Community-Driven Design of Urban Air Mobility Transportation Management Systems

Yasser Shoukry (UC Irvine), Cody Fleming (Iowa State Univ), Chandra Bhat (UT Austin), and Min Kyung Lee (UT Austin)
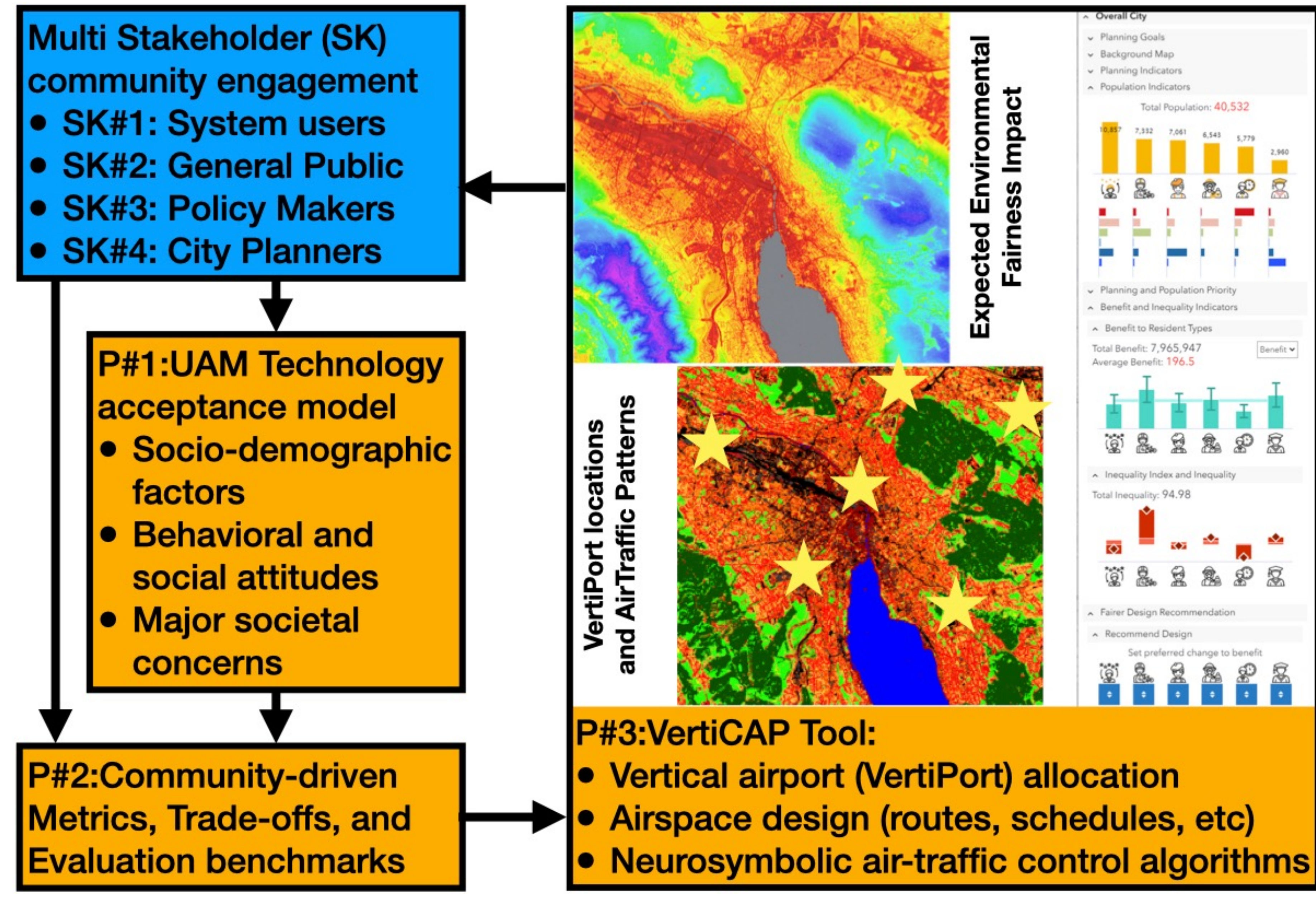
IRG Track 1: FY2023

The design of transportation systems has **a long-lasting, often discriminatory effect** that reinforces existing socio-economic inequality. As Urban Air Mobility (UAM) is being developed as a new transportation mode that is more effective and sustainable, we are at an opportune moment to design its infrastructure to provide effective and equitable air mobility for all, avoiding our past mistakes.

RQ 1. *What are the stakeholders' preferences, attitudes, and concerns about the new UAM technology? In particular: (RQ1-1) What preferences and concerns explain individuals' acceptance of and resistance to UAM? (RQ1-2) What are the aggregated community-level preferences, attitudes, and concerns? (RQ1-3) What are the recommendations and design constraints that ensure equity and feasibility of UAM technologies from a city planning and policy-making point-of-view?*

RQ 2. *How to create (RQ2-1) airspace design approaches that are scalable to larger traffic densities, enabling throughput while enforcing safety; (RQ2-2) design space exploration algorithms that optimize for the performance metrics and social indices; and Moreover, (RQ2-3) How to design provably safe, correct, and fair approaches for the air traffic control of UAM that are guaranteed to take into consideration societal preferences and concerns?*

RQ 3. *How to (RQ3-1) produce benchmarks that measure the satisfaction/violation of all the preferences/concerns of different community stakeholders? (RQ3-2) obtain community-centered measures that capture the stakeholders' preferences, concerns, and constraints? (RQ3-3) find the optimal trade-off between the different metrics?*

Meeting with community stakeholders (Government, policy makers, industry, and advocacy groups, UT Austin, 11/15/2023.)

Multi Stakeholder (SK) community engagement
- SK#1: System users
- SK#2: General Public
- SK#3: Policy Makers
- SK#4: City Planners

P#1:UAM Technology acceptance model
- Socio-demographic factors
- Behavioral and social attitudes
- Major societal concerns

P#2:Community-driven Metrics, Trade-offs, and Evaluation benchmarks

Expected Environmental Fairness Impact

VertiPort locations and AirTraffic Patterns

P#3:VertiCAP Tool:
- Vertical airport (VertiPort) allocation
- Airspace design (routes, schedules, etc)
- Neurosymbolic air-traffic control algorithms

Next steps:

- Survey community preferences and concerns (Spring 2024).

- Algorithms for fair and equitable UAM airspace design and management (Summer 2024).

- Targeted Community engagement through workshops and focus groups (Summer 2024).