CRII: CPS: Towards Efficient Shared Electric Micromobility: An Interaction-aware Management Framework for Mobile Cyber-Physical Systems

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Shared micromobility systems (e.g., shared bikes and scooters), as an emerging example of mobile CPS, have been increasingly popular in recent years. In this project, we aim to design an efficient electric shared micomobility **management framework**, especially considering **human interactions** with the system (e.g., usage, energy consumption, and preferences).

Challenge 1: model human interactions with the system (**Sensing**): Complex spatiotemporal causal for interactions.

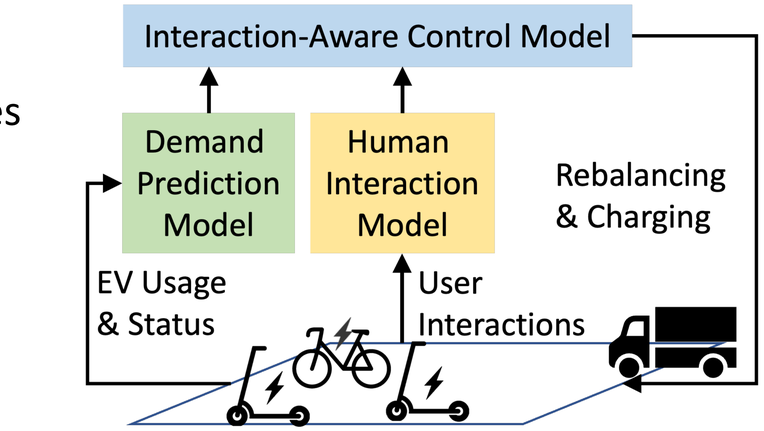
Challenge 2: incorporate interaction models to inform the management framework (**Control**): Uncertainty of interaction models.

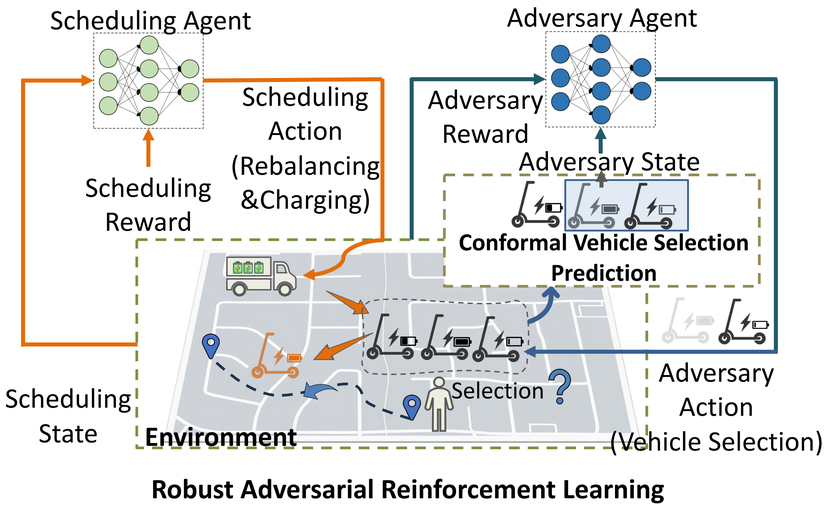
Solutions:

- Shared Electric Micromobility Vehicle Rebalancing and Charging with Energy-informed Demand [Best Paper Award at CIKM'23]
- Spatial-Temporal Conformal Prediction to Quantify Interaction Uncertainty [WWW'24]
- Human Preference-aware Rebalancing and Charging for Shared Electric Micromobility Vehicles [ICRA'24]

Scientific Impact on CPS

- Data-driven approaches for human interaction modeling
- Model uncertainty quantification with spatial-temporal conformal prediction
- Uncertainty-aware Reinforcement Learning-based Scheduling and Planning





Tan, Heng, et al. "Human Preference-aware Rebalancing and Charging for Shared Electric Micromobility Vehicles." To Appear in ICRA 2024.

Broader Impacts: Society

- Provide a human centered management framework for service operators with better service quality
- Meet residential demand for micromobility and connections

Broad Impacts: Education and Outreach

- Interaction platform for REU students
- Research training for undergraduate and graduate students
- Workshop: njbikeped.org/micromobility-workshop-2024/

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