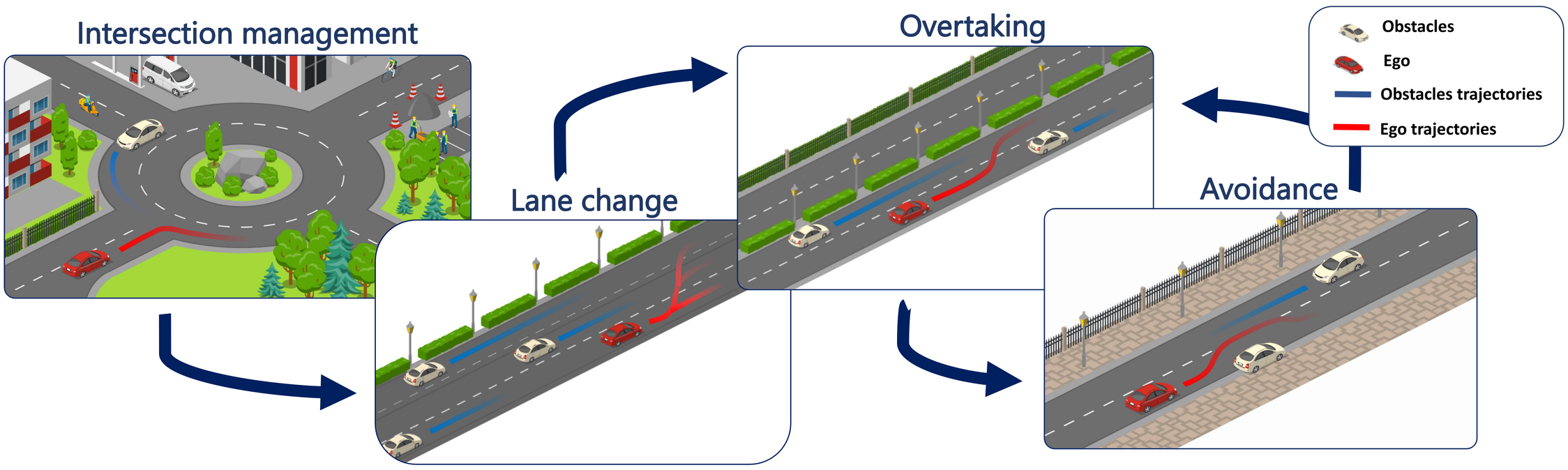
Flexible and Robust Multi-Controller Architecture for Autonomous Navigation under Risky Situations

Kévin Bellingard[1,2], Lounis Adouane[1] and Fabrice Peyrin[2]

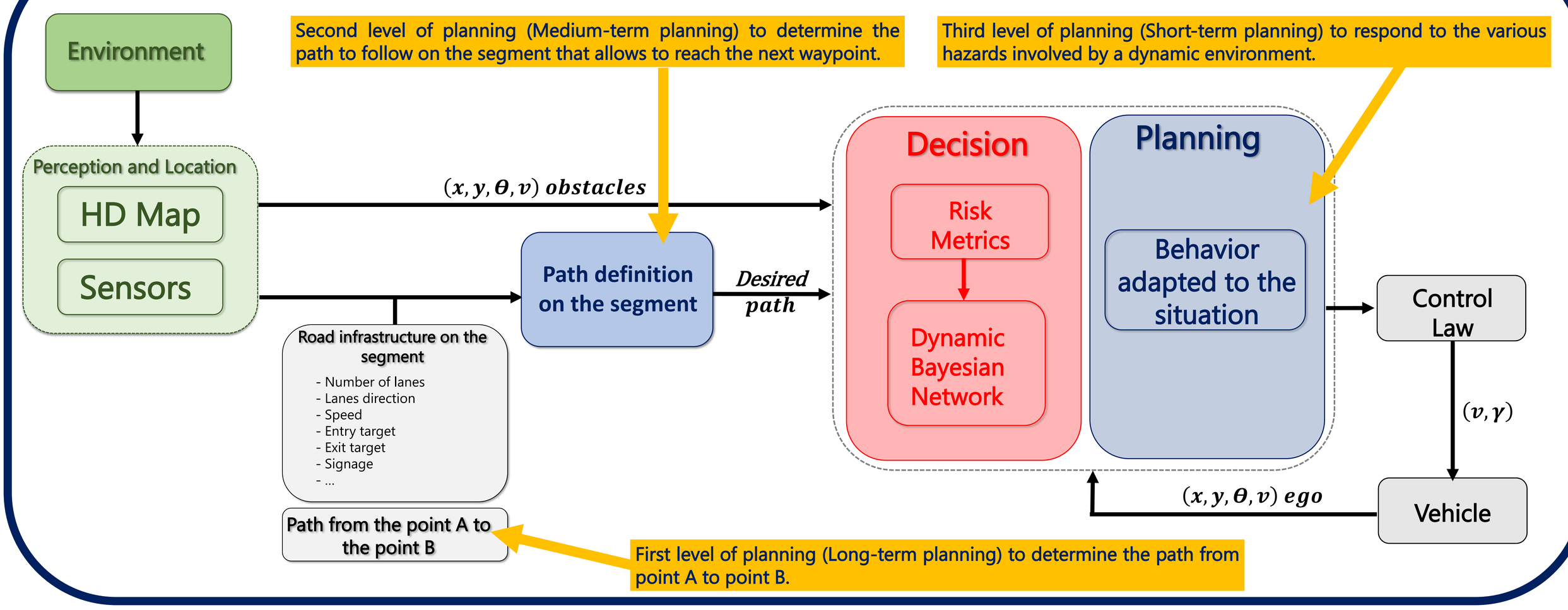
Objective

- Move from point A to point B in a constrained and dynamic urban environment
- Take into account the road infrastructure
- Adapt to the dynamic environment
- Take into account the uncertainties of perception and location, as well as the intensions of other vehicles



The final control architecture must be **flexible** and **robust** enough to be able to carry out all identified use cases as well as controlled transitions between them.

Proposed Control Architecture



Scientific contribution

The aim of this paper **[1]** is to **assess** and **manage the risk of collision** with the surrounding obstacles (mainly the one coming from behind) during the overtaking maneuver, and this while taking into account the new dynamic of the surrounding obstacles and the actual actuation capacity of the Ego-Vehicle (its maximum velocity and acceleration). This is done by using a new metric proposed which is the **Distance Awareness for Adaptive Velocity Profile (DA-AVP)** based on Dynamic Predicted Inter-Distance Profile (D-PIDP) [2] and including a safety margin while achieving the maneuver. This velocity profile is applied on the preplanned path based on an Elliptic Limit-Cycle [3].

Vidéo Simulation

Figure. Scenario with the positionning of vehicles from t_0 which is the time of avoidance decision-making, to t_f which is the end of the maneuver time.

References

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[2] D. Iberraken, L. Adouane and D. Denis, "Safe Autonomous Overtaking Maneuver based on Inter-Vehicular Distance Prediction and Multi-Level Bayesian Decision-Making," 21st International Conference on Intelligent Transportation Systems (ITSC), 2018, doi: 10.1109/ITSC.2018.8569401.

[3] Adouane, L. : Reactive versus cognitive vehicle navigation based on optimal local and global pelc. Robotics and Autonomous Systems, 88 (11), 2016.

Contacts

[1] Université de technologie de Compiègne, Heudiasyc (UMR CNRS/UTC), Compiègne, France FirstName.Lastname@hds.utc.fr
[2] Sherpa Engineering, R&D Department, Nanterre, France
[k.bellingard, f.peyrin] @sherpa-eng.com