

The perfect combination for Automotive & Co.



MicroSys Electronics adapts NXP® processors for real-time critical industries. In order to provide high-performance software, the embedded manufacturer has established a strategic partnership with Cetitec. This provides many advantages for customers.

The development of automotive applications is becoming more and more demanding. Today's vehicles are highly complex, networked systems, in which many control units and software modules interact with each other. Modern vehicle systems run millions of code lines that need to work reliably, safely and efficiently. The vision of the 'software-defined vehicle', which is continuously updated over-the-air (OTA) and interacts with its environment via car-to-x communication, presents new possibilities on the one hand, but poses considerable challenges on the other. In addition to functionality, developers have to comply with strict security standards such as ISO 21434 for cybersecurity and ISO 26262 for functional safety in order to prevent manipulation and data leaks and ensure the integrity of the software.

Electrifying the powertrain also poses new challenges: precise control of the battery management, optimization of energy recovery and seamless integration with charging infrastructures require highly specialized software solutions. Added to this are autonomous driving functions and AI-supported assistance systems such as adaptive cruise control or lane departure warning systems, which are based on highly developed algorithms and real-time processing of large amounts of sensor data. These systems must not only fulfil the specific technical requirements of

the automotive industry, but also be able to be flexibly adapted to different market requirements and regulatory specifications.

All these developments require a sophisticated software architecture, which in turn requires powerful hardware platforms. Chip manufacturers such as NXP Semiconductors® therefore develop system-on-chips (SoCs) specifically optimized for automotive applications, which companies such as MicroSys Electronics convert into highly integrated system-on-modules (SoMs) and powerful industrial PCs with AI and machine learning functionalities.

A strong relationship

To meet the ever growing demands on hardware and software systems, companies rely on specialized partnerships more and more. One good example of this is the collaboration between MicroSys Electronics and Cetitec. While MicroSys provides the highly developed hardware, Cetitec supplies the customized software for real-time applications. Both companies are NXP® Gold Partners and their close collaboration enables them to optimize the use of NXP® SoCs in order to offer customers innovative and future-proof solutions.

Cetitec itself is a leading global provider in the field of networked fieldbus systems and develops software solutions that serve as central communication interfaces in the automotive industry. As a subsidiary of Porsche, Cetitec has in-depth expertise in the field of networked vehicle architectures. The collaboration with MicroSys enables Cetitec to quickly and efficiently transfer new technologies to series production. Together, the two companies are adapting the automotive

processors from NXP® for applications in markets with high real-time requirements such as railway technology, aviation, mobile machines, medical technology, and automation.



Ina Sophia Schindler, Co-Managing Director at MicroSys Electronics, and Dr. Michael Back, CEO of Cetitec, see great opportunities in the cooperation: both companies are NXP® Gold Partners and their close collaboration enables the optimal use of NXP® SoCs for their customers. (Figure: Uwe Niklas)

MicroSys is currently working on a research project to optimize NXP's® S32Z2 processor for use in drones. As part of the 'BayCHAMP' project, MicroSys, Tech S.A.T. and AEE Aircraft Electronic Engineering are working together to develop a flight attitude control system that improves the stability and control precision of drones. These developments have great potential for the agricultural sector among others, where the use of drones is playing an increasingly important role.

Innovative hardware for modern deployment

The centrepiece of this innovation is the new miriac® MPX-S32Z2 SoM from MicroSys. It is based on the S32Z2 processor from NXP®, which has eight Arm Cortex-R52 32Bit cores with split-lock functionality, which achieve clock rates

of up to 1GHz. The architecture is complemented by a Cortex-M33 lockstep core, which is based on the Arm® TrustZone architecture and implements advanced security mechanisms such as memory protection and isolated application execution.

The CPU is optimized for high-performance real-time processing and features core-to-pin hardware virtualization, which enables individual cores to take over certain tasks. This allows safety-critical applications to be performed with high priority, while less critical processes are handled in isolated areas. The processor also handles digital signal processing (DSP), which has been specifically optimized for machine learning algorithms. With a computing power of up to 25 GigaFLOPS (Floating Operations per Second), the platform enables the implementation of AI-supported algorithms for driver assistance systems, autonomous driving functions or predictive maintenance.

With dimensions of just 82mm × 50mm, the module is optimized for space-critical applications and can be easily integrated into existing control unit housings thanks to its small footprint. For high-performance data processing, the module features 2GB LPDDR4 memory with 160MT/s and 512MB QSPI flash.

For example, the miriac® MPX-S32Z2 enables the integration and networking of prototypes and axle carriers in automotive applications. Existing axle carrier platforms can be expanded to include new subsystems, hybrid drives or infotainment systems, while the system simultaneously simulates an environment that is already equipped with the future technology.

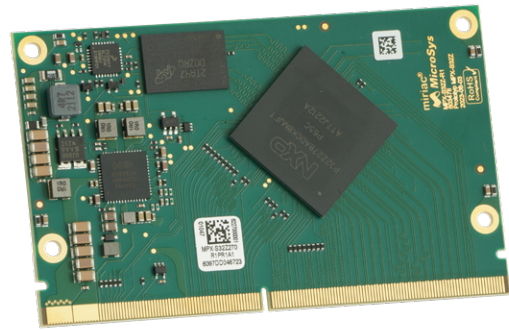
Efficient domain and zone control through specialized accelerators

One unique feature of the processor is its dedicated accelerators for security processing and network communication. At NXP®, this is also described as FlexLLCE (Low-Latency Communication Engine), or PFE (Packet Forwarding Engine).

These specialized engines enable the CPU to efficiently handle domain and zone control tasks in vehicle architectures. Processing takes place with minimal latency, which means that safety-critical applications such as ECU communication or real-time data processing in vehicle gateways can be significantly accelerated.

The term hardware acceleration is often used in this context, but the optimization is actually

based on specially developed firmware, which is precisely matched to the underlying architecture. This allows near-real-time signal processing and routing operations to be carried out without overloading the main processors.



The new miriac® MPX-S32Z2 SoM from MicroSys is based on the S32Z2 processor from NXP®, which has eight Arm Cortex-R52 cores with split-lock function. (Figure: MicroSys)

Also, the architecture is highly scalable and allows developers to implement different operating systems on the cores. In addition to QNX for high-performance control systems, AUTOSAR OS can also be adapted for resource-saving real-time processing. By using several operating systems in parallel, each software component can be optimized for its respective tasks.

Comprehensive connectivity for modern vehicle architectures

The increasing segmentation of modern vehicle architectures into domain and zone control systems requires powerful networking between different vehicle systems. For this reason, the SoM is equipped with a wide range of interfaces: The module supports up to double Gigabit Ethernet, 16 CAN interfaces, three I3C ports, as well as Zipwire, FlexRay and LIN. These communication

About Cetitec

Cetitec, a Porsche company, is a leading software specialist for the development of Connectivity and Networking System Solutions. Cetitec's scalable software products are key elements for the mobility solutions for worldwide leading car manufacturers needing the most up-to-date technology. With curiosity, passion and enthusiasm, Cetitec builds bridges for new car networking and communication technologies and has been successfully solving complex challenges since 1999.

standards cover both traditional and modern networking architectures and enable efficient connection to existing control units and sensors.

While CAN continues to be used for many classic ECUs and sensors, modern high-speed bus systems such as FlexRay and Ethernet-based communication protocols are gaining in importance. Aurora, a serial high-speed protocol, is used to transfer high-frequency data streams with minimal latency directly between FPGAs, processors, or other accelerators.

By supporting I3C, the module is able to efficiently connect modern sensors with driver assistance systems and for environmental perception. Compared to I2C, I3C offers a higher bandwidth, lower latency times and extended functionalities for connecting multiple sensors, which particularly benefits applications in the field of autonomous vehicles and AI-supported driver assistance systems (ADAS).



The demo application that both companies presented at embedded world describes a use case that Cetitec has already developed in series production. Here, data is abstracted, regrouped or converted into a different type. (Figure: MicroSys)

Comprehensive security architecture

In order to meet the high requirements for functional safety and cybersecurity, the S32Z2 processor is equipped with a dedicated hardware security engine (HSE) that ensures that the module boots in an authenticated manner, so that only signed and verified firmware is executed. By integrating a secure boot chain, the module is protected against manipulated software updates or cyberattacks on the control unit. This is particularly important in vehicles that receive over-the-air updates, as only a verified signature can ensure that only authorized software versions are installed.

In addition, a dedicated microcontroller provides voltage monitoring to reliably protect the system against unexpected voltage deviations, or faulty power supplies. This function increases operational safety in safety-critical applications and fulfills the requirements of ISO 26262.

The system is also designed to be future-proof in terms of long-term availability. NXP® guarantees long-term security of supply for the S32Z2 processors, so that automotive manufacturers and industrial customers can continue to develop their applications on the platform for many years to come.



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Jörg Stollfuß serves as a Field Application Engineer at MicroSys Electronics GmbH and holds a degree from Beuth Hochschule für Technik Berlin. At MicroSys, he adeptly bridges the gap between development teams, partners, and customers to craft technically fascinating solutions. His expertise and collaborative approach significantly contribute to the advancement of embedded systems technology.

Optimized sampling rates for precise control and regulation processes

Choosing the right sampling rate plays a decisive role for highly dynamic control processes. A sampling rate that is too low leads to aliasing effects, which can corrupt control algorithms and lead to unstable control processes. This is particularly important in high-speed applications. One example is the control of drones, which reach speeds of around 500 knots. Here, the sensors must work with a higher cut-off frequency in order to calculate precise flight attitude corrections in real time. The DSP of the S32Z2 processor enables highly efficient real-time signal processing to perform data interpolation and noise filtering, which significantly improves control and regulation accuracy.

Safety & Security

Cetitec's security architecture is based on the strict exclusion of wildcards, meaning that the software only processes validated messages. All messages are stored in a security matrix with defined access rights, message lengths and parameters and are transmitted via a secure process with the firmware containers. This significantly minimizes the risk of manipulation, as attacks would only be possible if the manufacturer's update chain were completely compromised.

Cetitec also meets the highest standards in terms of functional safety with ISO 26262. Safety-certified out-of-context elements, such as the Safetycore modules, enable the ASIL-compliant integration of safety-critical functions, and offer a flexible solution for sophisticated control systems.

About MicroSys Electronics

MicroSys Electronics has been developing and producing embedded system solutions since 1975, is a Gold Partner of NXP® and, significantly, integrates their S32 Automotive, Layerscape and QorIQ processor technology. Designs based on System-on-Modules (SoMs) are the strengths of the company from Sauerlach near Munich. The portfolio ranges from application-ready SoMs and customer-specific carrier board designs to fully integrated systems. These particularly robust and long life-expectancy designs are primarily used in markets where safety standards similar to IEC61508 are required, such as railroad technology (EN50155), aviation (DO-160) and mobile machines (ISO 13849) as well as production robots (ISO 10218), control systems (IEC 61131-6) and drive systems (IEC 61800-5-2). Further areas of applications can be found in medical technology (IEC 60601) and in critical infrastructures such as the nuclear sector (IEC 61513), or the process industry (IEC 61511). MicroSys works closely with its customers in all these industries to ensure that the relevant standards are fully met.

Further information can be found at www.microsys.de

Flexibility through operating system independence

A key advantage of Cetitec software is its operating system agnosticism. Post-build configurability allows developers to customize system-critical features without recompiling the source code. Cetitec provides a developer-friendly tool-chain for this purpose, which enables flexible configuration.

The software can be operated both bare-metal and on static systems, Linux or POSIX, which gives it broad scalability. To facilitate the transition between different operating systems, Cetitec also offers middleware frameworks that enable seamless communication between Linux, AUTOSAR and bare metal.

S32G und S32Z: A powerful combination

In addition to the S32Z2 processor, MicroSys also offers the S32G platforms from NXP®, which can be used as a companion chip for specific applications. Customers benefit from a standardized architecture from a single manufacturer, which simplifies system integration.

While the S32G processor is optimized for communication and gateway functions, the S32Z processor takes over real-time controlling. The combination enables efficient data aggregation, distribution and processing – controlled by the close integration of MicroSys and Cetitec. In practice, often not all applications can be covered

by a single chip, especially if new sensors or control functions are added during the development process. A redesign with additional Z-controller integration allows all functional requirements to be implemented flexibly and efficiently.

Comprehensive development expertise

Thanks to the close partnership between MicroSys and Cetitec, developers can concentrate on their core competencies and at the same time rely on optimal hardware and software integration. Especially in the area of hard real-time data processing in the automotive and avionics sector, the companies offer a powerful solution that ranges from application-ready system-on-modules to customer-specific adjustments.

The expertise extends across safety-critical markets where high safety standards such as IEC 61508 are required. Whether in railroad technology, aviation, mobile machinery, medical technology, industrial robots or industrial control systems – MicroSys and Cetitec deliver tailor-made solutions for demanding applications.

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