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Workshop on Exploring Interfaces for Enhanced Automation Assistance for Improving Manual Driving Abilities

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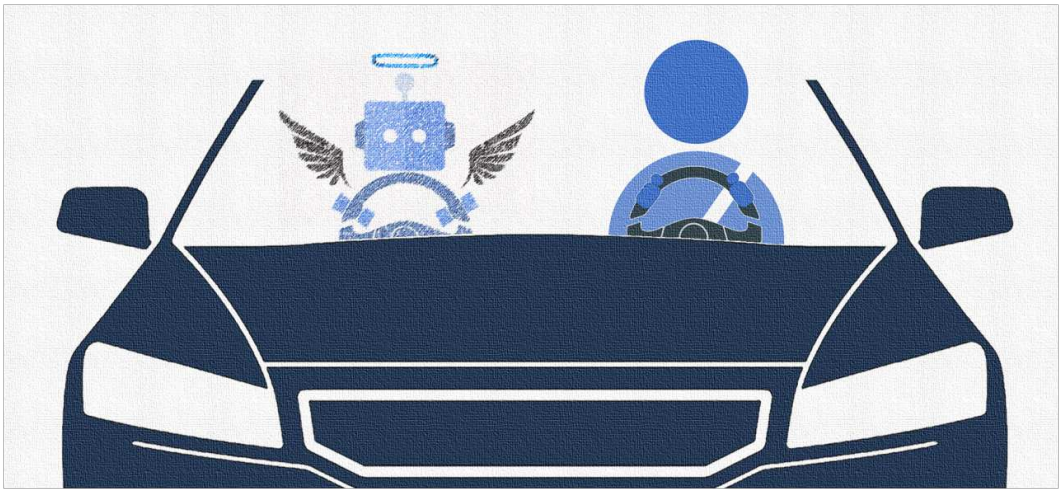

Figure 1: Automation assistance acting as a "guardian angel" driver assisted in manual mode by the intelligent automated system

ABSTRACT

With continually advancing automation capabilities in vehicles, there is increasing potential for these capabilities to be used not only as stopgaps towards full automation but to enhance humans' manual driving capabilities during this transition phase and beyond. By employing smart automation assistance (e.g., highlighting of relevant roadside information, maneuver interventions and corrections), it might even be possible to enable automation assisted "manual" driving for those, who might not be able to drive otherwise (older adults, individuals with impairments). In this workshop, we intend to explore this problem together with the participants and identify potentials for automation assistance to enhance manual driving performance, and what in-vehicle interfaces can contribute in this regard.

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CCS CONCEPTS

• **Human-centered computing** → **Interaction design**.

KEYWORDS

Automated driving, Automation assistance, manual driving support, Vehicle interfaces

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1 INTRODUCTION

The fully automated SAE L5 car has been set as the ideal goal of driving automation, without any consideration of human intervention. However, failsafe-operational highly automated vehicles with non-compulsory critical human intervention are still under development [2], and therefore the presence of both automation and human driver in an active role during the driving task is necessary for the route towards that goal. Additionally, there are many motivations to keep the driver highly involved (with active hands on the wheel), e.g., recent crashes that have occurred with the autopilot activated [7], legal dilemmas in terms of responsibility [4], the out-the-loop problem (drivers having difficulty to take back control appropriately [8]), and also the social aspect, as people actually enjoy driving, and their ratio of accidents per km is better than automated vehicles [6].

In this sense, while facing these challenges in the different domains (technological, social, and legal), the latest advances in technology for automated vehicles can be used to enhance driver performance, safety, and comfort during manual driving. This research line is becoming very attractive for industrial entities and researchers, and many efforts are being directed towards the design of more cooperative ADAS, in which the driver is kept in the control loop and strongly interacts with the automated system at the control level [3]. The novelty in comparison with available Advanced Driver Assistance Systems (ADAS) (which are more focused on assigning different tasks to each agent, or doing the same task but at different periods of time) consists in an increased level of cooperation between the driver and the automated system, achieved by simultaneously combining their control actions for the vehicle guidance.

In terms of commercial ADAS designed for highly-engaged drivers, there are two approaches. On the one hand, systems that provide momentary assistance, for example, the Blind Spot Active System or Lane Keeping Assistant System. These functionalities interact with the driver via audio warnings or vibration on the steering wheel when reaching the system limits (e.g., dangerous lane change maneuver, or crossing the lane borders). Additionally, when the driver does not respond to the initial warnings, the system applies a braking force or steering torque to correct the course. On the other hand, there are the autopilots (defined as SAE L2) that perform the lateral and longitudinal driving task, while requiring the driver to be involved in a supervisory role (doing recognition tasks, and having the hands on the steering wheel each certain time to ensure that he/she is attentive and ready to take control when needed [5] [1]). This type of assistance removes almost all possibility for driver-automation control cooperation and is prone to create driver's misusing and over-trusting the system.

This situation shows a gap between the two types of automated vehicles mentioned above, with space for a more continuous and cooperative mode of assistance, while having the driver engaged in the driving task. Thus, considering the current scope of lower levels of automation being used for manual driving support, and higher levels to diminish the need for manual driving, the aim of this workshop is the following: Why don't we also use higher automation to increase manual driving support? With this in mind, the goal of this workshop is to explore and gather feedback on a variety of interaction modalities, interfaces, and assistance strategies that a highly automated vehicle could provide for a driver under different scenarios looking for safer, trustworthy, and understandable driver-automation interaction.

2 WORKSHOP OBJECTIVES

The main intent of the workshop is to advance into the idea that automated driving does not only look like a super intelligent vehicle that dispenses with the driver, but that it also covers wider concepts where human and automation drive together, exploiting the benefits of both. The workshop aims at:

- Exploring the potential of automation assisted "manual" driving to enhance human capabilities.
- Identifying different automation support strategies for manual driving.
- Evaluating challenges of the concept of "driving together". Benefits and drawbacks.
- Fostering collaboration towards enhanced automation assistance for manual driving

3 WORKSHOP STRUCTURE AND SCHEDULE

The workshop is planned as an interactive ideation workshop. An overview of the planned schedule is shown in Table 1. The structuring into breakout sessions is intended for participant numbers between 12 and 30, resulting in 3-6 groups. In case of an attendance at or lower than 11, one 60 minute interactive plenary session will be held instead of the combination of breakout groups and consolidation session.

3.1 Participation

Due to the virtual setting, registration in advance is mandatory. Participants are not expected to send position papers as the workshop will be an interactive session. However, all participants are encouraged to check the pre-workshop material as a preparation step to improve the quality of the discussions. The workshop will be conducted virtually, with the possibility of having multiple sessions in case the number of participants allows for breakout groups. The workshop is planned to be held at 17:00 UTC+2, which enables participation across both Europe and the Americas (08:00 UTC+7). Due to the total length of 90 minutes, limited participation from East Asia is possible as well (00:00 UTC+9).

3.2 Schedule and Procedure

Before the conference: The participants registered for the workshop will receive a link to the workshop website and instructions pre-workshop, which will enable them to familiarize themselves with the topic and prepare for the workshop. The organizers will

also be available for questions via email during the pre-workshop period. This minimizes the necessary introduction and familiarisation phase at the workshop and allows for an extended interactive phase during the comparably overall short workshop duration of 90 minutes.

On the website, an introduction to the topic will be provided, and example use cases and connected limitations and restrictions in manual driving are outlined (e.g., use case of an elderly driver, who is limited in his visual field and cognitive processing speed; a driver novice with a lack of driving experience; a business person, who is tempted to perform office tasks while driving). In case participants want to add new use cases, they are encouraged to send their suggestions per email to the workshop organizers.

At the conference: The workshop will be held online as a conference call (via Zoom, Microsoft Teams, or Webex) with collaboration platform support (Miro or Trello). At the workshop, the participants will be greeted, followed by a short introductory round for the participants. Then, a condensed introduction to the workshop agenda, topic, and example use case outline are provided by the organisers. After that, the interactive sessions are prepared and explained to the participants. These introductory and preparatory sessions are scheduled for 10 minutes each in order to also allow for questions from the participants.

The *interactive session* will proceed in two parts: in the first part, the participants will be divided into breakout groups of 4-5 participants each. Each breakout group is moderated by one of the workshop co-organisers. The group sessions will last 30 minutes, during which the participants explore and envision how automation could support manual driving for the selected use case, respectively how new interaction concepts for automation support for manual driving could work. This will be organized as a moderated brainstorming session, where participants call out and discuss their ideas, which will be noted, structured, and summarized by each group moderator on the collaboration platform.

In the following *breakout consolidation session* (30 minutes), each moderator changes to another group and briefly presents the results of his/her group's brainstorming and discussion. Based on this, participants are encouraged to provide their feedback, add new ideas, and discuss advantages or disadvantages of the approach. This will again be noted by the moderator. After 15 minutes, the moderator again changes to another group and the procedure will be the same. This approach allows to iterate and refine the ideas and concepts with an adequate amount of time and with high involvement of participants.

The *wrap up* (10 minutes) serves to provide buffer time in case of particularly active discussions, as well as a summary by the workshop organisers and information regarding the dissemination of the results on the website.

After the conference: The results of each breakout group including the iterations and refinements in the breakout consolidation session will be summarized and published on the workshop website.

Table 1: Planned Workshop Schedule

Before the conference	
Context and topic introduction on workshop website	
At the conference	
10m	Greeting and introduction
10m	Interactive session preparation
30m	Interactive breakout groups
30m	Breakout consolidation session
10m	Wrap-up
After the conference	
Breakout results published on workshop website	

4 EXPECTED OUTCOMES

The workshop outcomes (overall and per group) will be made available on the workshop website post-workshop. Participants can also choose to have their name and contact listed on the website in order to further facilitate collaboration and outreach. The primary purpose of this workshop is to establish the topic of automation assistance for manual driving ability improvement as well as connect and create partnerships within the Automotive UI community towards this area of interest. The concepts and scenarios developed during the workshop shall not only serve as a means to an end, however, and are seen as stepping stones for further exploration and follow-up activities, which the organizers intend to actively pursue.

5 BIOGRAPHIES

Alexander Mirnig, *Yasemin Dönmez Özkan*, and *Jakub Sypniewski* are experienced researchers at the Center for Human-Computer Interaction and explore issues surrounding interaction with and within automated vehicles. Alexander has previously co-organized workshops at Automotive UI conferences. *Mauricio Marcano*, *Sergio Diaz* and *Joseba Sarabia* are researchers at the Automated Driving Group in Tecnalia, with experience in the field of Driver-Automation Cooperation, studying their interaction while sharing the driving task, from the perspective of control and decision-making. *Sandra Trösterer* is a researcher at Virtual Vehicle investigating user requirements, behavior, and interfaces in the domain of automated driving. *Ruth Madigan* is a Research Fellow at ITS, University of Leeds, and conducts research investigating driver and pedestrian interactions with automated vehicles, along with exploring the requirements of novice drivers..

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