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Visualization of vision for automated driving in EU

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0.1	22/02/2017	Draft	Julia Kaltschew, Gereon Meyer (gereon.meyer@vdivde-it.de)	Creation of vision
0.2	03/04/2017	Draft	Carolin Zachäus (carolin.zachaeus@vdivde-it.de)	Visualisation of vision
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0.4	25/08/2017	Final	Carolin Zachäus (carolin.zachaeus@vdivde-it.de)	Revision & Submission to EC
0.5	25/09/2017	Final	Carolin Zachäus, Gereon Meyer (carolin.zachaeus@vdivde-it.de)	2nd validation of vision
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0.7	01/16/2018	Final	Carolin Zachäus, Gereon Meyer (carolin.zachaeus@vdivde-it.de)	Final validation of vision
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Consortium

No	Participant organisation name	Short Name	Country
1	VDI/VDE Innovation + Technik GmbH	VDI/VDE-IT	DE
2	Renault SAS	RENAULT	FR
3	Centro Ricerche Fiat ScpA	CRF	IT
4	BMW Group	BMW	DE
5	Robert Bosch GmbH	BOSCH	DE
6	NXP Semiconductors Netherlands BV	NXP	NL
7	Telecom Italia S.p.A.	TIM	IT
8	NEC Europe Ltd.	NEC	UK
9	Rheinisch-Westfälische Technische Hochschule Aachen, Institute for Automotive Engineering	RWTH	DE
10	Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e. V., Institute for Structural Durability and System Reliability FHG	FHG	DE
11	CLEPA aisbl – The European Association of Automotive Suppliers	CLEPA	BE
12	Asociación Española de Fabricantes de Equipos y Componentes para Automoción SERNAUTO	SERNAUTO	ES

The roadmap development process within SCOUT started with the analysis of user expectations and requirements to co-create a vision of CAD in Europe in 2030. This initial work forms the basis for the development of a common European roadmap for CAD in 2030 (WP5).

The vision that is described throughout this document addresses the question "Which features (in view of user expectations) will connected and automated driving provide in 2030 and beyond?" and displays two different dimensions. The spatial dimension is illustrated by five different spheres (different grey tones) starting from urban areas over suburban, rural and interurban areas towards an international environment. The second dimension is related to the field of application clustered into mobility on demand (blue), passenger transport (red), goods delivery (yellow) and infrastructure (green) as well as solutions that could be applied in multiple fields (colour gradient).

The sector mobility on demand will gain increasing importance aiming for energy efficient, environmentally friendly and flexible as well as time efficient mobility for everyone. In this field user behaviours and expectations play a crucial role to develop new services and applications such as multi-modal travel planning, prediction of user behaviour with proactive pick up as well as CAD embedded in public transport, all of them building on the desire of flexible and time efficient transport. Those solutions will be displayed in environments with higher population densities and availability of public transportation systems (urban, suburban and rural areas). Connected modular shuttles with access for all describe the need of transportation for everyone, especially people with disabilities or elderly people that cannot drive anymore. One short-term solution is automated valet parking, which will be executed in an enclosed area with only automated vehicles operating. Due to the low complexity of this scenario it could function as an early adopter to advance user experience and with this enhance the acceptance of the general public. In contrast, shared, automated services are the final target of the future vision of mobility as a service. The idea would be to implement automated car and/or ride sharing systems as a cost effective as well as environmentally friendly alternative to private cars or conventional taxis. Shared, automated taxis could also be an attractive solution for the first & last mile of passenger transport when combined with public transportation. Additionally, automated on demand vehicle dislocation will further complement automated sharing services and will therefore enhance a seamless mobility experience. Due to a higher demand, shared services as well as automated valet parking will mainly be deployed in urban and suburban areas in 2030 and might be spatially expanded with time.

The second field of interest is passenger transport, which will be shaped by entertainment and infotainment applications, comfort and personalisation as well as electrification of passenger vehicles. The convergence between transport and entertainment/infotainment as well as augmented, virtual and mixed reality will strongly increase user satisfaction and illustrates one way of personalisation. Besides, universally designed vehicles and services aim for a wide accessibility of (individual) mobility for all (especially including elderly and disabled people). Furthermore, automated, long distance, light electric vehicles address the synergies between automation and electrification aiming for energy efficient, environmentally friendly alternatives to conventional passenger vehicles, including advantages of automated driving such as gain of time for additional tasks beside the actual driving (working, entertainment, relaxing, etc.). The concept of electrification should also be applied to sharing services mentioned above.

An efficient combination of passenger and goods delivery transport can be realised with the integration of both applications in one vehicle e.g. a long distance passenger coach could transport passengers and goods such as parcels at the same time (e.g. Postbus in Germany). This can be complemented by cross-modal transport for goods and passengers. Furthermore, highway pilots as well as truck/coach/car platooning can potentially increase road safety, energy and time efficiency as well as the comfort of the “driver” and additionally reduce congestion.

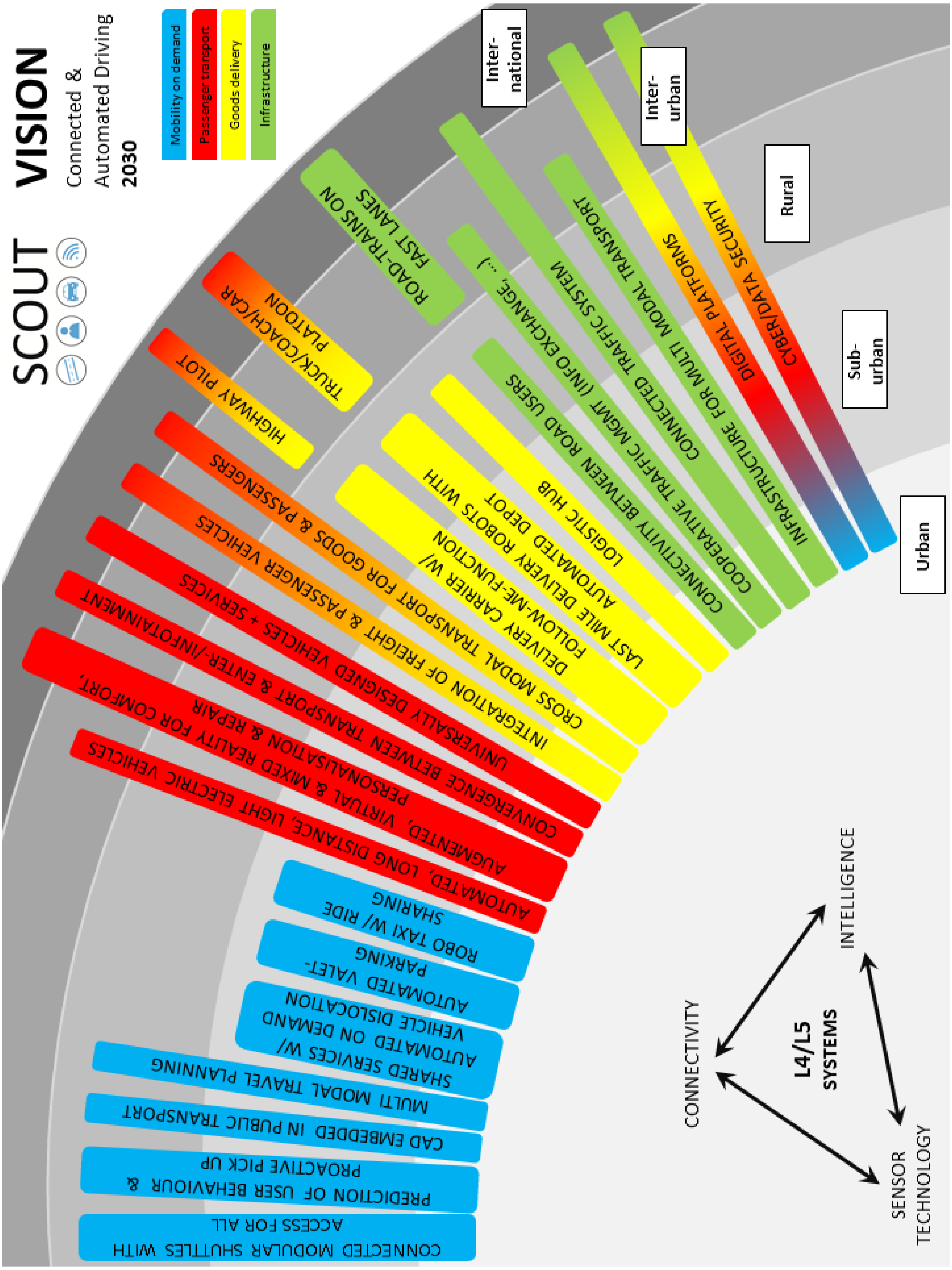
Logistic hubs and last mile delivery robots with automated depot complement highway pilots and truck platooning. Goods are transported via platooning (especially long distance) or via highway pilot functions to logistic hubs and/or automated depots. The last mile will be carried out by delivery robots to e.g. supermarkets (large scale) or to private homes (small scale). Further small-area applications are delivery carriers with follow me function, which can help e.g. elderly or people not in their best of health to “carry” purchases home.

To realise high coverage of automated mobility, investigations into specific infrastructure solutions have to be made. Hereby, connectivity between road users will be a crucial requirement to increase road safety as well as a smooth traffic flow. This solution is closely linked to a cooperative traffic management through e.g. information exchange and the application of connected traffic systems. Hereby, the traffic flow can be managed and controlled in real time, prioritising e.g. ambulances or police cars as well as vulnerable road users. This could further increase the overall traffic flow as well as road safety. Additionally, specific customised infrastructure developments are necessary to support the deployment of multi-modal transport options such as reserved parking spaces for e.g. car sharing fleets in front of train stations. To avoid difficult mixed traffic situations for the early implementation of automated vehicles special lanes (road trains on fast lanes) could be beneficial regarding road safety and traffic flow.

Solutions spanning over all fields of applications are digital platforms and cyber/data security issues that have to be widely addressed to increase reliability and user acceptance.

According to the results of this analysis of user expectation and the subsequent co-creation of the vision, level 4/5 automation would be the most preferred scenario from a users' perspective. To emphasise the core of the vision the 5-layer model of Lutz Eckstein was applied to it analysing the expectations and requirements of each layer (technical, societal, legal, economic and human factors).

Some of the expectations and requirements can be met and solved easily (or are even solved already). However, there are also some open questions remaining that need to be addressed to turn the vision into reality. It becomes apparent that interlinks within the layers, but also between layers are very important for a large scale implementation and deployment of CAD. Having e.g. a look into the technical layer, we observed that besides data protection and privacy as well as standardisation; sensors, connectivity and intelligence have been identified as the main technological drivers regarding the implementation of the different application of CAD addressed in this vision, which have to interact with each other in a broader context to assure the effective deployment of CAD by 2030. On a wider level, the different layers also need to be interlinked with some of them already being “naturally” related. Legal requirements for example are depending on technical capabilities and vice versa. And there should be for example close interactions between user expectations, technical capabilities and possible business models.


SCOUT
VISION
Connected & Automated Driving
2030
Mobility on demand
Passenger transport
Goods delivery
Infrastructure
CONNECTED MODULAR SHUTTLES WITH ACCESS FOR ALL
PREDICTION OF USER BEHAVIOUR & PROACTIVE PICK UP
CAD EMBEDDED IN PUBLIC TRANSPORT
MULTI MODAL TRAVEL PLANNING
SHARED SERVICES W/ AUTOMATED ON DEMAND VEHICLE DISLOCATION
AUTOMATED VALET-PARKING
ROBO TAXI W/ RIDE SHARING
AUTOMATED, LONG DISTANCE, LIGHT ELECTRIC VEHICLES
AUGMENTED, VIRTUAL & MIXED REALITY FOR COMFORT, PERSONALISATION & REPAIR
CONVERGENCE BETWEEN TRANSPORT & ENTER-/INFOTAINMENT
UNIVERSALLY DESIGNED VEHICLES + SERVICES
INTEGRATION OF FREIGHT & PASSENGER VEHICLES
CROSS MODAL TRANSPORT FOR GOODS & PASSENGERS
HIGHWAY PILOT
TRUCK/COACH/CAR PLATOON
DELIVERY CARRIER W/ FOLLOW-ME-FUNCTION
LAST MILE DELIVERY ROBOTS WITH AUTOMATED DEPOT
LOGISTIC HUB
ROAD-TRAINS ON FAST LANES
CONNECTIVITY BETWEEN ROAD USERS
COOPERATIVE TRAFFIC MGMT (INFO EXCHANGE, ...)
CONNECTED TRAFFIC SYSTEM
INFRASTRUCTURE FOR MULTI MODAL TRANSPORT
DIGITAL PLATFORMS
CYBER/DATA SECURITY
Inter-national
Inter-urban
Rural
Sub-urban
Urban
CONNECTIVITY
L4/L5 SYSTEMS
INTELLIGENCE
SENSOR TECHNOLOGY