

e-Health Technical Committee

May-June, 2012 Volume I

Editors' Corner

The e-Health Technical Committee of the IEEE Communication Society (ComSoc) has launched a global eHealth newsletter, which provides a platform for information sharing on technology advancement, national eHealth policy, service deployment and venture investment, as well as collaboration opportunities in the eHealth area. The Newsletter is contributed by a group of volunteers from different countries as follows. All volunteers from any country are welcome to contribute and provide useful information for the letter. It is with great pleasure that we present the first edition of our bi-monthly newsletter.

- Aravind Kailas (UNC Charlotte, USA) and Nazim Agoulmine (University of Evry, France)

IMPACT Lab@ASU's research on ensuring safety, security, and sustainability of pervasive health monitoring systems

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Pervasive healthcare systems (PHS) aims to provide anytime, anywhere monitoring of one's physiological state as well as delivery of medical care through use of embedded computing and communication technologies such as wireless and wearable sensors as well as gadgets such as smart mobile phones – forming a *body area network* potentially linked to a cloud via the Internet for added computation power and long-term storage of physiological state and health data. Over the years, pervasive healthcare research in the IMPACT Lab at Arizona State University (<http://impact.asu.edu>) has addressed many of the challenges involved in safe, secure and sustainable operation of PHS by considering the cyber-physical nature of body area networks and taking into account the characteristics of human body and physiological signals. An example is the Physiological Signal Based Key

Agreement (PSKA) developed under a Cyber-Trust grant from the US National Science Foundation (NSF). PSKA uses the sensed physiological signal to securely establish symmetric crypto keys amongst network nodes. Such BAN oriented techniques are being incorporated in Ayushman PHMS.

Given a PHS system, as illustrated in Fig. 1, consisting of its varied hardware and software components, verifying whether the system meets the safety, security, and sustainability requirements for long-term operation is important for social acceptance of PHS. Such a verification methodology should not only take into account their cyber-physical nature and characteristics of human host, but also take into account the dynamic contextual changes. Specifically, it is importance to formally establish that a PHS is - a) *truly pervasive*, i.e., not

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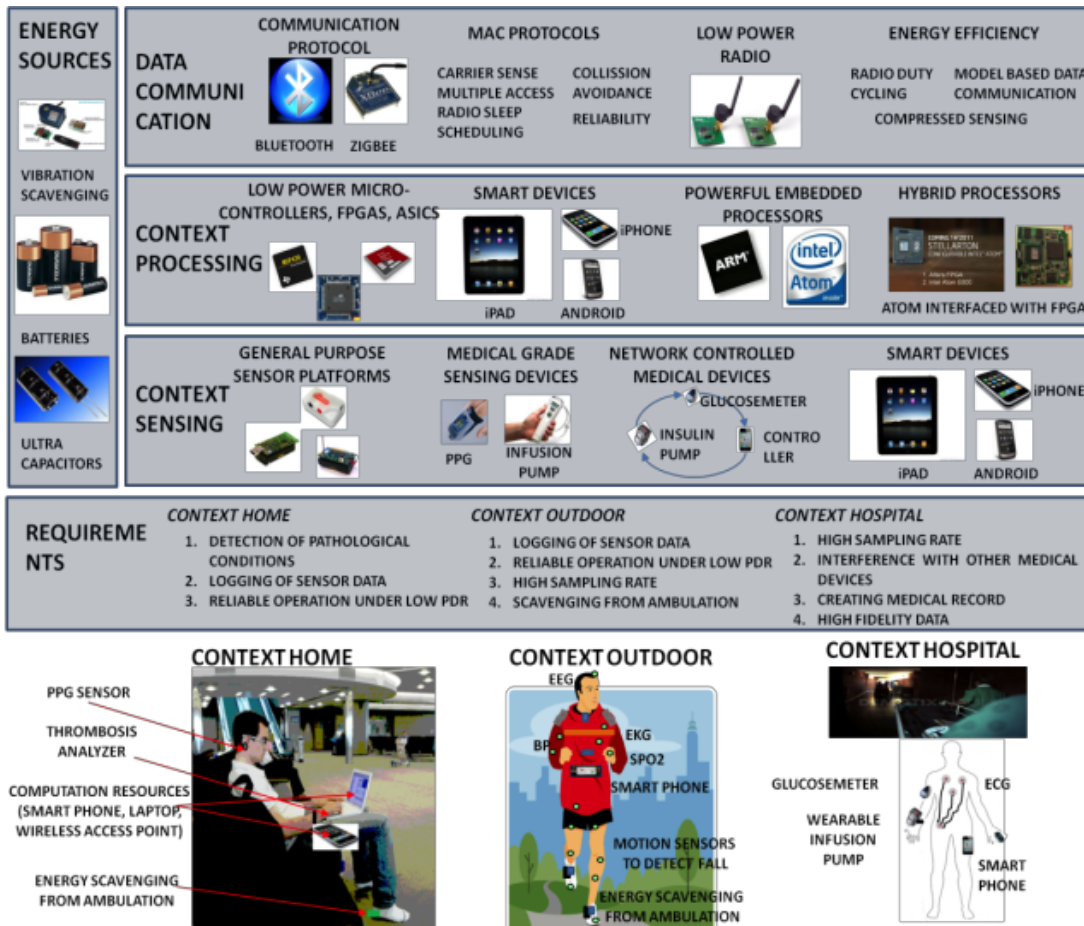


Figure 1: Pervasive Health Monitoring System with various User Contexts.

obtrusive to the user, easily wearable, and does not restrict the mobility of the user, b) *safe*, i.e., the sensors and the smart phones are risk free and safe from faulty operation, harmful thermal, and electromagnetic effects on the human body, and c) *sustainable*, i.e., capable of providing uninterrupted

and long term operation. Rigorous analysis should be conducted before any clinical study to minimize any harm to the users. Further, any analysis technique will have to consider the dynamic context driven interaction of the PHS devices with the human body.

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A recent paper from the IMPACT lab “Your mobility can be injurious to your health: analyzing pervasive health monitoring systems under dynamic context changes”, to appear in Percom 2012, presents such a specification and analysis methodology for PHS. This methodology takes into account the dynamic context changes and the effects on the computing infrastructure, their environment, and the interaction between them. The contexts such as home, outdoor (roaming), and hospital are specified using a finite state machine, *ContextFSM*, which for each state considers a different PHS configuration. The SAE Architecture Analysis and Design Language, AADL, is enhanced with ability to specify physiological processes, which enables modeling the interaction between the medical devices and the human body. This methodology is demonstrated by analyzing the safety and sustainability of Ayushman PHMS implemented on Shimmer motes, Intel ATOM platform and Google Nexus One smartphones. The results show that user mobility patterns can cause drug overdose but can also help sustain sensors longer with more scavenged energy. Context changes may result in increased communication resulting in higher heat dissipation.

Ambient Assisted Living (AAL) Joint Programme ICT-based Solutions for (Self-) Management of Daily Life Activities of Older Adults at Home

The aim of the AAL Joint Programme is to provide innovative ICT-based solutions including innovative products, systems or services to enhance older adults' quality of life and to strengthen the industrial base in Europe. Projects funded under the AAL Joint Programme address identified wishes and needs of the end-users. They are multinational, collaborative and cost-shared. Funding contracts of individual project partners are concluded with the relevant national funding authority.

Call for Proposals 2012, AAL-2012-5
<http://www.aal-europe.eu/calls/call-5-2012>

Physiology” is taking this work further and aims to develop a spatio-temporal hybrid automata for formally capturing time-variant processes and spatio-temporal variations to analyze the impact of the control operations in medical devices on the human physiology. This work is being done in collaboration with researchers at Food and Drug Administration (FDA).

The upcoming book from IMPACT lab “Body Area Networks: Safety, Security, and Sustainability” to be published by Cambridge University Press, will holistically present the state-of-the art in this area along with real-world case studies, tutorial on cutting-edge BAN technologies, and project ideas. This book is ideal for anyone involved in pervasive and mobile health care, telemedicine and mobile medical apps – stay tuned!

NEWSLETTER OF eHEALTH TECHNICAL COMMITTEE (TC)

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