CELTIC ADVANCED LIFE SCIENCE
INNOVATION NETWORK

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Wearables for health: Vision for the 2020s

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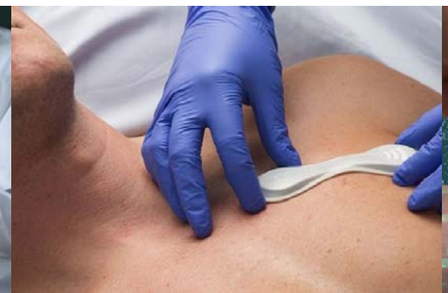

Wearables for health research overview

Wearable sensing technologies are becoming increasingly popular because of their vital contribution to human health, performance, personalised medicine and overall societal impact. The current generation of wearable sensor systems help to monitor health and/or provide clinically relevant data.

Any portable device should ideally be in a form of a wearable device that can be worn by the user and not present any additional burden using them in everyday life. Such a device will ideally be in the form of existing wearable device, expanding its functionality for example, smart watched. Such devices are omnipresent in today's sport and recreation domain in form of devices targeted at performance measurements of the user. They often measure a heart rate, activity, speed, step counting, body temperature, ECG, etc. All of these measurements are based on capturing physiological signals that are produced by human body. Wearable devices that measure these parameters were made possible not only by advancements in electronics and battery technologies. Substantial research has also been made in designing the algorithms which reduced power requirements for such devices.

Why are Wearables for health important?

Wearable technology provides us with the ability to monitor our health, our fitness levels, track our location with GPS, and interact with other technologies. In healthcare, wearable devices allow for continuous monitoring of patient vital signs and general well-being. This allows for the gathering of key health related data which can great aid diagnosis or monitoring of a variety of conditions.

An example of a wearable device that has greatly enhanced the quality of people's lives is wearable glucose monitors.

Blood glucose meters were initially developed in the 1980s and represented a life changing device for many diabetic patients. Initial devices required the application of a blood sample to an enzymatic strip. Overtime, glucose metres have been integrated into various wearable devices using optical sensing devices and now more recently microneedle array sensors. These devices allow for real time measurement of blood glucose levels.

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Application of Wearables for health in the current climate

The main purpose of wearable technology is to improve our lives. Technology aims to make life easier, and wearable technology is not different. One of the main uses of wearable technology is to help to make users healthier in their day-to-day life. Studies have shown that over 70 percent of users[1], say that wearable technology has improved their health. Wearable sensors are also being used to monitor sleep quality and track posture. [2]

Wearable technology is also being used to save lives. Many elderly patients now wear heart and vital sign monitors that can allow healthcare professionals to continually monitor the patients conditions. Many of these devices include GPS location devices which can alert caregivers or family members if the patient has left their care setting. Such GPS trackers are also being used to monitor and gather date about patient's movements. This data is being used to monitor and predict depression levels, frailty of the patient and potentially to assess the risk of the patient suffering a fall. Such information can allow caregivers to tailor their care to the exact needs of each patient. [3]

[1] https://www.zdnet.com/article/13-eye-opening-figures-about-wearable-tech/

[2] http://www.lumoback.com/

[3] https://carefolk.com/

Potential impacts of Wearables for health in both academia and industry moving forward?

The concept of wearable devices is well established, and current trends show sustained advancements in going from devices with very basic functionality to a wearable with fully developed sensor systems. One such an example is usage of sport tracker devices where a simple watch was replaced with a sport tracker packed with sensors providing valuable information, but still retaining its original functionality, i.e. having function as wristwatch. The possibility to develop a wearable point of care system where person can track certain parameters important for management of their health issue is not a science fiction anymore. The benefits of making such systems are endless. For example:

- Individual's quality of life can be significantly improved,
- expected lifespan can be extended
- Diagnosis time can be greatly reduced as the need to carry out complex, expensive and time-consuming lab-based tests is less.

In addition, wearable devices have the potential to work in tandem with new developments in telemedicine. Instead of being monitored in a hospital bed, wearable technology can allow the patient to be monitored remotely. This can free up hospital beds, allow for more efficient patient care and reduce the cost for health systems. This has enormous benefits to society including better health and wellbeing of citizens but also environmental due to reduced transport needs.

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Summary of thoughts and how is your institution working towards utilising this to drive innovation:

Tyndall National Institute is a world leader in the development of Smart Sensing systems for use in the body, on the body and around the body. Working closely with a global range of academic, business and clinical partners, our technology is under evaluation by several multinational corporations and is approaching market readiness in a number of areas including Connected IOT, Smart Agriculture, Industry 4.0, Environmental sensing and wearable sensing for fitness and health.

Examples of Tyndall's activity is this area:

1. In a review paper[1] recently published in the journal Sensing and Bio-Sensing Research, as part of the PhD thesis of Julia Madden, who works in the Life Sciences Interface Group at the Tyndall National Institute, the potential to integrate electrochemical sensors on to smart wearable microneedle patches was examined.

2. ELSAH is an EU-funded four-year collaborative project in the area of electronic smart systems that started in January 2019. Our objective is to develop and demonstrate an integrated wearable sensor system (the 'ELSAH-patch') for continuous monitoring of molecular biomarker concentrations.

3. Tyndall National Institute is working with international partners to develop the wearable biosensor technology for real-time wireless monitoring of remote patients in the SmartVista[3] project. The SmartVista wearable biosensor will deliver a seamless feed of patient data, particularly heart rhythm (electrocardiograph), respiration, temperature and oxygen flow.

4. The HOLISTICS project aims to create a disruptive Smart Wearables Industry Value Chain to deliver end-to-end HealthTech solutions based on emerging human-centric intelligent sensors and their wireless communication of medically validated data sets to support new products and services in the areas of Health and Wellness. More than €7.4 million will be invested in the project, which is led by Tyndall and includes 9 industry partners.

[1] https://www.sciencedirect.com/science/article/pii/S2214180420300064?via%3Dihub

[2] http://www.elsah.researchproject.at/

[3] https://www.smartvista.eu/

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