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## A Multi-User Integrated Platform for Supporting the Design and Management of Urban Mobility Systems

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### Abstract

Public transport networks were, in the past, mainly designed to maximize the efficiency of commuting trips. However, with such perspective there are considerable risks to marginalize some specific population groups (e.g. disabled, elderly, children, pregnant, people in poverty). For enhancing social inclusion and improving the accessibility of more vulnerable citizens, such networks are often redesigned and adjusted. Nevertheless, even with such adjustments, it is sometimes difficult to provide efficient services that fully address the real needs and capabilities of travelers, partially because of the failure in following the fast technological and demanding changes of modern societies. Taking in mind these challenges, we have developed a conceptual model to support knowledge sharing and decision-making in urban mobility, and to improve the way travel information is addressed. The multi-user integrated platform proposed in this work is supported by the idea that information from different channels must be centralized, organized, managed and properly distributed. This idea is grounded in two main principles: (i) past and real-time information from a wide range of sources is combined for knowledge extraction, and such knowledge is going to be used not only to allow travelers to better plan their trips, but also to help transport providers to develop services adapted to the needs and preferences of their customers; and (ii) information is provided in a personalized way taking into account socio-economical differences between groups of travelers.

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## 1. Introduction

Social exclusion was a term coined by Lenoir (1974) who identified a set of groups encompassing mentally and physically handicapped, suicidal people, aged invalids, abused children, substance abusers, delinquents, single parents, multi-problem households, marginal, asocial persons, and others with social misfits. In the meantime, the literature has increased this list, and although there is a continuous debate on what social exclusion really is (Preston and Rajé, 2007), the initial concept tends now to be dynamic and relative (Schwanen et al., 2015). Several authors include in this definition individuals that are personally, financially or physically affected (Sen, 2000; Kenyon et al., 2002; Mackett and Thoreau, 2015).

Kamruzzaman (2016) presents a set of several measures commonly used to quantify social exclusion. The use of these measures shows that some population groups behave differently and face specific challenges and problems in relation to transport and mobility, this meaning that transport plays a key role in the prevalence of social exclusion (Mackett and Thoreau, 2015).

In recent years, transport and social exclusion have been addressed through a variety of EU projects (e.g. SocialCar (<http://socialcar-project.eu/>), the Cost Action TU1305 (<http://www.tu1305.eu/>), ACCESS2ALL (<http://access-to-all.eu/>), or GOAL (<http://www.goal-project.eu/>)). These projects clearly show that transport-related social exclusion is more likely to affect some groups than others. Mackett and Thoreau (2015) explain that this exclusion is related with income, disability, age, gender and ethnicity. According to these authors there are barriers for traveling that affect some socially excluded people such as disabled (Rosenbloom, 2007), elderly (Titheridge et al., 2009), or people in poverty (Lucas et al., 2016), more than the rest of the population. Mackett and Thoreau (2015) explain that this can be related to cost, availability of transport, psychological and physical barriers, facilities, and information.

A study conducted by Lucas (2012) shows that, since 2003, with the publication of a strategic plan in the UK, researchers, policy makers and practitioners from several countries became interested in adopting a *social inclusion* approach to transport planning. Since then, city planners started to remove or minimize different types of barriers, developing more conscious city plans. In the last decade, with the widespread of new technologies, problems related with information provision also began to be addressed. At this level, Kenyon et al. (2002) explain that the use of information and communication technologies could enable a new, virtual mobility, promoting an internet-based increase in accessibility, as an alternative to an increase in physical mobility. Moreover, information increasingly needs to be provided in a variety of formats, and to be displayed using a clear language and characters with large fonts. Mackett and Thoreau (2015) state that data should be provided in ways that take into account the characteristics of the population as a whole. The *on-line* information that shows routes should include a variety of accessible alternatives, and allow for a variety of walking speeds, since this may significantly affect the overall optimal route.

Although new technologies have been consistently used to improve public transport, and new guidelines (e.g. Kenyon et al., 2002) and frameworks (e.g. i-TRIP (Rajapaksha et al., 2017)) have been proposed, some key questions have not yet been properly addressed in the domain of information provision. In particular, we should be aware that: (i) despite the wide availability of mobility-related information, access and use of that information by social excluded groups is still very limited; (ii) the adaptation of mobility services to the particular needs and expectations of travelers, according to their specific profiles, is also rather limited in practice; (iii) the existing public transport models do not have enough flexibility and knowledge to follow technological and societal dynamics, namely to provide more customized services.

To address the limitations and gaps identified in our literature review, travel data should be centralized, organized, managed and distributed, taking into account the particular needs of each citizen. Accordingly, this work proposes a conceptual model to frame a multi-user type integrated platform, supported by these principles, able to improve efficiency and inclusiveness of urban public transport systems. Such platform is based in the optimized use of mobility information.

Section 2 of this paper presents the main concepts for designing a multi-user type integrated platform, able to address the identified limitations. Policy implications related with the development of this platform are discussed in section 3.

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