



Supervisor: Dr. Zhiyi Huang
Second Examiner: Dr. Hubert T.H. Chan

Building an Easy-to-use Ride-sharing App for HK

FYP18028
Group members: Leung Hon Man, Lau Chun Yin, Lau Chi Ho



Abstract

In recent years, ride-sharing has been an alternative to public transportation or private car rental for commuters in countries around the world. It is believed that ride-sharing is a way to alleviate traffic congestion and reduce air pollution caused by vehicles. However, Hong Kong, as a world-class city which is suffering from traffic congestion, has not exploited the benefits of ride-sharing. One possible reason for this is the absence of an extensively used ride-sharing mobile application in Hong Kong up to this date.

In an effort to increase the popularity of ride-sharing in Hong Kong, this project aimed to design and implement a fully-featured handy ride sharing mobile application for Android and IOS platform and related web services which adapted matching algorithms from cutting-edge research. Two algorithms were implemented and evaluated using real-world test cases and a virtual grid world simulator in this project.

Technology Used

Frontend:



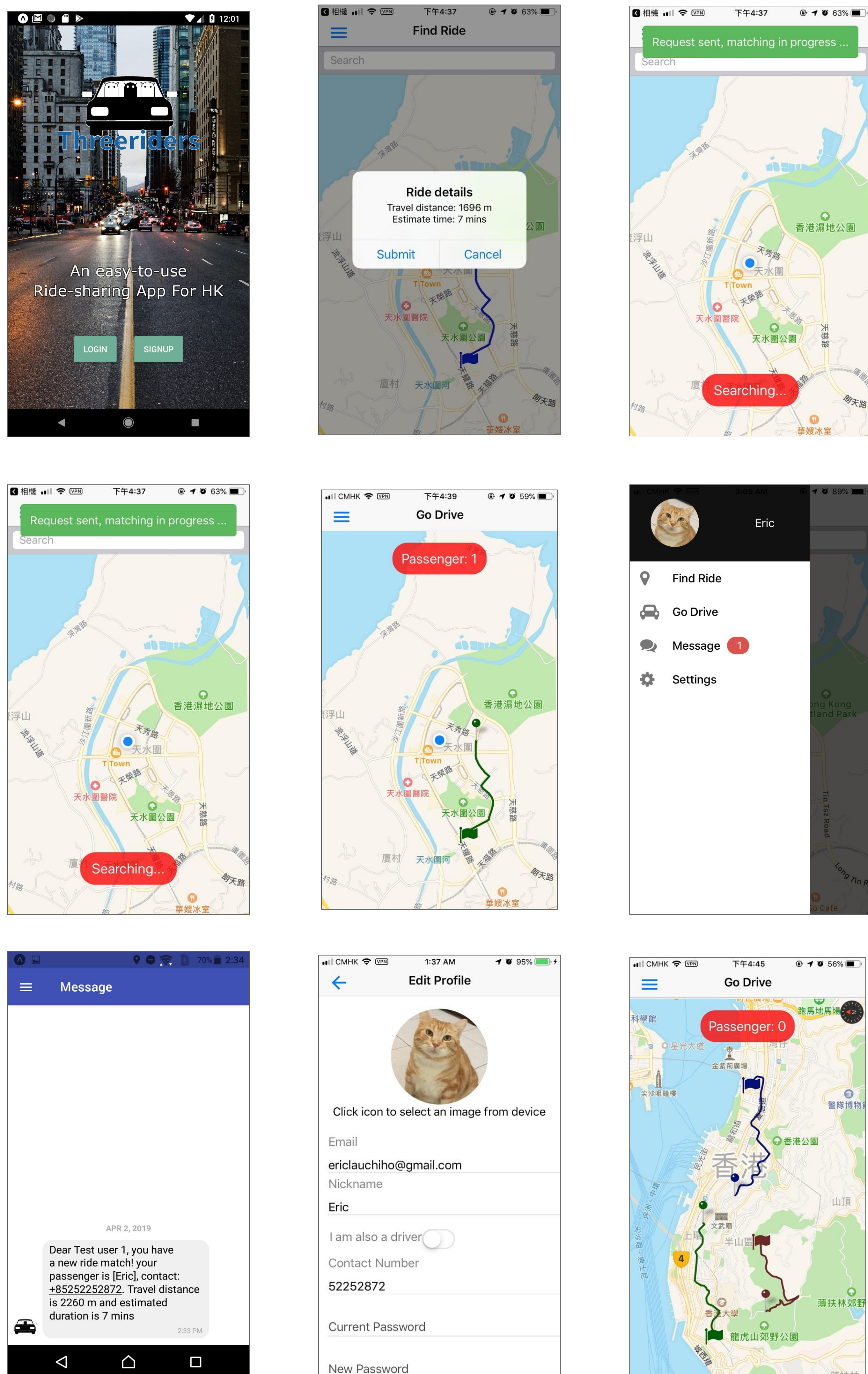
Backend:



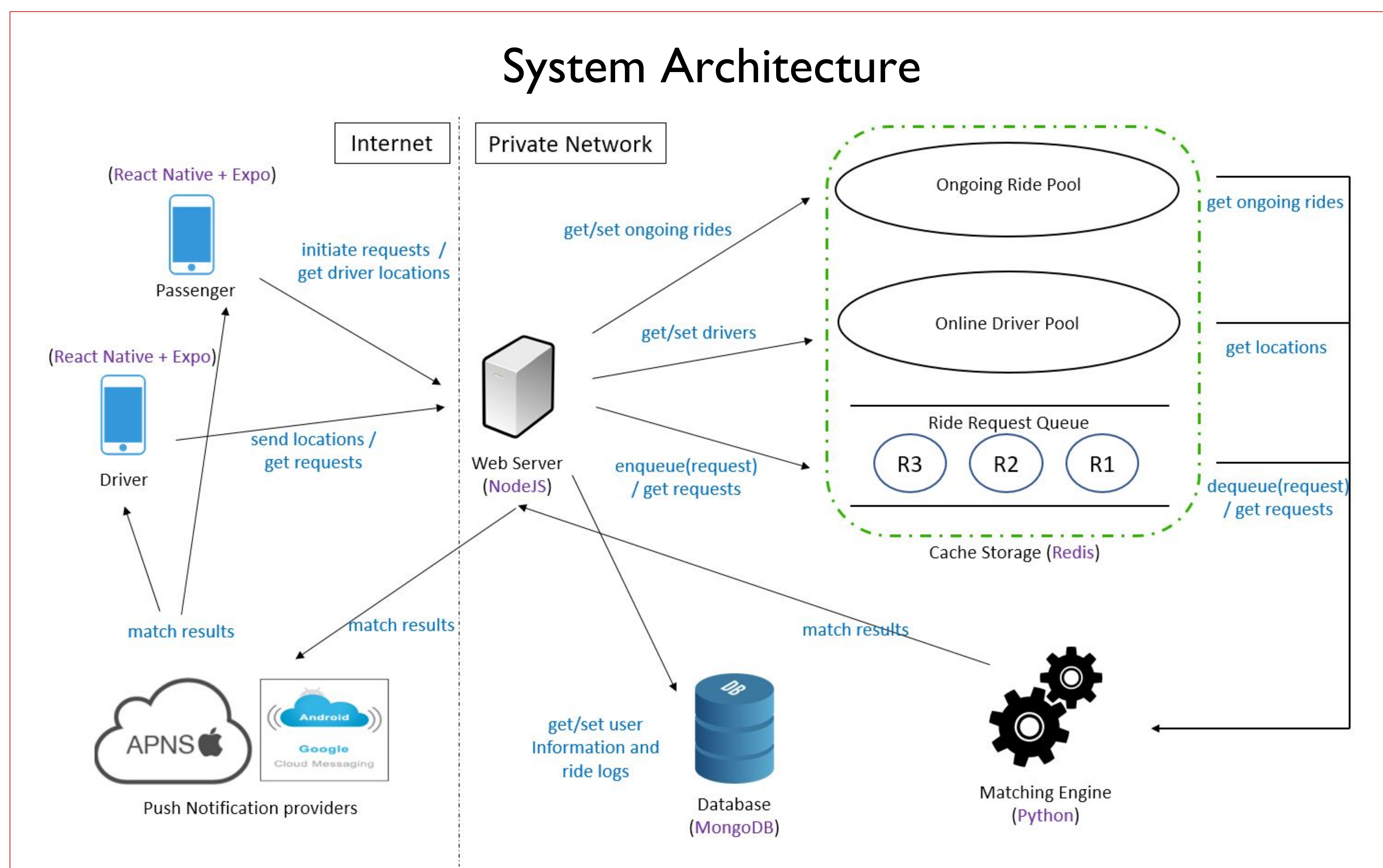
Database:



Screenshots of Our Mobile App



Methodology



Algorithm 1: Simple Greedy Algorithm

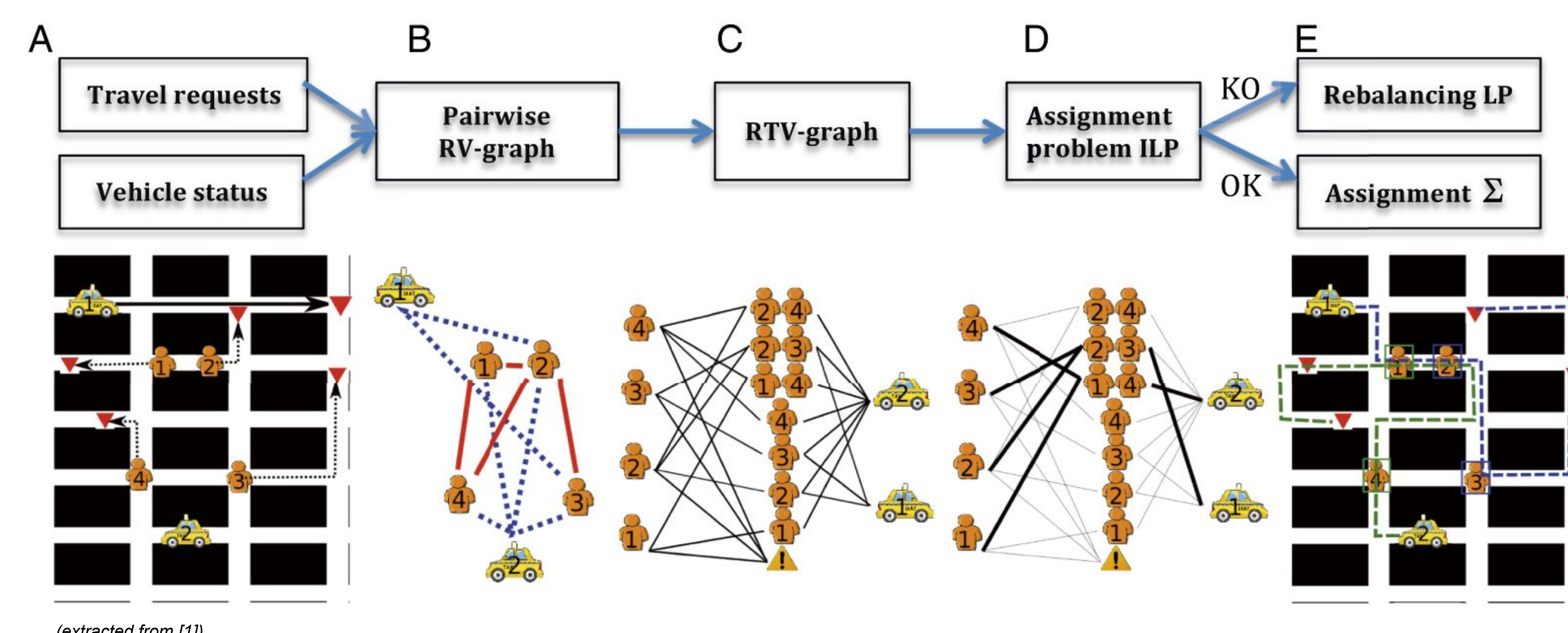
Input: Requests R , Vehicles V , Constraints Z
Output: Requests R' that cannot be matched where $R' \subseteq R$
Match results $M = \{m_1, m_2, \dots, m_n\}$ where $m = (r, v)$

Steps:

- $C \leftarrow \{(r, v) \mid r \in R \wedge v \in V\}$
- Sort C in asc order by $distance(r.origin, v.location)$
- $M \leftarrow \{c : c \in C \wedge r \text{ and } v \text{ satisfy } Z \text{ where } c = (r, v)\}$
- $R' \leftarrow \{r : r \in R \wedge r \notin \{r' : (r', v') \in M\}\}$
- Return M, R'

$Z = \{r \text{ is sharable with } v, v \text{ is not full, straight line distance of } r.origin \text{ and } v.location < 1 \text{ km}\}$

Algorithm 2: Dynamic Algorithm^[1]



Experiments and Results

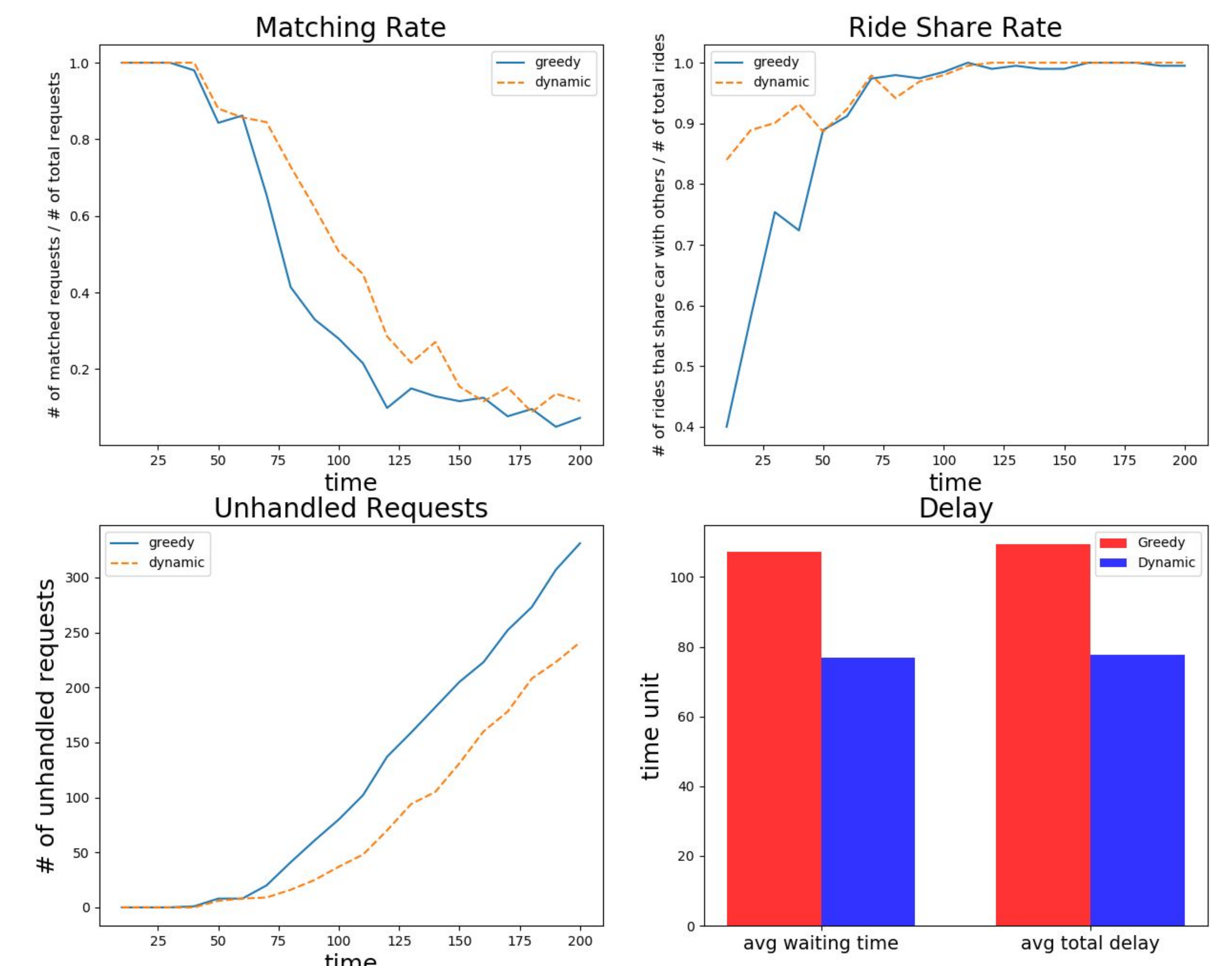
A Real World Case Study



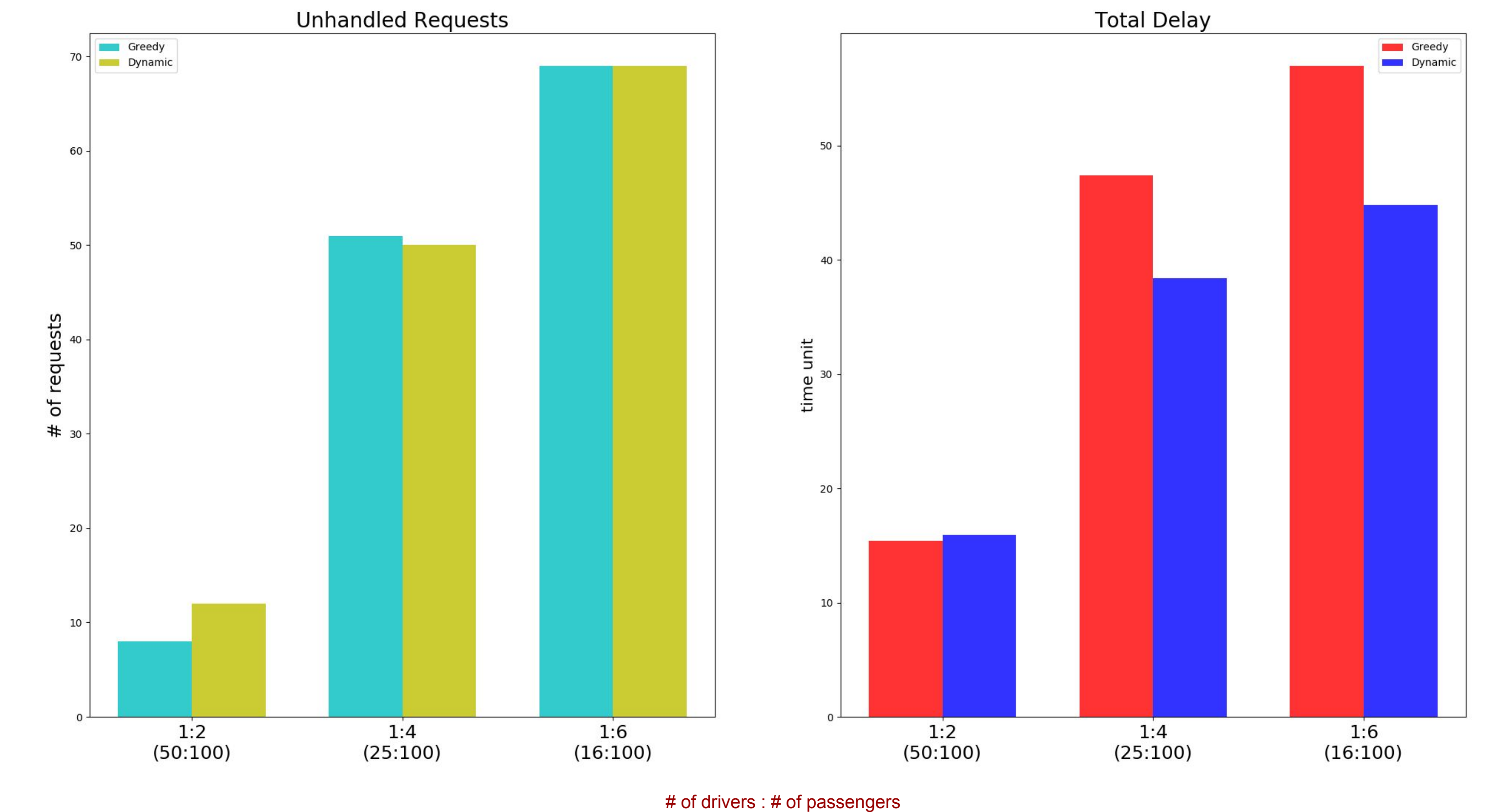
Results

Greedy Algorithm:
R1->D1
Dynamic Algorithm:
R1->D2
R3->D1

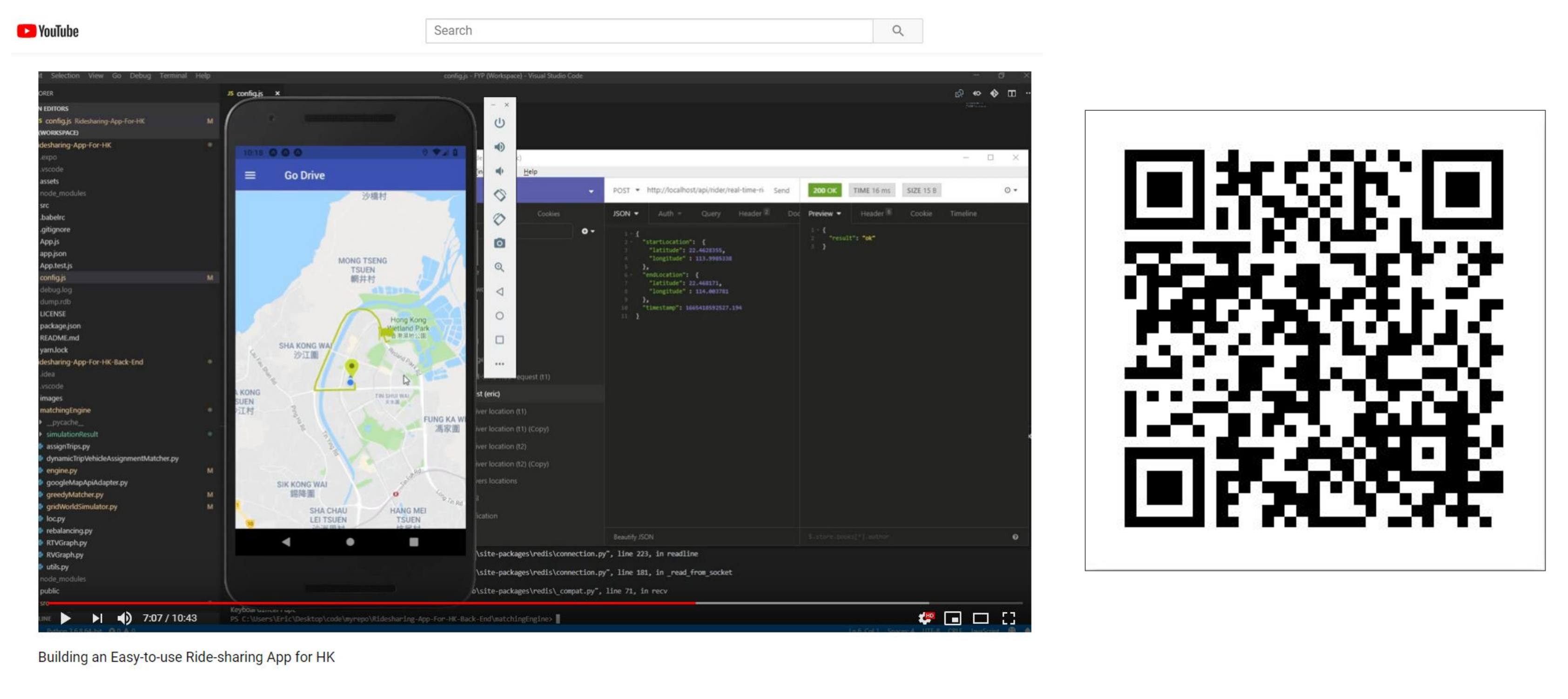
Grid World Simulator: Peak Traffic Time



Grid World Simulator: Benchmarking



Demonstration Video



Conclusion and Future Works

The results show that the dynamic algorithm has a better performance in general compared to the greedy algorithm. This project has created a free-of-charge and usable ride-sharing app.

In the future, the mobile application can be fine-tuned to production ready and be published to iOS App Store and Android Play Store. In addition, the UI/UX of the mobile application and the time efficiency of the matching algorithm can also be improved.

References

- [1] J. Alonso-Mora et al. (2017). On-demand high-capacity ride-sharing via dynamic trip-vehicle assignment. Proc Natl Acad Sci USA 114(3):462–467.
- [2] Santi P. et al. (2014). Quantifying the benefits of vehicle pooling with shareability networks. Proc Natl Acad Sci USA 111(37):13290–13294.
- [3] Our Mobile App GitHub Repository: <https://github.com/eric19960304/Ridesharing-App-For-HK>
- [4] Our Back-end GitHub Repository: <https://github.com/eric19960304/Ridesharing-App-For-HK-Back-End>