Impact Case Study

UoA 11: Computer Science and Informatics

A new range of outdoor clothing for the active ageing based on wearable technologies

In modern healthcare services, a growing emphasis is being placed on people to be more aware of their own health and wellbeing and to play a more active part in self-management of their health. This is particularly so amongst the increasing number of older but active members of the population. At the centre of this paradigm is a new range of biophysical monitoring devices (for example, heart rate monitors and step-counters). For such devices to be most effective, there are significant challenges about where and how to best locate them on the body. If the monitoring devices are not placed optimally, then there can be significant loss in accuracy of the measurements that are processed from the data acquired, and so the devices will be less effective for people who are for self-monitoring their health and wellbeing.

Researchers in the Computer Science Research Institute (CSRI) have been tackling this problem and have developed solutions that are now being incorporated into products that can enhance people's everyday lives. Based on research carried out by CSRI on wearable technologies for people who are ageing but active, two leading manufacturers of clothing for outdoor activities have produced a new range of functional clothing. The new outdoor garments are designed to be age-appropriate, and they incorporate wearable technologies that enable people to self-monitor their physiological parameters, such as heart-rate and respiration-rate, and their activity levels, such as step-counts and the distances that they have walked. These "smart garments" incorporate sensors that are positioned optimally to gather physiological signals from the body and to measure physical movements. Additionally, a company that produces components that are embedded in the smart garments has used feedback from Ulster's research evaluations to design a new range of components that can make the clothing easier to use by elderly people.

Research on processing and classifying physiological signals has been a core area of research at Ulster for over 15 years. Results of our research in electrocardiology have been extended through the classification of entire body surface potential maps. This research stimulated the hypothesis that a reduced set of electrodes from the body surface map could be used to improve the interpretation of cardiac signals. Our research also considered the restrictive nature of connecting electrodes/cables to human subjects and the impracticalities of this for long-term monitoring. Subsequently, textile-based electrodes showed promise for the measurement of the ECG signals, as they don't require any gel membrane or adhesive, and clothing enables textile sensors to be placed in close physical proximity to a large area of the body.

The results from this work formed the basis of the technologies that CSRI developed in the Design for Ageing Well project, which was funded by the UK Economic and Social Research Council's New Dynamics of Ageing research programme. User evaluations with walking groups provided insights into the ways in which the feedback on wearable devices should be provided to users and how the garments should be designed to incorporate the technological components to make them as easy as possible to use. The co-design process was one of the central results from the Design for Ageing Well project and was used as a methodology to produce a range of age-appropriate clothing with integrated technologies. These garments were demonstrated in a joint trade exhibition and the garment manufacturers have incorporated the research results into their current range of clothing relating to age-appropriate shape and fit, styling and fabric selection. The recommendations from the Design for Ageing Well project have also guided the companies in the design of the garment layering system as a basis for incorporating wearable electronics. These recommendations are a result of CSRI's research findings for the most appropriate positioning of sensor and control technologies within the garments in order to both make them easy to use from an active ageing perspective and to improve the accuracy of the physiological measurements processed from the data acquired by the sensors. A niche outdoor clothing manufacturer has now adapted their manufacturing procedures to support the incorporation of technology within their smart garments.

The smart garments have been tested with users from walking groups, and we have had a series of testimonials that report the positive experiences of active older persons who have used the new clothing for outdoor activities. A 70-year-old participant in the evaluations, who reported that she enjoyed walking as part of an active life, said that her involvement in the Design for Ageing Well project has resulted in her being "more inclined to go out and exercise" and that she was now "more aware of the options" available for technology-enabled age-appropriate clothing. A 67-year-old male member of a walking group said that in his opinion the use of the age-appropriate clothing would make people "more likely to become involved in recreational activities". The research expertise developed by CSRI in wearable technologies is also influencing new standards within the textile industry. The Textile Institute, a worldwide organisation for textiles, clothing and footwear, recognises the importance of "smart textiles" and has invited Prof Chris Nugent from CSRI to join a committee of 12 international experts from the smart textiles community.