

AUTONOMOUS VEHICLE LOCALISATION AND CONTROL

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Abstract

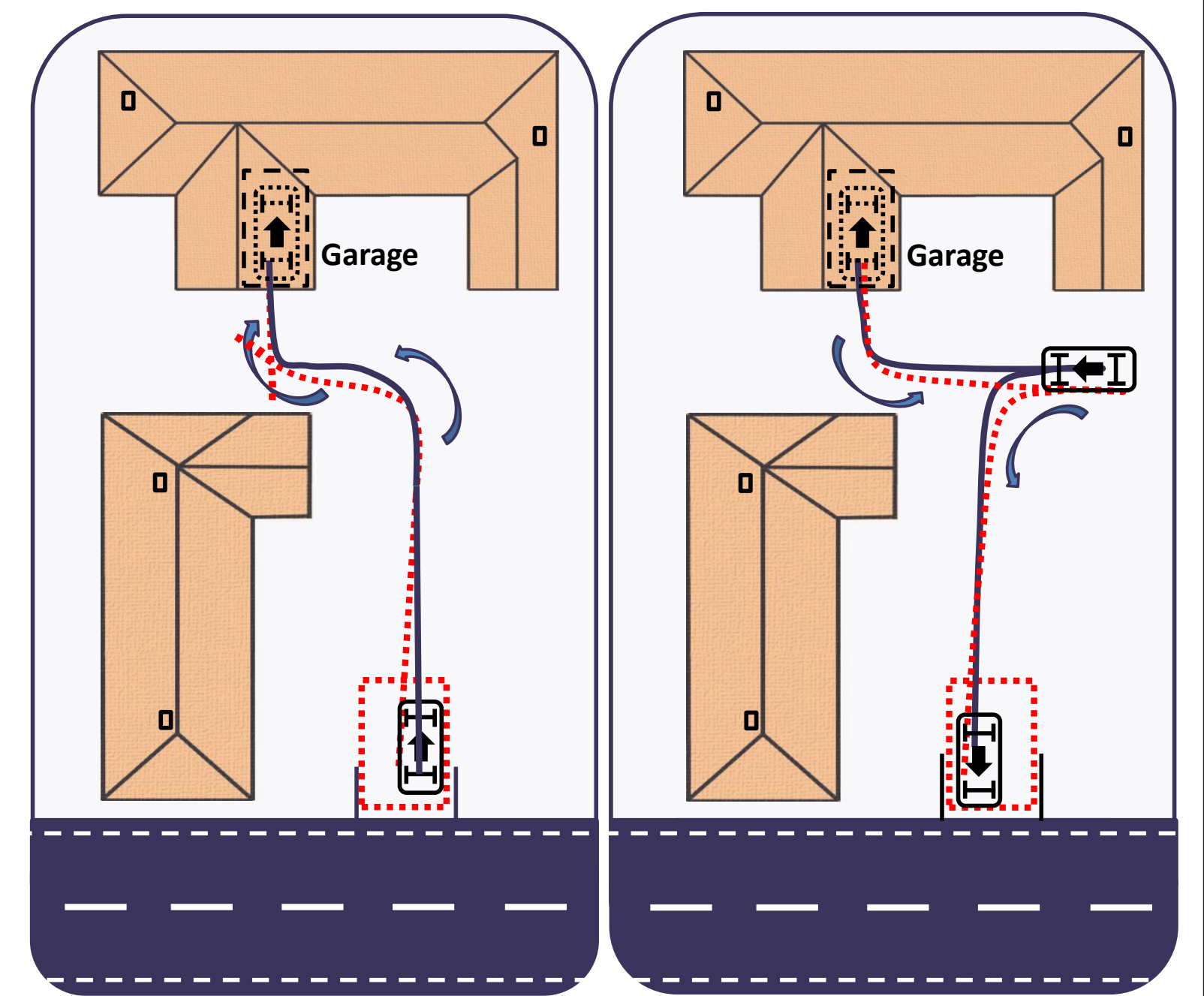
Autonomous driving, although demonstrations showed that it is possible, still remains a major challenge due to reliability, costs and legislation.

The objective of the thesis is to in-depth research and to develop an intelligent vehicle system for safe and fully automated driving in private designated areas.

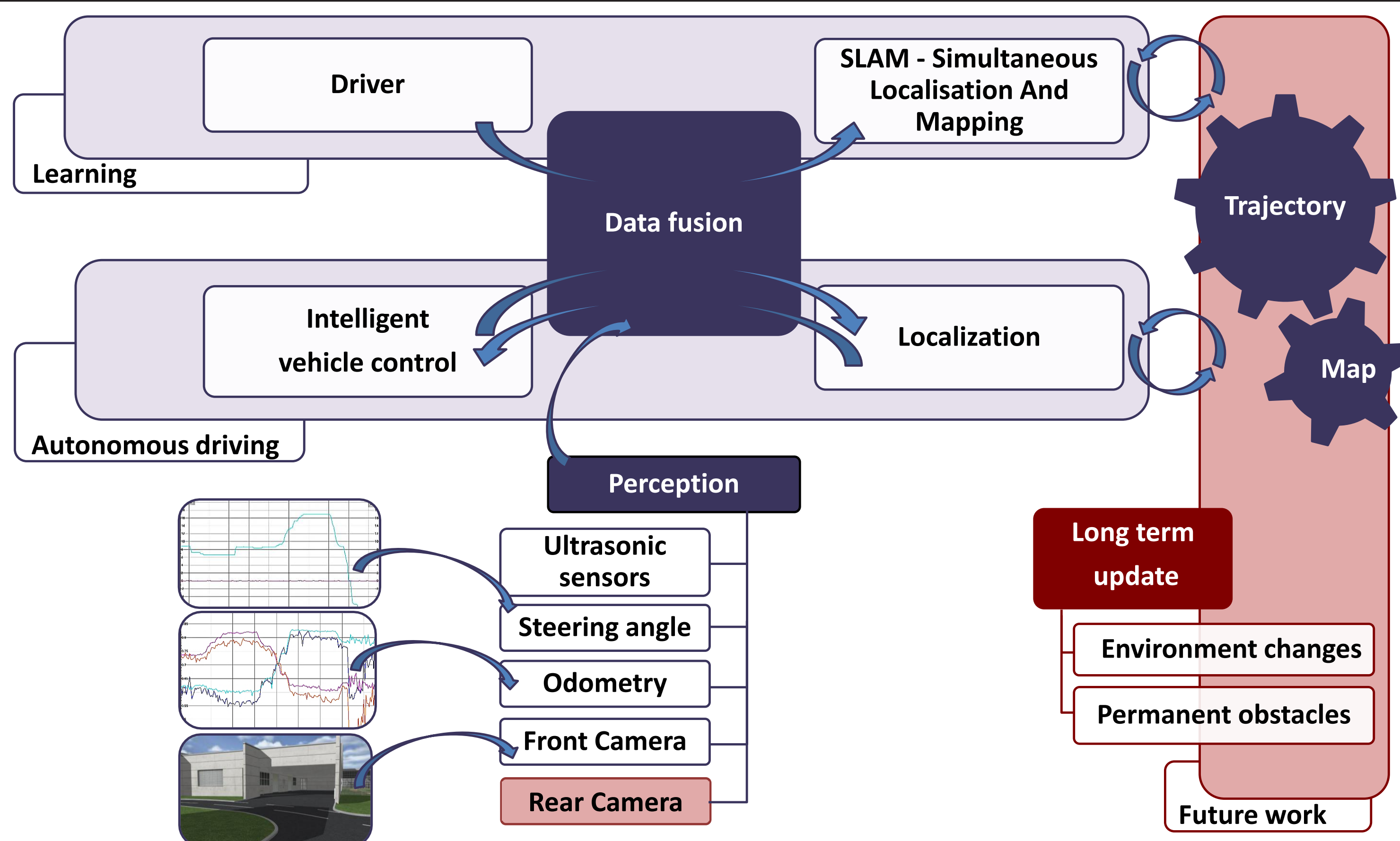
In order to do that, the driver must drive the car to and from the garage. In this way, the car learns a map and it will be able to drive itself on a optimized path to and from the private garage, once it's at home.

Home parking valet

- Driver teaches the driving path to the car
 - The system must learn the trajectory and the environment before use
- Replay of driving path
 - Landmarks are automatically recognised in the previously learned map
 - Automatic driving to target position (Garage \leftrightarrow Drop-Off/Pick-Up Zone)
 - Obstacle avoidance
- Optimisation / continuously update
 - Map
 - Trajectory

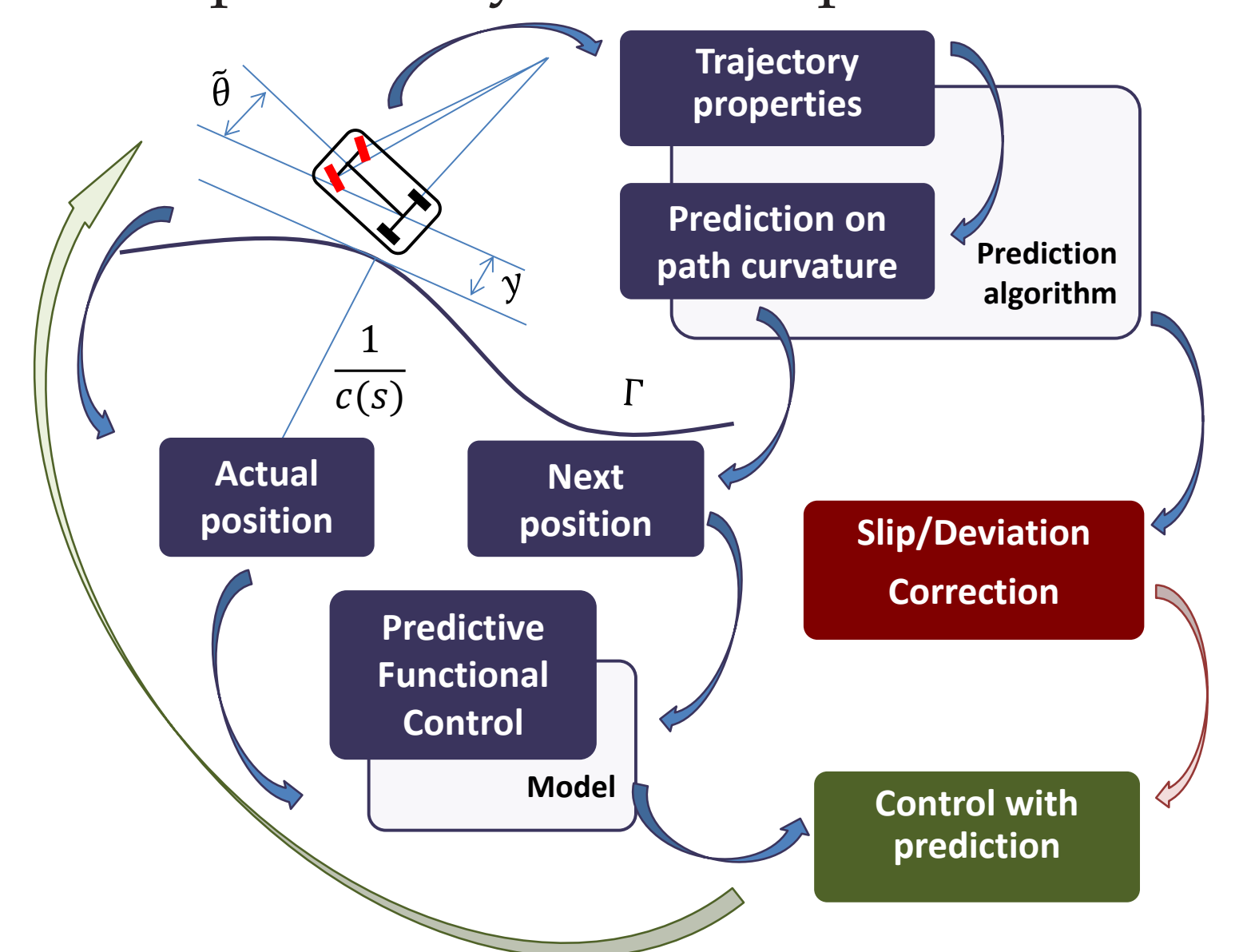


Global approach



Vehicle control

Automatic longitudinal and lateral control on previously recorded path.



Difficulty: low manoeuvrability of vehicle at low speed and the probable presence of breakpoint or obstacles

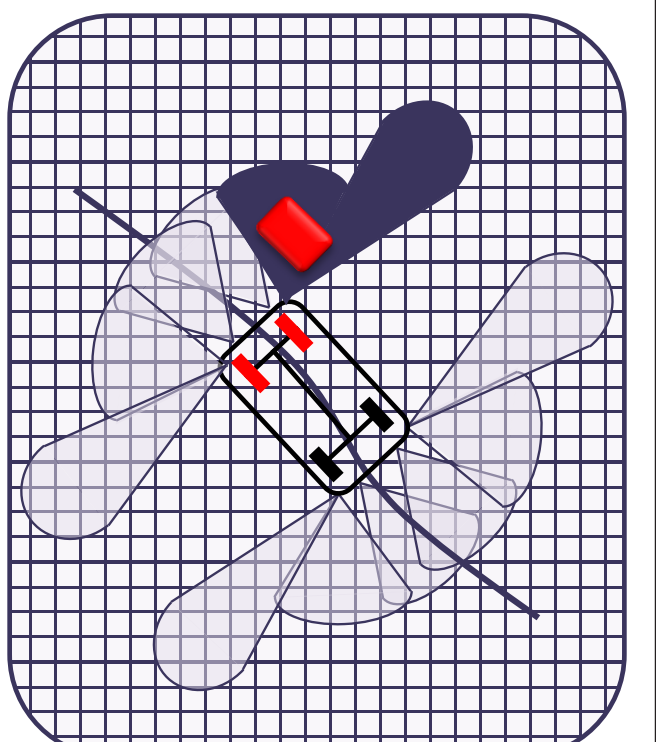
State of progress

- Algorithms implemented on a platform of multi-sensor data fusion
 - monocular SLAM and re-localisation using front camera
 - occupancy grid map using ultrasonic sensors
 - vehicle control for path following
- Firsts tests of data acquisition and control were successfully made on a real-time simulator



Obstacle avoidance

Ultrasonic sensors are used to detect obstacles. An occupancy grid map is computed in order to continuously update the traversable area and the trajectory.



Future work

- Bi-Monocular SLAM
 - Use also a rear camera to improve the precision of localisation in both navigation directions
- Improvements of visual localisation algorithms
 - Update map and trajectory considering environmental changes (like seasons or permanent obstacles)
- Trajectory re-planning to avoid obstacles on path
- Transfer of solutions and tests on real vehicles



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