Impact Case Study

UoA 11: Computer Science and Informatics

<u>**New software products for programming wireless sensor networks**</u>

Estimates from the World Health Organisation suggest that by 2050 the global number of older people will have increased 3-fold from the year 2000. Coupled with this will be an increase in prevalence of long-term chronic health conditions. Technology-based solutions have been introduced in efforts to address these challenges. One such solution is the "smart environment": a smart environment entails embedding technologies within the environment (for example, the home, the workplace, or a public building) to record people's interactions with objects in the environment, and subsequent processing of the data recorded to infer the activities that are being undertaken by persons in the environment. Smart environments make it possible to monitor a person's health-related conditions over a period of time, and by understanding a person's behaviour it is then possible to provide support when these conditions are detected to be deteriorating, or in cases of an emergency situation.

To successfully monitor a person's health through the use of technology requires the development of sensors that can be worn on the body and that can continuously collect and stream data wirelessly for analysis. Researchers at Ulster's Computer Science Research Institute (CSRI) have been tackling this problem in collaboration with a leading international manufacturer of sensor platforms. This sensor platform development company has produced a new software interface for programming their flagship platform based on research undertaken by researchers in CSRI on rapid prototype development of healthcare applications. This new product has led to an increase in turnover for the company and is now in use globally. The company is also currently marketing a new training product based on research in CSRI.

During 2009 CSRI established a smart environment at Ulster University, funded by the NI Department of Employment and Learning. The smart environment has a wireless sensor network, so that as a person interacts with objects in the environment the sensors continually generate data that are streamed wirelessly. Research has focussed on using these data to identify automatically what a person is doing (for example, entering a room, lifting an object, or sitting down), and this work has been extended to infer whether the person is carrying out particular everyday tasks known as "activities of daily living", such as making a drink, grooming, or watching TV. The research was developed further through a major cross-border project, the Centre for Intelligent Point-of-Care Sensors, to better understand the behaviour of persons within smart environments. This work developed innovative approaches to detect daily activities, incorporating measures of physical activity, such as step-counts and distance travelled, and physiological data from biometric signals.

Further collaborative research with the company led to user-friendly interfaces being developed that are suitable for non-technical users to programme sensor devices for use in clinical settings, thus enabling widespread use of the sensor platform across the healthcare sector. Configuration and programming of wireless sensor platforms would usually require use of an integrated development environment that could only be fully understood by electronic and software engineers. However, the results of CSRI's research have been used to provide an intermediate layer between the user and the integrated development environment. This intermediate layer makes it possible for healthcare professionals without technical knowledge of sensor platforms to configure wireless sensor devices easily, so that they can monitor functions such as vital signs, movement and orientation, and dictate how the information is visualised, all from a non-technical perspective.

The collaboration between CSRI and the company has been highly successful, resulting in winning a national Project of the Year Award in 2012 from a selection of 50 projects. As a direct result of the collaboration with CSRI the company has increased the number of staff within its Research and Development department, employing new research and development engineers and a new Research and Development Director. A further collaboration between the company and CSRI has led to the joint development of a new product launched in May 2013. This new product, guided and supported by CSRI, provides a starter-pack for the sensor platform that is targeted at the Educational market.