pHealth 2015 Demonstrations Program

WEDNSDAY, 3 JUNE 2015

11:00 – 11:20 Coffee and Demo Break (Exhibition area)

Arena for Health and Welfare Technology at Mälardalen University
Mia Folke and Marcus Persson (Mälardalen University, Sweden)

Abstract

The Arena for Health and Welfare Technology at Mälardalen University (MDH) is a driving force for cooperation and co-production aimed to find new health and welfare technologies and promote an increase in the use of technology within caregivers. The Arena is for researchers, organizations and companies that want to join in and develop the next generation's health and welfare technology, with a focus on children's, adults' and elderly´s needs, demands, and experiences of different types of health and welfare technology at work and in other contexts. The Arena is a knowledge-producing player that provides support in the innovation process and carries out evaluations of products and services within health and welfare technology. The Arena arrange activities and opportunities for meetings, for example in the form of seminars, workshops, theme days, and consulting expertise. Apart from arranging productive meetings and contacts with organizations and clients, the Arena organizes and participates in national and international conferences in the field. The Arena also initiates co-productive research projects and procures adequate competence for contract research.

Tele-Monitoring of the Rehabilitation Progress in Stroke Patients

Harald Jagos, Veronika David , Martin Reichel, Stefan Kotzian, Stefan Schlossarek , Michael Haller and Dietmar Rafolt (Medical University, University of Applied Sciences Technikum, Neurologisches Rehabilitationszentrum Rosenhügel and A3L e-Solutions GmbH, Austria)

Abstract

Preservation of mobility in conjunction with an independent life style is one of the major goals of rehabilitation after stroke. The Rehab@Home framework shall support the continuation of rehabilitation in the domestic area. The framework consists of instrumented insoles, wireless linked to a tablet PC, a server and a web-interface for medical experts. Sensor information is provides by 4 channel pressure, 3D acceleration, gyroscope and magnetic sensors. The rehabilitation progress is estimated via automated analysis of movement data from standardized assessment tests which are executed via the tablet PC application designed according to the needs of stroke patients. Initial evaluation of the analysis algorithms shows reproducible results for the overall time of the timed-up-and go test. Therefore it is assumed that the Rehab@Home framework is applicable as monitoring tool for the gait rehabilitation progress in stroke patients.

ExerGames - Multi-Sensor Interactive Games for Physical Rehabilitation and Fall Prevention

António Santos (Fraunhofer Research Center, Portugal)

Abstract

One of the most common issues found among patients under physiotherapy is the lack of motivation to face each session, mainly because the recovering process is long, tiresome and repetitive, sometimes leading patients to abandon it. Falls are dangerous and unfortunately common for older adults. The process of ageing leads to a decline in physical function, which makes older people more prone to falls when compared to younger adults. Generally, a person may fall due to lack of mobility, balance problems, poor strength, and slow reaction time. In order to address the aforementioned issues, the ExerGames project is being developed in the scope of Fraunhofer AICOS' Fall Competence Center. This project aims at developing interactive games for physical rehabilitation and fall prevention. All physical activity is tracked with the help of low-cost and commercially available motion sensors like Microsoft Kinect, Leap Motion, Orbotix Sphero, Balance Board or even Smartphones/Smartwatches, and specially designed algorithms. All data can be helpful in monitoring the rehabilitation process but also for fall risk prediction and analysis, namely in elderly people. It can be used in both medical and non-medical scenarios, being fully effective due to the metrics used to evaluate the performance of the player.

THURSDAY, 4 JUNE 2015

11:30 – 11:50 Coffee and Demo Break (Exhibition area)

MultiPos

Jiaying Dua and Christer Gerdtman (Mälardalen University and Motion Contro, Sweden)

Abstract

MultiPos, which is an alternative computer mouse, is primarily designed as a technical aid for persons with movement disorders. With MultiPos the computer is controlled by the head, instead of the hand. The MultiPos system consists of three parts. One wearable part that contains small MEMS-sensors, with which the users can control the cursor with movements of the head or other body parts; one 'sip and puff' that gives up to six different click functions of the computer mouse and can be replaced or combined with normal control switches such as click buttons; one communication box that connects the different functions and computers, in which maximum five click buttons can be plugged. MultiPos can be simply plugged into the computer as a normal computer mouse without extra hardware or software requirements. It can be used with all modules of computers with USB-port, ex. Linux, Macintosh OS, MAC OS X, Windows 95/98/2000/XP/7/8 etc. It can also be used with alternative software or the hardware can be programed to give extra functions as auto-click, tremor reduction and other personal settings (side, sensitivity, sounds etc.).

Psychologist in a Pocket – Towards Depression Screening on Mobile Phones

Tim Ix , Jó Ágila Bitsch, Roann Ramos, Paula Glenda Ferrer Cheng and Klaus Wehrle (RWTH Aachen University and University of Santo Tomas, Germany and Philippines)

Abstract

Depression is the most prevalent clinical disorder and one of the main causes of disability. This makes early detection of depressive symptoms critical in its prevention and management. Psychologist in a Pocket (PiaP) is a mental mHealth application for Android which screens and monitors for these symptoms, and–given the explicit permission of the user–alerts a trusted contact such as the mental health professional or a close friend, if it detects symptoms. All text inputted electronically–such as short message services, emails, social network posts–is analyzed based on keywords related to depression based on DSM-5 and ICD criteria as well as Beck's Cognitive Theory of Depression and the Self-Focus Model. Data evaluation and collection happen in the background, on-device, without requiring any user involvement. Currently, the application is in an early prototype phase entering initial clinical validation. Psychologist in a Pocket runs on a smartphone or tablet (Android 4.0 or later). We demonstrate how the application monitors depression symptoms and explain design decisions.

Design of a Pedobarography Measurement System

Per Hellström, Mia Folke and Martin Ekström (Mälardalen University, Sweden)

Abstract

Pedobarography is the study of force fields acting between the plantar surface of the foot and a supporting surface. Applications include ergonomics awareness by using posture feedback, monitoring of heavy working conditions and physical activity measurements. The basic operation of foot pressure measurements is the translation of a mechanical force by a sensor into an analogue electrical signal which is sampled to digital data for analysis. Pressure is the force acting between the foot and the insole of the shoe divided by the sensor area. The proposed system has four force sensing resistors and one temperature sensor in each insole. The temperature sensors are used for compensation of thermal drift. The sensor locations are mostly determined by the foot's bone structure. Heel, big toe pad and inner and outer metatarsal pad were chosen. The system is comfortable, uses wireless data transmission and is considerably cheaper than commercial solutions.

Development of an Eating Aid from the User Needs to a Product (51)

Ann-Louise Lindborg, Maria Lindén (Mälardalen University, Sweden)

Abstract

In this paper, the development process of an eating aid is described. The assistive devices must be worth using. To achieve this, the starting point has been the users need. The development started from the needs of an individual person, the inventor of the aid. The development has been about increasing the positive experience of the aid and decrease negative experience through an iterative development process. The development includes several evaluations, described in the paper, and as a conclusion, it is important to include the users throughout the development process.

THURSDAY, 4 JUNE 2015

15:50 – 16:10 Coffee and Demo Break (Exhibition area)

Towards Bringing EEG Research and Diagnostics out of the Lab

Cassandra Severijns, Jó Ágila Bitsch, Roann Ramos and Klaus Wehrle (RWTH Aachen University and University of Santo Tomas, Germany and Philippines)

Abstract

Bringing brain research tools like EEG devices out of the lab into the pockets of practitioners and researchers may fundamentally change the way we perform diagnostics and research. While most of the current techniques are limited to research clinics and require excessive set-up, new consumer EEG devices connected to standard, off-the-shelf mobile devices allow us to lift these limitations. This allows neuropsychological assessment and research in mobile settings, possibly even in remote areas with limited accessibility and infrastructure, thus bringing the equipment to the patient, instead of bringing the patient to the equipment. We are developing an Android based mobile framework to perform EEG studies. By connecting a mobile consumer EEG headset directly to an unmodified mobile device, presenting auditory and visual stimuli, as well as user interaction, we create a self-contained experimental platform. We complement this platform by a toolkit for immediate evaluation of the recorded data directly on the device, even without Internet connectivity. We demonstrate the functionality of the framework through an application on a smartphone or tablet connected to an Emotiv EEG Headset. Different ERP experiments designed by health care professionals will be presented in the application.

A Mobility Management Framework for Health Monitoring

Hossein Fotouhi (Mälardalen University, Sweden)

Abstract

Increasing the cost of health-care services and the population of elderly has motivated researchers to provide health monitoring systems that enable reliable data collection from patients. Early detection of clinical deterioration reduces mortality rates and length of stay in hospitals. Low-power wireless networks (LPWNs) are becoming one of the most promising technologies that drastically improve the quality of care. We propose a mobility management framework for LPWNs by devising appropriate hand-off and re-routing approaches. We assume that mobile nodes, which are simple sensor nodes attached to the patient body, are able to communicate through a fixed set of sensor nodes, which are known as the infrastructure. We present two hand-off models: (i) hard hand-off model, where the mobile node has to break a link and then search for a new link and (ii) soft hand-off model, where the mobile node selects the new link before disconnecting from the current one. The proposed hand-off mechanisms have been integrated within a widely used IETF routing standard for LPWNs (RPL). The evaluations show that our proposed hand-off mechanisms are able to provide nearly 100% packet delivery ratio, against 80% in the best scenario of default RPL. The proposed schemes are very responsive during nodes' mobility by switching between access points in few milliseconds (4 ms), while it takes few seconds in the default RPL (2.3-9.8 s).

Intelligent phonocardiography

Arash Gharehbaghi and Maria Lindén (Mälardalen University, Sweden)

Abstract

Phonocardiogram had been used as a diagnostic tool for cardiac assessments for almost three decades, but its application became less appreciated after the creation of echocardiography. Nevertheless, cardiac auscultation is still considered as an important technique for the screening in most of the clinical settings. Cardiac auscultation is often based on the subjective perception and interpretation of cardiac sounds in which knowledge, skill and experience of the auscultator play important roles in the screening result. The intelligent phonocardiography is an attempt to raise potential of phonocardiography in cardiac assessments and attribute objectivity to this approach, as a noninvasive and inexpensive approach, by invoking advanced machine learning methods. To this end, we developed novel processing methods for detecting and classifying pathological heart sounds. The methods were statistically validated using three databases of healthy and abnormal heart sound recordings, one from elderly patients with aortic stenosis (50 patients), one from healthy referrals (30 subjects), and one from the abnormal children with aortic stenosis (16 patients) and pulmonary stenosis (15 patients), collectively containing 111 individuals. Accuracy of the method was estimated to be 85% for screening aortic stenosis, 82% for detecting severe stenosis, and 90% for discriminating between aortic and pulmonary stenosis.

Measurement System for Microwave Imaging Towards a Biomedical Application

Nikola Petrovic, Magnus Otterskog and Maria Lindén (Mälardalen University, Sweden)

Abstract

Microwave imaging techniques have shown excellent capabilities in various fields such as civil engineering, nondestructive testing, industrial applications, and have in recent decades experienced strong growth as a research topic in biomedical diagnostics. Many research groups throughout the world work on prototype systems for producing images of human tissues in different biomedical applications, particularly breast tumor detection. However, the research community faces many challenges and in order to be competitive to other imaging modalities one of the means is to put emphasis on experimental work. Consequently, the use of flexible and accurate measurement systems, together with the design and fabrication of suitable antennas, are essential to the development of efficient microwave imaging systems. This demonstration will show a measurement systems for microwave imaging in terms of antenna design and development, robot controlled synthetic antenna array geometries, permittivity measurements, and calibration. In addition we will present the research challenges of designing high performance antennas to be placed in direct contact with or in close proximity to the imaged object. Numerical simulations and modeling shows that the proposed ridged waveguide antenna is capable of fulfilling the design requirements and the performance goals, demonstrating the potential for the future microwave imaging system for both breast tumor detection and brain stroke/bleeding classification.