Big in the City: The ZF Advanced Urban Vehicle

- Semi-automated assistance functions enhance comfort/convenience, safety, and efficiency
- Electric vehicle parks fully automatically with minimal moves
- Study of a cloud-based driver assistance system delivers greater safety, efficiency, comfort, and convenience on the road
- Innovative multifunction steering wheel with hands on/off detection and display in the steering wheel rim
- Maneuverability in urban traffic thanks to innovative front-axle concept and electric motors mounted close to the wheel on the rear axle

Extremely maneuverable, locally emission-free, and networked with driver and environment: ZF is demonstrating the potential inherent in intelligently networking individual chassis/driveline and driver assistance systems with the Advanced Urban Vehicle, and is presenting an exemplary solution for urban individual transport in the compact and subcompact segments. Two driver assistance functions provide comfort as well as safety and efficiency: Smart Parking Assist maneuvers the vehicle into virtually any small parking space – remote-controlled at the push of a button using mobile devices such as a smartphone or smartwatch. Comfortable, efficient motoring is possible with the concept vehicle thanks to the cloud-based assistance function, PreVision Cloud Assist. Where necessary, the concept study reduces the drive torque, for instance, in good time before entering the corner and thus throttles back the speed without any mechanical braking. The driver is also in direct touch with the Advanced Urban Vehicle via the steering wheel: The hands on/off detection function covers the steering wheel's entire surface and thus empowers assistance and automated driving functions. A display with OLED technology in the driver's direct field of view provides the driver with additional information.
“With the Advanced Urban Vehicle, ZF is demonstrating the kinds of specific solutions that are already feasible for urban individual transport by networking existing technologies and systems in the vehicle, having these functions interact with the driver, with the driver's behavior, and with the environment, or by accessing data which can be provided anywhere thanks to cloud connectivity,” explains Dr. Stefan Sommer, Chief Executive Officer of ZF Friedrichshafen AG. “At the same time, this study also marks to a certain extent a starting point from which concepts for future urban mobility can be derived very specifically – also with regard to the new competency areas opening up for ZF thanks to the acquisition of TRW.”

In addition to an all-electric drive concept and an innovative front-axle design, software solutions, which pave the way for all-new driving functions, stand front and center with the Advanced Urban Vehicle.

**Recognized, pressed, parked: The ZF Smart Parking Assist**

The Smart Parking Assist driver assistance function highlights the advantages of the concept vehicle: The system assists the driver not only in recognizing suitable parking spaces, but can also park the vehicle fully automatically in parallel or perpendicular spaces. The parking aid obtains its information from twelve ultrasound sensors and two infrared sensors on the vehicle's front-end, rear-end, and flanks; these sensors help find a suitable parking space. The control electronics process the information and control all the systems involved in the parking function – for instance, the electric drive and the required steering angle of the electric power steering.

The driver can interact with the vehicle during the process via the display in the cockpit or trigger the parking function once they exit the vehicle by using an application on a mobile device, e.g. a smartwatch. The Advanced Urban Vehicle then automatically searches the surroundings at walking pace for a suitable gap and automatically initiates the parking process.
The technical prerequisite comes in the shape of an innovative front-axle concept, which facilitates steering angles of up to 75 degrees. In order to utilize this wheel deflection from standstill, the all-electric rear-axle drive eTB (electric Twist Beam) mounted close to the wheel features a torque vectoring function, which assists the steering movements of the front axle and distributes the drive force individually to the two rear wheels.

**Enhances comfort for the driver, relieves pressure on cities**

For the future, the Smart Parking Assist opens up potential scenarios which provide additional benefits for the driver: The driver can get out at the destination, leaving the vehicle to head off autonomously for a parking garage, thus saving valuable time in the process. “When implementing the concept, we weren't only looking at the benefits for the driver,” explains Harald Naunheimer, Head of Research and Development at ZF Friedrichshafen AG. “If passenger cars in future park without a driver, parking space can also be used more effectively. As such the door opening angles would no longer need to be taken into account in the parking garage – thus making the parking spaces smaller. All of which also takes the pressure off cities because the freed-up space can then be used productively as additional living and working areas.”

**Driving experience from the cloud**

The cloud-based ZF PreVision Cloud Assist driver assistance function provides maximum range and driving safety in the Advanced Urban Vehicle. Unlike purely GPS-based systems, the ZF concept study not only takes into account geometry data and information on the permissible top speed, but also stores data in the cloud on the vehicle position, currently driven speed, and lateral and longitudinal acceleration for every journey. If the driver follows the same route again, the system calculates the optimum speed for an approaching corner on the basis of these empirical data. The assistance function then throttles back the torque early on before entering the corner, to the point where the corner can be negotiated without any mechanical braking. All of which not only
protects the vehicle's battery and braking system, but also provides greater safety particularly on blind corners.

**Communication via the steering wheel**
The driver is kept informed at all times about the intervention of PreVision Cloud Assist: The multifunction steering wheel, which ZF uses in the Advanced Urban Vehicle, features a display with OLED technology in the steering wheel rim in the driver's direct field of view. This display shows, for instance, how much drive torque the driver assistance system throttles back before entering the corner – or provides again after the corner.

The driver, however, remains in direct contact with the Advanced Urban Vehicle using hands on/off detection. The capacitive system covers the entire steering wheel and detects whether the driver is holding the steering wheel. The electronic control unit built into the steering wheel converts the identified state into a digital signal and sends this to the vehicle via the LIN (Local Interconnect Network). Depending on the situation, this alerts the driver or activates the available assistance systems.

“With the hands on/off detection, we are creating the basis for assistance and automated driving functions which reduce the driver's workload – such as in urban traffic, which is characterized by strenuous stop-and-go phases during rush-hour periods,” explains Dr. Alois Seewald, Technical Director Integrated Active & Passive Safety Technologies at ZF TRW. These assistance functions automatically maintain, for instance, a sufficient distance to the vehicle ahead or reliably initiate braking as required. “Thus we can improve active safety – even if the driver does not have their hands on the steering wheel.”
Captions:
1.) Smart Parking Assist combines innovations in chassis, driveline, and electronics. The parking process can also be triggered from outside the vehicle using smart device and parks the vehicle fully automatically with minimal moves.
2.) Anticipatory concept: The cloud-based driver assistance function PreVision Cloud Assist provides maximum range and driving safety in the Advanced Urban Vehicle.
3.) Extremely maneuverable, locally emission-free, and networked with driver and environment: With the Advanced Urban Vehicle concept, ZF is presenting an exemplary solution for urban individual transport in the compact and subcompact segments.
4.) The electric axle drive eTB (electric Twist Beam) mounted close to the wheel features a torque vectoring function at the rear axle, which assists the steering movements of the front axle – ideal for automatic parking in a single move even in the tightest parking spaces.
5.) ZF’s innovative front-axle concept paves the way for steering angles of up to 75 degrees on the Advanced Urban Vehicle concept vehicle. It forms the basis for a highly effective parking assist system.
6.) The steering wheel in the Advanced Urban Vehicle with hands on/off detection and OLED display is the ideal interface between driver and vehicle, thus forming the basis for assistance and automated driving functions.

Images: ZF

Press contact:
Robert Buchmeier, Technology and Product Communications, phone: +49 7541 77-2488, email: robert.buchmeier@zf.com

Thomas Wenzel, Head of Technology and Product Communications, phone: +49 7541 77-2543, email: thomas.wenzel@zf.com
ZF is a global leader in driveline and chassis technology as well as active and passive safety technology. The company, which acquired TRW Automotive on May 15, 2015, is now represented at about 230 locations in some 40 countries. The two companies, which were still independent in 2014, achieved a sales figure exceeding €30 billion with 134,000 employees. As in previous years, both companies have invested approximately 5 percent of their sales in research and development (recently €1.6 billion) in order to be successful with innovative products. ZF is one of the top three automotive suppliers worldwide.

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