

Department	School of Engineering and the Built Environment
Supervisors	Prof. Berk Canberk, Prof. Ahmed Al-Dubai, Prof. Amir Hussain
Project Title	Digital Twin Model for Coexistence of Wi-Fi and IoT in Smart Cities
<p>PROJECT DESCRIPTION</p> <p>Next-generation wireless networks have gained more importance with the increasing trend in smart and sustainable cities. More specifically, WiFi6 hit the marketplace in 2022, and WiFi7 is hoped to be ready around 2024. Besides, new enhancements proposed in these two recent amendments are planned to be prepared for Digital Twin Networks. Even if Digital Twin and IoT are two complementing research directions, there is no complete architecture on how to design wireless IoT communication for Digital Twin-aided smart cities. Put it differently, the power consumption and limited bandwidth capabilities of IoT devices make it difficult to provide "twinning" operations in terms of synchronization and bi-directional data communication.</p> <p>In the scope of the study, the candidate will research the literature to design a novel communication model considering the aforementioned challenges. Consequently, the new one-to-many twinning will be studied in large-scale IoT networks. A gateway will be designed so that this one-to-many data transfer is available for Digital Twin Networks in smart cities. For the two-way communication challenge, a new control packet and protocol stacks will be researched with respect to IoT devices and the twinning process.</p> <p>Perspective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should make it clear the project you are applying for and the name of the supervisors.</p> <p>Academic qualifications</p> <p>A first degree (at least a 2.1) ideally in Electrical and Computer Engineering with a good fundamental knowledge of Wireless Networks, Internet of Things, Simulation tools like NS-3, Ansys, Anylogic, Matworks Simulink, and programming languages like Python and C++.</p> <p>English language requirement</p> <p>IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.</p> <p>Essential attributes:</p> <ul style="list-style-type: none"> • Experience of fundamental Software Engineering, Computer Engineering • Competent in Algorithmic Design, Machine Learning and Database Systems • Knowledge of Simulation Environments, Data Management, Smart Cities, IoT • Good written and oral communication skills • Strong motivation, with evidence of independent research skills relevant to the project • Good time management <p>Desirable attributes:</p> <p>Real-Time Software Services, API management</p>	
Indicative Bibliography	T. Bilen, E. Ak, B. Bal, B. Canberk, 'A Proof of Concept on Digital Twin-Controlled WiFi Core Network Selection for In-Flight Connectivity', IEEE Communications Standards Magazine, September 2022

	<p>Deng, C., Fang, X., Han, X., Wang, X., Yan, L., He, R., Long, Y., and Guo. Y. 2020. "Ieee 802.11 be wi-fi 7: New challenges and opportunities" IEEE Communications Surveys & Tutorials, 22(4):2136–2166.</p> <p>Dong, R., She, C. She., Hardjawanaliu, W. Hardjawana., Li, Y. Li., and Vucetic., B. 2019. "Deep Learning for Hybrid 5G Services in Mobile Edge Computing Systems: Learn from a Digital Twin", IEEE Transactions on Wireless Communications, vol. 18, no. 10</p> <p>Mihai, Stefan, Mahnoor Yaqoob, Dang V. Hung, William Davis, Praveer Towakel, Mohsin Raza, Mehmet Karamanoglu et al. "Digital twins: a survey on enabling technologies, challenges, trends and future prospects." IEEE Communications Surveys & Tutorials, 2022.</p> <p>Fuller, A., Fan, Z., Day, C., and Barlow, C. 2020. "Digital Twin: Enabling Technologies, Challenges and Open Research", IEEE Access, vol. 8, pp. 108952-108971</p>
Enquiries	For informal enquiries about this PhD project, please contact Prof. Berk Canberk, b.canberk@napier.ac.uk
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process