Paper: Designing a Sustainable Mobility System for Shared Transportation

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ABSTRACT

Mobile digital devices can help foster more sustainable urban transport behaviours by providing useful and usable tools that support urban travellers when planning and executing their trips and enabling new and disruptive travel behaviours. Such digital tools can help travellers to organise shared journeys, such as taxi sharing and car-pooling which are low-emission alternatives to private car journeys. In this paper we report on the participatory design of such a system to support sustainable urban travel.

Categories and Subject Descriptors

H.5.2 [**Information interfaces and presentation (e.g., HCI)**]: User Interfaces - User-centered design

General Terms

Theory

Keywords

Sustainability; intelligent transport systems; social networks; participatory design

1. INTRODUCTION

We report on the participatory design of an urban mobility system that includes mobile digital clients for planning and executing journeys using shared taxis and car-pooling schemes. This is in the context of a wider urban mobility platform called SUPERHUB [7, 1] that aims to provide an integrated, multi-modal system which supports transport needs and encourages environmentally sustainable choices to help limit the environmental impact of transport in modern European urban environments. Based on the findings from the participatory design process, we have had to balance the need for privacy and security, with the sometimes conflicting needs of functionality, ease of use, versatility, and intuitive user experience. Digital technologies are helping to scaffold huge transformational impact in modern society. One area in which these technologies are effecting real, disruptive change is in transport, particularly personal, urban mobility. This is especially so where personal urban mobility and mobile digital devices meet. Modern urban mobility is being transformed by the advent of sensor rich, mobile digital devices that are technologically capable, always connected, and relatively cheap. Technology is helping huge numbers of people to travel more quickly, and more efficiently than ever before. Yet it is this very issue of large-scale urban mobility that is a problem. Travelling effectively and efficiently in a modern urban environment can be a complex undertaking, something that modern digital devices can be help manage. Our system will propose a shared ride between travelers, whose needs for transportation (such as traveling time and destination) are similar. Ride offers are clustered and a back-end negotiator takes care of matching similar journeys. For the design of such a system for shared transport, we argue that it is crucial to involve the potential end-users in the design process as early as possible in order to map out and accommodate the user requirements and ensure that the system contains relevant functionality. Adopting a user centered approach has already provided valuable insight into SUPERHUB users for the design of the persuasive technology aspects of the platform [8, 9]. As a result we have chosen to follow a participatory design approach throughout the project ensuring that users are at the center of our process.

2. BACKGROUND & MOTIVATION

The widespread use of smartphones and custom applications has driven the growth of a number of new taxi sharing, car-pooling and other innovative transport solutions. For example in Helsinki, the open journey planner API [3] offered by the local transport authority HSL has been applied to construct numerous mobile applications for planning journeys on public transport. Some new services are aiming to challenge directly the taxi market [4], and [5], while other services are aiming to simplify car-pooling (e.g., GreenRiders [2]), with little or no payment involved. Previous research on taxi sharing and car pooling systems have investigated for example efficient match-making algorithms [11] indicated that these systems can boost the use of taxi services [6], and proposed a framework based on positioning the mobile ter-

minals of the users of the shared transportation system [10].

3. DESIGN PROCESS

The design process of the taxi sharing and car-pooling interfaces and functionalities followed an iterative process beginning with focus groups, followed by mockups of initial user interfaces. The mockups were used in participatory design workshops and heuristic evaluations which lead to iterative refinements of the mockups. Finalised mockups were created which are in the process of implementation which will subsequently be deployed in large scale user trials. Several focus group sessions were conducted with different groups of people in three target cities: Helsinki, Barcelona, and Milan. The aim of the focus groups was to assess a set of usage scenarios of a sustainable mobility system from the perspective of different potential end-users. A set of mockup interface screens was developed separately for taxi sharing and car-pooling functionalities. The mockups contained a minimal set of screens and functionalities. Three participatory design (PD) workshops were conducted in Helsinki to discuss the concepts of taxi sharing and car-pooling and to reflect on the initial mockups. One of the three sessions was exclusively targeted to car drivers and in the other two the participants represented a mixed group of public transport users, cyclists, and also a bus driver. The conceptual discussion was based on scenarios developed in the project, capturing the functional elements and some exemplary use cases for the system. During the sessions, the participants were also shown examples of existing taxi sharing and car-pooling services and their interfaces. The participants were requested to sketch their proposals of the functionalities they would like to see in the application on paper on a blank mobile user interface. Based on the feedback gathered during the PD workshops, the interface mockups were refined to match the functionalities and aspects requested by the workshop participants. The mockups were implemented as clickable user interfaces. The refined mockups were subject to heuristic evaluation by experts chosen from within the project consortium. Each expert was chosen so that she or he did not take part in the PD workshops or the mockup design. The heuristics applied were a modified version of Nielsen's heuristics, adapted to match some of the specifics of a mobility application. Based on all the feedback gathered in the previous phases, the mockups were finalized to take into account both the PD workshop feedback and the heuristic evaluations.

4. FINDINGS

Our focus in these findings is on the results from the PD workshops. Generally users preferred a simpler interface. A recurring comment about the journey specification was that start and end points should be selectable on a map. Participants also called for the option of storing settings for repetitive journeys, number of passengers, need or capacity for luggage, and showing how much the same journey would cost at a different time when taxi night fees traffic were considered. Participants would like to be able to set user preferences for walk distance and maximum price. Map display of pickup spots was considered a very good idea, but participants noted that the markers should be clearer and more informative than the provided exemplars. For example, presenting the friends of the user in a different shape or color than the other prospective travel mates was proposed. Participants had concerns about trust and safety, particularly for car-pooling, noting that a female passenger would likely not want to share a taxi with unfamiliar men at night. This was mitigated to some extent by the idea of an integrated recommendation and rating system. They were keen on seeing how other SUPERHUB users had rated the prospective travel companions and considered especially useful the information on how their own friends or existing contacts had appraised the others. Drivers suggested potential problems if someone is late for an agreed pickup and a potential remedy, using a messaging system and contact information sharing between travelers was proposed. It was questioned if car owners are willing to sacrifice their freedom for the sake of picking up others especially during short urban journeys. Generally the car-pooling concept was found to be of most use on longer and/or repetitive journeys; otherwise the benefit is questionable since passengers could often use public transport within urban areas. Participants were keen to understand how trip pricing would work and the consensus was that price estimates in car-pooling should be based on gas expenses only. For taxi sharing, presenting a price per traveler was favorably received, but how the price could be estimated beforehand was questioned because it is not always obvious how long the journey will take and which route the driver would choose. They also noted that presenting at least a good guess of the price would be important to avoid non-paying travelers. None of the participants had used any dedicated system for taxi sharing or car-pooling, but most had arranged *ad hoc* journey shares using phone, email, Facebook, and face-to-face discussions. The concept was considered especially useful for people living close to each other and going to the same workplace, and for parents, whose children have the same hobby. The environmental value of a shared transportation system gained less attention during the workshops. Some participants considered public transportation and/or cycling a superior alternative, but still approved that a shared taxi and a car-pooled ride would be good alternatives for private taxis and cars.

5. CONCLUSIONS

We reported the design process and results for participatory design of interfaces and functionalities of a taxi sharing and car-pooling application. By participatory design it was possible to involve potential end-users of the system early in the design phase. Given the social aspects involved in such a system, the process participants especially highlighted the need for careful design of trust and safety issues. While the refinement of interface mockups produced well-justified and implementable interface design, this is only one step in the overall design process of the SUPERHUB system as a whole. The final system shall contain also other functionalities integrated into a single package, which sets extra requirements for the navigation in the application. Finally, the results of the process will be thoroughly evaluated only once the system has been launched for field tests. This requires linking the front-end with the back-end resource negotiator, which will enable automatic matching of prospective travel partners.

6. ACKNOWLEDGMENTS

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