KEYNOTE SESSION

KEYNOTE SPEAKER I

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Unobtrusive Smart Sensing and Pervasive Computing for Healthcare

The world s population is ageing fast. According to the United Nations the median age for all world countries will rise from 28 now to 38 by 2050. Also, it is estimated that by 2050, the population over 60 years will increase worldwide from 11% to 22%, a higher percentage (33%) of elderly population will be in developed countries. In this context, governments and private investors, in addition to work for increase efficiency and quality of healthcare, are searching for sustainable solutions to prevent increase expenditure on healthcare related with higher care demands of elderly people. As such, instrumented environments, pervasive computing and deployment of a seemingly invisible infrastructure of various wired and/or wireless communication networks, intelligent, real-time interactions between different players such as health professionals, informal caregiver and assessed people, are created and developed in various research institutions and healthcare system. This presentation reviews the recent advances in the development of sensing solutions for vital signals and daily activity monitoring. Will be highlighted: Vital signals acquisition and processing by embedded devices in clothes and/or accessories (e.g. smart wrist worn) or in walking aids and transportation equipment such as walker or manual wheelchair. The strength and drawbacks regarding cardiac and respiratory assessment capabilities, the studies on cardiac sensing accuracy estimation and artefacts influence on cardiac function sensing through capacitive coupled electrocardiography, electromechanical film sensor and microwave Doppler radar ballistocardiography, reflective photoplethysmography will be discussed. Blood pressure, heart rate variability and autonomous nervous system activity estimation based on virtual sensors included in wearable or object embedded devices will also be presented. Daily activity signals acquisition and processing through microwave motion sensor, MEMS inertial measurement units, infrared multi-point and Laser motion sensors. Acquisition and conditioning of signals for motion assessment and theragames based on motion sensing and recognition will be presented. Using a set of metrics that are calculated using the information delivered by the unobtrusive sensors for motion capture, objective evaluation of rehabilitation session effectiveness can be performed. Several methods for diagnosis and therapy monitoring, as time frequency analysis, principal component analysis and pattern recognition of motion signals with application to gait rehabilitation evaluation will described. The work under project Electronic Health Record for Physiotherapy promoted by Fundação para Ciência e Tecnologia, Portugal, for developing serious games for...
physiotherapy based on Kinect technology will be presented. Concerning the embedded processing, communication and interoperability requirements for smart sensing devices a critical analysis of the existent solutions and a proposed innovatory solutions are discussed. Special attention is granted to wireless sensor network, M2M and IoT as so as to ubiquitous computing particularly smartphone apps applications for healthcare. A fast prototyping vital signs and motor activity monitor as so as the usage of IEEE1451.X smart sensor standards for biomedical applications are included in the presentation. The creation of novel smart environments including remote vital signs and motor activity monitoring devices for health monitoring and physiotherapy interventions promote preventive, personalized and participative medicine, as in-home rehabilitation that can provide more comfort to the patients, better efficiency of treatments, and lower recovery periods and healthcare costs. The use of unobtrusive smart sensing and pervasive computing for health monitoring and physiotherapy interventions allow better assessment and communication between health professionals and clients, and increase likelihood of development and adoption of best practice based on adopting recognized research-based techniques and technologies, and sharing knowledge and expertise.

KEYNOTE SPEAKER II

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Optical Microfiber Based Sensing Devices

Optical microfibers are optical fibers with diameters close to the wavelength of guided light. They have attracted growing interest recently due to its interesting properties such as tight optical confinement, strong near-field interaction, and excellent mechanical strength, which offers plenty of choices for combining a variety of functionalized materials. This opens up plenty of opportunities in micro instrumentation and measurement. Here, we briefly describe the fabrication of microfiber and its structures such as loop, knot, Mach-Zehnder interferometer, coil resonator and micro-balloon using a flame brushing technique. A variety of applications of these structures are also presented. For instance, a compact inline microfiber Mach-Zehnder interferometer (MMZI) is demonstrated for high temperature sensing. The temperature sensitivity of the device was measured to be 13.4 pm/oC with an excellent linearity for temperature measurement up to 800 oC.