

A Programmable and Participatory Sensing Research Testbed using Micromobility Vehicles

Ubaidullah Khan, Raveen Wijewickrama, Buddhi Ashan M.K., A.H.M. Nazmus Sakib, Khoi Trinh, Christina Duthie, Nima Najafian, Ahmer Patel, R.N. Molina, Anindya Maiti, Sushil K. Prasad, Greg P. Griffin, Murtuza Jadliwala



scooterlab.utsa.edu

What is ScooterLab?

An NSF funded (awards #2234516 & #2234517) community research infrastructure initiative, currently under development at UTSA. This publicly-available micromobility testbed and crowd-sensing/crowd-sourcing infrastructure will provide researchers access to a community of riders and a fully operational fleet of customizable dockless e-scooters.

Issues & challenges in micromobility



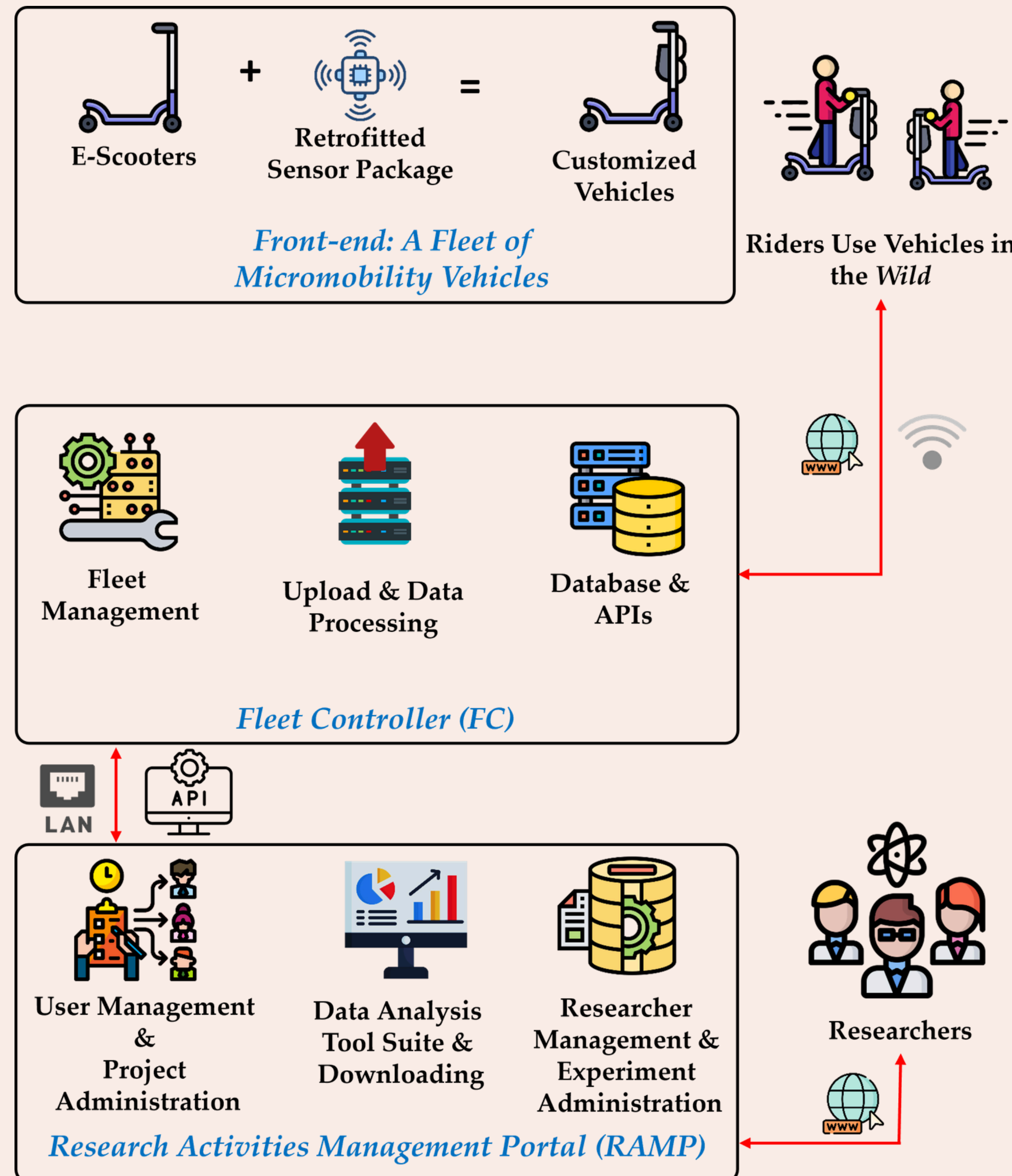
Why ScooterLab?

- Provides space for researchers to address multidisciplinary challenges
- Bypasses commercial service providers who may be unwilling to share data for research
- Offers more customizable sensors
- Creates infrastructure necessary to collect diverse rider, mobility, and contextual data in realistic settings

Broader impact:

- Rider/pedestrian safety
- Urban routing & infrastructure planning
- Public policy
- Transportation engineering
- Data privacy

The ScooterLab Architecture



ScooterLab Community Engagement

ScooterLab Workshop: Advancing Research and Collaboration using a Micromobility-supported Sensing and Research Infrastructure
May 19th, 2025

Join Us to Explore:

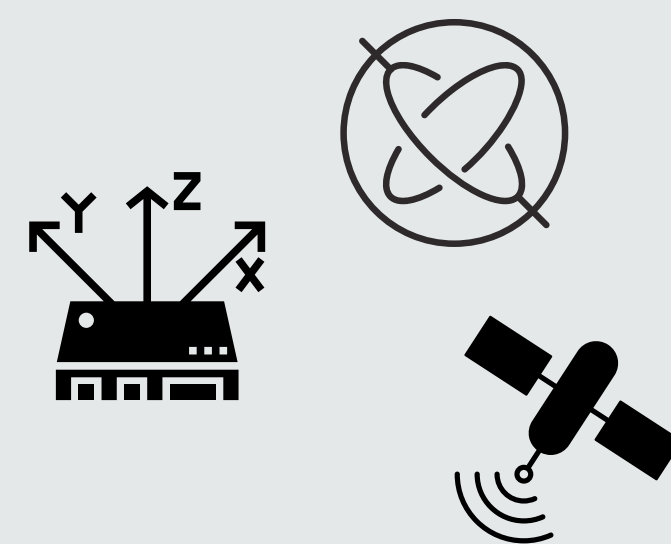
- Aims to showcase the diverse applications of ScooterLab, inspire researchers to address critical scientific and societal challenges through its infrastructure, and foster interdisciplinary collaborations.
- Research presentations from selected Call for Research Collaboration participants
- Community Advisory Board panel on mobility challenges & future opportunities

Scan here for more details or visit: scooterlab.utsa.edu/workshop2025



Vehicle & Front-End

- Initial Prototype E-Scooter - SLP1
- Rigorous testing under realistic conditions
- Prototype E-Scooters (SLP2 - SLP4)
- Deployment phase 1 completed (8 e-scooters)



Features:

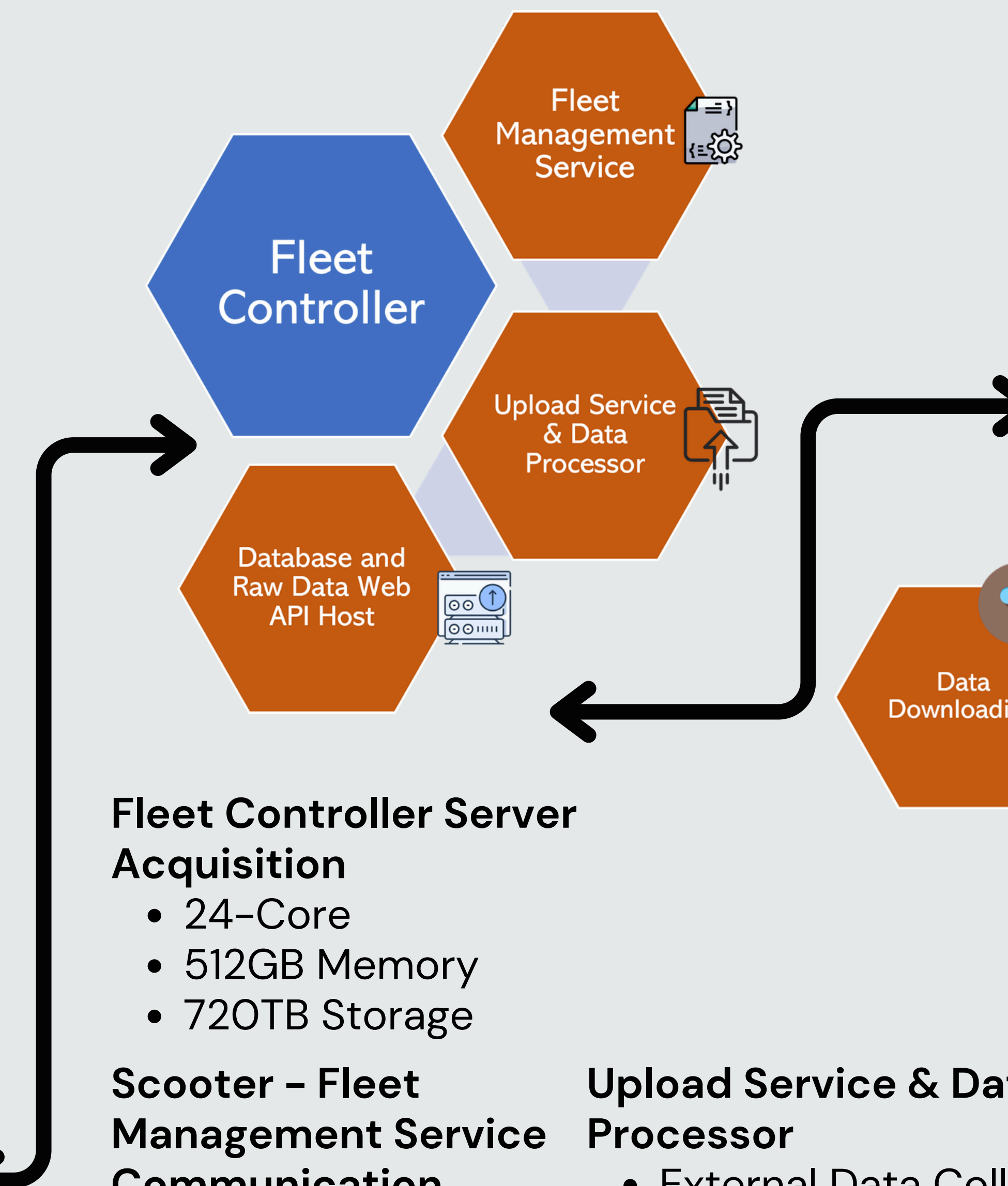
- Sensing: Temperature, Humidity, Pressure, Accelerometer, Gyroscope, Orientation, Magnetometer, GPS, Audio/Video, Light
- Future/Customizations: Air Quality, Lidar, IR, etc.

Statistics So Far

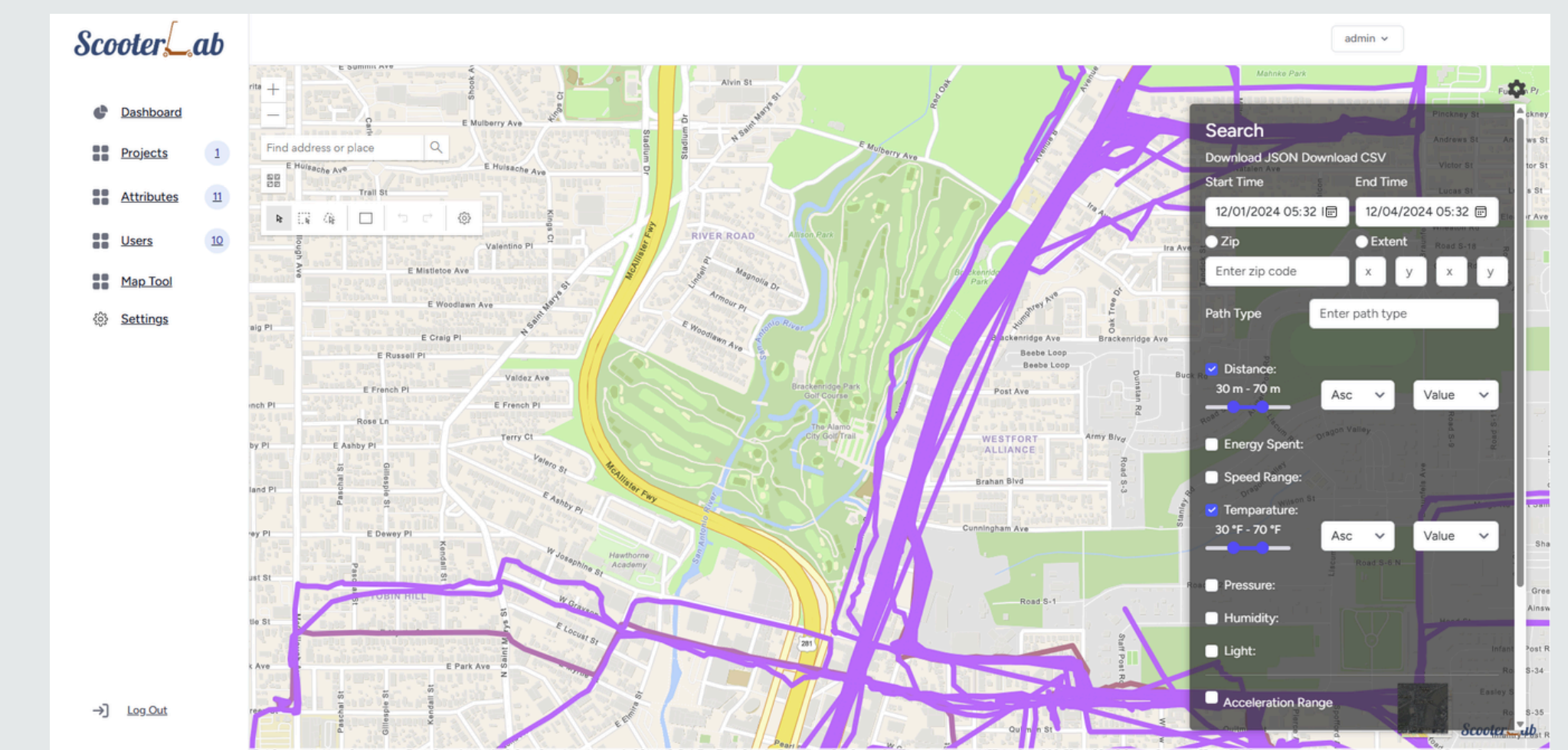
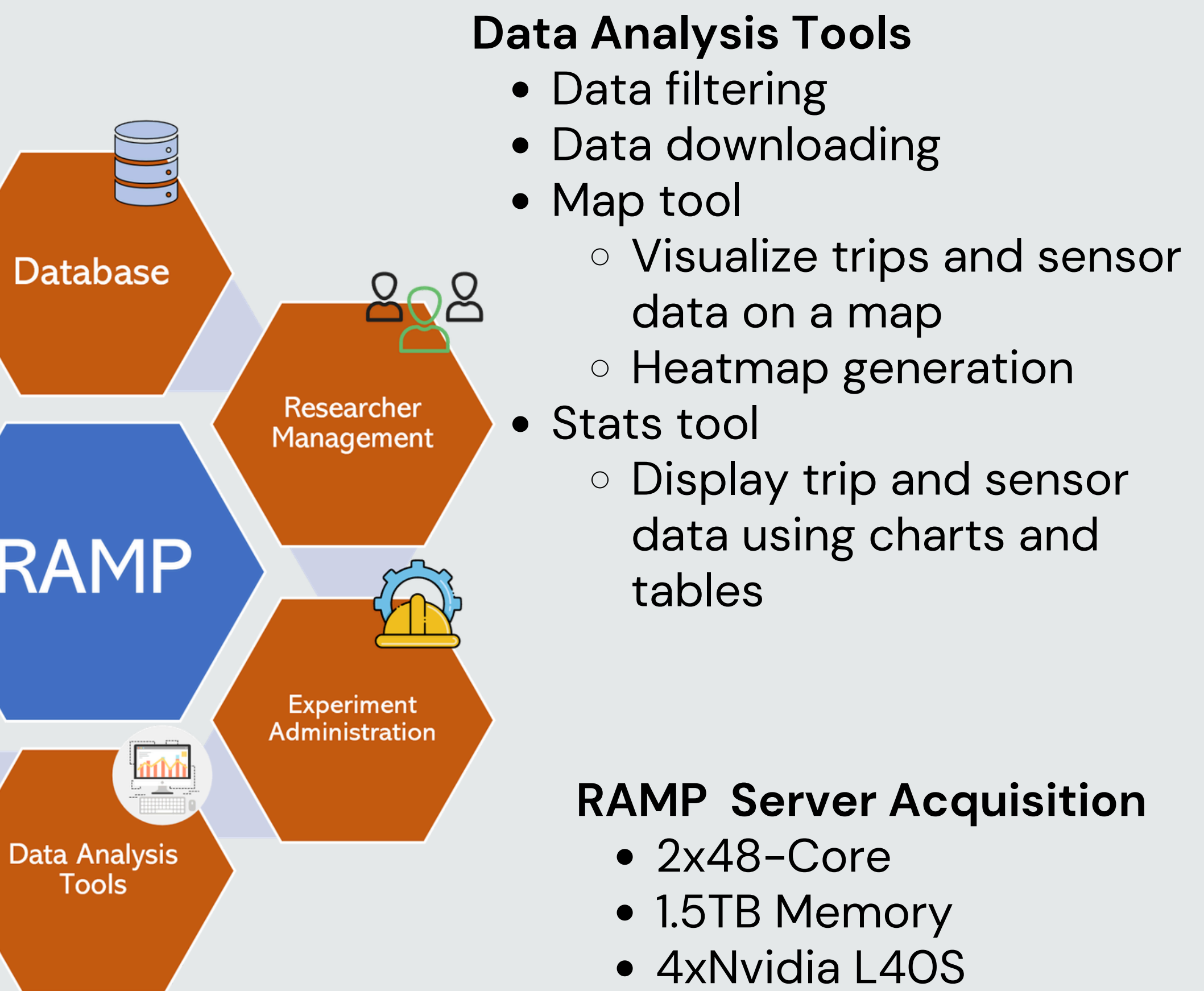
- # of participants: 6
- Total trip count: 457
- Total distance: 1102 km
- Avg trip distance: 2.4 km



Fleet Controller

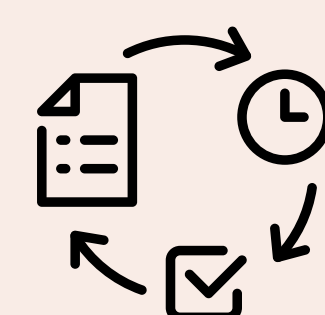


Research Activities Management Portal (RAMP)



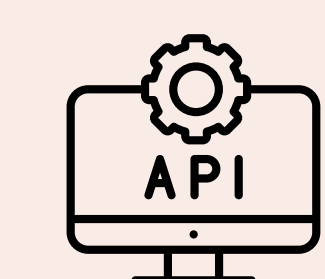
Next Steps

- Deployment Phase 2: 30 e-scooters (Spring 2025)
- Deployment phase 3: 50-100 e-scooters (Summer 2025)



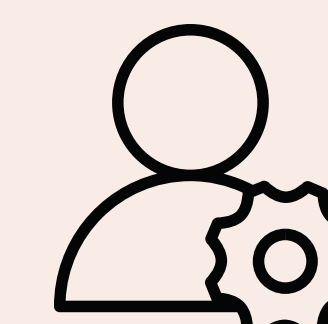
Fleet Management Service

- Reconfiguration Service
- Authentication Service
- Maintenance & operational safety



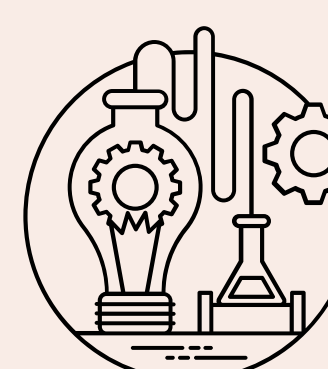
Database & Raw Data Web API Host

- Optimizations for experiment based data queries
- Incorporate external (traffic and weather) data



Researcher Management

- Secure connections to RAMP & data downloading



Experiment Administration

- Allow users to check research experiment progress & manage relevant data



Data Downloading

- File formats: TXT, SHP, CSV, GPX, JSON, GeoJSON