INTEGRATION OF HUMAN DRIVING BEHAVIOUR IN THE VALIDATION OF CCAM SYSTEMS

CCAM
CONNECTED, COOPERATIVE & AUTOMATED MOBILITY

CCAM WORK PROGRAMME 2025

CCAM Cluster	Topic title	Type of action	Budget (EUR million)	# of projects expected to be funded
Cross-cluster	Advancing remote operations to enable the sustainable and smart mobility of people and goods based on operational and societal needs – Societal Readiness Pilot	RIA	12	2
1	Preparing for large-scale CCAM demonstrations – *Societal Readiness Pilot*	CSA	4,5	1
2	Next-generation environment perception for real world CCAM operations: Error-free and secure technologies to improve energy-efficiency, cost-effectiveness, and circularity	RIA	8	2
3	Integration of human driving behaviour in the validation of CCAM systems	RIA	5	1
5	Approaches, verification and training for Edge-AI building blocks for CCAM Systems	RIA	4	1
7	Federated CCAM data exchange platform	IA	4	1

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Organisation name	University of Zilina (UNIZA)
Interest in the call and / or expertise to be brought into a consortium	• Human driver data collection and evaluation in Slovakia • Collaboration with The George Washington University (US stakeholder) on automated collection and processing of road user trajectory data for model calibration • Tools and experience for CCAM simulation of mixed traffic for safety validation • Reconstruction of accidents and near-miss situations by forensic research methods and data extraction
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	Łukasiewicz Research Network – Automotive Industry Institute
Interest in the call and / or expertise to be brought into a consortium	• **Development of AV control** systems based on the behavior of real drivers. The use of multimodal language models to control specific traffic situations and the context related to traffic conditions and the environment. • **Development of simulation environments and models** for validation of CCAM systems in accordance with AV approval. • **Tests for parameterization** of driver models based on manual control by drivers for various test scenarios (development of criteria for the implementation of manoeuvres). Research on large groups of drivers. • **Tests for repetitive traffic situations** and for critical/dangerous situations. • **Social research** on the acceptance of driver control in the aspect of modeling of CCAM systems. • **Conducting validation studies** of CCAM systems (simulation, test tracks and public roads) after parameterization, including the dynamics of various types of vehicles and traffic conditions (road traffic, weather conditions, lighting).
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Organisation name	FZI Research Center for Information Technology
Interest in the call and / or expertise to be brought into a consortium	**Background and expertise** • Driver interaction models for intersection scenarios • Extensive experience in including humans in the control loop using shared control • Verification and validation of highly automated systems wrt. human driving behavior • Behavior decision-tree-based scenario analysis and trajectory verification • Human Vehicle Interaction, Validation of HMIs, and CCAM behavior • Generator-based VR environments, including environmental and weather effects **Interests and ideas** • Validation of intersection behavior using human driver models • MIL / SIL / HIL approaches incorporating human behavior • AI-based verification and validation of driving functions • Vision-Language Model (VLM) based verification and validation of driving functions • Interpretable and explainable driving decisions for validation • Integration of VRU behavior models from field data, especially bicyclists, motorcyclists • Application of Digital Twins and VR for the Integration of Humans as VRU • User acceptance of CCAM Systems from the passenger and the bystander perspective
Contact details	Alexander Viehl, Division Manager, viehl@fzi.de; +497219654414

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Organisation name	ISTANBUL OKAN UNIVERSITY (OKAN)
Interest in the call and / or expertise to be brought into a consortium	OKAN concluded the OPINA Open Innovation Autonomous Vehicle Development and Testing Platform with IPAII support of the EU. So the university have the infrastructure and research team that could support a consortium on: - Any functional development and adaptation of a CCAM function on a demonstrator - SIL, MIL, HIL or DIL validation of CCAM functions and HW/SW components - Cooperations with the Faculty of Law and Faculty of Humanities and Social Sciences, OKAN can also suto define societal responsiveness / assessment criteria for CCAM systems in type approval schemes, consumer testing campaigns and industrial development processes, design safe, human-like behaviour of CCAM systems and validate them virtually.
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Organisation name	MOTOR TRANSPORT INSTITUTE (ITS, Poland)

Interest in the call and / or expertise to be brought into a consortium  	• high-class driving simulators – passenger car (6DoF), truck (3 DoF)
	• behavioural studies – **distraction**, **drowsiness**, **DUI,**
	• **dataset provider for building realistic driver behaviour model**
	  • driver performance measures,
	  • eye-tracking data,
	  • EEG, ECG,
	representing driver behaviour in safety-critical scenarios, considering the variation and statistical distribution of human behavioural patterns and the factors influencing such behaviour, including the parallel execution of non-driving related tasks,
	• different driver experiences / demographics,
	• integration of relevant expertise from SSH,
	• *possible cooperation with a company experienced in buidling driver behaviour models,*
	• has **own ethics committee**.

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Organisation name	RISE Research Institutes of Sweden
Interest in the call and / or expertise to be brought into a consortium	Interested in integration of human behavior models in safety assurance frameworks (in particular from the SUNRISE project). Defining criteria for the assessment of human-like behavior of CCAM systems. Extensive expertise in researching scenario-based testing frameworks related to human-machine interaction; special interests are functional safety analysis of HMI. Involved with international standardization efforts.
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Organisation name	TECNALIA
Interest in the call and / or expertise to be brought into a consortium	•Development of solutions to solve complex automated CCAM maneuvers, considering safety and human driving style •Development of methods and tools to verify the performance and safety of CCAM in complex maneuvers using human data as a reference. •Development of solutions that allow the automation performance to approach that of a human using a combination of imitation and reinforcement learning . • Implicit vehicle cooperation via human driving models (without communication). •Simulation of mixed traffic environments with human driven vehicle models, improved with shared control strategies
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Organisation name	Fondazione LINKS
Interest in the call and / or expertise to be brought into a consortium	• Possibility to involve the **CCAM Turin ecosystem**, leveraging the strong collaboration already established in previous CCAM demonstrations (e.g., SHOW, IN2CCAM and ToMove (national)) • Provision of **interaction models** between **CCAM systems** (i.e. autonomous vehicles) and **other road users** (including both VRUs and traditional vehicles) • **Simulation of CCAM systems** in mixed traffic using a micro-simulation environment, to realistically represent the **behaviour of human-driven vehicles** in relation to CCAM systems • Provision of realistic scenarios for **testing and simulation of driving behavior** in collaboration with CARS (PoliTo) • Provision of a **smartphone app for collecting data on human behavior**. The app can work with an external device to provide precise localization. • Algorithms for detection and tracking
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Organisation name	Aalto University
Interest in the call and / or expertise to be brought into a consortium	**Interest in the call** • Develop a cross-cultural mapping framework that identifies and categorizes distinct **driving behaviors**, **traffic patterns**, and **informal road norms** across the World , creating a standardized reference database for autonomous vehicle programming. • Design and implement a **simulation platform** that accurately replicates the unique urban mobility characteristics of regionally diverse cities (including infrastructure variations, pedestrian behaviors, and local transportation modes), enabling autonomous systems to achieve adaptation accuracy when transitioning between different cultural driving environments. • Establish a multinational **policy framework** in collaboration with representatives from each host city to address the regulatory challenges of autonomous vehicle deployment across diverse urban contexts, culminating in a unified set of technical standards that balance global interoperability with local cultural adaptation **Competences missing:** • Human modelling • Estimation of affective state • Research on cultural and sociological aspects of autonomous driving • Deploymnet • Policy making
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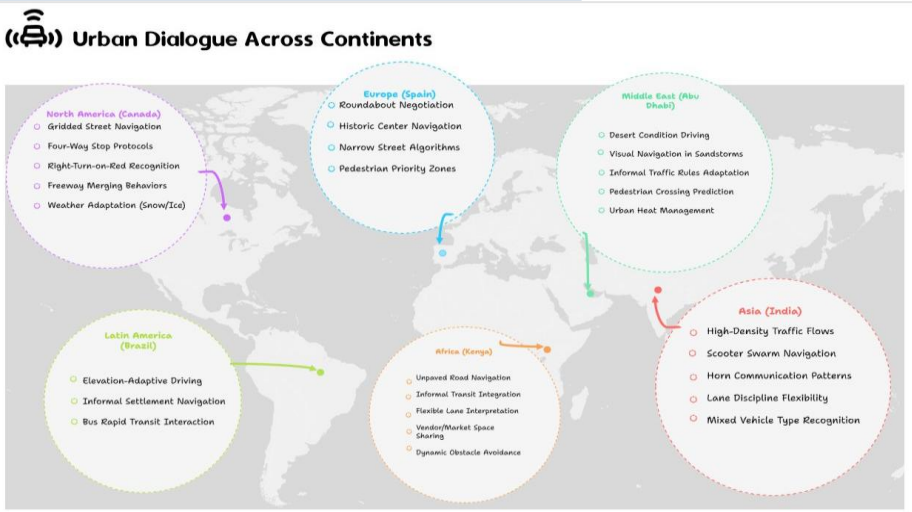

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Organisation name	Chalmers
Interest in the call and / or expertise to be brought into a consortium	Driver behaviour modelling, safety benefit analysis, experience from large scale NDS studies, Previous project experience include Drive C2X, HiDrive, L3-Pilot, EuroFOT, Udrive, V4 Safety
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Organisation name	IKERLAN
Interest in the call and / or expertise to be brought into a consortium	• Safety validation of human behavior, for instance, by applying **HAZOP methodologies** to identify risks. • Implementation of **safety mechanisms** and **robustness monitoring** to ensure reliable human behavior **modeling**. • **Safe architecture definition** through safety patterns, incorporating redundant inputs/logic/outputs, safety diagnostics, and monitoring to integrate AI safely. • OD/ODD monitoring using **uncertainty quantification** and classification to apply appropriate safety measures. • Conducting **risk assessments** and **security testing** (penetration testing, fuzz testing) to ensure human-driven systems are secure. • Alignment with IEC 62443 to assess the security of **simulation systems and driving models** in mixed traffic. • Integration of **SASE** (Secure Access Service Edge) to protect the simulation infrastructure.
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Organisation name	Federal Highway and Transport Research Institute (BASt)
Interest in the call and / or expertise to be brought into a consortium	**Extensive expertise in proving ground and public road testing:** BASt has a proven track record in conducting and analysing proving ground and large-scale public road studies including diverse samples of real human drivers. BASt's extended testing equipment can support to derive and analyse parameters from mixed and complex traffic scenarios , e.g. with a "Surrounding Traffic Detecting Vehicle". Together with BASt's expertise in psychological assessments and vehicle dynamic measurements a robust data collection setup for parameterisation and validation of human behavioral models is available. As part of the "SUNRISE" BASt has already gained experience in this area. **Close collaboration with regulatory authorities:** BASt's strong connections to legislative bodies and consumer protection organisations (e.g. EuroNCAP) enable to effectively contribute to the regulatory perspective, supporting alignment of project outcomes with regulatory frameworks, type approval processes, and consumer testing campaigns. **Interdisciplinary Integration for Enhanced CCAM Acceptance:** BASt's commitment to joint research activities between psychologists and engineers aligns precisely with the topics' scope, enabling comprehensive examination of CCAM system performance and human-machine interactions, thereby ensuring safe, predictable, and widely acceptable CCAM behavior.
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Organisation name	TNO
Interest in the call and / or expertise to be brought into a consortium	Driver and human driving modeling and linking it to (virtual) safety assessment methodologies Safety assessment of human driving State of the art driving simulator and CCAM vehicle labs
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Organisation name	EFA – European Driving Schools Association
Interest in the call and / or expertise to be brought into a consortium	EFA, through its associated partners, can offer the following services: - Data collection on different driver training systems in at least 25 European countries; - Network of operational contacts, also for road user training in at least 25 European countries; - Development of new training models and standard driver training models; - Validated human behavioural models representing the variety of human driving behaviour in safety-relevant scenarios; - To define pass criteria/assessment criteria for CCAM systems in type approval schemes, consumer testing campaigns and industrial development processes; - To design safe, human-like behaviour of CCAM systems that can be anticipated easily by all road users and is acceptable to both CCAM vehicle occupants and all road users; - Application of such human behavioural models in the virtual safety validation of CCAM systems to realistically represent the behaviour of human-driven vehicles in closed loop simulations of mixed traffic; - Awareness-raising campaigns based on the results obtained by the projects through its network of contacts across Europe.
Contact details	Manuel.Picardi@efa-eu.com www.efa-eu.com

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Organisation name	LIST (Luxembourg Institute of Science and Technology)
Interest in the call and / or expertise to be brought into a consortium	We can be involved in user studies either in vehicle or under simulated conditions. Other aspects include user interfaces, or use of data visualisation techniques to gain insights into the data obtained.
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Polytechnic University of Bari, Italy - POLIBA	
Interest in the call and / or expertise to be brought into a consortium	POLIBA has a long experience in EU HORIZON projects on transport of people and goods (CO-GISTICS, AEOLIX, FENIX, optiTruck), CCAM (IN2CCAM, CHORUS), as well as on related fields, like Electric Mobility (NEMO, eCharge4Drivers) and communications (6G-TWIN). On these projects, POLIBA develops several activities, such as project, WPs and Tasks management, design and implementation of tools using modelling, simulation, AI, optimization, automation, Digital Twins, etc., management of Living Labs in Bari, involvement of different types of stakeholders, development of Use Cases and definition and use of evaluation methodologies and assessment of KPIs. **For this call, POLIBA** is interested in considering safety-critical scenarios such as, for instance, the ones concerning the management of an intersection (controlled or not) during the passage of an emergency vehicle, in presence of mixed traffic (autonomous and human driven). In these cases, human behaviour can show exceptional features, up to wisely breaking traffic rules in order to expedite the run of the emergency vehicle. Furthermore, it could be expected that human behaviour could show large variations according, for instance, to regional attitudes. The development and use of AI tools for the automated vehicles, based on initial models already developed by POLIBA in IN2CCAM, is a promising way to face this kind of problems. Like for all the research projects in which it has been involved, POLIBA will exploit its international academic network to foster collaboration with relevant stakeholders around the world, in particular Japan and United States. Also, extended dissemination at scientific and qualified technical levels will be pursued, through publication of papers in scientific journals, and presentations in reviewed international conferences.
Contact details	prof. Maria Pia Fanti – mariapia.fanti@poliba.it prof. Walter Ukovich – ukovich@gmail.com

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Organisation name	VEDECOM
Interest in the call and / or expertise to be brought into a consortium	**Interest** • Application of **Explainable AI (XAI)** techniques to evaluate AI robustness, reliability, and human interpretability for CCAM systems validation. • Design of a **comparative evaluation framework** (KPIs) to assess driving performance and Measurement of **safety**, **user acceptance**, and **system fidelity** in real-world or simulated testing • **Deployment of prototypes** in controlled environments : FOT=test tracks, HIL/SIL/HumanIL/MIL. • Proposal of a **modular end-to-end architecture** for CCAM systems. • Exploration of **Visual Language Models (VLMs)** for enhanced scene and CCAM behaviour understanding. **Expertise** • **Naturalistic** driving data Acquisition (~2Millions of Km) • **Labeling** of critical maneuvers and edge cases; indentification of cultural and situational driving patterns • Deployment of **modular pipelines** for Level 4 AV (perception, localization, path planning, control) • Development of **uncertainty-aware AI models** and integration of **XAI approaches** • Experience in **collaborative perception** and **multi-sensor fusion** for CCAM systems • Building a **Driver Model** (partner in BERTHA project) • Modeling and analyzing human driving data
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Organisation name	IMEC
Interest in the call and / or expertise to be brought into a consortium	• Leveraging Edge AI testbed expertise, enabling relevant network information on human driving behaviour in real time • Definition of human behavioural models through increased perception models (building on own expertise in safety scenarios) • Virtual safety scenario validation in Digital Twin • Expertise in on road experiments **Assets to leverage:** Experiment design methodologies, Edge AI testbed, Simulation environment (Sensai)
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Organisation name	- International Road Union
Interest in the call and / or expertise to be brought into a consortium	Understanding human driving behaviour is essential for the successful deployment of automated transport systems. Ensuring that CCAM validation frameworks reflect the reality of mixed-traffic environments, where professional drivers, fleet operators and AI-driven systems must interact seamlessly is a priority. • Expertise in analysing and representing the perspectives of commercial vehicle operators, professional drivers and transport fleets. • Dissemination activities and stakeholders' engagement.
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Organisation name	F6S Network https://innovation.f6s.com/
Interest in the call and / or expertise to be brought into a consortium	**The F6S Network leverages the reach and assets of the F6S platform of +5.7 stakeholders via www.f6s.com** **Communication & Dissemination** We go beyond traditional methods, integrating social media, project websites, webinars, podcasts, events and innovative outreach in high impactful promotion & dissemination strategies. **Stakeholder Engagement** F6S drives stakeholder engagement through high-impact campaigns, global community building, and interactive co-design workshops.We are experienced in implementing an efficient multi actor approach and building synergies/ clustering activities among projects and EU initiatives. **Exploitation, Sustainability & Impact** F6S accelerating projects teams and value proposition towards market We provide guidance in exploitation pathways for Key Exploitable Results
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