HADRIAN

Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs

HADRIAN Newsletter November 2020

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General Project Information

The project "HADRIAN – Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs" is funded by the EU Horizon 2020 program and represents a revolution in Human-Systems Integration for the definition of driver roles in automated driving. The HADRIAN project is led by Virtual Vehicle Research Gmbh and brings together **16 European partners from large industry, SME, academia and research, thus, covering properly the entire value chain.** The HADRIAN project implements a novel approach to create automated driving systems that integrate human drivers, vehicles, and road infrastructure. HADRIAN partners design and validate novel, adaptive, and fluid Human-Systems Interactions that are enabled by advanced driver monitoring to reduce the interaction complexity and increase trust and acceptance of drivers and users. Also, active road Infrastructure Support Levels for Automated Driving (ISAD) are explored to increase the predictability of automated driving as well as support minimum risk maneuvers. Through such an integrated approach the problems of current driving automation systems will be addressed. Furthermore, this approach should provide a basis for pervasive and sustainable automated driving automation for European mobility needs. The results of the project will be demonstrated by the consortium partners using driving simulations and real vehicle demonstrators in closed-track and real-world traffic situations.

The first year of the HADRIAN project has been completed and the project is well on track to reach its planned research and innovation goals. This newsletter provides highlights from the technical work completed by the different work packages (WP).

ACHIEVEMENTS FROM THE FIRST YEAR OF HADRIAN PROJECT

OPERATIONAL CONCEPT FOR AN IMPROVED DRIVER ROLE FOR AUTOMATED DRIVING

Led by VIRTUAL VEHICLE RESEARCH GMBH

WP1 develops the operational concept and innovations to improve the safety and acceptability of driver tasks during automated driving.

To accomplish its objective, WP1 performed several workshops with all consortium partners to explore the current constraints of automated driving as well their opportunities for automated driving in the European mobility visions over the next 10 to 30 years. Prior to the workshops literature reviews were conducted to determine specific situations and challenges where automated driving could provide benefits and address human mobility needs. This material was assembled and discussed prior to the workshops. During the workshops the assembled workshop participants then elaborated different different perspectives of human driver and operator during concrete situations and environments.

In these workshops the context and personas were defined for three personas:

Harold is a 78 years old man living in the suburbs of Paris. He used to drive his car for his whole life. Now he lives alone and his only daughter is about an 1-hour drive away on the country side. Harold is hesitant to use novel technologies. He has difficulties using fancy new technologies and even does not have a smart phone! Though, he liked the safety assistance features on his previous car.

Sven is a 42 years old long-distance truck driver living in Frankfurt. He has a wife and an 8-year-old daughter. He is a truck driver for 20 years and when he is on a tour, he has a lot of responsibilities. Truck driving gives him a feeling of independence and he really likes his job, although it's not like in the past anymore. His job is stressful, and he often has to fight upcoming fatigue on monotonous drives. Over the years, he has got some health issues

Florence is a 27-year old businesswoman living in a suburb of Paris of the future (i.e., car sharing and intelligent traffic management are available). She is married and has two kids (10 months and 7 years old); her husband takes care of the kids at the moment. Since a year she leads an IT start-up and has 10 co-workers, her office is in Paris – that's why she needs to commute daily. Currently, she needs to take care of basically everything in order to ensure the success of the company and she has a lot of office work to do that she would like to accomplish while commuting. Also, Florence sometimes has problems to read in a driving car, since it can make her dizzy and feeling nauseous after some time.

For all of these personas 10 mobility scenarios were developed and described in deliverable 1.1 (accessible here) and delivered on time to the European Commission in May 2020. Over the following months, the description was refined and, seven HADRIAN innovations identified that were applied to five automated driving modes.

Hadrian Innovations			Modes of Automation to which the HADRIAN Innovations are applied		
1		Information assistant to simplify driving task for elderly drivers	1		Manual Driving Aid for Elderlies
2		Reduce human monitoring need during ADL 2	2		Innovation to ADL 2 Driving
3		Provide minimum guaranteed time for human driver to transition from ADL 2, 3 & 3+ to manual driving	3		Innovation to ADL 3 Driving
4		Guarantee minimum ADL 3/+ duration before the trip	4		Innovation to ADL 3 Driving for Extended Disengagment
5		Active driver monitoring & fluid interventions	5		Guarding Angel
6		Adaptive tutoring to improve driver skills, knowledge, and competences for AD usage			
7		Guarding angel as safety protector during manual driving			

These refined scenarios, the HADRIAN innovations and their applications to the five modes of automated driving were then described in a deliverable for use by the project partners for their subsequent research and implementation activities. Also, ASFINAG, BAST, Northern Technical University of Athen, University of Surrey, and Virtual Vehicle Research GmbH (VIF) derived an initial set of vehicle and infrastructure requirements for the HADRIAN operational concept based on previous work on infrastructure support levels for automated driving (ISAD) and performed a task analysis for the driver requirements. The refined operational concept and scenarios were delivered in November 2020 on time to the European Commission as deliverable D 1.2.

DRIVER STATE MONITORING CAPABILITY

Led by UNIVERSITY OF GRANADA

WP2 has been developing new sensing technologies for autonomous driving. This work allows to sense the driver state and attention in real time and provide this information to the vehicle for informed smart interventions to improve the safety of the situation and transition from automated to manual driving. This work will be made available to the other HADRIAN partners so that the HADRIAN operational concept can be implemented, tested, and demonstrated in the various HADRIAN activities. Despite the several travel constraints and safety measures due to COVID-19, significant progress has been made in WP2. The first six months of the project have been dedicated to the definition of the HADRIAN sensors and simulator requirements to perform a set of fundamental experiments in a virtual reality environment.

Sensors integration finalized

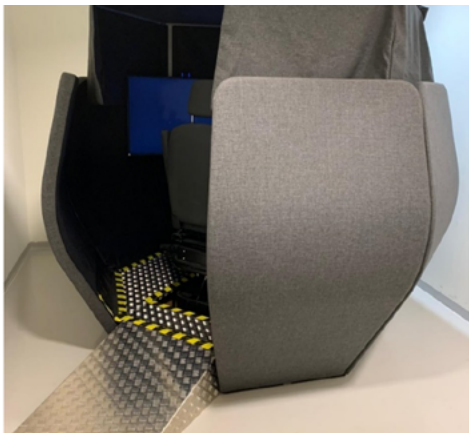
- Last week of June 2020: a group of HADRIAN consortium members (University of Granada, Nervtech) met at the Nervtech headquartes (Ljubljana, Slovenia) to define the last details for sensors integration into the HADRIAN simulator, including the installation and testing of a new Ford Transit swivel seat.

Sensorized driving simulator installation

- Last week of **July 2020**: delivery, installation and preliminary testing of the driving simulator at the Research Center for Mind, Brain and Behavior (CIMCYC) at the University of Granada (Nervtech, University of Granada, CEA), including more than 5 wearable sensors and a variety of cameras.


- First week of **October 2020**: a group of HADRIAN consortium members (University of Granada, Nervtech) met again at CIMCYC to install a new steering-wheel with a built-in grasping force sensor, developed by Nervtech and CEA. Moreover, the hardware and software parts of the HADRIAN simulator were refined. The partners also performed several more testing, with drivers from different age groups.

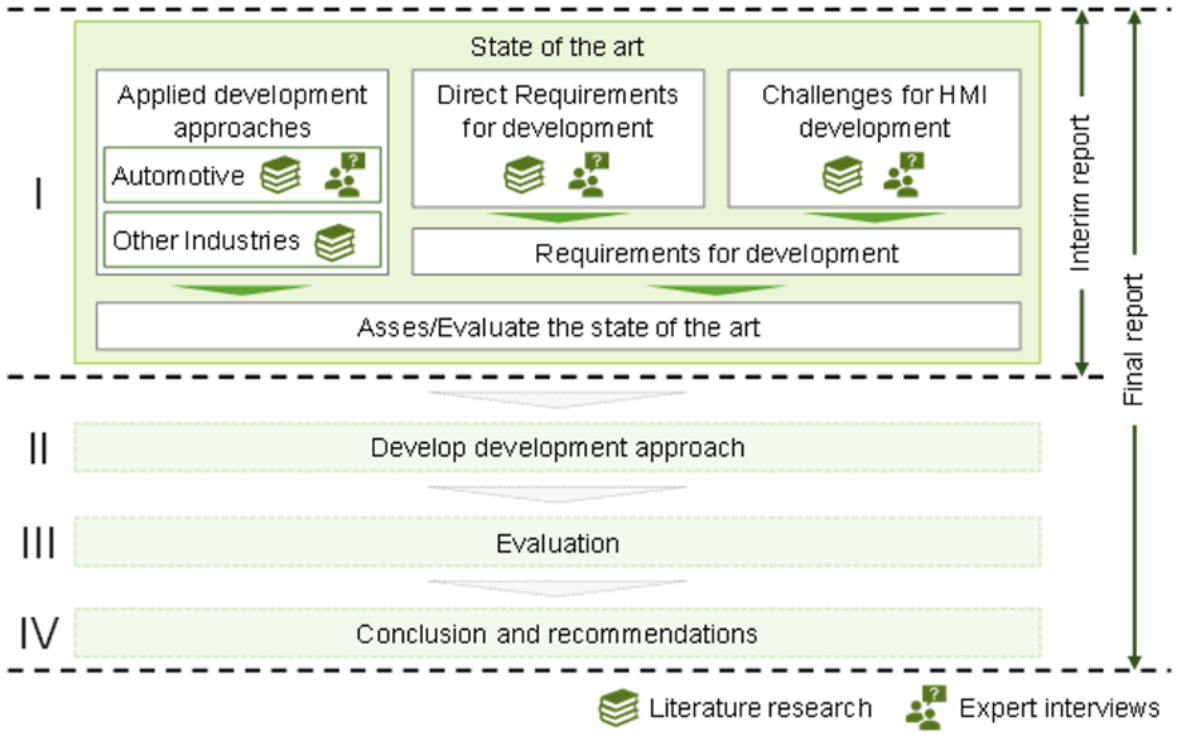
- In **November 2020**, WP 2 described the plans for the data collections and submitted deliverable D 2.1 on time to the European Comission.

HMI APPROACH

Led by FUNDACION TECNALIA RESEARCH & INNOVATION

WP3 is in charge of the conceptualization, design, development, and evaluation of the fluid-HMI (Human Machine Interface), which will be implemented to achieve the HADRIAN objectives in each of the use cases presented in WP1 (elderly driver, truck, and office vehicle).
During the first year, WP 3 has developed an approach toinvestigate the drawbacks of currently available HMI development approaches in order to define a novel approach for HMI development that meets the HADRIAN objectives. For this purpose IKA defined a comprehensive assessment of the state-of-the-art in literature and among operational experts within the consortium and beyond. This approach is shown in the figure below.

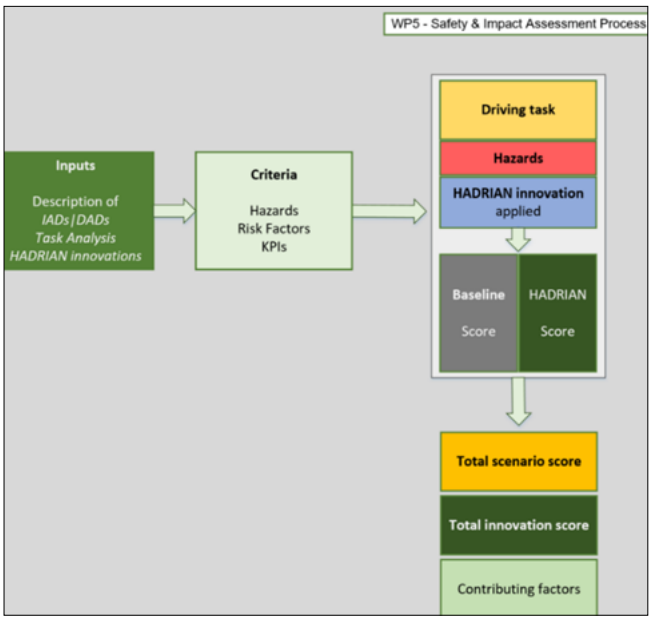


The results of this work was documented in deliverable D 3.6. The final results will provide guidelines to develop human-machine interactions for the automated driving functionalities based on the HADRIAN operational concept. These methods will then be applied throughout the project. In November, PLUS and Virtual Vehicle Research GmbH (VIF) conducted a first workshop with consortium partners to brainstorm human-centered principles for the concept and design of fluid HMIs.

SAFETY AND IMPACT ASSESSMENT

Led by NATIONAL TECHNICAL UNIVERSITY OF ATHENS

The general scope of WP5 is to develop and provide the safety and impact assessment regarding the examined and subsequently developed HADRIAN f-HMI (i.e. fluid-Human Machine Interface). The assessment will be the “tool”, which will evaluate and measure the effect of HADRIAN operational concept and driver role modifications on several safety and general impact aspects.

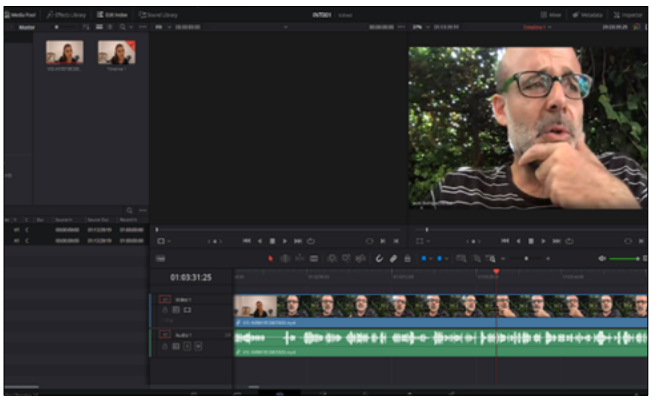


During the first six months of the project, WP5 was concerned with the development of the safety and impact assessment methodology for the project. The methodology takes into account the HADRIAN scenarios (i.e. Harold, Sven and Florence) and recognizing hazards that might arise during driving. After the identification of hazards and risk factors, a list of key performance indicators will be used to assess each driving task and each of the HADRIAN innovations. The ultimate aim of the assessment will be to compare and contrast cases where the HADRIAN system is applied to the ones where it is not, so as to measure the human-centered approach of HADRIAN. A schematic representation of the methodology is given in the figure.

ELABORATION OF ETHICAL AND LEGAL IMPLICATIONS FOR AUTOMATED DRIVING

Led by VDI/VDE INNOVATION + TECHNIK GMBH and the University of Granada

WP6 is investigating legal and ethical issues concerning data-flow privacy and security, which stem from the collection, use, and storage and dissemination of drivers' data, as well as issues related to drivers' autonomy when using fluid interactions. The partners have been examining moral values and trade-off preferences for social, economic, and/or environmental aspects of AVs technologies of (1) relevant stakeholders and experts and (2) different road users.



For this, the University of Granada conducted a qualitative study with in-depth semi-structured interviews of stakeholders and experts. In these interviews the stakeholders' main concerns and points of view about different ethical issues on artificial intelligence, autonomous driving, and fluid interactions were collected. The main topics addressed were privacy, autonomy of the driver, safety, security, and vehicle performance, and costs. Most parts of the interview were common to all interviewees, but some questions were specific to certain profiles of experts.

Between the **28th of July 2020** and the **16th of October 2020, 30 expert**s from inside and outside the HADRIAN Consortium were remotely interviewed via telephone. The Coronavirus outbreak affected the expected start date but the work could be effectiveley completed.

All HADRIAN Consortium partners were invited to participate. Specifically, one member of HADRIAN Advisory Board and 14 members of HADRIAN Consortium, from the following organizations:

ASFINAG	AVL	CEA	IESTA	IKA	NTUA	NVT	PLUS	TEC	UGR	VDI-VDE IT	ViF

In addition, other 15 stakeholders, from outside the HADRIAN Consortium, were interviewed. These experts came from 14, both public and private, European organizations.
Participants were organized in groups depending on their field of expertise: engineers working in Automotive Industry (9 experts) and Urban and transportation infrastructure (5), psychologists experts in Human Factors (3), philosophers experts in Ethics (4), professionals working in the Insurance sector (3), Law (4), and Traffic Medicine (2).

WordCloud of the most mentioned words in an Automotive Industry expert interview

WordCloud of the most mentioned words in an Automotive Industry expert interview

The interview were recorded and converted to text using an automated **transcription** software. Then, two judges and the interviewee checked the transcript of the interview. Subsequently the **content analysis has started** to identify common patterns across interviews and profiles. The results of this work will be reported in deliverable D 5.1 in January 2021. Furthermore, the University of Granada conducted focus groups with following stakeholders: students, elderly drivers, elders caregivers, high-tech companies managers, and law enforcement. The conduct of these focus groups will be continued in year 2.

OUTLOOK FOR YEAR 2

The HADRIAN project has just completed its first year and will run another 2.5 years. The focus of the following year will be on translating the HADRIAN operational concept into concrete research and development activities. For this, WP 3 will be developing a fluid-HMI concept and based on this, center the **development and evaluation activities within the project**. Thereby, WP 3 will define the principles for fluid-HMI that smartly adjusts to the driver and user to allow for safe and acceptable interactions. Accordingly, the HMI components will be designed around the HMI concept and provide collaborative or assistive interactions as needed, dependent on the use context. Furthermore, the initial **HMI development methodology** will be refined based on the experiences of the partners with the HMI development methodology within the project.
In year 2, WP2 will focus on data collection of driver state and behavior for the HADRIAN scenarios in the driving simulator. The driver state and behavioral observations will be translated into a decision logic to trigger appropriate HMI interactions.
WP5 will refine the safety assessment approach and identify detailed key performance indicators to be used by the various partners in their studies. WP 5 will also support the planning and conduct of these studies in order to make sure that all the necessary measurements for the safety and impact assessment are captured thoroughly.

WP 6 will finish the focus groups with stakeholders representing different different road users. Next target users are truck drivers. Finally, an online survey will be conducted to assess trade-off preferences for social and economic aspects of AVs for any kind of road user.

AVAILABLE HADRIAN RESULTS

HADRIAN Deliverables

- D1.1 Description of initial AD application descriptions
- D8.1 Project marketing basic and webpage
- D8.6 Communication, Dissemination and Exploitation Plan

HADRIAN PRESENTATIONS

Effects of non-driving related tasks performed during SAE Level 3 automated driving phases on following manual driving behaviour, Elisabeth Shi, Klaus Bengler
The 27th World Congress of International Traffic Medicine Association

Human-Systems Integration for Driving Automation Systems: Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs, Peter Mörtl
MOBITAS: 2nd International Conference on HCI in Mobility, Transport and Automotive Systems

Fluid interface concept for automated driving, Paolo Pretto, Peter Mörtl, Norah Neuhuber
MOBITAS: 2nd International Conference on HCI in Mobility, Transport and Automotive Systems
A fluid-HMI approach for Haptic Steering Shared Control for the HADRIAN Project, Myriam E. Vaca-Recalde, Mauricio Marcano, Joseba Sarabia, Leonardo Gonzalez, Joshue Perez, Sergio Diaz
HCI INTERNATIONAL 2020: 22nd International Conference on Human-Computer Interaction

Shared Control Framework and Application for European Research Projects, Mauricio Marcano, Sergio Diaz, Myriam Vaca, Joshue Perez, Eloy Irigoyen
SOCO 2020: 15th International Conference on Soft Computing Models in Industrial and Environmental Applications

GENERAL PROJECT INFORMATION

More information on HADRIAN is available on our website: https://hadrianproject.eu/

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PROJECT PARTNERS

PROJECT FACTS

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