Context B. Smart Mobility: Connected and automated

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The vision of our future transportation system is that we are able to radically improve the accessibility, efficiency and safety by developing new vehicles, functions and services that take advantage of the rapid advances in sensor, information, and communication technologies. In particular we foresee huge benefits from increased use of real-time management, planning and control.

People, vehicles, goods and infrastructure are being connected in a huge communication network where large amounts of data and information are shared and where anything can be monitored, managed and controlled. This emerging information and communication infrastructures give completely new ways of improving the efficiency and safety of transport. We already see many examples of cars and trucks that are used as probes for measuring the current traffic situation, to be used as real-time inputs to routing and speed advice optimizations; vehicles that sense, communicate and cooperate to increase safety and better utilize the road network, for example by forming autonomous platoons on the highway; and entire fleets of vehicles that are managed and coordinated to deliver goods and passengers timely at their destinations, while using as little energy as possible. The enabling information and communication technologies can provide very detailed data on the state of the transport system, and of the behavior and movement of people and goods, at resolutions and volumes we never had in the past. These data offer unique opportunities for research and development of intelligent, optimized and automated systems for decision support, planning and control.

In this context we aim at a deeper understanding of how to use the available information for development of an environment-friendly, cost-efficient and safe transport system, with the ultimate goal of eliminating fatal traffic accidents and reaching sustainable transportation in terms of energy consumption and emissions.

Project B3: Intelligent traffic intersections

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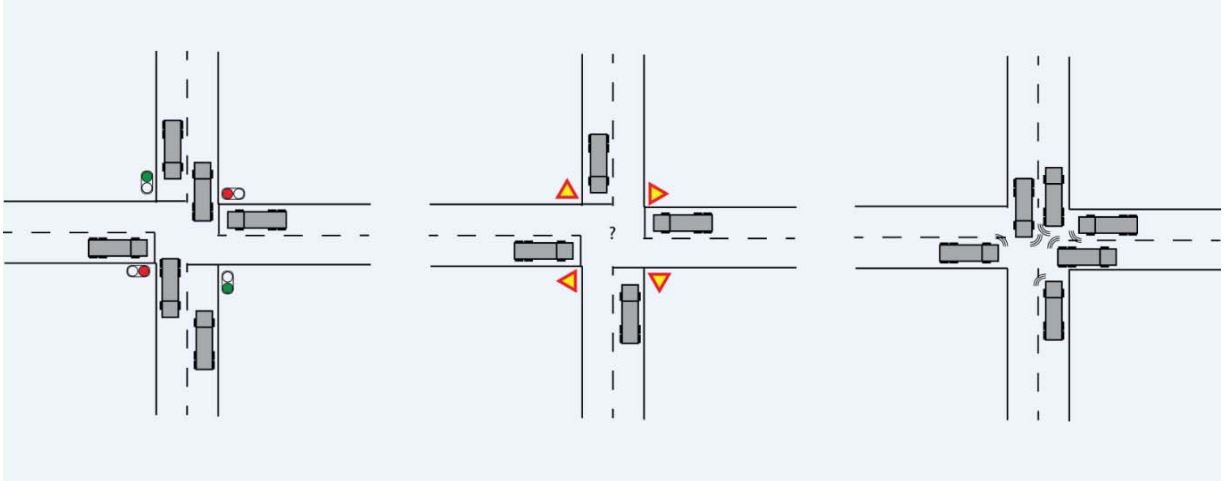

Traffic intersections are complicated for both human drivers and autonomous cars. A simple way to handle intersections is to introduce traffic lights to control the vehicles, but that also limits the capacity of the road since half the lanes are always closed. However, modern communication and control technology enable the intersection itself to manage the situation by commanding the vehicles directly or by sending speed requests to them. In this project you will study how such a system would be designed. Consider a four-way crossing where each incoming road has one lane and where all vehicles have the choice to drive straight through the intersection or to turn left or right. The project should address the following:

- Make a mathematical model of the intersection and the vehicles, including the “driver behavior” when following another vehicle.
- Model the information exchange between the vehicle and the intersection. Determine which variables would be transmitted and consider data rates, radio range and disturbances and other error sources.
- Design the control algorithm of the intelligent intersection.
- Create a simulation of the controlled intersection. Simulate several different scenarios and verify that the proposed solution works as intended. Study the performance of the system when the number of vehicles increases. Compare with a standard traffic light solution.
- Discuss the advantages and possibilities as well as the disadvantages and limitations of the proposed solution.
- Reflect upon the role of intelligent traffic intersections in a sustainable transport system.