School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Application instructions:
Detailed instructions are available at :
https://www.napier.ac.uk/research-and-innovation/doctoral-college/how-to-apply

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:
- DIRECTOR OF STUDY: Dr Faheem Ahmed Malik (Email: f.malik@napier.ac.uk)
- 2ND SUPERVISOR: tbc

Subject Group: Built Environment

Research Areas: Engineering and Mathematics.

Project Title: Developing a novel Modelling Framework for Modelling fifteen-minute cities

Project description:
As the world's population continues to urbanise at an unprecedented rate, urbanization's challenges, such as congestion, pollution, and social inequality, have grown more important than ever. The "fifteen-minute city" is a recent innovative urban development concept that aims to create liveable, sustainable, and inclusive urban environments by ensuring that essential services, amenities, and opportunities are accessible within a 15-minute walk or bike ride from any location. By prioritizing the needs and preferences of residents, and promoting equity and community engagement, the 15-minute city concept can help create more vibrant and inclusive urban environments, where residents can access the resources and amenities they need to thrive. Presently there are some niche works going on in Paris (France), Barcelona (Spain), 20-minute concept, Melbourne (Australia), Portland (Oregon). This PhD project seeks to develop a novel intelligent modelling framework that utilizes real transportation data to design and evaluate the feasibility of the "fifteen-minute city"

concept, with a focus on optimizing transportation systems, reducing congestion, and enhancing urban accessibility.

Objectives:

1. To develop an intelligent modelling framework specifically designed for modelling 15-minute cities combining mathematical, statistical and AI-based approaches.
2. To develop an integrated urban traffic simulation model that considers transportation data, land-use patterns, and mobility preferences as input variables to assess the potential for achieving a "fifteen-minute city".
3. To model the effectiveness of different transportation interventions, such as improved public transit, active transportation infrastructure, and traffic management strategies, in realizing the "fifteen-minute city" vision, and its corresponding benefits.
4. Scenario Modelling: Utilize scenario modelling and simulation modelling to project the potential benefits and challenges of implementing the "fifteen-minute city" in specific urban contexts, considering different transportation interventions and investment in sustainable mobility

References:

1. F. A. Malik, L. Dala and K. Busawon, "Intelligent Nanoscopic Cyclist Crash Modelling for Variable Environmental Conditions," in IEEE Transactions on Intelligent Transportation Systems, vol. 23, no. 8, pp. 11178-11189, Aug. 2022, doi: 10.1109/TITS.2021.3101118.
2. S. Torregrosa, V. Champaney, A. Ammar, V. Herbert, and F.Chinesta, "Hybrid twins based on optimal transport", in Computers & Mathematics with Applications, vol 127, pp. 12-24, 2022, doi: 10.1016/j.camwa.2022.09.026.
3. Birkenfeld, C., Victoriano-Habit, R., Alousi-Jones, M., Soliz, A. and El-Geneidy, A., 2023. Who is living a local lifestyle? Towards a better understanding of the 15-minute-city and 30-minute-city concepts from a behavioural perspective in Montréal, Canada. Journal of Urban Mobility, 3, p.100048

Candidate characteristics

Education:
Minimum 2:1 degree in the following subject areas - Transportation/ Civil Engineering, Mathematics/AI

Subject knowledge:
Transportation Planning, Mathematical Modelling

Essential attributes:
- A hardworking, enthusiastic, and dedicated student with a good academic track record