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

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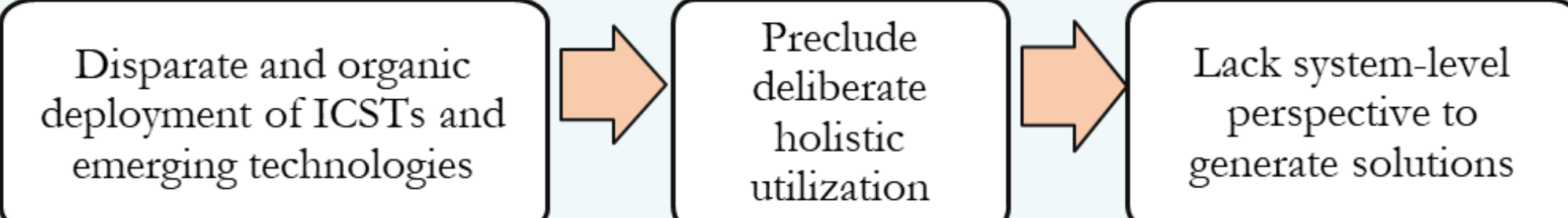Award Type: IRG [2125390]

Introduction

- ICSTs* and emerging technologies promise enhanced travel sustainability
- Translate data into intelligent, actionable information
- Achieve travel sustainability objectives: **mobility, access, safety, equity, health and active transportation**
- Solutions to enable equitable societal benefits at highest potential
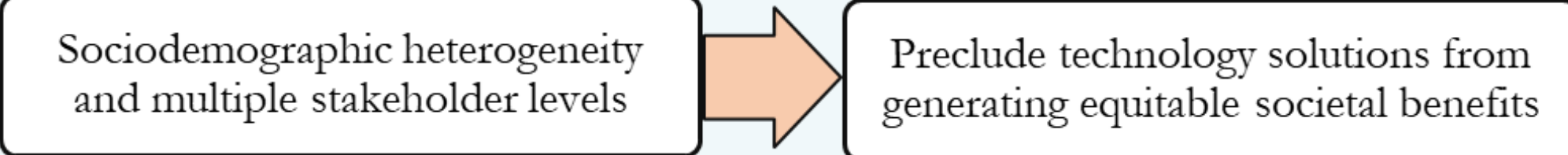
  *Information, Communication, and Sensor Technologies

Challenges Addressed

Challenges exist in two primary dimensions

Technological

Disparate and organic deployment of ICSTs and emerging technologies → Preclude deliberate holistic utilization → Lack system-level perspective to generate solutions

Social

Sociodemographic heterogeneity and multiple stakeholder levels → Preclude technology solutions from generating equitable societal benefits

- Existing technologies underutilized
- Emerging technologies not systematically explored

Project Vision

- **Integrate multidimensional solutions** across two dimensions
- **Develop an independently operable travel sustainability framework** for communities to track progress towards travel sustainability
- **Engage the community** at various stakeholder levels for generating stakeholder-consistent solutions
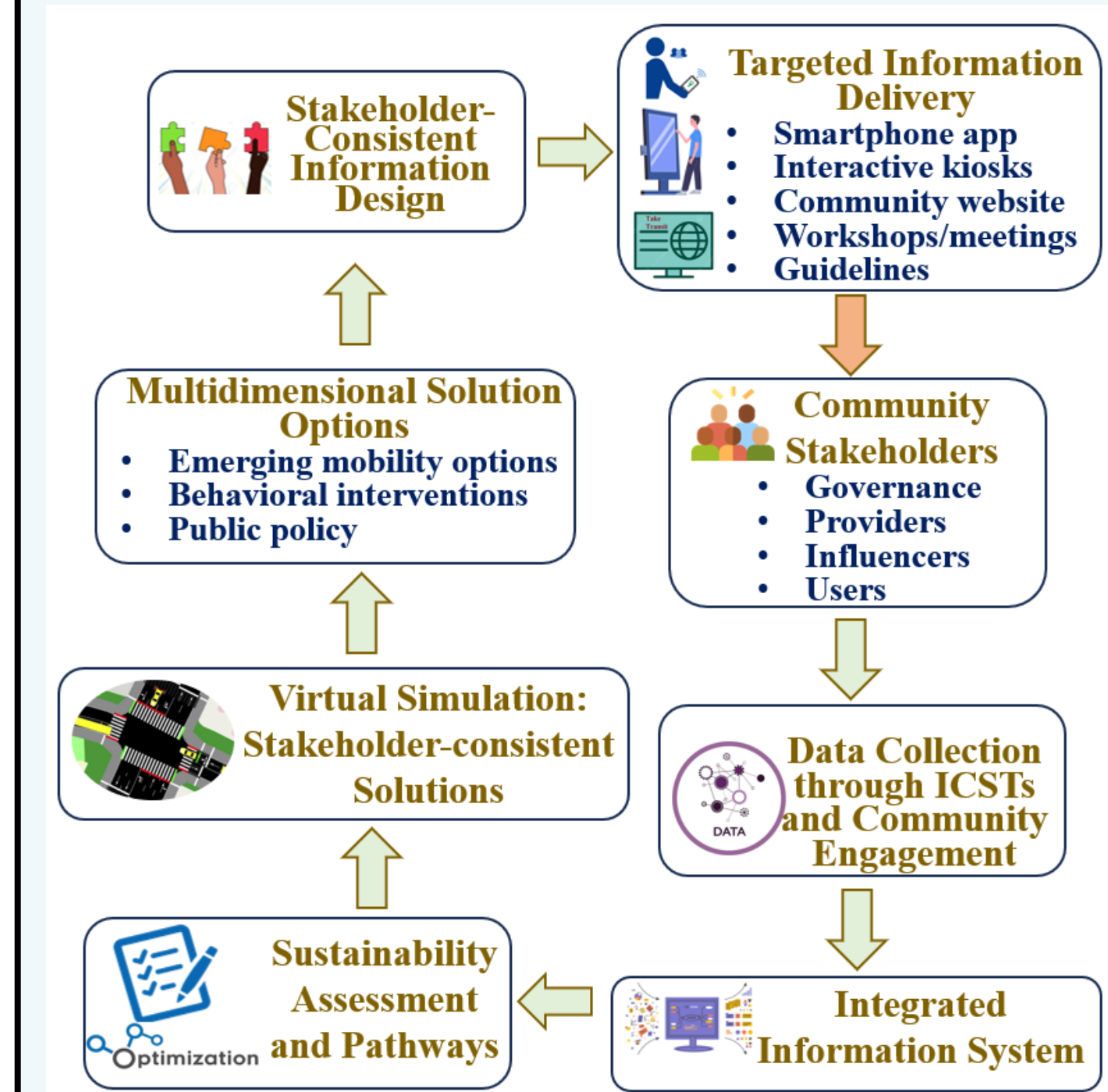
Integrative Research

- Integrate disparate data into actionable intelligence
- Develop solutions that intelligently target different stakeholder levels
- Systematically enable community progress towards sustainable travel
- Leverage organic emergence of new modes with existing modes

Intellectual Merit

- Advance theory and deployment paradigms associated with holistic, community-level decision-making
- Generate methods integrating disparate, multi-source data
- Generate multidimensional solution options to achieve sustainability objectives in a systematic, quantifiable manner

Broader Impacts

- Address inequities in S&CCs through systematic deployment tools, and with quantifiable outcomes
- Overcome transportation and information deserts
- K-12 initiatives, including engagement roles for a STEM high school
- Engage undergrad students in research via VIP course, REU program, and PIN's summer internship program

Major Outcomes/Progress

Integrated Information System
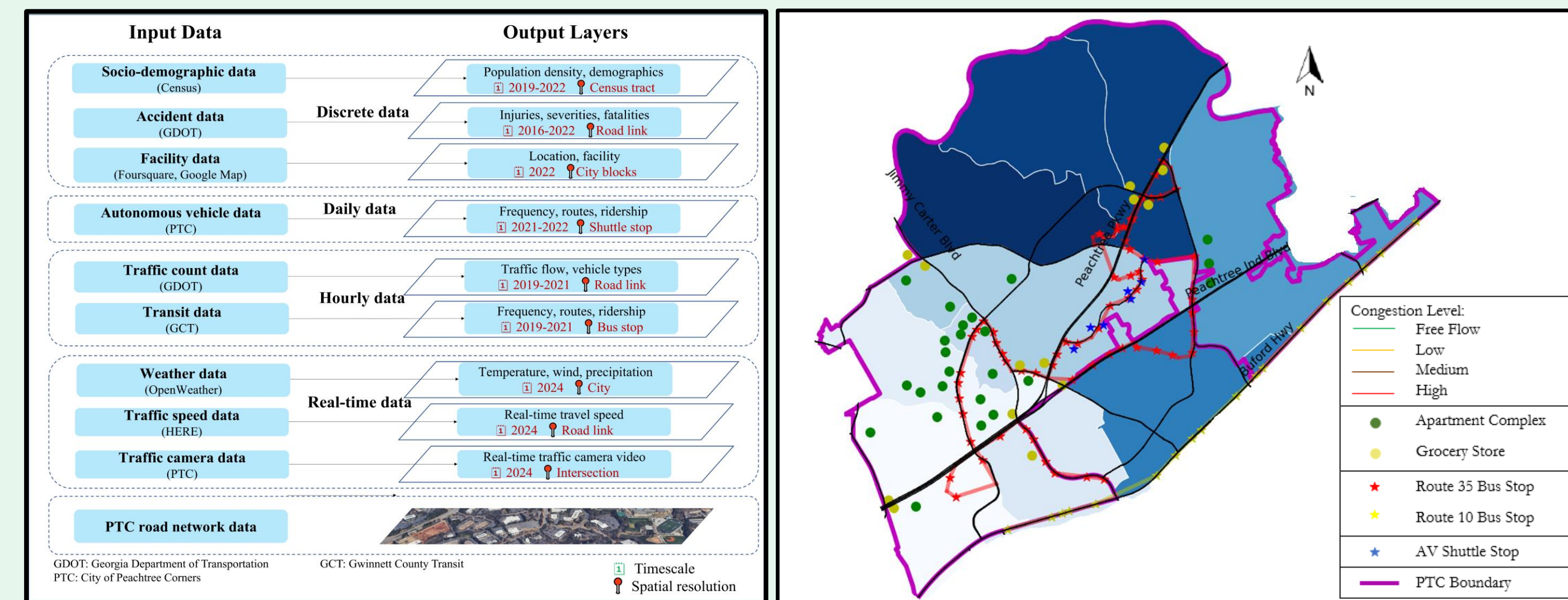
- Multi-source multi-timescale data integration
- Real-time data analysis capability
- Translate data into insights to address transportation challenges

Sustainability Assessment and Pathways

Quantifiably assess community's sustainability state and generate multidimensional pathways towards desired objectives
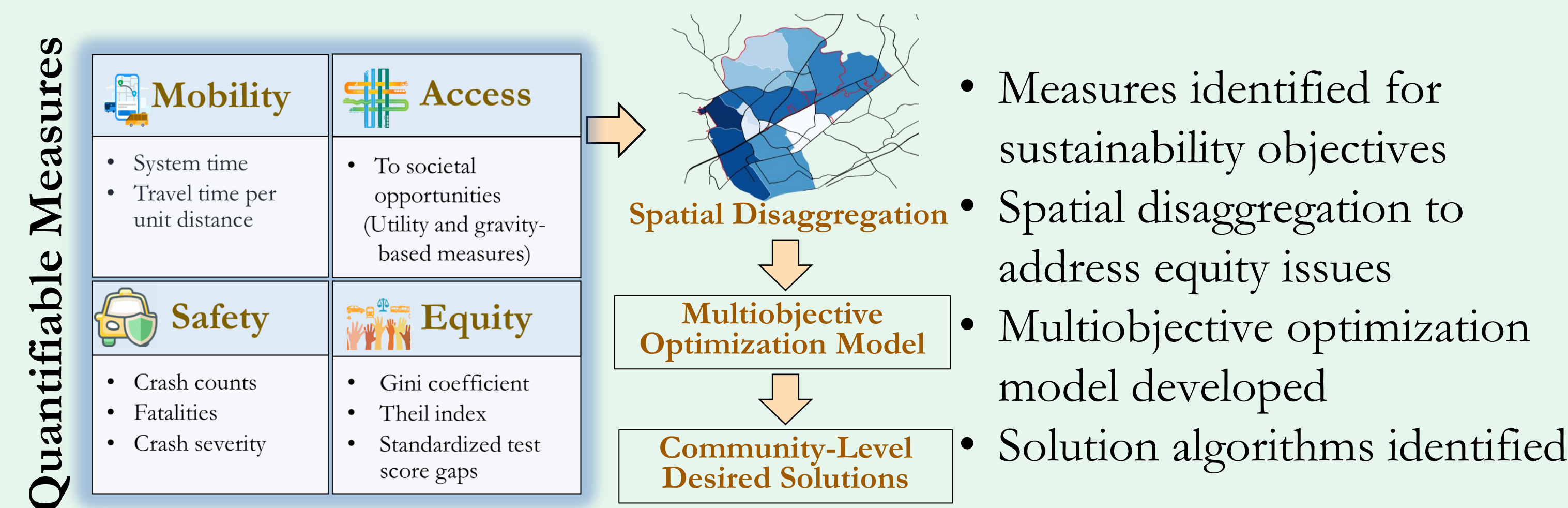

- Measures identified for sustainability objectives
- Spatial disaggregation to address equity issues
- Multiobjective optimization model developed
- Solution algorithms identified

Virtual Community Simulation

Translate community-level desired solutions to stakeholder-consistent solutions

- Peachtree Corner's network coded into SUMO (Simulation of Urban Mobility) software
- Multi-agent simulation system developed
- Complex real-world variables incorporated
- Simulation runtime improved
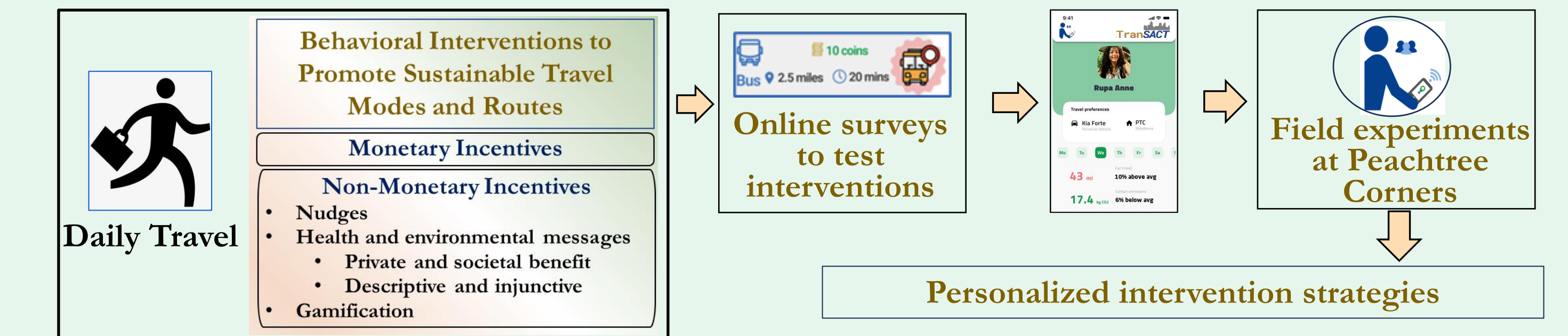- RL-based approach to generate community-level stakeholder-consistent solutions
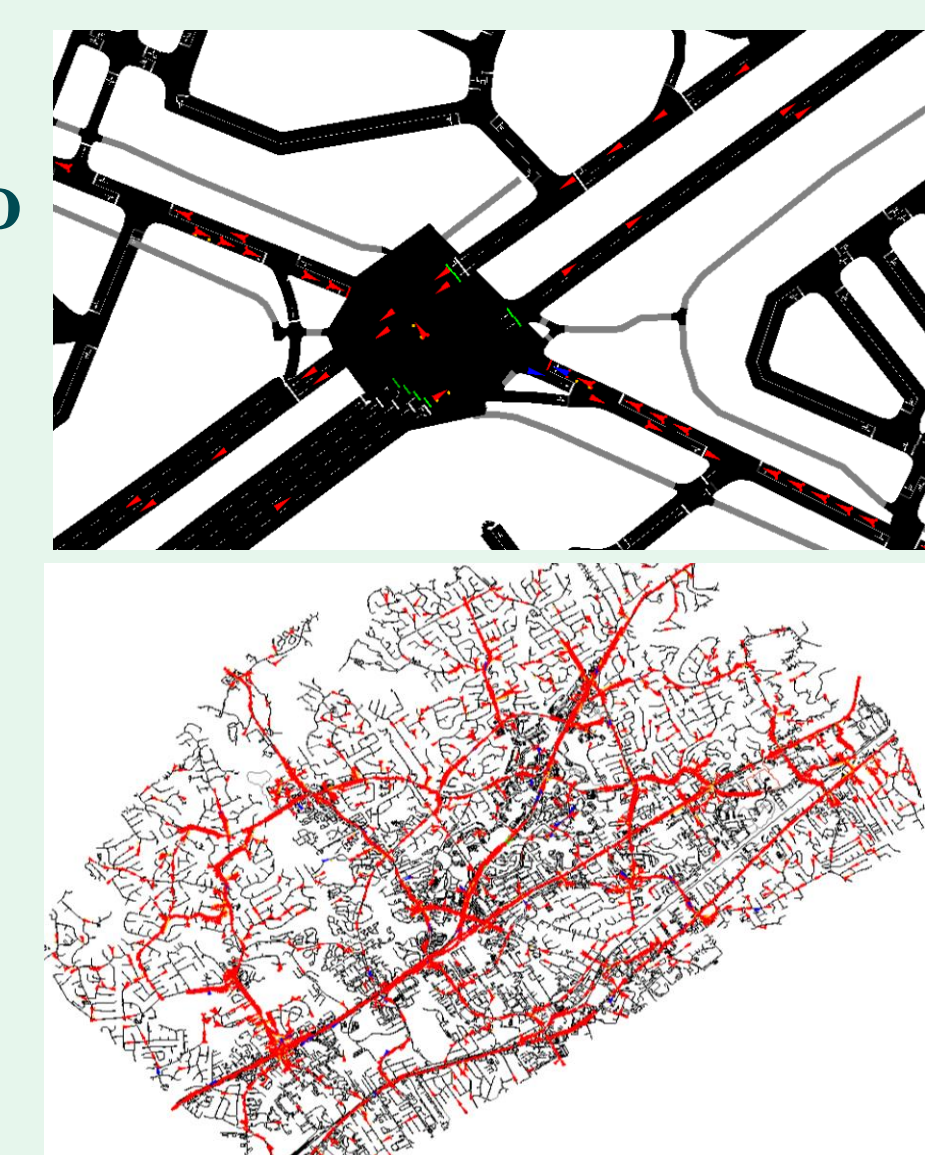
Traffic Simulation of Peachtree Corners

Multidimensional Solution Options to Promote Sustainable Travel

Behavioral Interventions

Monetary and non-monetary incentives to promote sustainable travel behavior (e.g., shift to sustainable modes/routes)

- Online surveys to identify interventions for sustainable travel behavior
- Behavioral models to predict and influence target behavioral changes being developed
- Field experiments to test real-world applicability
- TranSACT prototype app development
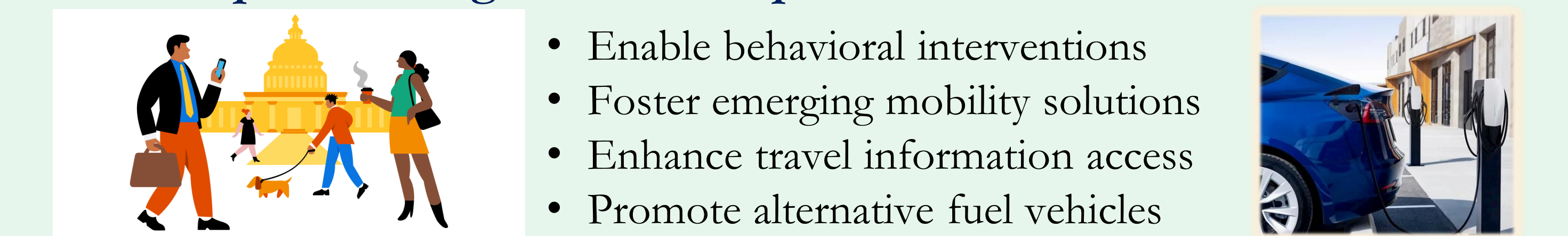
Emerging Mobility Solutions

Emerging mobility options and partnerships between private and public modes to promote sustainable travel

Emerging Mobility Modes | Partnerships Across Modes | Address First/Last Mile Connectivity and Other Access Issues

- Models for private-public partnerships
- Models to coordinate modes seamlessly across planning and operational scales to enhance mobility and accessibility
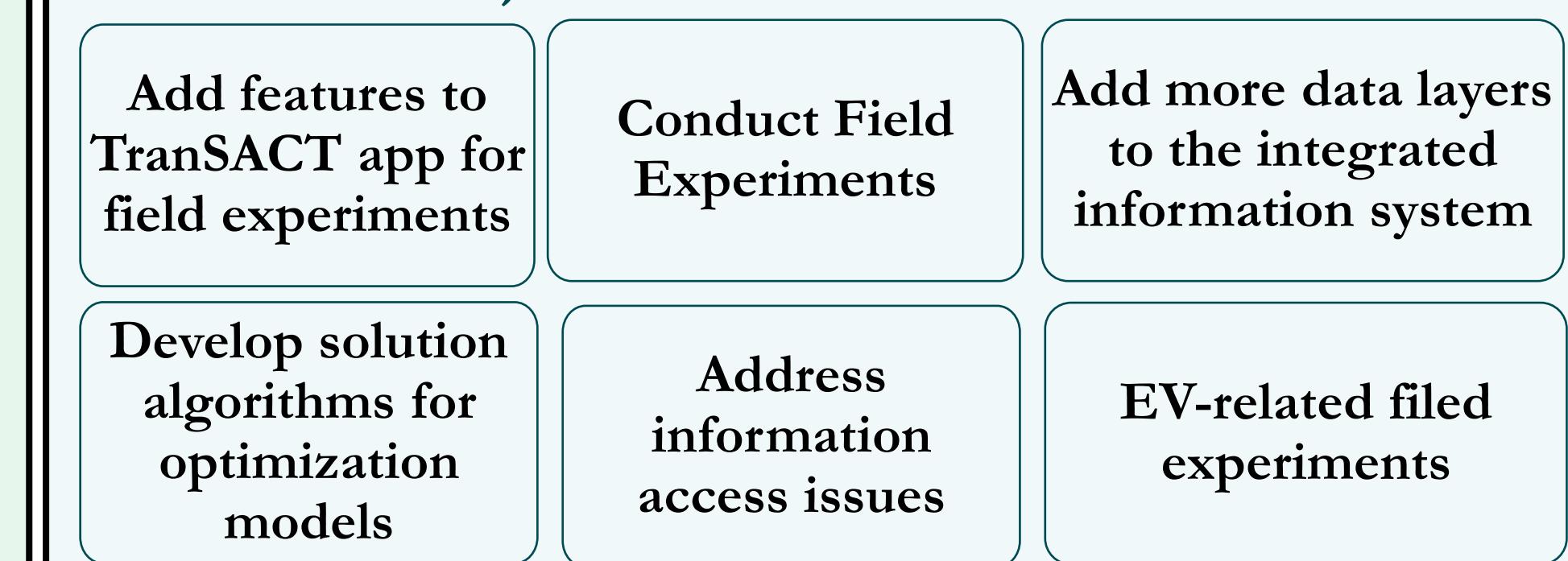- Incentive-driven optimization models to promote sustainable modes

Public Policy Interventions

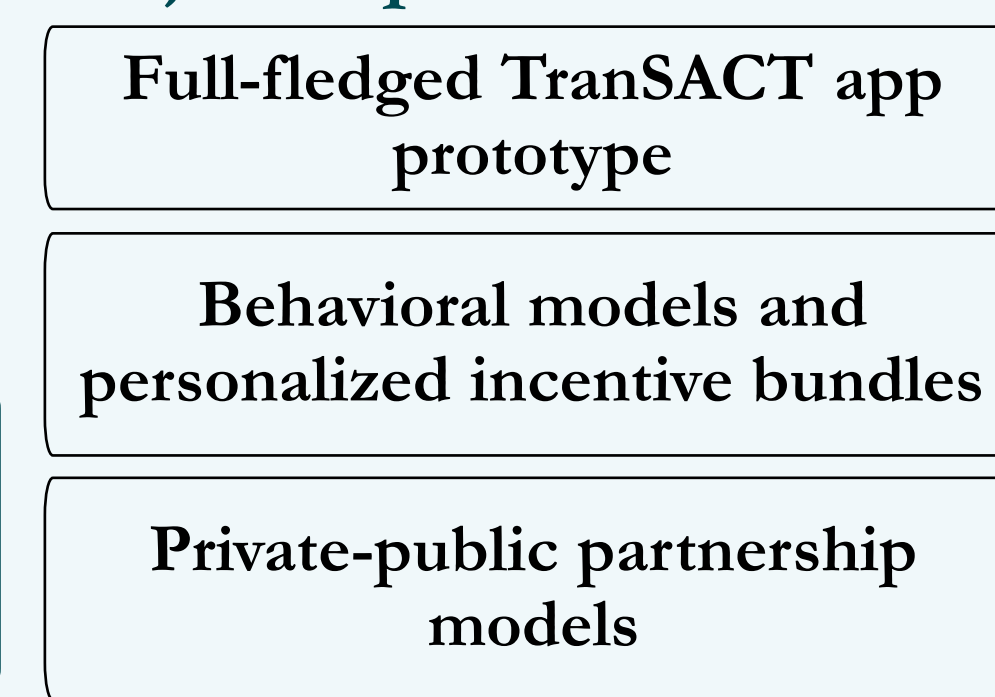**Diverse policies targeted at multiple stakeholder levels**

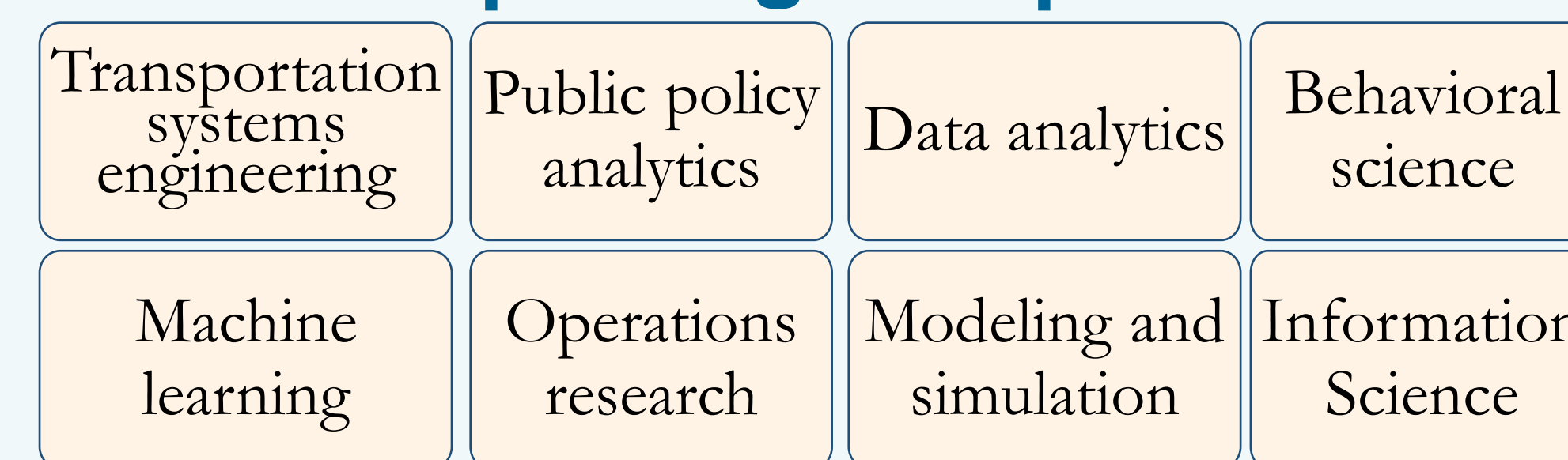- Enable behavioral interventions
- Foster emerging mobility solutions
- Enhance travel information access
- Promote alternative fuel vehicles

Future Goals

Major Planned Activities

- Add features to TranSACT app for field experiments
- Conduct Field Experiments
- Add more data layers to the integrated information system
- Develop solution algorithms for optimization models
- Address information access issues
- EV-related filed experiments

Major Expected Outcomes

- Full-fledged TranSACT app prototype
- Behavioral models and personalized incentive bundles
- Private-public partnership models

Methods Spanning Disciplines

Transportation systems engineering | Public policy analytics | Data analytics | Behavioral science

Machine learning | Operations research | Modeling and simulation | Information Science

Community and Technologies

- Part of Atlanta metropolitan area
- Largest city in Gwinnett County
- Population: 42,108
- Planned community

- AV shuttle
- AV test track
- V2X infrastructure
- 5G wireless environment
- Mobile interactive displays
- Smart streetlights

For more details

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