Implementing a Community-Based Mobility Lab: improving Traffic, Protecting Data Privacy

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Project Objective

This project pilots a scalable methodology to conduct community-based mobility research to address critical safety, environmental, and traffic congestion issues while also addressing the data privacy issues such as transparency and accountability associated with the extensive data collections necessary for predictive traffic modeling. This project provides a blueprint for a three-phase methodological approach to community-based mobility studies, including the collection of video footage, the data processing for the predictive traffic modeling technology, and the approach to addressing related data-privacy concerns.

Problem Statement

This project addresses the following two interrelated problem statements: (1) How to collect traffic/mobility data and use artificial intelligence techniques to develop Intelligent Transportation Systems (ITS) technologies to improve congestion and safety conditions at busy truck intersections; and (2) How to ensure that the data-privacy rights of Long Beach residents and visitors (who pass through intersections of study) are protected and assured through community-based research and outreach practices that foster stakeholder trust.

Research Methodology

To develop a scalable methodology for community-based research that called for 1) recording footage of the intersection of study, 2) extracting mobility data from that recorded footage into predictive traffic modeling technology, and 3) accounting for related data-privacy concerns, the research team implemented three phases to complete the study.

The first phase called for the collection of 25-30 hours of footage from the chosen intersection of study at Pacific Coast Highway and Santa Fe Avenue in West Long Beach. The research team identified several possible ways to collect the necessary footage, including a formal request to Long Beach City Hall requesting permission to access closed-circuit television (CCTV) footage from traffic cameras, but these efforts proved unsuccessful. Consequently, the research team was required to gather the necessary footage, rather than relying on existent sources of traffic footage.

To process the data captured in the footage, researchers utilized DataFromSky, an Intelligent Transportation Systems company, to convert raw data into a format which an Artificial Neural Network would then use to train the model simulator. The utilization of a data processing company allowed for a quick and insightful analysis of the collected footage and would prove indispensable in efforts to scale up community-based transportation research.

To develop a predictive traffic simulator for the chosen transportation node, researchers analyzed and evaluated multiple modeling methods. To train the Artificial Neural Network (ANN), researchers used data from the Caltrans Performance Measurement System (PeMS). Researchers then used the processed data from the traffic recordings to train the predictive traffic simulator.

To address data privacy concerns for residents living near the intersection of study during the footage collection, researchers conducted a 1.5-mile data walk around the neighborhood prompting study participants to reflect on various smart technologies, including traffic cameras and the recording sessions in place.

Results

The use of traffic cameras proved incompatible for this study, as their presence and oversight policies in municipal and state transportation networks varies greatly. Thus, while traffic cameras potentially could be used in other places, their distribution imposes substantial limits on future areas of study. For this project, the research team opted to record traffic footage manually. The research team noted that manual recording is not scalable and identified alternatives to manual video recording of intersections for future work. Those alternatives included possible utilization of high-altitude balloons and low-earth and geosynchronous orbiting satellites to obtain footage and related mobility data in a way that is scalable and repeatable.

Results from the data walks and related discussions showed that most participants were ambivalent about the presence and usage of smart technologies employed by the municipal government as long as city leadership would be held accountable for any negative consequence thereof. It was further found that a lack of public engagement and outreach on behalf of the city and its officials regarding the use of smart technologies unintentionally increased public apprehension, as the lack of communication led to increased speculation about any negative consequences of smart technologies and left study participants in the dark about any positive aspects or outcomes.

The approaches employed in this study suggest that community-based mobility labs are scalable not just across the State of California but serve as a blueprint for future community-based mobility research at other intersections, corridors, and networks of intersections and corridors across the United States.

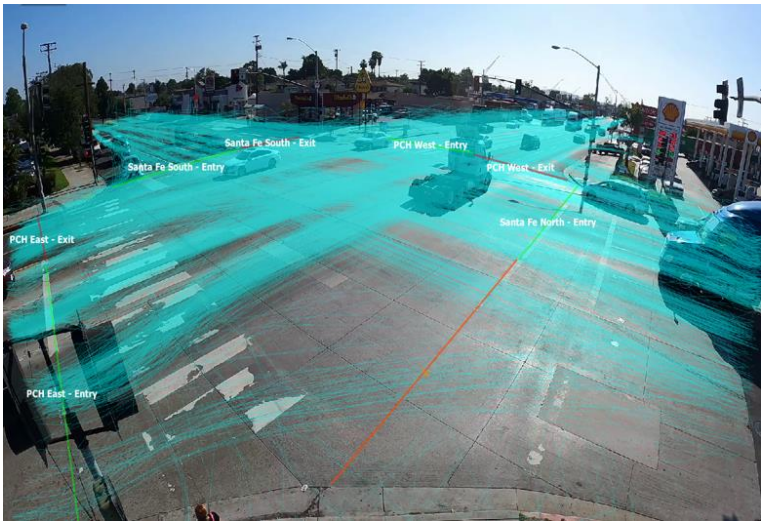

Figure 2: DataFromSky visual analysis.

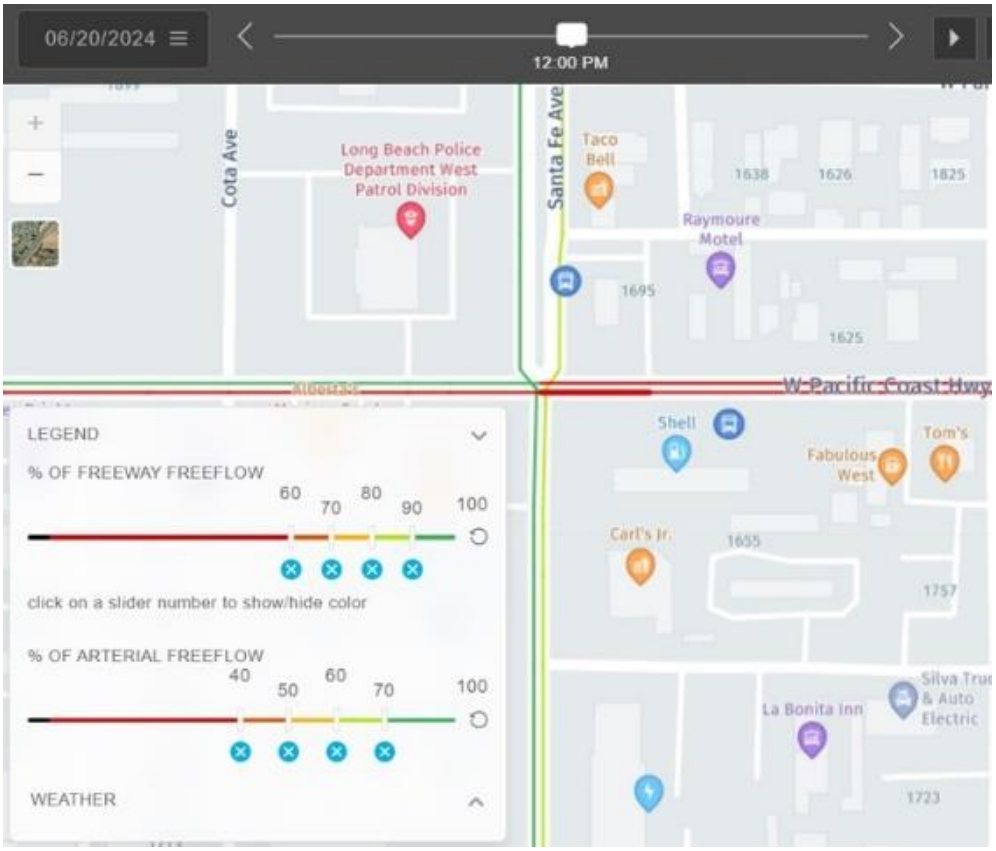

Figure 1: Iteris ClearGuide free flow map.