

The Brains Behind Advanced Robots: Accelerating the Future of Robotics with Powerful, Consolidated Computing

ADLINK

intel prestige partner

ADLINK edge AI computing technology is set to power tomorrow's biped and quadruped machines

Introduction

What once seemed like science fiction is now being deployed as real-world infrastructure. Mobile robotic systems are no longer confined to controlled environments or experimental use cases—they are actively operating in complex, real-world conditions across industries. These systems are positioned to impact a wide range of applications, including healthcare, agriculture, commerce, space exploration, and more. However, realizing this potential requires overcoming key engineering challenges. In particular, robotic platforms must integrate compact processing solutions capable of supporting AI, motion control, and sensor workloads, all while maintaining reliable operation in dynamic and often harsh environments.

To meet this need, ADLINK has developed low-power, ruggedized, high-performance, compact, open-standard computing platforms designed to support generative AI and advanced sensing workloads. These platforms provide the computational capability required for real-time perception, planning, and control in next-generation robotic systems. This includes the COM-HPC-mPTL and Express-PTL, a compact module that integrates multiple processors for space-constrained designs such as humanoid robots, and the SBC35-PTL, a compact 3.5" single-board computer that consolidates AI inference and low-latency control into a single system architecture for quadruped platforms.

These solutions are powered by Intel® Core™ Ultra Series 3, an AI-focused series of processors that includes a built-in neural processing unit (NPU) for AI acceleration. This series of processors is a unified computing architecture that consolidates AI, vision, and control workloads into a single platform, providing system-level benefits such as reduced complexity, improved determinism, and faster deployment.

A New Generation of Robotics

Until recently, industrial robots were largely rigid systems designed to perform repetitive tasks in structured environments. Now, the integration of AI is shifting robotics toward more adaptive and autonomous operations in real-world settings. Bipedal robots—two-legged humanoid systems designed for agility, strength, and environmental adaptation—are one such example (**Figure 1**). These systems are being developed for applications including outdoor operations, industrial and maritime maintenance, and service tasks on the factory floor and in residential and commercial environments.

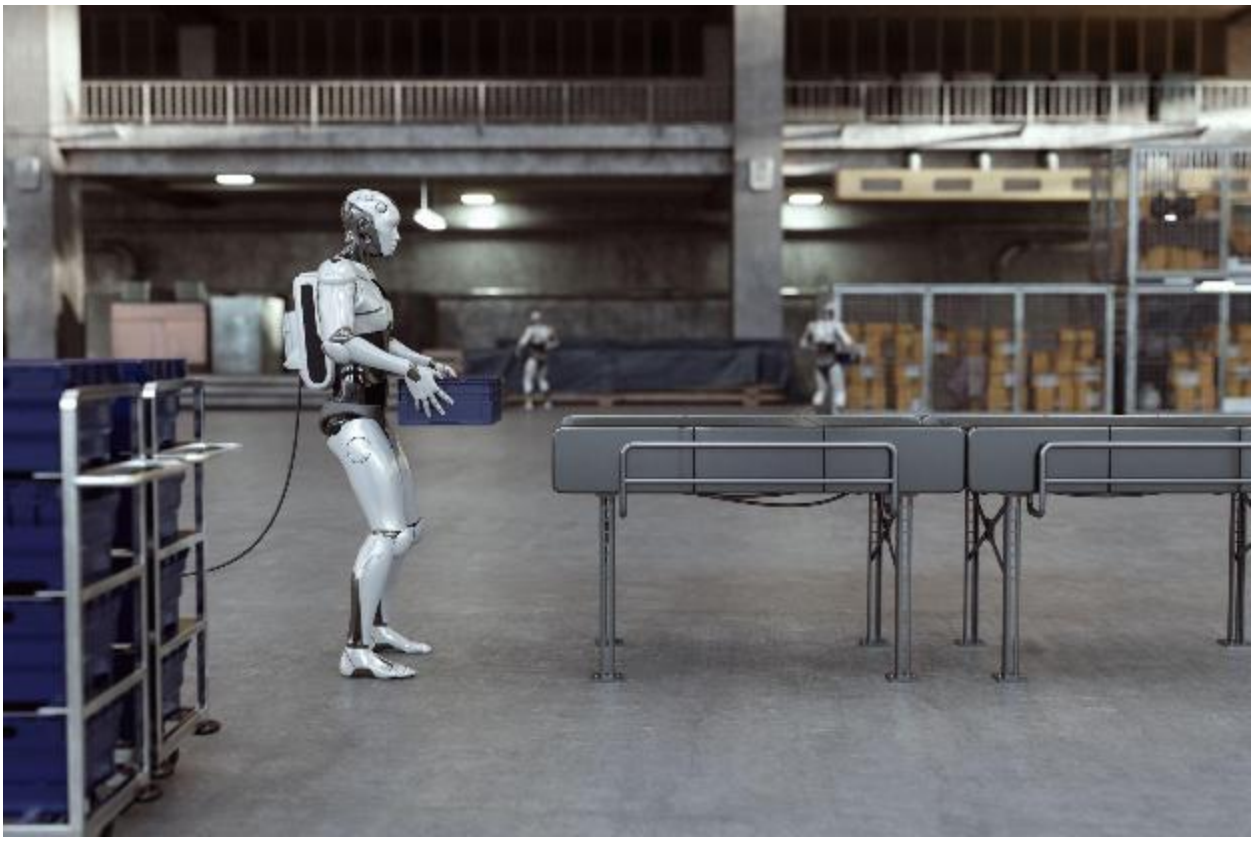


Figure 1: A humanoid robot performs tasks in a warehouse.

Quadruped robots—four-legged systems designed for stability, load bearing, and mobility across uneven terrain—are gaining traction in industrial and security sectors. They are already deployed in factories for tasks such as thermal imaging, leak detection, and facility monitoring, and are also used in public safety settings for explosive detection and data center security. Equipped with visual and thermal cameras and precision temperature sensors, these systems support applications such as carbon capture monitoring and oil and gas inspection. They are also used for patrol operations in remote and challenging environments. (**Figure 2**).



Figure 2: An advanced quadruped robot at work on a factory floor alongside modern stationary factory robotics.

Whether bipedal or quadruped, these systems share common computational requirements, including simultaneous localization and mapping for real-time positioning and environmental modeling. These functions, along with AI-based vision, motion control, and multi-sensor input, must run concurrently on platforms constrained by power, weight, and space. As a result, robots require compact, high-performance computing solutions that adapt to real-world conditions, while maintaining durability, efficiency, and reliability.

ADLINK's COM-HPC-mPTL and Express-PTL: Enabling a Humanoid Robotics Platform

Designing modern bipedal and humanoid robots requires real-time integration of intelligence, movement, and responsiveness within a tightly integrated system. These platforms must simultaneously support voice interaction, environmental perception, AI-driven vision processing, motion planning and optimization, and precise, coordinated actuation. Delivering these capabilities requires a central processing unit (CPU), a graphics processing unit (GPU), and an NPU. The primary challenge lies not only in performance, but in integrating these components efficiently within strict mechanical, thermal, and power constraints.

As a result, developers require a compact, tightly integrated computing platform that delivers CPU, GPU, and NPU performance within these same constraints. Powered by Intel® Core™ Ultra Series 3 processors, the ADLINK COM-HPC-mPTL and Express-PTL enable advanced edge AI and graphics capabilities in space-constrained systems such as humanoid robots.

Shown in **Figure 3** and **Figure 4**, its standardized, modular design is compliant with PICMG COM-HPC R1.3 and COM Express R3.1, supporting scalability while reducing time-to-market and total cost of ownership.

This approach allows developers to focus on application-level functionality rather than system integration. The platform provides high bandwidth, low latency, and power efficiency for deterministic edge AI, intelligent vision, robotics, and real-time analytics workloads.

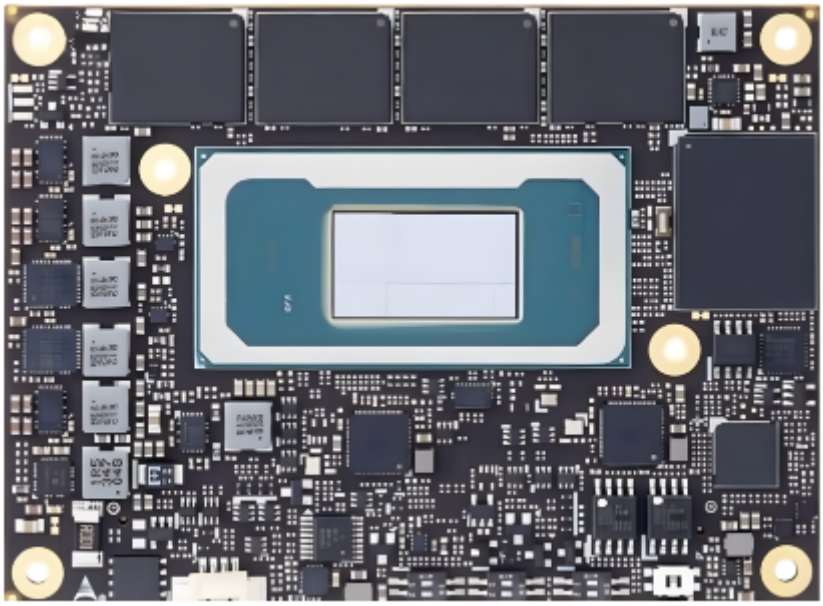


Figure 3: COM-HPC-mPTL based on the Intel® Core™ Ultra Series 3 platform for compact, high-performance edge computing.

COM-HPC-mPTL Specifications:

- Intel® Core™ Ultra Processor Series 3 processors at 15-65W TDP
- PICMG COM-HPC R1.3 compliant, Mini size module (95mm x 70mm)
- Intel® Arc™ Xe3 Graphics up to 120 TOPS, Intel® NPU 5.0 up to 50 TOPS
- 16 PCIe lanes (up to 12 PCIe Gen5 lanes)
- Up to 64GB LPDDR5X memory, up to 8533MT/s
- USB4, DP, HDMI, eDP display options
- Industrial temperature support: -40°C to +85°C (selected SKUs)
- 10 years of product availability

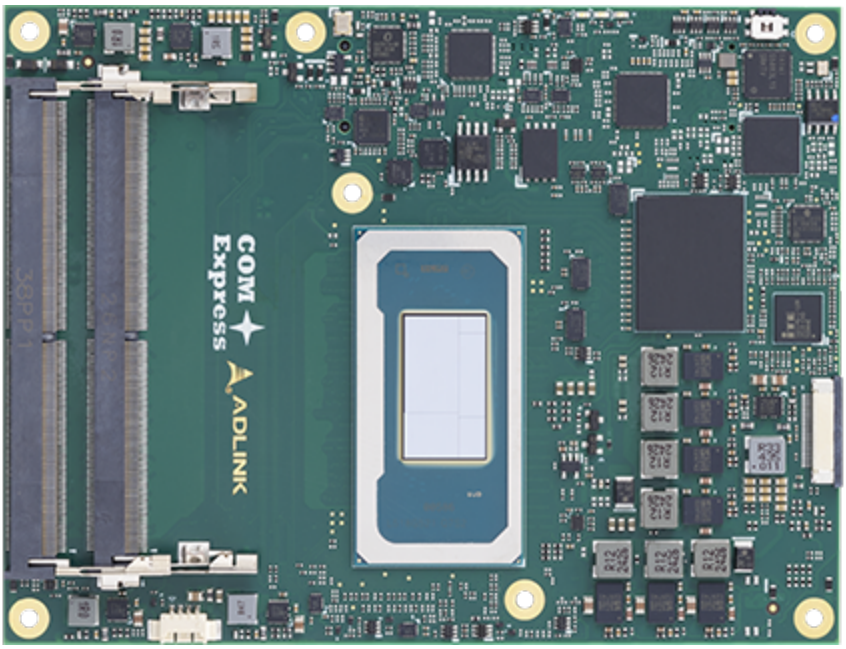


Figure 4: ADLINK COM Express Type 6 computer-on-module based on the Intel® Core™ Ultra Series 3 platform for compact, high-performance edge computing.

Express-PTL Specifications:

- Intel® Core™ Ultra Processor Series 3 processors at 15-65W TDP
- PICMG COM Express R3.1 compliant, Basic Size module (125mm x 95mm)
- Intel® Arc™ Xe3 Graphics up to 120 TOPS, Intel® NPU 5.0 up to 50 TOPS
- Up to 128GB (2x 64GB) DDR5 SO-DIMM memory support, up to 7200MHz, IBECC (selected SKUs)
- USB4, DP, HDMI, DVI, VGA, LVDS, eDP (build option) display options
- Industrial temperature support: -40°C to +85°C (selected SKUs)
- 10 years product availability

Speeding Up Humanoid Development

A humanoid robotics developer turned to ADLINK to rapidly integrate a reliable computing platform while meeting strict mechanical, thermal, and power constraints. By adopting ADLINK's COM-HPC and SMARC platforms, along with an ADLINK MXM GPU module, the developer established a compact, high-performance compute foundation. This reduced integration complexity, enabled advanced AI and motion control, and accelerated time-to-market for next-generation humanoid robots across both household and industrial applications. For more information, see ADLINK's case study on reducing time-to-market, simplifying development, and supporting the evolution of robotics platforms.

ADLINK's SBC35-PTL and SBC-FM for Quadruped Industrial Patrol Robots

Autonomous quadruped patrol robots are emerging as an effective solution for monitoring hazardous industrial environments, including energy facilities, utilities, and heavy industry sites. However, next-generation platforms face several challenges, including continuous 24/7 operation in environments with dust, vibration, and wide temperature ranges; the need for concurrent AI perception and deterministic multi-joint motion control; strict space constraints within the robot chassis; and integration of diverse peripherals such as RGB-D cameras, LiDAR, IMUs, and CAN-based motor drivers. ADLINK's SBC35-PTL, powered by Intel® Core™ Ultra Series 3 processors, provides robotics developers with a consolidated computing platform that integrates AI inference, sensor processing, and real-time control within a single embedded system (**Figure 5**).

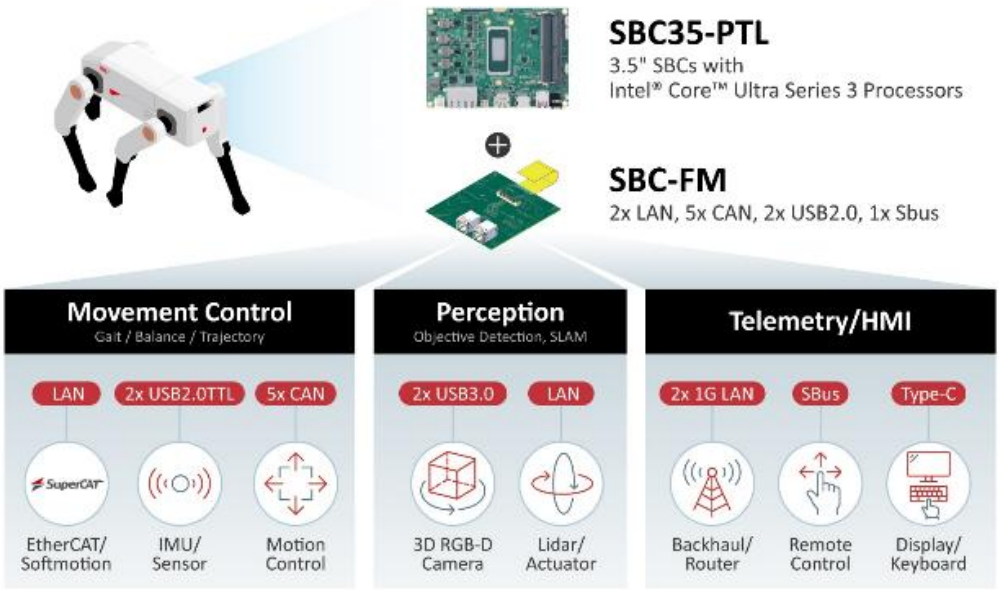


Figure 5: SBC35-PTL enables a unified AI and control architecture for quadruped robots.

An ADLINK-designed SBC-FM modular system architecture enables I/O expansion and supports customization, allowing users to develop application-specific function modules. As a scalable, industrial-grade control architecture, it supports evolving AI workloads without requiring system redesign, making it well-suited for patrol-based quadruped robots.

Together, SBC35-PTL and SBC-FM form a robotics-optimized computing architecture that balances performance, modularity, and system simplicity, enabling scalable deployment across diverse robotics applications.



Figure 6: SBC35-PTL integrates AI and control in a compact 3.5” platform, with modular I/O expansion via SBC-FM.

At the core of this architecture, SBC35-PTL serves as a compact edge AI platform that integrates AI inference and control on a single board. Its hybrid CPU architecture with integrated NPU enables efficient real-time AI processing, while its compact and industrial-grade design supports deployment in space-constrained and demanding environments.

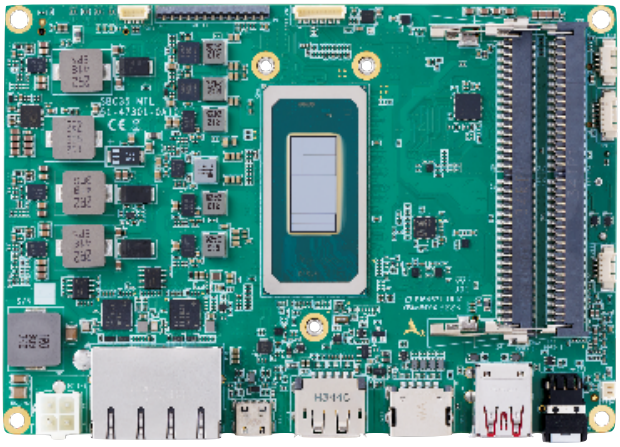


Figure 7: ADLINK’s 3.5" Single Board Computer with Intel® Core™ Ultra Series 3

ADLINK’s SBC35-PTL Features

- Intel® Core™ Ultra Series 3 hybrid CPU architecture (up to 16 cores + integrated NPU/GPU)
- Converged AI and real-time control on a single 3.5” SBC
- DDR5 high-speed memory for AI + motion workloads
- SBC-FM Adaptive Function Module (AFM) modular I/O architecture
- Robotics-ready connectivity (MIPI, CAN, Ethernet, USB, etc.)
- 24/7 industrial reliability and long life cycle support
- Reduced wiring complexity and faster integration
- Engineering co-design support

Enabling Robotics Through Intel Collaboration

Achieving high-performance compute, system integration, and scalability in robotics platforms requires close alignment across the hardware ecosystem. As a Prestige Partner of Intel's Partner Alliance, ADLINK works closely with Intel to accelerate the development and deployment of intelligent systems. Through this partnership, ADLINK leverages Intel® AI Edge Systems to enable interoperability and integration across graphic and neural processing functions. This approach reduces system complexity, improves manageability, and provides more predictable, long-term access to optimized hardware and components, supporting stable product lifecycles. ADLINK's Edge AI platforms, MXE-320 and DLAP-4100, as well as the Edge AI server, AXE-7440GW, are verified as Intel® AI Edge Systems.

This partnership provides ADLINK with access to technical enablement resources, including training on Intel architectures and edge AI platforms, and supports the joint development of optimized, interoperable hardware. Together, ADLINK and Intel deliver platforms that help robotics manufacturers reduce total cost of ownership and accelerate the transition from prototype to production.

ADLINK's Intel-based portfolio includes computer-on-modules, single-board computers and motherboards, edge AI computing platforms, edge AI servers, panel PCs, and additional embedded solutions. To learn more about ADLINK x Intel Edge AI solutions, visit the ADLINK x Intel landing page.

Powering the Future of Robotics

Across hospitals and warehouses, farms and factory floors, and in environments too remote or hazardous for human workers, robotics is transitioning toward large-scale deployment. Building these systems requires more than advances in mechanics or software alone—it demands tight integration across the entire system, from sensing and motion control to AI and edge computing. Rather than treating computing as a secondary consideration, ADLINK collaborates with robotics developers early in the design process to integrate real-time control and sensing into a unified, production-ready platform. By combining rugged, scalable hardware with deep domain expertise, ADLINK helps bridge the gap between prototype and deployment, enabling reliable operation in real-world conditions.

ADLINK's portfolio spans modules, embedded platforms, and edge systems, providing a comprehensive foundation for robotics development. For more information on ADLINK's robotics computing platforms, visit the ADLINK website to learn how these solutions can help bring robotics innovations to market.