Queen's Doctoral Training Programme on
Secure Connected Intelligent Design and Manufacturing

Title: DTP: Secure connection of multiple retrofitted smart building monitoring systems across a group of buildings.

This project is part of the Queen's Doctoral Training Programme in Secure Connected Intelligent Design and Manufacturing. Many of today's industrial approaches require transformative changes to ensure long term societal, economic and environmental resilience and sustainability. PhD projects in this programme explore the potential of emerging digital technologies, such as artificial intelligence, robotics, and the Internet of Things, to transform the way we design, manufacture and operate products and services.

Project description:

Smart technology is fast becoming the norm in new build construction, with widespread use of digital twins and integration of temperature, room occupancy, energy and light sensors enabling building energy management systems to track, predict and manage energy use. However, there exists a large stock of existing buildings which are, by comparison, largely 'dumb'; very little information is gathered on their efficiency, occupancy, and energy use, and their management often uses legacy, analogue systems.

Fitting sensors to monitor existing buildings presents a number of challenges: the integration of the technology with the existing building envelope; older mechanical and electrical systems which may use a mixture of heat and energy generation and distribution networks; and the security and reliability of information gathered.

This project responds to the UK construction 2025 strategy through the development and use of innovative techniques to record the existing built environment including connecting room and building wide information.

Aims and Objectives:

The project aims to generate a resilient network of secure, smart building models as an online digital building information system, with real time sensor data combined with user feedback / participation. This will aid energy use tracking, gathering real time data for analysis and prediction of energy use.

Research objectives:

To develop a network of non-invasive building sensors which can be retrofitted without unduly disturbing an existing building's fabric.

To develop a number of digital twins for existing buildings based on a laser scan / point cloud model.

To securely connect these digital twins to each other, to the building sensors, and to an interface for building user feedback. The information needs to be accessible and secure – the right person is able to access the right level of secure, reliable data from the system.

Key skills required for the post:
Knowledge and experience of working with BIM models, technology and processes. Knowledge of point cloud generation and manipulation. Knowledge of building sensor technology.

Key transferable skills that will be developed during the PhD:
The programme offers a bespoke research and training programme that aims to develop students into cross-disciplinary, industry-conscious thinkers and leaders who will influence the roadmaps of future advanced manufacturing technologies and their applications. They will have a balanced understanding of ICT (security, communications and data analytics) in the context of their application to Advanced Manufacturing and High Value Design.

Lead supervisor:	Tara Brooks, School of the Natural and Built Environment. t.brooks@qub.ac.uk
Other supervisor(s):	Roger Woods, School of Electronics, Electrical Engineering and Computer Science. r.woods@qub.ac.uk

Guaranteed stipend:	This is a 3.5 year funded Queen's DfE DTPs studentship with Training Grant, to commence on 1 October 2020 (N.B. stipend for 20/21 is not yet known, but is likely to exceed £15,000). The studentship covers fees and maintenance and is available for UK residents (see full eligibility criteria - nationality, residency, and academic qualification at: http://go.qub.ac.uk/dfeterms). **When applying using the Queen's portal please ensure you include "DTP:" along with the project title.**
Conditional top-up available:	

Queens University Belfast is a diverse and international institution which is strongly committed to equality and diversity, and to selection on merit. Currently women are under-represented in research positions in the School and accordingly applications from women are particularly welcome.