher productivity – and quality – to the factory floor. In addition, its extensive service networks around the globe provide direct communication and comprehensive support to customers. The global slogan

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"Automating the World" shows the company's approach to leveraging automation for the betterment of society through the application of advanced technology, sharing know-how, and supporting customers as a trusted partner.

For more about the story behind “Automating the World”, please visit:
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