**PhD Topic: Innovative first and last mile transportation service-system design and modeling**

Ref : Thesis-MSM-Renault

**Context**
Thesis aims at better defining potential services that are related to the first and last kilometer challenges. Renault as electric vehicle manufacturer wants to explore the possibility of developing and modeling innovative services in the context of multi-modal transportation. The Ph.D thesis is offered by Renault Company and will be conducted by Renault, CentraleSupelec and IRT SystemX within the context of MSM (Modélisation de Solutions de Mobilité) project. The successful candidate will join MSM project’s team of the IRT (Institut de Recherche Technologique) SystemX (http://www.irt-systemx.fr).

The post is available from September 2016.

**Supervisors:**
Marija Jankovic, LGI Centrale Supelec
Jakob Puchinger, LGI Centrale Supelec and Irt SystemX
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**Work Places :**
Renault Technocentre Guyancourt : 1 Avenue du Golf, 78280 Guyancourt and
IRT SystemX : 8 Avenue de la Vauve, 91120 Palaiseau

**Description of research work**
To promote sustainable transportation, it is important not only to stimulate the use of public transport but also to improve its accessibility. In order to get to a specific destination from a train station or bus stop, there may be very few available solutions, or none at all. In addition, the public transport does not cover the entire city; inconvenient, inflexible schedules and cannot deal with the problem of aging societies where old or disabled people need a door-to-door service. Although the last or first mile may deter even the dynamic users, the number of solutions is fortunately on the rise to reduce the extra time and hassle the commuters face going from, e.g., home to a transit (e.g., train/subway) station and back. Some first- and last-mile services such as walking, bike and car sharing and pooling can be coupled with public transit services and they can potentially provide cost-effective and sustainable door-to-door urban transportation. In addition to these existing first and last mile services, the introduction of autonomous vehicles could have notable impacts on the way people use car-sharing and taxi services in the future. These vehicles could operate in a number of ways. The autonomous taxi concept can be developed further by considering ridesharing and/or car sharing opportunities. For instance, they could drive up to car-sharing users, self-park, and self-charge in the case of electric vehicles. Another option is that vehicles could self-drive users from their origins and destinations more like a taxi service. Such systems can have multiple design and operational configurations and scenarios, each of them having very different impacts on the transportation and economic system and on individual choices themselves.

This thesis outlines the design and modeling of vehicle-based innovative first and last mile services. This thesis would like to study two major research axes:

1. **To develop a design methodology**
   This work aims first to investigate the convergence of existing shared first and last mile transport services, including car sharing and ride sharing and outlines their potential for interfacing with shared Autonomous Vehicle (AV) based service design. Product-Service System (PSS) design methodology would be used in the early conceptual phase of defining integrated products, services and its actor network and modelling cycle that form the business model for a new services. PSS methodology represent a promising approach to steer a broader scope of customer (and stakeholder) value dimensions that are traditionally not considered in product development. In addition, this work aims to develop the scenarios by taking into account the future mobility challenges and public policy assessments and to develop a Product/Service/System model for the future first and last mile mobility services.

2. **To conduct sensitivity analysis by using multi-modal traffic simulation environment**
   Build a predictive and policy sensitive traffic simulation model that can be used for new service design and configurations. This type of environment is ideal to allow testing the new shared-mobility scenarios such as car fleet size requirements given in a different environments, its capacity to absorb the demand over a day and what this means for future congestion patterns. This work aims also to analyze the complementarity and competitiveness of future new services with public transport.
Qualifications and Experience
We are looking for a highly motivated candidate holding:

- Master degree in transportation or industrial engineering and/or with background in cognate discipline such as mobility studies, design engineering or informatics etc.
- Experience with research methods: literature review, data collection and analysis, fieldwork, design research
- Knowledge of at least one programming language such as Python or Java would be a plus
- Knowledge in Model Based Systems Engineering would be a plus
- Knowledge in design and visual media experience (GIS, cartography, urban design, modelling) would be a plus
- Knowledge in transport optimization and agent-based traffic simulation tools experience would be a plus
- Strong writing and speaking skills in English
- Autonomy

Bibliography of Sources & Materials

Relevant research labs
Marco Pavone, Stanford University
Ryan C.C. Chin, MIT Media Lab
Marta C. Gonzalez, MIT CEE (Civil and Environmental Engineering) Lab
Moshe Ben-Akiva, Francisco C. Pereira and Emilio Frazzoli, Singapore-MIT Alliance for Research and Technology (SMART)
Kay W. AXHAUSEN, Francesco Ciari and P. M. Boesch, Singapore-ETH Zürich Centre (SEC)
Michael Batty, University College London, CASA Center for Advanced Spatial Analysis
Susan Shaheen and Michael Galczynski, Transportation Sustainability Research Center, UC Berkeley
Fabien Leurent, Laboratoire Ville Mobilité Transport, École des Ponts ParisTech

References:
- F. Ciari, M. Balac and M. Balmer, “Modeling the effect of different pricing schemes on free-floating carsharing travel demand: test case study for Zurich,” Switzerland, Transportation (forthcoming)

Contact : Applications including a comprehensive CV, internship and/or master thesis report and motivation letter should be sent to goknur.sirin@renault.com