



## **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://www.napier.ac.uk/research-and-innovation/research-degrees/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: Zhiyuan Tan (Email: [Z.Tan@napier.ac.uk](mailto:Z.Tan@napier.ac.uk))
- 2<sup>ND</sup> SUPERVISOR: Ahmed Al-Dubai

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

**Research Areas:** Cyber Security, Networks, Electrical Engineering

**Project Title:** Security of Electric Vehicle Charging Infrastructure

**Project description:**

The rise of Electric Vehicles (EVs) drives an increase in demand and rapid development of the charging infrastructure, where a charger interconnects with an EV and a charging provider as well as a site controller to authorise charging sessions and report any errors. Charging providers may federate with each other to permit cross-network interoperation and will incorporate with energy companies for automated billing in the near future. Exploring the operations and security of such an interconnected system is, therefore, crucial to avoid building insecure infrastructure.

Attacks on these interconnected systems stretch their potential impact from relatively minor local effects to long-term national disruptions. This project aims to explore the Electric Vehicle Supply Equipment (EVSE) vulnerabilities and the impact of cyberattacks on the EVSE environment and to develop innovative protections (potentially based on zero-knowledge proof, physically unclonable function, attribute-based privacy-preserving data sharing and data-driven anomaly detection) to secure the EV charging infrastructure.

### References:

- [1] Johnson, J., Anderson, B., Wright, B., Quiroz, J., Berg, T., Graves, R., ... & Hardy, K. (2022). Cybersecurity for Electric Vehicle Charging Infrastructure (No. SAND2022-9315). Sandia National Lab.(SNL-NM), Albuquerque, NM (United States).
- [2] Metere, R., Neaimeh, M., Morisset, C., Maple, C., Bellekens, X., & Czekster, R. M. (2021). Securing the electric vehicle charging infrastructure. arXiv preprint arXiv:2105.02905.
- [3] Chamberlain, K., & Al-Majeed, S. (2021). Standardisation of UK Electric Vehicle Charging Protocol, Payment and Charge Point Connection. *World Electric Vehicle Journal*, 12(2), 63.
- [4] Johnson, J., Berg, T., Anderson, B., & Wright, B. (2022). Review of Electric Vehicle Charger Cybersecurity Vulnerabilities, Potential Impacts, and Defenses. *Energies*, 15(11), 3931.
- [5] Acharya, S., Dvorkin, Y., Pandžić, H., & Karri, R. (2020). Cybersecurity of smart electric vehicle charging: A power grid perspective. *IEEE Access*, 8, 214434-214453.
- [6] Shamsoshoara, A., Korenda, A., Afghah, F., & Zeadally, S. (2020). A survey on physical unclonable function (PUF)-based security solutions for Internet of Things. *Computer Networks*, 183, 107593.
- [7] Wang, D., Zhao, J., & Wang, Y. (2020). A survey on privacy protection of blockchain: the technology and application. *IEEE Access*, 8, 108766-108781.
- [8] Nguyen, D. C., Ding, M., Pathirana, P. N., Seneviratne, A., Li, J., & Poor, H. V. (2021). Federated learning for internet of things: A comprehensive survey. *IEEE Communications Surveys & Tutorials*, 23(3), 1622-1658.

## Candidate characteristics

### Education:

A second class honour degree or equivalent qualification in Electronic Engineering or Computer Science with a good fundamental knowledge of Cybersecurity.

### Subject knowledge:

- Cybersecurity
- Computer Science
- Electronic Engineering

### Essential attributes:

- Experience of fundamental System Security
- Competent in handling High Voltage Electrical Equipment and Critical Analysis
- Knowledge of Electric Vehicle Charging Infrastructure
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project

- Good time management

**Desirable attributes:**

- Experience in Electric Vehicle Supply Equipment Standards and Communication Protocols
- Good knowledge of Zero-knowledge Proof, Privacy-preserving Data Sharing
- Preliminary experience in Federated Learning and its applications