Fostering Smart and Sustainable Travel through Engaged Communities using Integrated Multidimensional Information-Based Solutions

Dr. Srinivas Peeta – School of Civil and Environmental Engineering, H. Milton Stewart School of Industrial & Systems Engineering

Dr. Omar Asensio – School of Public Policy

Georgia Institute of Technology

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INTRODUCTION

The project leverages information, communication, and sensor technologies (ICSTs) to collect data and translate them into intelligent, actionable information and targeted solution mechanisms to achieve community-level sustainability objectives (**mobility, accessibility, safety, and equity**). Developed solutions will enable societal benefits to be realized at their highest potential for various community stakeholder levels.

INTELLECTUAL MERIT

This project will advance theory and deployment paradigms associated with holistic, community-level decision-making. It will generate methods integrating disparate, multi-source data and use it to systematically generate multidimensional solution options to meet multiple sustainability objectives in a systematic, quantifiable manner over time.

BROADER IMPACTS

- Addressing inequities in S&CCs by providing them systematic deployment tools, and with quantifiable outcomes.
- Overcoming information deserts in lower-income neighborhoods, technology savviness issues for senior residents, and reduced access to smartphones and transportation options.
- A new community app for PTC users for travel options and feedback.
- K-12 initiatives, including engagement roles for a local STEM high school.
- Engaging Georgia Tech students in research via VIP course and NSF REU.

OBJECTIVES

| Develop tools to achieve sustainability objectives	Generate multidimensional solutions	Explore control actions
• Systematic framework • Associated models, methods, and solution algorithms	• Integrating solutions across social and technological dimensions	• Behavioral interventions • Public policy interventions • Emerging mobility solutions

PARTNERS
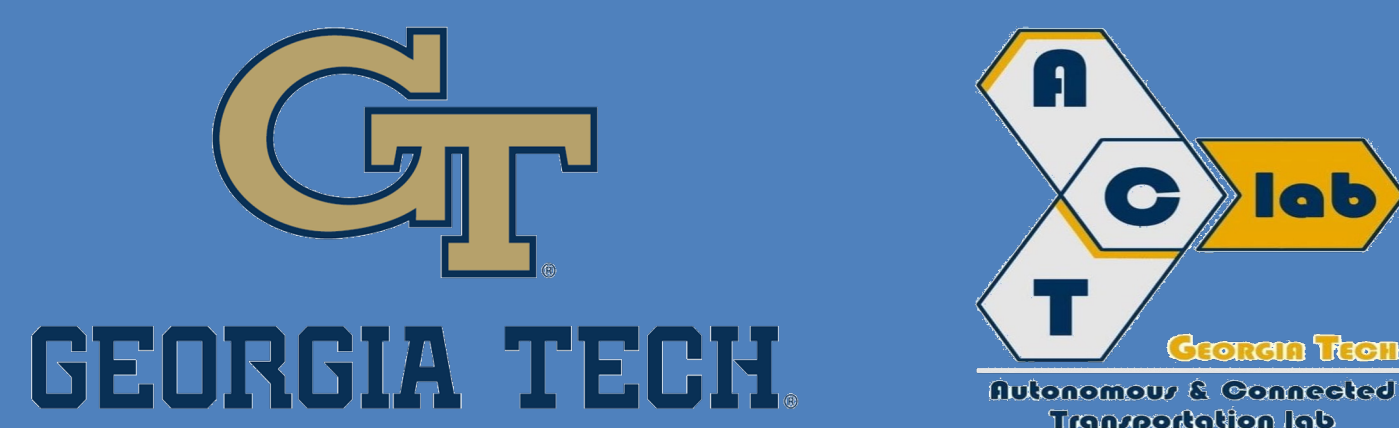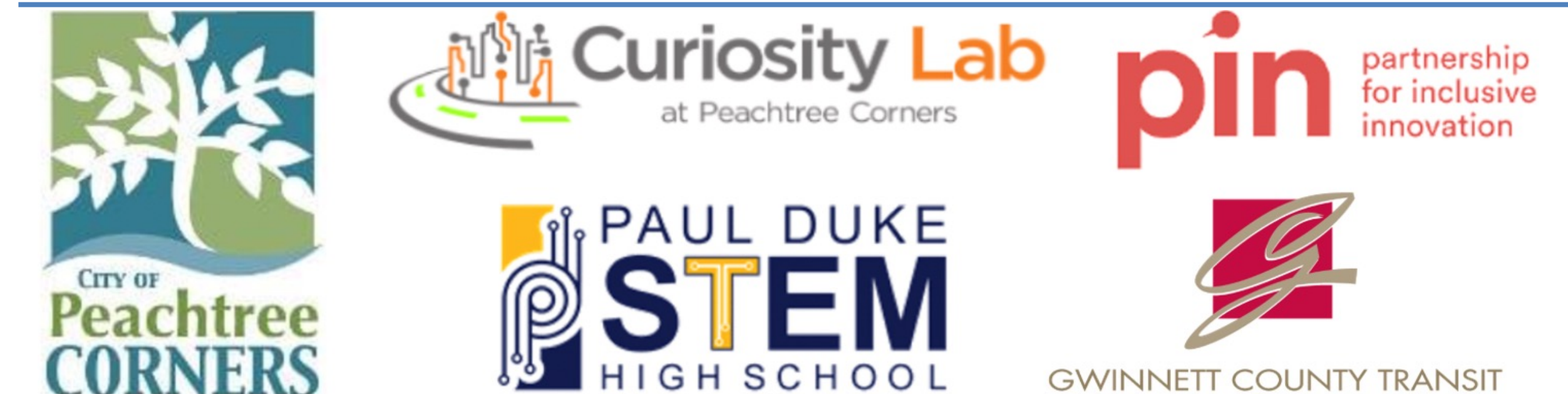
METHODS

ML-based Data Processing and Analysis

Dynamic visualization platform:
- Machine learning algorithms.
- Multidimensional data, including:
  - ✓ Sociodemographic characteristics
  - ✓ Real-time travel speed
  - ✓ Accidents & weather
  - ✓ Transit demand & supply
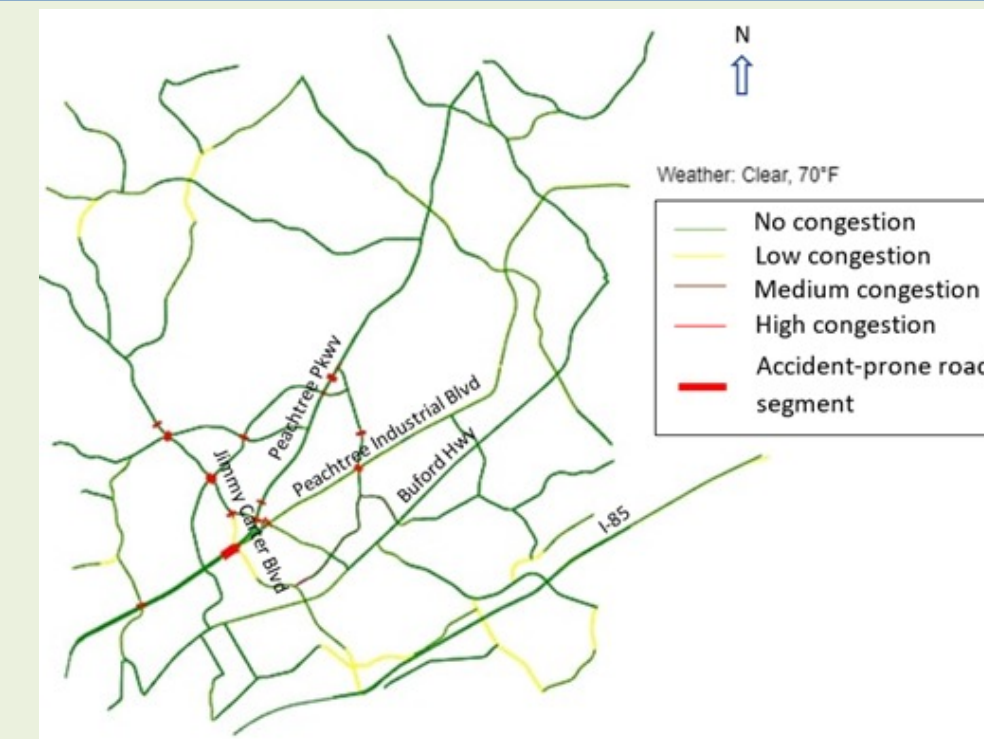
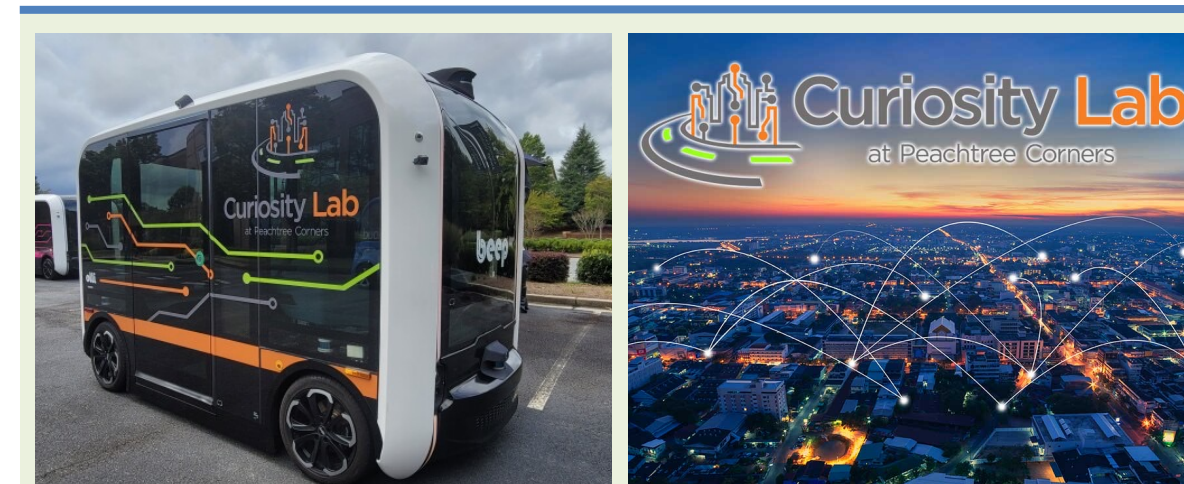### Behavioral and Public Policy Interventions

- Using concepts from **behavioral psychology** to promote behavior change at individual and community levels.
- Including tangible (monetary) and intangible (nudges and gamification) incentives.
- Waitlist interventions for EV charging stations.

Public Private Partnerships

- Exploring partnership mechanisms between emerging (e.g., autonomous shuttles) and traditional (e.g., transit) mobility service providers.
- Addressing **inequity** by focusing on disadvantaged groups.

App-based Data Collection and Dissemination

- The **TranSACT mobile app** is developed to collect location and behavioral data from PTC residents,. It also serves as a platform for delivering behavioral interventions.

Multi-objective Optimization & Simulation

- **Spatial disaggregation** to assess zonal sustainability characteristics.
- **Multi-objective equity-focused models** to optimize sustainability objectives.
- **Multi-agent simulation** to generate stakeholder-consistent solutions.

Spatially disaggregated PTC map

Community Engagement

- Workshops for PTC residents to disseminate information and **promote sustainable travel behaviors**.

TECHNOLOGIES

- ICSTs & emerging mobility tech.
- EV charging stations.
- Autonomous shuttles.
  - ✓ 3-mile autonomous test track
  - ✓ 5G-enabled V2X infrastructure

Curiosity Lab: A living lab for tech companies for real-world testing.

NOVELTY

Multidimensional solutions leveraging ICSTs, emerging transportation technologies, multimodal transportation, and community-level data.
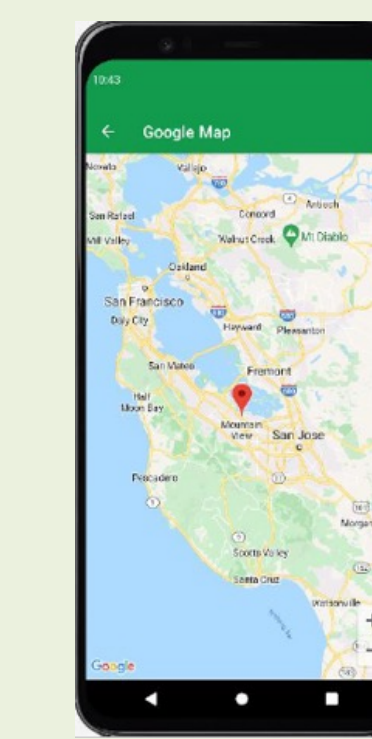
Decision-making tools based on multi-objective optimization, multi-agent simulation, and efficient solution algorithms.

City of Peachtree Corners (PTC), GA, leveraged as a living lab, to promote evidence-based guidance for other communities.
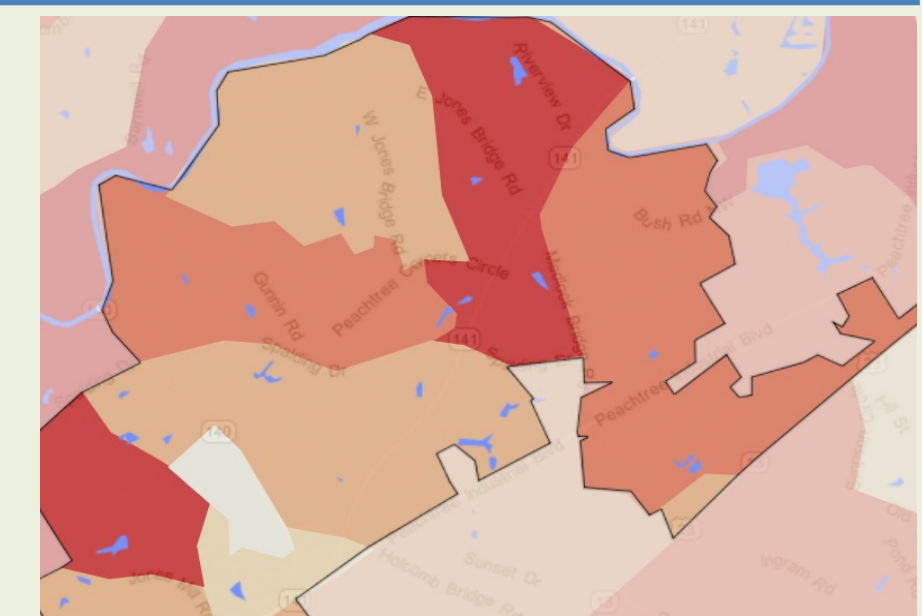
METRICS

Quantifiable measures used to track the four sustainability objectives:

Mobility	Access	Safety	Equity
• System time • User travel time • VMT • Travel speed on links	• Gravity-based & utility-based measures	• Crash count • Fatality count • Severity of crashes	• Zonal transit access • Zonal user travel time