

Teleoperation for Highly Automated Vehicles - A Human-Centered Workplace Design for Remote Assistants

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How should teleoperation workplaces be designed to support automated vehicles in stuck situations?



Legal foundation

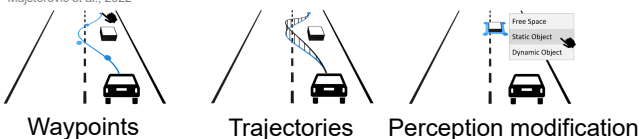


SAE level 4 vehicle encounters a problem and requests remote assistance. If necessary, a minimal-risk maneuver will be executed. The request is presented to the RO via the HMI. The maneuver from the RO is given back to the vehicle, which holds the lateral and longitudinal control. Besides the clearance and maneuvers as assistance, ROs can contact the passengers, deactivate or activate the automated driving function, and access functionality information (e.g., Tener & Lanir, 2023).

Scientific background

Highly automated vehicles lack the ability to deal with all road scenarios successfully (e.g., Kettwich et al., 2021). Problems arise from edge cases and situations outside the design domain, like perception problems, decision-making problems, and ambiguity. A proposed solution by industry and academia is **teleoperation**. It allows for efficient assist automation with human higher-level interpretation skills and semantic understanding. Currently, solutions are mainly investigated from a technical point of view or as design conceptualization. Discussed interaction concepts are setting waypoints, drawing trajectories, and modifying perception (Majstorovic et al., 2022). However, most of the proposed concepts still lack empirical research.

Majstorovic et al., 2022

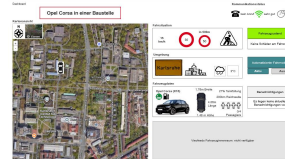


Solution concept

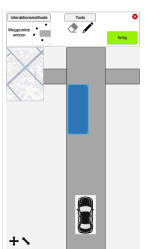
The **video screen** displays the recorded video with a front view, left mirror, and right mirror in the left and right screen corners. This is a simplified version for the current usability study.



The **dashboard** contains a problem description, a map view in satellite mode, and context information regarding the current speed limits, surroundings, vehicle information, sensor quality, and automation mode.



The **interactive unit** displays the problem situation in an abstract map view using the interaction method, simple input icons, a small map, and navigation icons. Investigated interaction methods are setting waypoints, drawing trajectories, and perception modification. The setup includes a remote **eye-tracking** system to analyze users' visual attention.



Research questions

How to consider frequent context switches & multi-tasking in workplace designs?

Which other interaction concepts & tasks should be considered for remote operators?

How do we empirically test different interfaces & designs?



Which information is required for efficient teleoperation?

What should an ergonomic workplace look like for various tasks in the field of teleoperation?