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Evaluation of an integrated mobile payment, route planner and social network solution for public transport

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Abstract

The proliferation of new technologies is revolutionizing the public transport sector, allowing Operators to replace complex and expensive infrastructures by travellers' mobile devices and online management channels and platforms. This paper aims to present the Seamless Mobility platform, a disruptive solution based on these new channels, which main goal is to facilitate and promote public transport usage for travellers, as well as reducing operational costs for public transport companies. The Seamless Mobility platform integrates three main components: (i) mobile payments, (ii) route planner, and (iii) social network. The payment component is based on the pay-as-you-go concept with check-in and check-out requiring the reading of the corresponding QR Code station. The route planner combines information from published schedules with real-time information to identify the nearest stops, the next departures, or the best route for a scheduled trip. The social network component allows real time sharing among travellers of public transport information, related to several aspects of the service (e.g. noise, skilfulness of drivers). To test the concept, a mobile application, called OneRide, was developed. This application was tested by users in real environment, in the city of Porto, Portugal. The results show that users considered the system extremely useful, since it is more convenient than traditional systems. It was also clear that users valued the integration of additional and complementary services with mobile payments, such as information about their journey, maps and schedules. Regarding the social component some users found it difficult to understand the concept, but once they understood they considered it very useful. The use of the QR Codes to perform the payment has shown to be one of the main challenges to be addressed, since lighting conditions, position and distance to the QR Code influences the reading process.

1. Introduction

The proliferation of new technologies is revolutionizing the public transport sector, allowing Operators to replace complex and expensive infrastructures by travellers' mobile devices and online management channels and platforms. This paper presents a disruptive solution, based on passengers' mobile devices, which enable an intermodal and integrated travelling ecosystem. Passengers may access to the mobility service providers that are part of the ecosystem,

anytime, anywhere, and without any particular knowledge about tariffs and ticket machines. The dematerialisation of travel tickets also contributes to the reduction of infrastructure operational and maintenance costs, as it will decrease the need of tickets production, vending machines and cash handling.

The Seamless Mobility solution also provides information services to passengers during the planning stage of the trip. It combines information from several transport operators, to offer services related to both transport network as well as timely route updates. Another distinctive characteristic of the present solution is to enable collaborative exchange of information between passengers. Passengers are aggregated in circumstantial social networks in real time. This increases the relevance of information received by each user and facilitates the provision of feedback from passengers to the transport provider in a structured way. Such shared information is useful for passengers to make decisions about their journeys and for Operators to have knowledge about their service quality.

The Seamless Mobility platform was materialized in a mobile application, called OneRide, developed for Android and IOS devices. It uses QR Codes technology combined with location providers (GPS) and wireless communication technologies (3G, 4G or Wi-Fi). This application was tested by potential users and experts in both laboratory and real environment. The testing procedures took place in the transport network of the Metropolitan Area of Porto, Portugal.

The contributions of this paper are twofold: (i) it describes the Seamless Mobility solution and how it has been evaluated; and (ii) it provides a set of design lessons, challenges and guidelines, resulting from the evaluation, which may help to shape future versions of transport-related mobile solutions.

The outline of the current paper is as follows: the next section presents the literature review related to mobile payments, traveller information systems and information exchange in public transport. Section 3 presents the Seamless Mobility solution. Section 4 describes the evaluation methodology and the corresponding results are presented in section 5. Finally, Section 6 presents the conclusions and future research.

2. Related work

The use of mobile technology on public transport has become extremely common. It provides travellers with access to voice and text communications, information and entertainment, enabling time spent waiting for buses or travelling on trains to be used more pleasantly and productively than before. Users who perceive public transport as providing an opportunity to multitasking may be more likely to choose public transport over driving (Dutzik et al., 2013).

Transport Operators are aware of this reality, and are introducing this new channel on their service delivery process. Mobile ticketing systems are an example of such initiatives. These systems can be defined as the purchase and validation of travel tickets through the use of mobile devices, such as smartphones or tablets. Mobile ticketing has several advantages when compared to traditional ticketing systems. They provide passengers remote and ubiquitous access to payment services, queue avoidance, simplicity and availability (Mallat 2007). They also allow transport operators to reduce operational costs of ticketing systems, improve fare collection efficiency, and enhance their knowledge about customers' behaviour, choices and preferences. Several mobile ticketing solutions have been proposed. Ferreira et al. (2013) propose a mobile ticketing solution based on customers mobile devices, which only need internet access to purchase and validate travel tickets. Sarma (2014) proposes a system that allows passengers to book travel tickets using USSD messages, then the passenger receives his ticket details through SMS. Others present an integrated mobile service solution based on the Near Field Communication (NFC) protocol (Rodrigues et al. 2014). The solution was tested in real-world payment situations and the results showed the lack of reliability of NFC as the major technical challenge. Finzgar and Trebar (2011) propose a mobile ticketing system based on QR codes and RFID tags that are used for registering passengers at the beginning and at the end of their journeys.

Real-time traffic information is another research topic that has being advocated as increasing satisfaction among customers and increasing the use of public transport, especially among new or infrequent passengers and for off-peak hours. Traveller information systems may enhance the usability of public transport, decrease waiting time, increase feelings of safety and increase overall satisfaction with public transport (Ferris et al., 2010). Liikka et al., (2008) propose a mobile public transport guide application, called KAMO, which offers journey planning and stop-specific timetable information. Similarly, OneBusAway provides real-time arrival information for Seattle-area bus passengers, which is based on information provided by the regional transit agency (Ferris et al., 2010). Further mobile solutions, like Move-Me (Cunha and Galvão 2014), not only provides real-time multi-modal public transport information, but