Autonomous intersection crossing

Background

In Europe, intersections-related accidents are responsible for 21% of traffic related deaths and 43% of the non-fatal injuries. Due to the high risk of accidents, these traffic scenarios are among the most regulated, with vehicles guided simultaneously by traffic lights, signs, road-markings and right-of-way rules. Consequently, they often form bottlenecks in the traffic system and even when not causing congestion, existing coordination rules are inherently inefficient, enforcing unnecessary decelerations and stops and thereby wasting both fuel and time. A safe system for coordinating automated vehicles through intersections is the next challenge for the automotive industry.

Problem description

A centralized system coordinates the control of automated vehicles, which appear randomly within a certain control radius. They may have different desired speed, as well as different acceleration and braking capabilities (e.g., light vs. heavy vehicles). The task in this project is to:

- Develop an intersection, e.g. in the form of a pretzel, such that vehicles may drive in loops and have intersecting paths.

- Create a centralized model predictive controller that calculates optimal speed trajectories for all the vehicles so that vehicles safely cross the intersection and deviate as little as possible from their individual preferred speed.

The control algorithms are to be evaluated in a platform with either small RC cars or Sphero bots. A video presentation of the platform can be found here.

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