Body Sensor Networks for Health-care Monitoring: Premises, Challenges and Prospective

Abstract: Advances in technology have led to development of various sensing, computing and communication devices that can be woven into the physical environment of our daily lives. Such systems enable on-body and mobile health-care monitoring, can integrate information from different sources, and can initiate actions or trigger alarms when needed. In this tutorial, we look at body sensor networks for health-care monitoring from several perspectives: 1) system integration 2) sensor fabrication and 3) medical applications. From system integration prospective, we describe the system architecture and several signal processing schemes. We elaborate a number of important design techniques that can be tightly coupled with the real-time signal processing, and may enhance the system performance. We employ physical movement monitoring as our pilot application to support the claims. From sensor integration prospective, we elaborate several fabrication techniques that enable integration of electronics and wearable organic materials on fabrics. From application prospective, we outline a variety of high-impact clinical applications. Finally, we present our results, demonstrate the feasibility of our proposed techniques and outline the future directions.

Intended Audience: Embedded system/CAD designers, Material scientists, and Medical professions.

Biographies:

Roozbeh Jafari received his B.Sc. in Electrical Engineering from Sharif University of Technology in 2000. He received an M.S. in Electrical Engineering from SUNY at Buffalo, and an M.S. and a Ph.D in Computer Science from UCLA in 2002, 2004 and 2006 respectively. He spent 2006-2007 in EECS department at UC Berkeley as a post-doctoral researcher. He is currently an assistant professor in Electrical Engineering at the University of Texas at Dallas. His main research is primarily in the area of networked embedded system design and reconfigurable computing with emphasis on medical/biological applications, their signal processing and algorithm design.

Manuel Quevedo-Lopez received a Ph.D. degree from the University of North Texas, Denton TX, USA in 2002. He then joined Texas Instruments's Silicon Technology Develoment Group as Member of technical Staff where his research focused on advanced high-k gate dielectric and CMOS isolation technologies. In 2004 He joined SEMATECH in Austin Texas as TI assignee to work on SEMATECH's advanced gate dielectric project. Dr. Quevedo-Lopez is author or co-author of more than 40 publications in peer reviewed journals and 3 US patents issued and 10 more pending.

Bruce Gnade is a Professor Electrical Engineering and Chemistry, and the Distinguished Chair in Microelectronics at the University of Texas at Dallas. Bruce received his BA in Chemistry from St. Louis University in 1976 and his Ph.D. in Nuclear Chemistry from the Georgia Institute of Technology in 1982. He managed several research and technology groups during his 14 years at Texas Instruments including Si Materials and

Processing, field emission display advanced technology, and Advanced DRAM Materials. From 1996-1999 he was on a temporary assignment at the Defense Advanced Research Projects Agency (DARPA) as a program manager, where he managed or co-managed the High Definition Systems Program, the Molecular Electronics Program, and the Heterogeneous Integration of Materials on Silicon Program. Prior to joining UTD he was at the University of North Texas (9/99 – 08/03) as Chair of the Materials Science Department. He has authored/co-authored approximately 100 refereed papers, 68 U.S. patents and 54 foreign patents.

John Hart, Jr., MD is presently the Jane and Bud Smith Distinguished Chair and the Cecil Green Chair in Systems Biology at the University of Texas at Dallas (UTD). He is also the Medical Science Director at the Center for BrainHealth at UTD and Professor of Neurology and Psychiatry at the University of Texas Southwestern Medical Center (clinical). Dr. Hart is one of the world's foremost experts on how you store and access knowledge in your brain, the field of cognition referred to as semantic memory. In addition to four seminal publications in Nature and Proceedings of the National Academy of Sciences (USA) on how the human nervous stores and retrieves knowledge in semantic memory, his laboratory has proposed one of the leading models in the field of cognitive neuroscience, the Neural Hybrid Model of Semantic Memory. His recent work has focused on applying these findings to adults and children with impairment in semantic memory to advance diagnoses and treatments. Dr. Hart is also President of the Society for Behavioral and Cognitive Neurology and the Behavioral Neurology Section of the American Academy of Neurology. These are the organizations of neurologists who work in the fields of healthy cognitive aging, memory, cognition, and dementia.