



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

### **PHD STUDENT PROJECT**

#### **Funding and application details**

**Funding status:** Self funded students only

**Application instructions:**

Detailed instructions are available at <https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/>

*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: Professor Ahmed Al-Dubai (Email: A.Al-Dubai@napier.ac.uk)
- 2<sup>ND</sup> SUPERVISOR: Professor Amir Hussain

**Subject Group:** Cyber-security and system engineering

**Research Areas:** AI, Internet of Things, Machine Learning, Networks

**Project Title:** Context-Aware Wireless Power Transfer Scheduling for Vehicular Edge Computing

**Project description:**

Vehicle Edge Computing (VEC) is a promising paradigm that exposes Mobile Edge Computing (MEC) to road scenarios. VEC and wireless power transfer (WPT) are regarded as promising technologies that have attracted significant attention in many areas. MEC/VEC can bring computation and data storage closer to where data is generated, enabling better data control, reduced costs, faster insights and actions, and continuous operation. Wireless Power Transfer (WPT) facilitates the development of ultra-low power communication technologies such as Internet of Everything (IoE) by providing a stable and reliable power source, enabling

numerous novel applications and services. Therefore, WPT is expected to play a crucial role in powering and connecting a diverse range of devices and services in the 6G-enabled world. WPT technologies are vital in advancing the capabilities of 6G networks. By eliminating the need for cords and cables, WPT allows for more seamless and convenient charging of devices. This enhances the mobility of devices, which is crucial for the growth of IoE applications. WPT technologies offer improved energy efficiency, reducing waste generated by traditional charging methods. Implementing WPT in 6G networks increase the popularity of wearable technology, such as smartwatches, fitness trackers, and IoT devices, which require constant power. The integration of WPT with 6G networks provides a more convenient and efficient solution for charging these devices, ultimately leading to the growth of technology and the advancement of the IoE. WPT modes of operation include power-sharing and time switching concerning the WPT receiver structure.

Recently, some studies on wireless charging scheduling have been proposed, aiming at enhancing the performance of power-limited devices by optimizing charging scheduling schemes and load scheduling. However, these studies did not context-aware scheduling within a wide range of parameters.

Unlike most existing works, this project will strive to propose smart WPT scheduling that depends on context-aware multi-criteria decision-making in selecting a sensor for charging. Novel AI-driven scheduling algorithms will be developed for VEC.

#### **References:**

- [1] A. Naji, A. Al-Dubai, A. Hussain, et al., "ESPP: Efficient Sector-based Charging Scheduling and Path Planning for WRSNs with Hexagonal Topology," in *IEEE Transactions on Sustainable Computing*, doi: 10.1109/TSUSC.2023.3296607., 2023
- [2] L. Zhao, A. Al-Dubai, et al., "MESON: A Mobility-aware Dependent Task Offloading Scheme for Urban Vehicular Edge Computing," in *IEEE Transactions on Mobile Computing*, doi: 10.1109/TMC.2023.3289611, 2023.
- [3] Xiaojie Wang, Jiameng Li, Zhaolong Ning, Qingyang Song, Lei Guo, Song Guo, and Mohammad S. Obaidat. 2023. Wireless Powered Mobile Edge Computing Networks: A Survey. *ACM Comput. Surv.* 55, 13s, Article 263 (December 2023), 37 pages. <https://doi.org/10.1145/3579992>

## **Candidate characteristics**

#### **Education:**

A first-class honours degree, or a distinction at master level, or equivalent achievements in Computer Science-related area with a good fundamental knowledge of computer science and communications.

#### **Subject knowledge:**

AI, Edge Computing, Vehicular Networks, Scheduling Algorithms, Simulations, Programming Skills

#### **Essential attributes:**

- Strong focus on Vehicular Communication and wireless charging
- Good background on distributed systems, including IoT, cloud and edge computing.
- Good written and oral communication skills.
- Strong motivation, with evidence of independent research skills relevant to the project.

- Good organization and time management skills.

**Desirable attributes:**

- Excellent in programming and algorithms
- Good knowledge and understanding of mobile edge computing .
- Has experience in conducting simulation in distributed systems
- Knowledge of data analysis