Post-Doctoral position at LAMIH UMR CNRS 8201

Haptic Shared Control for Safe and Collaborative Teleoperation of Autonomous Vehicles in Complex Urban Environments

Location: LAMIH UMR CNRS 8201, Hauts-de-France Polytechnic University, Valenciennes.
Duration: 13 months
Funding: CPER RITMEA
Monthly Salary: Approximately €2,700 gross
Application Deadline: November 30, 2025
Regional positioning:

- « Automated vehicles » topic and AV-Lab platform of CPER RITMEA program
- Strategic objective "Autonomous vehicles" of the FRA CNRS 3733 TTM

Scientific Context

Over the past decade, many advanced driver-assistance functions have been commercialized and integrated into vehicles. Autonomous vehicles of SAE Levels 2 and 3 are also available on the market. However, these systems are currently capable of handling only relatively simple lateral and longitudinal control situations, mainly on highways or open roads.

The gradual deployment of autonomous driving increasingly relies on hybrid solutions combining onboard intelligence with remote human supervision. Teleoperation opens the door to several innovative use cases:

- Remote taxi services, where vehicles are dispatched or retrieved without a physical driver;
- Remote takeover of vehicles (car, autonomous train, mobile robot) in complex situations;
- Accessibility solutions for people with reduced mobility (PRM), facilitating access to personalized transportation services.

In the context of autonomous vehicle development, the LAMIH conducts extensive research on shared control and human-machine cooperation. Until full autonomy is achieved, the human operator remains a critical component of the system, as they must be able to supervise and take over control remotely in the case of trajectory errors or system failures. However, tele-driving in real-world conditions presents several major scientific challenges:

- Limited perception for the remote operator (2D vision, lack of proprioceptive feedback, network delays, etc.);
- Need for dynamic arbitration between vehicle autonomy and human intervention;
- Uncertainties inherent to urban environments;
- High requirements in terms of safety and robustness given the variability of situations;
- Latency and limited reliability of communications (variable delays, packet loss, temporary interruptions, etc.);
- Risk of cognitive overload (dense traffic, parking, interactions with pedestrians, ambiguity in other users' intentions, etc.).

Haptic shared control therefore appears as a key solution to optimize cooperation between onboard automation and remote human decision-making. It helps restore reliable sensorimotor perception despite distance, network delays, and the absence of direct physical feedback. This *human-in-the-loop* paradigm is also a strong lever for societal acceptance and technological maturation.

Objectives and main missions

This postdoctoral project is part of Axis 3 (WP4) of the CPER RITMEA program (Research and Innovation in Eco-Responsible and Autonomous Transport and Mobility). Its goal is to develop new human–machine shared-control strategies integrating haptic guidance, in order to ensure safer, more intuitive, and more robust teleoperation.

These solutions will strengthen the performance and safety of mobility services relying on tele-driving, such as remote taxi operations, remote takeover of autonomous or semi-autonomous vehicles, and improved accessibility for PRM.

The main objective is to design, evaluate, and validate effective and reliable shared-control strategies integrating predictive haptic guidance to enable safe teleoperation in complex environments. The work will focus on:

- Dynamically distributing control authority between the human operator and the autonomous vehicle, according to the driving context, cognitive workload, confidence in sensors and algorithms, and network communication quality;
- Assisting the remote operator during complex maneuvers (parking, dense traffic, intersections, interactions with vulnerable road users);
- Ensuring functional safety, including in cases of partial or intermittent communication loss;
- Improving operator experience by integrating physiological and behavioral measurements (cognitive workload, stress, distraction, etc.).

Developments will first be validated on LAMIH's SHERPA simulator, then ported to the laboratory's experimental vehicles (PRIVAC and SHIFT) for testing on the Gyrovia test track (Transalley Technopole, near the UPHF campus).

The dissemination of results through demonstrations (simulator and experimental platform) and scientific publications will be an important objective of the mission.

The PRIVAC and SHIFT platforms, the LAMIH SHERPA simulator, and the Gyrovia test track at the Transalley Technopole (UPHF, Valenciennes).

Required Knowledge and Skills

Candidate Profile

The candidate should have solid experience with a multidisciplinary approach. More generally, the position is open to researchers in Control Engineering, with strong skills in modeling, state estimation, and control of complex systems, as well as a strong interest in human-machine systems and experimental validation. Experience in teleoperation, mobile robotics, or human-robot interaction will be considered a valuable asset.

The candidate should also possess competencies in industrial computing (Matlab/Simulink, real-time architectures and programming, C language) and a good understanding of network-related issues (latency, packet loss, etc.).

Contact and Application Submission

Candidates should send their detailed CV, motivation letter, and recommendation letters to: Chouki Sentouh (Chouki.Sentouh@uphf.fr)

References:

[1] Quentin Gadmer, Human-Machine Cooperation for the deployment of autonomous trains-Driver assistance in a remote authority transfer situation. PhD thesis, Université Polytechnique Hauts de France, octobre 2024.
[2] Mohamed Oudainia. Contrôle partagé adaptatif et élaboration de stratégies de conduite personnalisées pour le véhicule automatisé : une approche par apprentissage progressif. PhD thesis, Université Polytechnique Hauts de France, décembre 2023.
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[4] Glida H., Sentouh C., Chelihi A., Ménard T., Farza M., Popieul J.-C. (2025). Event-triggered shared control for lane keeping assist system in steer-by-wire vehicles under unknown dynamics and actuator failure. Control Engineering Practice, 165:106566, ISSN 0967-0661. DOI=10.1016/j.conengprac. 2025.106566.
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[6] I. Bellamri, A. Benine-Neto, X. Moreau, G. B. H. Frej and F. Aioun, "Speed Limitation for Remote Control of Automated Vehicles*," *2025 33rd Mediterranean Conference on Control and Automation (MED)*, Tangier, Morocco, 2025, pp. 292-298, doi: 10.1109/MED64031.2025.11073521.
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[9] Sentouh C., Fouka M., Rath J., Popieul J.-C. (2024). Adaptive Observer-Based Output Feedback FTC for Nonlinear Interconnected Vehicle Dynamics with Unknown Actuator Faults. IEEE Transactions on Intelligent Vehicles. DOI=10.1109/TIV.2024.3384547.
[10] Glida H., Sentouh C., Chelihi A., Floris J., Popieul J.-C. (2024). Event-Triggered Adaptive Fault-Tolerant Control Based on Sliding Mode/Neural Network for Lane Keeping Assistance Systems in Steer-by-Wire Vehicles. IEEE Transactions on Intelligent Vehicles. DOI=10.1109/TIV.2024.3430086].
[11] Sentouh C., Nguyen A.-T., Benloucif M., Popieul J.-C. (2019). Driver-Automation Cooperation Oriented Approach for Shared Control of Lane Keeping Assist Systems. IEEE Transactions on Control Systems Technology, 27 (5), pp. 1962-1978.
[12] Benloucif M., Nguyen A.-T., Sentouh C., Popieul J.-C. (2019). Cooperative Trajectory Planning for Haptic Shared Control between Driver and Automation in Highway Driving. IEEE Transactions on Industrial Electronics, 66 (2), pp. 9846-9857, ISSN 0278-0046.
[13] Nguyen A.-T., Sentouh C., Popieul J.-C. (2017). Driver-Automation Cooperative Approach for Shared Steering Control under Multiple System Constraints: Design and Experiments. IEEE Transactions on Industrial Electronics, 64 (5), pp. 3819-3830, ISSN 0278-0046. DOI=10.1109/TIE.2016.2645146.