

The car of the future.
Automated driving

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Highly automated driving and, in further development, autonomous driving will change the car industry and our mobility behavior in a revolutionary manner. The difficulties on the way to this point are not as much determined by technical problems rather than by ethical and legal questions. The large American IT-enterprises have already gained a huge head start in the competition concerning self driving cars. It's high time for the German and European car business to start catching up.

Challenges for the car business

The presentation of the Google car, which has already driven several millions of kilometers without any accident, caught the interest of the car business and led to increased endeavor. Currently many people ask themselves whether the cars of the future will be delivered by silicon valley or by the traditional car manufacturers if they are able to keep up pace with the new trend of highly automated driving. Without doubt, this new technology will initiate a revolution in the car business.

In spring of the year 2015 the consulting company McKinsey published a survey "Bavaria 2020". This study analyzes clearly, that the Achilles heel of the German and especially the Bavarian industry is the electronic and the car business. In their study Elsner and Stuchtay conclude that in Bavaria alone up to 100,000 working places will be in danger in the three largest enterprises.

In another study of the Prognos company, published in the middle of 2015 by the Association of the Bavarian economy (Vbw) confirms this conclusion: "The free state of Bavaria has been, in recent years, a winner of the dynamic development of their home based car manufacturing business. But the risk is high if there are severe problems in a situation of a downswing in the economic situation. The authors of the study show at the same time that the German enterprises can set new standards in the field of connected cars. It is mentioned, that the German enterprises dominate the committees and organizations relevant for standardization, for example the car-to-car communication consortium.

Topic on the political agenda

The committee for economic and traffic affairs of the Bavarian parliament took appropriate action by inviting experts to a hearing about autonomous driving in the autumn of 2015 chaired by the former minister Erwin Huber. In the 220 pages comprising documentation the statements of the experts in the car business manufacturers and the car business suppliers, the representatives of the associations and the representatives of science are noted down. Also published are the main results of the discussion during this hearing.

In this hearing the experts of Audi, BMW and MAN and of the association of German car industry expressed the unanimous opinion, that there will be a continuous evolutionary development from highly automated driving to autonomous driving.

So the experts assume, that there will be no disruptive process as one can see it in the case of the Google car. The experts further assume that the existing traffic infrastructure is sufficient. Only the systems of the second generation need additional information received from outside the car to describe the environment of the vehicle.

For these further measures, the experts state concordantly that there is a necessity for a perfect mobile net.

Initiative by the federal government

Parallel to this development the federal minister for traffic and digitalization, Alexander Dobrindt declared in February 2015, the sector of the motorway A 9 between Ingolstadt and Munich as a testbed for highly automated driving. In fall 2015 the federal ministry for traffic and digital infrastructure, the free state of Bavaria, the association of the German car industry and the association Bitkom signed an innovation charter "digital testbed motorway" on the A9.

The partners arranged to construct and operate this testbed to test innovations of mobility 4.0, to evaluate and develop them further. This testbed is meant to be an offer open to technology to industry and research and shall be used by all innovation-minded interest groups from car industry, digital business and science. The main emphasis should be put on the field of automated driving, the car-to-car communication and the car to infrastructure communication with highly modern sensor technology, highly precise maps as well as realtime communication with the most modern transferring standard.

In Bavaria there has been a digital testbed since fall 2015 on the A9

As important this initiative is, it is far behind the technological developments in the United States of America. There are already four large testbeds in which the highly automated driving is tested, or is just before start as it is in California and in Florida. Furthermore some states, especially Nevada created the legal pre-requisites to test highly automated driving on a broad level. So for example the FAZ used the headline "Mercedes is number one in the desert" at the beginning of 2016.

As pleasing as it is, that also German politics have recognized the importance of this new technology, one has to complain at the same time, that there is still a clear industrial policy initiative missing. Totally different to the United States of America.

There the US administration published an invitation for a bid to advance the autonomous driving with \$4 billion dollar.

Overdue industrial policy initiative

The prime minister of Bavaria, Horst Seehofer, pointed out the enormous importance of highly automated driving at a large "future congress" organized by the Association of Bavarian economy on ninth of July 2015 in Munich. But there is not yet a concept of how Germany can compete with the United States of America in this technology. Minks and Dietrich called for a clear initiative of the state: "absolutely necessary are clear steering capacities of the state: he has to cooperate with the private sector for the development of the traffic system. This has to be backed by new laws, which regulate approval, liability right,

insurance as well as a concept which creates acceptance of the topics data management and standardization of data (Open source, compatibility of interfaces, Data protection and security).

One flicker of hope was the 100. anniversary of BMW in Spring 2016 as one presented a new vehicle which can be as well steered by man as well as driven autonomously.

Nevertheless during this event was also declared that the highly automated driving is still in the far future.

Much hope offers the initiative of the Bavarian government in founding a center for digitalisation in Garching. This center "crosslinked mobility" is meant to be dealt with one of five technology fields.

Ethical and legal challenges.

It is clear that for highly automated driving many questions of jurisdiction and ethics have to be answered. It is always argued against highly automated driving that one has to program algorithms which have to decide for example whom a car should evade if it has to decide between an old lady and an eight-year old girl on the other

side of the street. As difficult as this ethical question is, it can not be a reason to reject this new technology. Also the driver has to decide within milliseconds to evade left or right.

It's a fact that highly automated driving has already been tested in many other countries. So one participant of an Congress in Vancouver reported, that he drove the way between his hotel and the Congress Center with a self driving Tesla. Similar statements are reported from Shanghai or from some cities in the United states.

Obstacle of the Vienna convention for road traffic

A big obstacle on the way to highly automated driving is the Vienna convention of road traffic. In this document is stated that the driver must always be the ruler of his vehicle, even if there have been made some modifications in September 2015.

The association of the Bavarian economy (vbw) demanded a position paper for the future of automated driving and the connected legal hurdles and that the Vienna convention has to be opened for the use of highly automated cars and for autonomous driving. It is mentioned that currently driving a car is only permitted in such constellations where the system can be overruled or switched off by the driver.

Furthermore it is said that monitored automatic cars are not allowed under the rule of the Vienna convention and activities which have nothing to do with driving are restricted.

Data security and cyber attacks

Further arguments against highly automated driving have to do with data security and the danger of Hacker attacks which results for example in a car steering into a ditch. These are indeed very important questions with which science and social discussion have to deal with as soon as possible. Within the hearing of the Bavarian parliament it was reported for example that the office of data security analyzed which data have already been saved in the cars of today and then to deal with the question which data are deleted after a short time as well as clarifying who the data belong to.

It's extremely difficult to clarify the question how to prevent that

Data security in automatic car's is not yet guaranteed. It's extremely difficult to answer the question how to prevent highly automated driving cars being attacked by hackers. Especially

in a time in which more and more firms and institutions and even hospitals can become victims of hacker attacks, the importance of this question can't be rated highly enough.

Reduction of number of accidents

Highly automated driving can reduce the number of accidents in traffic drastically.. Experts think that 90% off all accidents are based on human failure. This speaks in favor of the new form of mobility and their success. Also insurance companies have reacted and offer insurance premium which depend on the style of driving.

This means that the insured people who agree, that their driving style is analyzed have to pay lower insurance premium.

Scenario of the future

Strongly connected with the highly automated driving is the topic of car sharing. One can see nowadays in the younger generation, that it is not any more important to own a car, but to have access to mobility without any obstacles. If you imagine that it will be possible to book a self driving car via smartphone the day before starting your trip and that this car will take you from your home to the nearest ICE stop. There you take the train and arrive at the destination by being driven by another self driving car to the place you want to be, or by using the App of the German railway which already today offers information about all public transport means. This works already nowadays without booking a ticket and only billing by smartphone.

The rule of today is testing autonomous driving in a testbed in a real environment . The best way of a project promoter would be a public private partnership open for private investments as well as investments in public infrastructure. To include this sector makes sense as the demands of the legislation referring to the regulatory of the Vienna convention for traffic and the adaptation of the national legislation considering these challenges would be possibly quicker and easier. It would make sense to connect such a testbed with a business incubation center in which young research groups can deal with the challenges of highly automated driving up to autonomous driving in all intensity and complexity. It has to be a target to integrate the vehicles in an intelligent energy and communication structure to achieve holistic attractive mobility solutions.

Autonomous driving should be tested under real conditions

German innovation lab

Project aims of such an innovation lab, as it was designed by the founder of networks of automotive excellence, Herbert Kopplinger, could be as follows:

- research of all use cases in context of highly automated driving in an urban environment: driving, parking, loading
- Investigation of the potentials of multimodal solutions (active, hybrid and micro mobility, alternative car and mobility concepts
- Development of solutions to integrate people, means of transport, goods and informations (logistics, fleet management, mobility of people)
- Research off the preference of users and user acceptance

After reaching the project aims there would exist the possibility of further developing the testbed to a space of experience for innovative mobility. This could be useful for the research of the connection between mobility and life quality and as a hotspot for political and

business decision making. This testbed could be developed continuously and could deliver new impulses for urban infrastructure.

In this space for testing and experience one can integrate the topics of energy concerning creating, storing and distributing connected with the implementation of the zero-emission goal. This test and experience space could be useful for manufacturers of cars and lorries, the suppliers, the enterprises of the IT and telecommunication business and for the insurance companies as an ideal lab

for their specific use cases. It will be exciting to see how and if this idea will be implemented into the center of Digitalization in Garching near Munich.

Already today it is clear, that such a concept is not only of interest for start up companies and their connected venture capital enterprises but also for the public sector and the federal and "Leander" politics.

Such a project could also be an integral part of an international network as well between the European member states and beyond. In this context, it could be an important crystallization point for a planned European institute for innovation and technology in the field of mobility.

Future

The topic "highly automated driving" will experience a revolutionary change in the coming years and decades in the car industry. In this context the technical questions will be less a problem but the questions in the field of ethics and the legal framework. The digitalization will be tangible for the citizens and change our current mobility activities dramatically. This is why, it makes sense, to consider the topic integrated mobility in the holistic approach. In all considerations the demands for mobility of the clients have to be in the focus. It makes sense, to recognize the client's needs in time. It will be smart to work with so called use cases, this means, to notice often occurring situations of the client and to analyze the optimal solution to the problems. Within such an innovation framework there is enough space for start-up companies and for creating highly interesting working places in our country. Through this the innovation power in the Free state of Bavaria and Germany could be enhanced extremely. The topic "highly automated driving" and "autonomous driving" have the potential to become a central driver of our economy.