Department	School of Computing
Supervisors	Prof. Ahmed Al-Dubai, Prof. Berk Canberk and Prof Amir Hussain
Project Title	Collaborative Edge Computing for Vehicular Networks

PROJECT DESCRIPTION

Vehicular communication is a key element in intelligent transportation systems. Mobile edge computing (MEC) is a promising technology to support mission-critical vehicular communication applications, such as intelligent path planning and safety applications. The central cloud processing schemes have exhibited high latency and scalability related problems. Vehicular communications in particular are very sensitive to latency and in need for federated cloud based systems. In this context, a collaborative edge computing paradigm is emerging to reduce the computing service latency and improve service reliability for vehicular networks. It also enables sharing resources.

In this study, scheduling algorithms for task offloading to the edge servers will be developed. Machine learning based collaborative computing approach will be developed to determine the most appropriate and contextualised task offloading. Simulation experiments would be carried out to validate the proposed solutions and conduct comparisons with existing counterparts.

Academic qualifications

A first degree (at least a 2.1) ideally in Electronic Engineering or Computer Science with a good fundamental knowledge of networking and communications .

English language requirement

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.

Essential attributes:

- Experience of fundamental networked systems and clouds
- Competent in distributed clouds and edge computing
- Knowledge of communication algorithms and simulation
- 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 networking and communications
- Good knowledge of edge compuimg and vehicular communications
- Preliminary experience in machine learning

Indicative Bibliography	- L. Zhao, Ahmed Al-Dubai *et al*., "Novel Online Sequential Learning-Based Adaptive Routing for Edge Software-Defined Vehicular Networks," in *IEEE Transactions on Wireless Communications*, vol. 20, no. 5, pp. 2991-3004, May 2021, doi: 10.1109/TWC.2020.3046275. - N. Lin, L. Fu, L. Zhao, G. Min, A. Al-Dubai and H. Gacanin, "A Novel Multimodal Collaborative Drone-Assisted VANET Networking Model," in *IEEE Transactions on Wireless Communications*, vol. 19, no. 7, pp. 4919-4933, July 2020, doi: 10.1109/TWC.2020.2988363.

	- L. Zhao, Ahmed Al-Dubai *et al*., "Vehicular Computation Offloading for Industrial Mobile Edge Computing," in *IEEE Transactions on Industrial Informatics*, vol. 17, no. 11, pp. 7871-7881, Nov. 2021, doi: 10.1109/TII.2021.3059640. - M. Li, J. Gao, L. Zhao and X. Shen, "Deep Reinforcement Learning for Collaborative Edge Computing in Vehicular Networks," in *IEEE Transactions on Cognitive Communications and Networking*, vol. 6, no. 4, pp. 1122-1135, Dec. 2020, doi: 10.1109/TCCN.2020.3003036. - Z. Qin, S. Leng, J. Zhou and S. Mao, "Collaborative Edge Computing and Caching in Vehicular Networks," *2020 IEEE Wireless Communications and Networking Conference (WCNC)*, 2020, pp. 1-6, doi: 10.1109/WCNC45663.2020.9120600. - K. Wang, H. Yin, W. Quan and G. Min, "Enabling Collaborative Edge Computing for Software Defined Vehicular Networks," in *IEEE Network*, vol. 32, no. 5, pp. 112-117, September/October 2018, doi: 10.1109/MNET.2018.1700364. - X. Li, L. Cheng, C. Sun, K. -Y. Lam, X. Wang and F. Li, "Federated-Learning-Empowered Collaborative Data Sharing for Vehicular Edge Networks," in *IEEE Network*, vol. 35, no. 3, pp. 116-124, May/June 2021, doi: 10.1109/MNET.011.2000558.
Enquiries	For informal enquiries about this PhD project, please contact Prof Ahmed Al-Dubai
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process