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Negotiating Shared Intentions in Virtual Space for Intelligent Mobility On-Demand

Introduction

Existing user interfaces for ad-hoc ride sharing are rigid. Derived from algorithms in operations research and transportation theory, they require that all trip information be disclosed a priori in a single step. However for a client this results in two issues: service knowledge and location privacy. Addressing these *OppRide* [1] was developed to provide a client with a lens into the ride matching process. The 2-step negotiation (Fig. 1) requires that only discrete drop-off constraints be initially disclosed. From this information, a relevant set of rides is identified and the client's potential pick-up locations are communicated in the form of interactive features called *launch pads* (Fig. 2).

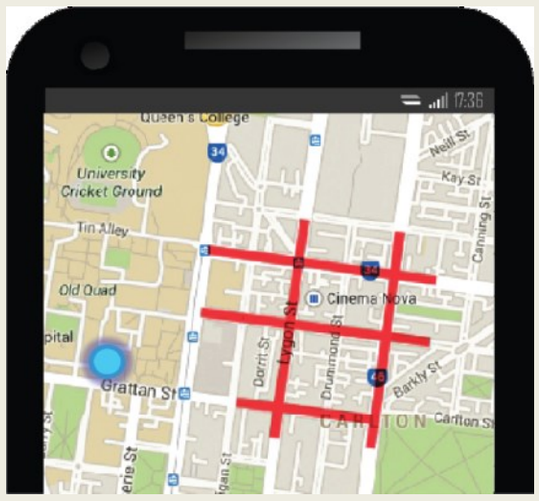
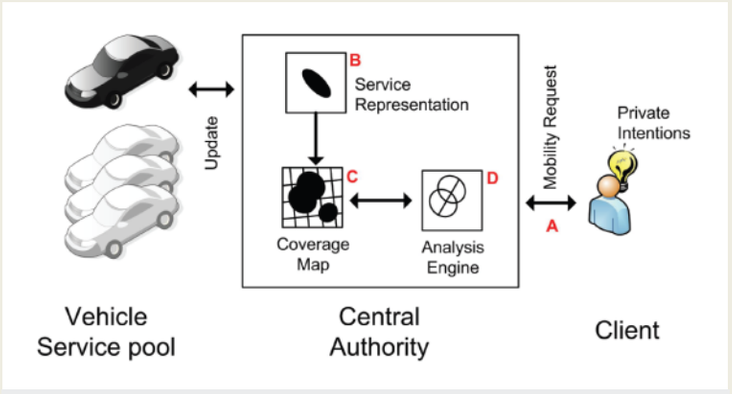


Figure 2: Launch pads (red) visualized within a client's mobile device

OppRide: Client Perspective



A Client mobility request
Drop-off only: location, d, arrival time t_d with flexibility t_{flex} and an additional factor, α, for some minimum decision making time.

$$Q = [t_{now} + t_\alpha,\ t_d + t_{flex}]$$

B Vehicle network time prism
Three dimensional (x,y,t) network time prism (NTP) [2].

C Service coverage map
An aggregate representation of all active vehicles' service potential.

D Deriving launch pads
Applying the client's query, a space-time slab is derived from each relevant vehicle's NTP. Projecting the slab $\mathbb{R}^3 \mapsto \mathbb{R}^2$, the vector map, X, is created.

Figure 1: OppRide architecture

Adding Dimensions

To improve the pick-up choice set, launch pads can be extended to 3D (x,y,colour). Revisiting map algebra theory, we examine the suitability of operators for various types of choice factors to aggregate individual vehicle maps into launch pads (Fig. 3).

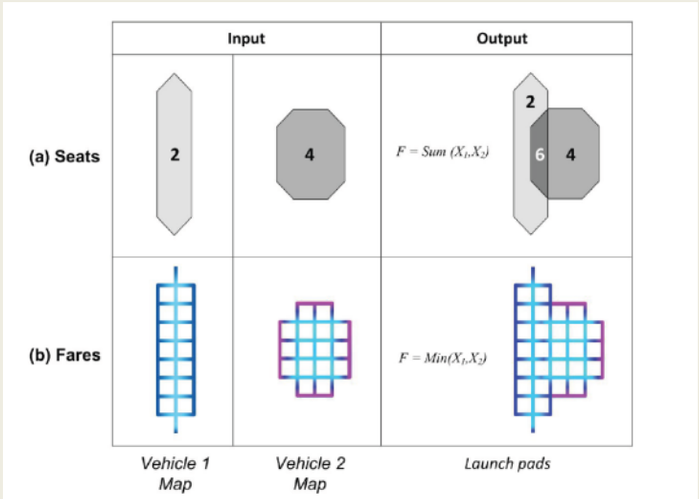


Figure 3: Example operators for two vehicle maps overlapping in space-time

References:

[1] Rigby, M., Krüger, A., & Winter, S. (2013). An opportunistic client user interface to support centralized ride share planning. Proceedings of the 21st ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems, Orlando, Florida.

[2] Kuijpers, B., & Othman, W. (2009). Modeling uncertainty of moving objects on road networks via space-time prisms. *International Journal of Geographical Information Science*, 23(9), 1095-1117.

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