State of the Art and Future Perspectives for Smart Support Services for Public Transport

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Abstract. This paper summarizes existing systems and research on information transport services, and proposes a hypothetic scenario for future travellers using public transport. Increased distributed intelligence in pervasive mobile smart devices and in sensor networks in public transport vehicles is enabling a new approach for enhancing the experience of public transport customers. Such environment could be modelled through a distributed multi-agent service system. This paper presents advanced information services already available on such environments, in particular the MOVE-ME smartphone application, and indicates a possible service environment where people’s feedback may benefit all transport service stakeholders. Mobile computing and crowdsourcing are key enablers for enhancing user experience in the transport services, and also for enhancing overall public transport services. Better experience leads to increased usage of shared mobility modes, and therefore to more sustainable cities in the future. Concerns about data security, and anonymity of travellers will need to be adequately addressed in the future scenarios presented.

Keywords: mobile, integrated, multimodal, information systems.

1 Introduction

Pervasive mobile smart devices and sensor networks in public transport vehicles are enabling a new approach for enhancing the experience of public transport customers. The experience may actually start before a journey takes place, by planning a trip, and travellers could still be providing relevant information after reaching their destinations. Transport services and associated information services are closely coupled, and this relation needs to be better understood to improve overall service.

We claim that pervasive mobile services can be used for enhancing user experience in the transport services, and also for enhancing overall public transport services, including providing accurate feedback to management. Research going on in public transport information services at FEUP, the School of Engineering of the University of Porto for the past ten years, and at Imperial College London for the past three years has been aiming at providing users with real time information, but also finding ways to use the user feedback for benefiting all other transport service stakeholders in particular usual or sporadic travellers. Mobile computing is a key enabler for making such vision possible [1].
The transport infrastructure, networks and vehicles, is being continuously monitored using a variety of sensors with variable degrees of intelligence. The information that they produce combined with the information available from the user’s devices and feedback creates vast amounts of data and an opportunity. With adequate management it is possible that patterns will be derived from such data in order to help transport users to have an improved experience, and also other transport stakeholders such as control staff in the transit authorities. For instance, the smart device of a regular user of some transport service may be monitoring the network information and be able to advise if changes are required, or if some special promotions are being offered on the usual route or in an alternative route. The smart device of a tourist arriving in a new destination and already aware of the user needs, and her behaviour patterns, may provide advice on alternative travel modes, points of interest, and prices.

This paper will introduce the MOVE-ME service, application and infrastructure, and then refer to work in progress on extending it in several directions. Experiments with emotional and operational feedback from travellers, in a crowdsourcing approach, are presented, and also a prototype mobile payment and validation service. These prototypes have being tested in real situations in Porto and London with voluntary users. Finally some ideas are presented of how a distributed multi-agent system could be used to model and improve the overall service. An imaginary future scenario of traveling in a city with the support of an intelligent application is presented. This application relies on bringing together existing information and services, using new infrastructure technologies and business models.

2 The MOVE-ME Service and Architecture

The MOVE-ME project (www.move-me.mobi) has developed an infrastructure and a mobile application enabling users to access public transport information in real time. From 2012, this application enables travellers to plan their journeys based on real time or planned data from metro, bus, coach, and train schedules (see Fig 1 and 2). The infrastructure brings together geo-referenced data from different transport companies, Google map data, and also relevant touristic locations enabling multimodal journey planning. Real time multimodal travel planning can be done in a 60 minute time horizon. When real time data is not available or when the time window is larger than 60 minutes and shorter than 3 days, travel planning is done based on available published schedules over a 3 days horizon [1]. With such time horizons the current available infrastructure has been able to guarantee acceptable user response time in the order of less than 20 seconds in 95% of cases. Interaction is also supported by a location based service that enables answers to be calculated taking into consideration the user location.

The MOVE-ME service with advanced real time functionalities was launched in May 2012 in the Metropolitan Area of Porto, and is now also available in the Metropolitan Area of Lisbon, and in other regions of Portugal. Over 25 distinct metro, bus, coach, and train companies share information on their service, and over 30,000 Android and iPhone users are now benefiting from such service. Its user interface adapts to the default language of the device, and offers Portuguese and English details. There is also a Web interface, but with limited functionality.