Guest Editorial
New Generation of Smart Wearable Health Systems and Applications

RESEARCH and development in smart wearable systems and applications for personalized services, especially for health purposes, has significantly increased worldwide over the last few years. The motivation in the health and healthcare areas is guided by the need to respond successfully to a set of healthcare challenges, i.e., reducing healthcare costs while maintaining high service quality, providing easy access from anywhere, anytime, to as many people as possible, and shifting the focus of healthcare expenditure from treatment to prevention through wellness programs.

Smart, wearable health systems have the capability of supporting the extension/expansion of health services outside the domain of classical healthcare establishments, and monitoring patients over extended periods of time. New promising research recently emerged from the miniaturization of electronics and informatics (computers, microsensors, signal processing, transmissions, etc.), making possible the integration of multiple, smart functions into textiles, free from any encumbrance.

The advantages of this integration are obvious. First, about 90% of the skin surface can come into contact with textiles, which is the most "natural" interface with the body. Second, fabrics are flexible and conform well to the human body. Last, they are also inexpensive and eventually disposable.

Truly intelligent biomedical clothes that can combine the function of sophisticated medical devices with the comfort and user-friendliness of apparel products can only be conceived through a combination of recent advantages from many diverse research fields, such as polymers, fibersh, advanced material processing, microelectronics, sensors, nanotechnologies, telecommunication, informatics, and health knowledge.

The huge progress in wearable health technology and its potential role in the new healthcare-delivery landscape have been recognized by the international community. The IEEE EMB Society created a technical committee on wearable biomedical sensors and systems (TC on WBS) to promote the field worldwide. European research has also put forth a significant effort through the Information Society Technologies (IST) R&D program of the European Commission, enabling the establishment of a dedicated, competitive research community able to provide innovative wearable health solutions for better disease management, disease prevention, and health promotion. R&D efforts in North America and Asia are rapidly growing, as well, with a somewhat different focus; while in Europe, medical health-care systems are particularly emphasized, military and space applications are specifically targeted in the US, also under DARPA and NASA guidance. Because of the large and very active textile industry in Asia, textile technology and e-textile systems are intensively targeted, particularly in Hong Kong and China.

This special section focuses on the development of e-textile applications for telemedicine and wearable health-care systems, aimed at providing original contributions to the aforementioned research fields. Most of the papers originate from the *New Generation of Wearable Systems for eHealth: Toward a Revolution of Citizens' Health and Life Style International Workshop*, held in Lucca, Italy, on December 11–14, 2003, and the Guest Editors made a selection based on the quality, pertinence, and adequate coverage of the field.

Polymer-based devices, compatible with textile technology and aimed at enlarging the functional features of existing systems, are extensively discussed in the review paper of Carpi and De Rossi [1], featuring sensing actuation, energy harvesting, and storage. Bonfiglio *et al.* [2] report about some recent findings related to logic and amplification functions potentially compatible with textiles.

Bioclothes for wearable healthcare are reported and critically examined in the papers of Axisa *et al.*, Paradiso *et al.*, and Scilingo *et al.* [3]–[5]. Homecare and telemedicine services also constitute major points of care where wireless communication plays a critical role. The papers of Maglaveras *et al.* and Yao *et al.* address these issues [6], [7]. Posture, gesture monitoring, and classification for rehabilitation or ergonomic studies represent an extremely interesting and far-reaching area of study, where new methodologies and technologies are strongly needed. The results reported by Lorussi *et al.* address current research endeavors in these directions [8]. Medical applications in future military protective-clothing systems and space applications will also benefit from major advances in e-textile and wearable technologies for multiparameter recording and data communication, as reported by Mundt *et al.* and Winterhalter *et al.* [9], [10].

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will stimulate readers' imaginations for more innovative developments in smart, wearable health systems and biomedical clothing.

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[1]The views developed in this editorial are those of the co-editor, and do not necessarily reflect the position of the European Commission.

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