Mobile Context-based Ride Sharing

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Abstract. When it comes to transportation, especially in densely populated areas, people usually face a trade-off between convenience and costs. Whereas on one hand convenience as a driving factor leads to that people are preferring to use cars, air pollution, traffic jams, and high cost due to fuel price on the other hand encourage many people (e.g., commuters) to use collective transportation (CT), such as public transport systems. However it does not support door-to-door transportation and might be inconvenient due to limited services in off-peak hours or high costs when travelling long distances. A solution growing in popularity is ride sharing, a form of CT making alternative transportation more affordable. In this paper we present a modular platform supporting different forms of ride sharing based on context information. *WEtaxi* is a system, which allows sharing taxis among multiple persons. *WEticket* supports sharing train tickets through finding additional people going onto the same journey.

Keywords: ride sharing, ticket sharing, mobile phone, collective transportation

1 Introduction

Modern forms of vehicles nowadays have made transportation much easier and more convenient. However, the increasing number of vehicles in densely populated areas creates various problems for modern life effecting not only the environment but also the economy and our lives. Transportation is a major contributor to air pollution and traffic jams as well as scarce parking space are omnipresent concerns for inhabitants of large cities. Despite these problems, convenience is still a driving factor leading to that people are nevertheless using their cars, often individually. Hence, reducing the number of vehicles is one of the solutions for these problems. Collective Transportation (CT) and particularly public transportation as its most common form, contribute to this solution. However, there are many situations where public transportation is inconvenient, e.g., when trying to reach remote locations, for door-to-door transportation, or in off-peak hours where services are limited. Another factor is high costs involved with using public transport, especially when used irregularly so that no dis-

counts are applicable (e.g., for monthly tickets). Therefore, a new form of transportation, called ride sharing, is becoming more and more popular. People organize themselves in groups to share cars (car pooling), taxis, or (group) tickets for trains. However, ad hoc situations (e.g., getting home from a party) make it often difficult to find other people taking the same / similar routes as they cannot be planned in advance.

Various systems exist nowadays which support users in finding rides for their trips, e.g., [5] and [4]. Cab-sharing is a type of ride sharing aiming at using unoccupied cab space to reduce the cost of transportation [2]. Furthermore, optimization of CT has been investigated in [6] and [1]. Gidofalvi *et al*. [3] focused on how ride sharing requests can be grouped together efficiently through mathematical algorithms to utilize ride sharing and achieve significant savings. However, none of the aforementioned systems support the use of context information in order to assist in finding people close by, or which are on the same route.

In this paper we use a modular context-based ride sharing platform, called *WEtransport* [7] on top of which we designed and implemented two applications: (1) *WEtaxi* is an application which allows sharing taxis among multiple persons; (2) *WEticket* supports sharing train tickets that allow taking additional people onto a journey (e.g., using a group ticket). We are currently working on releasing both services to the public in order to assess suitability, uptake, and impact on how people use ride sharing.

2 Mobile Context-based Ride Sharing

Ride sharing can be applied to different types of transportation, such as cars, taxis, trains, etc. In order to support ride sharing, a system requires a set of information, such as time, origin, or destination for finding appropriate matches (i.e., people, having the same or similar ways of travel). Transportation-specific information depends on the chosen mode of transport. This might be the number of available seats (e.g., car, cab), the type of ticket (e.g., pair or group tickets when travelling by train), etc.

WEtransport is a modular context-based ride sharing platform allowing to store rides consisting of both general and transportation specific-information within a database. The platform aims at enhancing convenience, reliability, and affordability of different forms of ride sharing by means of context data. The platform is extendable for sharing any type of transportation such as taxi, car, or public services following fixed routes (train, bus, ...). A RESTful API allows external applications or services to access the platform's information and tailor its user interface for the use among different means of transport. Apart from the type of transport the users of the WEtransport system generally can be divided into two groups: (1) users who want to share rides and are looking for one or more ride-mates (based on the capacity) and (2) users who are looking for hitching and sharing rides. Users in the first group can define a ride and enter the details to the system. The information includes time, origin, and destination points, the ride's description, and the meeting point. On the other side, users in the second group are able to search for a ride based on the given information (time, origin, and destination points). If an appropriate ride is found, then the user can sign up and wait for the confirmation from the ride's owner (if necessary). As soon as

a user signs up for a ride, a notification is sent to the ride's owner. After the owner has made the decision, a notification is sent back to the user.

Based on this platform we implemented two context-based ride sharing mobile applications that support two different transportation modes: *WEticket* (train) and *WEtaxi* (taxi). The mobile phone assesses users' context information and allows users to find or share a ride spontaneously on the way.

3 WEticket

In many countries the railway transportation is among the most popular types of public transport due to the fact that it is not affected by traffic jam, hence allowing highly predictable travel times. Usually several types of tickets are available that let more than one passenger use the ticket. The higher price compared to a single ticket is quickly compensated as additional passengers (up to the maximum number allowed) share the ticket and potentially reduces the price drastically. The main problem with sharing tickets is, unless travelling in a group, to find people sharing the same route (or parts of a route). We see large potential in considering the users' current context (e.g., his location, destination, time of travel) when it comes to searching ride mates, if this can be done in an implicit way (i.e., users do not have to manually browse a long list of somewhat similar rides).

We implemented *WEticket*, a module, which is capable of incorporating and using the rail connection plan of certain regions or even countries. As a result, stations that are being passed on a ride as well as connecting trains can be considered when matching offers and requests. As users enter names of train stations, the location of stations can be extracted from the GPS information on the mobile phone or through available web services, e.g., Google Maps and merged with existing line-information. This process is completely transparent to the user.

4 WEtaxi

Taxis are the most popular and convenient means of public transport for door-to-door transportation. However, the rather high cost of usage discourages many people from using it. However, if the cost is divided among a number of passengers, the price for using the taxi becomes comparable to the price of public transport. For example, when the capacity of a taxi is shared between 4 passengers instead of one, the cost can be reduced up to 75%. Hence, sharing unoccupied taxi space is a solution for reducing the cost of transportation, fuel, and CO_2 emission. Even it might be a chance to create new social connections.

The *WEtaxi* application helps users to find ride-mates and share a taxi in a very fast and effective way. The mobile app allows users to use this service in ad hoc situations. It provides a map-based assistance (and GPS-based information on mobile devices) for entering start and destination points. The platform automatically calculates the fastest route, distance, and estimated cost for the planned ride. It also offers a ride-board where passengers can leave messages for coordination and notification. The

process of matching requests and finding rides is completely performed by the system. The search result includes all information about available rides such as already signed up passengers and their ratings, the estimated price, the meeting point, and the number of available seats. So signing up for a ride requires just one click.

5 Study and Discussion

We are currently planning to release the platform and the mobile clients to the public. Mobile clients will be distributed via App Store and Android Market. We have evaluated both mobile applications' interfaces in lab studies and plan to conduct a study in the wild in order to answer the following major research questions:

- How can context information improve the user experience of ride-sharing? Current approaches often suffer from inconvenient user interfaces where information and suitable rides have to be provided and found manually. By automatically assessing the user's context we envision to enhance the user experience.
- What is the social impact of our platform? Ride sharing with strangers requires trust between all parties. Which information is required to build such a trust?
- How we can encourage people to use such services? And what incentives should be provided?

6 Conclusion

In this paper we use a modular context-based ride sharing platform, called *WEtransport*, and implemented two different ridesharing systems: *WEticket* and *WEtaxi*. *WEticket* lets users share train group tickets with others. On the other hand *WEtaxi* allows finding ride-mates and share a taxi in a very fast and effective way.

As a future work we plan to further extend our platform, to e.g., support carpooling. Hence, free seats could be shared with people travelling in the same direction. Though conceptually this is similar to taxi sharing, the social component becomes much more important as people probably do not want to ride with arbitrary strangers. Hence, social mechanisms, such as profiles and ratings will be important.

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