

GUEST EDITORIAL PREFACE

Special Issue on Biomedical Monitoring Technologies: Selected Papers from the 12th IEEE International Conference on BioInformatics and BioEngineering (BIBE 2012) and the 8th International Symposium on Advanced Topics in Electrical Engineering (ATEE 2013), Part 1

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INTRODUCTION

This is the first part of two special issues based on a selected number of papers presented at the 12th IEEE International Conference on BioInformatics and BioEngineering (BIBE 2012), Nov. 11-13, 2012, Cyprus (<http://bibe2012.cs.ucy.ac.cy/>) and the 8th International Symposium on Advanced Topics in Electrical Engineering (ATEE 2013), May 23-25, 2013, Romania (www.atee.upb.ro).

BIBE was organized and sponsored by IEEE, the IEEE Computer Society, the University of Cyprus and the Biological & AI Foundation (BAIF), co-organized and co-sponsored by the Frederick University, Cyprus, the Hellenic Society for Computational Biology and Bioinformatics (HSCBB), and the Technical University of Cyprus, Cyprus. BIBE 2012 was technically co-sponsored by the IEEE Engineering in Medicine and Biology Society (IEEE EMBS) and the International Federation for Medical and Biological Engineering (IFMBE). It was supported by the IEEE EMBS Cyprus Chapter, the IEEE CIS Cyprus Chapter, the IEEE Cyprus Section, the Cyprus Society of Medical Informatics, and the Cyprus Association of Medical Physics and Biomedical Engineering. Additional support was also given by the Cyprus Tourism Organization. The overall objective of BIBE 2012 was to cover the state of the art in Information Technology Applications in Biomedicine, under the theme. In total, 134 papers authored by 460 scientists were presented at BIBE 2012, with 31 papers on Bioinformatics, 86 on Bioengineering, and 17 on the special session on computational solutions to large-scale data management and analysis in translational and personalized medicine.

ATEE is a scientific event traditionally organized since 1996 and co-sponsored by the Faculty of Electrical Engineering, University POLITEHNICA of Bucharest, and it represents a forum for effective exchange of information between researchers in various areas of theoretical and applied electrical engineering. The 8th ATEE conference, held in 2013, was

co-sponsored by several national organizations: the Ministry of Education Youth and Sports, the ALUMNI ELTH Association, and the Association of Electrical and Electronics Engineers of Romania. ATEE 2013 was technically co-sponsored by IEEE, IEEE Romania Section, and by several IEEE Romanian Chapters: Engineering in Medicine and Biology, Electromagnetic Compatibility, Communications/Information Theory/Signal Processing, Power & Energy, Control Systems, Power Electronics, Magnetics. The conference also benefited from the technical co-sponsorship of the Romanian Academy of Technical Sciences, the University POLITEHNICA of Bucharest, and the National Society of Medical Engineering and Biological Technology. Additional support was also obtained from several companies working in the electrical engineering area: AMETEK, INSOFTECH, ELECTROALFA, SIMTECH, SCHRACK TECHNIK, TECHNOVOLT, EATON, and ICPE CA. From the total of 195 scientific papers presented at ATEE 2013, connected to 24 identified topics of applied research in electrical engineering, 20 papers were presented in the section of Engineering in Medicine and Biology.

The aim of these special issues of this newly launched journal is to provide a snapshot of emerging technologies in biomedical monitoring demonstrating how these can contribute to healthcare and quality of life. Authors were invited to submit papers expanding their work presented at the BIBE 2012 and ATEE 2013 conferences. Topics to be covered include: telemedicine and telemonitoring systems (5 papers in this issue, Part 1), intelligent monitoring and decision making systems (4 papers, in second issue, Part 2), and medical image and video processing systems (2 papers in second issue, Part 2).

The structure of the preface is as follows. In the next section, a summary of the papers appearing in this special issue, IJMSTR 1(3), is given, with the papers grouped into the thematic topics. The following section gives the concluding remarks.

PAPERS IN THIS SPECIAL ISSUE

Part 1: Telemedicine and Telemonitoring Systems

The paper by Pierre Vieyres *et al.*, presents robotized telemedicine via specific networks to bring forth the issue of transparency in order to enable the medical ultrasound specialist, to safely and accurately perform bilateral tele-operation tasks despite the long time delays inherent to the communication link. To counter these effects, two strategies were combined to improve, at the operator site, the rendering of the interactions between the remote robotic systems with its environment (i.e. the patient), and the control of the robot's orientation at the operator site. The first approach was the development of a new control architecture based on an internal model providing an anticipated value of the distant environment stiffness; it was complemented with a graphic user interface (GUI) which provides the expert with the real-time relative position of the haptic probe with the robot's end effector for better tele-operated control. These combined strategies provide the expert with an improved interactive tool for tele-diagnosis.

Rosu and Pasca, present an approach for real-time ECG (Electrocardiogram) signal monitoring and long-term recording based on healthcare solution Wearable Wireless Body/Personal Area Network (WBAN). Healthcare solutions using anytime, and anywhere remote healthcare surveillance devices, have become a major challenge. The patients with chronic diseases who need only therapeutic supervision are not advised to occupy a hospital bed. Using WWBAN intelligent monitoring of heart can supply information about medical conditions. ECG is the core reference in the diagnosis and medication process. A Low-power wireless sensor node with local processing and encoding capabilities in order to achieve maximum mobility and flexibility was the paper's main goal. ZigBee wireless technology was used for

transmission. Sensor devices were programmed to process locally the ECG signal and to raise an alert. Low-power and miniaturization were essential physical requirements.

The paper by Marghescou *et al.* aims to investigate the performance of a system consisting of plethysmographic sensors used to measure the human pulse (or heart rate), and ZigBee wireless networks used to collect the data in view of processing and storing. A demo system build around a MICROCHIP development kit (PICDEM Z) is described. Some conclusion derived on the basis of the observations obtained during the implementation of the demo system and during the measurement campaign are given.

Vehkaoja *et al.* develop an unobtrusive bed integrated system for monitoring physiological parameters during sleep. The system uses textile electrodes attached to a bed sheet for measuring multiple channels of electrocardiogram. The channels were also combined in order to form several additional ECG leads. One lead at a time was selected for beat-to-beat-interval detection. In addition the system includes force sensors located under a bed post for detecting respiration and movements. The movement information was also used to assist in heart rate detection and combining the ECG derived respiration information with respiration information derived from force sensors, is investigated. The system was tested with ten subjects in one hour recordings and achieved an average of 95.9% detection coverage and 99 percentile absolute error of 3.47 ms for the BB-interval signal. The relative mean absolute error of the detected respiration cycle lengths was 2.1%.

Theodosiou and Tsapatsoulis investigate the application of mobile technologies for health monitoring. The sensors together with a mobile device formed a personal area network that monitors the patient's health status. It gives advice to the patient, adjusts the environmental conditions according to the patient's needs, and in the case of an emergency, notifies the patient's doctor or the corresponding medical center. The authors present an attention-based

architecture for health monitoring emphasizing on the identification of attention seeking and dangerous health states. The experimental results indicate that the proposed architecture responds very fast to the changes of the patient's biosignals and accurately in decisions concerning the patient's health status.

CONCLUDING REMARKS

Given the rapidly growing aging population, the increased burden of chronic diseases, the offering of innovative and demanding healthcare services, and the ever increasing healthcare costs, there is a strong and urgent need for the development, implementation, and deployment in everyday medical practice of intelligent biomedical monitoring systems and services in support of the citizen. Towards this direction, in the last ten years, there has been a significant effort in the development of innovative biomedical monitoring sensors, devices, algorithms, and

applications. The aim of these special issues is to provide a snapshot of biomedical monitoring technologies in telemedicine and telemonitoring systems, intelligent monitoring and decision making systems, and medical image and video processing systems. It is anticipated that technological advances in the aforementioned areas will support the further development of these systems for the offering of more advanced healthcare services that would also facilitate their deployment at a world-wide scale.

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