Making Micromobility Smarter and Safer

NSF Award 1951890

Clinton Andrews, Rutgers University – New Brunswick

IRG-2, FY 2020

Principal Research Investigators:

Rutgers University – New Brunswick

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Community Partners:

- The City of Asbury Park, NJ
- Borough of Highland Park, NJ
- Hudson County Transportation Management Association
- The City of Hoboken, NJ
- Keep Middlesex Moving
- The City of New Brunswick, NJ
- North Jersey Transportation Planning Authority
- Rutgers University Transportation Services
- Veo (Micromobility Service Provider)

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Project Overview

	Problem Definition	Solution Generation
Technological Dimensions	Measure and warn near misses	• Connect smart pedestrian, e-scooter, driver & intersection systems • Develop an app for pedestrians, e-scooters, and drivers
Social Dimensions	Build consensus for public action	• Encourage behavior change for all road users • Redesign roadways

Project Vision

- Analyze how **changes to the streetscape** through tactical urbanism experiments and smart-city technologies can **improve safety** for micromobility users, pedestrians, and motorists.
- Create a **novel connected solution for E-scooter riders and pedestrians** for intervention via Mobile and Ubiquitous Sensing and Computer Vision technology
- **Produce evidence that informs the community deliberation** of plans involving the adoption of micromobility services within communities.

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Project Overview

Use-Inspired Research

- The introduction of e-scooters and e-bikes to automobile-centric streets has resulted in **increased safety risk for pedestrians and micromobility users**.
- We are **assessing how human behavior, road design, environmental conditions and technology impact crash risk and safety** in several municipalities that have recently adopted e-scooters including:
  - Asbury Park, NJ
  - Highland Park, NJ
  - Hoboken, NJ
  - New Brunswick, NJ

Fundamental Research Contributions

- **Develop a predictive social model** that reduces safety risks for pedestrians and micromobility users.
- Design a **connected system via novel mobile sensing technology** for activities recognition, driving skill and potential fall detection, along with trajectory and collision prediction.
- **Refine computer vision algorithms** to more accurately detect pedestrians, e-scooters, bikes, and vehicles while also predicting trajectories (direction, velocity) and near misses.

Source: U.S. FHWA MUTCD

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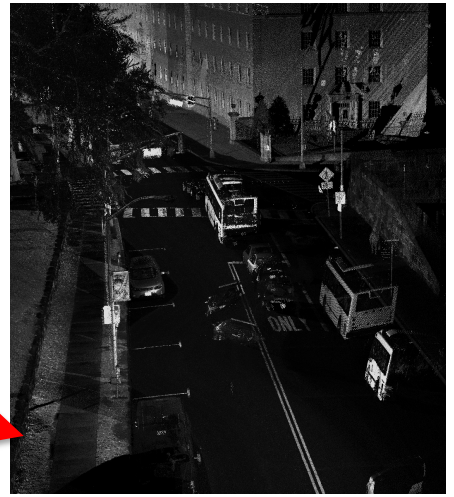
Project Update

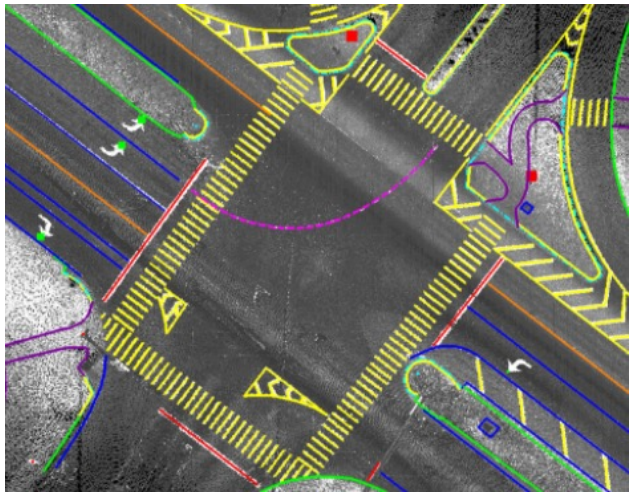
Spatial-Temporal Veo Scooter Usage Data in New Brunswick Downtown

Connecting multi-mode sensors & Data

Quantifying & Modeling the Built Environment

Geospatial Digital Twin of the Built Environment





Observing & Quantifying Dynamic Traffic Data

Disentangling factors contributing to accidents
Inform VR Scooter Simulation Design

Project Update: E-Scooter VR Prototype

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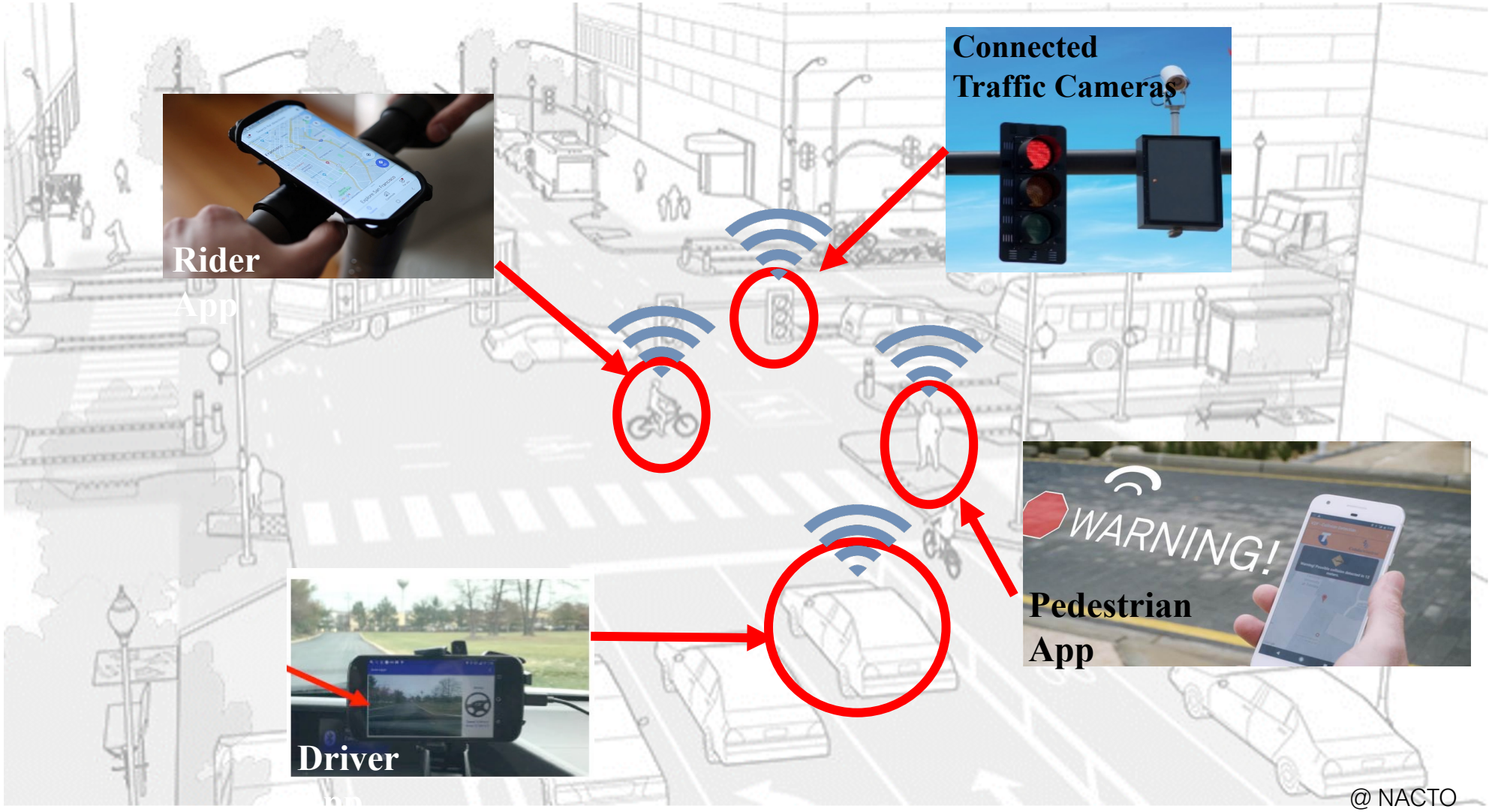
Project Update: Connected Solution for Micromobility Safety



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Project Evolution

Technological—CV+

We learned that detecting near misses of e-scooters with pedestrians, cyclists, and other hazards requires a combination of sensors, including radar and cameras, to more accurately predict the trajectory of those hazards. As a result, we are going to utilize a network of sensors mounted on e-scooters, at street intersections (e.g., traffic cameras, drones, etc.) , and on mobile devices to create a comprehensive dataset for our analyses.

Social—Community Concerns

We have learned that the perception of the threat of crashing into a hazard, such as a pedestrian or car door, by users of various micromobility devices, may be higher than actually crashing into these hazards. Thus, we are going to assess various modifications to streetscapes that provide micromobility riders a sense of security while also prioritizing pedestrian safety.

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Anticipated outcomes & success measures for next year

- **Anticipated Project Milestones**
  - Assess what **specific safety risks** exist for micromobility users and pedestrians at intersections and **what types of modifications to the streetscape** will make them feel safer.
  - Monitor how e-scooter users **interact** with vehicles, pedestrians, cyclists, and other users of roadways.
- **Research Activities We Will Undertake**
  - Perform **observational studies on traffic intersections** utilizing cameras and sensors to determine rates for motorists failing to yield to pedestrians.
  - Design and perform **tactical urbanism experiments at intersections**, including protected bike lanes, narrower vehicle lanes, and sharper bump outs.
  - **Optimize computer vision algorithms** to track micromobility users, pedestrians, vehicles, and other agents at intersections

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Visual Schematic

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