ROYAL INSTITUTE OF TECHNOLOGY

ACCESS the future

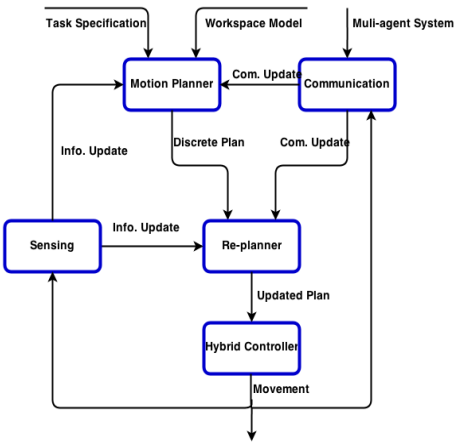
Centre for Autonomous Systems

Master Thesis / Semester Project

Motion and Task Planning for Autonomous Vehicles under Temporal Logic Specifications

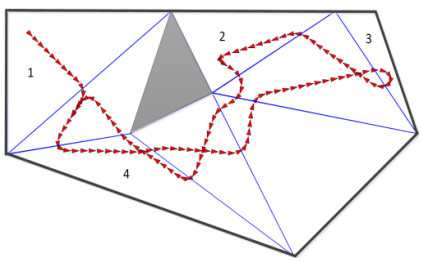
Description:

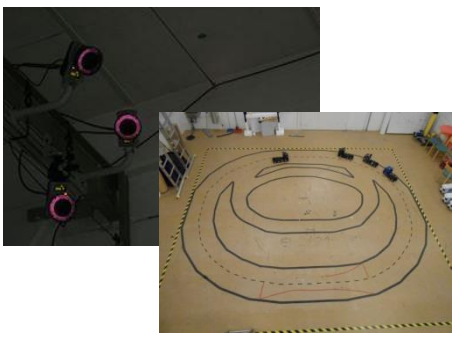
Temporal-logic-based task and motion planning (TMP) provides a fully automated correct-by-design controller synthesis approach for single or multiple autonomous vehicles, under much more complex missions than the traditional point-to-point navigation. A high-level discrete plan is first found by the off-the-shelf model-checking algorithms [1]. This plan is then implemented through the corresponding low-level hybrid controllers. Some interesting examples can be found in robotic team deployment [2] and symbolic motion planning [3],[4].



The goals of this Master Thesis project are to: (1) learn the state-of-art TMP algorithms [5]; (2) construct the framework as Python scripts; (3) implement relevant demonstrations in the **Smart Mobility Lab**.

An experimental testbed for autonomous vehicles has been built at the **Smart Mobility Lab.** The primary architecture of the testbed is shown in the figure above, consisting of the Qualisys MotionCapture system, distributed wireless sensor networks, several Nexus ground Vehicles. This testbed is an excellent practical system to implement and evaluate the TMP for automated cooperative guidance and control of the autonomous vehicles.





Prerequisites:

Good at Python, Courses in Automatic Control and general programming skills

Contact:

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Reference:

[1] C. Baier, J.-P Katoen. Principles of model checking. *The MIT Press*, 2008.
[2] X. Ding, M. Kloetzer, Y. Chen, C. Belta. Automatic deployment of robotic teams. *IEEE Robotics Automation Magazine*, 18: 75-86, 2011.
[3] C. Belta, A. Bicchi, M. Egerstedt, E. Frazzoli, E. Klavins, G. J. Pappas. Symbolic planning and control of robot motion. *IEEE Robotics and Automation Magazine*, 14: 61-71, 2007.
[4] S. L. Smith, J. Tumova, C. Belta, D. Rus. Optimal Path Planning for Surveillance with Temporal Logic Constraints. *The International Journal of Robotics Research*, 30(14): 1695-1708, 2011.
[5] M. Guo and D. V. Dimarogonas. Reconfiguration in Motion Planning of Single- and Multi-agent Systems under Infeasible Local LTL Specifications. IEEE Conference on Decision and Control, 2013.