INTRODUCTION

The convergence of self-driving and electric vehicle technology holds great promise for transforming urban land use (in an on-demand carsharing platform with increased parking infrastructure) and alleviating congestion (in a dynamic ridesharing platform with increased vehicle occupancy). Ridesharing services, such as UberPOOL and Lyft Line, were introduced by transportation network companies (TNCs), and have shown great potential in improving mobility services in terms of accessibility and sustainability. This poster presents the impacts of integrating a ride matching system to a fleet of Shared Autonomus Electric Vehicles (SAEVs), using regional travel data from Puget Sound Regional Council (PSRC).

RIDE MATCHING ALGORITHM

At each time step, each trip is matched with other trips in the adjacent area. This is accomplished by implementing a K-Nearest Neighbor (KNN) search algorithm that identifies similar trips by comparing their origin to destination vector. After the trips are matched with the SAEV, an itinerary is created by solving the Vehicle Routing Problem (VRP) that provides the optimum travel route. Since the vehicles modeled are standard passenger cars (4 seat capacity), the problem can be solved by finding the shortest path to traverse the nodes (maximum 8) with the constraint of visiting the origin before the destination for any given trip.

MODEL SETUP

A discrete-time agent-based simulation model is used to evaluate the SAEV fleet operations in a spatially discretized Seattle region (King, Kitsap, Pierce, and Snohomish Counties). Different operation scenarios are simulated, including vehicle type range (Short Range [SR] vs. Long Range [LR]), charging infrastructure (Fast Charge [FC] vs. Slow Charge [SC]) and market penetration rate. The impacts on mobility sustainability are measured in terms of vehicle miles traveled (VMT), fleet size, passenger wait time, charging station distribution, and the ability to meet trip demand.

CONCLUSIONS

The proposed SAEV fleet can serve as a sustainable transportation option in metropolitan areas. Results have show a positive correlation between market penetration and operational efficiency. In addition, trip-making pattern and population density influence the optimal SAEV fleet configuration, and therefore region-specific analyses are recommended for cities interested in implementing such a service.

FUTURE WORK

We are currently expanding the capability of the simulator to evaluate the potential of the SAEV fleet to provide last-mile connection service to public transit and replace the park-and-ride model.