Newsletter

Year 2

June 2023

AI4CSM

Automotive Intelligence for Connected Shared Mobility

Project Facts:

Project Coordinator: Jochen Koszescha
INFINEON TECHNOLOGIES GERMANY AG
Project Start: 01-05-2021
Duration: 36M
Total investment: ~€M 41,7
EU contribution: ~€M 11,9
Participating organizations: 41
Number of Countries: 10

The AI4CSM project will develop advanced electronic components, systems and architectures for future mass-market ECAS vehicles. This fuels the digital transformation in the automotive sector to support the mobility trends and accelerate the transition towards a sustainable ecosystem.

AI4CSM has been accepted for funding within the Electronic Components and Systems For European Leadership Joint Undertaking in collaboration with the European Union's H2020 Framework Programme (H2020/2014-2020) and National Authorities, under grant agreement n° 101007326.

ABOUT THE PROJECT

Motivation and Objectives

Climate change and environmental degradation are global existential threats. Therefore, the European Green Deal roadmap entails a growth strategy to transform Europe into a modern, resource-efficient, and competitive economy. The roadmap aims to transform the economy to achieve climate neutrality by 2050.

The Green Deal defines four key elements for a sustainable mobility and automotive industry: **climate neutrality**, **zero pollution**, **sustainable transport,** and the **transition to a circular economy**.

Digital technologies are a significant enabler for attaining the sustainability goals of the European Green Deal in many different sectors including mobility and transportation.

In the Green Deal context, ECAS vehicles will offer new mobility services with reduced ecological footprint while extending safety, security, reliability, availability, and affordability.

AI4CSM is coordinated by Infineon Technologies Germany AG.

The overall consortium structure including 41 partners:

- ✓ 3 OEMs
- ✓ 4 Tier-1 suppliers
- ✓ 9 Tier-2 and semiconductor suppliers
- ✓ 8 Technology suppliers
- ✓ 6 Research institutes
- ✓ 11 Academic partners

Vision and Mission

AI4CSM aims to enable the future mobility developments following the electrification, standardization, automatization and digitalization implementation strategy by providing new AI-enabled electronic components and systems for ECAS vehicles for advanced perception, efficient propulsion and batteries, advanced connectivity, new integration and platform concepts and intelligent components based on trustworthy AI.

Vision: Build Europe’s intelligent electronic component and systems for ECAS 2030 vehicles supporting European mass market production, manufacturability and scalability based on the Green Deal principles.

Mission: Develop the functional architectures for next generation ECAS vehicles based on ECS, embedded intelligence and functional virtualization for connected and shared mobility using trustworthy AI.

AI4CSM promotes a collaborative concept where the stakeholders of key domains of vehicles, HW/SW electronic components, systems and AI experts work together. The main advantage of this approach is that AI4CSM perceives an ECAS vehicle as combination of Systems or System-of-Systems (SoS), which at the end need to work hand in hand. Otherwise, safety hazards, incompatibles and missed opportunities are very likely to happen.

Objectives

O1: Develop robust and reliable mobile platforms

O2: Develop scalable and embedded intelligence for edge and edge/cloud operation

O3: Design silicon for deterministic low latency and build AI-accelerators for decision and learning

O4: Solve complexity by trustable AI in functional integrated systems

O5: Design functional integrated ECS systems

O6: Build ECAS vehicles for the green deal and future connected, shared mobility

SC1 - Smart Connected Shared Mobility for Urban Area

With respect to demonstrator SCD1.1, progress was made in all three parts of the demonstrator. This includes integrating initial versions for deviation detection within the simulation framework, modelling of abstract scenarios in Scenic, applying sampling strategies to those scenarios, and integrating initial safety monitors into the simulation and safety evaluation framework.

With respect to demonstrator SCD1.2, demonstration platform B-a closed loop simulation for testing perception and AD function realized within the Carla framework - was completed. First results with self-developed AI-based algorithms (UNET) for semantic segmentation of Lidar have been developed and validated.

The SCD1.3 demonstrator has been extended to include a solver for the energy-efficient dial-a-ride problem based on reinforcement learning and a simulation comparing different levels of autonomous vehicles in an urban scenario of the city of Amberg.

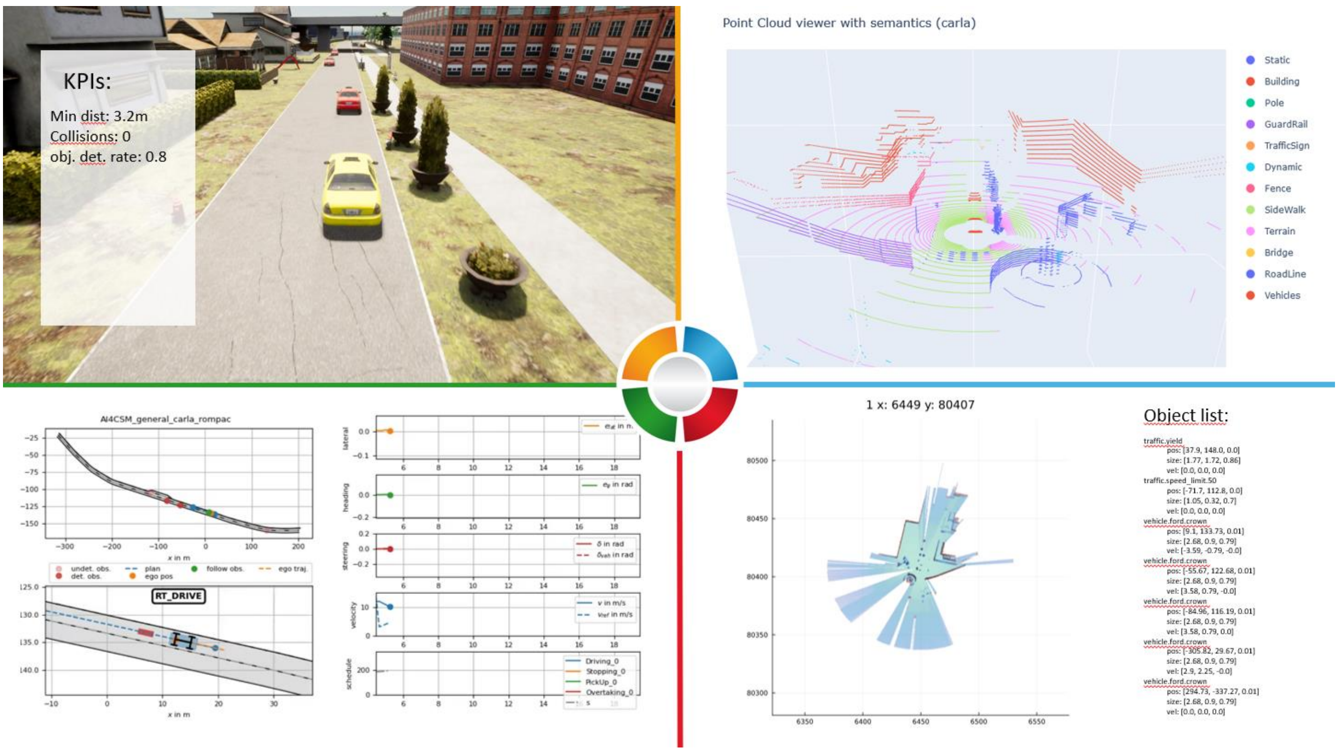

Figure 1. Overview of SC1 Core Activities

SC2 - EV 2030 by AI inside

In the second project year the main achievements of SC2 were the design and collection of the SW/HW components, based on their interaction and automotive requirements for the AI based EV demonstrator vehicle. The work performed focused on:

• description of the comprehensive vehicle simulation model and its adaptations based on project-specific mechanical and thermal requirements for the integration of the new components,

• finalization of architecture analysis based on partner inputs to enable the BMS as a platform “foxBMS” for the development and integration of intelligent algorithms and research on AI algorithms for both, the anomaly detection in battery systems, and the condition monitoring of electric drives,

• selection and provision based on the specifications of an electric drivetrain, which consists of the electric machine, gearbox and drive shafts to fit the project and vehicle targets and allowing an easy connection of the new inverter,

• re-designing of the 800V inverter to fit the requirements of the newly provided electric drive unit, with new classical and AI-based diagnostic and control strategies for electric drivetrains,

• the system design and architectural aspects concerning the V2C communication module,

• integration of the cognitive diagnostic system in the vehicle, which required changes compared to the laboratory electric drive demonstrator setup,

• provision of inverter control and CAN communication software,

• conceptual diagrams of data-collection and data-processing pipelines, test drives with an EV and data post-processing.

Geometrical and functional integrations of the newly selected electric machine and inverter have been fulfilled by **AVL**, who also provided the updated comprehensive vehicle model consisting of both the powertrain-and the thermal management-model. These include high and low voltage systems, cooling package and cooling circuit model, thermal models of the HV battery and of the drivetrain, model of the refrigerant circuit and the passenger cabin. The vehicle model is used to evaluate total energy consumption and how it is influenced by the thermal management system.

Fraunhofer IISB finalized the architecture for an AI-enhanced BMS, based on its foxBMS® platform. This includes the specification and selection of an edge device with necessary computational power to integrate intelligent algorithms. A data pre-processing pipeline was developed which filters raw battery data and processes it into structured CAN messages. In parallel, the software architecture for AI-driven algorithms that enable cognitive diagnosis of sensor faults in the battery system was developed, and a hardware test system was set up to support validation.

EDI finalized the overall architecture for the AI-based near-field, high-resolution 360° perception system demonstrator as well as developed the initial version of the laboratory demonstrator. In addition, EDI finalized the initial calibration procedure and information handoff, explored the time-of-flight camera acquisition modes (including shared trigger) and defined internal communication of the system/demonstrator.

SSol utilized two-fold GUI interface that helps the engineering objectives of the sensor information and provides an interactive user-friendly interface.

ZF has selected an appropriate 800V SiC inverter for integration into the vehicle demonstrator. In collaboration with AVL, BUT and MBAG an appropriate electric motor has also been selected. In order to accommodate the new AURIX TC499 with PPU platform, new control electronics have been designed and fabricated, which is compatible with the parallel developments between SC2 and SC4.

The **OTH** defined, organized and carried out several months of test drives in order to collect data to train an AI based route planning system. Overall, 13000 km of test drives in several cities were driven with the help of 16 test drivers during summer and winter. The data has been analyzed in numerous ways and is now being prepared for AI training. Based on the results a concrete federated learning concept will be implemented.

MBAG provided information on electrical and geometrical environment of the vehicle necessary for integration of the prototypes and demonstrators. In addition, MBAG obtained a suitable drivetrain to serve as counterpart of the 800V-SiC-inverter and to provide traction for the demonstrator vehicle.

BUT proposed the architecture of the diagnostic system to be integrated into the EV demonstrator. It is based on simultaneous monitoring of mechanical and electrical quantities and their fusion to provide highly reliable fault detection. Additionally, BUT prepared the control algorithms enabled by the CAN communication between the car and the inverter.

IFAG realized the demonstrator of a 48V DC motor, thus proving that solutions for drive inverters can be evaluated with the AI support. The application of the solution to a 400V motor is made with systems for hardware-in-the-loop (HIL) and rapid prototyping that support them in testing in a real environment, with real sensors and actuators. For this purpose, dSpace's Scalexio solution is suitable since it enables the validation of algorithms for drive controllers, and can be adapted to different types of motors, thus reducing development effort and costs. System configuration consists of dSPACE software tools in combination with MathWorks' MATLAB/Simulink tools. The system is equipped with ready-to-use I/O, bus, and network interfaces. Hardware accelerators such as GPUs or FPGAs are supported for AI functions execution, such as perception or sensor fusion, or for executing fast control algorithms in the µs range.

SC3 - Functional Integrated Highly Automated L3 Driving

SC3 has worked on the development of technologies to be integrated on two demonstrators. POLITO designed a drowsiness detection which can detect sleep onset up to 5 minutes before it occurs, using a wearable sensor from VEM and radars from IFX. VEM also design an on-board-unit telematic gateway for cloud integration that can upload and act as anti-theft unit.

This will be integrated with the UNIMORE behavioural-based driver monitoring system that detects the current state of the driver, whether it is distracted, smoking, or sleeping. I&M designed the AI-SDF platform with new Aurix with its PMIC and a Xilinx FPGA, that will aggregate the data inputs with the data coming from remote camera that detects pedestrian and the weather conditions thanks to WVIEW algorithms. BYLO design their interaction pattern identification and prepared their electrical vehicle for the integration of the demonstrator. For the second demonstrator, I&M designed and assembled the prototypes of an ECU that integrates the motor inverter (using IFX MOSFETs) with a body controller. This ECU will communicate with the on-board-unit gateway from VEM.

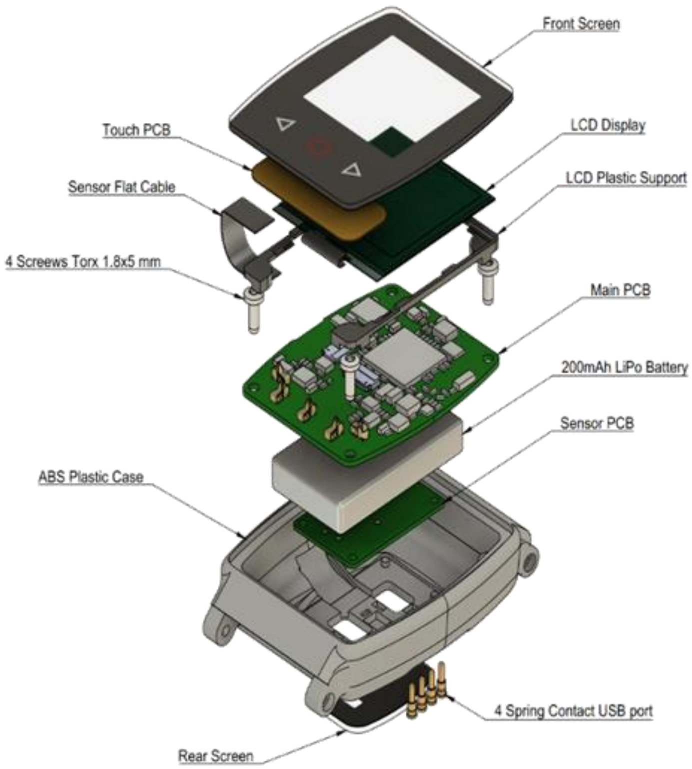

Figure 2. VEM wearable sensor

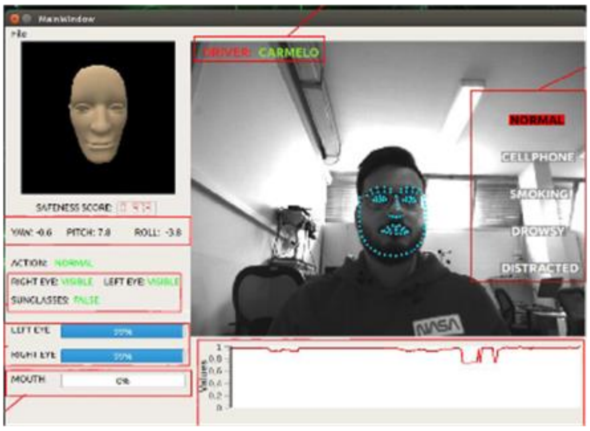

Figure 3. UNIMORE driver monitoring system

Figure 4. Bylogix vehicle

SC4 - Robust Propulsion System for Shared Connected Mobility

Powertrain

The fail-operational powertrain with a GaN-powered 3-level inverter is one of the core demonstrators of the Supply Chain. For this device a first prototype of a single phase has been assembled, as well as an initial version of the gate driver. Further achievements include the completion of the control board layout, which is currently being assembled.

Associated with the powertrain demonstrator is also the inductive rotor position sensor with a high-speed interface. This prototype has been assembled and will be implemented into the demonstrator as a next step.

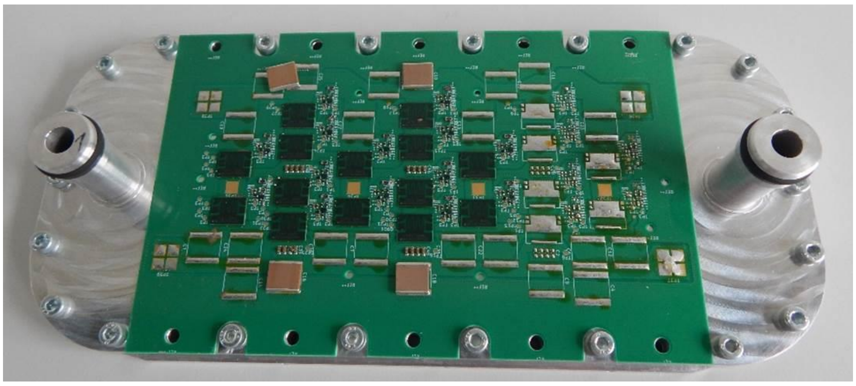

Figure 5. Inverter single phase prototype

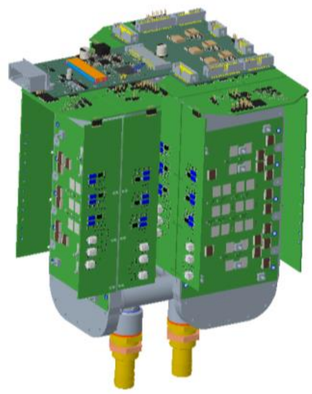

Figure 6. Entire inverter assembly

Cognitive diagnostic system and failure detection

The cognitive diagnostic system, enabling AI-based detection of faults in the powertrain, has been implemented in a simulation environment and will be migrated to the target hardware platform next.
Further activities in the supply chain include the detection of demagnetization failures in electric machines. This method has been proven on actual machines and will be migrated to automotive grade machines next. Detection algorithms for battery temperature sensor degradation could be validated as working as well.

PMIC

Prototype available with basic functionality proven. Implementation of AI-based functionalities coming up.

Wireless Charging System

The foreign object detection will showcase improvements in availability of availability and safety of wireless chargers. The detection functionality could be proven in simulation and validated in hardware. The results will also be published in a scientific paper within Q2/2023.

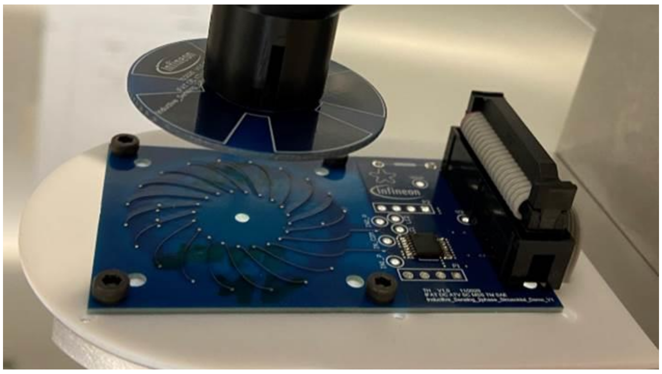

Figure 7. Rotor position sensor prototype board

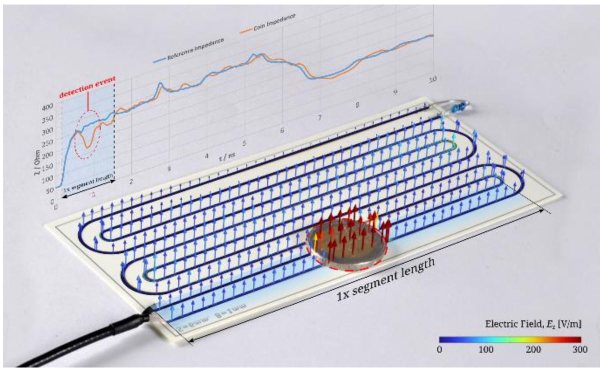

Figure 8. Visualization of the electric field z-component of a TDR-based coin detection measurement

SC5 Connectivity and Cognitive Communication

In the second project year the main achievements of SC5 are a collection of design on sub-components and component as well as system level w.r.t the demonstrators in the supply chain. SC5 is concerned with the internal and external connectivity in automated vehicle, which require a strong safety and security-by-design approach in order to be trustworthy and resilient. Selected highlights in the supply chain activities are:

IFAG has deployed the first 5G mmW Front End Module (FEM) demonstrator to the Fraunhofer HHI Berlin. Further test on beam forming hardware will be done on HHI and IFAG site. Delivery 2.6 including the architectural freeze was carried out. FEM mmW antenna paper was presented on IEEE EuCap 2023 in Florenze. Lab setup in picture shows the tripod mounted motor driven FEM Demonstrator for evaluations and the internal mmW Antenna Array configuration.

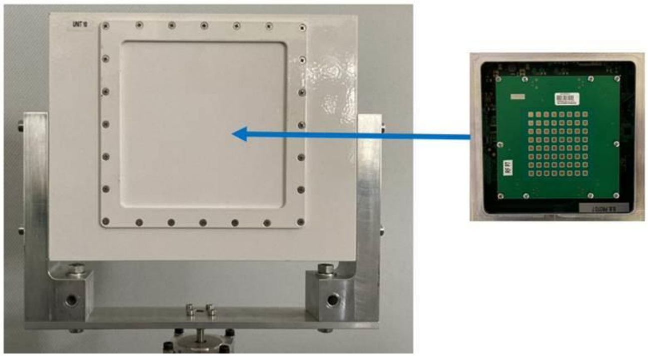

Figure 9. FEM Demonstrator

At **NXP**, we created a platform for demonstrating safe and secure communication in Zonal Architectures. In the zone, redundant communication is used to transfer the data. Heterogeneous communication media are used: redundant Ethernet with the IEEE802.1cb protocol, and a CAN-XL link in which Ethernet traffic is tunnelled through. The diverse physical implementation and protocols contribute to the independence of the communication links for a safety analysis. Moreover, the difference in the protocols and in the security mechanisms that are applied on the two technologies results in a more difficult scenario for an attacker to take full control of the network. As part of our contributions, we added to the deliverable D2.6 a comprehensive report on state of the art security mechanisms for both Ethernet and CAN technologies.

TTTech Auto has made significant progress on the in-car communication platform concerning communication architecture and middleware abstraction. The development concentrated on implementing the abstraction layers on inter-process, inter-host and between multi-core SOCs. The design focused in addition on the demonstrators in SC5. A cross supply-chain approach was performed since the activities of TTTech Auto in other demonstrators e.g. SC1, SC7 are based on the results in SC5.

AIT worked in SC5 on establishing a concept-phase engineering approach which is compliant with novel cybersecurity requirements in the vehicular domain, introduced by regulations like UN R155 and ISO/SAE 21434. For that, an asset-driven engineering was developed and implemented in a prototypical model-based analysis engine. Here a concept-level system diagram is generated and based on system function and data Assets, e.g. elements that need protection, are assigned. A model of potential abstract attacks with a contract-based connectivity framework is utilized to identify potential attack paths and recommend countermeasures. In addition to that AIT worked on Frame Error Rate Prediction for Vehicular Communication using AI for Vehicle to X communication.

IMA is working on secured building blocks for car access control and access rights distribution. The system employs advanced cryptographic mechanisms, facilitating robust two-way communication between the vehicle and infrastructure. It leverages encryption protocols based on asymmetric cryptography to ensure data integrity, privacy and preventing unauthorized access.

SC6 AI-Enabled Perception and Sensor Fusion Platforms

The main achievements are the definition of system-level architectures and designs for AI-enabled perception and sensors fusion systems and the HW/SW partitioning that provide an overview of the system-level architectures applied in different use cases and demonstrators, including the HW/SW subcomponents, functions and AI methods/techniques and used in the design flow. The results are fundamental for the implementation and integration activities of five demonstrators.

- Perception and vehicle intelligence platform
- Neuromorphic sensor fusion
- Affordable AI-enabled perception
- Localization and 3D mapping
- 3D Time of Flight with Aurix PPU

The hardware design activities include a set of prototypes of components for AI-enabled perception, e.g., the prototype of components for cognitive sensing at the deep edge.

Figure 10. Concept of autonomous vehicles fleets for delivering goods

SC7 AI-based Methods for Simulation and Virtualization

In the second project year the main achievements of SC7 are a collection of general information and development of the architecture of the different Demonstrators for AI-based methods for simulation and virtualization.

In demonstrator SCD7.1, the partners AVL, AIT and TUGRAZ, present an approach to bridge the gap between the collection of real-world data and achieving trustworthy autonomous driving functions through AI controllers. SCD7.1 is strongly collaborating and connected with SC1 and SCD1.1. The overarching objective is to integrate the results obtained from SCD7.1 also into demonstrator SCD1.1. To achieve the aim of generating enriched virtual models, the first step involves collecting real-world data according to data specifications that ensure that the necessary inputs for virtualization are available. After pre-processing of the collected data in a designated data center, the prerequisites for the data conversion into a virtual test scenario are given. Virtual test scenarios are facilitated for training an AI-based controller to handle specific safety-critical scenarios. For training an AI-based controller, reinforcement learning will be utilized, and a respective reward function will be formulated. With this, the goal is to achieve a safe controller for autonomous driving, employing formal specifications to define the set of safe controller behaviors. Based on the formal specifications, the reward strategy for reinforcement learning will be synthesized and a dedicated training environment like MetaDrive will be used. In addition to this a monitoring system will be used to assess and verify the techniques and methods developed.

The demonstrator SCD7.2 with TTTECH will utilize an autonomous driving evaluation platform which incorporates a Volta GPU architecture equipped with 256 Cuda CUDA cores, which allows it to achieve a speed processing power of 1.3 TFLOPS. Additionally, the SoC features 8 custom Carmel ARMv8 CPUs from Nvidia and a specialized Tensor Processing Unit called Deep Learning Accelerator (DLA). The fabrication process is TSMC 12nm FinFET, with an estimated area of 300 mm2 and containing 7 billion transistors. LPDDR4 memory will be used, and the system has a power consumption of 30W. The software methods are targeted to abstract vendor specific functionalities as long at the compatibility with standardized interfaces OpenCL and CUDA are guaranteed.

In demonstrator SCD7.3 with AIDIGI+, The CANedge2 device has been connected to a BMW i3 to capture and log data from the vehicle's CAN bus. The CAN bus is a network that allows different electronic systems in a vehicle to communicate with each other. By connecting the CANedge2 to the BMW i3's CAN bus, it is possible to log data related to various vehicle parameters, such as Vehicle speed, Battery voltage, State of charge (SOC) of the battery, Charging status and rate, Acceleration and braking behavior, Engine and motor performance, Temperature of different components, Vehicle location and route.

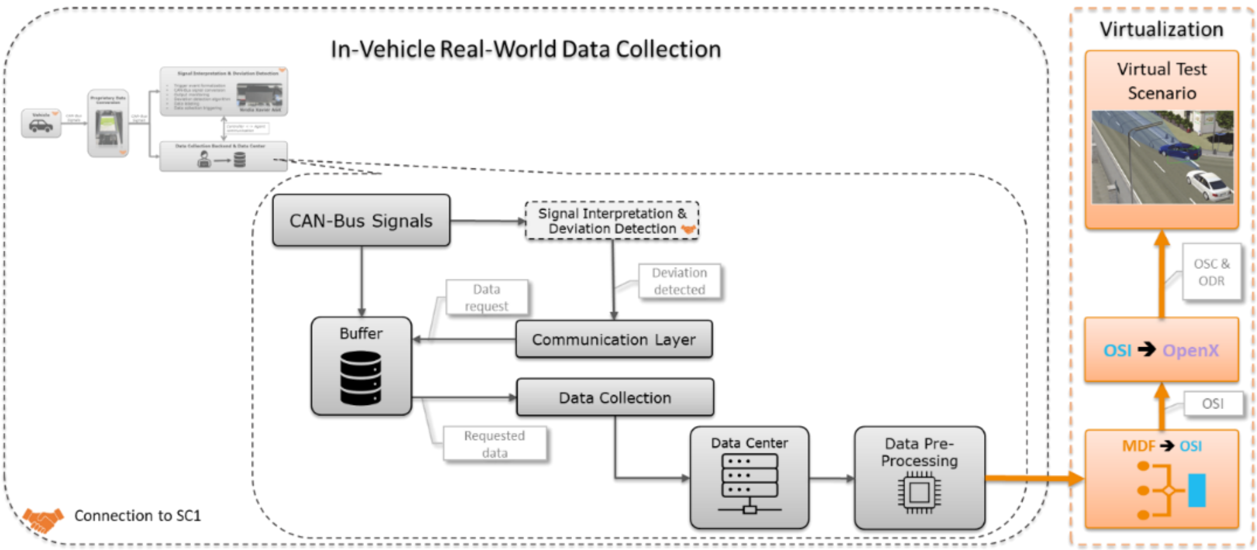

Figure 11. In-Vehicle Real-World data Collection

The data logged by the CANedge2 can be analyzed to gain insights into the performance and behavior of the BMW i3 under different driving and charging conditions. This information can be used by researchers, vehicle designers, and policy makers to optimize the design and deployment of electric vehicles, as well as to develop new transportation policies and strategies. Additionally, the data can be used by vehicle owners to monitor their vehicle's performance and to optimize their driving and charging behavior to maximize efficiency and minimize costs. Overall, using CANedge2 connected to a BMW i3 allows for the collection of valuable data that can inform a wide range of applications related to electric vehicles and sustainable transportation. After collecting the data with the CANedge2 the data will be used to be enriched in a simulation program as Sumo. Furthermore, the data management will be implemented in MAGICLOOP. For the simulation of the energy usage based on different sources the collected data will be implemented in MultiMob. With this tool the different energy paths regarding well-to-wheel and tank-to-wheel will be considered.

SC8 - European Values Impact: Green Deal, Standardization, Certification, Ethical Aspects

Supply Chain 8 is a horizontal support function for partners triggering futureproof developments and thus facilitation early uptake of AI4CSM results. SC8 is a Values Enabler pushing and evaluating AI4CSM results with respect to the European Green Deal and the European answer to the 17 UN SDGs (Sustainable Development goals). Connected and shared mobility are driven particularly by technologies making use of Artificial Intelligence as key element in safety critical parts of the Automated Driving Systems, and additionally also in components of conventional, but already highly automated systems. Therefore, Standardization in the areas of functional safety, cybersecurity, road vehicles and Artificial Intelligence is key for meeting the European values with respect to climate neutrality, safety, security, privacy and ethically aligned implementations, fulfilling public stakeholders' interests under fair economic competitive conditions.

Objectives Related to the Green Deal

The partners of AI4CSM see sustainable and smart mobility as one of the core elements of the European Green Deal as presented by the EC. According to the EC "transport accounts for a quarter of the EU's greenhouse gas emissions" and "to achieve climate neutrality, a 90% reduction in transport emissions is needed by 2050". These goals are addressed by four pillars.

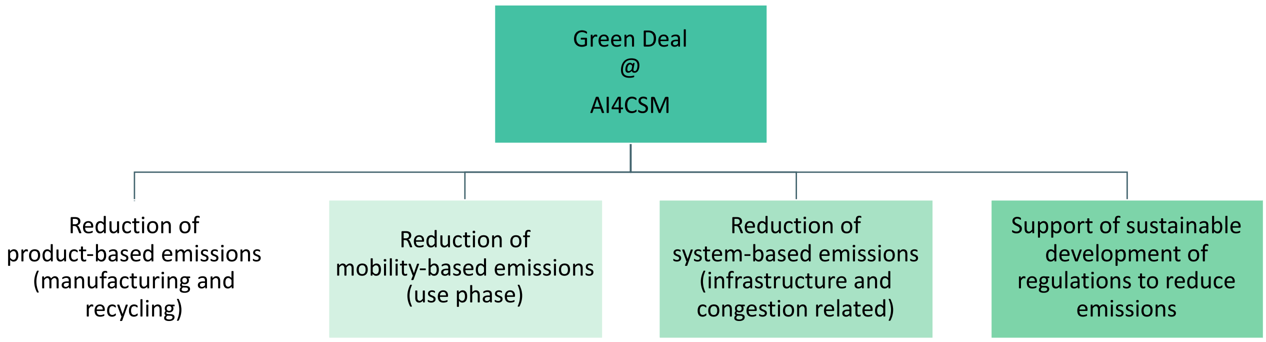

Figure 12: The four pillars the AI4CSM team will work on to implement the EUs Green Deal

Key Standardization Activities

Key partners have been involved in the generic, domain independent standard on "Functional safety and AI systems", ISO/IEC TR 5469. This Technical report was developed jointly by members of IEC SC65A, IEC 61508-3 Maintenance Team for the software-part of the domain-independent basic functional safety standard IEC 61508, and ISO/IEC JTC1 SC42 (AI) WG03 (Trustworthiness) and is very close to publication now.

We are also supporting now the next step to develop this document further to a TS (Technical specification) which was already initiated as proposal for a new work item.

The approach taken, in short, was to classify AI technology classes and usage classes. The following table tries to map these and provide recommendations:

AI Technology Classes
Class I: developed and reviewed using existing functional safety methods and standards.

Class II: cannot be fully developed and reviewed using existing functional safety methods and standards, but it is still possible to identify a set of available methods and techniques satisfying the properties (e.g., additional V&V) to achieve the necessary risk reduction.

Class III: cannot be developed and reviewed using existing functional safety methods and international functional safety standards and it is also not possible to identify a set of available methods and techniques satisfying the functional safety properties.

AI Application and Usage Classes
A1: Used in safety relevant E/E/PE system and automated decision making possible.

A2: Used in safety relevant E/E/PE system and no automated decision making (e.g., for uncritical diagnostics).

B1: Used to develop safety relevant E/E/PE systems (offline support tool). Automated decision making of developed function is possible.

B2: Used to develop safety relevant E/E/PE systems (offline support tool). No automated decision making of the developed function is possible.

C: AI technology is not part of a functional safety function in the E/E/PE system but can have indirect impact on the function (e.g., increase demand placed on a safety system).

D: AI technology is not part of a safety function in the E/E/PE system. No impact on safety due to sufficient segregation and behavior control.

Table 1 — Recommendations for Usage of AI Technology Classes in certain Usage Classes
(Source: ISO/IEC DTR 5469)

<table>
<tr><th>AI application and usage level</th><th>AI Technology Class I</th><th>AI Technology Class II</th><th>AI Technology Class III</th></tr>
<tr><td>Usage Level A1 (1)</td><td rowspan="5">Application of risk reduction concepts of existing functional safety International Standards possible</td><td>Appropriate set of requirements (3)</td><td rowspan="5">At the time of writing this document no appropriate set of properties with related methods and techniques is known to achieve sufficiently reduction of risk</td></tr>
<tr><td>Usage Level A2 (1)</td><td>Appropriate set of requirements (3)</td></tr>
<tr><td>Usage Level B1 (1)</td><td>Appropriate set of requirements (3)</td></tr>
<tr><td>Usage Level B2 (1)</td><td>Appropriate set of requirements (3)</td></tr>
<tr><td>Usage Level C (1)</td><td>Appropriate set of requirements (3)</td></tr>
<tr><td>Usage Level D (2)</td><td colspan="3">No specific functional safety requirements for AI technology,
but application of risk reduction concepts of existing functional safety International Standards</td></tr>
</table>

1 Static (offline) (during development) teaching or learning only

2 Dynamic (online) teaching or learning possible

3 The appropriate set of requirements for each usage level can be established by application of risk reduction concepts of existing functional safety International Standards and additional consideration of Clauses 8, 9, 10 and 11 of this document. Examples are provided in Annex B. Defining detailed requirements for each usage level is beyond the Scope of this document.

The work in standardization of road vehicles safety continued particularly in ISO TC22 SC32 WG08 (Road vehicles - Functional safety, working in several groups on TRs and PAS's towards Edition 3 of ISO 26262), WG11 (ISO/SAE 21434 Road vehicles - Cybersecurity engineering, working on several subtopics on TRs and PASs), WG 13 (TS 5083 – Road vehicles – Safety for automated Driving Systems) and WG14 (PAS 8800 – Road vehicles – Safety and Artificial Intelligence). AI4CSM partners and partner countries are involved in most of these subgroups and editorial teams, where a lot of progress was achieved, but the work is still ongoing (overview on interrelations in Newsletter No. 1). One of the goals is also to provide feed-back to the partners in AI4CSM Supply Chains and to bring forward potential inputs from AI4CSM.

To assess the involvement of partners in standardization activities and interests, a questionnaire was distributed among partners to show the strong involvement in a structured manner. A second questionnaire was submitted to the Supply Chains particularly addressing the status and usage of AI components in the demonstrators. This questionnaire tries to figure out which AI Systems and Components are implemented in the different use cases, identify their functionality, their role in context and their possible criticality as compared to the considerations of DTR 5469. A rather exhaustive overview on the existing standards and evolving standards with supporting information was distributed by SC8 accompanying both questionnaires to provide support to the partners, covering general AI, functional safety, cybersecurity, and the automotive standardization landscape (some information is also provided in Newsletter no. 1 and in this newsletter). The results are now under detailed evaluation. Preliminary information on the potential impact of the different SCDs (demonstrators of the respective supply chain) with respect to the SC8 objectives is already available in the publicly available mid-term SC8 standardization-related reports D1.8 and D7.7. A good example is SC1, Smart connected mobility for urban area, with the three demonstrators

- SCD 1.1: Lessons-learned based (critical scenario) update of ADAS/AD Controller (lead: AVL)
- SCD 1.2: Robo-taxi (lead: VIF)
- SCD 1.3: Virtual city routing (lead: OTH)

Supply Chain 1 features demonstrators, which are directly dedicated to EU Green Deal objectives: Automated Driving, Robo-taxi and virtual city routing, which are complementary concepts each contributing to better usage of vehicles, road/land usage, energy efficiency, less emissions overall, optimized usage of infrastructure and resources. This supports particularly "Pillar Two" (reduction of mobility-based emissions (use phase)) and "Pillar Three" (reduction of system-based emissions (infrastructure and congestion related) of the "Green Deal" objectives of AI4CSM.

In context of the AI-related questionnaire, one information part is on "Critical decision making: Could potentially ethical (e.g., German or EU recommendations) or environmental aspects be impacted (accidents, incidents)". This is e.g., of relevance in SC1 as an example. As a guidance, an overview on certain documents of standards and recommendations was given (most of them available on the web for free download).

Figure 13 AI challenges on Trustworthiness, Cybersecurity and Ethical Aspects – a collection of standards & recommendations

EU Regulation 2022/1426 for type-approval of ADS (implementation)

AI4CSM has via SC8 not only consider standards and ethical aspects, but particularly the upcoming EU-regulations for Automated Driving. Although EU- Regulation 2022/1426 (published August 2022) is only addressing a limited scope of automated driving situations at the moment, it is laying down rules for the application of Regulation (EU) 2019/2144 of the European Parliament and of the Council as regards uniform procedures and technical specifications for the type-approval of the automated driving system (ADS) of fully automated vehicles. It covers fully automated vehicles category M (vehicles having at least four wheels and used for the carriage of passengers) or N (power-driven vehicles having at least four wheels and used for the carriage of goods) (i.e., standard vehicles for passengers and goods) for the following use cases:

- Fully automated vehicles, including dual mode vehicles, designed and constructed for the carriage of passengers or carriage of goods on a predefined area.
- ‘Hub-to-hub’: fully automated vehicles, including dual mode vehicles, designed and constructed for the carriage of passengers or carriage of goods on a predefined route with fixed start and end points of a journey/trip.
- Automated valet parking

If we study the TR 4804 (predecessor of TS 5083) and the evolving documents of TS 5083 (Safety for automated driving systems – Design, verification and validation methods), we find that this regulation covers all important topics that have been raised by the OEMs and the standardization people in ISO TC22 SC32 WG13, ADS, and the preceding working group, on 64 pages in several parts and Annexes, including use cases as examples.

As next stage, the Commission will continue the work to further develop and adopt by July 2024 the necessary requirements for the EU whole vehicle type approval of fully automated vehicles produced in unlimited series.

Standardization work is also very important for EU-regulations, and mandates are given to European SDOs to cover aspects in relevant fields like safety, cybersecurity, AI and others. Harmonized standards (standards having undergone the so-called HAS-consultancy process) are then referenced by EU Directives and Regulations. There is still a lot of work upcoming for AI4CSM partners in standardization – to contribute as well as to consider the ongoing developments in our work!

AI4CSM at Events

15th Graz Symposium Virtual Vehicle

From the 31st of August - the 1st of September 2022, VIF presented the AI4CSM project at the 15th Graz Symposium Virtual Vehicle. The GSVF 2022 served as a platform to discuss recent advances in system integration and virtual validation and its optimal coexistence with physical testing. It mainly focused on methods, tools, data, and processes for virtual validation. The symposium thus takes current trends into account: at the moment, the industry moves away from strictly vertical to broadly horizontal vehicle system development approaches. So collaboration, virtualization, and agile-enriched processes are vital to cope with related complexity, uncertainties, quality, costs and timely delivery, to ultimately accelerate system delivery, ensuring global competitiveness and market shares.

VIF, leading the AI4CSM SC1 "Smart Connected Shared Mobility for Urban Area" is developing and applying perception and intelligence algorithms and tests its performance in a demonstrator vehicle (Ford Mondeo) and the demonstrator poster "Robo Taxi automated operation in challenging urban use cases" was presented at the event to represent expected results.

Figure 14: AI4CSM SCD1.2 poster at GSVF 2022

The Autonomous

The Autonomous is a global community shaping the future of safe autonomous mobility. On September 27, 2022, 500 participants met in Vienna's magnificent Hofburg imperial palace for the annual The Autonomous Main Event.

Autonomous, Connected, and Electric mobility are recognized as the most disruptive trends in the automotive industry. Among all of them, autonomous vehicle technologies are the most heavily researched topic.

Figure 15: AI4CSM at The Autonomous Main Event

The AI4CSM had a chance to join a parallel Spotlight Session "Research & Innovation in Autonomous Mobility", hosted by the TTTech Group's Innovation Projects and Funding Management Team. The project coordinator Jochen Koszescha gave a presentation about AI4CSM vision, mission, and expected outcomes. The workshop presented the state-of-the-art challenges of these technologies and the R&I programs that the European Commission had set up to tackle them.

EFECS2022

On 24th-25th of November 2022, AI4CSM was presented in the EFECS exhibition in Amsterdam. EFECS is the international forum to create impact by collaborative innovation for an autonomous and sustainable Europe along the Electronic Components and Systems value chain in Europe. The event gathered participants from the whole Europe. The AI4CSM project was represented by the project coordinating team from Infineon Technologies and other partners from Teraglobus, AVL, AIT Austrian Institute of Technology, Brno University of Technology, Institute of Electronics and Computer Science, SmartSol. etc.

Figure 16: AI4CSM booth at EFECS 2022

At the conference in the AI4CSM booth, we had a roll-up, several posters, leaflets and branded chocolates. Furthermore, we used LCD screen to present the videos with a general AI4CSM presentation and SCs' posters. The event provided a great opportunity to meet our partners, discuss ongoing topics and probably establish new connections for the future collaborations.

Upcoming Events

15.06.2023 IMAGINE 23
21-23.06.2023 WiMob 2023: The 19th International Conference on Wireless and Mobile Computing, Networking and Communications
5-8.09.2023 IEEE PIMRC: IEEE International Symposium on Personal, Indoor and Mobile Radio Communications
6-8.09.2023 IDIMT2023
14.09.2023 The Autonomous
19-22.09.2023 SAFECOMP 2023: The 42nd International Conference on Computer Safety, Reliability and Security
16-18.10.2023 IAVVC 2023: IEEE International Automated Vehicle Validation Conference 2023
16-19.10.2023 IECON 2023: The 49th Annual Conference of the IEEE Industrial Electronics Society
17-19.10.2023 MESAS 2023: Modelling&Simulation for Autonomous Systems
2023 EFECS2023

Project Partners:

Funding

AI4CSM project has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 101007326. The JU receives support from the European Union's Horizon 2020 research and innovation programme. It is co-funded by the consortium members and grants from Germany, Netherlands, Czech Republic, Austria and Norway, Belgium, Italy, Latvia, India.

ECSEL JU