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A concept for the architecture of an open platform for modular mobility services in the smart city

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Abstract

It is difficult for developers of mobility solutions to gather accurate mobility data, such as the traffic flow or available parking spaces. This data is available in a smart city, but it is not made accessible to external developers for creating innovative mobility solutions. As it remains unclear how this could be done, this paper proposes a concept for the architecture of an open platform for modular mobility services. The design of the architecture follows a design science research approach. The developed concept for the architecture of the platform consists of the following elements: data sources, layers of modular services, integration layer and solutions. Additionally, possible modular services are described. This paper is limited by the fact that the architecture has not yet been implemented and evaluated. However, this is planned for future research. This paper contributes to theory by giving guidance for future research on service platforms and to practice as it shows how available mobility data could be made accessible for mobility solution developers.

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Keywords: Mobility services; mobility solutions; platform; smart city; open platform

1. Introduction

Today, the traffic situation in many cities is challenging. Due to increasing traffic volume, people lose more and more time in traffic jams and additionally the search for parking spots takes up a lot of time representing up to 30% of the traffic in cities (Banister, 2011; Priester, Miramontes, & Wulfhorst, 2014; Van Ommeren, Wentink, & Rietveld,

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2012). It is estimated that European cities lose between 2.69% and 4.63% of their Gross Domestic Product (GDP) because of traffic congestions (Willoughby, 2000).

Many different providers offer digital mobility solutions to improve and ease an individual's mobility. Due to their benefits, a variety of smartphone based services are being developed. For instance, a study clarified the benefits of a journey planner for public transport, testing how people plan their trips (Cain, 2007). They asked people to plan a trip with a map and timetables and only 52.5% could plot the trip, triggering the development of the digital journey planners (Cain, 2007). Smart navigation tries to avoid traffic jams by suggesting alternative routes, carpooling and ridesharing applications encourage individuals to share their cars and multi-modal traffic information offers alternatives to car-based transportation. Many of those solutions are dependent on accurate data, e.g. the location of the users, time-schedule of public transportation or information on the current traffic or parking situation.

However, it is difficult for developers of mobility solutions to gather this data, because there are only a few platforms, such as Google Maps (2016) or Bing Maps (2016), that offer mobility data and services through standardized interfaces. The access to these data and services is often limited and restricted according to the interests of the providers. Furthermore, these providers only offer isolated services with a specific focus and therefore it is necessary to access many different platforms in order to develop a mobility solution. This limited availability of data sets and services is limiting the capabilities of the developers. After reviewing the current digital services for urban transport, Schreieck, Wiesche, and Krcmar (2016) state, the existing services are not yet integrated, the landscape of digital solutions is vast and unstructured.

On the other hand, a smart city generates quite extensive mobility data, but it is not offered to external providers for developing mobility solutions. For instance, municipalities gather a lot of data in particular on traffic to measure and predict the traffic situation within the municipality. These data are mostly used in traffic management to improve traffic routing and other aspects such as parking. These data could be made accessible for the development of innovative mobility solutions. However, only offering data might not be sufficient, because it creates a high effort for mobility solution providers. They have to understand the structure of the data and also have to aggregate as well as analyze it on their own. Because of this, offering standardized modular services that aggregate and analyze the available mobility data eases the effort for mobility solution providers. For instance, floating car data of individual vehicles is quite complicated to handle, but a service that has analyzed this data and offers information on the traffic intensity on certain roads through a standardized interface can be used by mobility solution providers more easily.

The aim of this research is to design an open platform for modular services that facilitate the development of mobility solutions within a smart city. Instead of focusing on isolated mobility services, we develop a concept for the architecture of a platform that offers modular services that can then be integrated in apps via open and standardized interfaces, so called Application Programming Interfaces (API). This architecture allows the usage of existing data in different services which can then be used for the development of innovative mobility services. The platform is a key contribution and will bring together stakeholder that offer digital services or plan to offer one.

The remainder of the paper is structured after the publication schema for design science research studies suggested by Gregor and Hevner (2013). First, we present the theoretical background on existing digital mobility services as well as on existing mobility data and services platforms. Then, the research method is outlined in detail and the concept for the architecture of an open mobility services platform is presented. After that, there is a discussion of the concept and the paper ends with a conclusion.

2. Theoretical Background

2.1. Digital mobility services

The world is getting digital, the current digital revolution triggers innovation in many industries, one of them is personal mobility. A big variety of services is offered in the market and the popularity of smartphones is intensifying it. The digital mobility services are well received by the public, forming the fourth most important application category used in smartphone, just after weather, social networking and communication (Forrester, 2013). The variety of services provided include journey planning, ride-share matching, maps, navigation etc. and use a variety of data sources. For instance, the solutions that support the search for parking spaces are either based on data from sensors, on statistical prediction or on data provided by the crowd (Greengard, 2015; Inrix, 2015; McNeal, 2013; Nandugudi, Ki, Nuessle,