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Editorial

Editorial for the Special Issue "Personal Health and Wellbeing Intelligent Systems Based on Wearable and Mobile Technologies"

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Wearable and mobile personal devices, from smart phones, bands, glasses, and watches to smart clothes and implants, are becoming increasingly ubiquitous. These wearable sensing technologies can provide 24/7 physiological and movement data that enhance the knowledge base of users or groups of users. They constitute the internal fabric of an Internet of Smart Things, which provides the basis for better understanding the user—what the user does, when, how, and even why. Both physical and mental health-related information can be extracted or inferred from the diverse nature of the data. Sensor miniaturization and affordable prices are bridging the gap between theoretical health and wellbeing scenarios based on wearable technology and their feasible deployment on real settings. Personal health monitoring applications based on wearable sensors will empower the role of the user in its health self-management and will decrease the pressure of care-related resources for public health systems. Several medical conditions, from temporary illnesses to long-term chronic conditions, can benefit from the deployment of wearable sensors that monitor the user physiological parameters and physical activities on a continuous basis and provide automated feedback in real time to help each user in a personal way.

This special issue gathers up-to-date research in developing personal applications, methods, and algorithms based on information extracted or inferred from wearable and mobile sensor devices. This wealth of information facilitates users to better plan, manage, and monitor their health and wellbeing. There are four papers in this special issue. In the first paper [1], Abdullah Bin Queyam et al. present a robust method for feto-maternal heart rate extraction from a non-invasive composite abdominal electrocardiogram (aECG) signal. The proposed method is based on the Complete Ensemble Empirical Mode Decomposition with Adaptive Noise (CEEMDAN) method, in which a composite aECG signal is decomposed into its constituent frequency components. A manual selection process is used in order to extract maternal and fetal heart rate information. The authors use three different datasets in order to validate the proposed approach achieving an overall sensitivity of 98.83% for maternal heart rate (MHR) quantification, and an overall sensitivity of 98.13% for the case of fetal heart rate (FHR) quantification. The authors conclude that non-invasive aECG is an effective and reliable method for long-term FHR and MHR monitoring during pregnancy and labor, although the requirement of manual intervention for the probable maternal and fetal components selection limits the real-time application of the proposed methodology. The paper by Sandra Mattsson et al. [2] focuses on how physiological data from wearable sensors can be applied in order to assess the wellbeing and performance of operators in industrial settings. Wearable technology is capable of providing real-time measures, which can be used to assess the physical and mental state of an operator wearing it. The authors recognize that there is still a need for testing wearable systems in real industrial settings and a further regulatory development. This paper empirically investigates how concurrent physiological measurement technologies can be integrated into an industrial application, in order to increase operator wellbeing and performance. A mixed method approach is used including a literature study, two laboratory tests, two case studies and a workshop. Although the results show that the operator wellbeing could be assessed using physiological measures such as the electro-dermal activity, data interpretation and user-friendly visualization tools are required. The paper by Beth A. Smith et al. [3] presents the results of an entropy-based method that could be used as a potential marker of the development of neuromotor control in infants using movement sensors and acceleration data in both legs. Data from 11 infants with typical development and 20 infants at risk are analyzed. The infants at risk demonstrated smaller entropy values than the infants with typical development. Although the authors recognize the same limitations in the study, the results show a promising direction for further studies. The final paper by Ivan A. Trujillo-Priego et al. [4] presents a new algorithm using a wearable sensor to determine the number of arm movement bouts that an infant produces across a full day in a natural environment. Measures were taken from 33 infants (22 infants with typical development and 11 infants at risk of atypical development) across multiple days and months by placing wearable sensors on each wrist. The gold standard for counting the number of arm movement bouts was based on 20 s sections of synchronized video. The algorithm was able to count 173 bouts while the observer identified 180. Each identified bout was characterized based on its duration, average, and peak acceleration, average and peak angular velocity, and type of movement. The authors observed that the presented method could be used for early identification of developmental delays and the provision of early intervention therapies to support optimal infant development.

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