Department	School of Computing
Supervisors	Brian Davison, Andreas Steyven
Project Title	Multi-objective optimisation of sensor network data collection with a mobile gateway

PROJECT DESCRIPTION

IoT applications such as precision agriculture and environmental monitoring often require sensors distributed over a wide area without fixed infrastructure. To overcome constraints such as cost, energy use and communication reliability, drones may be used as mobile gateways. Drones can also collect data directly using on-board sensors such as cameras and lidar.

This project will investigate the performance of data collection strategies with parameters such as network configuration, protocol, power source, location stability, flight path and speed, etc. Artificial intelligence (AI) techniques will be used to optimise parameters for typical contexts and the predictions will be evaluated in simulation and through practical fieldwork.

The first phase of the project will consist of a thorough review of existing literature on two topics:

- The use of drones as mobile sink nodes for data collection
- AI techniques for multi-objective optimisation

Later phases will focus on

- The specification of test scenarios
- The application of selected optimisation techniques
- Simulation of data collection within the test scenarios
- Field work to test the predictions of the simulation results using physical equipment

Prospective 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 supervisor(s).

Academic qualifications

A first degree (at least a 2.1) ideally in computer science with a good fundamental knowledge of software development techniques.

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 principles of artificial intelligence or machine learning
- Competent in software development
- Knowledge of basic physical health and safety procedures
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

Any previous experience with sensors, drones or practical fieldwork would be highly beneficial. This could include projects from undergraduate or postgraduate study. The project would suit candidates with an interest in practical work in remote locations.	
Indicative Bibliography	García, L., Parra, L., Jimenez, J. M., Lloret, J., Mauri, P. V., & Lorenz, P. (2020). DronAway: A proposal on the use of remote sensing drones as mobile gateway for wsn in precision agriculture. *Applied Sciences (Switzerland)*, *10*(19). https://doi.org/10.3390/APP10196668 Martos, V., Ahmad, A., Cartujo, P., & Ordoñez, J. (2021). Ensuring agricultural sustainability through remote sensing in the era of agriculture 5.0. *Applied Sciences (Switzerland)*, *11*(13). https://doi.org/10.3390/app11135911 Wei, Z., Zhu, M., Zhang, N., Wang, L., Zou, Y., Meng, Z., … Feng, Z. (2022). UAV-Assisted Data Collection for Internet of Things: A Survey. *IEEE Internet of Things Journal*, *9*(17), 15460–15483. https://doi.org/10.1109/JIOT.2022.3176903 Yu, Y., Tang, J., Huang, J., Zhang, X., So, D. K. C., & Wong, K. K. (2021). Multi-Objective Optimization for UAV-Assisted Wireless Powered IoT Networks Based on Extended DDPG Algorithm. *IEEE Transactions on Communications*, *69*(9), 6361–6374. https://doi.org/10.1109/TCOMM.2021.3089476
Enquiries	For informal enquiries about this PhD project, please contact Dr Brian Davison (b.davison@napier.ac.uk)
Web page	https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process