

# How AI and AOI Technology Drive Superior Product Quality for Electronics Companies



Primary functionalities:



IP65 Protection



WiFi Transmission

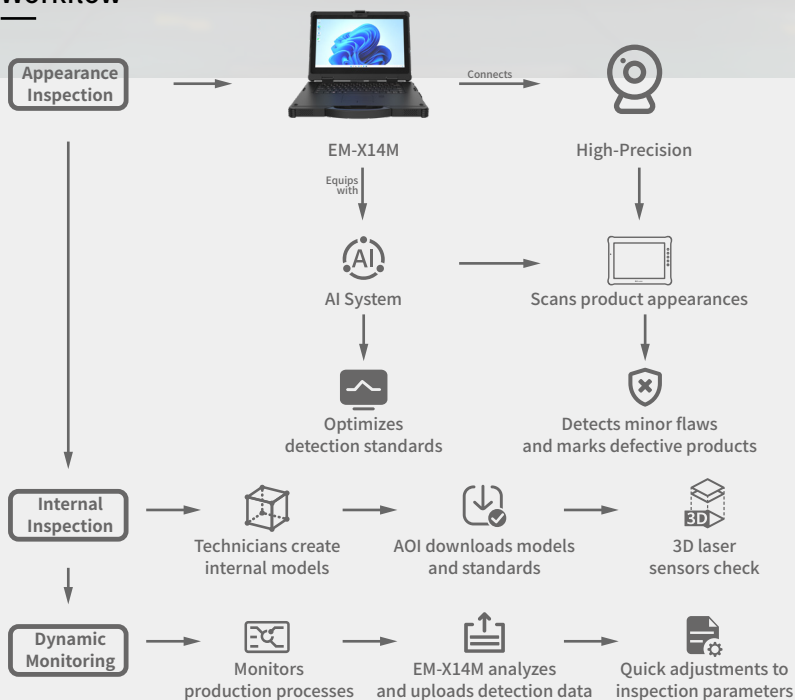


AI-Powered



Thunderbolt 4 Ports

### Workflow



## Challenge

A leading electronics company focused on high-quality product development and manufacturing is encountering challenges as it expands its smart factory operations to meet rapid market growth. Ensuring product consistency and quality while improving inspection efficiency has become an urgent priority. Traditional manual inspections for products rely on worker experience and visual judgment, which are time-consuming and prone to error, especially in ensuring precision for intricate components and external finish. With the complex and precise design of electronic devices, traditional inspection can no longer meet the company's dual demands for high quality and operational efficiency.

## Solution

The company has introduced advanced AI and AOI (Automated Optical Inspection) technology into its production line, comprehensively upgrading its electronic product inspection processes. The production line is equipped with the EM-X14M rugged notebook of Emdoor Information to run the AI inspection system, which can automatically inspect product appearance and internal assembly by learning models, ensuring flawless component fit. The AOI equipment utilizes high-precision cameras and laser sensors to inspect screw tightness, component placement accuracy, and other fine details. By combining AI's intelligent analysis with AOI's high-precision detection, the factory achieves real-time monitoring of all critical components during production, ensuring every product meets strict quality standards.

## Benefits

By combining AI and AOI technology alongside rugged AI PCs, the company has significantly improved production efficiency and product quality. Inspection speed has increased multiple times compared to previous manual methods, reducing inspection time per product to just a few seconds and minimizing errors and inconsistencies caused by manual handling. AI's self-learning capabilities continually optimize the inspection system, ensuring that each product meets high quality standards upon release. Automated inspection has also reduced the rate of returns and enhanced the product experience for customers, further strengthening the company's brand competitiveness and market share.

**EM-X14M**

AI Rugged Notebook

# Challenge

As global manufacturing evolves, automated production and high-precision inspection have become key competitive factors in the electronics industry. The client, a leading Chinese electronics company specializing in laptops and tablets, has consistently aimed to deliver high-quality products to customers worldwide. However, with rising demand and increasingly complex products, the limitations of manual inspection are becoming more apparent. Manual inspection relies heavily on worker experience and visual judgment, resulting in subjective errors. This is particularly challenging when inspecting intricate components such as cameras, touchscreens, chips, and speakers, where subtle assembly misalignments or quality issues are often difficult to detect manually. Small inconsistencies—like improper screw tightness, cable connections, or shell integrity—might not be noticeable during final inspection but can cause malfunctions during use, affecting user experience and potentially harming brand reputation.

Additionally, the growing workload on production lines has made it difficult for manual inspections to keep pace, creating a bottleneck in production. This approach is not only inefficient but also leads to higher labor and training costs. Furthermore, the need for real-time data tracking and standardized inspection results poses another major challenge. Manual inspections lack consistency, making it difficult to standardize data and ensure uniform quality across batches, highlighting the need for smart devices to assist. However, the complex factory environment demands high reliability and performance from equipment. As the focus on high-quality products and lower return rates intensifies, automating and standardizing inspections while improving accuracy and efficiency has become an urgent priority.

# Solution

To tackle these inspection challenges, the client has adopted an AI system and AOI inspection device, equipped with Emdoor Information's EM-X14M

rugged AI PC tailored to their factory's needs. This notebook powers the AI automated inspection system, revolutionizing their production quality management process. The EM-X14M features a next-generation Intel Core Ultra processor and a dedicated NPU AI engine, providing powerful computing capabilities that fully leverage the advantages of the AI inspection system. Additionally, its IP65 and MIL-STD-810H certifications make it well-suited for complex factory environments. The workflow consists of three key stages: appearance inspection, internal structure inspection, and dynamic real-time monitoring, enabling comprehensive automation of the inspection process.

1. Appearance Inspection: The EM-X14M, stationed on production lines, uses its AI system to conduct a thorough visual scan of products, detecting minor flaws on components like camera lenses, screens, and casings, such as scratches, dents, or color discrepancies. Based on historical inspection data and extensive training, the AI algorithm optimizes detection standards for enhanced accuracy. After imaging, the EM-X14M uses AI for automated analysis, quickly identifying and marking defective products while recording data for upload to the backend system.

2. Internal Structure Inspection: Technicians create custom internal models for each product model, which are then loaded into AOI equipment with specific inspection standards. The AOI system, using 3D laser sensors, performs in-depth checks on screw tightness, cable connection angles, and component placements. It precisely measures the height of screws and chip components using a "zero plane" reference and verifies cable insertion from dual angles to ensure accurate connections and color consistency. This automated inspection minimizes human error in assembling fine components and allows real-time assembly monitoring. Adjustments are easy; simply remove items from the template when inspection is unnecessary.

3. Dynamic Real-Time Monitoring: Throughout production, the AOI system and AI form an

intelligent inspection network, continuously monitoring the process to ensure product quality and detect issues early. Using the EM-X14M rugged AI PC, technicians can analyze inspection data in real-time, ensuring quick data processing and precise analysis, which aids in adjusting inspection parameters and optimizing production flows efficiently.

# Benefits

## Enhanced Inspection Efficiency

AI and AOI automation greatly outpaces traditional manual checks. The high-performance EM-X14M rugged AI PC processes and analyzes each product in seconds, significantly shortening production time. This speed boost streamlines workflow, meets rising market demands, and greatly increases production capacity.

## Improved Product Quality Stability

AI technology, with self-learning and data optimization, ensures consistent inspection results for every device. The high precision of the AOI system, especially with 3D detection, catches minute component deviations often missed by manual checks. This enhances product reliability, reducing rework rates and after-sales costs.

## Reduced Maintenance Costs

The high accuracy of automated inspections effectively lowers maintenance frequency, reducing both labor costs and equipment wear. The rugged design and durability of the EM-X14M AI laptop significantly decrease damage rates, extending its lifespan and cutting replacement expenses.

## Enhanced Market Competitiveness

With AI and AOI-driven smart production management, customers achieve higher product quality and faster production cycles, enabling swift responses to market demands. Consistent, high-quality output significantly reduces complaints, building a strong industry reputation and supporting customers in establishing a competitive market position.