FUTURE URBAN MOBILITY

**Research Projects in the SMART FM IRG**
(August 23, 2019)

1. **SimMobility Pax**
   Develop and integrate state-of-the-art behavioural models with simulation tools to predict the impact of different mobility portfolios, including flexible mobility on demand services and autonomous mobility, on travel demand and activities, both for passengers and freight, and on transportation networks and land-use. The research includes:

   - *Short-Term*: Calibration of the entire Singapore network and development of flexible traffic, fleet and information control modules that will enable the design and testing of innovative ITS solutions.
   - *Mid-Term*: Implement a rescheduling plan model (i.e. in terms of en-route choice, changes in modes, departure times and trip making) and representation of individual day-pattern choices.
   - *Long-Term*: Development and testing of the components that relate to land use, residential and commercial real estate, and their sensitivity to transportation infrastructure and various accessibility and mobility measures.

   ***MIT Principal Investigator(s):***
   *Moshe BEN-AKIVA (Civil and Environmental Engineering)*
   *Joseph FERREIRA (Urban Studies and Planning)*
   *Chris ZEGRAS (Urban Studies and Planning)*

   ***Singapore Co-Investigator(s):***
   *Mi DIAO (NUS, Real Estate)*
   *Gary TAN (NUS, Department of Computer Science)*

2. **SimMobility Freight**
   Develop agent-based models for the movement of goods and materials in the urban environment. Commodities will be traced through their entire life cycle; from its production, its distribution through various channels and its consumption by an end-consumer, to its final disposal or recycling. All relevant transport and logistics choices will be simulated using behavioural models, estimated based on innovative data collection methods.

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   *Lynette CHEAH (SUTD, Engineering Systems and Design)*

**3. DynaMIT 2.0**

Develop a multi-modal network state estimation and prediction system that utilizes heterogeneous real-time data from a variety of sources to assess the impact of congestion-causing planned and unplanned events and optimize interventions/network management strategies to facilitate the real-time deployment of measures to mitigate congestion. The research includes:

- *Multi-Modal Traffic State Estimation and Prediction System*
- *Online Calibration Methodologies*

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**4. Data-Driven Traffic Modelling and Route Guidance**

Algorithms that use real-time data from many heterogeneous sources in order to (i) track and predict paths in dynamic transportation networks, and (ii) provide on-demand route guidance under uncertainty, based on a combination of optimization, data-fusion, machine learning, and novel behavioural techniques.

The main current research focus within this theme includes the use and development of modern machine learning methodologies for *Automatic Probabilistic Machine Learning for Traffic Modeling and Prediction*

***MIT Principal Investigator(s):***
*Patrick JAILLET (Electrical Engineering and Computer Science)*

***Singapore Co-Investigator(s):***
*Bryan LOW (NUS, Department of Computer Science)*

**5. Mobility on Demand**

Develop models and algorithms to configure dynamically portions of the urban transportation service network to meet mobility demands in real- time; the objective is to provide passenger-centric, timely service while minimizing costs and maximizing system efficiency. The research includes:

- *Anytime Planning with Optimal Schedules*
- *Activity Recognition Planning with Ride Sharing*
- *Routing Algorithms for Mobility-on-Demand*

***MIT Principal Investigator(s):***
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*Malika MEGHJANI (SUTD, Information Systems Technology and Design)*

**6. Technologies of Autonomy**

Assess and demonstrate the role of autonomy in mobility-on-demand and its impact in terms of feasibility, safety, and efficiency through modelling and simulation, algorithm development and experimental demonstration ("*Autonomy for Mobility-on-Demand*").

***MIT Principal Investigator(s):***
*Sertac KARAMAN (Aeronautics and Astronautics)*
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***Singapore Co-Investigator(s):***
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*David HSU (NUS, Department of Computer Science)*
*Malika MEGHJANI (SUTD, Information Systems Technology and Design)*

**7. Mobility Management**

Envision a future scenario for Singapore in which the urban mobility service provided as a public utility that combines public transit, walking and bicycling, and autonomous vehicles. The project aims to design and test the new mobility scenarios in which autonomous vehicles are embedded in the public transit system.

***MIT Principal Investigator(s):***
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*Mi DIAO (NUS, Department of Real Estate)*
*Hai WANG (SMU, School of Information Systems)*

**8. LIVE Singapore! 2.0**

LIVE Singapore encompasses four research topics: a) A travel-focused data visualization interface; b) Data on the Street to achieve transition to liveable cities today and in the future; c) Urban Data Analytics to investigate the limits of shared AV fleet size and parking needs; d) Data-driven optimization approach to systemically or holistically improve the resilience of the MRT. Through these innovative approaches we are seeking to change the way the people interact and communicate with the city.

***MIT Principal Investigator(s):***
*Carlo RATTI (Urban Studies and Planning)*

***Singapore Co-Investigator(s):***
*Arijit KHAN (NTU, School of Computer Science and Engineering)*

**9. FMS E-Commerce**

Future Mobility Sensing (FMS) E-Commerce is a laboratory under development to facilitate the study of individuals' on-line and offline activity and travel behaviours, a component of which is an app-based integrated solution to household travel surveys that not only collects details of daily activities and trips of individuals but also allows designing personalized study scenarios based on user histories collected. Its ongoing application is focused on shopping activities, such as e-commerce, with the goal of supporting ongoing modelling and simulation studies of e-commerce technologies and associated policies. To achieve this, new technologies and data collection methods need to be investigated and implemented in the platform.

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