Poster: MULMOD – MULtiMODal Sustainable Mobility for Smart Cities in China and Germany

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Abstract

High density use of (mostly gasoline or diesel fueled) cars has led to a number of environmental and social problems in urban environments. Towards addressing these challenges, shifting urban transportation modes from private cars to other more sustainable modes has been considered as a promising solution. However, underlying policies and constraints for the mode shift as well as user mobility and behavior patterns are largely unknown. Also, the performance of the mode shift still lacks thorough quantitative evaluation in both simulation and showcases. To this end, we propose to review the current sustainable mobility practice, simulate user behaviors and traffic scenarios, design and implement strategies in real world, and assess its impacts in China and Germany. The results obtained may provide fundamental guidelines and promote sustainable transportation systems.

1 Introduction

Over the past ten years, while the passenger car sales in developed countries like Germany kept quite stable (but relatively high per thousand persons), developing countries like China have witnessed a rapid increase in demand (see Fig. 1). This causes substantial environmental and societal challenges, such as air pollution, congestion and lack of parking spaces. As a result, shifting passenger traffic from private cars to more sustainable transport modes (electronic car, bicycle, pedestrian, public transport and CarSharing etc.) is a very important process in both Germany and China. There have been a couple of attempts in both countries (e.g., [1, 10]). However, reasons behind such importance, scale and scope of such initiatives as well as business and social implications are quite different.

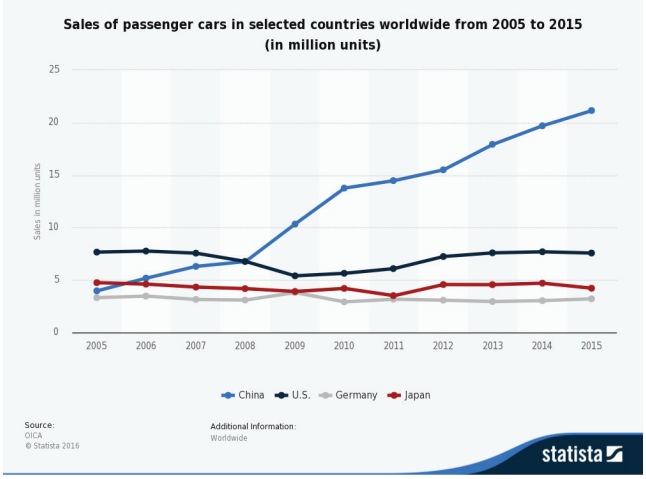

Figure 1. Sales of passenger cars in several countries (source: Statista)

We propose MULMOD, a new initiative to:

- understand the technology, behavioral, and urban planning policy differences and identify representative scenarios between Germany and China on sustainable mobility, integrating user mobility data, traffic data and user survey data;
- model and simulate the scenarios, evaluating the feasibility of sustainable mobility solutions; and
- develop two showcases, one in the Shandong region in China and the other in the metropolitan region Hanover-Brunswick-Wolfsburg-Göttingen in Germany.

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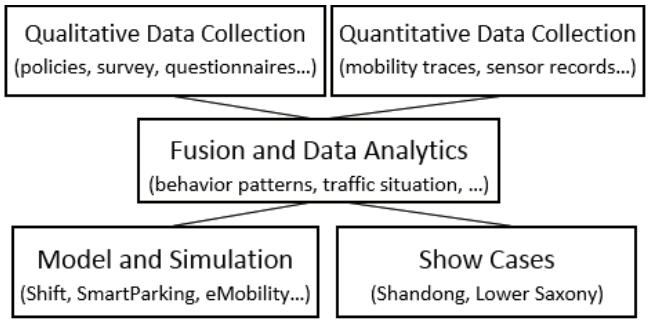

Figure 2. Technical Approach

2 Technical Approach

As illustrated in Fig. 2, we will conduct empiric studies starting with questionnaires, mobile data analysis and focus group research. The empiric data will be fused with long-term big datasets including user and traffic mobility trajectory records from municipalities and users wireless devices such as mobile phones [8] or in-vehicular devices [5], as well as social opportunistic sensing [9] and results from existing projects (e.g., [1, 10]). Based on data analysis results, the project will model user mobility behavior patterns for different passenger groups, different transportation conditions and different traffic situations, simulate and demonstrate several different scenarios for the impacts on behavior, economy and environment. The ultimate goal is to explore the design and deployment opportunities of a global sustainable transportation system able to support a variety of settings, including multi-level governance systems [3].

We will start with understanding the governmental and social frameworks in Germany and China concerning:

- passengers' willingness to shift transport demand from private cars to more sustainable means;
- existing policies towards promoting such actions;
- existing infrastructural and operational situation for new means of transport like CarSharing, bike sharing, electric cars [5] and smart parking; and
- existing framework for mobility management methods (e.g. public mobility consulting agencies).

Apart from literature research and an overview about existing systems, three steps of empiric research will be conducted (and a few typical scenarios will be identified):

- stakeholder analysis both for China and Germany by stakeholder interviews and a Delphi analysis;
- A worldwide benchmarking by searching online materials and performing stakeholder interviews;
- Questionnaires with possible demanding users.

Various quantitative data e.g., "checkin" logs of smart phones on some OSN platforms or in-vehicular meters tell the time and location which allows the temporal-spatial analysis of mobility patterns, including leveraging the social relationships and movement patterns [4,5,8,9]. We will leverage these analyses to quantify work-life trajectories and more generally mobility behavior of users. In the simulations, different scenarios and solutions will be considered and compared under different parameter settings, e.g., regarding urban infrastructure planning [2, 6, 7].

For both Germany and China, a focus group and a control group will be identified and examined for the show cases, to understand their behavioral impact for the reflected regions. Special attention will be paid on the policies, users' economic situation, time budget, travel distance and environmental awareness.

Application areas include the development of mobile apps for CarSharing systems and navigators with community information, and advanced city infrastructure planning and deployment.

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