Master's Thesis of Sharifullah Asady

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Fig 1: Number of requests served in percentage

The size of the fleet also plays a pivotal role in the efficiency of the service. Various fleet sizes, ranging from 28 to 64 vehicles, have been considered.

As indicated in Fig 1, ZB-rebalancing and no-rebalancing exhibit similar performance in terms of the number of passenger requests served. However, the taxi-stand rebalancing strategy serves a smaller number of requests. It is also noticeable that for ZBrebalancing and no-rebalancing strategies, the impact of assignment methods is more pronounced in smaller fleets, but this influence diminishes as fleet size increases. Among the smaller fleets, the NN assignment method is markedly superior.

Similar outcomes are observable in Fig 2. An increase in fleet size corresponds with a decrease in waiting time, and the distinct effects of the assignment methods begin to fade. This trend is attributed to a more effective distribution of vehicles within the service area, resulting in fairly consistent waiting times. Nevertheless, with a smaller fleet, the NN method still outperforms the others.



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Ride-hailing services, facilitated by smartphone applications, provide on-demand transportation solutions distinct from traditional taxi offerings. For users, these platforms offer unparalleled convenience and often reduced travel costs.

These platforms use assignment methods to efficiently pair drivers and passengers. These methods leverage advanced algorithms and optimization strategies to enhance efficiency, ensure user satisfaction, and boost profitability. The main goal is to connect drivers to riders promptly, thus reducing wait times for users, minimizing idle periods for drivers, and improving the system's overall performance. The assignment methods utilized include First Come First Serve (FCFS), Last Come First Serve (LCFS), Nearest-Neighbor (NN), and Zone-Based (ZB).

In addition, the effectiveness of different rebalancing strategies decisions on how vehicles should be positioned after passenger drop-offs—has been evaluated. The strategies examined are taxistand rebalancing, no-rebalancing, and Zone-based rebalancing.



Fig 2: Standard deviation of waiting time in minutes

Fig 3 illustrates the impact of assignment methods, rebalancing strategies, and fleet size on the empty mileage per trip, measured in kilometers. In fleets with fewer vehicles, assignment methods have a significant influence, but as the fleet size expands, their impact lessens. The taxi-stand rebalancing strategy results in the highest empty mileage because vehicles must return to a designated taxi-stand after each drop-off, thus incurring additional unoccupied travel. Conversely, the no-rebalancing strategy is the most efficient, as vehicles are parked off-road immediately after a drop-off. The ZB-rebalancing, which directs vehicles towards areas with higher demand, leads to increased empty mileage as fleet size increases, since all vehicles converge on the high-demand zones, adding extra travel without passengers.

Despite these varying effects, the NN method consistently outperforms the alternative approaches.

Fig 3: Empty Mileage per trip in kilometers