ADLINK
LEADING EDGE AI COMPUTING

Quadruped Robots



Reliable 24/7 Quadruped Robotics for Harsh Industrial Environments Powered by ADLINK Edge AI Platforms

Application Story

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Intelligent Edge Computing for Autonomous Outdoor Patrol Robots

Autonomous quadruped robots are increasingly deployed for industrial inspection and security patrol, operating in environments such as energy plants, chemical facilities, and heavy industrial sites. These robots must navigate complex terrain while continuously analyzing sensor data to detect anomalies and safety risks.

Achieving reliable autonomy requires a computing architecture that can simultaneously support AI perception, multi-sensor fusion, and deterministic motion control within a compact, rugged platform built for continuous outdoor operation.

To address these requirements, a robotics solution provider partnered with ADLINK Technology to implement a distributed dual-compute architecture implement a distributed dual-compute architecture that separates AI perception and real-time control for predictable performance and scalability. By combining the AI-optimized DLAP-211-Orin powered by NVIDIA's Jetson Orin NX with the industrial control platform built around SBC35-RPL and modular SBC-FM I/O, the developer created a compact, scalable robotics platform that accelerates integration, ensures deterministic control, and supports reliable 24/7 deployment.



Key Challenges

Balancing AI Processing with Deterministic Motion Control

Quadruped robots rely on AI perception systems to process data from RGB-D cameras, LiDAR, and inertial sensors, while real-time motion control must coordinate multiple joints with precise timing.

Running these workloads on a single system can cause resource contention, where AI inference spikes disrupt time-critical control loops. Developers therefore required an architecture that separates perception and control workloads while maintaining tight system coordination.

Reliability for Continuous Outdoor Operation

Industrial inspection robots must operate 24/7 in environments with dust, vibration, and wide temperature variations. Traditional computing hardware often experiences thermal throttling, instability, or downtime under these conditions.

Industrial-grade reliability and rugged system design were therefore critical for long-term field deployment.

Space-Constrained System Integration

Quadruped robots offer limited space for onboard electronics, making integration of sensors, controllers, and networking interfaces complex.

Developers required a compact platform capable of integrating diverse interfaces while minimizing internal wiring and fragile adapters.

The Solution: Distributed Dual-Compute Architecture

To overcome these challenges, robotics developers are increasingly adopting distributed computing architectures that separate AI perception from deterministic control, enabling both high-performance processing and predictable system behavior.

ADLINK addresses these challenges with a distributed architecture that assigns each workload to the most suitable compute platform—maximizing performance while maintaining deterministic behavior.



Figure 1. DLAP-211-Orin as a dedicated AI perception node for real-time sensor processing

AI Perception Node

The DLAP-211-Orin serves as the dedicated AI perception engine, powered by the Jetson Orin NX module from NVIDIA. It processes real-time sensor inputs including:

- Real-time RGB-D perception
- LiDAR data through Gigabit Ethernet
- Sensor fusion and AI inference for environmental awareness

By isolating AI workloads on a dedicated platform, developers can scale perception performance without impacting real-time control.

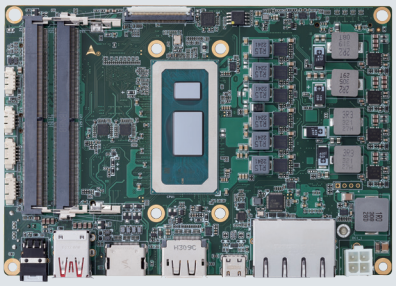


Figure 2. SBC35-RPL enables deterministic motion control with industrial I/O integration

Real-Time Control Node

The robot's deterministic motion control platform is built on the industrial-grade SBC35-RPL powered by processors from Intel. Combined with the SBC-FM I/O module, the control platform manages:

- Deterministic motion control via EtherCAT/CAN
- IMU connectivity via USB-TTL
- SBus remote control interface
- Dual Gigabit Ethernet and digital I/O

Separating perception and control ensures predictable real-time performance while maintaining high AI throughput.

High-Speed System Coordination

The perception and control nodes communicate via Gigabit Ethernet, enabling low-latency data exchange between AI analysis and motion planning layers.

This architecture simplifies system validation, improves debugging efficiency, and supports scalable robotics system design.

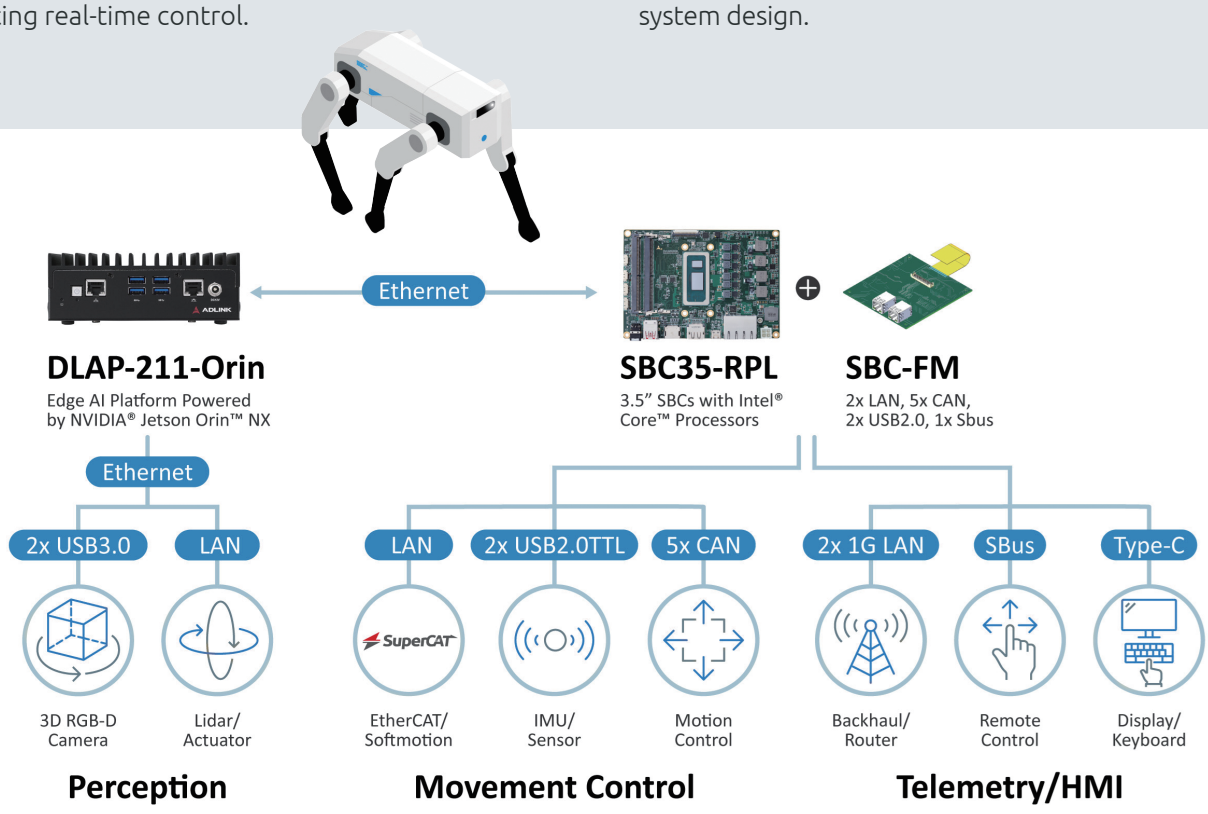


Figure 3. Illustrates how perception and control workloads are separated yet tightly coordinated within the dual-compute architecture.

Platform Highlights

Industrial Reliability for 24/7 Robotics Operation

ADLINK's embedded platforms are designed for continuous operation in demanding environments, featuring:

- Wide operating temperature support
- Rugged connectors and industrial components
- Stable performance under vibration and dust exposure

This reliability enables dependable 24/7 patrol and inspection operations.

High Performance in a Compact Robotics Form Factor

Quadruped robots require high-performance computing within strict space and power constraints.

The compact 3.5-inch SBC35-RPL delivers powerful edge computing in a small footprint, while the DLAP-211-Orin provides scalable AI acceleration for advanced perception workloads.

Together, these platforms enable robotics developers to deploy advanced autonomy without increasing system size or power consumption.

Key Differentiators

Modular I/O That Simplifies Robotics Integration

The SBC-FM Adaptive Function Module consolidates diverse I/O interfaces into a compact, customizable module, with benefits including:

- Simplified internal wiring
- Reduced reliance on external adapters
- Faster system integration and validation

This modular approach shortened the developer's integration cycle by approximately 30%, accelerating the transition from prototype to deployment.

Co-Engineering Support for Faster Deployment

Beyond hardware platforms, ADLINK provided hands-on engineering collaboration, including:

- Schematic design reviews
- BIOS customization
- Thermal chamber validation
- On-site technical integration support

This collaboration helps robotics developers reduce integration risk and accelerate time-to-market.



Figure 4. SBC35 Series with modular SBC-FM enables compact, adaptable robotics system design

Scalable Architecture for Future Robotics Innovation

As AI models evolve and perception workloads grow, robotics systems must adapt without costly hardware redesigns.

ADLINK's distributed architecture allows developers to upgrade the AI compute node independently of the motion control platform, preserving the existing control and I/O infrastructure.

This flexibility enables:

- Incremental AI performance upgrades
- Integration of additional sensors
- Expansion to multi-node edge computing architectures

By protecting software investment and simplifying hardware upgrades, the platform supports long-term robotics product roadmaps.

How ADLINK Accelerates Autonomous Robotics Deployment

This deployment demonstrates how a distributed dual-compute architecture enables robotics developers to achieve both high-performance AI perception and deterministic real-time control without compromise.

With rugged embedded platforms, modular I/O integration, and collaborative engineering support, ADLINK Technology provides robotics solution providers with a scalable foundation for next-generation autonomous systems.

Whether for industrial inspection, security patrol, or infrastructure monitoring, ADLINK's robotics-ready platforms help developers move from prototype to deployment faster—while maintaining the reliability, scalability, and performance required for 24/7 autonomous operation.

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