Automated Driving: ZF Strengthens Capabilities for ADAS Turnkey Solutions

- **Market leader in smart cameras for advanced driver assist systems (ADAS)**
- **ProAI automotive computing power from XS to XXL**
- **ADAS driving functions as stand-alone software solution: Ready for software-defined vehicles and new E/E architectures**
- **Accelerating development cycles: AI based virtual testing and validation**

Friedrichshafen / Koblenz, Germany. Since July 2024, all new vehicles registered in the European Union must be equipped with assistance systems for emergency braking, lane keeping, or intelligent speed control. These features make driving safer and more comfortable. Increasingly, the intelligence for these assistance functions is migrating from sensors to central computers, which can also use their computing power to control driving dynamics or in-vehicle infotainment.

With a global market share of 30 percent, ZF is the leader in smart cameras for advanced driver assist systems (ADAS), which combine sensors, perception, and driving functions in a single device. A new addition to the company's portfolio is automated driving functions as stand-alone software. These solutions are designed flexible to fit on controllers from different providers and have the capability to control vehicle actuators such as braking and steering systems via central or domain computers.

In response to growing customer demand for ADAS turnkey solutions, ZF also offers these systems including testing, validation, and homologation. This can be achieved faster and more efficiently using AI-supported tools such as ZF Annotate, which tests and validates ADAS hardware and software to ensure full functionality.

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"We have continuously expanded our expertise in recent years and offer our customers turnkey driver assist systems that meet the requirements of software-defined vehicles and new E/E architectures," said Dr. Christian Brenneke, head of the Electronics & ADAS division at ZF Group. "These turnkey solutions start with the system design of hardware and software and range through to the validation and homologation of driver assist systems. This portfolio puts us in an excellent market position for future growth."

Worldwide leader in automotive smart cameras for ADAS functions

ZF has long been at the forefront of smart cameras for ADAS functions. As the market leader, ZF surpassed 75 million cameras sold to date and continues to build on its reputation as an innovator in the field. Beginning with its first smart camera, which hit the market in 2008, ZF has continually made upgrades to its front-facing cameras, including when it became the first to offer the capability of a 100-degree horizontal field of view.

With its newest generation – Smart Camera 6 – ZF has taken the next step in the evolution of front-facing cameras. The Smart Camera 6 features a 120-degree field of view with more than 4x higher image resolution (8 megapixels) than the previous generation and greater processing power. With the capability for over-the-air updates, Smart Camera 6 enhances performance and enables new functions to allow for future system upgrades.

As a supplier of ADAS sensor technologies including front-facing cameras to more than a dozen vehicle manufacturers globally, ZF's portfolio helps enable manufacturers enhance vehicle safety and supports critical driving functions and driver assistance systems.

ADAS and parking functions as stand-alone software solutions

Previously, many ADAS software functions were implemented in the hardware and stored on chips in the respective components, e.g., smart cameras. However, with the trend toward centralized architectures,

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where software is deployed centrally, it is now possible to use these functions independently of the hardware.

Therefore, ZF also offers its ADAS and parking functions as stand-alone software-as-a-product, encompassing approximately 25 safety, comfort, and parking features. Vehicle manufacturers can select the functions they want to use for a particular vehicle series from a pool of functions in an individual, modular, and scalable manner.

ProAI: Automotive compute solutions from XS to XXL

To ensure the safe and real-time calculation of these functions, future vehicle architectures will necessitate increasing computing power. The ProAI family from ZF is an automotive-grade central computer suitable for all vehicle platforms, software applications, and E/E-architectures. A high-performance version of ProAI went into series production at the end of 2024. Several other versions – for example, for ADAS cameras and parking solutions – had already entered series production prior to this.

In addition to the ProAI versions already established, ZF is expanding its product portfolio and can now offer more cost-effective compute units for volume models under the ProAI name. Thanks to the scalability and modularity of ProAI, this is a logical step toward a clearly structured product offering: ProAI can be configured individually and as required for all vehicle classes, types, and architectures – from low-cost entry-level models for pure front camera solutions or parking-only applications to powerful comfort configurations for Level 2+ and Level 3 ADAS and chassis solutions in the premium segment, right through to all-in-one supercomputers that control entire autonomous applications. This makes “ProAI” synonymous with automotive compute solutions at ZF.

ProAI: Computing power for all vehicle domains

The highest configuration level is a multi-domain capable edition with multiple performance boards and a computing power of more than 1,500 TOPS (1.5 quadrillion computing steps per second). These performance boards can be individually equipped with microprocessors from all major manufacturers and different operating systems, thus

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ensuring the maximum possible flexibility and freedom when developing new architectures with centralized design.

This version of ProAI can serve different domains in the vehicle in “one box” – for example ADAS/AD, chassis and in-vehicle infotainment (IVI). This solution offers unparalleled options in flexibility and a wide range of planning and design options for software-defined vehicles with centralized E/E architecture.

ProConnect: Connecting vehicles and the cloud

To enable the seamless continuation of our connected world in vehicles, connectivity solutions are needed. With its ProConnect platform, ZF offers a modularly configurable solution for the highest performance requirements of modern connectivity like the AD/ADAS from SAE Level 2+ to Level 4. This includes hardware modules of the latest generation for the orchestration of all connectivity standards (cellular, satellite, Bluetooth, Wi-Fi, V2X), cyber security, a flexible cloud environment and a comprehensive digital services portfolio (OTA/Over-The-Air updates, HD map generation, fleet orchestration, data collection, incident management, remote diagnosis, etc.) that meet all requirements for the software-defined vehicle of the future. Especially for high-precision positioning, ZF also offers the ProConnect GNSS, including correction service as a separate tailor-made product adaptation.

Annotate: Virtual testing and validation of ADAS functions

To further advance the development of ADAS and AD solutions, ZF has developed the cloud-based and AI-enabled validation service ZF Annotate.

Sensor data must be processed digitally correctly so that the vehicle always receives the “absolute truth” – known in the industry as “ground truth” – to calculate and implement a driving function based on it. Comparing the collected sensor information with a reliable and high-precision reference sensor set increases accuracy. This is where ZF Annotate comes in.

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Based on the customer's own vehicle data and additional ZF sensor data recordings – the reference measurement – the cloud-based service solution provides the "ground truth." ZF Annotate acts as a redundant setup that is independent of the sensor set to be checked and is confronted with the same information while driving on the road. The recorded data is then uploaded to the cloud and analyzed. Thanks to artificial intelligence, all relevant objects are accurately marked, classified, attributed and assigned unique ID numbers and moving objects are tracked. This object information forms part of the complete description of the environment model – the ground truth. After this "annotation," the software provides a highly precise comparative measurement. This makes ZF Annotate a state-of-the-art, AI-supported validation solution for testing and training modern ADAS/AD systems from Level 2+ to Level 5. Thereby, ZF can speed up the validation process by up to 10 times and thus reduce an annotation from 12 to two months.

Press pictures are available at https://press.zf.com

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About ZF

ZF is a global technology company supplying advanced mobility products and systems for passenger cars, commercial vehicles and industrial technology. Its comprehensive product range is primarily aimed at vehicle manufacturers, mobility providers and start-up companies in the fields of transportation and mobility. ZF electrifies a wide range of vehicle types. With its products, the company contributes to reducing emissions, protecting the climate as well as enhancing safe mobility. Alongside the automotive sector – passenger cars and commercial vehicles – ZF also serves market segments such as construction and agricultural machinery, wind power, marine propulsion, rail drives and test systems.

With some 161,600 employees worldwide, ZF reported sales of €41.4 billion in fiscal 2024. The company operates 161 production locations in 30 countries.

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