AI-Based Intersection Monitoring System and Analytics Demonstration Pilot

U.S. Department of Energy DE-EE0009661

HORIBA Institute for Mobility and Connectivity²

HIMaC²

UCI Institute of Transportation Studies

Argonne NATIONAL LABORATORY

SCAG™

Listening Session 2

11/5/2024

Agenda

- Welcome and Brief Team Introduction (SCAG/UCI)
  - 5 Minutes
- Project Overview (UCI)
  - 15 Minutes
- Comments and Discussion (All)
  - 30 Minutes
- Next Steps (SCAG/UCI)
  - 10 Minutes

Outline

- Project Overview
  - Project Timeline, Goal, and Objectives
  - Brief Summary of Listening Session #1
- Public Road Network Platform
  - AI-System at Culver / University
  - Platform Map
- AI-System Traffic Data
  - Near Misses
  - Red and Yellow-Light Runners
  - Next-Generation Lidar Imaging

Poll Questions

Poll #1: What type of organization do you represent?

- Community Member
- Advocacy Organization
- School or Academic Institution
- Tribal Organization
- Local Government
- Regional Government
- State or Federal Government
- Private Company
- Other

Poll Questions

Poll #2: What best describes where you are today?

- SCAG Region
  - *Imperial, Los Angeles, Orange, Riverside, San Bernardino, or Ventura Counties*
- Elsewhere in California
- Elsewhere in the US
- Outside of the US

Poll Questions

Poll #3: What is your Experience/Familiarity with use of Intelligent Transportation Systems (ITS), AI, and sensors for Transportation Projects?

- Very experienced/familiar
- Experienced/familiar
- Slightly experienced/familiar
- No experience/familiarity

DOE VTO Project Overview

Project Timeline

– Start Date: October 1, 2021 / End Date: December 31, 2024 / Duration: 3.25 years (39 Months)

Project Goals

1. Assess a novel energy efficient AI-based mobility monitoring system in a real-world transportation application;
2. Provide needed insight into key use cases of AI-based systems to meet DOE goals including mobility energy productivity (MEP) and vehicle energy efficiency;
3. Quantify system-level impact of an AI-based system technology at multiple scales while demonstrating at least a 15% improvement in energy efficiency; and
4. Provide data and results to National Laboratories, Energy Efficient Mobility Systems (EEMS) researchers, and the Clean Cities/Technology Integration network

Project Objectives

1. Outfit three vehicle fleets and the *Public Road Network Platform*;
2. Establish a simulation of the ***Network*** at the UCI *Simulation Laboratory Platform* and at Argonne National Laboratory (ANL);
3. Characterize the vehicles using the UCI *Controlled Physical Laboratory Platform* and at ANL;
4. Establish and test the use cases;
5. Assess the technology and its impact on project goals;
6. Format and provide data and results to the SMART Mobility National Lab Consortium through the Livewire Data Platform, EEMS researchers, and the Clean Cities/Technology Integration network; and
7. Through outreach with Saddleback Community College and SCAG, communicate the results to the broader transportation community and inspire a needed workforce.

DOE VTO Project: Brief Summary of Listening Session #1

AI-System Traffic Analytics

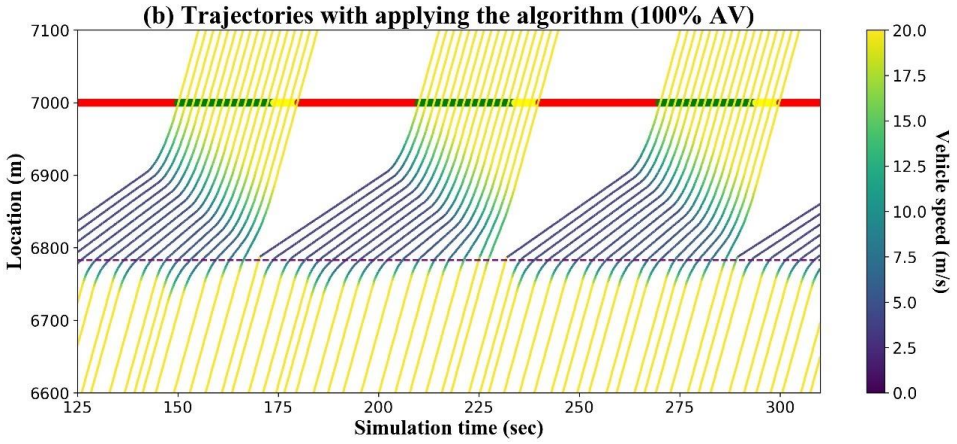
- Gathered critical sample data regarding traffic counts (buses, passenger vehicles, trucks)
- Included signal timing, arrival patterns, and crosswalk events

Project Approach with AI-System

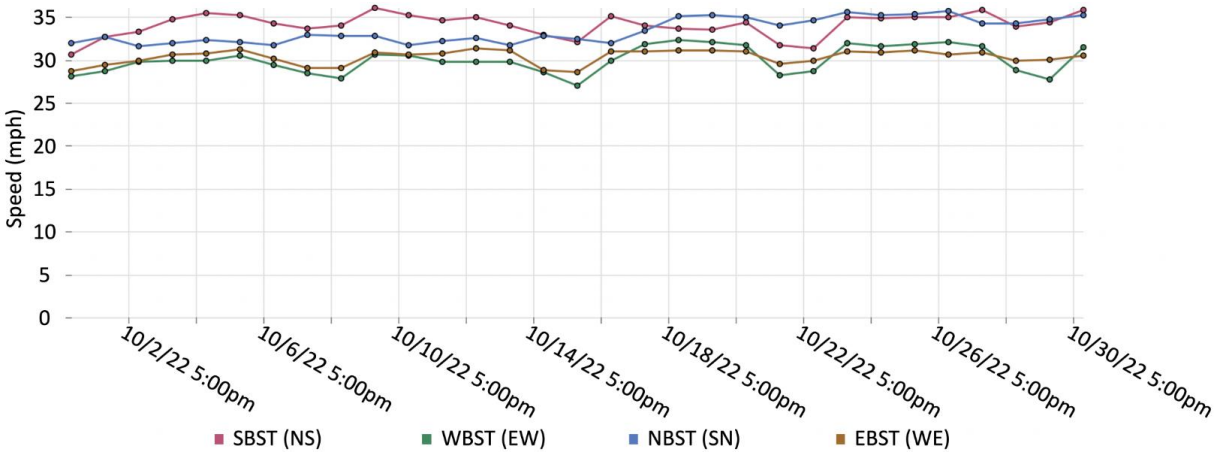
- Illustrated the project approach using AI monitoring intersection dynamics
- Showcased the workflow, i.e. AI sends message to human drivers' app, the AI-enhanced traffic signal communicates with the vehicle-in-the-loop, and the autonomous vehicle reacts to AI-message

AI-System Simulation Results

- Shown to improve fuel efficiency, decrease queueing, and increase average vehicle speed
- Vehicle dynamometer testbed for development to ensure safety



Traffic with AI-System



Traffic Speeds

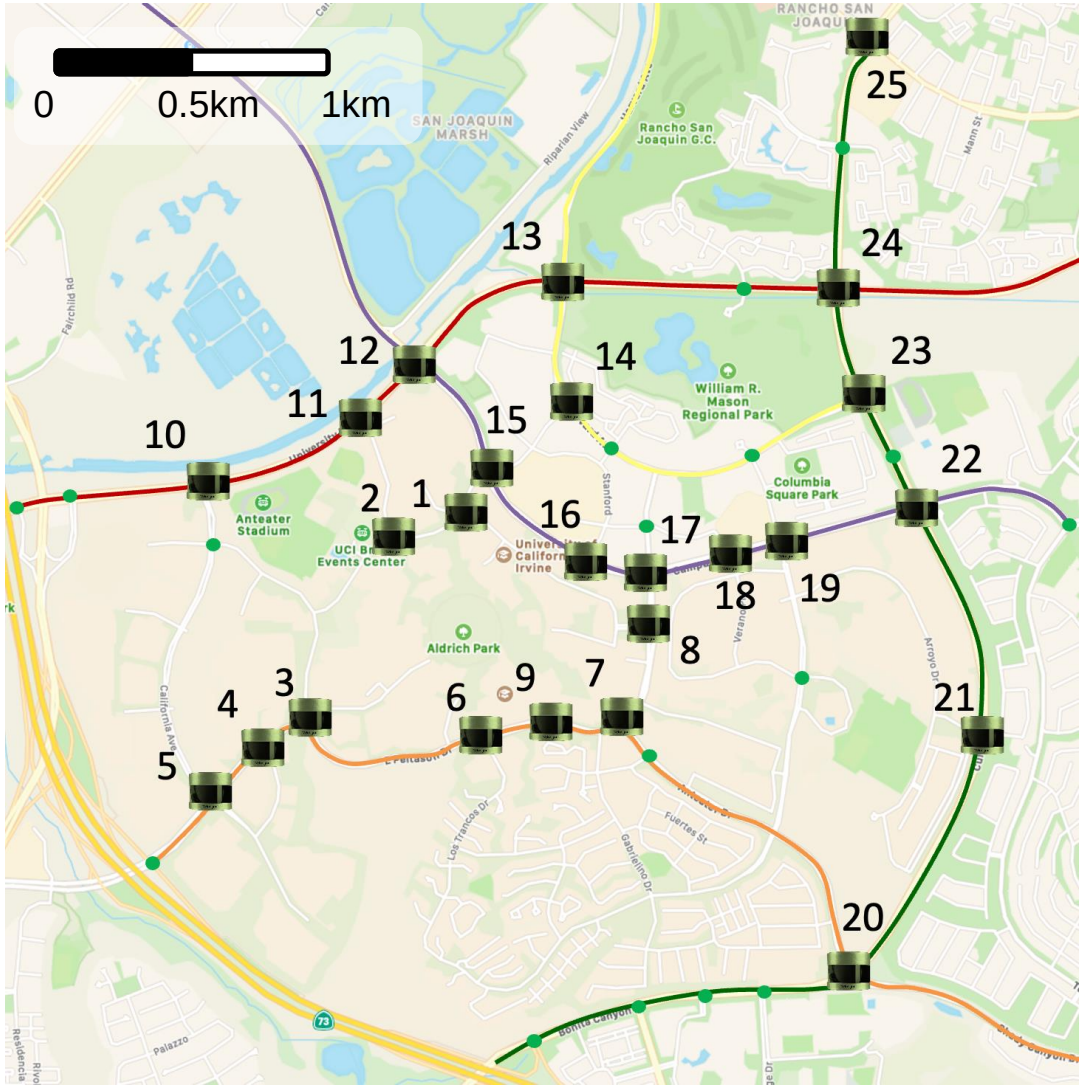
AI-System Installation and *Platform* Overview

AI-System:
LiDAR
+
Artificial Intelligence (AI)
on Edge Box

AI-System Installation

AI-Systems installed on **public roads** both in the City of Irvine and UC Irvine, effectively **two municipalities**

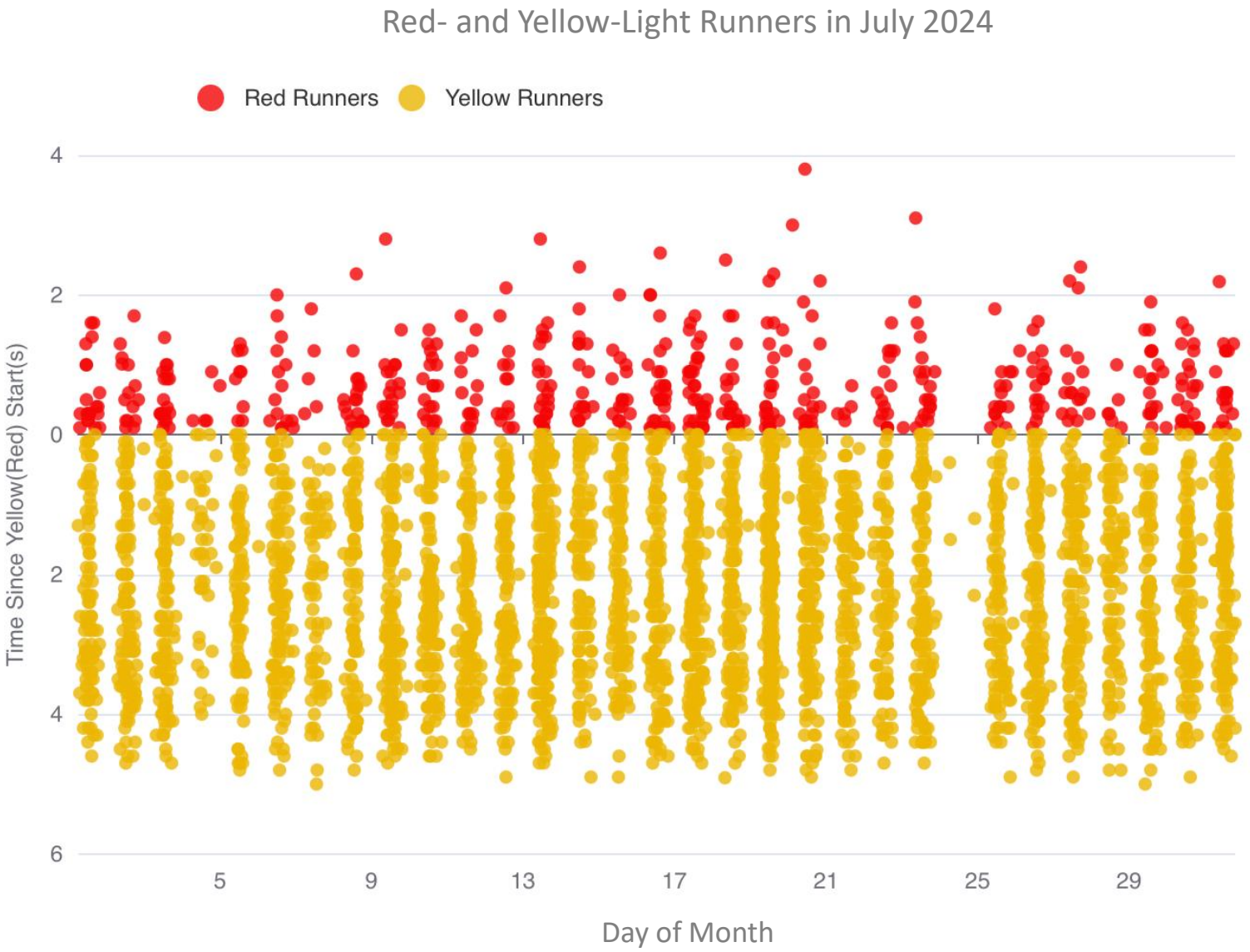
Public Road Network Platform 25 Intersections



AI-System Traffic Data on CDA *Platform*

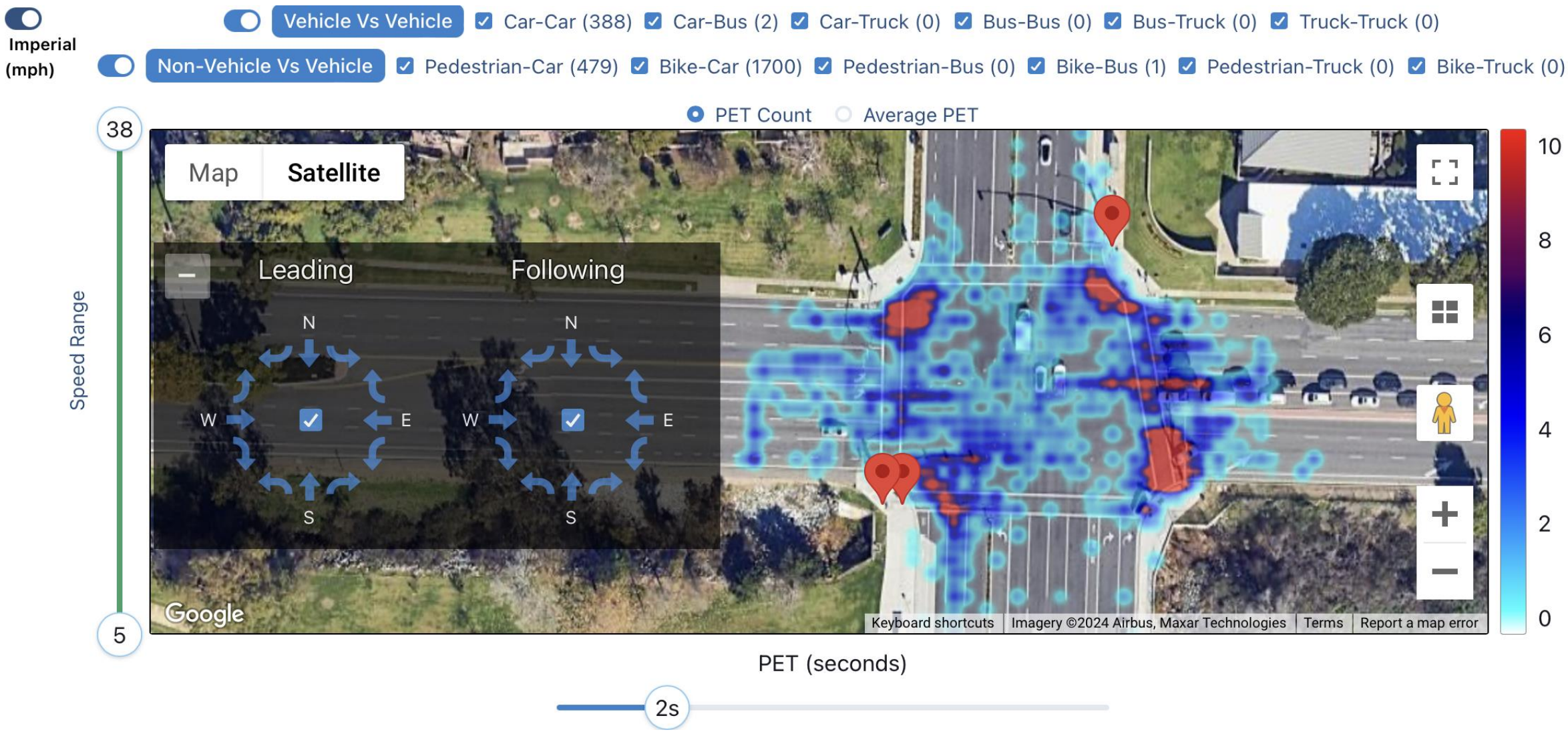
Next-Generation 3D Lidar View

AI-System Traffic Data on CDA *Platform*



AI-System Traffic Data on CDA *Platform*

Near Miss Heat Map at Culver and University
from August 2023 through July 2024



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Facilitated Discussion

- General Experience and Familiarity
  - How if at all have you used ITS/AI/sensors to manage transportation efficiency and safety?
  - Are you aware of incentives that might support (or completely pay for) a technology which gives substantial reduction in transportation-related emissions?

Facilitated Discussion

- Concerns and Challenges
  - What concerns, if any, do you have about the use of AI in managing transportation systems?
  - How do you feel about the accuracy and reliability of traffic sensors currently in use?

Facilitated Discussion

- Public Input and Engagement
  - Are there any ideas for how to better inform the public about the benefits and risks of implementing AI in transportation systems?
  - How can ITS technology be designed to ensure that all communities benefit equally, especially underserved or marginalized groups?

Facilitated Discussion

- Improvement and Innovation
  - What improvements or innovations would you like to see in the region's transportation system through the use of ITS and AI?
  - Are there specific areas, such as busy intersections or particular corridors, which should be prioritized for upgrades? What about specific vehicle types to be given signal priority?

Facilitated Discussion

- Data Privacy and Security
  - What safeguards should be in place to ensure the security of transportation data?
  - How important are privacy and security concerns when selecting sensors for transportation and other use cases?

Facilitated Discussion

- Vision for the Future
  - What specific outcomes would you like to see in the future, such as reduced congestion, lower emissions, or improved safety?
  - Should Southern California consider similar pilots in other cities or communities?
  - Would you support an expansion of this (or a similar) project?
    - Which study areas would be of interest?
    - Should any corridors, intersections, or study areas be prioritized?

Facilitated Discussion

- Operational Efficiency and Tech Integration **(Transit Operators)**
  - How has ITS been integrated into your transit operations so far? (e.g., real-time bus tracking, signal prioritization, dynamic scheduling)
    - Have any ITS tools in particular been most impactful for improving service delivery?
  - Have new technologies improved operations or have they introduced complexities or additional training needs?

Facilitated Discussion

- Reliability and Concerns **(Transit Operators)**
  - Have there been any incidents or situations where AI or traffic sensor data were inaccurate or caused operational disruptions?
  - How could training programs be adapted to ensure employees can work alongside new technologies effectively?

Facilitated Discussion

- Policy and Innovation **(Transit Operators)**
  - Are there any legal or regulatory hurdles that make it difficult to fully implement these technologies?
  - What emerging technologies (e.g., AI-driven predictive maintenance, advanced traffic management) would you like to see implemented in your transit operations?

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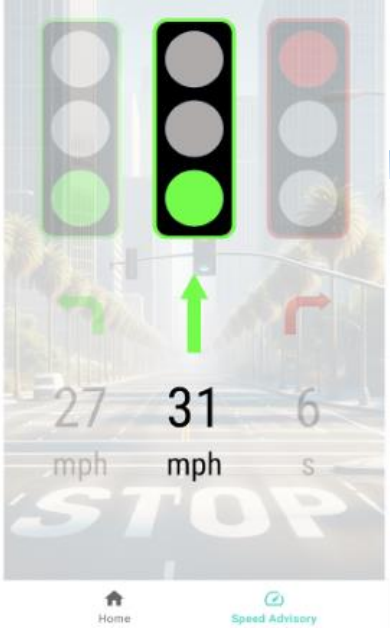
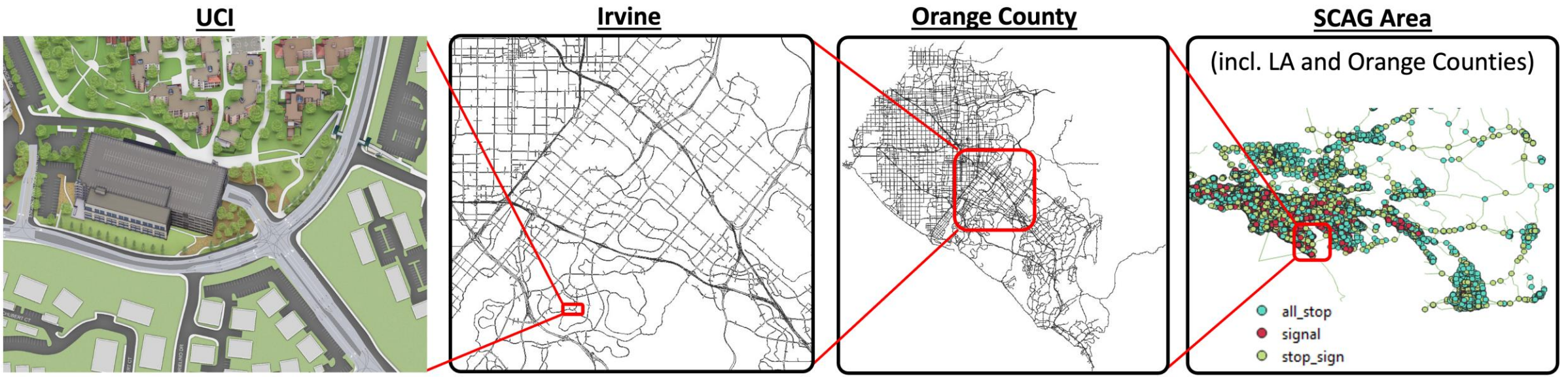
Next Steps



- On-road testing is in-progress, with advisory speed limits provided to participants on the *Platform* and detailed data from both the AI-Systems and vehicle fleets collected
- In parallel, a cost/benefit analysis of the AI-System in a southern California network model is underway to determine the impact at a metropolitan scale



Thank you!

Post-Session Survey:
https://forms.office.com/r/CRshdVVSDi

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