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: Dr. Oluwaseun Bamgboye (Email: O.Bamgboye@napier.ac.uk)
- 2ND SUPERVISOR: Prof. Xiaodong Liu

Subject Group: Computer science

Research Areas: Internet of Things, Computer Science, Software Engineering, Data Science

Project Title: Trusted-Edge and Semantic-based Approach for Dependable IoT and Smart Systems

Project description:

The integration of sensors and embedded devices for the purpose of data acquisition to support human activity recognition, management of living challenges, and behavioural patterns for the purpose of proactive decision making has continue to open more direction of research in smart home applications such as Ambient Assisted Living (AAL). The monitoring and predictive activities is made possible through use of wearable IoT (WIoT) devices, which are connected to

human body in order to collect real-time data, analyse, and assists the user with daily tasks or for predictions.

Furthermore the WIoT has recently changed the paradigm of pervasive and personal computing. They are now finding the way into the field of medical diagnosis for certain types of diseases and send data/information remotely to healthcare professional in near real-time for safety-critical situation. Therefore, it is highly significance for any innovative wearable IoT technology to guarantee the end-user trust to achieve its full adoption.

However, most WIoT devices have been known to be confronted with trust related issues. This is because these devices need to work together close to each other and be able to analyse and transfer data across the network. Most trust issues are often related to the quality of data (Consistency and Completeness) and output that these devices are producing at the computing edge, the timeliness of the data for real-time requirement, security and privacy, device and data availability, Interoperability issues, and reliability of service.

The edge computing with the cloud computing research domain has been seen to be successful in the management of IoT data processing and elastic storage management. It will still be possible to consider the integration of semantic technologies and fault tolerance management to guarantee high degree of interoperability and availability of device and data.

In this PhD project, a successful candidate will explore the current state of the wearable IoT technologies, cloud and the edge computing to develop a novel adaptive trust management approach and relevant frameworks to improve the quality of service and adoption of wearable IoT devices. The objective of the project is as follows:

- Develop a large Sematic-based Knowledge graph model to support IoT data and devices modelling and reasoning for interoperability
- Develop a scalable cloud-based fault recovery approach for sensor stream processing.
- A prototype framework for self-adaptive trusted-edge approach

References:

[1] Bamgboye, O., Liu, X., & Cruickshank, P. (2018). Towards Modelling and Reasoning About Uncertain Data of Sensor Measurements for Decision Support in Smart Spaces. 2018 IEEE 42nd Annual Computer Software and Applications Conference (COMPSAC), 744–749.

[2] Bhatt, V., & Chakraborty, S. (2020). Importance of Trust in IoT based Wearable Device Adoption by Patient: An Empirical Investigation. 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 1226–1231.

[3] Shipunova, O., Berezovskaya, I., Pozdeeva, E., Evseeva, L., & Barlybayeva, S. (2022). Digital Trust Indicators in Human-Computer Interaction (pp. 245–254). Springer, Cham.

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Computer Science/Computing, Mathematics, any other numerate discipline

Subject knowledge:

- Software Engineering
- Internet of Things
- Semantic Technologies and Modelling
- Machine Learning including Artificial Intelligence
- Cloud Computing

Essential attributes:

- Fundamentals of Software Engineering and Programming
- Competent in scientific research
- Good knowledge of IoT
- Good written and Oral communication skills
- Strong motivation and evidence of undertaking independent research
- Excellent Time management

Desirable attributes:

- Familiarity with data processing and analysis of wearable IoT
- understanding of large graph models
- Generative AI