Planning, Policy & Programming

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Project Title:
National Center for Sustainable Transportation (NCST-FAST Act)

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Task Manager:
Stuart Mori,
Associate Transportation Planner
stuart.mori@dot.ca.gov

Congestion Reduction via Personalized Incentives

This research aims to reduce congestion by providing customized incentives and alternative routes to drivers in real-time using their smart devices and a central controller.

WHAT IS THE NEED?

The right incentives and alternative routes need to be chosen wisely to maximize the probability of acceptance by drivers and to avoid the creation of new congestion in other parts of the road network.   To this end, the research team will develop and test a real-time, traffic prediction and incentive-offering mechanism using individuals' routing and aggregate traffic information on smart devices via simulation based on real data.

WHAT ARE WE DOING?

The methodology relies on online and historical traffic data collected from various sensors as well as individual preferences and routing options.

Some of the key features of the methodology include:

a) Individual's route preferences and constraints
b) Travel time constraints
c) Possibility of using High Occupancy Vehicle lanes
d) Randomly determined and uncertain nature of driver's responses to offers made
e) Providing guarantees with reasonable risk measures for suggested routes
f) Individual's preference among the existing set of incentives

The research team will first begin with a literature review and implementation of a real-time traffic prediction procedure based on historic and current traffic data. The next task will be to model and formulate a real-time personalized incentive offering problem or a series of problems. In the third task, efficient algorithms for

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solving the incentive-offering problem will be developed. In the final task, a portion of the Los Angeles area traffic network will be used to perform an experimental analysis to:
1) Demonstrate the capabilities of the method
2) Assess the validity of the developed model, and
3) Understand how factors affect the proposed method.

WHAT IS OUR GOAL?

The goal of this research is to aim for environmentally responsible highway and road operations by reducing congestion through personalized incentives via communication between smart devices and a central traffic planner.

WHAT IS THE BENEFIT?

First, the research would reduce traffic congestion and improve routing efficiency by offering personalized incentives to drivers. Second, the research would avoid the creation of new congestion on the transportation network.

WHAT IS THE PROGRESS TO DATE?

1. A literature review and a real-time traffic prediction procedure have been completed.
2. The next step is to model and formulate a real-time personalized incentive offering program.
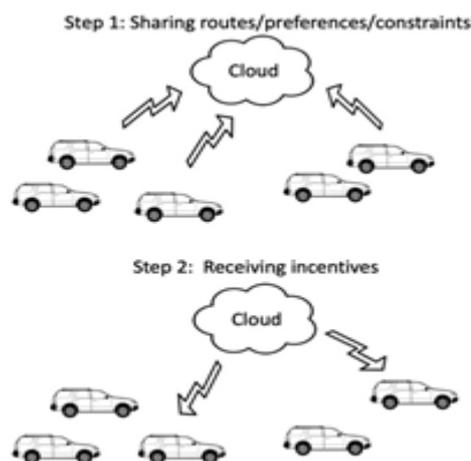
IMAGES

Image 1: Proposed method - In the first step, drivers share their routes, preferences, and constraints. In the second step, the central controller suggests incentives to drivers to alter their routes.
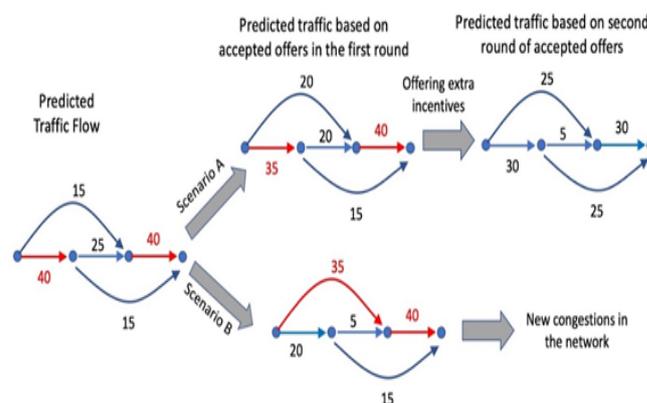

Image 2: Two different incentive offering strategies with two different outcomes. Scenario B leads to the creation of new congestions in the network. The number on each edge shows the number of cars on that particular road/edge. The red edges show the congested roads.