Study of the lane change maneuver: automated driving use case

Ray Lattarulo and Joshué Pérez

Tecnalia Research and Innovation,
Parque Científico y Tecnológico de Bizkaia, Geldo Auzoa, Edif. 700, 48160 Derio, Bizkaia
{rayalejandro.lattarulo,joshue.perez}@tecnalia.com
www.tecnalia.com/en/

Extended abstract

Nowadays, the idea of a completely interconnected city with infrastructure, vehicles and even the humans on a connectivity loop is a reality. They are commonly found on the people's everyday life. For instances, smart phones applications are capable to interact with the some city devices, and even with automated driving functions. All these characteristic have been well-received by users around the world, even the idea of automated vehicles. Some studies shows than 55 percent of the population would like to take rides on automated vehicles and even more than 65 percent on a partly automated vehicle [1].

With the evolution of the Intelligent Transportation Systems (ITS) in the last decade, a great variety of ADAS systems have been tested accomplishing the deployment of them in commercial vehicles as: lane departure warning and assistance, automatic parking, blind spot monitoring, among others. Most of them are based on on-board sensors as radars, LiDAR, cameras, ultrasonic sensors and communication V2X [2]. But in the case of a complete automated driving there are still a great variety of different scenarios to be tested to accomplish the commercial deployment of a SAE level 4 and 5 of automation [5].

Great varieties of tests related have been performed on highways. However, planning constrains and control techniques have been implemented but not in an extensive way as the first two cases [3]. One of the big and interesting challenging scenarios is the lane change maneuver. This scenario is defined by a series of constrains and conditions given by the perception systems, as detection of the environment and obstacles, and others of control part, as speed considerations and even communication with another vehicles.

On the current paper, the control architecture implemented was made based on [4] and the approaches are related with the behavioral planner on the decision block for the Lane Change maneuver on Highways. We are considering the information obtained from the sensors as frontal LiDAR and cameras to detect obstacles on the road, and communication with other vehicles to coordinate in a cooperative way the maneuver.

Three possible stages were established to validate the maneuver. The first is the generation of a parametric (continuous) curve to change the lane, considering

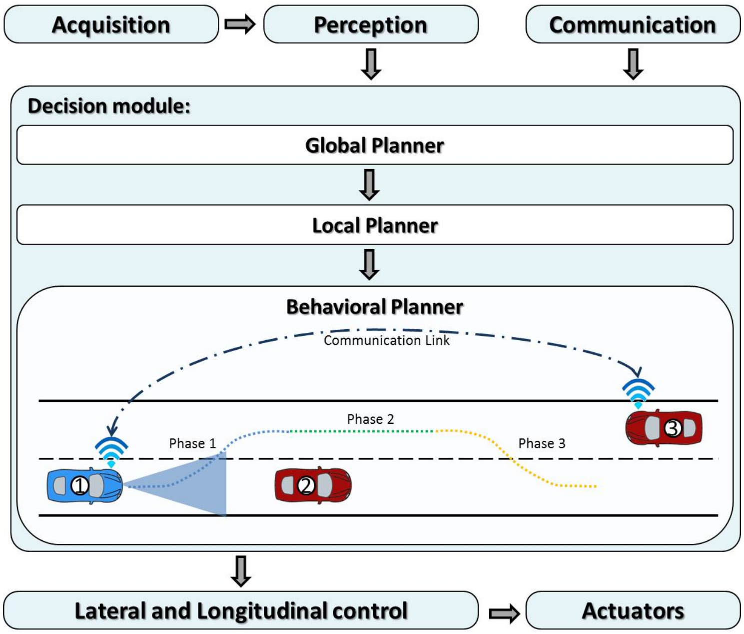

Fig. 1. Control architecture in detail with obstacle avoidance.

the possibilities that a vehicle could come on the opposite direction and the total time to recreate the maneuver. The second stage is to overtake the other vehicle in the opposite lane (adding a secure distance in front of the overtaken vehicle) and the third stage is the return of the vehicle to the lane.

The implementation of these algorithms and the control architecture was performed in a simulator based on simulink, and with the capabilities of simulated the dynamics of the vehicle, called Dynacar [6].

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