Self-driving cars crossing road intersections

Autonomous driving is becoming a reality. By automating the road intersection crossing process, we can reduce accidents and decrease daily commuting times. To achieve this objective, we regulate the motion of each vehicle in relation to other vehicles with conflicting paths. In this way, vehicles avoid collisions. The implementation of this solution showed that it is possible to achieve a collision-free flow of vehicles through the intersection, which eliminates the need to wait for a traffic light to gain access to the intersection.

Nowadays, passenger cars are equipped with a wide range of sensors and actuators that allow for functionalities such as Cruise Control and GPS navigation. By adding wireless communication to the vehicles, we can design cooperative maneuvers that aim to make traffic safer.

A high percentage of collisions between vehicles occur at road intersections. Traffic lights help to reduce the amount of accidents but they also increase the commuting time. This is particularly more evident at peak hours.

To achieve safer and faster commuting of vehicles, we embrace the trend to design a methodology that allows vehicles to cross an intersection without stopping, in a safer manner.

The first step to achieve safer crossing, is to develop a control strategy that allows a vehicle to follow some given path. The second step is to define all the possible crossing paths through the intersection. Given these paths and vehicles with the ability to follow them, we can regulate the relative motion between vehicles, such that they are always at a safe distance from each other. The final step is to determine a crossing sequence that minimizes the time that it takes a vehicle to cross the intersection.

A simulation study shows the benefits of the continuous vehicle flow using our methodology. This has been compared to the intermittent flow regulated by traffic lights. The benefits are a smooth dynamical behavior of the vehicles, characterized by low acceleration levels. Moreover, since vehicles do not come to a standstill, we also eliminated the time that vehicles spend waiting in front of a green traffic light.

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