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“Autonomous driving must offer multiple benefits”

Foldaway steering wheels and informative navigation maps are some of the newfeatures of partially and fully automated vehicles, alongside digitization and connectivity. Other requirements for these cars include safe and intuitive operation at all times. In the ATZ interview, Klaus Härtl and Rainer Schuler from Bertrandt describe the functions that drivers want in autonomous cars and explain how the development process for cars is becoming part of the fourth industrial revolution.

ATZ _ Klaus Härtl, Rainer Schuler, digitization is becoming increasingly important in all areas of our lives and our work. Which functions and systems do drivers want to see in the cars of tomorrow?

SCHULER _ Drivers want to be able to behave in the same way in their cars as they do at home on their smartphones and computers. The experience and the results must be the same. The main difference, which also represents a challenge, is that drivers must constantly be looking at their surroundings while driving. That is the key task for the developers. Where does the accountability lie? What is it safe for drivers to do while driving? From a purely technical perspective we can already offer a wide range of features, but which functions are really useful and beneficial, particularly when the car is on the move?

HÄRTL _ We are trying to find the happy medium between experienced test driv-

Klaus Härtl (born in 1966) is Head of the Electronics Competence Center at the Bertrandt Group. He joined the company in Munich (Germany) in 1996. Since 2000 he has held a number of technical and line management positions. In 2011 he became Head of the Electronics Competence Center, which is a cross-disciplinary role with responsibility for the strategic and technical direction of the center within the group. He is also involved with innovation management and business development. As well as completing a combined apprenticeship as an electrical and electronics specialist in the field of energy supply, Härtl also took a further education course to become a state-certified electrical and communications engineer.

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ers and people who only get behind the wheel occasionally. Assistance systems must provide support to varying degrees across the entire bandwidth of experience. Important questions include: What is the driver's current situation and what are his or her typical driving habits? Is the traffic flowing smoothly or is a critical incident about to occur? What are the criteria? Can the system take over responsibility for driving? Should the driver not become involved at all? Or must the driver definitely take control? Autonomous driving must provide real benefits in a number of different ways. It should be easy to use and function proactively to manage critical situations and avoid accidents. It must also take the driver's individual habits into consideration, operate reliably in the background, andhave interactiveand intuitive functions, to the extent that this is still necessary.

Is there one means of communication in cars that is more intuitive than the others, for example voice control?

HÄRTL _ A huge amount of progress has been made with voice assistants and systems with natural language capability. This is definitely the right way to go. However, we should not be aiming to use predefined text strings in cars so that the system can understand. The ability to speak freely results in a high level of positive feedback and increases acceptance among users.

SCHULER _ It is possible to speak and to monitor the car's surroundings at the same time. Although speech is probably the best link between the driver and the car's computers, gestures and touch functions should not be totally disregarded. If you use your hands, you automatically look at them. Is my finger in the right place on the button or touch screen? Additional development disciplines such as psychology, ergonomics, and, in some cases, medicine are needed to ensure that the driver's intentions and the feedback are clear and unambiguous.

"Software development has become highly important."

How often will drivers use the autonomous mode?

HÄRTL _ That depends on the situation. If you're making a non-work-related journey or traveling on ordinary highways, you may not need it. But if you're driving for work and have something else that you need to do during your journey, you will want to use assistance systems. For example, when I drive through Stuttgart in the mornings to get to my office in Ehningen, the stop-and-go traffic is really tiring. An intelligent driving assistant could transport me safely to my destination while I reply to some e-mails, which means that I would arrive at work feeling more relaxed.

What do digitization and the Internet of Things (IoT) mean for you at Bertrandt?

HÄRTL _ Exactly what they mean to our customers in the automotive sector and in other industries, who are primarily manufacturers and suppliers. We are a service provider, but we see the market requirements from the perspective of a solutions partner. We make use of digitization to develop products and solutions. To do this, we need to be familiar with the technologies and the options available, understand their pros and cons, and know how to apply them. We can only succeed in doing this if we have carried out in-depth investigations in advance. Our customers expect a partner that provides a solution and implements it efficiently. This requires a high level of networking within our organization. Our knowledge, processes, and teams must interact seamlessly across the different sites to enable us to provide a high-performance and high-quality service. Our IT systems, tools, software, and analysis functions must work smoothly together. It is not only the business models that are changing but also the work models. Digitization leads to flexibility and scalability. We are investing heavily at an early stageto ensure that we can grow and develop on an ongoing basis and provide the high-quality services that our customers need. Our internal IT

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Rainer Schuler (born in 1964) has been Head of Engineering Services and also Head of the Production Support Services department since 2008. He is based at the Technikum at Bertrandt's site in Ehningen, (Germany). His role covers all aspects of the fourth industrial revolution and quality management. One key area of his quality management activities involves analyzing the causes of faults using big data technologies, in particular in relation to components and processes in the automotive industry. He joined Bertrandt in 2004. He has a degree in mechanical engineering from Paderborn University.

department is constantly updating and upgrading our systems, services, and deployment functions.

SCHULER _ For the last two years we have been working closely on digitizing our internal processes and making them more user friendly. Nowadays we must be able to respond quickly and our administrative functions must run smoothly. Our employees and our job applicants expect this level of service. They want to be able to perform a lot of tasks directly over the web or on the intranet. One example is submitting a job application at the click of a mouse, for example when the applicant attaches their Xing profile to their email. Another is the option of using internal chat functions to discuss technical subjects. Our employees can also manage their personal data and their knowledge independently. This allows managers to draw up staffing plans more quickly. However, we must remain aware of security issues during the digital transformation process. It is important to make security solutions available and to incorporate our experiences into our IoT projects.

The development process for cars is becoming part of the fourth industrial revolution. How are you managing to complete tasks more quickly and shorten product life cycles?

HÄRTL _ We have to take an overall view of this at Bertrandt because we have more than 50 sites worldwide. We need to know how to set up processes that function effectively and securely across our German sites and those in other countries. It is also important for our employees to understand the situation in the same way, so that we can produce useful and usable solutions.

SCHULER _ The product life cycle for cars will not become significantly shorter. As we all know, software opens up a lot of opportunities and can be developed more quickly than mechanical components. The important factor is to be able to keep functions and features in cars constantly updated. Despite the level of complexity, updates and cloud solutions will make this straightforward, but we need to talk about function life cycles rather than product life cycles.

"The ability to speak freely results in a high level of positive feedback."

HÄRTL _ The trend for more individual mobility and the efforts being made by OEMs to transform themselves from car manufacturers into mobility service providers highlight the importance of personalization. Cars can be supplied with a basic configuration and other functions can be made available as over-the-air updates or services. Someone who has a car with a powerful motor and does not want this amount of power to be available to their children for various reasons can make use of this option. The car may also be able to detect that there is a different, younger driver behind the wheel and will supply only 150 kW of power instead of the full 300 kW.

You use high-performance IT systems and servers for software development. What advantages does cloud computing offer?

HÄRTL _ It has been obvious for a long time that the cloud will make it possible to overcome a number of challenges. Systems can only become smarter if they are supplied with information and data that they can analyze and process intelligently. Machine learning allows data from all the vehicles on the road to be integrated, together with traffic information and details of individual situations. This gives us the huge advantage that the system does not learn just from one driver and his or her experience, but from the so-called swarm. Hopefully this will bring us closer to the goal of no mistakes on the roads and zero accidents. Software development has become highly important and we need to guarantee its functional security. We are working on an internal project to develop a level 5 demonstrator. This will give us the innovative and creative freedom we need and, at the same time, enable us to develop our knowledge and skills. The project will, of course, cover all aspects

of autonomous driving, including new architectures, high-performance computing, and sensor fusion.

Systems such as foldaway steering wheels and highly accurate navigation maps need to be available in redundant form for fully automated driving. How will you make this possible?

SCHULER _ It goes without saying that functions of this kind must have a redundant design with fallback levels. In addition, the systems must undergo detailed testing. Several sensor signals at a time will be received by the information processing system for autonomous driving. These will typically come from radar, (stereo) cameras, and laser scanners, all of which have their advantages and disadvantages. If one of the systems fails or cannot supply any plausible data, the remaining sensors are guaranteed to provide at least the basic function. This means that the possibility of function restrictions cannot be completely excluded, but that these restrictions can be managed effectively. The camera can measure distances, so a laser is not necessarily needed. The computing capacity and performance must be taken into consideration during the design of the system and the software.

But in a normal situation you don't always want to drag a second system around with you.

HÄRTL _ Redundancy doesn't mean duplicating every system. Instead it means that functions which used to be provided by one system or, in particular, one ECU operating independently are now spread across several ECUs to create a redundant system. This of course calls for new types of architecture. It is possible to swap out partial or complete functions. The key requirement is to design functions using the available information and algorithms so that in theory one function will always cover more than 100 % of the demand. In the worst case this figure may fall to 100 %. Using classification methods, the criticality of each function can be assessed and the necessary fallback levels can be defined.

A data recorder is needed in order to transfer responsibility for driving from the driver to the car and back again, including in difficult situations, such as accidents. What do you think of the idea of a blackbox for cars like those in aircraft?

HÄRTL _ Conventional control units already provide logging and tracking functions and their memory and data can be exported for diagnostics purposes. For additional functions to be made available, an interface to the cloud is definitely needed. The quality of the information increases with the number of vehicles, as we explained earlier in relation to swarm data. It is not up to us to decide whether the manufacturers should agree on a central standardized data recorder or a shared memory for autonomous driving. The critical factor is data protection. We ultimately need to be able to explain to end users why we are processing their data and what the benefits for them are and to assure them that it will not be possible to link the data to individual users without their explicit consent. If drivers only notice during the second stage of the process that the data which have been recorded could be used to their disadvantage, this is likely to have a negative impact on their level of acceptance.

SCHULER _ Data protection is a challenge for the politicians. In the case of autonomous driving, everyone needs to understand that computers work faster and more reliably than people do. For example, computers do not get tired when driving at night and do not fail to spot road signs, unlike drivers.

Klaus Härtl, Rainer Schuler, thank you very much for this informative discussion.

You can find more of the interview in German on the ATZ online portal at www.springerprofessional.de.

The complete system must be designed in such a way that it can primarily decide for itself whether it is ready to operate autonomously, explains Rainer Schuler (right), in conversation with Klaus Härtl (center) and Michael Reichenbach (left), deputy editor in chief of ATZ

INTERVIEW: Michael Reichenbach