Center for Embedded Sensor Systems for Health - ESS-H

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Abstract—The research profile ESS-H, Embedded Sensor Systems for Health, hosted by Mälardalen University, pursues academic research on problems identified by health care and care givers in close collaboration with industry. The research is performed from a system perspective, including hardware as well as software aspects, and aims at finding novel technical solutions to support health in home as well as at work.

I. INTRODUCTION

ESS-H is a research profile targeting Embedded Sensor Systems for Health. The profile is hosted by Mälardalen University, School of Innovation, Design and Engineering, and is conducted together with industrial partners. The profile combines a multidisciplinary set of competences including both hardware and software aspects. The goal of the ESS-H research profile is that academia and industry together with healthcare and care providers find novel technical solutions to support health in home and at work.

II. MOTIVATION

Sweden, as well as all industrialized countries, has rising costs and volumes of healthcare, mainly related to an aging population, and to the proliferation of multi-factorial diseases such as diabetes, stroke, chronic respiratory diseases, and heart disease. Intelligent and adaptive systems for the sensing and evaluation of health status for prevention, monitoring and rehabilitation are amongst the most important elements in resource-efficient and individualized healthcare. Hence, the world market for products in the area of embedded sensor systems for health will grow tremendously in the decades to come.

The rapid development in physiological sensor and embedded systems technologies gives possibilities for a broad deployment of sensor systems. This is an enabler for more intelligent and cognitive sensor systems; better informed systems as well as safer and more dependable systems, deployable in safety-critical applications (e.g. healthcare monitoring and machine operator safety). To enable this, more efficient and predictable sensor nodes and communication techniques must be developed to match the development of the sensors themselves. For systems used in safety-critical applications like the ones addressed in ESS-H, it is of uttermost importance that the behavior of the system and the dependability of the system can be tested and verified. Proper testing and verification of systems and system components will also enhance product quality and lower maintenance costs.

III. CORE COMPETENCES AND SUPPORTING TECHNOLOGY

The core competence areas within ESS-H are Biomedical Sensor Technology, Biomedical Signal Processing, and Intelligent Decision Support. Dependability, verifiability and safety are important properties of embedded sensor systems in health applications. The supporting technology areas Software Testing and Dependable Wireless Communication contribute to ensure these properties, and are thus important for the successful deployment of embedded sensor systems in health applications.

Figure 1. Core Competence areas within ESS-H.

RESEARCH CHALLENGES

Three main research challenges are identified within ESS-H:

- Reliable Acquisition of Physiological Data
- Personal Biofeedback
- Reliable Distribution of Decision Support

Each of these challenges requires multi-disciplinary research. The research challenges are addressed in the setting of collaborative research projects, where each project combines all competence areas within ESS-H, including Mälardalen University researchers from the core areas, expertise from the partner companies, and Mälardalen University researchers from the supporting technology areas.

RESEARCH PROJECTS

The research within the projects is systems-oriented and the projects address the three main research challenges identified. Initially there are three projects within ESS-H:

- Sensor Systems for Health Monitoring at Home
- Sensor Systems for Health at Work
- Infrastructure for Physiological Data Management

There will be considerable synergies and collaboration between the projects.

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