V2I Intersection Control Algorithm

CE assignment introduction and approach

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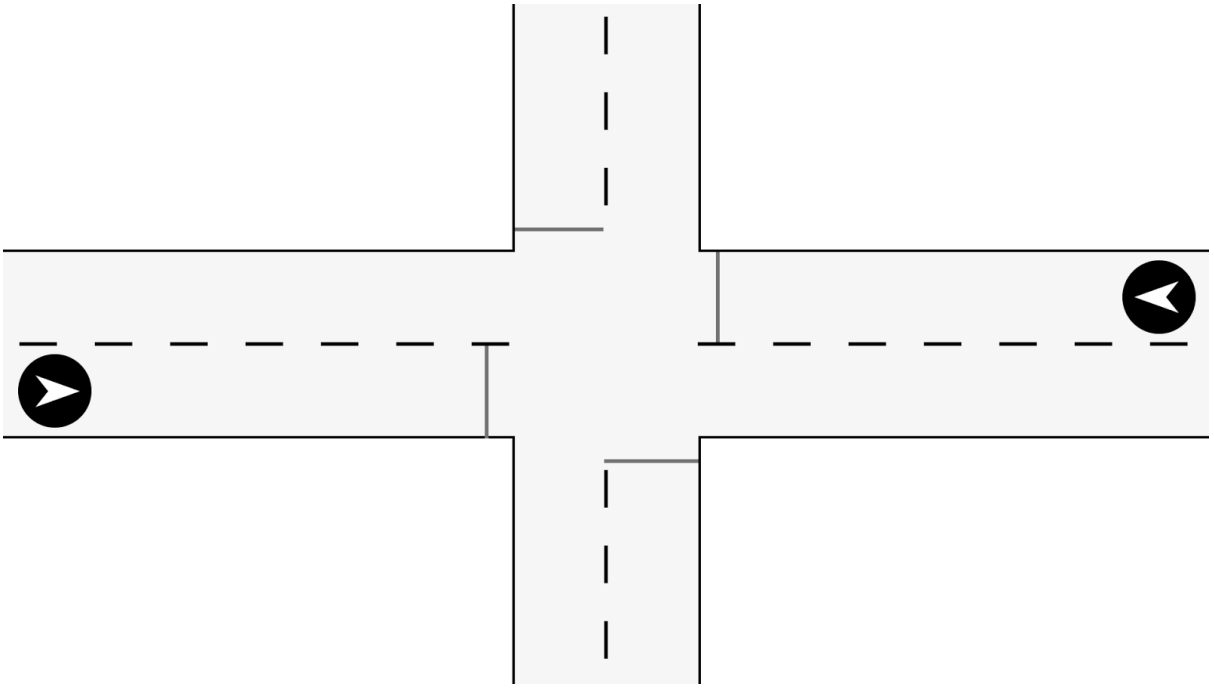

Creative Engineering (CE)

Creative Engineering is a minor of half a year at the Rotterdam University of Applied Sciences (RUAS). In this minor you are working on your own innovative engineering project. The goal of the minor is to make students more open to collect data from different fields of interests and using the data creatively to proceed with their own project.

Contents

1. Introduction

With this assignment we are making a vehicle-to-infrastructure (V2I) communication algorithm for more efficient intersections. A major technical challenge to overcome is creating an algorithm that can control the traffic on an intersection with various road situations. We will start by controlling the traffic lights but later on we will be minimizing the use of traffic lights overall to create a fluent flow of vehicles.

Emerging wireless technologies for vehicle-to-vehicle (V2V) and V2I communications are creating opportunities to increase the flow on an intersection while increasing fuel efficiency [4]. Cars are evolving very rapidly nowadays and companies like Tesla Inc [1], Mercedes-Benz [2] and Toyota [3] are just a view of the company's investing in new technologies that make traffic more autonomous.

2. Abbreviations

Abbreviations used in this document:

CE	Creative Engineering
ICA	Intersection Control Algorithm
RUAS	Rotterdam University of Applied Sciences
V2I	Vehicle-to-Infrastructure
V2V	Vehicle-to-Vehicle

3. Vision

Vehicles are getting more aware of their surroundings because companies are placing more sensors on their vehicles. With all the data generated by the sensors companies are making algorithms that help the driver on their way. These algorithms are getting better and better and will provide fully autonomous driving. For example Tesla’s autopilot [1], which can already drive fully autonomous. More vehicles will be getting this feature and the price of these vehicles will decrease over time. This way more people will be able to afford an autonomous vehicle.

Apart from that, vehicles will be able to talk to each other and to the infrastructure on the road. By transferring data with each other vehicles and infrastructure will be able to calculate more efficient routes and advise the speed of vehicles. This will result in traffic moving more fluently which means less time waiting in traffic and a more efficient use of fuel [4].

Within 20 years you will be able to give your vehicle a destination and it will drive there fully autonomous. In the meantime you can relax, read a book or work on your laptop. There is no need for a steering wheel and you don’t need to be focused on the road, everything will happen autonomous.

4. Target

The target of this assignment is as follows: create a V2I algorithm that controls the flow of vehicles crossing an intersection and minimizes the time vehicles need to wait.

5. Approach

The RUAS greatly supports the idea of following your intuition to solve a problem. This idea of learning is different from most learning programs where it's normal to follow a strict set of actions and reports. This means that there is a lot of freedom involved in doing this project and in our opinion this works really well.

To achieve the target we set some subgoals to make the target more approachable. The first subgoal is: an algorithm for an intersection with traffic lights, that sends an advise speed to the vehicles driving towards the intersection. This way vehicles will be able to cross the intersection without stopping more often because vehicles are entering the intersection when the light turns green.

After that we'll focus on making the ICA for an intersection where autonomous vehicles won't have to look at the traffic lights but will be able to communicate with other vehicles and the intersection. Together they will calculate the advise speed of every vehicle so no one has to stop and a fluent flow of vehicles is created.

We'll design the ICA to work on a great variety of intersections.

References

[1] Tesla's autopilot demonstration video,
tesla.com/videos/autopilot-self-driving-hardware-neighborhood-long

[2] Car-to-x communication by Mercedes-Benz,
mercedes-benz.com/en/mercedes-benz/innovation/car-to-x-communication

[3] Vehicle-Infrastructure Cooperative Systems by Toyota,
newsroom.toyota.co.jp/en/detail/4228471

[4] Mascha van der Voort and Martin van Maarseveen Apr 29, 2014, Design and Evaluation of a new-generation fuel-efficiency support tool, University of Twente,
researchgate.net/publication/228409804_DESIGN_AND_EVALUTION_OF_A_NEW-GENERATION_FUEL-EFFICIENCY_SUPPORT_TOOL