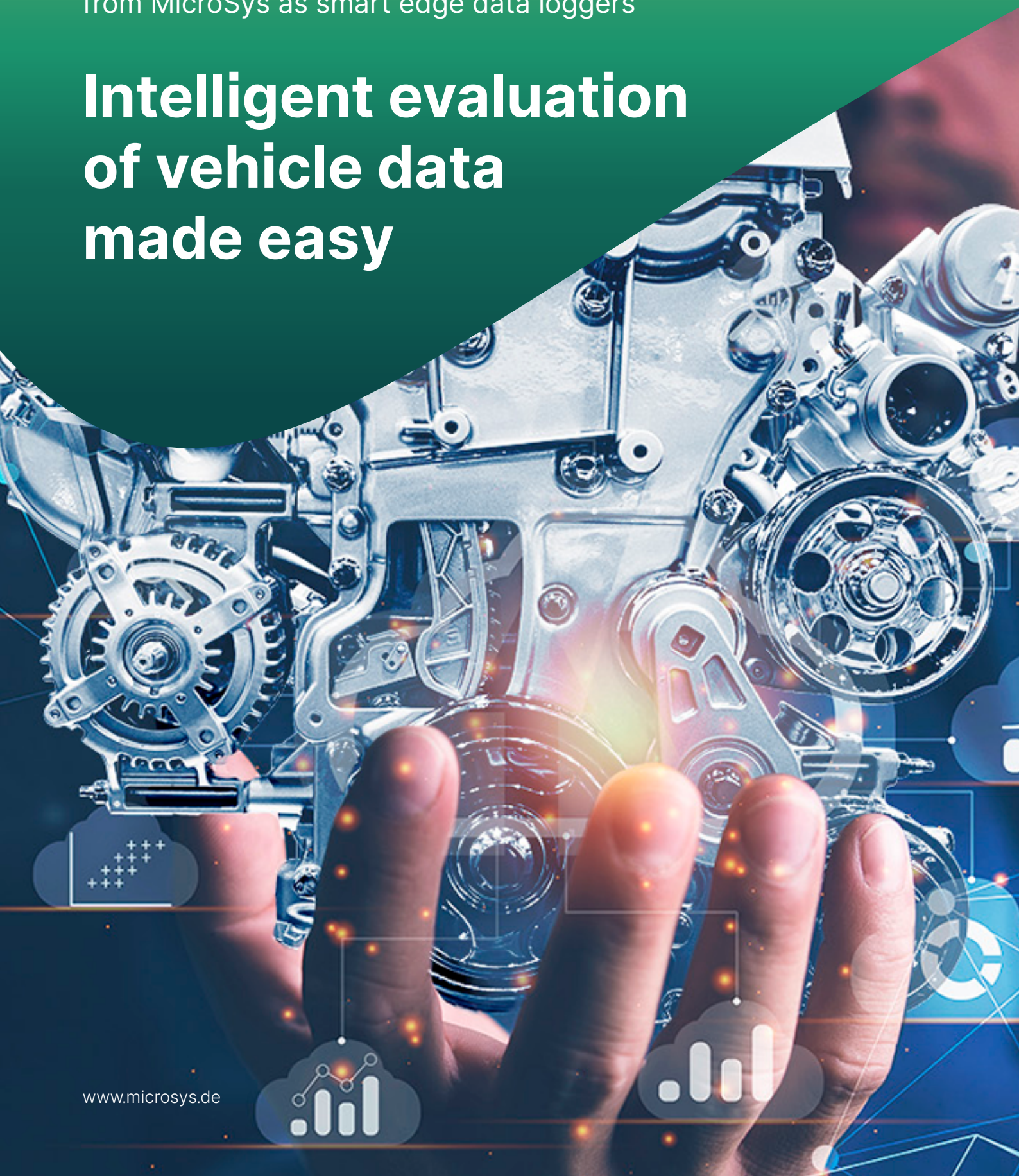
MicroSys
Creating Embedded Systems

NXP GOLD PARTNER

Weiß ELEKTRONIK & SOFTWARE

Weiß Elektronik & Software uses System-on-Modules from MicroSys as smart edge data loggers

Intelligent evaluation of vehicle data made easy



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MicroSys hardware design expertise for vehicle computers makes intelligent evaluation of vehicle data easy

WeMOTA G2 is an in-vehicle edge computing platform that can be updated over-the-air. Developed by German Weiß Elektronik & Software GmbH, it is used for the intelligent evaluation of component and environmental data of vehicles during testing as well as throughout the entire vehicle lifespan. The system solution is based on automotive-grade System-on-Modules from embedded and edge computing platform provider and NXP Gold Partner MicroSys.

The NXP S32G vehicle network processor based solution has been designed for universal use in vehicles. Applications range from data loggers and connected car gateways to domain or safety controllers.

WeMOTA G2 from Weiß Elektronik & Software GmbH is a vehicle edge gateway that offers developers powerful edge logic for evaluating vehicle data in the field and for filtering out specific vehicle and environmental data that is relevant for their needs. This minimizes the amount of data to be transferred to the cloud. Over-the-air updates can be deployed at any time to reset the vehicle and environmental data parameters.

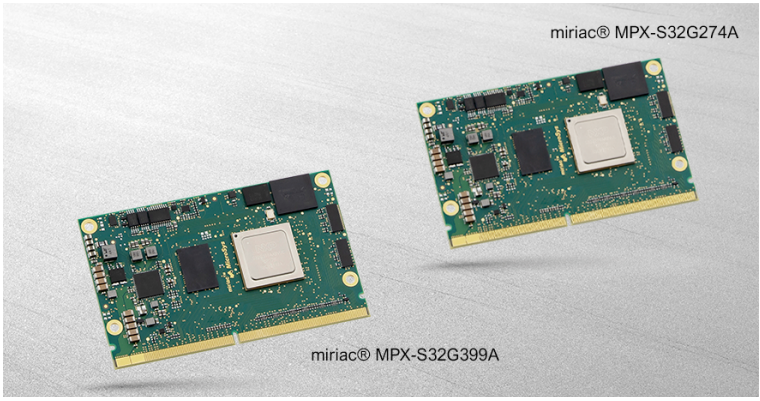
WeMOTA G2

Standard current and future vehicle interfaces such as CAN, FlexRay and LIN as well as Ethernet, Ethernet T1 are supported. And with up to eight optional Arm Cortex-A53 cores, the system is even suitable for recording and evaluating lidar and camera data, which is crucial for increasingly autonomous vehicles.

MicroSys Electronics supplies both the application-ready System-on-Module and the WeMOTA mainboard for the system. For customers requiring additional interfaces, Weiß Elektronik & Software also develops and manufactures mezzanine cards for the mainboard.

To the point Big Data

The unique selling point of the system is virtually unlimited over-the-air configurability, which enables highly differentiated data acquisition and evaluation at the edge. Intelligent markers and triggers make it possible to distill the immense data volumes produced by smart vehicles to the essentials. The goal is to provide only and exactly the required data. During Big Data aggregation, the high WeMOTA computing power can be used for complex data pre-processing tasks – for instance



WeMOTA G2 is based on MicroSys miriac System-on-Modules with NXP S32G processors, which are predestined for use in vehicles thanks to native support of CAN, FlexRay and LIN, as well as TSN-enabled Ethernet and Ethernet T1. MicroSys currently offers two configurations, featuring either 4 Arm Cortex-A53 processors and 3 Arm Cortex-M7 processors, or 8 Arm Cortex-A53 processors and 4 Arm Cortex-M7 processors clustered as a dual lockstep pair.

miriac® MPX-S32G399A
miriac® MPX-S32G274A

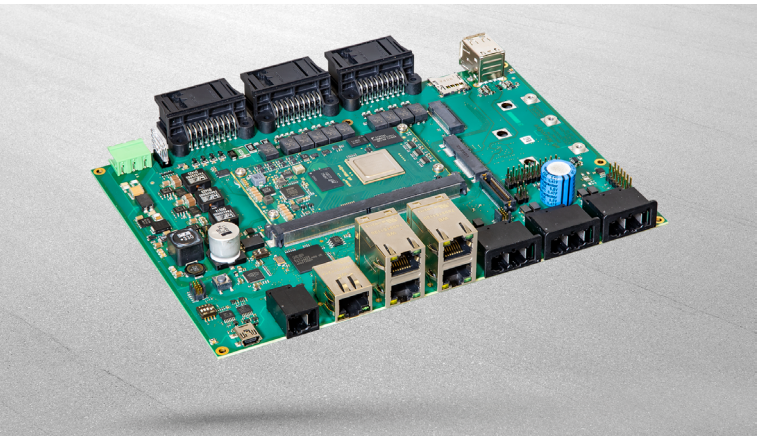
to create collective loads to show component stress in a few relevant key figures that are transmitted on a weekly basis. Armed with this data, customers can predictively initiate further investigation or maintenance work. This puts an end to simply logging and transmitting gigabytes of raw data for later analysis in a cloud. Now, series of measurements can be reduced to a few

kilobytes, compressed and encrypted for data transmission. This makes it possible to carry out all necessary analysis at the edge. It also leads to significantly reduced bandwidth and data volume requirements for the integrated GSM and radio modules and, above all, yields information that developers are actually interested in.

Minimizing data transfer to the cloud

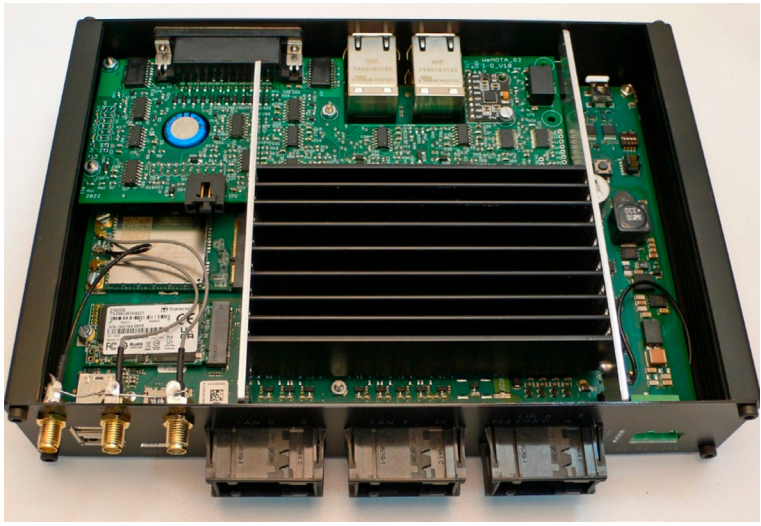
Via the cloud backend, the data is also processed into customized reports that are displayed on a dashboard and made available for download. As this process is fully configurable, users can decide whether they want to receive the data in Excel, CSV, HTML or TXT format, to name just a few options.

The new WeMOTA G2 system can even record camera data for specific situations – for instance, when a temperature sensor triggers a thermal camera to start recording a glowing exhaust manifold. Traffic events can also be documented. For example, by saving a video sequence 15 seconds before and 30 seconds after an emergency braking event. Everything is freely configurable and can be linked to numerous conditions. What is more, the Linux-based system can be updated over the air whenever necessary, thereby making it possible to remotely adapt and flash new measurement configurations, application software and system firmware.



MicroSys' also designs custom specific carrier boards for its System-on-Modules. They are deployed as application-ready modular SBCs in the WeMOTA G2 system. Custom-specific designs can be implemented much more cost-effectively on such carrier boards than with a full custom design.

miriac® SBC-S32G399A



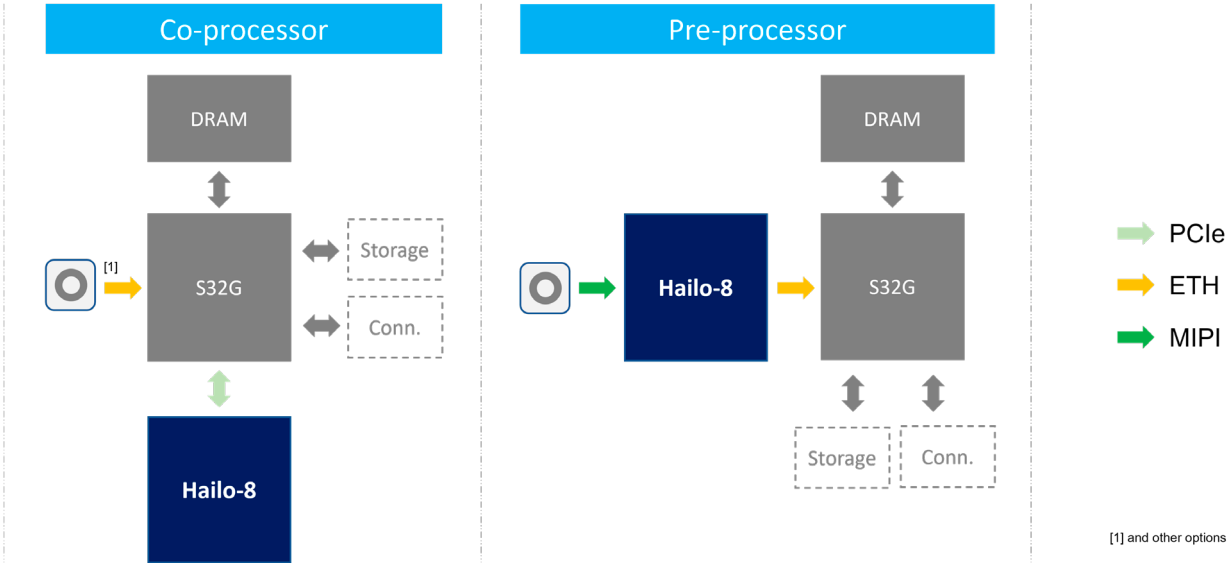
Weiß Elektronik & Software GmbH has developed a dedicated mezzanine card for analog inputs, TFT display support, GPS, acceleration and gyro sensors, and power outputs. It is mounted on the custom SBC. The WeMOTA G2 heatspreader couples directly to the housing and is milled out towards the module for an optimum fit.

Allows OTA updates of configuration and firmware

WeMOTA G2 systems are primarily used for generating usage data that yields valuable insights to guide the further development of vehicle components. Another area of application is pre-series development, for example to test new sensors. The systems can not only be used to read data for this purpose, but also to implement gateways between different bus systems. Other application areas include misuse and behavior testing to evaluat the robustness of a system configuration. For instance, to test third-party components. The systems can also be used in the show car sector, for example to demonstrate functions that have not yet been implemented.

Users of the WeMOTA G2 system include not only engine, chassis and base vehicle manufacturers, but also OEMs whose core competence lies in manufacturing all types of vehicle superstructures. They can all use the system to understand how their solutions perform under real operating conditions and optimize components as a result. A refuse vehicle manufacturer, for example, may have a special interest in data from the hydraulics. Or the compressor and fill level of the refuse compactor. Or the speed of the vehicle. In case of the latter, if manufacturers don't have access to the speed sensor of the engine, they can also determine the position and speed via the GPS sensor integrated in the system.

Hailo-8 System Usage Scenarios



MicroSys also supports Hailo-8 AI accelerators on its NXP S32G platforms. Combining high computing performance with minimal power consumption, these accelerators are ideal for edge computing applications in vehicles.

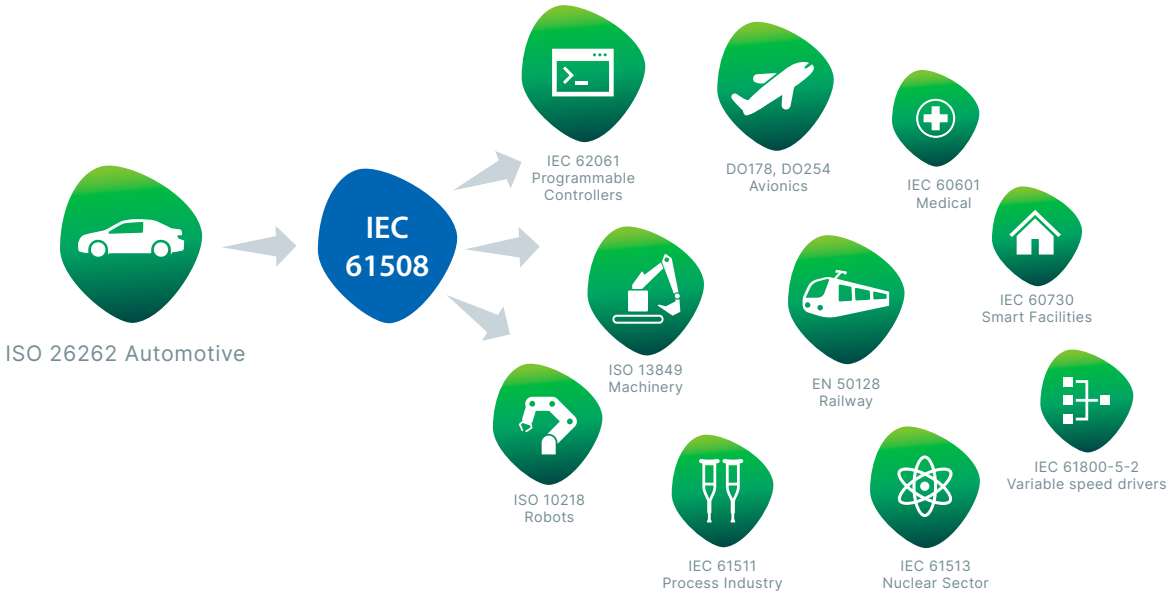
Suits all applications

For these and numerous other applications, the WeMOTA G2 offers all of today's standard vehicle interfaces, including Ethernet, 100 Base-T1, 1000 Base-T1, USB, LIN, CAN and FlexRay, as well as digital I/Os and outputs for power switching and pulse width modulation. If adaptation is required, this can be realized with a custom-designed mezzanine card or carrier board. To allow deployment in vehicle cabins up to an ambient temperature of 75°C, WeMOTA G2 systems come with a custom heat spreader that cools the processor and is directly coupled to the housing. The passive aluminum heat sink concept can also be used as a reference for other custom-specific system designs.

System-on-Modules designed for vehicles

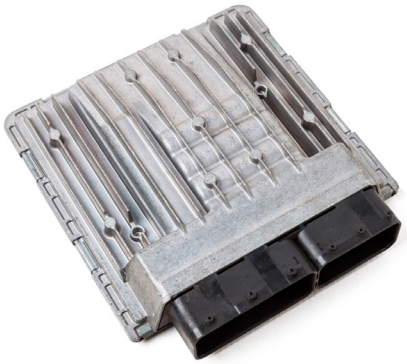
WeMOTA G2 is one of the first systems deploying the new genre of System-on-Modules to have reached production maturity. Designed specifically for vehicle network computing and first made available by MicroSys in 2021, Weiß Elektronik & Software was an early adopter to design-in these NXP S32G processor-based modules. The new automotive-grade MicroSys System-on-Modules with functional safety support are especially suited for individual system platform designs in industrial batches, enabling solution providers like Weiß Elektronik & Software to reduce their development costs for custom-designed system solutions and secure NRE costs long-term with simple processor module upgrades.

"Accelerating the development process was particularly important to us," explains Dipl. Ing. (FH) Gerhard Weiß, Managing Director of Weiß Elektronik & Software GmbH.



MicroSys System-on-Modules are scheduled to become available for deployment in mass-produced vehicles. The components are ISO 26262 qualified, and MicroSys also ports them to all application areas analog to IEC 61508, including markets such as railroad technology (EN 50155), aviation (DO-160), stationary and mobile machines (ISO 13849), as well as manufacturing robots (ISO 10218), control systems (IEC 62061) and drive systems (IEC 61800-5-2).

Besides vehicle engineering, the new System-on-Modules also have many in-vehicle uses. For example, they are deployed as edge systems in commercial vehicles with special superstructures, construction and agricultural machinery, mobile robots and autonomous guided logistics vehicles. They all have typical production volumes of hundreds or thousands rather than hundreds of thousands. This requires a modular design as it is the only way to use application-ready commercial-off-the-shelf components (COTS). This was also key for Weiß Elektronik & Software.



While metal housings are usually injection molded in mass-produced vehicles, MicroSys manufactures such systems optional also from milled aluminum blocks, eliminating the extremely high tooling costs associated with industrial series.

Systems from milled aluminium blocks

"Accelerating the development process was particularly important to us," explains Dipl. Ing. (FH) Gerhard Weiß, Managing Director of Weiß Elektronik & Software GmbH. The selected system design is convincing in two respects. First, the NXP S32G processor family with native CAN, FlexRay, LIN and numerous other native interfaces is already highly integrated, which per se makes designs very efficient. Secondly, system design is accelerated by the fact that all this is now obtainable not only at component level, but also as a commercial-off-the-shelf and directly bootable board level platform from MicroSys.

NXP S32G processor based System-on-Modules

NXP S32G system solutions from MicroSys are available in different configurations that currently range from the miriac MPX-S32G274A System-on-Module with 4 Arm Cortex-A53 processors and 3 Arm Cortex-M7 processors to the miriac MPX-S32G399A with 8 Arm Cortex-A53 processors and 4 Arm Cortex-M7 processors clustered as a dual lockstep pair. With integrated 18x CAN FD, 2x FlexRay and 4x LIN interfaces, as well as integrated 10BASE-T1L support of TSN for real-time operation via IP-based protocols, these solutions are predestined for in-vehicle communication.

When does it make sense for vehicle manufacturers to log data during operation?

Universally deployable vehicle data loggers must support numerous interfaces.

Data is the gold of the 21st century. The pictured close-up of the wiring of a truck engine control unit illustrates the extreme diversity of data. Systems that record all usage data offer valuable information for the further development of vehicles: For instance, if customers frequently drive in third gear, it is important to factor this into the design of the transmission so that engines achieve a lifespan of e.g. one million kilometers. If the customer hardly ever drives in 12th gear, this can be dimensioned weaker. Such data is also important for troubleshooting. For this purpose, it is first necessary to collect reference data from normal and good-case operation. Faults and outliers can then be compared with this reference data to find out whether there are specific application scenarios in which these faults occur: For example, if a user's turbocharger breaks down frequently, it could be because he or she uses the vehicle at altitudes above 6,000 meters in cold air. After all, such scenarios are strikingly different from normal operation because the air pressure decreases with every meter of altitude. However, as the air pressure drops, the turbocharger will run faster. Therefore, the WeMOTA G2 system can be programmed, for example, to record the ambient air pressure, engine speed and torque only when the geodata states that the vehicle is above 3,000 meters. If the exact geo-position and speed of the vehicle is recorded as well, it is also possible to identify inclines accurately, for instance.

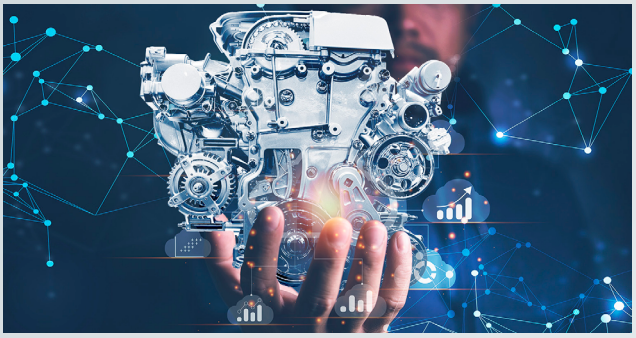
MicroSys also offers suitable development kits that enable developers to start creating their own applications immediately. Together with the modules, these can also be used as application-ready modular single board computers (SBCs) or, if required, adapted to custom-specific application needs with comparatively little development effort. Besides products and engineering services at board level, MicroSys also offers custom-specific system designs. Here, MicroSys specializes primarily in extremely rugged system designs for off-road vehicles such as construction and agricultural machinery. MicroSys counts one of the world's largest manufacturers of construction machinery among its customers, for instance. However, Weiß Elektronik & Software wanted to implement the system design itself, especially since the company has sufficient and relevant experience from the development of its own mezzanine board.

Weiß Elektronik & Software decided in favor of the MicroSys miriac MPX-S32G274A System-on-Module with the associated carrier board because it offers them the option to equip WeMOTA G2 with even more computing power in the future. The additional mezzanine module developed by Weiß Elektronik & Software expands the functionality of this basic platform with analog inputs, TFT display support, GPS, acceleration and gyro sensors, and power outputs. In addition, WeMOTA G2 comes with connected mass storage and communication cards for GSM, 3G, 4G and 5G via PCIe and M.2 interfaces.

Efficient engineering partnership

Weiß Elektronik & Software has only good things to say about the cooperation with MicroSys. "The collaboration with the MicroSys developers was direct and constructive. All requirements were understood correctly

Commissioning the WeMOTA G2



The WeMOTA G2 system from Weiß Elektronik & Software serves developers all the information they need on a silver platter.

The WeMOTA G2 system from Weiß Elektronik & Software has been designed to give customers access to all standard modern vehicle interfaces. However, users must have details of the specific vehicle networks and communication protocols. OEMs who assemble vehicles with components from several manufacturers must therefore also know the data from their suppliers. Once they have this, commissioning is easy. They can then simply use the configuration software of the WeMOTA G2 system to read in these databases – for example, the CAN network descriptions – and right away configure their specific measurement parameters – for example, to read the engine speed every 10 milliseconds – and record highly customized data. These can be aggregated in the edge system in such a way that only the essential data is transferred to the cloud dashboards, serving developers the information they need on a silver platter.

and implemented extremely expertly. On the software side, too, all our concerns were dealt with quickly, even though the processor and thus also the MicroSys modules were still in the beta testing phase at the beginning of the design," explains Gerhard Weiß. For Weiß Elektronik & Software, this superb support is also proof that MicroSys works very closely with NXP, which is crucial if the worst comes to the worst, as it means that problems can be solved quickly. The company's local presence was also important, because ultimately you want the development teams to be able to sit down together when challenges arise. That is also why Gerhard Weiß is glad that MicroSys is based only a little more than 100 kilometers away from his company location.

Artificial intelligence is also an option

The possibility to integrate Hailo-8 AI accelerators, which MicroSys also offers for its S32G platforms, is a welcome option for Weiß as it will enable them to analyze data directly in the vehicle in future developments with OEM partners. After all, deep learning methods are ideally suited to extract relevant bits of information from the ever-growing stream of data. For example, a developer may not be interested in a complete video data stream, but only in the number of vehicles detected, etc. This reduces the amount of data to be

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transmitted, which ties in perfectly with the strategy of Gerhard Weiß: "Reduce data to the essentials to provide customers with cost-effective, secure and reliable mobile connectivity for data transmission."

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About MicroSys Electronics

MicroSys Electronics has been designing and developing embedded system solutions since 1975, is an NXP Gold Partner and widely integrates NXP's S32 Automotive, Layerscape and QorIQ processor technology. Designs based on System-on-Modules (SoMs) are the strengths of this German company, with the portfolio ranging from application-ready SoMs and customer-specific carrier board designs to fully integrated systems. Application areas for these extremely rugged designs with long-term availability are primarily found in markets where safety standards analog to IEC 61508 are required, such as railway technology (EN 50155), aviation (DO-160), and mobile machinery (ISO 13849), as well as manufacturing robots (ISO 10218), control systems (IEC 61131-6), and drive systems (IEC 61800-5-2). Further application areas can be found in medical technology (60601), and in critical infrastructures, for instance in 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 specific applicable standards are fully met.

For more information, visit www.microsys.de

NXP GOLD PARTNER

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About Weiß Elektronik & Software GmbH

Dipl.-Ing. (FH) Gerhard Weiß founded the engineering office “Ingenieurbüro Weiß” in Warmisried, Gemany, in 1993. In 1995, the engineering office was renamed to “Weiß Elektronik & Software GmbH”. Since then, Weiß Elektronik & Software GmbH has been developing and manufacturing a wide range of control units and gateways for small series, and prototypes for the automotive sector and industrial applications.
Among other things, Weiß Elektronik & Software GmbH develops control units and data loggers that are used by vehicle manufacturers worldwide to acquire component and environmental data in test vehicles and throughout the entire vehicle lifespan. Besides continuous data streaming, they also use collective load monitoring algorithms that process and synthesize data during acquisition. This greatly reduces the amount of data, which in turn reduces costs and the bandwidth requirements for the integrated GSM and radio modules. The recorded data is compressed and encrypted before transmission to the servers, processed in line with customer requirements, and made available for download. The dashboard provides status information and configures the data download. The firmware/software can be updated remotely at any time.

For more information, visit www.weiss-elektronik.de

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