

**Ambient Intelligence Advanced Technologies in Support  
of Healthcare and Assisted Living****ABSTRACTS****DAY 1: Thursday 26 September 2013****PERSONAL HEALTH SYSTEMS FOR DIABETES**

Session Chairs: Gerald Cultot and Lydia Montandon

**Reaction: a Service Platform for Remote Accessibility to Diabetes Management and Therapy***Lydia Montandon, Atos, Spain*

The REACTION project has developed a platform which can provide remote monitoring and therapy management of patients with diabetes. Depending on the different contexts of care, different developments of the project provide support for regular or continuous control of the blood-glucose level, as well as other vital measurements, which are crucial for good diabetes management and insulin therapy. As a result, REACTION allows healthcare professionals to access information about measurements and patients to know more about the status of their health, and adapt their behaviours accordingly. The presentation will give an overview of project, which is reaching its final phase of development and is involved in the last round of clinical trials.

**AP@home: Bringing the artificial pancreas home***Steve Lane, Triteq Co, UK*

The overall vision of the AP@home project is to improve the treatment of patients with diabetes at home through the use of closed loop algorithms to regulate insulin delivery from continuous glucose monitoring. The aim of the project is to build a single port artificial pancreas with remote telemedicine and monitoring functions. This presentation will review the work of the AP@home project consortium and the development of a technology platform and AP system by Triteq for clinical and home trials. Triteq has a balanced and highly intelligent team, with extensive experience in feasibility, validation, design and regulatory requirements. Our integrated team of technical specialists has enabled us to review the far reaching potential applications of this and other research to enhance and improve the lives of many people worldwide.

**Commodity12: A Smart e-Health Environment for Diabetes Management***Oliver Keller, German Research Center for Artificial Intelligence, Germany*

We present the development of COMMODITY12, a Personal Health System (PHS) to assist in the provision of continuous and personalised health services to diabetic patients, thus empowering their lifestyle regardless of their location. COMMODITY12 consists of ambient, wearable and portable devices, which acquire, monitor and communicate physiological parameters and other health-related context of an individual, such as physical activity and vital body signals. This data is interpreted by intelligent agents that use expert biomedical knowledge to derive important insights about the individual's health status, which are then presented in the form of active feedback to the patient directly from the device, or via health professionals who assist in diagnosis, treatment and life management. The emphasis of the work is on the design of the PHS in terms of its main components, their integration and deployment to address major problems of interest to both diabetic patients and doctors that treat diabetes.

**Empower: an intelligent self-management pathway for diabetes patients***Manuela Plössnig, Salzburg Research, Austria*

EMPOWER aims at facilitating the self-management of diabetes patients. This includes personalised services for supporting changing behaviour and services for monitoring of vital, physical, mental parameters as well as physical and lifestyle activities. EMPOWER semantically integrates multiple information sources (EHR/PHR, diabetes guidelines, patterns of daily living) for a shared knowledge model and focuses on a patient-centric perspective that involves both healthcare professionals and patients based on iterative cycles.

## **GoCarb: Food Image Understanding: How close can we get? Preliminary results of the GoCARB project**

*Marios Anthimopoulos, University of Bern, Switzerland*

The GoCARB project implements an innovative solution for diabetic patients towards carbohydrate counting and insulin dose estimation. The system employs computer vision and machine learning techniques for counting the carbohydrate content of the upcoming meal by just using two images of the plate as an input. The obtained nutritional information is used for the estimation of insulin bolus size. The system intends to run on a smart phone in order to support the diabetic patients in their everyday life. The project will be completed by September 2015.

Scope of the presentation is to demonstrate the implemented components of the prototype system regarding the food recognition, volume estimation and carbohydrate counting. Preliminary results using data from different sources will be presented. Emphasis will be given in the technological challenges and the importance of such a system in healthcare delivery. Furthermore, the various datasets and protocols for the system's evaluation will be addressed. Finally, the perspectives of such a system to be used for the nutritional management of healthy individuals, as well as of individuals with other metabolic diseases (e.g. obesity) will be discussed.

## **SOCIAL CARE THROUGH ROBOTS**

Session Chairs: Jan Komarek and Margherita Antona

### **Dali: exploring new frontiers for assisted living devices**

*Daniele Fontanelli, Università degli Studi di Trento, Italy*

There is an unmistakable trend in developed countries towards population ageing. The median age in Europe is predicted to increase from 37.7 years old in 2003 to 52.3 years old by 2050. The incoming demographic tide presents important economic and societal challenges ranging from cost-effective health care and social services to pension provision. At stake is the quality of life for our ageing populations. In this context, the DALi (Devices for Assisted Living) project targets a user group consisting of older adults with emerging non-severe cognitive disabilities. These are often compounded by a deterioration in auditory and visual sensing abilities. Our target population exhibits retarded reaction to external stimuli and diminished navigation skills. One major consequence of these problems is an increasing difficulty in moving in complex unstructured environments such as shops, parks, or public transportation stations. Such cognitive deficiencies gradually reduce the space for autonomous life and deprive the afflicted of essential social interactions. Standard assistive devices are of little help for cognitive disabilities. What is needed is a new approach: a cognitive navigation prosthesis (CNP). This is a device that assists navigation in unstructured and crowded environments by acquiring sensory information, by anticipating the intent of human agents and by deciding the path that minimises the risk of impacts or of anti-social behaviours. With recent advances in sensing, automated reasoning, and crowd modelling this ambitious objective becomes technologically feasible.

### **Accompany: Acceptable robotiCs COMPanions for AgeiNg Years, concept and progress**

*Farshid Amirabdollahian, University of Hertfordshire, UK*

The talk covers an introduction to our project ACCOMPANY, with highlighting areas distinct to the project regarding progress beyond state of art, including social and empathic interaction, robot memory and visualisation of its memory, monitoring activities of daily living by means of an ambient assisted living environment and a mobile robot, and finally integrating these aspects as a prototype for evaluation for acceptability and usefulness. Additionally, the talk highlight our activities towards establishing an ethical framework for use of companion technology, where tension between values such as autonomy, independence, enablement, safety, privacy and social connectedness is further explored.

### **GiraffPlus: Combining social interaction & long term monitoring for promoting independent living**

*António Damasceno, ISA sensing, Portugal*

GiraffPlus is a complex system which can monitor activities in the home using a network of sensors, both in and around the home as well as on the body. The sensors can measure e.g. blood pressure or detect e.g. whether somebody falls down. Different services, depending on the individual's needs, can be pre-selected and tailored to the requirements of both the older adults and health care professionals. At the heart of the system is a unique telepresence robot, Giraff, which lends its name to the project. The robot uses a Skype-like interface to allow e.g. relatives or caregivers to virtually visit an elderly person in the home. This presentation focus the current status and the key innovations expected to be delivered by the project.

### **Hobbit: The Mutual Care Robot**

*Alexandra Schmid, Akademie Fur Altersforschung Am Haus Der Barmherzigkeit, Austria*

From all past experience with service robots, it is evident that acceptance, usability and affordability will be prime factors for any successful introduction of technology into the homes of older people. While world players in home care robotics tend to follow a pragmatic approach such as single function systems and humanoid robots, we introduce a new, more user-centred concept called "Mutual Care". The intention is the possibility for the human to take care of the robot. It is easier to accept assistance from a robot when in certain situations the older person also can assist the machine. In turn, older users will more readily accept the help of the robot Hobbit.

## SOCIAL CARE

Session Chairs: Jan Komarek and Angelina Kouroubali

### **p-Medicine: Smart recommendation services enabling patient profiling and intelligent patient-doctor interaction**

*Haridimos Kondylakis, FORTH-ICS, Greece*

The p-medicine EU project aspires to create an infrastructure that will facilitate the translation from current medical practice to personalized medicine. Part of this effort focuses on the design and implementation of an intelligent patient empowerment platform and its services.

A prerequisite of personalized delivery of information and intelligent guidance of the patient into his/her treatment plans is the ability to develop an appropriate and accurate profile of the user. In the p-medicine project we focus on modeling and profiling the psycho-cognitive capabilities of the patient. A profiling server collects information from different sources (questionnaires, features and behaviors extracted from a personal health record) and combines them to construct patient profiles. Incorporating a profiling server give us the ability to (i) optimize information delivery from doctors to patients, (ii) optimize information delivery to patients according to each specific profile and (iii) identify relevant clinical information, such as trials for enrollment, automatically.

The ultimate objective of patient empowerment within p-medicine is to implement a smart environment (recommender system) able to act as a decision support infrastructure to support the communication, interaction and information delivery process from the doctor to the patient. Furthermore, the environment will give the possibility to a patient to view data organized according to her/his perception of the domain, to retrieve patient-understandable information, to state decisions and to put her/him in control over the use of her/his data.

### **BackHome, BrainAble: Brain Computer Interfaces on track to home to provide active independent living and telemonitoring services to the disabled.**

*Guillem Serra, Barcelona Digital Technology Centre, Spain*

The long term goal of rehabilitation for the individual with a severe disability is resettlement back in the community away from institutional care. BackHome project expands just finished BrainAble project's results in order to research, design, implement and validate person-centered solutions to disabled users. The Assistive Technologies embedded within BackHome include BCIs, environmental control systems and a range of other technologies which are usually classified as ambient intelligence and which can provide a considerable support to make BCI solutions really work in environments with a lack of human support. Besides, integration of context-aware telehabilitation and telemonitoring tools will help to reduce the cost and hassle of the transition from the hospital to home.

### **Care@Home: SmartTV technology as window on the world and eHealth interface**

*Nick Guldemond, Delft University of Technology, Netherlands*

The ageing of western society is a great challenge that is having a major impact on healthcare costs and community resources. Overcoming the problems of ageing and chronic conditions can only be achieved by transforming the current healthcare system with an integrated approach where multidisciplinary care teams, self-management and community involvement all play a central role. Technology is essential to this transition successful. Care@Home is about enabling empowerment, wellness and social care services to the home of the elderly through interactive multimedia SmartTV. The idea is to enclose the social support system for the elderly and carry this as a personalized communication and service channel in their home. Whereby the technology provide a two-way communication for family, friends and care givers as well as entertainment and services for household, shopping and community information.

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Care@Home involve continuous, automatic and remote monitoring (e.g. by mobile phone/wireless / fixed sensors) of real time emergencies and lifestyle changes over time in order to manage the risks associated with independent living. Care@Home enables such care services to the home environment without the prohibitive costs of retrofitting existing dwellings. Care@Home aims at creating an open platform able to enable services to elderly who care to live independently while enjoying the assurance of timely access to caregivers when needed and thereby offer better living which provides elderly around the world with a sense of security, comfort and joy. In this presentation the use of SmartTV technology is put in perspective of the healthcare paradigm shift illustrated by practical examples in the current social-economic context.

### **inCasa: Presenting results from the inCASA Remote Monitoring Platform**

*Malcolm Clarke, Russell Jones, Brunel University, UK*

inCASA is an EU co-funded pilot project. The aim of the inCASA project is the delivery of integrated care for the frail and elderly using interoperable technology platforms and collaborative health and social care services. This presentation will describe outcomes of the inCasa project, which monitors health and behavior on an integrated platform. 200 participants across 5 pilot sites were enrolled onto the service for up to 9 months based on a number of inclusion criteria that were used to measure frailty. These included number of co-morbidities, hospital admissions, falls and completion of the Edmonton Frailty Scale. Telehealth and Telecare devices were installed into participants' homes. Participants were asked to take a combination of physiological measures such as blood pressure, weight and oxygen saturation as determined by their chronic disease. A patient portal was also used in some cases to gather additional information such as depression scoring. Passive Telecare sensors including Actigraph, PIR, bed, chair, temperature and TV usage sensors sent data about habits and movement within the home. All data was transmitted to a server and algorithms to detect deviations from personalized thresholds and normal routine were applied. Clinicians, psychologists, social workers and other community workers were able to view data and alerts on a portal which managed and prioritised incoming data based on pre-defined rules.

The MAST methodology was used to evaluate the introduction of the service across a number of domains. This presentation will describe the UK pilots approach, the information available from combined monitoring, and the benefits of collaborative delivery of services to frail elderly patients.

### **Saapho: Context-aware participation, safety and healthcare services to foster Active Ageing**

*Guillem Serra, Barcelona Digital Technology Centre, Spain*

SAAPHO AAL project is to support Active Ageing by assisting seniors to participate in the self-serve society preserving and enhancing their independence and dignity through the application of innovative ICT-based solutions.

According to the three main axes of Active Ageing's WHO policy, the services provided are focused on offering intelligent, intuitive and user-friendly tools using mobile tactile devices that allow and facilitate the access to participation, safety and healthcare services.

The openness, flexibility, context-awareness, and adaptability of the SAAPHO core framework and components reinforce the capability of fulfilling the final purpose of the project which is to bring the idea to market.

### **UniversAAL: An enabler of AAL service space**

*Ioannis Moulos, CERTH, Greece*

UniversAAL aims to produce an open platform that provides a standardized approach making it technically feasible and economically viable to develop Ambient Assisted Living (AAL) solutions. UniversAAL constitutes a software platform that helps the development of "assistive systems" by connecting various, heterogeneous devices to a single, unified network and also delivers the means to control this distributed system and its devices. In the scope of UniversAAL, such assistive systems resemble "intelligent agents", capable of perceiving the state of their environment, using sensors, assessing the perceived state and if the state is not desirable trying to find a way of how to influence their environment to reach a more desirable state.

## DAY 2: Friday 27 September 2013

### PERSONAL HEALTH SYSTEMS

Session Chairs: Gerald Cultot and Franco Chiarugi

#### **MovingLife: A roadmap for supporting mHealth wide deployment**

*Ann-Katrin Habbig, VUB, Belgium*

The use of mobile technologies to support medical activities (mHealth) is transforming the way healthcare is delivered. mHealth is already impacting not only on medical workflow procedures, but also and more importantly in the relationships between doctors and patients. MovingLife project dealt with developing of roadmaps for technological research, implementation practice and policy support with the aim of accelerating the establishment, acceptance and wide use of mobile eHealth solutions. The results show that different influential aspects are driving the above mentioned transformation starting with the maturity of the technology and continuing with the development of applications but mainly the ever-increasing interest of the citizens for being more active in the management of their own health. These rapid advances should be legally regulated and special policies should be developed for defining clear laws and rules that allow the satisfactory and harmonized growth of this new industry. Liability, reimbursement, cross-border healthcare, security and safety are key issues in mHealth that should be addressed by policy makers at European and National level, but also more technological aspects such as data interoperability, spectrum allocation and standard adoptions should be supported by the competent authorities.

#### **Rempark: Technological approach for Parkinson Disease assessment and management**

*Joan Cabestany, Universitat Politècnica de Catalunya, Spain*

REMPARK project objective is to develop a personal health system with closed loop detection, response and action capabilities for the assessment and possible management of Parkinson's Disease (PD) patients. The project is developing a wearable monitoring system able to identify in real time the motor status of the PD patients and evaluating ON/OFF/Dyskinesia status with a very high sensitivity and specificity degree (>80%) in operation during ambulatory conditions. Identification of the motor status is based on the knowledge included in a large database obtained with the collaboration of a number of volunteer PD patients, according a specific defined protocol in ambulatory conditions. Artificial Intelligence (AI) methods are applied to the database information for the automatic detection of motor symptoms.

#### **Dem@Care: Dementia Ambient Care: Multi-Sensing Monitoring for Intelligent Remote Management and Decision Support**

*Alexia Briassouli, CERTH, Greece*

As populations age worldwide, incidences of age-related chronic conditions like dementia are increasing rapidly. Concerted efforts are being made to help people with dementia remain independent and active members of society. The FP7 project Dem@Care aims to contribute to these efforts by providing a comprehensive multi-sensor monitoring solution, with two feedback loops, connecting the multi-sensor outputs with the patient and the carer, for reliable remote care and increased independence.

We will present the central ideas and goals of Dem@Care, as well as its progress until now. Our presentation, accompanied by demos, will demonstrate how the multi-sensor processing can be integrated in a person's daily life and provide valuable descriptions and insights on their condition, as well as relevant feedback and support. The role of clinicians' inputs, sensor data analysis and protection of privacy will also be demonstrated.

#### **eHealthMonitor: Knowledge Sharing for Patient Guidance eHealth Services**

*Michael Schüle, Universität Hohenheim, Germany*

The European society is characterised by high costs for its health system and a shrinking work force due to health reasons and an aging population. The project eHealthMonitor (FP7 - No. 287509) analyses the provision of personal guidance services in eHealth service networks. The fragmentation of knowledge about personal risk factors hinders the assessment of disease risks. In addition, security and privacy protection requirements may aggravate physicians and patients from accessing all relevant knowledge sources. The project eHealthMonitor addresses the problem of distributed knowledge sharing, which we study from the perspective of multiagent systems, semantic web technologies and modelling techniques. eHealthMonitor offers technical solutions in the areas of information



aggregation, personalization and summarization, and monitoring towards a physician-patient shared decision making process. The added value we expect to produce within the individualized support is to increase the competences and to reduce the burden of the participants. The efficacy of the platform will be demonstrated via three different scenario-based evaluations (dementia, cardiovascular diseases and prevention) in three different European countries (Germany, Poland and Greece).

### **Antilope and Shared Care Platform**

*Morten Bruun-Rasmussen, MEDIQ, Denmark*

During the last years MEDIQ has been strongly involved in the Shared Care Platform which is at the moment in daily (trial) operation in Svendborg Hospital and the surrounding municipalities (South Region of Denmark), GP's and selected patients. The first trial is for Heart diseases and the plan is to continue with Diabetes, COPD and Cancer. The Shared Care Platform includes a number of functionality to establish cross sector collaboration and continuity of care. The adoption of standards and profiles eHealth interoperability is paramount for the integration of different levels of care. MEDIQ is involved in the EC funded project ANTILOPE - Adoption and take up of standards and profiles for eHealth Interoperability and have been working by the development of a Quality Manual for Interoperability testing. The experience with the project has been and will be useful in order to facilitate and sustain the integration of different levels of care in the Shared Care Platform.

### **MobiGuide: A Ubiquitous Knowledge-driven and Context-aware Clinical Guidance System**

*Arturo Gonzalez Ferrer, University of Haifa, Israel*

Traditional clinical guideline-based decision support systems (DSS) provide patient-specific recommendations to care providers during clinical encounters. In the MobiGuide project we extend this functionality to develop a secure guideline-based ubiquitous guidance system (UGS) which provides personalized guidance to patients and shared decision-making, any time and everywhere, while addressing also non-clinical patient context. Guided by these objectives, and following a top-down approach, we developed a generic, distributed, service-oriented architecture (SOA) for UGS.

## **FALLS**

Session Chairs: Andreu Catala and Nick Guldemond

### **Farseeing: The design of smart and assistive environments that stimulate physical activity and prevent falls**

*Lorenzo Chiari, Università di Bologna, Italy*

Healthy independent living is a major challenge for the ageing European population. Promotion of stimulating physical activity and prevention of falls are two key factors. Smart ICT offers unique proactive opportunities to support older people in their own homes that become the place of choice for efficient and effective interventions. Falls in older persons are indeed common, often leading to institutionalisation and loss of independence. FARSEEING aims to promote better prediction, prevention and support of older persons, by long-term analysis of behavioural and physiological data collected using smartphones, wearable and environmental sensors. The inclusion of a longstanding cohort study (InChianti) ensures a representative population sample, which is urgently needed to translate technological advance into real world service provision. Telemedicine service models using open technological platforms, independent of sensor systems, are being developed for detection of falls and exchange of information between the older person, family, caregivers and health-care personnel. Novel exercise regimens are under design that increase adaptability and stimulate motor learning, and cognitive and emotional well being. During this talk the scenarios for home-based monitoring, training, and fall detection and management will be presented.

### **I-Dont-Fall: An innovative solution to improve fall prevention and detection**

*Gianna Tsakou, SingularLogic S.A., Greece*

Falls are the most prominent among external causes of unintentional injury: they account for approximately 40% of all injury deaths. Falls may be caused by several risks factors spanning from health to sociological conditions as well as to a constant increase of the ageing population. For this reason, fall management start to become a significant cost on the EU Governments overall budgets with relevant impact on the elderly care and assistance.

In recent years, ICT technologies have manifested their potential to enhance the autonomy and quality of life of elderly people, through boosting detection and/or prevention of elderly falls. Likewise, ICT solutions for fall detection and prevention could significantly reduce the cost associated with elderly care. In this respect, I-DONT-FALL (an EU

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initiative founded under CIP Work programme 2011), will deploy, pilot and evaluate a wide yet innovative range of highly personalized ICT-based solutions for fall detection and prevention management, which will be able to be flexibly configured to the needs of specific target groups and risk factors associated with fall incidents.

The presentation will provide an overall project presentation, clinical trial and technological solution that will be deployed in the 8 different pilot sites and used on more than 500 patients all over Europe.

**Fate: Experiences on an automatic detection service of falls for elderly people**

*Joan Cabestany, Universitat Politècnica de Catalunya, Spain*

FATE is a project funded by the European Union under the program CIP/ICT-PSP with the main objective of organizing a big pilot on the automatic falls detection in aging people living at home. Automatic detection of falls is done in indoors and outdoors conditions, and in both cases the detection generates an alarm sent to a call center. The detection system is designed around a sensor sub-system based on accelerometers and gyroscopes able to detect falls with a high reliability. The complete system is based on a communications layer based in ZigBee and Bluetooth protocols. The gateway for sending the alarm to the call center is a mobile phone. Pilots are organized in three different countries (Spain, Italy and Ireland) where different models of health service and implemented call centers are available. Pilot duration will be one year, involving 175 users and one of the main final objectives is to gain experience with the integration of an automatic fall detection service in an already care/health existing service.

**e-No Falls: First period results or/and the relation with EIP on Active and Healthy Aging A2 (Fall Prevention)**

*Andreu Catala, Universitat Politècnica de Catalunya, Spain*

The main goal of E-NO FALLS thematic network is to integrate and bring together knowledge, experiences and best practices acquired at European and international level in the area of fall prevention, intervention and safety, with the aim of coordinating ongoing activities and creating the necessary conditions and consensus on action plans, standards and specifications in view to ensure the widest future replication and co-deployment of innovative solutions (with special emphasis on ICT-based ones). In this way, the E-NO FALLS thematic network will be a forum for all stakeholders within the value chain (industry, user organizations, informal and formal care providers, public authorities, investors, housing and insurance companies and service providers across Europe) to share knowledge, expertise, resources, best practice experiences and to build consensus concerning obstacles as well as to provide guidance for ICT-enabled solutions and their roll-out. The output expectation of the network is to maximize the social and economic potential of ICT-based solutions, while promoting and accelerating wider deployments for improving quality of life and sustainability of care for the ageing population.