Intelligent Traffic Lights

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# Abstract

Traffic signal systems have been employed since the early twentieth century and since then many different signal systems have been implemented to minimize the waiting time and most importantly deadly accidents at dangerous road intersections, streets on which schools are located and bad curves. Optimizing the traffic systems in real-time based on the vehicle flow and adapting accordingly is challenging problem; mainly because as the size of the road increases there is a continuous increase of traffic congestion. This in-turn increase the total travel time and ultimately cost of travel. This project aims to address the issue and implement a method which can effectively reduce travel time, and cost of travel.

# Introduction

The current state of traffic signal ecosystem comprises of variety of different control systems ranging from clockwork mechanism to computerized control that self-adjust to minimize delay to people using the road. This project falls under the category of computerized control. With the advancement in computer vision the computerized control can be given the ability to see and analyze traffic to self-adjust based on the traffic at a particular signal. When waiting for a traffic light, the driver loses time and the car uses fuel. Hence, reducing waiting times can save society billions of dollars annually. Here is small fact to support the statement, based on the review and research, if travel time is reduced by 30-40% then the travel costs reduces by 15-20%. This is for one vehicle, so collectively 253 million cars and trucks on U.S. roads could easily save billions of dollars.[[1]](#footnote-1)

Local time based signal controllers are among the most fundamental traffic signal system component. This often results in delay at red lights, when we have to wait while no one is using the green. Traffic signal control is an important practical problem. A recent study in the USA indicates that travel delays due to traffic congestion caused drivers to waste more than 3 billion gallons of fuel and kept travelers stuck in their cars for nearly 7 billion extra hours – 42 hours per rush-hour commuter. The total nationwide wasted money amounts to $160 billion, or $960 per commuter.[[2]](#footnote-2) Moreover, since this wasted fuel and time leads directly to the percentage of time drivers spend in traffic; there are additional negative impacts on environmental conditions. The problem is so bad that most intensive exposure to air pollution happens at traffic junctions. It is mainly due to the ‘stop and go’ nature of the traffic flow. This severely affects the health of the people which may also lead to major respiratory problems. With the invention of computers, traffic lights started to become computerized. We all remember those days when a man stands at the center of a junction and controlling traffic at that junction. Since human have the capability of looking and understanding the traffic issue this was probably the best implementation to control traffic. But, Over time computers improved, and the traffic lights subsequently improved, and they could now monitor traffic and change lights accordingly. Based on the software, the traffic of a city could now be predicted and accordingly controlled.

But the computerized approach still does not provide the human power of looking at the traffic, analyzing and acting accordingly. Our project aims to provide a sophisticated approach to resolve unnecessary waiting time at traffic signal by providing vision to traffic system and an algorithm that can effectively control traffic.

# Traffic signal control algorithm

The control problem is at a single intersection and the objective is to make the best local decisions possible, given the information that is locally available. The adaptive methods for optimization, based on dynamic programming, have been used for controlling a single intersection. [[3]](#footnote-3)

# Implementation

# Results

# Conclusions & Future Work

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1. <http://www.latimes.com/business/autos/la-fi-hy-ihs-automotive-average-age-car-20140609-story.html> [↑](#footnote-ref-1)
2. <https://mobility.tamu.edu/ums/media-information/press-release/> [↑](#footnote-ref-2)
3. S. G. Shelby. Single-intersection evaluation of real-time adaptive traffic signal control algorithms. Transportation Research Record, 1867:183–192, 2004. <https://doi.org/10.3141/1867-21> [↑](#footnote-ref-3)