Design and Evaluation of Impact of Traffic Light Priority for Trucks on Traffic Flow

PI: Petros Ioannou

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Professor of Department of Electrical Engineering;
University of Southern California
Hughes Aircraft Electrical Engineering Center (EEB) 200B
Los Angeles, CA 90089-2562
Email: ioannou@usc.edu

Project Objective

Under this project we plan to investigate the impact of giving priority to trucks at traffic lights in order to minimize the travel time of all vehicles involved. The concept is similar to that of giving priority to buses even though the motivation for doing so for trucks is different.

By timing the traffic signals to give priority to trucks when trucks are present we can achieve two benefits. First the trucks will clear the intersection faster without having to make frequent stops that introduce additional delays due to the time it takes for a truck to accelerate from zero speed to a desired speed and second the less decelerations/accelerations a truck goes through the less pollution it generates and the less fuel it consumes. Such traffic light priority may also have beneficial effect on the travel time of passenger vehicles due to elimination of delays caused by trucks stopping and going. Our analysis is to reveal these benefits and possible tradeoffs.

Problem Statement

Current traffic lights treat every vehicle the same in generating the sequence of stop and go signals. Trucks however have different dynamical characteristics and sizes than passenger vehicles. They take longer time and distance to stop and have lower acceleration rates than passenger vehicles. In addition they consume more fuel and generate more pollution especially during transients such as those occurring at traffic lights where trucks need to stop at red and accelerate when the lights go green. These differences in dynamical characteristics add to traffic delays that affect all vehicles.

In this project we developed a traffic light controller for a road network that takes into account the difference in size and dynamics of trucks and passenger vehicles. It optimizes the traffic light sequences in order to minimize the delays so that all vehicles benefit. The traffic light controller often gives priority to trucks in order to minimize the delay of the trucks but also that of the passenger vehicles. For example when a truck is approaching a green light that is about to turn red it may be to the benefit of all vehicles in the network to extend the green light for the truck to go through. This action will prevent the truck from stopping and then accelerating again when the green comes back on.

Research Methodology

System Arichitecture (Figure 1)

- ✓ **Combine Passive and Active Strategies**
- ✓ **Passive – Multiagent Simulation-based Approach**
- ✓ **Active – Priority Request & Response**
- ✓ **Online & Adaptive**

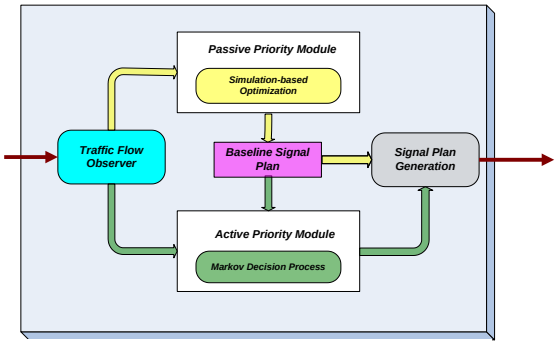

Figure 1

Approach (Figure2)

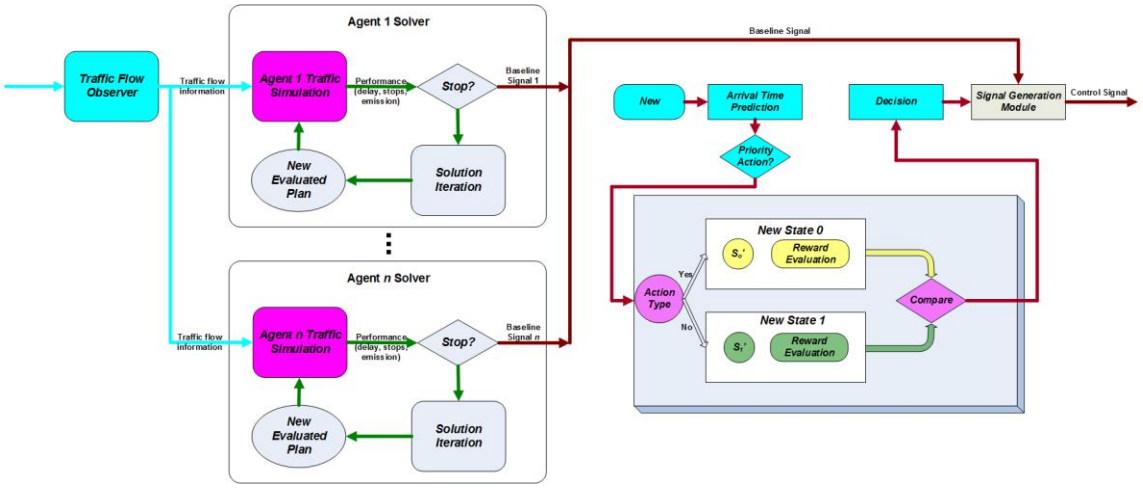

Figure 2

Result

As a result the delay associated with stop and go of trucks will be reduced or eliminated and the pollution and gas fuel consumption that is worse especially for trucks during stop and go will be reduced. We used two different approaches which we analyzed and compared. A simulation based approach together with optimization and a neural based approach to control traffic lights in a selected road network adjacent to the twin ports of Los Angeles/Long Beach where the truck volume is relatively high compared to other places. The results demonstrate that by taking into account the trucks and their characteristics the resulting traffic light controllers can lead to improvements by lowering the overall delay for all vehicles and reduce pollution as well as the number of vehicle stops.