MONTEREY WORKSHOP

Presentation of the automatic motorway case study

1 Case study: the automatic motorway

Let us briefly present the principles of the case study : the automatic motorway (see figure 1. It is, extracted from previous works [2, 1, 3] and a cooperation with LIVIC (Laboratoire sur les Interactions Véhicules-Infrastructure-Conducteurs).

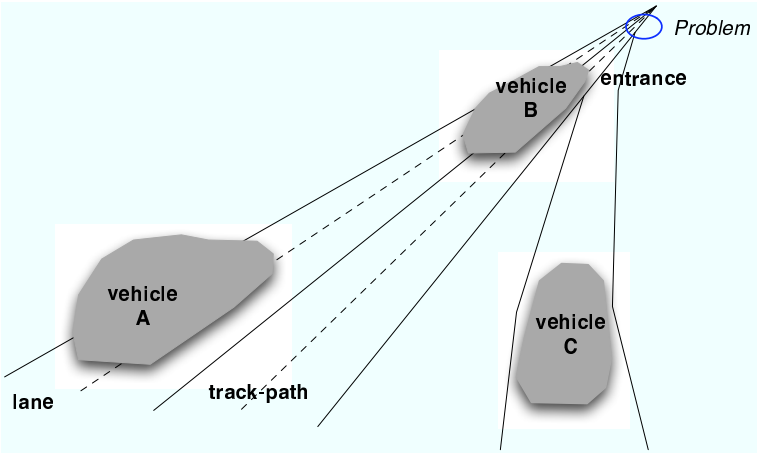

Figure 1: Structure of the automatic motorway.

An automatic motorway is a road with two lanes and, regularly, exits and entrances. The road itself should have as few monitoring elements as possible since the cost is very high. So far, we assume that there is a track-path that enables vehicles to detect curves, entrances and exits. It only accepts especially equipped vehicles (trucks for example).

Each vehicle is able to automatically follow the track-path and get information from it. They are also equipped with radars and sensors to evaluate the distance to the vehicle in front as well as to the vehicle behind (if any).

Vehicles are also able to communicate with each other and propagate any information that could be necessary. The idea is here to study several implementation strategies of the system to guarantee properties such as:

1. When a problem occurs (for example, an obstacle), propagation of the information among vehicles avoids collisions (e.g. information about that is not only detected locally by radars, but when B detects the problem — see figure 1, it forwards it to A that anticipates it).

2. When a vehicle (C in figure 1) enters the motorway, it smoothly gets into the traffic. Similarly, a vehicle must exit the motorway whatever the conditions after the motorway exit.

3. The two lanes are used to avoid collisions (changing lane should be investigated).

The main interest of this study is to evaluate our methodology on several points:

- its capability to capture the behaviour of physical elements (such as the relation between braking distance and speed according to parameters of the car),

- its capability to scale up in order to consider realistic situations,
- its capability to evaluate the impact of some parameters (maximum speed allowed, density of traffic, etc.) on the system reliability.

References

[1] E. Dolginova. Safety verification for automated vehicle maneuvers. Master's thesis, Department of EECS, Massachussets Institute of Technology, 1998.

[2] F. Eskafi. *Modeling and Simulation of the Automated Highway System.* PhD thesis, Department of EECS, University of California, Berkeley, 1996.

[3] R. Horowitz and P. Varaiya. Control design of an automated highway system. In *Proc. of the IEEE 88(7)*, 2000.