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Case Study

Smart Rail: AI-Powered Track Inspection Solution

AIE900A-AO

Advancing Railway Safety with Edge AI

Ensuring railway safety and efficiency requires continuous, accurate monitoring solutions capable of detecting track defects in real time. With AI-powered edge computing, inspections can now be carried out with precision—without disrupting active rail services. By combining high-performance computing with multi-sensor and camera integration, these systems can process massive volumes of video data on the move and transmit insights remotely. This enables predictive maintenance, reduces operational risks, and enhances reliability, even under demanding railway conditions.

Challenges

Railway tracks must be continuously monitored to detect cracks, misalignments, or wear before they disrupt operations. Manual inspections are labor-intensive, error-prone, and too slow for modern rail traffic. To address these challenges, the customer—an established global engineering leader with operations in over 25 countries—sought a compact, high-performance edge AI solution capable of performing real-time defect detection directly onboard moving inspection vehicles.

Key Requirements:

- Real-time analytics: Process multiple high-resolution video streams at line speed with low latency.
- Sensor integration: Support diverse cameras (GigE, USB, MIPI) and auxiliary sensors (IMU, GPS).
- Remote connectivity: Expandable 5G for high-bandwidth transmission and centralized control.
- Rugged design: Fanless, anti-vibration build resistant to shock, dust, and temperature extremes.
- Stable power: Reliable USB power management for uninterrupted in-vehicle operation.

Railway Track Inspection Solution

AIE900A-AO for Real-Time AI Defect Detection

To address the challenges of traditional railway inspection, Axiomtek proposed the AIE900A-AO—an edge AI computing system powered by the NVIDIA® Jetson AGX Orin™ platform, delivering up to 275 TOPS of AI performance. Compact yet powerful, the AIE900A-AO enables real-time defect detection directly onboard moving inspection vehicles, ensuring continuous and uninterrupted track monitoring.

Built for versatility and rugged environments, the AIE900A-AO seamlessly integrates with multiple sensors and cameras. Its robust, fanless design ensures reliable performance under harsh railway conditions. By combining high-performance AI processing with edge intelligence, the AIE900A-AO empowers predictive maintenance, enhances operational safety, and significantly improves inspection efficiency.

Application

Edge AI in Rail Inspection Operations

The AIE900A-AO was integrated into a custom enclosure mounted on rail inspection vehicles, where it processed high-resolution video streams from multiple cameras. Leveraging onboard AI inference, the system immediately detected and flagged track anomalies, enabling continuous, high-speed monitoring, automated defect detection, and data-driven maintenance decisions that minimize the risk of costly operational failures.

AIE900A-AO

System Configurations

Next-Level Edge AI System:

- NVIDIA® Jetson AGX Orin™ platform, up to 275 TOPS
- 5G, Wi-Fi 6E, and 2.5 GbE for seamless data transmission
- 9–36 VDC with ignition support (E-Mark compliant)
- 8 PoE ports and GMSL for cameras and LiDAR integration
- -25˚C to +60˚C operating temperatures
- Optional OTA deployment and monitoring via Allxon platform

Why Axiomtek

Axiomtek provides rugged, high-performance edge AI solutions designed for critical railway operations. The AIE900A-AO enables real-time defect detection, predictive maintenance, and continuous track monitoring. Its advanced hardware, reliable connectivity, and optional remote management allow operators to boost efficiency and maintain safer, more reliable rail networks.

> **The Axiomtek AIE900A has excelled in meeting the real-time demands of railway track inspection. Its rugged fanless design, 275-TOPS edge-AI performance, and rich PoE/5G-ready I/O have significantly streamlined our maintenance workflows. This platform sets a new benchmark for rail-side AI solutions.**
>
> — Technical Leader of the customer

About
Axiomtek Co., Ltd.

Axiomtek has achieved remarkable growth over the past 35 years thanks to our dedicated people, industry expertise, and commitment to delivering easy-to-integrate solutions. Celebrating 35 years of innovation, we continue to invest in our team of software, hardware, firmware, and application engineers who drive our progress.

As we look to the future, our success will depend on leading with advanced AIoT technologies and offering comprehensive hardware and software solutions. By providing exceptional engineering, value-added services, and innovative solutions, we help system integrators, OEMs, and ODMs overcome challenges and succeed in their markets.

In our 35th year, we are focused on building stronger partnerships and expanding our network of technology leaders. These alliances create synergy and enhance our ability to deliver the solutions and expertise our customers need.

Axiomtek is also a proud member of the Intel IoT® Solutions Alliance — a global network of over 800 industry leaders. This membership grants us exclusive access to Intel technology, expertise, and support, enabling us to deliver top-tier solutions to our customers.

With 35 years of experience behind us, we are excited to continue driving innovation and delivering value to our partners and customers.