

Title: Ontologies for Smart Mobility

- **Names and Affiliations of Speakers.**

Bilal Farooq, Ph.D.

Laboratory of Innovations in Transportation (LiTrans)

Ryerson University

- **Abstract, objectives and motivation**

Ontology is the explicit and formal representation of the concepts in a domain and relations among them. Transportation science is a wide domain dealing with mobility over various complex and interconnected transportation systems, such as land, aviation, and maritime transport, and can take considerable advantage from ontology development. In this context, there exists a strong potential to develop and study comprehensive smart mobility ontologies. The objective of this tutorial is to present different aspects of ontology development in general, such as ontology development methods, languages, tools, and software. Subsequently, we will present the currently available mobility-related ontologies developed across different domains, such as transportation, smart cities, goods mobility, sensors. Current gaps in the available ontologies are identified, and future directions regarding ontology development are exposed that can incorporate the forthcoming autonomous and connected vehicles, mobility as a service (MaaS), and other disruptive transportation technologies and services.

- **Keywords**

Smart Cities, Human-centric Computing, Intelligent Environments, Internet of Things, Information and Communication Technology, 5G Connectivity, Sensor System Integration, Context-awareness, Urban Strategies, Societal Implications of Technology

- **Intended Audience**

The tutorial is intended for researchers, including, postdocs and PhD students who are interested in starting research in the areas of smart cities, smart mobility, intelligent transportation systems, and intelligent environment. This tutorial is of intermediate nature with expectations that the audience are familiar with the general areas and are interested using ontologies in their specific research problem.

- **Content outline**

1. Basic components of ontology
2. Classification of different ontologies
3. Approaches to the development of ontology
4. Ontology languages
5. Mobility Ontologies
6. Future directions

- **Description**

Transportation systems and mobility over them are rapidly adopting the advanced digital technologies and moving from being only physical to highly intelligent cyber-physical systems. Mobility has thus become more and more complex, agile, multimodal, and interconnected, encompassing land, aviation, and maritime transport. The research in this domain can take considerable advantage from ontology development to incorporate these issues. In this context, there exists a strong potential to develop and study comprehensive

smart mobility ontologies. This tutorial can provide a comprehensive background to the researchers who want to start their research on the topic. The contents are designed in a way that at the end of the tutorial, the participants will have the basic knowledge and understanding, and they will be introduced to the key directions in which they can further focus.

- **Teaching mode**

The tutorial can be face-to-face, while the option of streaming can be provided to the audience who want to attend remotely. In case, no one can attend in person, the tutorial can be moved to virtual set up. The presenter will be able to setup a Zoom session and invite all the participants to it.

- **Materials**

The audience will be provided the following:

- Presentation slides from the tutorial
- A preprint of the book chapter on the topic from the Handbook of Smart Cities
- Some basic code snippets

All the material will be uploaded to a github repository from where the audience can access them.

- **Bio-sketches**

Dr. Bilal Farooq is the Canada Research Chair in Disruptive Transportation Technologies and Services. He is currently an Associate Professor in Transportation Engineering at Ryerson University. He received a Master's degree in Computer Science from the Lahore University of Management Sciences, Pakistan. He worked in the software industry for several years before starting his Ph.D. in Transportation Engineering at the University of Toronto in 2006. From 2011-2013 he did his Post-Doctoral research at EPFL, in Switzerland. From 2013-2017 he worked as an Assistant Professor at Polytechnique Montréal. He received the Early Career Researcher Awards in the provinces of Québec (2014) and Ontario (2018). Bilal is interested in understanding the network and behavioural effects of smart mobility and in developing the associated algorithms, models, and solutions.