Intelligent Transport System with 3 Smart Components: Road, Traffic Light and Car

# Abstract

As autonomous vehicles are developed, we will shortly encounter fully connected transport system which cars do not need human control. Cars communicate with themselves and all traffic components e.g. road and traffic light. This report describes an algorithm how fully connected intelligent transport system operates. The goals of the algorithm can be summarized in four ways. Reducing average time to destination, managing load on the road, operating traffic components efficiently and dealing with emergency effectively.

# Introduction

The reason why we’re using the term ‘algorithm’, not policy, is the intelligent traffic system is probably run by a high functional computer rather than human.

We describe the algorithm how intelligent transport system operates in following circumstances.

* Fully automated driving which human control no longer needed.
* Fully connected traffic components, e.g. road, traffic light and car.
* Traffic components communicate and update their information in real time.
* Electronic road can shift centerline forward and backward.
* The system knows conditions of traffic components in detail.

## The goals of the algorithm.

* Reducing average time to destination.
* Managing load on the road.
* Operating traffic components efficiently.
* Dealing with emergency effectively.

## These three traffic components are mainly discussed in this topic.

* Car (fully automated).
* Road (with electronic variable lane)
* Traffic light

# The Road

Road is the way that cars are passing. Its lane is managed electronically. So, it operates its lane fluidly by certain situation, e.g. its centerline can be shifted.

The most important task of road is calculating congestion rate and the time consumed passing in real time.

Congestion can be described as following

Code of conduct

To reduce congestion rate, the road can act as following.

* If congestion rate of one lane has significant differences with opposite lane, road can shift centerline toward lane that has significantly less congestion rate.
* Can change speed limit of the road
* If road has an emergency, it can shut down some lanes.

Role

* Calculate congestion rate
* Calculate passing time

# The Traffic Light

Traffic lights determine the order of crossing intersections. In other words, cars must be waiting until they have a right signal. The traffic light is responsive to the cars that is waiting. So, it can skip the green light duration time or allocate extra time to specific road.

The most important task of traffic light is reducing average waiting time in its intersection. In this case, we assume there is only 4 road intersection in system.

Code of conduct

To reduce waiting time on intersection, the traffic lights act as following.

* Use marking as signal. Mark the cars approaching the intersection as pass or wait. The cars with pass mark can cross intersection and one with wait mark can’t.
* Can skip the signal when no cars are waiting to cross.
* Can allocate additional passing signal in certain condition, e.g. too high congestion rate.

# The Car

The car takes efficient way to get to the destination. The roads have the passing time. So, we can calculate estimate time to destination in real time. Though the course can be changed by traffic state, the course is always the best.

Code of conduct

* Take fastest way in real time.
* If possible, Take less congest lane in road

# Emergency Vehicles or Situations

Emergency vehicles like police patrols, ambulances and fire trucks must go faster than any other vehicles due to security of our society. System must pass through them as a top priority.

Or some incident can happen on road like car accidents. In this situation, road must detect its problem and notify it to system. System may shutdown some lanes to handle situations.

So, the algorithm must process those exceptions.