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| Department | School of Engineering and the Built Environment |
| Supervisors | Dr Abdelfateh Kerrouche |
| Funding Status | Funded PhD Project (worldwide) |
| Application Deadline | 14/04/22 |
| Project Title | Autonomous Underwater Vehicle with multi-sensors prototype for underwater onsite monitoring |

PROJECT DESCRIPTION

The increasing demand of protein for a growing world population puts the aquaculture industry under pressure to increase production. The expansion of aquaculture practices with diversified species and higher stocking density has resulted in more frequent incidence of disease outbreaks often leading to higher fish mortalities with reduced overall production. Chemicals used in aquaculture can enter natural waters which lead to water pollution. The use of modern technologies such as Underwater Vehicles (UVs) to reform the traditional coastal activities is of great significance for improving the efficiency and quality of the aquaculture. Novel monitoring technologies designed to act as early warning systems for water quality that take only hours to obtain results are therefore essential tools to allow farm workers to take necessary precautions in a timely manner, thereby mitigating health risks.

The aim of this project is to, design, build and test an innovative pilot solution based on optical sensors technology integrated into microfluidic devices (a set of micro-channels etched into a material e.g. glass), coupled with novel artificial intelligence (AI) algorithms, for autonomous, underwater and real-time chemical compounds detection.

In addition, the project will exploit the use of embedded electrochemical biosensors for molecular fingerprinting detection. This interdisciplinary project will evaluate existing biosensors and acoustics technologies to determine suitability for their integration into a next-generation portable monitoring system.

Significant demand is expected for such a real-time monitoring system with environmental regulators, water utilities and environmental consultancies. The envisioned prototype system could change monitoring strategies for toxic molecules in water and diseases related to pathogens by providing on-site analysis capability, without the need for subjective microscopy for identification, subsequently reducing costs and process time significantly.

Academic qualifications

A first degree (at least a 2.1) ideally in Computer Science, Electrical/Electronic Engineering, Mechanical engineering with a good fundamental knowledge of Embedded systems, IoT sensors and devices.

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 Strong AI, machine and deep learning background
- Competent in Optical sensors
- Knowledge of Biomedical Optics
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

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| Desirable attributes: Practical research expertise in an optical lab and/or a clean-room environment | |
| Indicative Bibliography | Kerrouche, A., Lithgow, J., Muhammad, I., & Romdhani, I. (2020). Towards the Development of Rapid and Low-Cost Pathogen Detection Systems Using Microfluidic Technology and Optical Image Processing. Applied Sciences, 10(7), https://doi.org/10.3390/app10072527 |
| Funding notes | This project may be funded by a scholarship of the School of Engineering and Built and Environment. Please see School-funded PhD scholarships - RESEARCH AND INNOVATION (napier.ac.uk) for information on the scholarships and how to apply for them. |
| Enquiries | For informal enquiries about this PhD project, please contact Dr Abdelfateh Kerrouche: a.kerrouche@napier.ac.uk |
| Web page | https://www.napier.ac.uk/research-and-innovation/research-degrees/application-process |

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