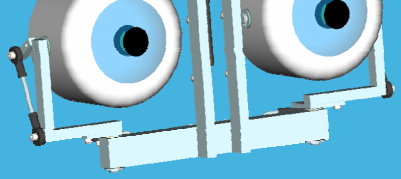
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

AUTONOMOUS SYSTEMS LAB



Autonomous vehicle navigation

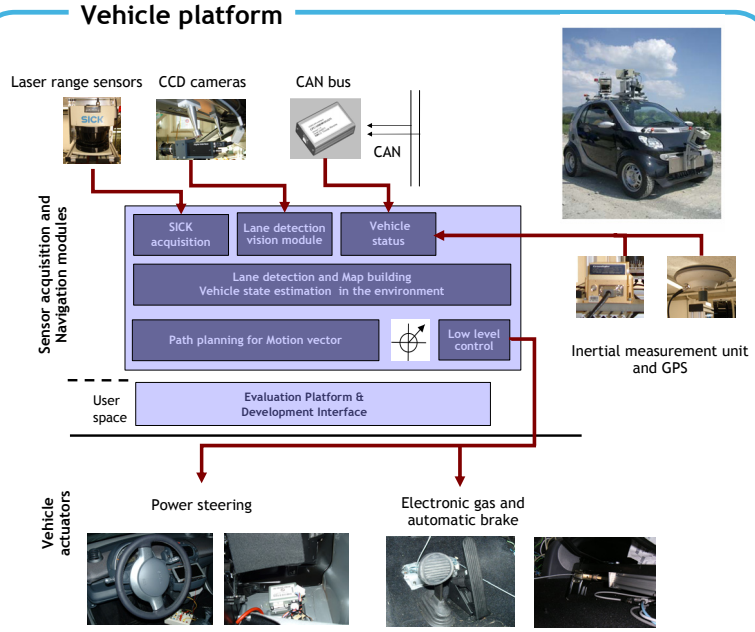
Motivation

- Introducing vehicles in traffic that have a high level of autonomy could increase the general traffic safety;
- Accidents in particular with pedestrians and other vehicles could be avoided or minimized;
- Traffic flow could be optimized with greater number of vehicles per road area;
- By optimizing the driving pattern the benefits could also be environmental, i.e. less pollution.

Objectives

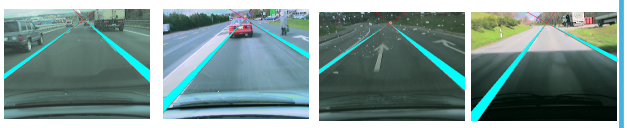
- The main goal of this project is to develop a motion planning strategy for dynamic urban environments, i.e. finding a feasible path among other vehicles and pedestrians, within the environment constraints imposed by the road structure;
- Model the road structure and local surrounds while detecting objects of interest, such as other vehicles and pedestrians for autonomous navigation purposes;
- Define the level of mitigation between driver and vehicle navigation system in nominal and critical situations.

Vehicle platform

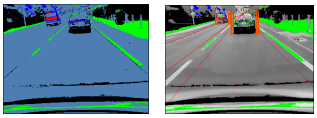


Environment perception

- Lane detection is performed under various real-road conditions for local environment representation and lane keeping navigation module;

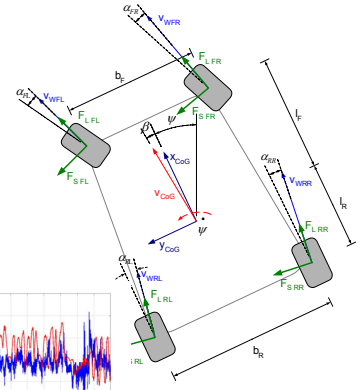


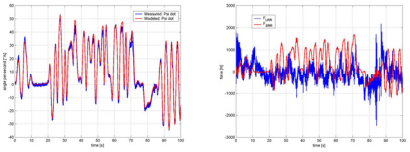
- Vehicle detection performed on color and gradient information with a particle tracking scheme for tracking.



Vehicle dynamics modeling

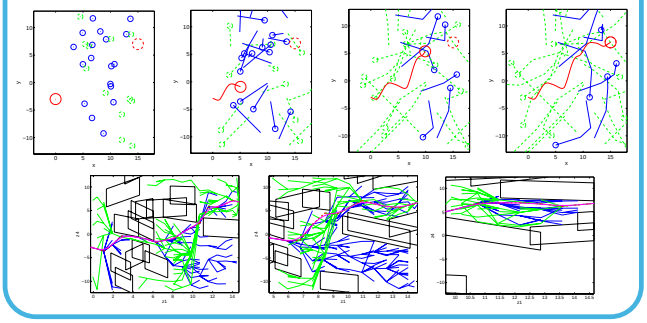
- Vehicle dynamics is modeled according to the physical vehicle to road contact characteristics.
- Example 1: Inertial measurement unit rotational speed of the vehicle compared to dynamic vehicle model with vehicle odometry data;
- Example 2: Longitudinal and lateral forces acting on the rear right wheel (model calculation).





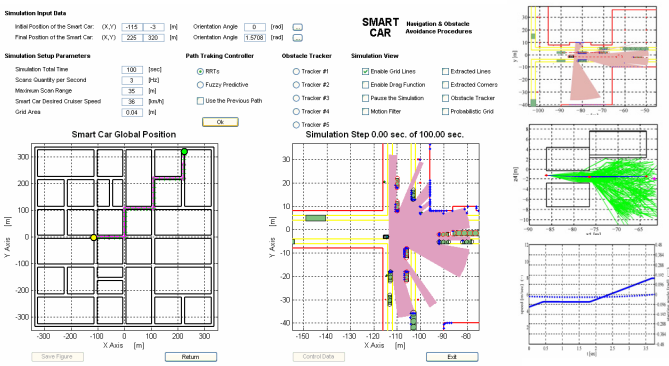
Motion planning in dynamic populated environments

- Trajectory to a global objective is calculated among moving obstacles based on Random Expanding Trees search for free-space and B-splines for feasible robot velocities;
- Potential collision check for each obstacle (example: blue obstacles are potentially dangerous).



Motion planning in dynamic urban environments

- Motion planning strategy for urban dynamic scenarios is developed with local vehicle perceptual modeling and generation of a feasible path among other moving vehicles and pedestrians



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