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Autonomous inspection robot

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Computer-on-Modules in its autonomous inspection robot

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ANYbotics is a leading provider of innovative, intelligent, and integrated robotic solutions that improve workers' lives, increase productivity, and support more sustainable industrial facilities. Partnering with global technology leaders, ANYbotics provides large asset operators with autonomous, automated, end-to-end robotic inspection solutions for complex, hazardous, and explosive industrial environments.

Solution:

ANYbotics uses application-ready Computer-on-Modules in the open COM Express standard as the integrated computing system for navigation, path planning and real-time motion control.

Challenge:

The maintenance and inspection robots of the ANYbotics' ANYmal family are designed to perform the same tasks as humans in complex and even potentially hazardous industrial environments. This requires high-performance and highly scalable embedded computing technology to provide autonomy, situational awareness, navigation and path planning. Furthermore, it should be possible to easily add future intelligence capabilities.

Benefits:

Thanks to Computer-on-Modules, ANYbotics can focus fully on its core competencies and improve the time-to-market of its solutions. The modular approach also allows optimum balancing of performance, power consumption and cost. What is more, systems can be upgraded with the latest processor technology even after years of use. This optimizes total cost of ownership.

ANYbotics' ANYmal family of autonomous inspection robots is designed for use in complex industrial environments that are potentially hazardous for humans. Applications are found in power and energy supply installations, refineries in the process industry, offshore and onshore facilities in the oil and gas industry, as well as mining and large construction sites.

Compared to other intelligent robots, the ANYmal family delivers a high degree of autonomy in environments designed for humans. The systems respond autonomously without external input when they encounter moving or unexpected obstacles, or when environmental conditions (lightning, rain, snow, etc.) change. ANYbotics deploys high-performance Computer-on-Modules for three major tasks:

Motion

The complex movement apparatus, which supports even omnidirectional movement, requires powerful real-time control. This lets ANYmal inspection robots negotiate steps with a maximum height of 25 cm, climb industrial stairs with slopes of up to 45°, and crawl under obstacles that are less than 50 cm high.

Navigation and situational awareness

Data streams from LIDAR and stereoscopic depth cameras are processed to provide highly accurate 360-degree views for localization and mapping. For outdoor use cases, ANYmal can additionally be equipped with a global navigation satellite systems (GNSS) receiver. Teleoperation, which is also possible, is simplified by integrated wide-angle cameras and industrial-grade remote control.

Autonomous inspection intelligence

ANYmal robots are designed to perform a wide variety of inspection tasks in industrial, hazardous, and even potentially explosive environments. For this purpose, they can be freely configured with sensor payloads of up to 10 kg for 2 to 3 hours of autonomous operation. To read measurements from analog displays and measuring instruments, and to check valves, ANYmal can be equipped with a pan/tilt inspection unit with optical zoom camera. A thermal camera can be deployed to inspect machinery and other equipment for unwanted waste heat or thermal anomalies. Gas sensors are used to expose leaks, and an ultrasonic microphone helps to acoustically detect machine anomalies.
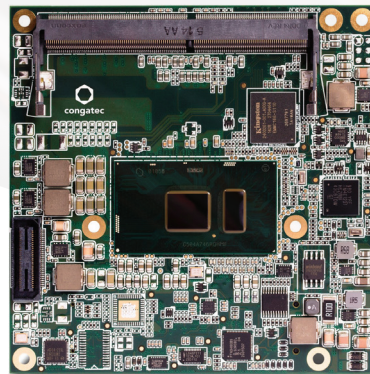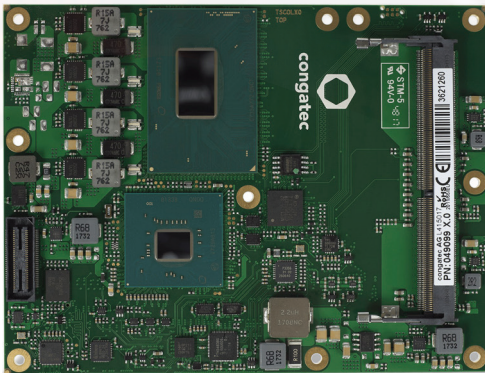
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Besides its extensive sensor array with stereoscopic cameras for a 360-degree field of vision, LIDAR for environment mapping ANYmal can carry a 10 kg payload of additional sensors for inspection.

Modular approach yields greater agility and cost optimization

ANYbotics employs a modular design to ensure that all three tasks can be executed in parallel with highest reliability and optimum performance. The design is based on highly scalable COM Express Computer-on-Modules from congatec, which are assigned with the individual tasks. This way, it is possible to optimize the performance, energy consumption and cost of each individual task. It also enables later performance upgrades since these modules are standardized and easy interchangeable – even across processor generations as well as manufacturers. All it takes is a simple module exchange to add new application options and extend the service life. As this can be done even years after the first product launch, it sustainably reduces the total cost of ownership (TCO) of the overall solution for the user.

ANYbotics uses congatec Computer-on-Modules on its ANYmal inspection robot. The workloads are consolidated using dedicated processor cores for mapping, path planning and real-time motion control. In addition to this, another segment is reserved for individual customer applications.

Faster to market with modules

Application-ready modules make it easy to obtain generic computing power. So, instead of battling with the complex task of designing a full custom computing solution from the scratch, ANYbotics saves time by leveraging ready-made COMs. Only the application specific functions and interfaces are executed via a customized carrier board. But this is comparatively easy to develop. This simplifies and accelerates application development. So ANYbotics is able to focus fully on its core competencies and gains greater agility to introduce new innovations into the highly dynamic market of autonomous mobile robots.

What makes the right partner?

Although standardized COM Express modules are available from many different manufacturers, which facilitates implementation of a reliable second-source strategy, choosing the right module partner still requires some consideration. Above all, the design quality is important to ensure that modules have high thermal, mechanical, and electromagnetic resistance. Embedded suppliers such as congatec can provide comprehensive test documentation to prove a compliant design. congatec's modules also come with a comprehensive Board Support Package that includes all required hardware-related software to simplify operating system and software integration. Yet another key factor is the long-term module availability of up to 15 years, which lowers TCO. congatec further offers comprehensive customer-specific integration services and technical support. Besides best-practice schematics and design guides, this includes comprehensive testing and inspection services to ensure that carrier boards developed in-house by OEMs meet all technical requirements in terms of ruggedness and signal quality.

Computer-on-Modules integrate all essential computing components such as CPU, main memory, high-speed interfaces, and graphics unit – and sometimes also AI accelerators – on a single, application-ready super-component. Modules within one standard are highly scalable across processor generations and manufacturers, and for each task there is an optimum selection. Existing systems can be upgraded with the latest processor technology at any time. All that's required is a simple module swap; there is no need for design changes. This is an easy way to expand the range of possible applications and also to extend the service life of designs.
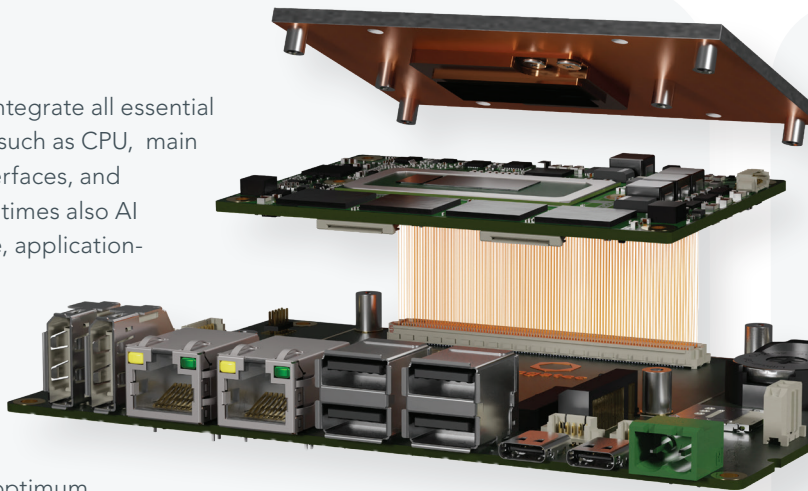
Experience the latest Computer-on-Module standard, COM-HPC, bringing AMRs unprecedented performance and bandwidth.

About ANYbotics

Since 2016, Swiss robotics company ANYbotics has developed innovative, intelligent, and integrated robotic solutions that improve workers' lives, increase productivity, and support more sustainable industrial facilities. Partnering with global technology leaders, ANYbotics provides large asset operators with autonomous, automated, end-to-end robotic inspection solutions for complex, hazardous, and explosive industrial environments. ANYbotics is a fast-growing company with over 100 employees focused on supporting the inspection needs of workers in the oil & gas, power, energy, mining, processing, chemicals, transportation, and construction industries.

About congatec

congatec is a rapidly growing technology company focusing on embedded and edge computing products and services. The high-performance computer modules are used in a wide range of applications and devices in industrial automation, medical technology, robotics, telecommunications, and many other verticals. congatec is the global market leader in the Computer-on-Module segment with an excellent customer base from start-ups to international blue chip companies. More information is available on our website at www.congatec.com.

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