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

School of Electronics, Electrical Engineering and Computer Science

PhD Studentship 2020/21

Proposed Project Title: DTP: Optimising adaptive skill delivery systems for human users and learners in Industry 4.0

Principal Supervisor: **Matthew Rodger, Psychology** **(Second supervisor: Nikolaos Athanasopoulos, EEECS)** **Contact Details:** **QUB Address: David Keir Building, Stranmillis Road, Room 03.535** **Tele No: +44 (0) 28 9097 4177** **E-Mail: m.rodger@qub.ac.uk**	**Research Area** Skill acquisition, Learning, Psychology, Control and Systems Theory, Cyber-Physical Systems **Proposal open to other School** (indicate area of Interest) Psychology, EEECS

Degree linked to ELE (delete as appropriate)

Degree linked to CSC (delete as appropriate)

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.

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.

Project Description:
Although more and more aspects of the manufacturing industry are becoming intelligently automated, there are still many tasks that need skilled human operators to perform them. This often requires operators to perform unpractised sequences of actions accurately or to quickly train up on new skills. Ensuring that human operators can perform these tasks to the best of their abilities (*skill delivery*) has important ramifications for both productivity and safety. However, a challenge is that optimal skill delivery is not guaranteed by one-size-fits-all instructions or feedback, but rather needs to consider individual differences (e.g. in pre-existing skill levels) and within-individual variations (e.g. fatigue, stress, or changes with practice). Recent advances in both sensor technology and pattern recognition software have expanded the possibilities for developing 'adaptive' skill delivery systems which are sensitive to individuals and contexts, and may adjust task instructions or user feedback accordingly. Nevertheless, much research is still required to understand the most effective ways to customise instructions and feedback provided to the user/learner in context-dependent situations within these systems.

That is the topic of this PhD project. Informed by psychological theories of perception, action and skill learning, adaptive skill delivery systems will be designed and tested through experiments to understand how well they sense and respond to human actions and contexts, and how effectively they support users to perform or learn manufacturing-relevant skills. This will be an inter-disciplinary project, building on knowledge across Psychology, Systems Engineering, and Computer Science, with intended real-world applications for Industry 4.0.

Objectives:
- Test effectiveness of different adaptive skill delivery systems for enhancing task performance in industry-relevant skills
- Compare different modes of context-sensitive instruction and feedback within adaptive skill delivery systems
- Develop principles to enhance skill delivery through adaptive systems in real-world industry 4.0 applications

Academic Requirements:

A minimum 2.1 honours degree or equivalent in Psychology, Engineering or other subject directly relevant to the project is required.

GENERAL INFORMATION
This 3.5 year PhD studentship, potentially funded by the Department for Employment and Learning (DfE), commences on 1 October 2020.

Eligibility for both fees and maintenance (approximately £15,000) depends on the applicants being either an ordinary UK resident or those EU residents who have lived permanently in the UK for the 3 years immediately preceding the start of the studentship. Non UK residents who hold EU residency may also apply but if successful may receive fees only.

Applicants should apply electronically through the Queen's online application portal at: https://dap.qub.ac.uk/portal/

Further information available at: https://www.qub.ac.uk/schools/eeecs/Research/PhDStudy/

Closing date for applications: 15 March 2020