Socially compliant motion planning for autonomous vehicles

MSc. Project Proposal at the Autonomous Multi-Robots Lab, Cognitive Robotics, TU Delft

Description: You will join a team of researchers within the context of the project "Sustainable Transportation and Logistics over Water: Electrification, Automation and Optimization (TRiLOGy)" funded by the Dutch Research Council (NWO). In this project, we will investigate (i) fleet management decisions at the high level and (ii) autonomous navigation methodologies for autonomous vessels in urban canals. You will work on the second topic, autonomous navigation.

The objective of this thesis is to develop a motion planning method for navigation in inland waterways, among other manned and unmanned vessels. The main challenge to ensure safe and efficient navigation of autonomous vessels in urban waters is that of generating safe trajectories that (i) consider the complex dynamics of the vessel, (ii) coordinate with other traffic participants and (iii) show socially-compliant behavior. The developed motion planner will closely interact with the perception modules of the autonomous vessel. A typical scenario is that of crowded canals and intersections, where efficient navigation can be achieved with tight coordination among the interacting participants. The intended approach is to rely on online trajectory optimization methods, such as model predictive control and incorporate regulations and/or data-driven models of real vessel trajectories.

You will test your approach in experiments with an autonomous vessel at the Researchlab Autonomous Shipping (RAS) or at the Amsterdam Institute for Advanced Metropolitan Solutions.

Desired qualities:

- Motivated and independent
- Good problem-solving skills
- Experience/interest in motion planning, constrained optimization, MPC and/or autonomous navigation
- Experience in Python/C++ programming and Robot Operating System (ROS)

For further questions or to apply, please contact Ass. Prof. Dr. J. Alonso-Mora <j.alonsomora@tudelft.nl>. When applying, please provide a short motivation, up to date CV, a transcript of your current degree program and intended start date.

References:

[1] B. Brito, B. Floor, L. Ferranti and J. Alonso-Mora, "Model Predictive Contouring Control for Collision Avoidance in Unstructured Dynamic Environments", in *IEEE Robotics and Automation Letters (RA-L)*, Jul. 2019

[2] H. Zhu, and J. Alonso-Mora, “Chance-constrained collision avoidance for mavs in dynamic environments,” *IEEE Robotics and Automation Letters*, vol. 4, no. 2, pp. 776–783, 2019.