Smartphones as Incentive Systems for Energy- and Operation-Efficiency of eCarsharing Users

Bachelorarbeit

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Vorgelegt von

Name: Osterwold Vorname: Marvin

[redacted]

Prüfer: Prof. Dr. Michael H. Breitner

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1. Introduction

1.1 Relevance and Motivation

As a consequence of the evaluation of current on-going research projects as well as the evaluation of those vehicles which are already in the market, many experts coincide with the idea that the current situation is a highly dynamic development plight which will lead to a drastic social change. Nowadays most of the vehicles which are taken from the manufacturers' standard program and most of the ones whose combustion engine is substituted by electric motors, providing them with a larger battery, are mostly conventional vehicles. The appearance of the new mobility concept applied to completely new vehicles through a new drive system is slowly but gradually beginning to emerge. On the contrary, it seems that researchers will not focus so much on the development of a universal service characterised by the fact that just one single vehicle would be able to be used for both long and short distance journeys, that is for using them in cities or in highways. In the future, the concept of mobility will be intended to the purchase of mobility by customers without the necessity of own vehicles. It is considered that a new efficient mobility model will be defined by Carsharing, renting a bike or using public transports among others and this will contribute to encourage the use of electric vehicles for long distance journeys through urban and local transports. The successfully introduction into the market of an initial concept of Carsharing – using conventional vehicles- foresees a revolution into the whole transport concept, where electro mobility may become a major component.[1]

As a consequence of current developments and of the increasing interests of many organizations to develop intelligent cars, it will be soon able to be satisfied with highly intelligent Carsharing systems that will fulfil all of the different needs of their customers: the required and convenient time, low costs and refuelled/recharged vehicles to the precise extent that the customers need for reaching their final destination. Those new services introduced above will be presented by new mobility providers. In order to develop these new systems, it will be necessary to create a communication system that will inform about who needs a vehicle, the type of vehicle required by the user, the exactly use that they will make of it, for instance if it would be used on urban or on rural areas, since that fact is a factor that influences on the consumption of the battery of the vehicle. In addition to that, it would be

[1] Cp. (Dr. Becks, et al., 2010), pp. 14-20

necessary to develop a system which will provide data about available cars and last but not least it would be of great relevance to develop a system which would provide customers information about how to recharge these cars and how long would that take to do it. Therefore, it is a challenge to develop an efficient system which controls the fare structure in dependence to the battery charge and daytime. It is required to handle the information about the public transport schedule in order to give the Carsharing user the option of a comprehensive mobility. This will lead to an operation efficiency of the Carsharing vehicles. On the one hand, the user needs information for example about the current price, the position of the car and the battery range. Hence, mobility providers will be the ones whose main function will consist on establishing the necessary information and communication infrastructures which will be in charge of providing internet platforms for easing framework agreements, booking vehicles and paying for journeys. On the other hand, mobile information and communications technologies can be defined as drivers in a Carsharing model as well as all connecting points of service between physical distances which enable the integration of several processes and apps on a flexible way.

In side of a Carsharing context it is possible to define the empowerment of new intelligent mobility apps as the mobile communication technologies aside from the relationship between the distributed data and the features and services provided by networks in vehicles. Nowadays, the importance of automotive apps, for instance intelligent Information and Technology (IT) based apps, is achieving a great relevance for the business model and for the added value. Notwithstanding, the inexistence of complicity between experts from different app domains do not let them to acquire a general vision of the app over and above the requirements and restrictions necessary for the development of innovative softwares for their apps. Moreover, the challenges provided by the automotive domain, as a consequence of the high demand of the software in the car, do not contribute to a naive development of automotive apps. Especially in the developing of electric car sharing (eCarsharing) market there is a great potential of wide scale app services and features which are extending beyond the standard localisation and booking of a car. To reach an energy- and operation efficiency for eCarsharing users different perspectives have to be taken into account, from the user and the company side. As a key factor, the resulting incentive model has to be integrated into the communication systems. The research question is therefore: How should an app for smartphones be technically conceptualized to provide incentives for an energy- and operation efficiency driving behavior of eCarsharing users?

1.2 Structure of the Bachelor Thesis

This bachelor thesis is divided into six chapters. After a brief introduction into the topic, a second chapter which is structured into three models will be presented. At first side a technical background based on the involvement of smartphones into the back-end systems will be described. Here it will be pointed out the incentives for Carsharing users which lead them to use an electric (e)Car and affecting in that way the driving behavior. The last section of chapter two will be focused on how to integrate the incentive model in an energy- and operation efficiency model for eCars. These fundamental coherences will be implemented into the information management and the conception of the comprehensive app model by analysing the booking and charging management, the connecting mobility and lastly, the social media integration which is developed in chapter three. The aim of this paper is to provide a technical conception of the incentives for an energy- and operation efficiency driving behavior. After the discussion of the conception of the app model in chapter four, the paper will present several implications for practice and research, including the limitations of this bachelor thesis in chapter five. Chapter six contains a summary of the most relevant results concerning the incentive and technical factors as well as their implementation into the app.

2. Background

2.1 eCarsharing

Limited resources, urbanization, the legal framework regarding to CO_2 among other emissions and the protection of our environment are dominant topics in the public debate and raises the question, how vehicle concepts could be prepared in the future. The relevance of such concepts is clearly partly due to the fact that around 80 percent of global CO_2 emissions are originated in large cities and metropolitan areas.[2] There is nowadays a consensus about the efficient use of energy, which is one of the most pressing challenges for the future. The private automobile is largely responsible for the majority of the most serious environmental and social problems in metropolitan cities. Automobile usage is a major source of air and noise pollution. A promising approach for reducing the negative impact of passengers transport with a simultaneous preservation of the individual mobility provides the property

[2] Cp. (Prof. Dr. Reinhard F. Hüttl, 2010), p. 75

to use the integrated Bluetooth. It is also not clear the way in which the driver might interact with the driving analysing feature. It could happen that the suggested eco-driving bar would be too small for a normal smartphone screen, so that the actual status would be unperceived or that it would divert the user while driving. Moreover this paper cannot give an estimation about how high the efficiency enhancement would be or for instance about how high the monetary discount would need to be for influencing the driving behaviour. The described features could show in another context that they lead to influence the user, however the combination of the different background incentives in the Carsharing context is a new scope of app. Further studies would therefore be necessary in order to figure out the interaction and the collaboration of the features and the linked incentives. And last but not least, the expected efficiency enhancement should need to be offset with the developing and the implementation costs. Because of the possible transferability to fuel cars an implementation, such as test period, could be imaginable.

6. Conclusion

Electric mobility is the key to a low carbon and sustainable mobility. With the integration of electric vehicles into the Carsharing fleets, a variety of new challenges for the booking and battery range management are appearing. These challenges need to be adapted to the necessary information and mobile communication infrastructures. In the presented work, a detailed technical application conception was described with the aim to provide incentives for an energy- and operation efficient driving behaviour of electric Carsharing users. It enables electric Carsharing providers to get specific information about the estimated battery consumption of the users' trips and leads them to an increasing operation efficiency of the booking system. A specific incentive model could be derived and integrated into customized application features. With the implementation of the presented application model the user would get directly a feedback about the current ecological driving behaviour which would allow a continuous improving of the energy efficiency while using an electric vehicle. Relating features, like the statistical evaluation ranking, the discount system and the possibility to share the results at social media platforms are initiating concrete incentives for an ecological behaviour. Additionally, this introduces a kind of gaming factor and it increases the driving enjoyment. The application allows now an intuitive distance calculation of the planned trip and therefore it avoids wrong entries and related costs for the users as well as too long or too short calculated charging times for the electric cars. Based on an energy optimized

selection model, the application will be able to suggest the appropriate electric car to the user with the best compliances of his needs. In particular, the proposed connection mobility feature helps users in the choice of the most environmentally friendly public transport solution, matching their needs and their actual location, before and after using the electric Carsharing offered. The application model is therefore a first step of a comprehensive integration of the Carsharing into a sustainable mobility network.

Finally there were specific approaches for the technical implementation of the features, as well as for the integration into the car Information and Technology and the telematics discussed. Arising thereby were concrete implications for the application development and the Carsharing providers derived. Moreover this paper was showing the great potential of wide scale application services and features, which are extending beyond the standard localisation and the booking of a car. To reach with the implementation of smartphones as incentive systems into the business processes, an improved energy- and operation efficiency of electric Carsharing.