Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 187 (2017) 483 – 491

Procedia Engineering

www.elsevier.com/locate/procedia

10th International Scientific Conference Transbaltica 2017:
Transportation Science and Technology

Information Management of Demand-Responsive Mobility Service Based on Autonomous Vehicles

Szilárd Szigeti, Csaba Csiszár, Dávid Földes*

Department of Transport Technology and Economics, Faculty of Transportation Engineering and Vehicle Engineering, Budapest University of Technology and Economics, Hungary

Abstract

The autonomous road vehicle (AV) technology implies significant alteration of urban mobility services. The identified transit modes based on AVs are the individual cars, the demand-responsive public transportation with small or medium sized pods and the high capacity public transportation on arterial routes. The introduction of the telematics-based, shared, demand responsive mobility service requires new information management methods. Accordingly, the aim of our research was to model the structure and the operation of this rather complex information system considering both the operators and the users. Since the passenger functions are the keys of the advanced information service the conceptual plan of the mobile application with personalized functions has been also elaborated. The research questions were: how the architecture and the functions of the information system are to be modelled, what the novel information management functions of passengers and operators are, what data structure is needed and how it is related to the functions as well as what kind of functions are to be realized in the mobile application. The results are applicable as foundations for innovation and development projects aiming realization of either the back-end or the front-end components and for planning information management processes.

Peer-review under responsibility of the organizing committee of the 10th International Scientific Conference Transbaltica 2017

Keywords: autonomous vehicle, demand-responsive transportation, information management, mobile application, modelling

* Corresponding author.
E-mail address: foldes.david@mail.bme.hu

Peer-review under responsibility of the organizing committee of the 10th International Scientific Conference Transbaltica 2017
doi:10.1016/j.proeng.2017.04.404

1. Introduction

Nowadays focus of the mobility developments is laid on the technological and the infocommunication solutions. Emerging of autonomous road vehicles (AVs) alters the entire mobility system. Consequently, transportation modes should be more and more integrated as well as both the passenger handling functions and the operational management processes should be altered. A new, telematics-based, shared, demand-responsive transportation mode (TS-DRT) based on small or medium sized pods (AVs) turns up, which merges several currently available modes (e.g. taxi, car-sharing, ride-sharing, ride-sourcing, chauffeur service) [1–3]. The role of mobile applications is much more significant in case of this new service as this tool is the main connective medium between the passengers and the mobility service. Information acquiring, ordering, seat reservation, payment, complaining, etc. are managed via mobile application. The society barriers towards the completely new technology are diminished by the application. Therefore, one of the key elements of future autonomous passenger mobility is the development of personalized mobile applications in accordance with the back-end information system.

In this paper, we focused on the information management issues of TS-DRT. The remainder of the paper is structured as follows. States of the art is summarized in Section 2. In Section 3, the system architecture of autonomous mobility service and the aiding information system has been revealed. The functions and operational method of the system have been elaborated in Section 4. In Section 5, we have analyzed advanced information applications of current transportation modes having similarities with TS-DRT. Based on the analysis results, we have determined the concept of the mobile application for the autonomous mobility service. The paper is completed by the concluding remarks, including also potential future research directions.

2. State of the art

AVs can be employed beside TS-DRT as individual cars or for high capacity public transportation purposes on arterial routes. The individual cars are used for the most flexible travel purposes. The traditional public transportation (e.g. bus) is used in case of large volume of passengers. In this field the employment of AVs is slightly delayed. These mobility service types are to be integrated in a seamless way to realize efficient urban mobility. Two types of TS-DRTs spread: door-to-door and feeder. The new service not only takes over the role of current DRT (e.g. transporting people being disabled, or people living in less densely populated areas [4, 5]), but takes over the role of other transportation modes. Several existing autonomous small capacity pod services were introduced for demonstration purposes in a borderless EU trial project (CityMobil2). Passenger reactions to the driverless vehicle concept were positive, however, reactions at the regulatory levels were less enthusiastic [6].

Several studies collected information about opinion and expectations towards autonomous passenger services by questionnaire survey. Automation is, on average, not necessarily perceived as valuable, if the travel time and fare of the automated services are the same as those of a conventional bus. There is a relatively higher preference for autonomous service when this is implemented within a major facility (e.g. university campus) [7]. The intention of using AVs was partially explained by attitudes and contextual acceptability. The higher the driving-related sensation-seeking, the more drivers intended to use them [8]. Travelers' attitudes regarding 'sustainability of automated vehicles' is the most important attitudinal factor for using the AVs [9]. Higher-income, tech-savvy males in denser settings are more interested in autonomous services [3]. Service attributes (cost, travel and waiting time) may be critical determinants of the use of AVs. Current car-sharing users are more likely to use AVs with dynamic ride-sharing. Car drivers are more likely to choose the option shared AV without ride-sharing [10].

During our research, in order to reveal the potential expectations towards autonomous mobility services a survey was performed. However, in this study we highlighted only some relevant results regarding information management, especially mobile applications. The most important features are the fast reservation process and the provision of dynamic information (e.g. vehicle position, occupancy). Real-time information generally is one of the most required feature in case of mobile applications [11]. The personalization opportunities are also an important feature, however, providing feedback or rating the service are rather neutral. We examined the general expectations of an autonomous passenger mobility services. It can be stated that the expectation towards mobility is a fast, flexible and cost-effective service. Autonomous TS-DRT services can meet these expectations. Although, the respondents expect door-to-door services it cannot be the most effective form because of road capacity limitations.