Number 87, October 2011

ERCIM NEWS

European Research Consortium
for Informatics and Mathematics
www.ercim.eu

Special theme:

Ambient Assisted Living

Also in this issue:

ERCIM News is the magazine of ERCIM. Published quarterly, it reports on joint actions of the ERCIM partners, and aims to reflect the contribution made by ERCIM to the European Community in Information Technology and Applied Mathematics. Through short articles and news items, it provides a forum for the exchange of information between the institutes and also with the wider scientific community. This issue has a circulation of about 9,000 copies. The printed version of ERCIM News has a production cost of €8 per copy. Subscription is currently available free of charge.

ERCIM News is published by ERCIM EEIG
BP 93, F-06902 Sophia Antipolis Cedex, France
Tel: +33 4 9238 5010, E-mail: contact@ercim.eu
Director: Jérôme Chailloux
ISSN 0926-4981

Next issue
January 2011, Special theme: "Evolving Software"

Ambient Assisted Living and Ambient Intelligence: Improving the Quality of Life for European Citizens

The continuous growth of the older population in Europe and worldwide calls for new technological solutions for improving the health, independent living, quality of life, and active ageing of older citizens in the Information Society.

Recent advances in ICT have great potential for meeting the needs of older people and help them stay healthier, live independently for longer, counteract reduced capabilities due to age, and remain active for longer.

Still, today the majority of older people in Europe do not yet enjoy the benefits of the digital age. Vision, hearing, dexterity or memory problems may hinder older people's ability and willingness to adopt interactive technologies, thus preventing their active inclusion and participation in the Information Society.

In response to these opportunities and challenges, policy initiatives have been launched in Europe to create a favourable ground towards developing and deploying ICT technologies for aging. The "Ageing Well in the Information Society" Action Plan of the European Commission[1] brings forward a package of measures targeted to foster a greater uptake of ICTs by Europe's senior citizens. This action plan aims to improve the quality of life of elderly people, create new business opportunities for Europe's ICT industry, and personalise health and social care. The main strategy pillars are raising awareness and building consensus among stakeholders, overcoming technical and regulatory barriers to market development, accelerating take-up, and boosting research and innovation to foster the emergence of innovative ICT-based products and services for Europe's ageing population.

Ambient Assisted Living (AAL) constitutes a fundamental research domain in which Europe is investing heavily. AAL refers to intelligent systems of assistance for a better, healthier and safer life in the preferred living environment and covers concepts, products and services that interlink and improve new technologies and the social environment, with a focus on older people.

The European Commission supports RTD in AAL through a dedicated action in the 7th Framework Programme and partial funding of the Ambient Assisted Living Joint Research and Innovation Programme[2], involving most EU Member States. Currently, a large number of European and national

Constantine Stephanidis
Director, ICS-FORTH

research projects take place in the field of AAL. These efforts are characterized by multidisciplinarity and technological innovation.

The AALIANCE project ("The European Ambient Assisted Living Innovation Alliance")[3], funded within the 7th European Framework Programme, has elaborated a roadmap of AAL research challenges[4] based on the identification of the needs of elderly people and of the necessary technological support. Three principal application domains are considered: (i) AAL for home and mobile support, including AAL for health, rehabilitation and care, personal and home safety and security, etc. (ii) AAL in the community, addressing social inclusion, entertainment and mobility; (iii) AAL at work, addressing the needs of older people in the workplace.

Enabling technologies for AAL include sensing, reasoning, actuation and control, communication, and interaction. The latter is particularly relevant in the perspective of making ICT for aging accessible and usable for the largest possible population and taking into account the requirements of older users.

AAL relies heavily on Ambient Intelligence (AmI) to provide seamless and unobtrusive (ie, natural) interaction in the human environment, thus radically moving away from more traditional assistive technologies towards Universal Access. While a wide variety of different technologies is involved in AmI, the underlying goal is to hide their presence from users or to smoothly integrate them within the surrounding context as augmented physical objects, rather than technological gadgets. The pervasiveness of AmI fosters the elaboration of new interaction concepts beyond current user interfaces, (eg the desktop metaphor), through embedding interaction in everyday objects and seamlessly integrating the physical and digital worlds.

However, the benefits of AmI and AAL environments can only be fully achieved and enjoyed if such technologies can guarantee seamless accessibility for diverse functional limitations due to age. The accessibility of such environments poses different problems and is more complex than the accessibility of desktop or web applications and services, as AAL environments do not simply introduce a new technology, but an integrated set of technologies.

Therefore, AAL environments cannot be made accessible through the applications of guidelines or the use of conventional assistive technologies, and multimodality and the availability of alternative interaction techniques become key features towards supporting personalised accessibility.

Although several interaction technologies, such as voice output, are already widely available, and other, such as eye-tracking, are reaching a maturity stage where they can be robustly exploited for accessibility purposes, a number of fundamental research challenges need to be addressed towards the provision of accessibility solutions in AmI and AAL environments:

- Knowledge of user requirements. Age-related factors are crucial, and the current understanding of the interaction requirements of older users in complex technological environments is limited.
- Ready-to-use accessibility solutions supporting alternative interaction techniques. Most available assistive technologies are limited to specific devices, and cannot be easily made compatible with complex environments including a variety of devices.
- Architectural frameworks supporting the integration and management accessibility solutions.
- Tools supporting the development lifecycle of accessible AAL environments (eg requirements analysis, design and prototyping, evaluation).

Addressing these fundamental issues is a necessary step towards further developing AAL technologies so that they have the potential to support older people in everyday life and be widely adopted and used in practice.

Constantine Stephanidis

[1] ***http://ec.europa.eu/information_society/activities/einclusion/policy/ageing/action_plan/index_en.htm***
[2] ***http://www.aal-europe.eu***
[3] ***http://www.aaliance.eu/public/***
[4] ***http://www.aaliance.eu/public/documents/aaliance-roadmap/ambient-assisted-living-roadmap***

RESEARCH AND INNOVATION

This section features news about research activities and innovative developments from European research institutes

EVENTS, BOOKS, IN BRIEF

Keith G Jeffery
President ERCIM AISBL

Michel Cosnard
President ERCIM EEIG

The Evolved ERCIM

It is an honour and pleasure for us to inform you about the evolved ERCIM (sometimes known as ERCIM 2.0). After more than 20 years of success in 'cooperating for excellence in research' and helping to realise the ERA (European Research Area) - by linking together research groups around single node institutions in each country - we are evolving. As explained in ERCIM News 86 and on the website, the increased cooperation across European research groups in ICST (Information and Communications Science and Technology) and AM (Applied Mathematics), changes in both European and national research strategies and the shifting balances of international research require ERCIM to evolve to continue to serve those communities.

As announced in EN86 Joint ERCIM Actions section, in June 2011 the evolved ERCIM structure was defined as having two components: firstly, an AISBL (Association International Sans But Lucratif) responsible for cooperating for excellence in research and secondly, the existing EEIG (European Economic Interest Grouping) responsible for the management of W3C Europe and the ERCIM Office.

The two components may be characterised as 'front office' and 'back office' functions respectively. They are co-joined through an agreement as 'ERCIM' and thus present a single face to the community.

Furthermore, in June 2011 we held the first General Assembly of the ERCIM AISBL including the board elections (with Keith Jeffery as President) for 2012. Similarly the present 'old ERCIM' President (Michel Cosnard) continues as President of the EEIG in 2012 with existing board members.

So much for the structural changes; the practicality is that we now have an evolved ERCIM which acts as one entity (although having two underlying legal structures) and this:

- removes the previous restriction of one member per country that was implicit in the 'old ERCIM' thus allowing much broader participation of members in all areas of ERCIM activity and evolving ERCIM to include all the best research institutions;
- ensures the management of W3C Europe is on the solid foundation of the EEIG;
- provides for a single ERCIM Office to handle management, administrative, legal and financial matters for both the EEIG and the AISBL.

It is gratifying that our evolution has resulted in new members joining ERCIM and more applying to join.

Since June 2011 the AISBL board – working jointly with the EEIG President and the ERCIM Office Manager - has been extremely active.

Thus we preserve the best of the 'old ERCIM' and provide the launch pad for the 'new ERCIM'. With the new ERCIM in place, we expect more active participation in Task Groups and Working Groups not only from our existing members but also the new members that we are welcoming.

Our expectation and intention is that this evolved ERCIM will be better placed to serve the ICST and AM community in Europe with greater participation and representation so continuing to reach and fulfil our mission 'cooperating for excellence in research'.

Keith G. Jeffery and Michel Cosnard

Cor Baayen Award 2011 Shared by two Winners: Stratos Idreos and Luca Mottola

This year, ERCIM has exceptionally selected two winners for the Cor Baayen Award: Stratos Idreos, researcher in the Database Architectures group of CWI and Luca Mottola, researcher in the Networked Embedded Systems Group at SICS.

Stratos Idreos did his PhD research at CWI and received his PhD degree in 2010 at the University of Amsterdam, where he defended his thesis "Database Cracking: Towards Auto-tuning Database Kernels".

In his thesis, Stratos addressed a core component of database management systems and takes a radical departure from the baseline for building efficient systems. He invented the concept of "database cracking", a remarkable result in an area that is fundamental for database systems and has been studied for decades.

The potential impact is very promising; especially in areas where large amounts of data have to be handled and where a priori workload knowledge is not readily available as, for example, in scientific databases, dealing with multiple Terabytes of new data on a daily basis. The technique has been fully realized in the open-source system "MonetDB", developed at CWI, which is already widely used for data warehouses and forms a basis for scientific databases.

Luca Mottola, researcher and former ERCIM fellow at SICS. His research focuses on wireless sensor networks, and their programming in particular. These are key components in the "Internet of Things" vision. Luca is among the few researchers able to claim the design of high-level programming abstractions successfully used in real deployments. His programming systems are used in challenging real-world scenarios, for example in safety critical control systems in road tunnels.

Luca received his PhD degree at Politecnico di Milano, Italy with the thesis "Programming Wireless Sensor Networks: From Physical to Logical Neighborhoods" in 2008. Since then his work has gained international recognition with several awards. Luca's expertise in wireless sensor networks extends beyond programming. Over time, his research has broadened to embrace a number of diverse topics, from theoretical work on distributed algorithms to formal verification of embedded software and investigations on MAC protocols and low-power wireless.

Luca's results represent a paradigmatic example of how the research activity in a field may have direct real-world impact. The specific field Luca is focusing on holds great potential, as it represents a fundamental building block of the "Internet of Things" vision.

The Cor Baayen Award, named after the first president of ERCIM and the ERCIM "president d'honneur", is awarded each year to a promising young researcher in computer science and applied mathematics.

More information on the Cor Baayen Award:
http://www.ercim.eu/activity/cor-baayen-award

Finalists of the 2011 Cor Baayen Award

- *Christoph Becker nominated by Andreas Rauber, Vienna University of Technology Austria*
- *Libor Behounek nominated by Jiri Sima, Institute of Computer Science, Academy of Sciences of the Czech Republic*
- *Csaba Benedek nominated by Tamás Szirányi, SZTAKI, Hungary*
- *Michele Berlingerio nominated by Fosca Giannotti, ISTI-CNR, Italy*
- *Stefan Canzar nominated by Gunnar W. Klau, CWI Amsterdam, The Netherlands*
- *Pietro Ducange nominated by Francesco Marcelloni, University of Pisa, Italy*
- *Pål From nominated by Jan Tommy Gravdahl, Norwegian University of Science and Technology, Norway*
- *Sarunas Girdzijauskas nominated by Seif Haridi, SICS, Sweden*
- *Stratos Idreos nominated by Stefan Manegold, CWI, The Netherlands*
- *Philip Ingrey nominated by Keith Hopcraft, University of Nottingham, United Kingdom*
- *Raphaël Jungers nominated by Vincent Blondel, UCL, Belgium*
- *Dalia Khader nominated by Peter Y A Ryan, University of Luxembourg*
- *Niels Landwehr nominated by Tobias Scheffer, University of Potsdam, Germany*
- *Pål Liljebäck nominated by Kristin Y. Pettersen, Norwegian University of Science and Technology, Norway*
- *Philippe Moireau nominated by Dominique Chapelle, INRIA, France*
- *Luca Mottola nominated by Thiemo Voigt, SICS, Sweden*
- *Marc Pouly nominated by Peter Y A Ryan, University of Luxembourg, Luxembourg*
- *Balazs Rath nominated by Balint Toth, Budapest University of Technology and Economics, Institute of Mathematics, Hungary*
- *Thomas Schultz nominated by Hans-Peter Seidel, MPI Informatics, Germany*
- *Jukka Suomela nominated by Patrik Floréen, University of Helsinki, Finland*
- *Thomas Weigold nominated by Peter Buhler, IBM Research - Zurich, Switzerland*
- *Andrei Zaharescu nominated by Radu Horaud, INRIA, France.*

7th International ERCIM Workshop on Security and Trust Management

by Javier Lopez

The 7th International Workshop on Security and Trust Management (STM'11) was held in Copenhagen 27-28 June 2011. It was co-located with IFIPTM'11.

This year's program included two invited talks. The first, entitled "A Non-Standard for Trust", was delivered by Stephen Marsh from the Communications Research Centre in Ottawa (Canada). His talk considered the proliferation of mobile technologies that are available to users in every day applications. Owing to the wide range of technologies available, it is difficult to ensure security and to apply traditional trust models in order to establish trust relationships among users.

The second talk was delivered by Audun Josang from the University of Oslo (Norway) with the title "Trust Extortion on the Internet". He discussed the problem of user-perceived security risks associated with online commerce. Public perception of security risks may have a negative impact on the many businesses that rely on the Internet as a commercial platform. An alternative business model was developed with the aim of increasing the perception of security for users. Josang thus discussed the validity of auto signed certificates that are generally considered to provide proof of authenticity, although this is not always the case. This is forcing some companies to buy certificates produced by these certification authorities in order to ensure survival of their businesses.

As one of the main goals of the ERCIM STM Working Group is to promote the scientific growth of young researchers interested in the field of security and trust management, an award for the best PhD. thesis in the area has been established. The main objective of this award is to increase the visibility of young researchers inside the ERCIM scientific community as well as in the broader European community. The PhD thesis ERCIM award winner for this year is "Automorphic Signatures and its Applications" by Georg Fuchsbauer.

In addition to the invited talks, the technical program consisted of four sessions focusing on different topics such as Access Control, Authorization and Authentication, Trust Management or Architectures and Protocols. In these sessions 12 accepted papers, out of 37 submissions, were presented. The submissions, as well as the accepted papers, came not only from Europe but also from the United States and India.

This year's workshop also included a panel on "New Paradigms on Trust". The members of the panel were Audung Josang, Stephen Marsh, Michael Goldsmith, Carsten Rudolph and Ketil Stolen.

The General Chairs of this year event were Christian Damsgaard Jensen from The Technical University of Denmark and Aljosa Pasic from Atos (Spain). Catherine Meadows from the Naval Research laboratory (US) and

Georg Fuchsbauer (right) receives the ERCIM Security and Trust Management PhD thesis award from Javier Lopez.

Carmen Fernandez-Gago from the University of Malaga (Spain) served as programme co-chairs. The proceedings will be published by Springer in the Lecture Notes in Computer Science series.

Please contact:
Javier Lopez, Security and Trust Working Group chairman,
University of Malaga / SpaRCIM, Spain
E-mail: jlm@lcc.uma.es

Annual ERCIM CoreGRID Workshop

by Frédéric Desprez

The ERCIM Working Group "CoreGRID" ran its annual one-day workshop at the EuroPAR conference in Bordeaux, France, held 29 August to 2 September 2011. The workshop's goal was to provide a forum for members of CoreGRID and the wider research community to discuss the latest developments in the world of Cloud, Grid, and P2P computing.

The workshop attracted around 50 researchers from the European community. Nine papers were presented after one keynote talk given by Françoise Baude (Univ. de Nice, CNRS, INRIA Sophia Antipolis) that presented an overview of the Grid Component Model (GCM) supporting large applications over Grids and Clouds.

The first paper presented a study of the mapping of evolving applications over resource managers. Results showed that resource usage and application response time can be significantly improved with short scheduling times. The second paper discussed the use of model checking to support conflict resolution in multiple non-functional concern management. A trade-off must be found between the ability to independently develop management of individual concerns and the detection and resolution of conflicts that may arise when combining the independently developed management code. The next paper showed how consistent reconfiguration protocols can be derived for stream-based ASSISTANT applications, and their costs characterized in terms of proper performance models. The fourth paper described challenges around highly interactive virtual environments, also known as Real-Time Online Interactive Applications (ROIA). A

dynamic resource management system RTF-RMS which implements a load-balancing strategy for ROIA on Clouds was presented. In the fifth paper, the architecture of Contrail federations of Clouds were presented and motivated. In addition to supporting user authentication and applications deployment, Contrail federations aim at providing extended SLA management functionalities, by integrating the SLA management approach of SLA@SOI project in the federation architecture. The sixth paper presented a novel tool to synthesize ontologies for the Abstract Grid Workflow Language (AGWL). This presentation outlined experiments based on two separate application domains that demonstrate the effectiveness of the approach by semi-automatically generating ontologies which are then used to automatically create workflow applications. The seventh paper presented the chemical machine, an interpreter for the Higher Order Chemical Language. The design follows that of logic/functional languages and bridges the gap between the highly abstract chemical model and the physical machine by an abstract interpreter engine. The next paper described OP2, an "active" library framework for the solution of unstructured mesh applications. This presentation discussed the OP2 code generation and compiler framework which, given an application written using the OP2 API, generates efficient code for state-of-the-art hardware (eg GPUs and multi-core CPUs). The last paper proposed a dynamic load balancing strategy to enhance the performance of parallel association rule mining algorithms in the context of a Grid computing environment.

The workshop was organised by Marco Danelutto (Univ. of Pisa), Frédéric Desprez (INRIA), Vladimir Getov (Univ. of Westminster), and Wolfgang Ziegler (Fraunhofer SCAI).

Link: Abstracts and slides of the presentations are available at http://www.di.unipi.it/CGWS2011/

Please contact: Frédéric Desprez, INRIA, France
E-mail: frederic.desprez@inria.fr

16th ERCIM Workshop on Formal Methods for Industrial Critical Systems

by Gwen Salaün and Bernhard Schätz

The 16th ERCIM International Workshop on Formal Methods for Industrial Critical Systems (FMICS'11) was held on 29-30 August 2011 in Trento, Italy. The workshop was held together with the 19th IEEE International Requirements Engineering Conference (RE 2011)

The aim of the FMICS workshop series, organized annually by the ERCIM Working Group, is to provide a forum for researchers who are interested in the development and application of formal methods in industry. In particular, these workshops bring together scientists and engineers who are active in the area of formal methods and are interested in exchanging their experiences in the industrial usage of these methods. These workshops also strive to promote research

From left: Alessandro Fantechi, Thomas Reinbacher, Joerg Brauer, Bernhard Schätz, Gwen Salaün.

and development for the improvement of formal methods and tools for industrial applications. The topics of interest for FMICS 2011 included:

- Design, specification, code generation and testing based on formal methods.
- Methods, techniques and tools to support automated analysis, certification, debugging, learning, optimization and transformation of complex, distributed, real-time systems and embedded systems.
- Verification and validation methods that address shortcomings of existing methods with respect to their industrial applicability (eg scalability and usability issues).
- Tools for the development of formal design descriptions.
- Case studies and experience reports on industrial applications of formal methods, focusing on lessons learned or identification of new research directions.
- Impact of the adoption of formal methods on the development process and associated costs.
- Application of formal methods in standardization and industrial forums.

This year, we received 39 submissions. Papers underwent a rigorous review process, each receiving three or four review reports. After the review process, the international Program Committee of FMICS 2011 decided to select 16 papers for presentation during the workshop and inclusion in the proceedings (LNCS volume 6959 published by Springer). The workshop also featured two invited talks by Leonardo de Moura (Microsoft Research, USA) and Joost-Pieter Katoen (RWTH Aachen University, Germany).

Following a tradition established over the past few years, the European Association of Software Science and Technology (EASST) offered an award to the best FMICS paper. This year, the reviewers selected the contribution by Thomas Reinbacher, Joerg Brauer, Martin Horauer, Andreas Steininger and Stefan Kowalewski on "Past Time LTL Runtime Verification for Microcontroller Binary Code".

Link:
FMICS Working Group and the next FMICS workshop can be found at: http://www.inrialpes.fr/vasy/fmics

Please contact:
Gwen Salaün, Grenoble INP, INRIA, France
E-mail: gwen.salaun@inria.fr

Bernhard Schätz, fortiss GmbH, Germany
E-mail: schaetz@fortiss.org

IWPSE-EVOL 2011 - 7th ERCIM Workshop on Software Evolution and 12th International Workshop on Principles of Software Evolution

by Anthony Cleve and Romain Robbes

The seventh annual workshop of the ERCIM Working Group of Software Evolution took place in Szeged, Hungary, 5-6 September 2011. The event gathered theorists and practitioners to present and discuss the state-of-the-art in research and practice on software maintenance and evolution.

For the third year in a row, the ERCIM Working Group on Software Evolution jointly organized its annual workshop on software evolution (EVOL) together with the International Workshop on Principles of Software Evolution (IWPSE). This year's edition was held in conjunction with ESEC/FSE 2011, the 8th joint meeting of the European Software Engineering Conference and the ACM SIGSOFT Symposium on the Foundations of Software Engineering.

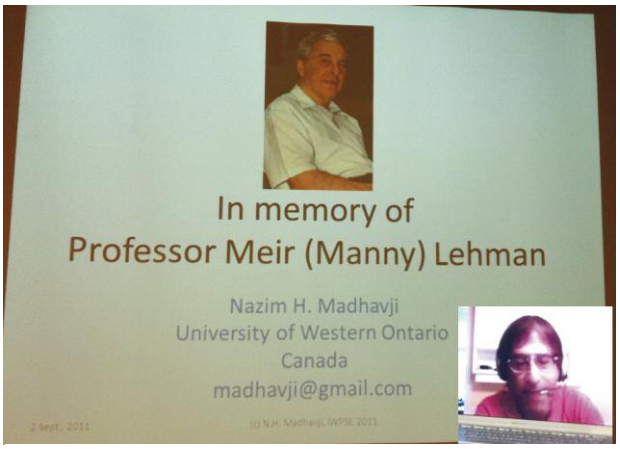
The workshop, co-organized by Anthony Cleve (University of Namur) and Romain Robbes (University of Chile), was dedicated to the memory of Prof. Meir M. "Manny" Lehman, who sadly passed away in December 2010. Manny Lehman was known as the "Father of software evolution", since his seminal work with Les Belady on the development of IBM's OS/360. Their early empirical studies gave birth to the widely known Laws of Software Evolution.

IWPSE-EVOL 2011 was the most successful workshop of ESEC/FSE 2011 with 29 participants originating from all continents. The workshop attracted 37 submissions from 87 authors. The 27 programme committee members and 16 external reviewers selected 17 submissions for presentation and publication. The accepted submissions (see workshop website for the full list) include nine full research papers, six short or position papers, and two tool demonstration papers. All accepted papers have been formally published by ACM and they have been made available in the ACM Digital Library and indexed in DBLP.

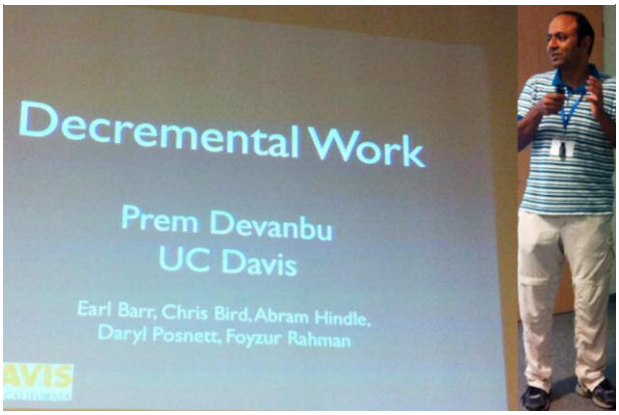
The best paper award was presented to Allan R. Gregersen and Bo N. Jørgensen from University of Southern Denmark for their paper entitled Run-Time Phenomena in Dynamic Software Updating: Causes and Effects.

The workshop also welcomed two invited speakers. The first was Prof. Nazim Madhavji, from University of Western Ontario, who gave (via skype) an unforgettable tribute speech in memory of Prof. Manny Lehman (see photo). With the help of several former collaborators, he managed to summarize, in a bit less than two hours (!), the numerous seminal contributions of Prof. Manny Lehman to the field of software evolution, thereby repositioning those contributions in their original research context.

The second invited speaker was Prof. Prem Devanbu, from University of California at Davis, who gave an inspiring keynote address entitled Decremental Work, as opposed to the notion of incremental research. According to Prem, a sign of maturity for a research community is that researchers are also looking back, not just forward: besides replicating existing work, they are also challenging assumptions made in prior work. This is an exciting opportunity and direction the software evolution community should definitely try to further explore.



Nazim Madhavji from University of Western Ontario gives a tribute speech in memory of Manny Lehman.



Invited speaker Prem Devanbu from University of California at Davis.

Links:
Workshop Proceedings: http://bit.ly/pdWTAT
Workshop website: http://pleiad.cl/iwpse-evol/
Working Group website:
http://wiki.ercim.eu/wg/SoftwareEvolution

Please contact:
Anthony Cleve, ERCIM Software Evolution co-chair
University of Namur, Belgium
Tel: +32 81 72 49 63
E-mail: anthony.cleve@fundp.ac.be

Mario Campolargo,
European Commission Director,
Directorate F: Emerging Technologies
and Infrastructures Information Society
and Media Directorate General

FET Flagships

by Mario Campolargo

Future and Emerging Technologies (FET) is an incubator and pathfinder for new ideas and themes related to Information and Communication Technologies (ICT) in Europe, supporting high-risk research with a potential for substantial technological or societal impact. The scheme encourages the exploration of new approaches and provides sustained support to emerging areas that require long-term fundamental research. FET looks for breakthroughs in ICT that open the way for new forms and uses of information and information technologies. Its mission is to go beyond the conventional boundaries of ICT and to venture into uncharted areas, to seek fresh synergies, and to promote cross-pollination and convergence between different scientific disciplines, the arts and humanities.

Over the past 10 years or so FET has developed around two schemes, Open and Proactive, to which has recently been added a prominent new dimension, namely FET Flagship initiatives.

Originating from the FP7 ICT programme, FET Flagships will be large-scale, goal-oriented, science-driven research initiatives. They will be highly multidisciplinary with links to research in other programmes and scientific areas, with a budget that may reach up to €100 million per year over a 10-year period. Similar to other initiatives such as the Human Genome project, FET Flagships will aim at unprecedented discoveries and will put Europe at the forefront of science and technology.

In May 2011, six pilot actions were selected to prepare, over one year, a detailed plan for FET Flagships. This preparatory work is developing research roadmaps, plans for resource coordination and models for implementation, and ensures the commitment of key stakeholders. Hundreds of scientists around Europe are already mobilised in this competition which is expected to result in the selection of two full FET Flagships which would begin work in 2013.

FET Flagship initiatives will also significantly contribute to the Digital Agenda for Europe . By encouraging collaborations under strong scientific leadership, FET Flagships will address the fragmentation of European research. They will leverage the investments in basic research seeded from ICT, providing innovation in technology and results for the benefit of society. FET Flagships will be in full swing under Horizon 2020 - the next EU framework programme for Research and Innovation. In this context, the FET Flagship concept offers a 'Blueprint' for other large-scale European goal driven research initiatives.

FET Flagships present an exciting opportunity for European researchers to work at the leading edge of scientific endeavour. Although only two Flagships will be launched in 2013, all six pilot actions presented here will undoubtedly have a profound and lasting impact on the European research landscape as a result of their work in mobilising the research community. I hope as many people as possible will contribute to this work and help make Europe the best place in the world to carry out research.

More information on the FET Flagships initiative:
http://cordis.europa.eu/fp7/ict/programme/fet/flagship/

A Look into the Future

ERCIM News asked the FET Flagship Pilots to tell our readers their vision and what they would like to achieve in the next ten years. The six selected actions are:

- Graphene
- Guardian Angels for a Smarter Life
- FuturICT
- IT Future of Medicine
- The Human Brain Project
- Robot Companions for Citizens.

They present their ideas on the following pages.

Graphene – The Future in a Pencil Trace

by Jari Kinaret

The FET Flagship Pilot on graphene and related two-dimensional materials targets a revolution in information and communication technology, with impacts reaching into most areas of the society. Our mission is to take graphene and related layered materials from a state of raw potential to a point where they can revolutionize multiple industries - from flexible, wearable and transparent electronics to high performance computing and spintronics. This will bring a new dimension to future technology – a faster, thinner, stronger, flexible, and broadband revolution. Our program will put Europe firmly at the heart of the process, with a manifold return on the investment in terms of technological innovation and economic exploitation.

The material with most superlatives

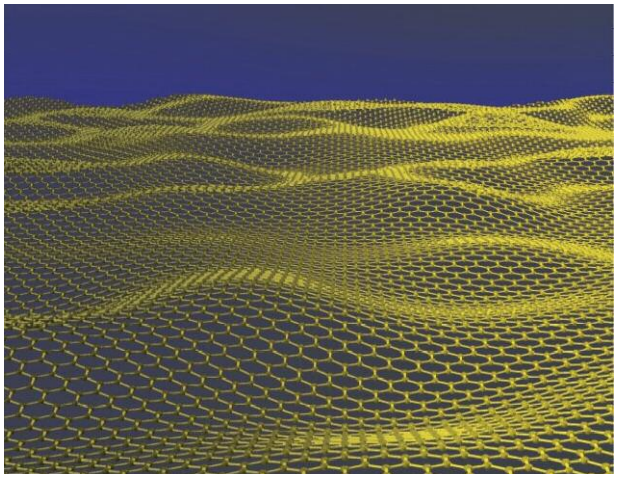
Graphene is single layer of carbon atoms with a host of properties ideal for applications. One of the commonly occurring forms of carbon, graphite, is a stack of graphene layers, and has been used in a number of applications for hundreds of years, while monolayer graphene is still mainly confined to academia. The overall goal of the pilot is to change this and harness the potential of graphene and related materials to revolutionize information and communication technology (ICT) and find new applications in other areas.

Since the start of the graphene revolution in 2004, numerous application concepts based on graphene have been demonstrated. In just a few years, high-frequency graphene transistors have reached performance that rivals that of the best semiconductor devices, despite the fact that graphene electronics is still very much at its infancy. In optoelectronics, touch screens are expected to be one of the first commercial applications, partly because the materials choice is quite limited: the screens must exhibit both electrical and optical functionalities, and very few materials conduct both electricity (like metals) and light (like window glass).

Despite the great progress in graphene science and technology during the past six years, the field is still very young and many challenges remain. Some of the challenges are fundamental: due to the unique structure of graphene, many of the possibilities it offers are still poorly understood, and their analysis requires sophisticated methods; to quote the Nobel Laureate Frank Wilczek, "graphene is probably the only system where ideas from quantum field theory can lead to patentable innovations".

Industrialization of graphene technology

Graphene research is an example of translational nanotechnology where discoveries in academia are rapidly transferred to applications. The concept is typically associated with biomedicine but the principle can be applied to ICT as well: the most striking example is giant magnetoresistance that moved from an academic discovery to a dominant information storage technology in a few years. Similarly, graphene has



Artistic impression of a corrugated graphene sheet. Illustration by Jannik Meyer.

the potential to make a profound impact in ICT in the short and long term: Integrating graphene components with silicon-based electronics, and gradually replacing silicon in some applications, allows not only substantial performance improvements but, more importantly, enables completely new applications.

Graphene represents a disruptive technology shift, and, as such, faces great uncertainties and challenges. A concentrated effort can address all parts of the value chain and catalyze the technology shift that no single player or branch would dare to undertake on their own. The branching of the value chain – usage of same materials or components in different applications – is another strength of such approach. It allows the actors to pursue both the low-hanging fruits, the first applications, and a larger strategic goal.

Implementation of the FET Flagship pilot

The pilot consortium involves nine academic and industrial partners in seven EU member states. They carry the main responsibility for preparing the full flagship, and engaging the large European graphene community in the project. The flagship consortium is still developing: presently over 470 research groups have expressed interest in joining the flagship. The prospective flagship partners represent a wide range of academic and industrial activities that come together to face the challenges of creating a major technology shift in ICT.

EU member states have recognized the potential of graphene, as demonstrated by the announcement made by George Osbourne, the Chancellor of the Exchequer in the United Kingdom. "We will invest £50 million in a Graphene Global Research and Technology Hub to commercialise graphene. This will capitalise on the UK's international leadership in the field. It will act as a catalyst to spawn new businesses, attract global companies and translate the value of scientific discovery into wealth and job creation for the UK". The FET Flagship will do this on the European level.

Link: http://www.graphene-flagship.eu/

Please contact:
Jari Kinaret, Chalmers University of Technology. Sweden
E-mail: jari.kinaret@chalmers.se

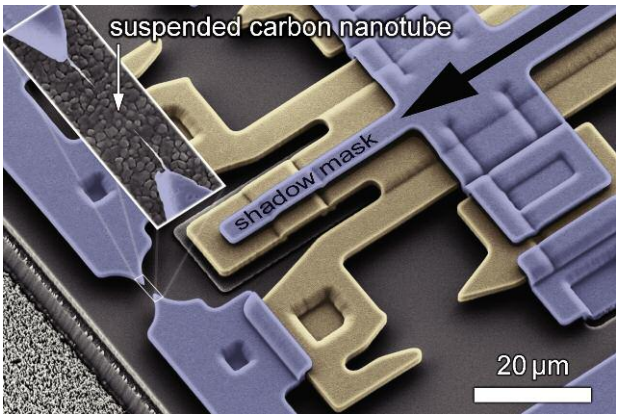
Heightened Sense Perception but Zero-Power

by Barbara Simpson

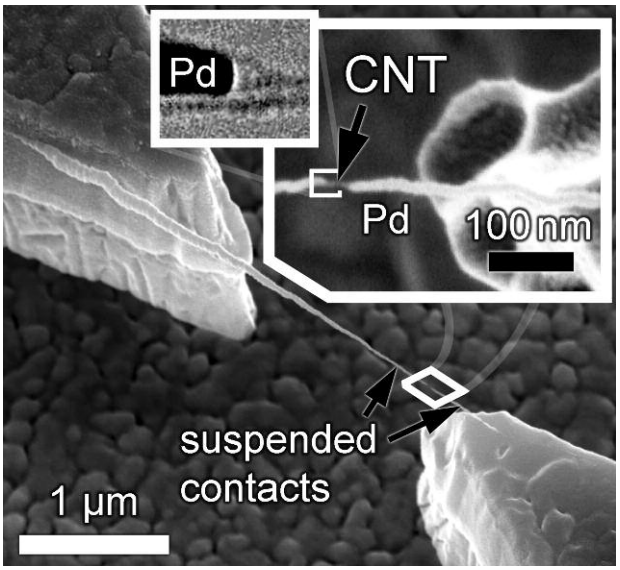
The FET Flagship pilot "Guardian Angels for a Smarter Life" will develop enabling technologies for electronic personal assistants. Joining expertise from 13 different European countries, the Guardian Angel Project endeavours to take energy harvesting, communication, sensing and computation to an exciting level of performance and efficiency.

Disruptive technological development is needed to fulfil the bold vision of Guardian Angel project leaders Prof Adrian Ionescu (EPF Lausanne) and Prof Christofer Hierold (ETH Zurich). Nanosensors which will be intuitive to use, convenient as well as energy-efficient, are intended to guard our safety and monitor our wellbeing, extend our range of sense perception and provide intelligent advice. These intelligent, autonomous systems feature sensing, computation, and communication with characteristics well beyond human capabilities.

Ultimately they will assist – as our modern day guardian angels, so to speak - for example elderly people to maintain their quality of life even in the case of a continuous reduction of mobility. They could help individuals to prematurely recognize environmental threats and dangerous situations. And they will feature a wireless networking capability to increase the information database far beyond the radius of action of the individual.



Coloured SEM images of a suspended carbon nanotube transistor.



Hysteresis-free carbon nanotube transistor fabricated by ultraclean shadow masking. Adapted from M. Muoth et al., Nature Nanotech., 2010.

Smart advice and prevention

"Our technology platform will create the ultimate smart device that everyone will be able to benefit from," said Adrian Ionescu. Some of the main applications of Guardian Angels will be centered on concepts of prevention of harm in areas like bio-medical, security, etc. but also on smart advice based on sensor fusion and inter-device communication. It is further envisioned that these personal companions directly interact with the human neurological system to allow for man-machine interfacing, eg for disabled persons. The device will enlarge the sensorial abilities of individuals and will provide access to a useful augmented reality while preserving full control by the individuals of their Guardian Angels and a high degree of security of information.

The ambitious objective: "zero power"

For these applications, the Guardian Angels device will have to be small, intuitive to use, comprise a multitude of sensor and communication functions – and foremost, achieve all its functions with an absolute minimum of energy consumption. The scientific and technological challenge of the Guardian Angels project is thus related to the development of a full ultra-low energy innovation chain: from materials and devices, to the heterogeneous system integration, as well as software and communication techniques enabling drastic energy consumption reduction compared to existing state-of-the-art technologies.

Moreover, the devices will scavenge for energy in very diverse environments. Therefore, disruptive scientific progress is needed in the field of novel concepts and technologies for energy harvesting (eg solar, thermal, movement, electromagnetic, etc) to propel European research forward in the next 10 years. Christofer Hierold points out: "We will focus our research on highly energy efficient systems mainly for Guardian Angels applications; but we expect that our research will also yield impact for all other areas in Information Technology".

A vision beyond anything achieved so far

The high complexity, key functions and enabling technologies envisioned in this project are unique and go beyond any system complexity that has been achieved so far. The goal of the Guardian Angels flagship is to demonstrate the feasibility and functionality of systems-of-systems, by visionary concepts and targeted research towards applications dealing with the concept of a smarter life.

Link: http://www.ga-project.eu

Please contact:
Adrian Ionescu, EPF Lausanne, Switzerland
E-mail: adrian.ionescu@epfl.ch

Christofer Hierold, ETH Zurich, Switzerland
E-mail: hierold@micro.mavt.ethz.ch

FuturICT: A Visionary Project to Explore and Manage our Future

by Steven Bishop

Today, society and technology is changing at a pace that often outstrips our capacity to understand and manage them. As the recent financial crisis demonstrates, the systems that we have built to organize our affairs now possess an unprecedented degree of complexity and interdependence among their technological, social and economic components. This complexity often brings about counter-intuitive events driven by positive feedbacks that lead to domino-like cascades of failures. Neither the precepts of traditional science, nor our collective experience from a simpler past, adequately prepare us for the future. Thus the need to understand our complex world is the most urgent human challenge of the 21st century.

The FuturICT project aims to develop a visionary system, aided by information generated by the data revolution. The project will use, and further develop, modern information technology integrated with the rest of science, producing a system that will be able to act as a 'flight simulator' so that we can produce pluralistic outcomes which themselves form a 'policy wind tunnel' for the development and testing of policies in the face of a complex and uncertain world. Such a system would gather and process data on a massive scale, giving politicians, decision-makers and citizens, much better knowledge on which to base decisions.

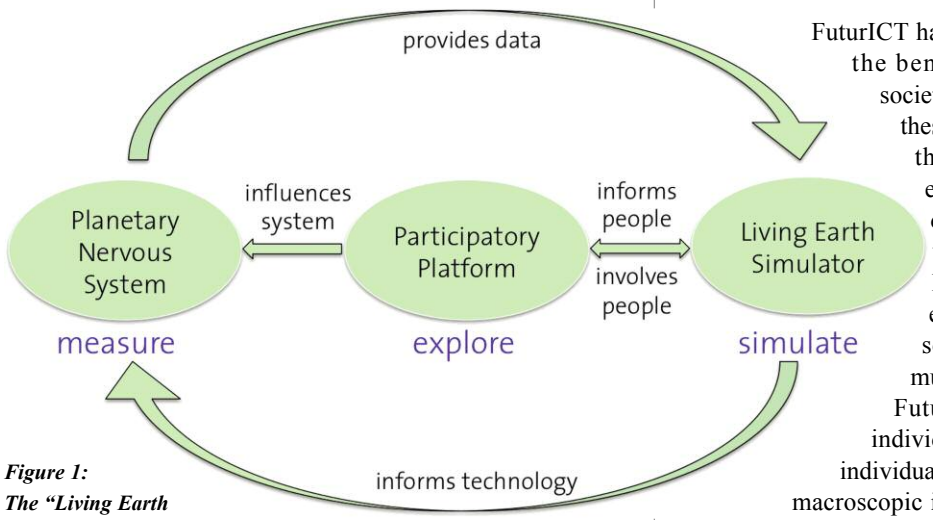


Figure 1: The "Living Earth Simulator" architecture.

The Living Earth Simulator will enable the exploration of future scenarios at different degrees of detail, employing a variety of methods (such as sophisticated agent-based simulations and multi-scale models). Exploration will be supported via an open platform (what we call the 'World of Modelling'), comparable to an app-store, to which scientists and developers can provide theoretically informed and empirically validated modelling components that map parts of our real world. The Planetary Nervous System acts as a global sensor network, providing data in real-time about socio-economic, environmental or technological systems. The Global Participatory Platform will promote communication, coordination, cooperation and participation of citizens. In this way, FuturICT will create opportunities to reduce the strict separation between users and providers, enabling us to harness the knowledge and creativity of multiple minds. The Global Participatory Platform will also support the creation of virtual worlds allowing us to explore possible futures in silico.

In addition, FuturICT will create an Innovation Accelerator that will identify innovations early on, discover valuable bits of knowledge in the flood of information, help to find the best experts for projects, and support the distributed generation of new knowledge. In particular, it will support communication and flexible coordination in large-scale projects and enhance quality assessment.

How: To succeed with its ambitious endeavour, the FuturICT project team is building communities, which integrate ICT, social and complexity sciences, in most European countries, the US, Japan, China, and Singapore. It will build the Living Earth Simulator by integrating Interactive Observatories, which explore certain areas of our global systems through a combination of large-scale data mining, computational modelling, supercomputing and participatory approaches. For example, FuturICT will build interconnected Observatories of Financial and Economic Instabilities, of Conflicts and Wars, of Social Well-Being, of Health Risks, and of Transportation and Logistics. These Observatories will be closely connected to overcome disciplinary silo thinking, to gain a systemic picture of risks and opportunities, and to facilitate an integrated risk management.

FuturICT has the potential to promote not only the beneficial co-evolution of ICT and society, but also to encourage a new synthesis of the social sciences. It is likely that a new information science will emerge from the availability of big data, and its massive application in theory-building and validating tools. Furthermore, the FuturICT project is expected to trigger off a new era of socio-inspired information and communication technologies. A final note, FuturICT is not interested in tracking individual behaviour or gathering data on individual actions. Its aim is to understand the macroscopic interdependencies within the highly complex systems on which we all depend. The FuturICT project will have a strong research focus on ethical issues, and is committed to informing the public about the use of socio-economic data. Thus FuturICT will exploit information responsibly, preserving individual freedom.

Link: http://www.futurict.eu

Please contact: Steven Bishop
University College London, UK
E-mail: s.bishop@ucl.ac.uk

ITFoM: IT Future of Medicine – an IT Revolution in Medicine and Health Care

by the ITFoM Consortium

The IT Future of Medicine (ITFoM) initiative will produce computational models of individuals to enable the prediction of their future health risks, progression of diseases and selection and efficacy of treatments while minimizing side effects. As one of six Future and Emerging Technologies (FET) Flagship Pilot Projects funded by the European Commission, ITFoM will foster massive advances in ICT to enable the generation of these models and, moreover, to make them available for clinical application. The programme will yield long term benefits for the medicine of the future and will lead the way towards truly personalized health care.

Since the sequencing of the first human genome ten years ago, at a cost of some three billion dollars, analytical technologies in the life sciences have advanced at a tremendous rate. Next generation sequencing (NGS) methods are rapidly reducing the costs of obtaining a human genome sequence (currently around $20,000) and this trend will undoubtedly continue, soon resulting in costs under $1,000. This highly detailed information about an individual's genetic makeup can be enriched with data gathered through other advanced analytical techniques (like mass spectroscopy and advanced imaging methodologies) to give an unprecedented insight into the functioning of a person's cells, tissues, organs, and even the individual as a whole. However, mere collection of these data has very limited use in a clinical setting. An analytical system is required to integrate these heterogeneous and complex data into something useful.

Systems biology offers the methodologies and tools to analyse, integrate and interpret biological data, providing mathematical conceptualizations, or models, of biological processes which may then be simulated computationally. The ITFoM project will produce a "Virtual Patient" system that can integrate all of these data into personalized models of individual people, enabling predictions based on lifestyle choices and medical interventions on a tailored case-by-case basis.

To implement this vision and see the use of "Virtual Patients" become part of standard clinical practice, substantial advances must be made in underpinning hardware and software infrastructures, computational paradigms and human computer interfaces, as well as in the instrumentation and automation of techniques required to gather all relevant information. These datasets will then be integrated to provide detailed models for the "Virtual Patients" and will thus enable the provision of concrete health advice on a personal basis.

ITFoM is a consortium of nearly 50 academic institutions and industrial partners with unparalleled expertise in ICT, life sciences, public health and medicine. Together they will address for the first time the ICT implications of worldwide-individualized patient care in combination with genomics and medical requirements. Ultimately this will revolutionize our health care with enormous benefits for health (prevention, diagnosis and therapy), a reduction in costs by individualizing combinations of a limited number of drugs and reducing side effects of treatments. Valuable research tools will help to discover and validate potential drug treatments, and new commercial opportunities in ICT, analytics and health care. Within the next 10 years we will see the vision of a "Virtual Patient" vision start to become reality and begin to reap the rewards afforded by this huge, and necessary, advance in technology.

Link: http://www.itfom.eu/

Please contact: Hans Lehrach
ITFoM Future of Medicine
c/o Max Planck Institute of Molecular Genetics, Germany
E-mail: lehrach@molgen.mpg.de

The Human Brain Project

by Henry Markram

Today, brain disease affects some 164 million European citizens at an annual cost of many hundreds of billions of euros. Yet despite huge investment in research, there are still very few brain disorders whose causes are fully understood, and very few drugs that do more than relieve symptoms. In the past, 95% of brain research was funded by pharmaceutical and biotech companies. Today they are pulling out. The number of new patents for brain-related drugs and brain implants is dropping every year. "Brain-inspired" computers face similar problems. The human brain is a highly flexible, very fast, massively parallel system that consumes just 20-30 Watts. Computers and robots with a fraction of these capabilities would transform 21st century society. Yet we still cannot build computers that match the human brain on even the simplest cognitive task.

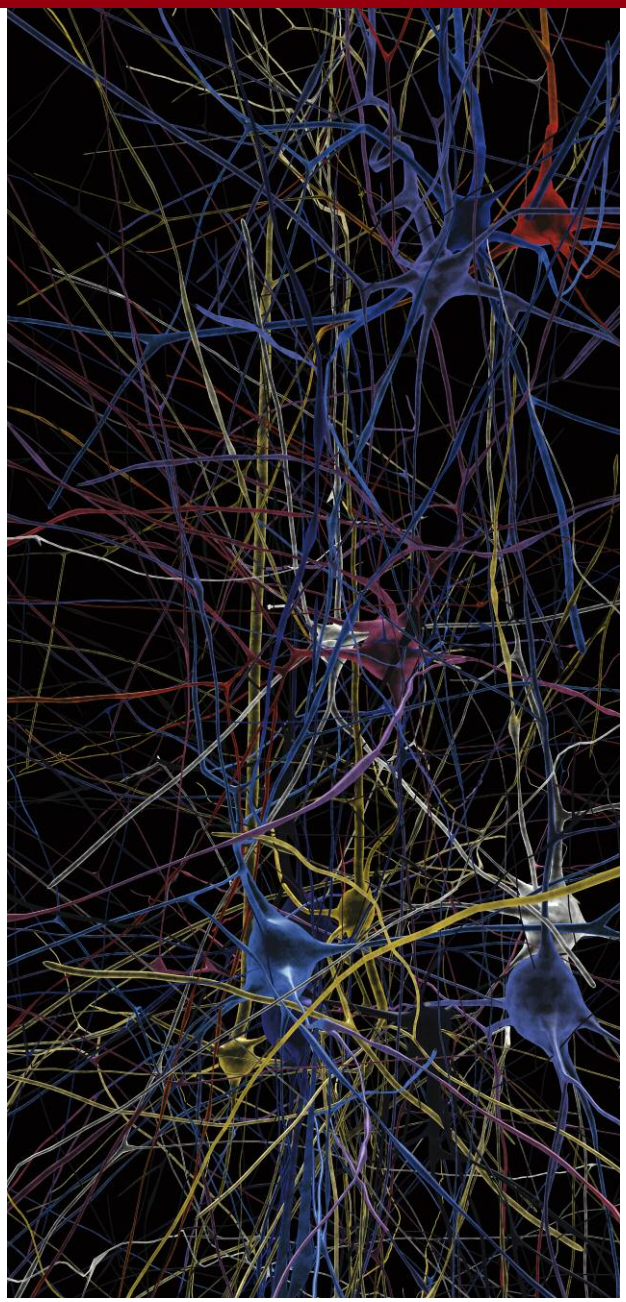
What is missing is a true understanding of how the brain works. A century of neuroscience has accumulated vast amounts of data and knowledge but it is badly fragmented. Yet we still lack an "integration strategy" – a way of putting them together.

This is the goal of the Human Brain Project. The project proposes to build a new research platform for modelling and simulating the brain, a new kind of scientific instrument– the equivalent of a new telescope. With the new instrument, the project will pool experimental and clinical data from all over the world and integrate it in detailed computer models, flexible enough to incorporate the rising flood of results from new research. It will look for patterns in the data and use them to understand basic rules of brain design. And it will use these rules to predict hard-to-measure features of the brain. Given that many rules are valid across different areas of the brain and different species, it will not need to measure every single neuron, synapse, molecule, and gene. In fact, it will model the human brain without using invasive methods at all.

Every time we use the instrument, we will learn more about the brain, and everything we learn will help us improve the instrument, until it gives us a full and comprehensive picture of the way the brain works. The new instrument will make it easier to design brain prosthetics for disabled people. Medical researchers will use it to investigate the causes of brain disease, to produce better diagnostic tools, to find and test new therapeutic leads, and to develop better treatments. The end result: lower health costs and better lives for patients.

Engineers, for their part, will take models of brain circuitry developed with the platform, simplify them, and use them to build new kinds of computing systems and robots. Even if the first machines only have limited capabilities, everything we learn about the brain will make the task easier.

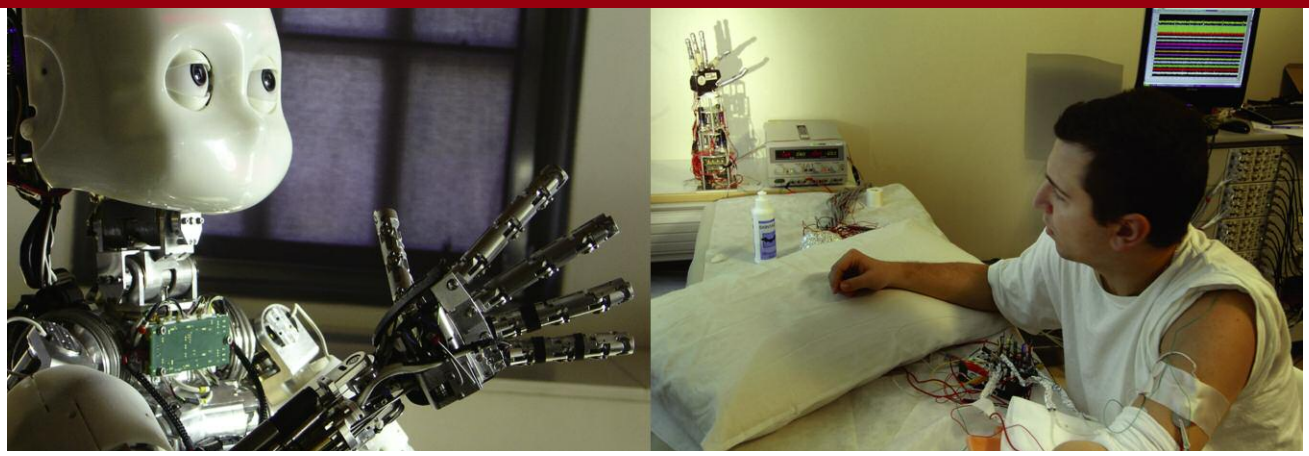
Ten years ago none of this would have been thinkable. What makes it feasible now is enormous progress in supercomputing. Already, the world's most powerful machines can perform a million billion calculations per second; by 2018 that will reach a billion billion - more than enough to build realistic models of the brain. The instrument proposed by the Human Brain Project will exploit these capabilities. Of course it will not resolve every problem in neuroscience, medicine or technology. What the project will do is integrate what we know in a completely new way. If we are to understand the brain and develop effective treatments for brain disease, if we are to build completely new Information Technologies, based on knowledge of the brain, this is the essential first step.



Simulated neural network. The brain, with its billions of interconnected neurons, is without any doubt the most complex organ in the body and it will be a long time before we understand all its mysteries. © Blue Brain/HBP.

Link: http://www.humanbrainproject.eu/

Please contact: Henry Markram
Brain Mind Institute, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland
E-mail: henry.markram@epfl.ch



New sentient technology based on the natural principles underlying this phenomenon will be available to build the future generation of robots and prosthetics. iCub.org (photo © SPECS @ Universitat Pompeu Fabra) and CYBERHAND (photo © Università Campus Bio-Medico di Roma - Scuola Superiore Sant'Anna di Pisa).

Robot Companions for Citizens: An Enabling Technology for Sustainable Welfare

by Paolo Dario

Humans have moved beyond their evolutionary inheritance by progressively mastering nature through the use of tools and the development of culture. Current welfare, however, is not without challenges and its sustainability is at stake in our private, social, economic, urban and physical environments. One source of these challenges is the ageing of the population. In fact, in 40 years' time nearly 35 per cent of the European population is projected to be 60 years old or over. Paradoxically the increase in life expectancy, is now creating new challenges. How to provide an ageing society with sustainable solutions in order to remain active, creative, productive, and above all, independent?

We envisage that to achieve sustainable welfare will require a new class of machines and linked technologies, namely the Robot Companions for Citizens. These Robot Companions (RCs) will be a new generation of machines representing a true quantum leap compared to current robotic and mechatronic systems. RCs will be affordable, fully recyclable and a dependable technology for the foundation of a new sustainable welfare. RCs will be able to perform a multitude of assistive roles for humanity thanks to their capabilities to act and interact, physically, emotionally, socially and safely with humans. RCs will be ubiquitous yet unobtrusive, user-friendly and safe. This new generation of robots will extend the active independent lives of citizens, bolster the labour force, preserve and support human capabilities and experience. Also RCs will provide key services in our cities, aid us to cope with natural and man-made disasters and maintain our planet.

The drive to answer the grand scientific challenge of the RCC initiative requires, and will foster, an advanced understanding of the principles underlying the relationship between mind and body, the role of "matter" in building the mind, the natural design principles underlying brains and bodies, the relationship between structure and function and the principles that make living beings cognizant and sentient. In this context, sentience implies the need for the integration of feeling, emotion, perception, cognition and action.

The vision of RCC is that robotics becomes a platform for science and an active technology provider rather than a passive technology user: robotics as a method and technology to advance and validate natural principles of sentience and to translate them into synthetic ones. This paradigm shift will be based on the systematic and federated contribution and continuous involvement of several disciplines and communities that can be grouped as addressing: Matter, Body, Brain, Mind and Society. Matter includes nanotechnology, material science and tissue engineering supporting a new bodyware; biomaterials, and micro- and macro-scale cell biology, for developing bioartificial hybrid systems; nanofabrication technologies for energy storage, production and harvesting; Body: includes sensing, actuation and the construction of new compliant, light yet strong morphologies. Brain addresses neuroscience, in particular systems neuroscience for understanding the design principles of brains and the processes that allow their evolution, development, adaptation and maintenance in the real world; social neuroscience, cognition and sentience. Mind: includes the development and validation of the theoretical framework of sentience, communication, perception, cognition, emotion and action; the principles of human-human, human-robot and robot-robot interaction; principles of knowledge accumulation and expression. Society pertains to humanities and social sciences to favour the social integration and acceptability of the Robot Companions and facilitate their co-existence with humans, with attentive analysis to any potential ethical and legal implications. In this multidisciplinary and integrated framework RCC will develop experimental platforms of sentient robots at multiple scales of morphologies, complexity and sentience. These in turn will drive the delivery of specific human compatible deployment platforms.

Link: http://www.robotcompanions.eu

Please contact: Paolo Dario
Scuola Superiore Sant'Anna, Italy
Coordinator of the CA-RoboCom Project
secretariat@robotcompanions.eu

Introduction to the Special Theme

Ambient Assisted Living

by Michael Pieper, Margherita Antona and Ulises Cortés

Over the last 50 years, the number of older persons worldwide has tripled - and will more than triple again over the next 50-year period as the annual growth of the older population (1.9%) is significantly higher than that of the total population (1.02%). The European Commission has predicted that between 1995 and 2025 the UK alone will see a 44% rise in people over 60, while in the United States the baby-boomer generation which consists of about 76 million people and is the largest group ever in the U.S., is heading towards retirement. This situation asks for new solutions towards improving the independence, the quality of life, and the active ageing of older citizens.

Ambient Assisted Living (AAL) comprises interoperable concepts, products and services, that combine new information and communication technologies (ICT) and social environments with the aim to improve and increase the quality of life for people in all stages of the life cycle. AAL can at best be understood as age-based assistance systems for a healthy and independent life that cater for the different abilities of their users. It also outlines that AAL is primarily concerned with the individual in his or her immediate environment by offering user-friendly interfaces for all sorts of equipment in the home and outside, taking into account that many older people have impairments in vision, hearing, mobility or dexterity. Thus it implies not only challenges but also opportunities for the citizens, the social and healthcare systems as well as industry and the European market.

The roots of AAL are in traditional Assistive Technologies for people with disabilities, Design for All approaches to accessibility, usability and ultimately acceptability of interactive technologies, as well as in the emerging computing paradigm of Ambient Intelligence, which offers new possibility of providing intelligent, unobtrusive and ubiquitous forms of assistance to older people and to citizens in general.

The aim of this Special Theme of ERCIM News is to spread information about the breadth and depth of activities in the AAL domain in Europe. Many projects in this area are funded by the AAL Joint National Programme, which covers market-oriented R&D on concrete ICT-based solutions for ageing-well with a time to market of 2-3 years, with a particular focus on involvement of SMEs and the business potential. This complements activities in the ICT theme of the FP7 Programme that focus on integrating emerging ICT concepts with a 5-10 years time to market, as well as essential research requiring large scale projects at EU level. Finally, a variety of initiatives are carried out at national level in various EU Member States.

The articles in this Special Theme address a variety of important topics.

Home Based Empowered Living addresses the improvement of the quality of life and health of the older population in the home environment, through the development of intelligent technologies which can easily support everyday activities, home management and self-care management, thus increasing the chances of a part of the population to live independently for a longer time in their own homes. Toward this end, the proposed approaches address platforms for software smart embedded services in immersive environments, agent-based societies of ambient-aware assistive tools, ambient assisted social networks, and intelligent home management, including older-friendly user interfaces and smart furniture for self-and health-care.

Home Care Monitoring Systems are intelligent technologies capable of "following" older home inhabitants in their daily activities, and thus prevents health and security risks or alert family members or healthcare providers when specific situations occur. Current efforts in this context address fall detection and prevention, detection of helplessness, as well as computational vision techniques for lifelogging.

The area of Online Ageing investigates the role of the web in the context of AAL and of improving the quality of life for the older population through social interaction, including a Social TV community platform for elderly people, augmented by game technologies and smart furniture, a virtual coach to prevent and overcome loneliness in the aging population, and a framework for designing personalized, adaptive and ubiquitous services and applications.

Another important area is Guidance and Awareness Services for Independent Living, concerning mobility, route planning, orientation and intelligent guidance in indoor and outdoor environments, and especially public buildings such as hospitals, museums, office buildings and shopping malls, as well as pedestrian and public transport.

In the context of AAL for Rehabilitation, a natural interaction system is proposed which provides a novel solution for neurocognitive rehabilitation for people with neglect syndrome.

Among enabling technologies for AAL, solutions in the area of ontologies for smart assistive solutions address activity modelling and recognition, whereas in the areas of Home Care Robotics and Automation, an adaptive robotic ecology is proposed consisting of mobile robotic devices, sensors, effectors and appliances.

Finally, important horizontal issues for the deployment of those technologies are Interoperability, Standards and Benchmarking for AAL. Article in this area discuss current efforts towards the development of standards and open platforms for AAL, as well as towards the reliable evaluation and comparison of AAL systems.

This wide range of activities confirms the very high and still increasing interest in the AAL field in Europe, both at a research and at an industrial level. The results reported in the selected articles demonstrate that AAL is rapidly maturing in terms of enabling technologies, technological frameworks and practical systems. At the same time, they confirm that the next fundamental step towards AAL technologies to be adopted in practice is addressing in a systematic way of interaction in AAL environments and providing accessibility, usability and user-friendliness by design.

Please contact:
Michael Pieper, Fraunhofer FIT, Germany
E-mail: michael.pieper@fit.fraunhofer.de

Margherita Antona, ICS-FORTH, Greece
E-mail: antona@ics.forth.gr

Ulises Cortés, UPC, Barcelona, Spain
E-mail: ia@lsi.upc.edu

Ambient Socio-Technical Support for Assisted Autonomous Living

by Andreas Schrader, Peter Rothenpieler, Stefan Fischer and Jens-Martin Träder

Autonomous living for the elderly is increasingly challenging due to the demographic change. With an ambient assisted social network, autonomy and quality of life can be significantly increased. The SmartAssist system is being developed in a three-year project funded by the German Federal Ministry of Education and Research (BMBF).

In Ambient Assisted Living (AAL) research, the negative aspects of the growing life expectancy and accompanying challenges for our societies' healthcare system are often overemphasised. AAL projects typically approach these challenges with high-tech infrastructure (eg ambient intelligence) in order to augment or even replace human healthcare services with (semi-)automatic technical services (eg robotic intervention).

Higher life expectancy should also be considered as a very positive development, providing us with more time for private, professional and social activities. The elderly of the future will also have greater potential for an autonomous and active lifestyle, including all aspects of a healthy and fulfilled life such as sports, nutrition, education, entertainment, travel and social interaction.

AAL should therefore focus on the positive, as well as the negative, aspects of growing life spans and strengthen the existing private and professional networks and infrastructures, reducing the burden on caregivers and increasing the autonomy of caretakers at the same time, while preserving the immense skills and experiences of the elderly cohort within our society. In particular, AAL could be used to extend the autonomous life time within the private home for as long as possible and delay or even prevent the transition to nursing home healthcare services.

This goal can only be reached by a coordinated and supported action of many peers (which we call patrons) of the social network, including relatives, friends, neighbours, service providers, nursing staff, doctors and emergency rescue services.

This is the motivation for developing the SmartAssist platform, which intends to realise an ambient assisted autonomous living for elderly people and their social networks seamlessly at home and on the move.

The SmartAssist consortium consists of three institutes of the University of Luebeck: Telematics (system design), Signal Processing (data analysis), and General Medicine (medical evaluation); coalesenses (sensor components); and Vorwerker Diakonie (households). The project leader is the security and service provider Lübecker Wachunternehmen.

The SmartAssist platform consists of a web based service portal; an in-home sensor network; a central data server; and an extendable infrastructure for mobile devices. Through the integration of open standards (Android, OSGi, OpenSocial, etc.), the system can be

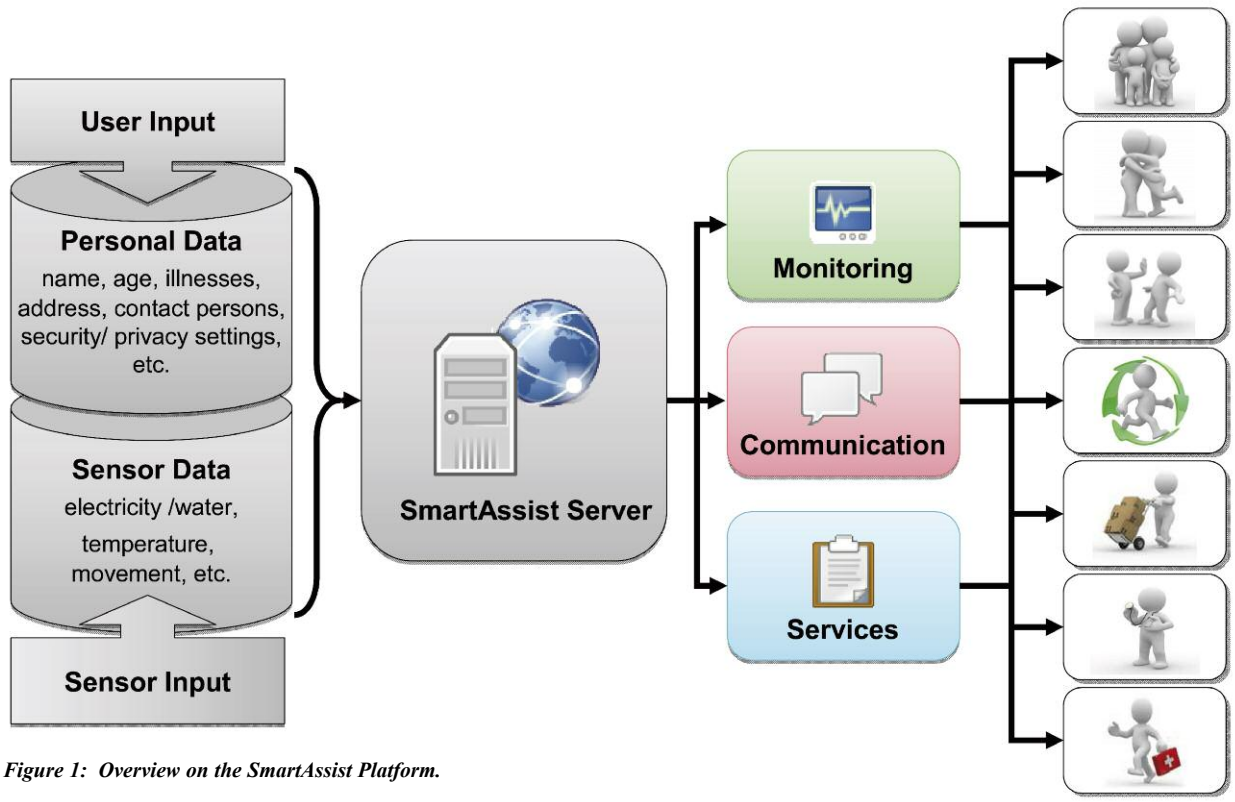


Figure 1: Overview on the SmartAssist Platform.

extended in a flexible manner and allows for building context-sensitive services with integrated data protection and privacy control.

SmartAssist patrons are registered members of a SmartAssist network. Profile information includes personal data and preferences, as well as security and privacy settings, allowing for customized data access. Patrons also dynamically specify their role as service consumers or providers. Service providers can act as domain experts and offer dedicated support on the platform (eg nursing services). The elderly users themselves can also act as service providers to other members of the network (eg offering homework supervision for school children).

Context information is provided by a novel in-house, unobtrusive, wireless sensor network realising self-configuration with minimal maintenance. Sensors monitor normal daily life activities (eg temperature, movement, water and electricity consumption, location, humidity). A gateway transports the data to the server, where dedicated signal processing algorithms are provided, that enable automatic detection of gradual changes of the user's health status based on slow variation of typical activity patterns. In addition, a novel platform (Dynamix) has been developed, converting Android devices to mobile sensors for environmental parameters and user activities and facilitating connection of other (wireless) medical devices.

Registered patrons can use the platform to monitor the condition of the elderly and trigger context-sensitive stationary or mobile services, for instance, sending an SMS to the neighbour in case of a prolonged period of inactivity. External third-party providers can use the system to offer health or lifestyle services (eg automatically scheduled taxi transport for dialysis sessions based on calendar entries in the profile).

We realise a few prototypical example services within the framework, including iGoogle gadget service integration; sensor value visualization; mobile health awareness cockpit; augmented reality kitchen; medication reminder service; and a multi-user exercise biking game. This list is constantly expanded over time and we are targeting a large integrated set of stationary and mobile third-party services within the SmartAssist platform.

Currently, we are equipping about 50 SmartAssist households in the city of Luebeck. In addition, a second group of 50 patients with equal age and gender distribution has been selected as a comparison group. Over the course of 12 months, we plan intensive evaluation of the system both in medical and social terms.

The SmartAssist project is supported by the Federal Ministry of Education and Research (BMBF), Germany. ID: 16KT0942.

Link:
http://www.smartassist.de

Please contact:
Andreas Schrader
Ambient Computing Group
Institute of Telematics
University of Lübeck, Germany
Tel: +49 451 500 3724
E-mail: schrader@itm.uni-luebeck.de

Smart Homes for All: Simplifying Lives with Service Composition over Embedded Devices

by Massimo Mecella and Roberto Baldoni

SM4All has studied and developed an innovative platform, based on a service-oriented approach and composition techniques, for smart embedded services in immersive environments. This has been applied to the challenging scenario of private homes having inhabitants with diverse abilities and needs (eg young, elderly or disabled people).

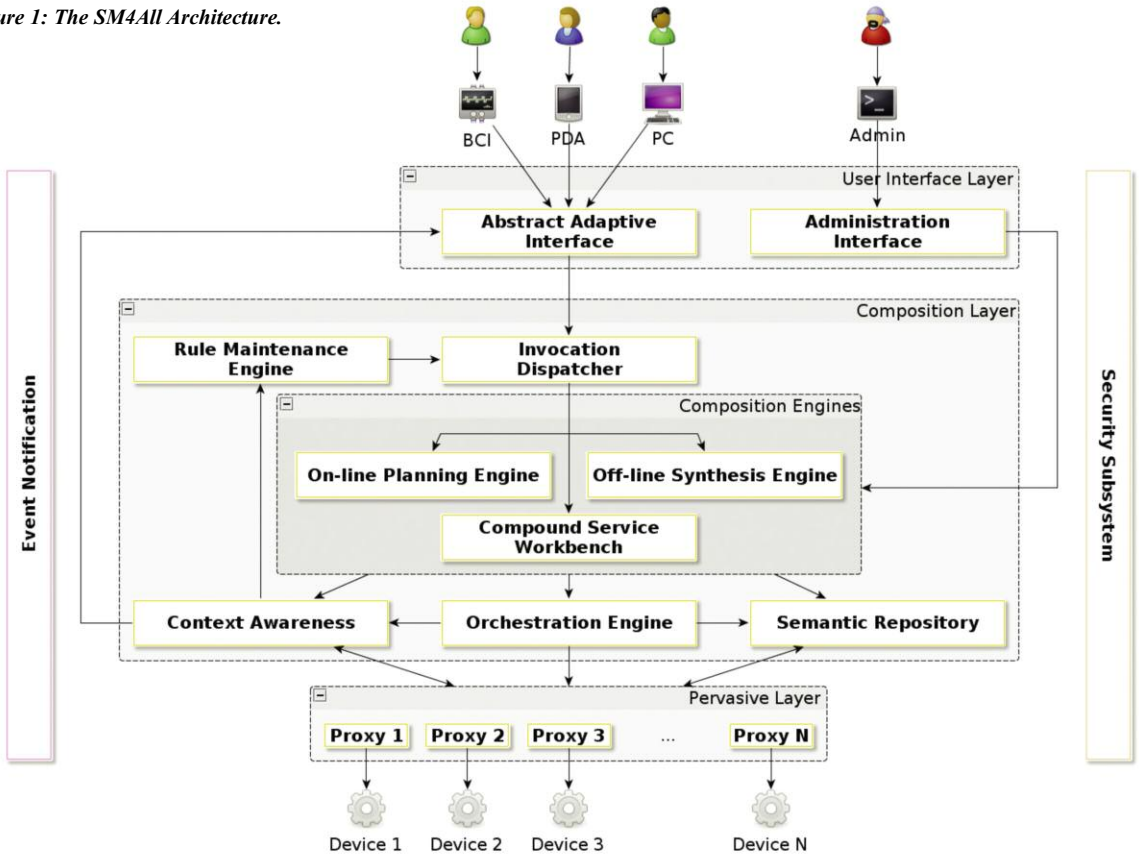
The SM4All project has the ambitious goal of boosting and structuring the cyber intelligence surrounding us in order to simplify our lives. The basic idea is to bring together all devices present in a house and coordinate their activities automatically in order to execute complex tasks that involve many appliances (such as preparing a bath, creating a certain mood in a room, following a video, saving energy, closing the house, etc.). Inhabitants can both interact with and programme the intelligent house, in a simple fashion, through user devices such as the iPad and smartphones.

Demos have been built using Brain Computer Interface technology, which allows the user to interact with the SM4all environment using brain waves, without touching any input device. The user simply concentrates on a specific icon shown on a screen in order to initiate an action.

Let us consider the following SM4All scenario. When someone expresses the intention to take a bath, the available services will collaborate to create the desirable environment. The temperature in the bathroom is raised by the heating service, the wardrobe in the bedroom is opened to offer the bathrobe, the bath is filled with water at 37 degrees C, etc. If the person is disabled, an assistant could be notified through a PDA to help the patient at the right moment. The idea is of a set of services, some of which are offered by completely automated systems (such as sensors, appliances or actuators), while others are realized through human collaboration. Clearly, there are tradeoffs to consider: for instance, an assistant might not be available at the desired moment. Such issues have been addressed by SM4All, and some novel solutions are proposed.

The architecture abstracts all the devices interacting within SM4All as

Figure 1: The SM4All Architecture.



SOAP (Simple Object Access Protocol)-based services, both in the UPnP (Universal Plug and Play) technology and in the WSDL (Web Services Definition Language)-based one, employing a rich service model consisting not only of the service interface specification, but also of its conversational description, of the related graphical widgets (ie, icons) to be presented in the user layer (by means of graphical interfaces, Brain Computer Interfaces (BCIs), . . .), etc. The software components offer these services by "wrapping" and abstracting the real devices providing the functionality. Services are not necessarily offered by hardware devices, but can also be provided through human intervention; in this case, the proxy exposes a SOAP-based service to the platform, whereas it interacts with the service provider (ie the human) by means of a dedicated GUI, when executing the requested operations.

Composition engines are in charge of providing complex services by suitably composing the available ones. In SM4All, three different complementary approaches are tested, each providing different functionalities, in order to provide the users with a rich and innovative environment. Users interact with the home and the platform through different kinds of user interface, eg a home control station accessible through a touch-screen in the living room. In particular, BCIs also allow people with disabilities to interact with the system.

A well-defined approach to embedded services and their composition is a key factor in European industrial competitiveness. The data and service models defined by SM4All could become a de-facto standard, and be adopted by many other projects. Introducing a smart embedded service platform and BCI technologies to assist elderly and disabled citizens can radically change current approaches to prevention and AAL. During our preliminary tests, most users looked forward to the large scale availability of technologies such as those pioneered in SM4All.

The SM4All project ran from September 2008 to August 2011. In late October 2011, a living demonstrator of SM4All will be run in the Fondazione Santa Lucia, Roma, Italy, where a smart home, with four rooms and about 25 services, has been equipped. Able and disabled users will test the system in interactive sessions.

Partners in SM4All were University of Rome – Sapienza (coordinator); Fondazione Santa Lucia, Rome, a hospital and research centre specializing in disabilities in collaboration with Guger Technologies, Austria, for the BCI part; Thuiszorg Het Friese Land, who work with elderly and disabled people, provided requirements, test beds and user validation. Other consortium members included the University of Groningen (The Netherlands); Technical University Vienna, Austria; the Royal Institute of Technology and the Swedish Defense Research Agency (Sweden). These partners worked on the core service-based middleware technologies and automatic service composition approaches. Industrial partners included Telefonica R&D (Spain) and Elsag Datamat (Italy), who worked on bringing the technology to market.

Link:
http://www.sm4all-project.eu

Please contact:
Massimo Mecella
SM4All Technical Manager
University of Rome, Italy
mecella@dis.uniroma1.it

A Society of Situated Agents for Adaptable Eldercare

by Ignasi Gómez-Sebastià, Dario García-Gasulla and Sergio Alvarez-Napagao

Assistive technologies are applied to support people in their daily life. Most approaches focus solely on the direct interaction between users – in our case, disabled patients - and the assistive tool, but Artificial Intelligence (AI) has the potential to provide innovative mechanisms and methods capable of taking into account more complex interactions. For instance, such an approach can take into account the important role that third parties may have in user activities, and explicitly reflect the social constraints that apply in the relationship between device and patient. In COAALAS (COmpanion for Ambient Assisted Living on Alive-ShareIt platforms), organizational and normative structures are used to model the sensor network around disabled users as societies, along with the expected behavioural patterns, effectively supporting smart assistive tools that integrate in perfect harmony with the humans around them. The result is an assistive society of ambient-aware assistive tools.

The main goal of COAALAS is to contribute to the state-of-the-art in semi-autonomous and intelligent devices for elderly people. The target population for these supporting devices includes individuals who are independent enough to live autonomously in their community. The role of intelligent devices is to maximize their safety and comfort, thus increasing their quality of life and delaying their institutionalization.

Scientific foundations

COAALAS builds on the results of two European projects: EU-Share-It (FP6-045088) and EU-ALIVE (FP7-215890). COAALAS aims to produce a new generation of AmI devices for elderly people by utilizing several state-of-the-art AI techniques:

- Autonomy: the device is integrated into the environment and is able to perceive and react in a timely fashion to environmental variables.
- Proactivity: the device is able to anticipate and take the initiative in order to fulfil its design objectives.
- Social behaviour: the device is integrated within a community of actors and is aware of social regulations and protocols.
- Adaptability: the device will modify its behaviour based on the and the other actors around it.

Using a combination of these techniques, COAALAS focuses on making sensors intelligent enough to organize, reorganize and interact with other actors. Sensors have an awareness of their social role in the system -- their commitments and responsibilities -- and are capable of taking over other roles if there are unexpected events or failures. In short: our objective is to create a society of physically organizational-aware sensors able to adapt to a wide range of Ambient Assisted Living situations that could have an impact on the well-being of the user.

Use case

The main purpose of COAALAS is to facilitate necessary and periodic tasks, which in normal conditions would force a physically or psychologically disabled patient to leave their house.

For instance, care-giving tasks involve periodic interaction with a doctor, which might include provision of medication. Tests and validation of a medication coordination system in COAALAS are to be conducted in domotic houses with real users. In this scenario we have identified several actors: the medication dispenser and the rest of the usual domotic house sensors (smoke detectors, domotic doors with identification systems, and so on), the patient, the doctor, the caregiver, and the delivery person. Non-human actors are represented by intelligent agents embedded to the sensors.

The medical dispenser is autonomous and proactive, adapted from previous work done in the EU-Share-It project. The dispenser keeps track of the number of medication doses it has dispensed. Depending on the number of doses left and the medication plan of the patient – ie, the number of doses per day – the dispenser autonomously schedules and sends a request to the patient's pharmacy for more medication. Therefore, the user does not have to leave his or her house to get more medication.

The dispenser has a social role to fulfil: to provide the correct dose of medication to the user at regular intervals. As the dispenser cannot provide medication once the medication has run out, it will proactively request more medication in order to successfully fulfil its goal. This particular behaviour is the result of the ability to anticipate unusual events and to take action to ensure that goals can still be fulfilled.

In order to achieve a social and adaptive behaviour, we model the social network around the user. It effectively allows for connecting the patient to caregivers and relatives, specifying social regulations for detecting unusual and unwanted situations. Detecting these kinds of events and being able to re-plan the behaviour allow for a fast and adaptive response to potentially harmful situations.

Modelling the society

COAALAS follows the OperA methodology, already used in the EU-ALIVE project, in order to describe organizational models. This methodology enables the identification of the different actors and the relationships among them. For instance, the medical dispenser depends on the delivery person to accomplish medication refills. Furthermore, OperA allows social restrictions and protocols to be defined and be applied to the interactions among actors. For example, the delivery person cannot refill the medical dispenser unless he has checked the medication's best-before date.

In case an agent is not able to fulfil its obligation, COAALAS provides means for re-organizing the social structure, looking for alternative ways to achieve the goals. For instance, if the medical dispenser is out of medication and the

patient needs his dose but the delivery person is unable to arrive on time, a caregiver can be sent to the patient's house to temporarily fill this role. In case any of the social restrictions is not fulfilled, repair actions are available for returning the scenario to an acceptable state. For instance, if the delivery person has entered the house without identifying himself at the domotic door, he can be sanctioned for this inappropriate behaviour and a caregiver is requested to visit the patient to check that everything is okay.

This project is lead by the KEMLg research group, specializing in intelligent agents - autonomous software entities that observe and act upon the environment, with the aim of achieving particular goals - and argumentation - how to reach mutually acceptable conclusions through premise-driven reasoning.

The ALIVE project is a European project of the 7th framework coordinated by the Universitat Politécnica de Catalunya (UPC) and developed in collaboration with: University of Bath, Trinity College Dublin, Thales Nederland B.V., Tech Media Telecom Factory SL, The University Court of The University of Aberdeen and Universiteit Utrecht.

The SHARE-it project is a European project of the 6th framework coordinated by the Universitat Politécnica de Catalunya (UPC) and developed in collaboration with: Fondazione Santa Lucia, Universidad de Malaga, Telefonica I+D, Universität Bremen, DFKI, Centro Assistenza Domiciliarie Roma.

Links:
https://www.kemlg.upc.edu/
http://www.ist-alive.eu/
http://www.ist-shareit.eu/
http://kemlg.upc.edu/coaalas

Please contact:
Ignasi Gómez-Sebastià, Dario García-Gasulla and Sergio Alvarez-Napagao
Universitat Politècnica de Catalunya, Spain
Tel: + 43 934134011
E-mail:
{igomez,dariog,salvarez}@lsi.upc.edu

Towards an Intelligent Assistive Home

by Sokratis Kartakis and Constantine Stephanidis

Ambient Intelligence Technologies in the home assist inhabitants in their everyday life, providing environment control, power consumption monitoring and intelligent patient assistance.

The ICS-FORTH Ambient Intelligence Programme is an on-going horizontal interdisciplinary RTD Programme that aims to develop and apply pioneering human-centric AmI technologies for smart environments, capable of "understanding" and fulfilling individual human needs. This Programme constitutes a systematic effort towards addressing socio-technical challenges, by providing natural forms of interaction and access to information. In this context, a wide variety of AmI applications and services have been developed for various environments and domains, including home and everyday living, office work, museums / exhibitions, public spaces, education, and health. These developments constitute showcases for demonstrating AmI technologies in practice and their potential and benefits in different aspects of everyday life and activities.

In the context of the AmI Programme, a line of research is targeted towards intelligent home environments capable of assisting their inhabitants in everyday life by supporting the pervasive diffusion of "intelligence" in the surrounding environment through various wireless technologies and intelligent sensors. To simulate such environments, a laboratory space has been adapted which integrates various hardware (such as Zigbee, Bluetooth, Wi-Fi, RFID, custom hardware controllers,) and software technologies, allowing the user to control electrical and electronic devices automatically or manually.

In this environment, a number of experimental control applications have been developed. The first such application, named CAMILE, allows users with disabilities to control lights easily through an accessible user interface. The acquired experience in this context led to the conclusion that the main drawback of developing independent control applications is that the provided solutions are not sufficiently general purpose, as every time a new appliance is installed in the smart environment (eg a new light), the existing application needs to be modified or a new application becomes necessary.

To overcome this issue, subsequent efforts focused on the creation of an abstract application which can control electronic appliances with various interactive devices like touch screens, mobile phones, switches for motor impaired users, etc. A first approach was the development of two tools, named AmIDesigner and AmIPlayer, which have been specifically developed to address the above challenges through automatic generation of accessible GUIs in AmI environments. The disadvantage of this approach was that an expert user was needed in order to design the Smart User Interface that binds the virtual widgets with the real devices through AmIDesigner.

Thus, we decided to create an application that auto-generates User Interfaces based on information provided by the Smart Environment. The Control Home Easily application auto-generates user interfaces and allows users to easily manage the home appliances of every room from inside or outside the home using various interactive units through simple touch. Two versions of the application have been developed, one for large interactive devices, such as touch screens, and one for mobile devices.

The main advantage of this application is that it can automatically identify the smart devices of the desired room and register them with different hardware technologies. On the other hand,

Figure 1: Control Home Easily application.

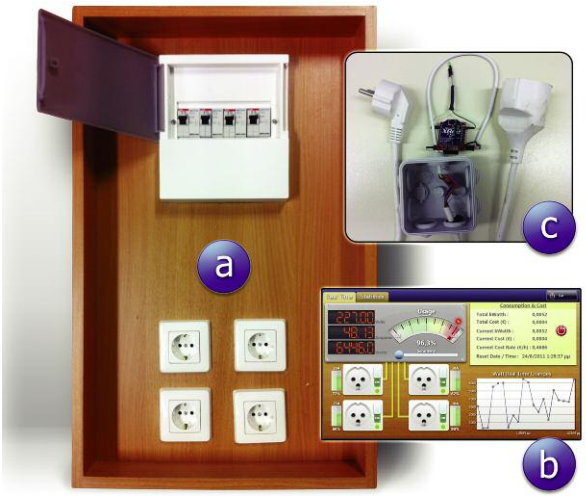


Figure 2: (a) Simulation box with electrical panel and four plugs, (b) application for control and monitoring and (c) circuit for retrieving data wirelessly.

Control Home Easily incorporates various hardware technologies such as Zigbee, DMX controllers and devices that use serial protocols. The only overhead for each device is the necessary creation of a user interface element called "widget". As a consequence, everyone can use the system, integrating each smart device without special software or hardware installation.

Another important issue in a smart home is power consumption monitoring. Various custom circuits have been created that allow the retrieval of data from the plugs, including voltages and amperes measurements, as well as the ability to control them (wired and wirelessly). These data can be saved and used for statistical processing, and the environment can advise the resident about optimal power usage, as well as providing information about the total cost of power consumption.

Based on the developed control and monitoring applications, simulations of real environments are also being developed. The first such environment is a Smart Patient Room which can be located in a home or a hospital, and allows users to control the environment and efficiently use the facilities of an exclusive nurse, while simultaneously helping the nurse or doctor in their clinical routine. With the use of an application tailored to a touch pad device, the patient can control various devices including lights, window blinds, TV sets and bed position. Additionally, various sensors can measure blood pressure, heart rate, oxygen level and patient's weight and can create a real time heart graph. This data is available to the patient's doctor from his office, enabling him or her to monitor the patient's status at any time.

Figure 3. Smart Patient Room and touch pad application.

The applications described above have the potential to facilitate the independent living and everyday activities of older people at home, but also of other home inhabitants, by providing accessible and user-friendly interaction with the smart environment. The new ICS-FORTH AmI Research Facility, due for completion at the end of 2011, will comprise simulated AmI-augmented environments and their support spaces, as well as laboratory spaces for developing and testing related technologies, and will provide an appropriate environment for pilot deployment and longer-term user-based evaluation of the developed AmI technologies under conditions very similar to real life.

Link:
http://www.ics.forth.gr/ami/

Please contact:
Constantine Stephanidis
ICS-FORTH, Greece
Tel: +30 2810 391741
E-mail: cs@ics.forth.gr

The Intelligent Bed – Ambient Monitoring of Sick and Disabled Persons through the Use of Load Sensors in Bed Legs

by Jürgen Nehmer, Thomas Luiz and Marie Consolée Sibomana

Today, the body functions of bedridden sick or disabled persons are still being monitored almost exclusively by means of intermittent personal monitoring done by medical staff and / or machines suitable for the respective disease pattern, such as an ECG. This kind of monitoring is either costly in terms of staff, or the connecting cables impede the patient's mobility. In addition, in the case of intermittent monitoring, there is also a delay in recording pathological deviations of a patient's health status. We present a concept for an ambient monitoring system based on the continuous measurement and interpretation of the bed load by load sensors integrated in bed legs.

In recent years, numerous attempts have been undertaken to monitor a patient's health status by using unobtrusive (ambient) technologies. In addition to monitoring vital functions such as breathing, consciousness, and circulation, the focus is on monitoring physical activity and behaviour, eg sleep disorders due to neurodegenerative diseases (eg dementia) or psychiatric (eg depression) diseases, insufficient mobility with pathologically increased pressure on the skin, or increased proneness to falls.

Here we present a system concept for a "smart bed" with ambient monitoring technology, which is based on capturing and interpreting the temporal progression of perpendicular load impact on the four legs of a bed by means of load sensors. This system can be used to measure:

- whether the bed is occupied or empty (presence or absence of a perpendicular load exceeding the load created by the weight of the bed itself)
- when the bed was occupied or vacated, respectively (temporal sequence of load being added or removed)
- how a person moves in bed (transfer of the perpendicular deflection to the load distribution in the area).

The experiments are being carried out in the AAL lab of the Fraunhofer IESE.

The hardware technology for suitable load sensors is mature and is utilized in numerous products on the market. Our prototype of a smart bed uses the iLoad Pro USB Kit from the company Loadstar Sensors. It consists of four capacitive load sensors with a measurement range of 500lb/2000N and an interface node (hub), which is used to trigger the load sensors and to read their measurement results in a packaged form. To do so, the load sensors are connected with the hub via a USB port; the hub itself is connected to a computer via another USB port. Experimenting with this system is facilitated by the availability of evaluation software, which is used to control the way the load sensors work and to package the measurement values in EXCEL tables for further processing. Figure 1 shows the iLoad system with the four disc-shaped load sensors, which can be mounted on the legs of a bed with little effort.

Whereas measuring the occupation/vacancy phases of the bed is a trivial matter, the recognition of typical movement patterns and their interpretation is a challenge since the interaction between the temporal load progressions of the four load sensors must be analysed.

In our studies, we initially concentrated on two movement patterns, which we studied using several test persons in numerous experiments. The two patterns were:

- *Turning:* Turns of the body can, on the one hand, serve as indicators of a sufficient ability to minimize local pressure on the skin. On the other hand, frequent turns can serve to detect pathological sleep patterns.
- *Getting up:* The goal is to recognize pathological patterns that indicate an increased risk of a subsequent fall (eg in the case of muscle weakness).

For these movement patterns, we observed the following typical load progression:

Turning

When a person turns over, the body is first lifted up briefly. Therefore, there are stronger loads on the bed at first, which is followed by a brief reduction in the load during the time the body actually turns. At the end, the body sinks back on the bed, which generates another load peak (see Figure 2).

Getting up

When a person gets up, the body is usually first turned towards the side of the bed from which the person gets up. Therefore, an initial shifting of loads takes place, which can be measured by all four load sensors. In the end phase, the body is put upright. During this phase, stronger loads are applied for a short time. When the person then gets

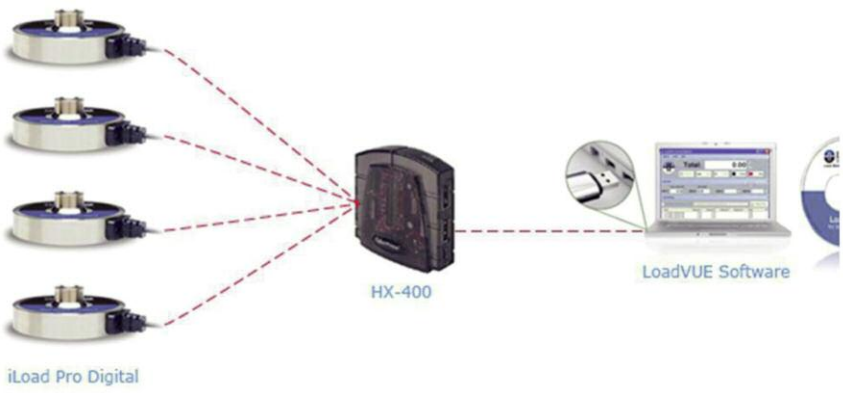


Figure 1: iLoad Pro Digital USBLoad Cell Kit (http://www.loadstarsensors.com).

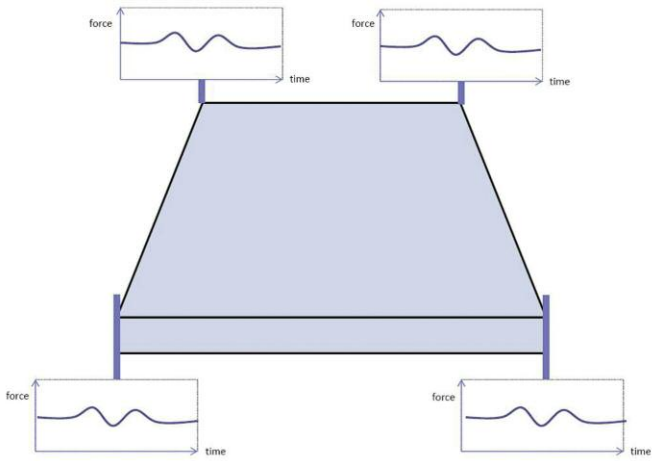


Figure 2: Pattern of movement when turning.

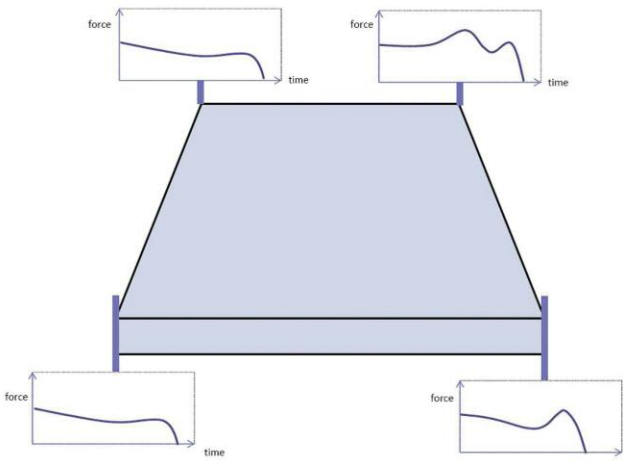


Figure 3: Pattern of movement when getting up.

up, the body is pushed upwards from the side of the bed, which leads to another short load peak, before the body finally leaves the bed (see Figure 3).

We are currently experimenting with different algorithmic variations for the signal analysis in order to achieve the highest possible success rate in recognizing specific movement patterns. Future studies will focus on recognizing small, load-reducing movements (when the body position is maintained), which are highly relevant for preventing pressure ulcers.

Regarding this issue, other institutes are working with pressure mats that are placed underneath the mattress. These are highly sensitive, enabling the recording of even the tiniest variations in pressure, such as those caused by the heartbeat. However, signal analysis is very complex in this case, since a large number of pressure sensors integrated in the area must be analysed and related to each other.

Due to the wireless, unobstrusive and in-expensive technology that does not interfere with the patients´natural behavior there is a broad scope of potential clinical applications of this solution, ie:

- screening for and monitoring of sleep disorders (patients with upper airway obstruction, heart failure, depression, dementia, chronic pain)
- monitoring of disoriented patients or patients with an increased risk of fall (ie alerting the nursing staff about an upcoming fall out of the bed)
- screening for and monitoring of increased risks for decubital ulcers ie in postoperative immobilized patients
- close-mesh weight control (patients with cardiac or renal failure)
- corresponding scenarios include both hospitals and long-term nursing facilities as well as the patients´ domestic environment.

Links:
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Please contact:
Jürgen Nehmer,
Fraunhofer IESE, Germany
Tel: +49 631 6800 3906
E-mail:
Juergen.nehmer@iese.fraunhofer.de

Utilizing Wearable and Environmental Sensors to Create a Smarter, Safer Home

by James Lanagan, Alan F. Smeaton and Brian Caulfield

Falls are a major cause of injury and fatality for older people and the number one cause of injury and fatality within the elderly population. This doesn't provide the full picture however, as the effects of falls are far-reaching; a fear of falling (the "post-fall syndrome") leads to a marked decline in the activities of daily living (ADL). Those who have fallen in the past are more likely to fall in the future, meaning that not only is a burden created on the part of family to provide increased vigilance, but also a considerable stress is placed on the victim of a fall.

In our work we create a clearer picture of the interactions between people and their environments through the use of environmental and wearable sensors. Our sensors provide rich context for analysing gait, allowing health professionals to re-construct the circumstances in which motor behaviours that might lead to increased risk of falling (such as increased gait variability) have occurred. Such sensors provide feedback on the movements of elderly people within and outside their homes and information on how a home is being used. Typically a person may be unable

to remember the circumstances and events leading up to a near fall incident such as loss of balance, but by using the aforementioned sensors we are able to provide additional context to help reconstruct those circumstances and lead to better diagnoses.

Current approaches to reducing falls such as environmental modification –identification and removal of possible causes of falls (sliding rugs, poor lighting etc.) using home intervention teams who audit a home for hazards – are expensive and are quite intrusive, again leading to stress for all parties concerned. Through the use of visual and environmental sensors, we create an autonomous system to collect information without altering behaviour as a result of observation and external presence.

A Sensor-Based System for Re-establishing Context

In order to build a complete system to capture, analyse, and understand the contexts and circumstances of fall and near-fall events, we utilize a number of sensors including SHIMMER (Sensing Health with Intelligence, Modularity, Mobility and Experimental Reusability, http://www.shimmer-research.com/). SHIMMER is a small wireless sensor platform that can record and transmit physiological and kinematic data in real-time. The device itself is about the size of a wristwatch and in the case of monitoring gait, fits on the shank of the wearer, providing data on multiple gait variables. By measuring the rise and fall of the wearer's feet we are able to detect abnormalities that might indicate a "close call".

Figure 1: The SHIMMER unit can be worn around the ankle and measure gait.

Figure 2: The SenseCam provides passive image capture, enabling increased contextual cues.

We also use the Microsoft SenseCam to recreate the context of these close calls (SenseCam is now marketed by Vicon as the "Vicon Revue"). The SenseCam is a wearable, passive-capture camera typically hung from a lanyard around the neck capturing the wearer's day-to-day activities as a series of photographs and readings from built-in sensors. Its built-in sensors monitor the wearer's environment taking a picture every 30 seconds, or when triggered by onboard sensors. Used in conjunction with gait analytics software, the SenseCam helps to identify the contexts and circumstances around abnormal walking events that may be indicative of potential fall scenarios. The images captured by the SenseCam also provide a strong level of context to these events. Additionally, we are able to automatically identify semantic concepts appearing within the images themselves to infer activities like eating, shopping etc.

Finally, in order to increase contextual cues we look to the environment of our users. Analysis of the electrical power usage of a home provides household appliance signatures that enable identification of these appliances, clarifying classified/recognized events from other sensor platforms. (eg a kettle being switched on is a good indication of its presence within the associated SenseCam images, as well as providing a possible 'kitchen' context to SHIMMER gait data.)

Methodology

Older participants – 60 years and over, living independently and with no cognitive impairment – are being used in our study. We install household energy monitoring and describe how and when the SenseCam and SHIMMER sensors are to be worn. Participants wear the devices for up to four weeks at a time. Our sensed data then enables clinicians and health professionals to understand their patients' needs and to minimise the risks and injuries caused by falls. We achieve this though the innovative combination of multiple sensor modalities without the intrusive requirements of current risk-reduction methods.

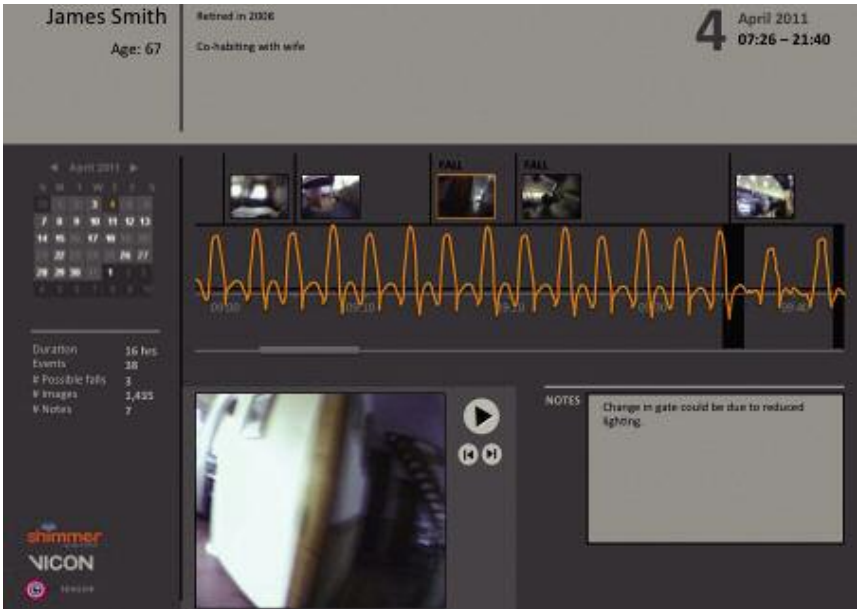


Figure 3: A future system may be used by clinicians to help patients identify and minimise risk within their daily lives.

Please contact:
James Lanagan, Alan F. Smeaton
CLARITY: Centre for Sensor Web Technologies
Dublin City University, Ireland
E-mail: jlanagan@computing.dcu.ie, alan.smeaton@dcu.ie

Brian Caulfield
TRIL: Technology Research for Independent Living, Ireland;
University College Dublin, Ireland
E-mail: b.caulfield@ucd.ie

Smart Caring Cameras for Safe and Independent Living of the Elderly: A Non-Wearable Technology and Service for Fall Detection

by Ahmed Nabil Belbachir, Ferenc Vajda, Tommi Lunden and Erwin Schoitsch

In the frame of CARE, a co-funded project within the first call of EC-AAL (Ambient Assisted Living) joint programme initiative, we have developed a new technology with on-board fall detection for elderly safety at home. The system includes a visual sensor and a wireless communication module integrated into the already-established product "Everon caring system". This new sensor technology allows real-time detection of a person's fall by permanently monitoring, analysing and interpreting elderly activity at home, and automatically sending an alarm in case of falls. The system takes advantage of the strength of visual sensing without intruding on the individual's privacy.

Europe is ageing. The percentage of the population that is 65 years or older, and the life expectancy is rising. The number of elderly people will be more than double by 2050 and the proportion of people living alone will increase. One of the highest risks for elderly persons living alone or spending much time alone is falling down (Figure 3) and being unable to call for help, especially in case of loss of consciousness. The main challenge in installing ICT-based monitoring systems is finding the balance between surveillance and privacy, ie, home safety versus ethics. Since privacy is a fundamental human right, any means of improving safety in the living environments of elderly persons need to respect and ensure privacy. Falls can occur in all home locations and situations. Wearable tools currently used for monitoring are often not continuously used by elderly persons, rendering them of little use for detecting potentially hazardous situations. As a consequence, "smart ambient" approaches, like vision-based surveillance, appear to be more appropriate for that purpose. This CARE initiative is an end-user driven R&D activity where end-users represent major players in AAL activities in the context of safety and independent living. The consortium is well balanced two research institutes (AIT, Budapest University of Technology and Economics), two small and medium enterprises (Everon, SensoCube) and two end-users (Senioren Wohnpark Weser in Germany and Yrjö & Hanna homes in Finland). Selected elderly homes of the partner end-users are used for the evaluation and demonstration of the CARE concept (Figure 3).

Figure 1: CARE key technologies: Stereo vision system for fall detection (left), Everon wireless module (right).

In the early phase of the project, it was necessary to conduct interviews with end-users, collect a list of needs and to find out the most important safety-relevant situations encountered. More than 200 end-users in Austria, Finland, Germany and Hungary were questioned. These end-users agreed about a definitive need for a fall detector at elderly homes and that the actual fall detectors (eg wearable systems) are not satisfactory and do not have high acceptance in the independent living context. Based on these interview results, a list of requirements was created for the CARE ICT system with a focus on the fall detection as the main target. Architecture for a biologically-inspired stereo vision sensor was designed (Figure 1- left) and the sensor and algorithms for the detection of falls were developed. The CARE system is currently under testing and evaluation with first installations in Germany.

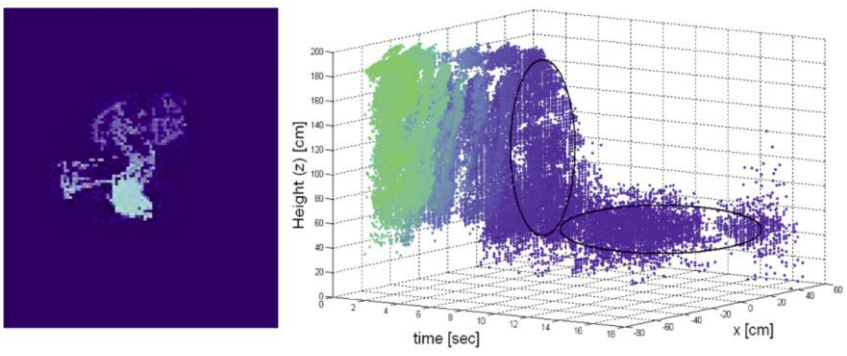


Figure 2. Left: CARE data from the stereo sensor of a fall instant rendered in an image-like representation; Right: the spatiotemporal 4D data of a person during a fall from walking position.

Figure 2 shows the visual data from the CARE dynamic stereo sensor, which do not correspond to an image but to scene dynamics (ensure privacy) such that events representing contours are only generated upon person motion. In the left, the instant acquisition of the fall is recorded in an-image like representation. The right figure shows the 4D representation of the fall (space and time). The depth is color coded so that with

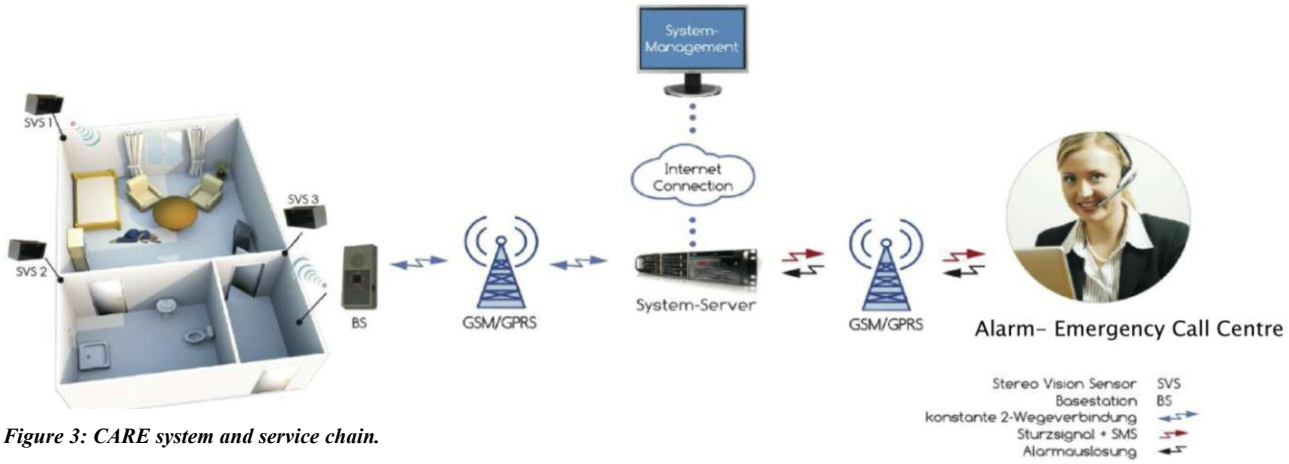


Figure 3: CARE system and service chain.

rising distance between the object and the sensor the object is marked darker (from green to blue). The person walks away from the sensor and falls after 9 sec in the same direction of his walking. Therefore the color of the data points representing the person decreases with time from bright to dark blue. CARE mainly targets single individual elderly people living in their own private homes (Figure 4) with a huge potential. The AAL market is changing and is expected to boom in the next few years as a result of demographic developments and large investments of industries and stakeholders. Actual products, which are on the market for several years, mainly consist of wearable systems and intelligent floor technologies; however their success is restricted to limited markets like nursing homes rather than the broader aged communities. In the context of independent living, wearable systems do not have the best acceptance for primary end-users (elderly), especially those who are not impaired.

The CARE system for fall detection services is integrated with the Everon caring system (see Figure 1, right) for wider deployment in Europe, strengthening the independent living market and society.

Link: http://www.care-aal.eu

Please contact:
Ahmed Nabil Belbachir, Erwin Schoitsch, AIT Austrian Institute of Technology / AARIT, Austria
E-mail: {nabil.belbachir, erwin.schoitsch}@ait.ac.at

Ferenc Vajda
Budapest University of Technology and Economics, Hungary
E-mail: vajda@iit.bme.hu

Tommi Lunden
Oy Everon Ab, Finland
E-mail: tommi.lunden@everon.fi

Automatically Detecting ‘‘Significant Events’’ on SenseCam™

by Na Li, Martin Crane and Heather J. Ruskin

SenseCam™ is a wearable, automatic camera with support for memory recall used as a lifelogging device. Recent and continuing work in Dublin City University to apply sophisticated time series analysis methods to the multiple time series generated on a Microsoft SenseCam™ have proved useful in detecting ‘‘Significant Events’’.

A SenseCam™ is a small, wearable camera that takes images, automatically, in order to document the events of wearer’s day. It can be periodically reviewed to refresh and strengthen the wearer’s memory of an event. With a picture, taken typically every 30 seconds, thousands of images are captured per day. Although experience shows that the SenseCam™ can be an effective memory-aiding device, as it helps wearers to improve retention of an experience, wearers seldom wish to review life events by browsing large collections of images manually. The challenge is to manage, organise and analyse these large image collections in order to automatically highlight key episodes.

Researchers within the Centre for Scientific Computing and Complex System Modelling, (Sci-Sym) at Dublin City University have addressed this problem by applying sophisticated time series methods to analysis of the multiple time series recorded by the SenseCam™, in order to automatically capture important or significant events of the wearer’s day.

Detrended Fluctuation Analysis (DFA) was used initially to analyse image time series, recorded by the SenseCam™ and exposed strong long-range correlation in these collections. It implies that continuous low levels of background information picked up all the time by the device. Consequently,

Figure 1: SenseCam.

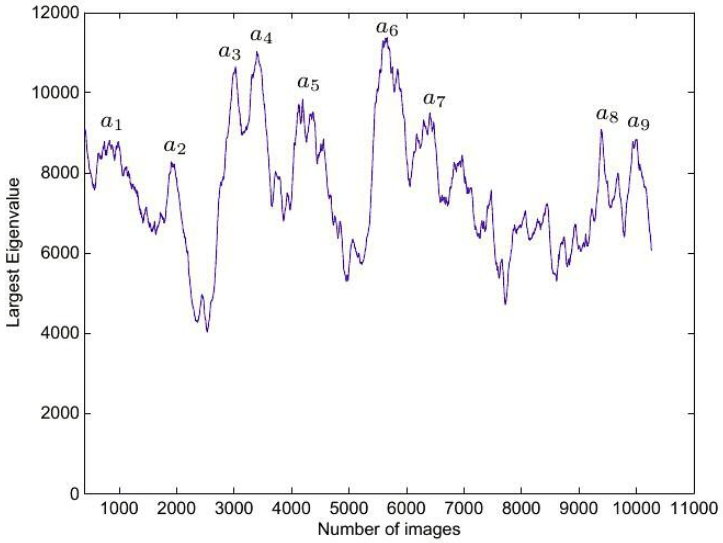


Figure 2: Largest Eigenvalue Distribution using a sliding window of 400 Images.

DFA provides a useful background summary.

The equal-time cross-correlation matrix with different sliding window size was also used to investigate the largest eigenvalue and the changes in the sub-dominant eigenvalue ratio spectrums. The smoothness of the largest eigenvalue series was improved by choosing a larger window size, to filter small changes, with peaks evident across all scales, and large changes highlighted. We detail the scenario for the peaks in Figure 2 as an example: peaks a3 and a4 correspond to the wearer based in the office and sitting in front of the laptop. The laptop is predominantly white, with the screen the largest object in these images. The SenseCam™ captures the image basis for the two peaks, including lights on the ceiling. A small dip between the two peaks implies that the camera was blocked for a while. Clearly, images captured when objects are maintained without change are of higher quality than when movement is increased. Thus, the laptop, lights and unchanged 'seated position' contribute higher pixel values in these sequences of images. These consistently occurring peaks in Figure 2 aided identification of light intensity as a major event delineator during static periods of image sequence. An eigenvalue ratio analysis confirmed that the largest eigenvalue carries most of the major event information, whereas sub-eigenvalues carry information on supporting or lead in/lead out events.

The dynamics of the largest eigenvalue and changes of ratios of eigenvalues were examined, using the Maximum Overlap Discrete Wavelet Transform (MODWT) method. This technique gives a clear picture of the movements in the image time series by reconstructing them using each wavelet component. Some peaks were visible across all scales, as expected, with specific event information markedly apparent at larger scales. By studying the largest eigenvalue across all wavelet scales, it was possible to identify the time series fluctuation caused by change of a single type, eg with environment constant, but with wearer movement increased or more people joining a scene. It was also possible to validate the analysis approach, by confirming that the largest time series effects are due to grouped or combined changes, eg when the wearer's environment changes completely; (involving light intensity, temperature, additional people etc.). The eigenvalue ratios analyses are in good agreement with findings for the largest eigenvalue, indicating that wavelet methods, (MODWT), provide a powerful tool for examination of the nature of the captured SenseCam™ data.

Future work includes extension of the Maximum Overlap Discrete Wavelet Transform to the investigation of changes in the cross-correlation structure across all scales. Particular features should be marked at different scales, enabling identification of key components of major or related events, and even potential classification of event type in the SenseCam™ data.

Acknowledgements

We would like to thank our colleagues from the Centre for Sensor Web Technologies, (CLARITY), at Dublin City University for research assistance.

Links:

http://research.microsoft.com/en-us/um/cambridge/projects/sensecam/
http://sci-sym.dcu.ie/
http://www.clarity-centre.org/

Please contact:
Na Li, University of Limerick and Dublin City University, Ireland
E-mail: Na.Li@ul.ie

Martin Crane
Dublin City University, Ireland
E-mail: mcrane@computing.dcu.ie

Heather Ruskin
Dublin City University, Ireland
E-mail: hruskin@computing.dcu.ie

Situation-of-Helplessness Detection System for Senior Citizens

by Dieter Rombach, Holger Storf and Thomas Kleinberger

Elderly people living alone lead dangerous lives: If they fall, they often spend hours lying on the floor before their situation comes to anyone's attention and a doctor can be sent for. But falls are not the sole reason for critical situations. Physical frailty or sudden disorientation can also lead to precarious situations, which is why a fall detection system alone is not sufficient. A new system automatically detects elderly people stuck in difficult situations and informs a trusted person. This makes it possible for elderly people to live an independent life in their own home for a longer period of time.

Ms. K. is vision-impaired and can't get around very well anymore. Still, the 80-year-old woman, who lives alone, has no intention whatsoever of moving to a retirement home. Most elderly people think the same way. They want to stay in their familiar surroundings for as long as possible and lead an autonomous life. What many fail to realize is that they are risking their health and their lives. Cardiovascular problems are more frequent among the elderly, and the risk of falling is more prevalent: One person in three above the age of 65 falls once a year; among those older than 80, the quota is nearly one in two. While it is doubtlessly true that not every fall is critical, there are many other causes for critical situations in which elderly people get trapped. It can happen in the bath tub, in the armchair in front of the TV, in bed, or in the kitchen – basically any place any time.

So, many situations of helplessness occur in private homes during the course of everyday activities, and often at night. Frequently it takes hours before the person who is in trouble – and who is often injured – receives any care. Well-known home emergency-call systems turn out to be of limited help as senior citizens often cannot operate them when in need. They may be injured or disoriented, or may simply not have the emergency button within reach. Help could be forthcoming from an intelligent system that automatically identifies and responds to these kinds of emergency situations.

One such solution is under development by researchers at the Fraunhofer Institute for Experimental Software Engineering IESE in Kaiserslautern, Germany. Their project is called "ProAssist4Life" - shorthand for "Proactive Assistance for Critical Life Situations". The project partners include the companies CIBEK technology + trading and Binder Elektronik, as well as the Westpfalz Klinikum (hospital) in Kaiserslautern.

The goal of the project is to develop an unobtrusive system that provides permanent "companionship" to elderly people living in single households or in retirement facilities. Multisensory nodes mounted on the ceiling of a room register an individual's movements. One multisensory node contains six motion sensors, one brightness sensor, and one oxygen sensor. The system records how

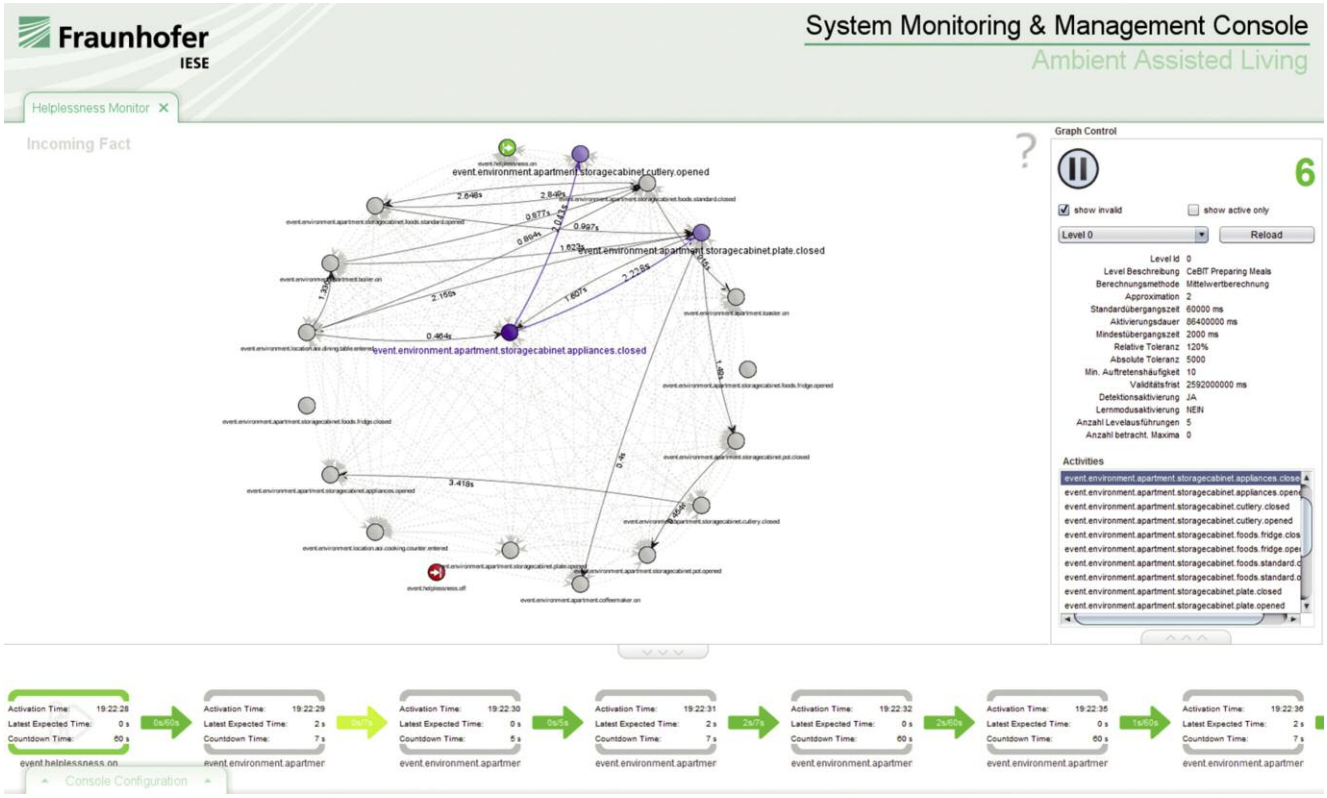


Figure 1: System Monitoring and Management Console.

much time a person spends in which part of the home. A radio signal transmits the data to a computer. Software documents the individual's daily activities, continuously learning about the person's "normal behavior" and thus creating a (predictive) model. The used approach is comparable with a self-creating finite state machine. The software continuously compares the resident's current activity with its model and identifies situations that significantly deviate from the norm. Imagine the person has fallen, is lying on the ground unconsciously, and is thus in a helpless state. This might be detected by means of the model because she spends a considerably longer amount of time in the bathroom than expected by the model. To prevent false alarms, the first action is to prompt the elderly person herself.

Figure 2: A multisensory node with several motion sensors.

This can be accomplished with a phone call, or by means of a touchscreen monitor with an integrated speaker. If she answers the phone or touches the monitor within a given time span, the alarm is cancelled. Should Ms. K. fail to respond, the software sends a text message to a trusted individual such as a family member or caregiver and help will be on its way. It is also possible to extract characteristic behavior patterns, such as instrumental activities of daily living (IADL). These can be used to determine critical long-term trends, which may be indicators for typical diseases of elderly people.

Link:
http://www.proassist4life.de

Please contact:
Dieter Rombach
Fraunhofer IESE, Germany
Tel: +49 (631) 6800 1000
E-mail:
dieter.rombach@iese.fraunhofer.de

FoSIBLE: Design of an Integrated Environment for Social Interaction

by Mario Drobics, Matthias Zima, Dalibor Hrg, Jan Bobeth and Steffen Budweg

Within the AAL-Joint-Programme project FoSIBLE, a Social TV community platform for elderly people, augmented by game technologies and smart furniture, is currently being developed. The platform aims to provide social support for interaction between peers, friends and families. We present first results from our approach of integrating different multi-modal interaction techniques for an integrated Smart TV with Social Community solution.

Within the FoSIBLE project, a Social TV community platform for elderly people is being developed. To ensure high usability and acceptance, a novel combination of input methods is used. The central element of the application is a Smart-TV system, which is used to display messages, images and videos. A dedicated application runs on the Smart TV and provides chat functionality, as well as games and virtual libraries. To encourage the elderly to deal with this application, different input methods are supported. In addition to traditional manufacturer-specific remote controls or applications, gestures can be used for navigating through the menus, while a tablet-PC provides easy text input as well as the ability to navigate the system. The system is completed by sensor information and smart furniture to detect the presence and state of the user.

Figure 1: A prototype of the Smart TV widget for the FoSIBLE Social TV Community.

Multi-modal input approaches for controlling Smart-TV systems seem promising from a usability perspective, as active user input can be reduced to essential tasks. Based on context analysis and evaluation of measurements provided by visual, pressure and movement sensors, appropriate assistance can be provided, for instance by pre-selecting relevant menu options, automating sign-in processes and suggesting relevant information. In conjunction with a natural user interface, based on touch interactions on a tablet-PC as well as gesture recognition, applications can be designed to support heterogenic user groups, even without previous technology experience. To reach this goal, guidelines for user interface design need to be taken into account, supported by extensive end-user involvement through the whole development process.

Smart TV is a recent approach to integration of web-based interactive content into modern television sets. Our application is designed as a widget that runs on a standard Smart TV platform and which is connected to our social community platform (Figure 1). It implements social features and functionalities identified during an end-user requirements process, including support for communication and awareness while watching TV, as well as a social media platform for exchanging information (eg on interesting TV programs or books) and playing games. A presence awareness implementation allows

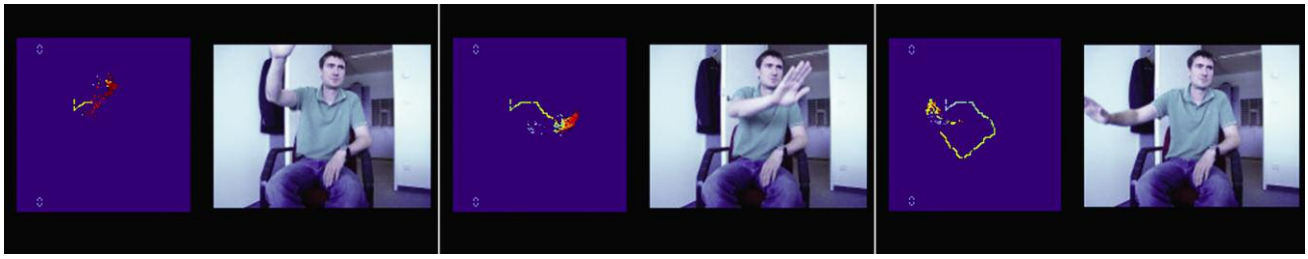


Figure 2: A sequence of still images provide an example of raw hand tracking data (left pane) and synchronous video (right pane) for a person performing a "circle" gesture.

for further enrichments by making use of various sensors and smart furniture available in the future living room.

Gesture recognition promises to provide a simple to use, intuitive interface for interacting with Smart TV platforms. The appearance of Microsoft's Kinect device lead to a boom in the development and demonstration of gesture control interfaces. However, devices like Microsoft's Kinect regularly target only three-dimensional scene recognition and additional hardware and software are often necessary to perform the actual gesture recognition in real time. This results in increased system cost and complexity when deployed, because the device cannot be connected to a TV-set or set-top box directly. In FoSIBLE, we therefore targeted the development of a fully embedded system for hand gesture recognition based on a biology inspired "Silicon Retina" optical stereo sensor, which is ideally suited for the recognition of dynamic gestures. The sensor is only sensitive to light intensity changes and therefore tracks hand motion in its field of view robustly and with high accuracy. It can detect whether the user is in front of the TV set, and whether the user is in company or alone. The hand gesture recognition software (see Figure 2) for the embedded device is developed within the FoSIBLE project and will be evaluated against comparable gesture recognition software available for the Kinect device. The underlying gestures have been defined as a result of an end-user evaluation process, to ensure that the target group can cope with the defined gestures.

Although gestures can be used for most navigation and selection tasks, not all inputs can be done using gestures alone. Furthermore, some users might not want to use gestures at all. Thus, additional input modes should be provided to users, which they can use to navigate the Smart TV system, but also to enter text (eg during chats or when writing a short article). As traditional input devices like keyboards and mice are quite cumbersome to use in a living-room environment, a tablet PC is used for this task. The tablet can also be used to display messages when the TV is switched off and is connected to the Smart TV system and the Social Community platform.

Additionally, smart furniture is used to detect the presence and state of the user and to adopt the system to the users need. For this purpose, touch sensitive tables are used, as well as sensor equipped chairs and beds. By detecting the position of the user, context sensitive functionality can be provided, such as to start an application when the person sits in front of the TV and interacts with the couch-table. Furthermore, it is possible to adjust the TV screen and the camera, so they are directed towards the user.

The integrated FoSIBLE Social TV community system will be deployed in multiple home environments in France and Germany throughout the next year, delivering more results from the real-life usage and more insights about the end-user acceptance and usability for novel multi-modal interaction techniques for Smart and Social TV systems.

Acknowledgments

The FoSIBLE project is funded by the European Ambient Assisted Living (AAL) Joint Program together with BMBF, ANR and FFG.

Link: http://FoSIBLE.eu

Please contact:
Mario Drobics
AIT Austrian Institute of Technology GmbH / AARIT, Austria
E-mail: mario.drobics@ait.ac.at, coordination@FoSIBLE.eu

Virtual Coach Reaches Out to me: The V2me-Project

by Daniel Tantinger and Andreas Braun

The V2me project combines real life and virtual social network elements to prevent and overcome loneliness in Europe's aging population. Its overall goal is to enhance the joy of living for the network members. To fulfil this goal, V2me supports active ageing by improving integration into society through the provision of advanced social connectedness and social network services and activities.

Rooted in scientific theory and research, V2me uses evidence-based prevention and intervention strategies to develop a social facilitator that enables both prevention of loneliness in young-old individuals (65-74 years) and successful intervention in older generations (75+ years). V2me encourages older people to continue their social participation, to

share their knowledge and experiences and to stay mobile and cognitively agile. Development of an adaptive and easily expandable ICT solution for assistive living with particular emphasis on acceptance by senior end users that addresses the social interaction of people and contributes to preventing and alleviating loneliness was the initial motive, and still is the main goal, for the V2me project. This European AAL Joint Programme project started in May 2010 and will run for 36 months.

Specifically, V2me stimulates beneficial levels of social activity in elderly individuals who are at risk of isolation. Furthermore, it supports behavioural changes in patients who consider themselves lonely or isolated. The system is integrated into existing online social networks and amends them with innovative services that improve usability for elderly users.

The fact that adaptive ambient solutions include the whole gamut of high end software and devices in conjunction with psychological intervention methods leads to a hybrid program between technological and psychological state-of-the-art knowledge. The project combines the application of state-of-the-art social sciences (social gerontology, psychology, and communication) and state-of-the-art technology in a real-life environment that allows user participation in all phases of the project. Furthermore, it combines approaches from various scientific fields to prevent loneliness especially for elderly people.

Specifically, V2me provides senior individuals suffering from or being at risk of loneliness with an adaptive ICT environment that implements a multifacetted approach to motivate the user to engage in different forms of social activity. This includes a mediator function to stimulate the use of ICT technology for developing network relationships. This aspect facilitates contact with family, friends, and professional networks, as well as potential new communication partners (enriching social networks). The second cornerstone is the friendship function, compensating the absence of social connectedness through offering coaching in deepening relationships. The system interacts with the user in an adaptive, personalized way to establish a para-social relationship as an additional contribution to preventing loneliness. Both aspects are incorporated in the V2me Virtual Coach, an emotionally expressive virtual character that is companion, instructor or even a mate. It is based on previous work accomplished in the AAL JP Call 1 project - A2E2. Our approach does not only rely on intrinsic motivation or knowledge about successful intervention, but stimulates user motivation and positive reinforcement. To achieve the latter, we use state-of-the art technology to tailor the V2me User Avatar. This virtual self-representation of the user is a dynamic virtual entity that is directly or indirectly controlled by the end-user, offering various abstraction levels of representation that are controllable and individually configurable by the user, giving the user full control of his appearance to the system or other users.

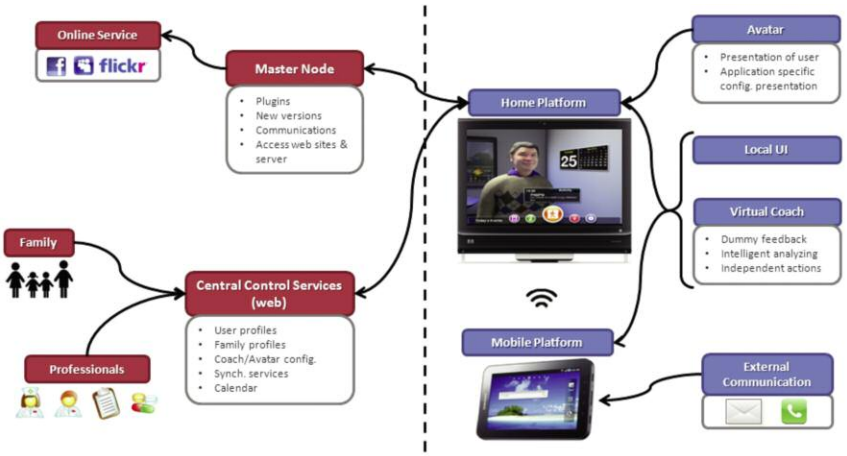


Figure 1: Schematic concept of the V2me project.

The V2me system consists of three main components - the *Mobile Platform*, a location-aware tablet-based solution that allows the user to connect with his social network and interact intuitively with the Virtual Coach. This emotionally expressive 3D character is residing on the *Home Platform*, a large screen device that is placed in the user's immediate environment and uses naturally sounding speech synthesis for communication. Both devices are connected to the *Web Platform* that connects the different users and integrates third-party services. The first prototypes have been tested and we will continue with further user studies in three different countries - Finland, Germany and the Netherlands. This will include a long-term study on the effectiveness of our approach on loneliness prevention.

The core consortium is formed by a strong group of organizations from six member states with long-standing experience of working together in different European and international projects and a deep knowledge and expertise in the different domains of Ambient Assisted Living, e Health and e Inclusion. The consortium is composed of nine partners - small and medium enterprises, health care providers, research and development organizations and social science research institutions that mutually share the V2me vision. Those partners are: Fraunhofer Gesellschaft, Germany (project coordination); Diakonie Neuendettelsau, Germany; Hospital IT AS, Norway; Mawell Ltd., Finland; Graz University of Technology, Austria; User Interface Design GmbH, Germany Université du Luxembourg; VU University Amsterdam, Netherlands; VTT Technical Research Centre of Finland.

Link:
http://www.v2me.org

Please contact:
Daniel Tantinger
Fraunhofer Institute for Integrated Circuits IIS, Germany
Tel: +49 9131 776-7343
E-Mail:
daniel.tantinger@iis.fraunhofer.de

Andreas Braun
Fraunhofer Institute for Computer Graphics Research IGD, Germany
Tel: +49 6151 155-208
E-Mail:
andreas.braun@igd.fraunhofer.de

ACTIVAge: proACTIVe and Self-Adaptive Social Sensor Network for Ageing People

by Flavio Corradini, Emanuela Merelli, Diletta R. Cacciagrano, Rosario Culmone, Luca Tesei and Leonardo Vito

ACTIVAge is an on-going project at the University of Camerino within the JADE project "Joining innovative Approaches for the integration and Development of transnational knowledge of cluster policies related to independent living of Elderly" (FP7-Capacities 2011-2013). ACTIVAge aims at defining a framework for designing personalized, adaptive and ubiquitous services and applications improving the quality of life of elderly people.

Community care policies and socio-cultural values make family care the predominant model of welfare support for elderly people across Europe. This model also fulfils the wish of many elders who prefer to safely live at their home, keep their own social context, socialize with family members and friends, and cultivate their own interests and hobbies. Within a familiar home environment they receive support for their loneliness and possibly for their chronic illnesses. During recent years, however, the global increase in divorce rates, family mobility, women in the workforce and higher average age of retirement for women have altered family patterns and, as a consequence, it is becoming unfeasible to provide care to the elderly according to the classical model. Furthermore, governments are under economic pressure to keep under control the costs of the public welfare system that is usually committed to providing in-hospital care, day services, institute-based respite care, holiday respite and home-based sitting services. ACTIVAge addresses this challenge by supporting a paradigm shift in welfare delivery. It is focused on the autonomous citizen and on an independent, high-quality living model. Consequently, pressure on the overburdened welfare system is reduced and, at the same time, it benefits involved users.

The ACTIVAge idea (Figure 1) is to provide a new generation of services and applications that are different from the traditional ones owing to (i) their ability to be personalized, ie, customized to the specific individual needs (Figure 2), (ii) their adaptive nature, ie, they are able to adapt, at run-time, to changes of the user needs, and (iii) their ubiquity/pervasiveness, ie, they are available at any place and at any time.

ACTIVAge pivots on an abstract concept of sensor. According to its vision, the general concept of entity is used to identify any kind of object either physical, artefact or abstract. Physical and artefact entities (eg people, smartphones, domestic appliances, air conditioning, automatic doors, and so on) play the role of pervasive sensors, that is, they are equipped with a traditional device permitting identification and/or transmission of signals (RFId, GPS, Wi-Fi, and so on). Abstract entities, including social networking activities such as Facebook and Skype, act as social sensors, gathering information about the way the user is feeling.

Figure 1: ACTIVAge idea: the smart home is equipped with sensors that enable personalized services.

Any entity is described using the ACTIVAge description language. This language, based on a multi-level ontology meta-model, allows the description and annotation of both environmental and emotional data. The core of ACTIVAge is a reasoning and planning engine (Figure 3). It is based on an adaptive planning solver and on decision making algorithms. Thus, it can provide personalized and adaptive services at run-time, ie, specific solutions are given to reach the same user goal depending on its contin-

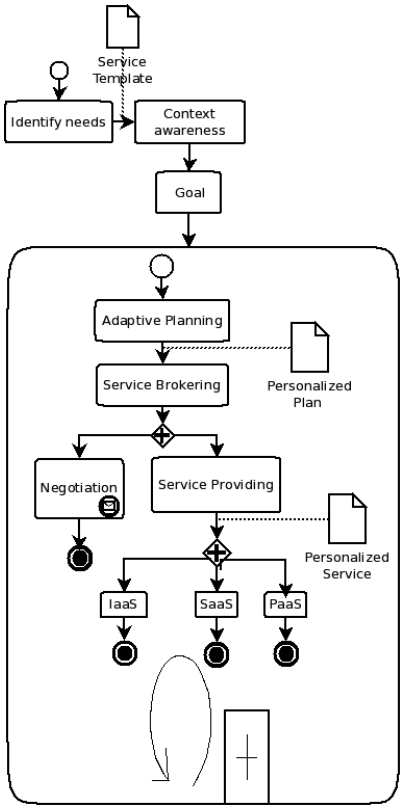


Figure 2 Adaptive approach: a BPMN description of the planning process to provide a personalized service.

uously changing needs and states. For instance, if the service is a Web Service then the planning solver can exploit run-time orchestration of services to identify a way to deliver the service that is the best for the user under consideration and its current context. ACTIVAge provides its run-time services using the cloud computing paradigm.

Currently, ACTIVAge is partially implemented and is being used in the healthcare domain for the development of a drug dispensary service for people with mild cognitive impairment (MCI).

Link:
http://cosy.cs.unicam.it/AAL

Please contact:
Emanuela Merelli
University of Camerino, Italy
Tel: +39 0737402567
E-mail: emanuela.merelli@unicam.it

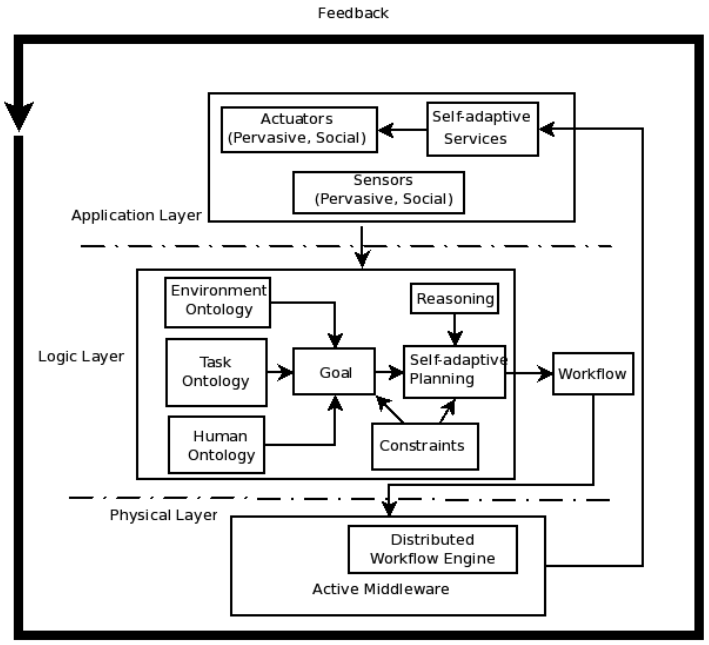


Figure 3: ACTIVAge engine architecture: multi-layer organization, integration and interaction of the main components.

WayFiS: Way Finding for Seniors

by Mattia Gustarini, Katarzyna Wac and Dimitri Konstantas

The WayFis project is the first European AAL project to help the elderly plan personalized routes and guide them in complex paths in different contexts including indoors, outdoors, pedestrian, and on public transport.

The European WayFiS project (2011-2013), launched in the Ambient Assisted Living program aims to improve the capability of seniors to plan, manage and execute travel and transportation projects at their own discretion by solving the problems encountered by elderly people when trying to move in unknown indoor and outdoor environments, thus enabling them to take part in a self-serve society.

The problems addressed by this project are mainly related to access to information, sight problems, walking and/or motor abilities, cognitive abilities, associated health limitations and poor availability of proper information regarding transport options and accessibility of stations and stops. The target group constitutes people aged over 70 years old who are unfamiliar with ICT and with technologies in general, usually living alone and suffering from health limitations due to aging. The resulting WayFiS services will be tested in target groups in Spain, Hungary and possibly Switzerland.

The project involves six European partners: from Switzerland, the University of Geneva and the company Arx iT; from Spain, the companies HI-Iberia and Cetiex; and from Hungary, the research institute Bay Zoltán and the elderly care home Hársfalevél.

The innovation of WayFiS is the development of a personalized way-finding service for elderly people, considering both public transport and paths by foot, and focused on the objective of making the elderly feel healthy, well, and safe. It

takes into account their specific limitations and health habits, with the challenge of aggregating a huge amount of information from different sources and including them into one mobile service with an intuitive interface (eg voice-touch-write). The WayFiS is the first route planning service for elderly people that considers both the pedestrian and public transportation mobility issues. It includes a wide range of personalization features based on the health state of the user and his common behaviours and needs. For example, it considers his ability to walk only a specific distance at once, the impossibility to walk on an uneven terrain or the difficulty in taking stairs in a bus. WayFiS also includes localization and positioning features for both indoor and outdoor environments that will guide the elderly along complex paths.

The success of WayFiS service will largely depend on use and usability of sources of information such as public transport maps, web-based and mobile services. To ensure its success, we will start the development of the project by defining detailed user scenarios, which will depend on the target population's characteristics and needs and hence be specific to each participating country. Based on the defined scenarios, we will design the system and its services by delineating the WayFiS architecture and its components, which furthermore will serve as a basis for the system implementation. We have already discovered that availability of public transport information is very different in each participating country, which will, to a large extent, influence the way the system is deployed there. With respect to the deployment platform, owing to its openness and flexibility, we define an Android operating system as a target system for WayFiS deployment.

The evaluation of the WayFiS will be done with its end-users and will include quantitative as well as qualitative evaluation procedures. Namely, based on measurements-based performance evaluation methods, we will quantify WayFiS service speed, accuracy, dependability and scalability for a real-time, continuous navigation of seniors in real-life environments. Furthermore, we will employ evaluation methods from the human-computer interaction domain in order to evaluate WayFiS usability, interface design and effectiveness of service interactions on mobile devices. These methods will be employed in at least two stages, ie involving first young and healthy student volunteers to get their initial feedback, and then the target end-users at a later stage of system development.

Links:
http://www.wayfis.eu/
http://www.qol.unige.ch/

Please contact:
Mattia Gustarini, Université de Genève, Switzerland
Tel: +41 22 379 02 46
E-mail: Mattia.Gustarini@unige.ch

ILI: A Framework for Implementing Smart Spaces

by Péter Pallinger and László Kovács

The ILI (Intelligent Visitor Guidance) system is able to transform hospitals, museums, parking lots, office buildings or even a shopping mall into semantically driven, adaptive, smart spaces by integrating various pieces of sensory information and providing customised, context-sensitive information and services for visitors, patients, doctors or customers.

The necessary components for smart spaces will become increasingly widespread as intelligent self-regulating devices are becoming readily available. However, these devices usually act individually which limits their capabilities. The ILI system is a robust framework for easy implementation of intelligent environments which helps to integrate various devices. The project focused on visitor guidance and customer service tasks, but it may be adapted to other scenarios where ambient intelligence is required. It was designed to support various environments such as museums, hospitals, shopping centres, parking lots or office buildings. The system is able to assist and adaptively interact with its users depending on the available sensory and actuator devices (eg location services, sensors, RFID readers, screens, PDAs, smart-phones). At its core, ILI uses a real-time agent platform for decision making processes, augmented by a semantic data store, ontology and reasoner, making the project unique in its scope. We also created a pilot project to demonstrate the inherent facilities of the system: an augmented office at one project member's headquarters.

The architecture of the system follows a service-oriented design, with multiple loosely coupled modules that communicate through SOAP and REST. The structure is designed to be scalable and fault-tolerant. The main structure consists of three layers: a hardware-near layer that controls sensors, actuators, interactive devices and the software needed to connect them to the system; a middle-ware that polls and aggregates sensory data, and caches and distributes output data; and a processing layer that consists of an event handler, an agent system as real-time processor and decision maker, a semantic database and inference engine, a Content Management System, and various databases that are used by the previous components.

The hardware-near layer is augmented by software wrappers that make the hardware accessible to the upper layers. Interactive devices may run "heavier"client software. Possible sensors for a smart environment include RFID sensors, location providers (ie active ultra-wideband or ultrasound tags), cameras, smoke sensors, motion detectors and keypads (used for authentication, for example). Actuators may include various types of displays, speakers, phones, switchboards, door locks, gates and alarms. Interactive

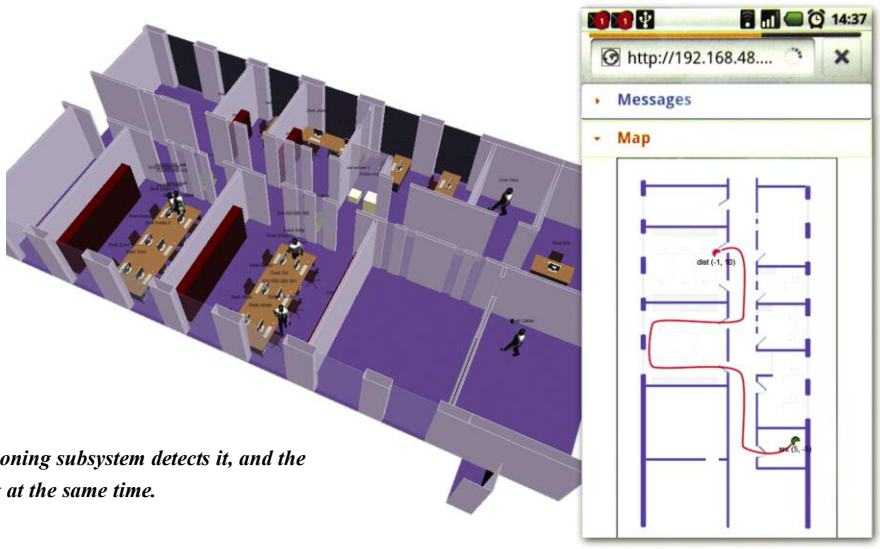


Figure 1: The office as the positioning subsystem detects it, and the indoor routing interface running at the same time.

devices may include kiosks, PDAs, smart-phones and touch screens. As every network-enabled device may be connected to the system, it essentially handles an internet of things.

The middle-ware layer polls the hardware sensors and optionally aggregates them, and sends the relevant events to the event handler. The middle-ware does complex filtering and low-level aggregation of input data, for example noise filtering or collision detection. For the actuators, it receives device-independent commands which are then transformed to device-specific formats, ie it performs modality switching.

The main control and decision making process is done by intelligent software agents that run in the real-time Cougaar agent platform. The Cougaar platform is transparently scalable and, as an agent platform, it is inherently modular. Each visitor/customer, and each device handled by the system is represented by a Cougaar agent, and these agents determine eventual system behaviour using message passing. A semantic database and inference engine (currently Jena) is also integrated into the agent platform, thus allowing semantic capabilities for all agents. Due to the inherent unpredictability of semantic inference times, the semantic layer can be used with time constraints: with rules to fall back to, or in an any-time fashion where simple rules provide a preliminary agent behaviour which is later augmented when the semantic inference completes.

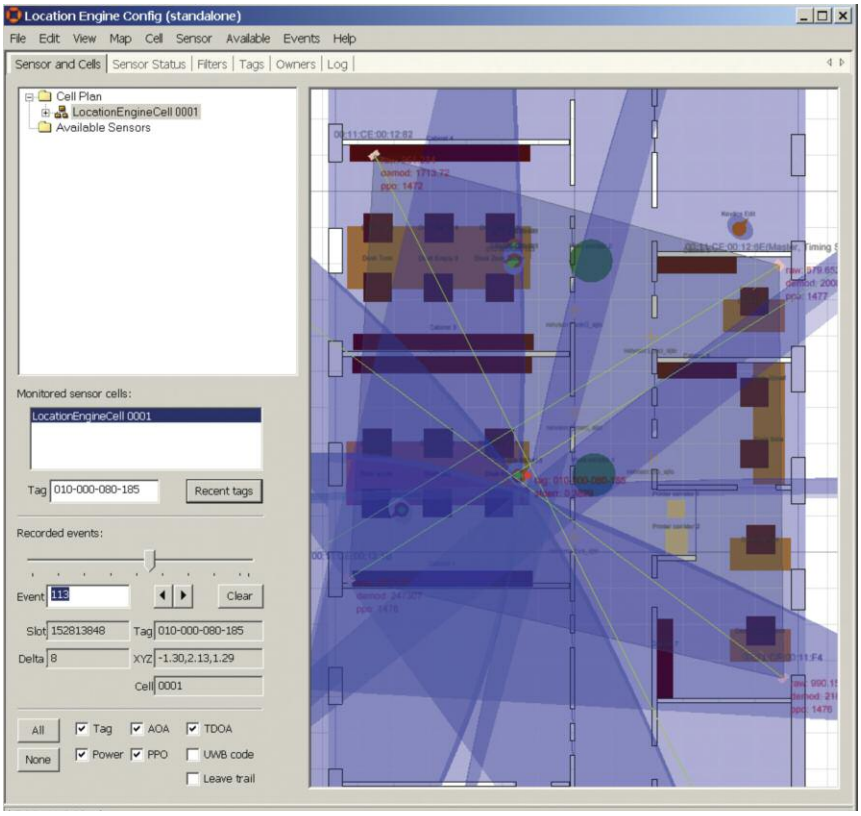


Figure 2: Coverage of UWB signals as reported by the location engine.

The pilot implementation facilitated intelligent behaviour and various services in an office environment. Ubisense UWB (ultra-wideband) indoor positioning system was used to provide location information about workers and visitors, enabling location-aware services, such as providing information about people and office devices in a context-sensitive manner and enabling automatic redirection of office phone calls. The pilot system provided indoor navigation as well, using a web-based interface designed for smart-phones, and displayed useful information in case of emergency on appropriate display devices, such as the position of people still in the building and possible escape routes.

ILI was concluded in 2010, as a result of a collaboration between p92 IT Solutions Ltd. and NETvisor Inc. development companies and SZTAKI. The project was partially funded by the Hungarian National Development Agency (NFÜ) in KMOP 1.1.4. Its industrial deployment opportunities are currently under negotiation.

Links:
http://dsd.sztaki.hu/projects/ili/en/
http://www.p92.hu/p92/?locale=en
http://www.netvisor.hu/en/index.html

Please contact:
László Kovács, SZTAKI, Hungary
Tel: +36 1 279 6212
E-mail: laszlo.kovacs@sztaki.hu

OntoFarm: An Ontology-based Framework for Activity Recognition and Model Evolution

by Liming Chen and Chris Nugent

OntoFarm aims to co-ordinate and streamline the core activities within the process of Activity Recognition within Ambient Assisted Living (AAL) towards a systematic solution that is scalable and applicable to real world use cases such as smart homes.

Ambient Assisted Living (AAL) is a recently emerged area of applied computing that aims to provide technology-driven solutions for independent living and ageing in place. It is a multi-faceted process that involves activity and environment monitoring, data collection and processing, activity modelling and recognition and assistance provisioning. Among these processes, activity modelling and recognition play a pivotal role. Activity assistance can only be provided once the activity an inhabitant performs has been detected. Activity recognition has received much attention in recent years. Techniques considered have progressed from image and video based processing systems to those that make use of an array of heterogeneous sensors, seamlessly embedded within the environment. Although contemporary machine learning techniques have been successfully applied within this domain, the ability of an activity recognition system to manage the diversity and uniqueness of all possible scenarios lies at the heart of the challenge in producing a truly scalable solution. In an effort to address this challenge a trend has been adopted which has moved towards using domain knowledge such as user activity profiles, domain-specific constraints and common sense heuristics as the basis for a new generation of approaches to activity modelling and recognition.

We have developed OntoFarm, an ontology-based framework for activity modelling, evolution and recognition as presented in Figure 1. OntoFarm aims to co-ordinate and streamline the core activities within the process of Activity Recognition within AAL towards a systematic solution that is scalable and applicable to real world use cases such as smart homes. The central concept of OntoFarm is that extensive a priori and domain knowledge are available in AAL, and formal knowledge modelling, representation and reasoning techniques can be used to develop a top-down approach to activity modelling and recognition. Ontologies have been adopted as the unified conceptual backbone for modelling, representing and inferring Activities of Daily Living (ADL), user activity profiles and contexts. Ontology engineering along with the Semantic Web technologies, such as ontology editors, languages, reasoners and semantic repositories, provide the enabling technologies for OntoFarm.

OntoFarm consists of four key tasks, namely Ontological Activity Modelling, Semantic-based Activity Recognition, Activity Learning and Activity Model Evolution. Each task is undertaken by a number of supportive components. The goal of the Ontological Activity Modelling task is

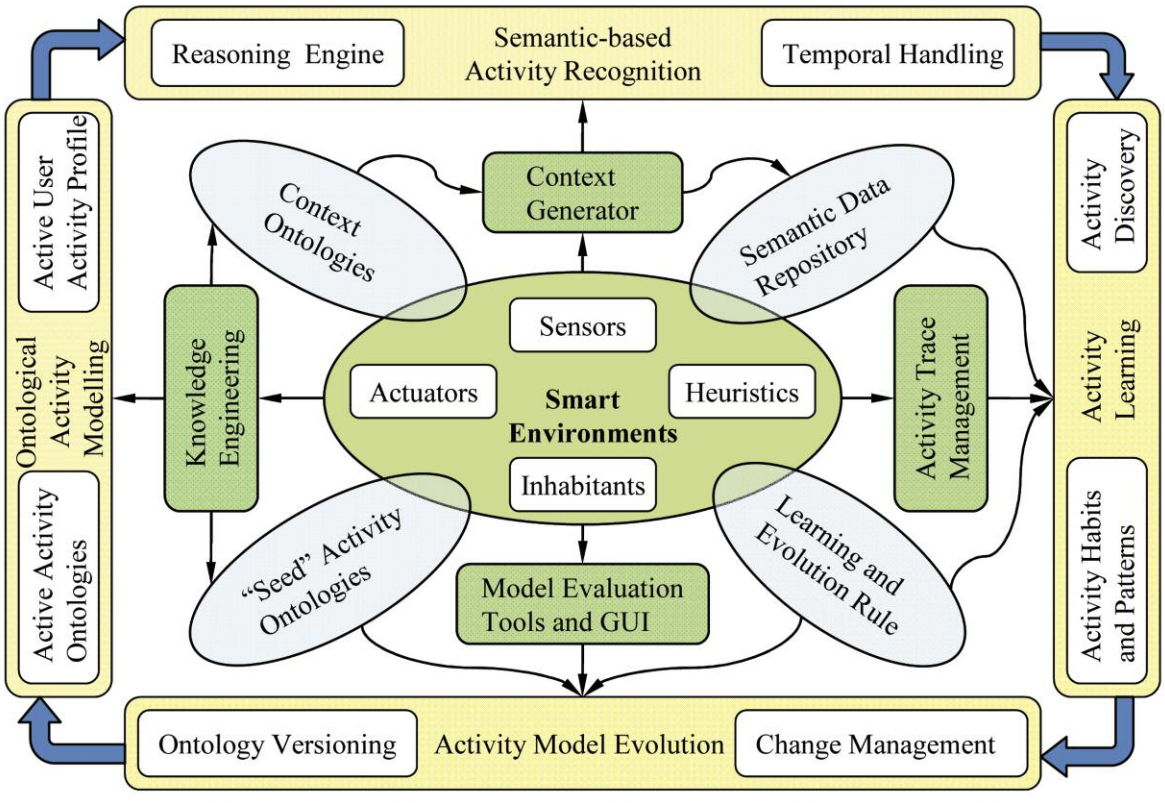


Figure 1: The ontology-based framework for activity modelling and recognition.

Figure 2: An OntoFarm-based assistive system.

to create a number of formal knowledge models by the Ontology Engineering component. These models include the initial activity ontologies, user activity profiles, context ontologies, and learning and evolution rules. The initial activity models are stored in the "Seed" Activity Ontologies component and used as the starting Active activity models for activity recognition.

The Semantic-based Activity Recognition task performs ontological classification using semantic subsumption reasoning to realise continuous progressive activity recognition in real time. It takes as inputs the active activity models and a context generated by the Context Generator and Context Ontologies components, and generates a sequence of activity traces in the Activity Trace Management component. These traces could be labelled activities already modelled in the seed ontologies or unlabelled activities that do not exist in the seed activity ontologies.

The purpose of the Activity Learning task is to identify the activities that a user performs which have not been modelled in the activity ontologies, and to learn the specific manner in which a user performs an activity. In this way, it can learn and adapt activity models in an evolutionary way according to a user's behaviour, thus addressing model incompleteness and accuracy. The task is accomplished by reasoning the activity traces and time series of sensor data using learning rules in the Learning and Evolution Rules component.

The Activity Model Evolution task identifies changes that need to be made for the previous version of models based on the discovered and learnt activities. In addition, it recommends the locations and labels for these new activities in the hierarchy of the ADL ontologies. Model evolution is supported by ontology change management and versioning techniques. Human intervention is required to review and validate the changes for activity models, which is facilitated by the Model Evaluation Tools component. Once the current version of the activity models is updated, it serves as the latest active activity models for future activity recognition.

The four key tasks interact with each other and form an integral lifecycle that can iterate indefinitely. As such, OntoFarm enables and supports the following compelling features, a top-down approach to activity modelling and recognition, incremental activity discovery and learning, adaptive activity model evolution, activity recognition at both coarse-grained and fine-grained levels and increased accuracy of activity recognition.

To date, OntoFarm has been investigated in three separate projects each addressing a specific aspect, ie, semantic context management, knowledge-driven activity recognition and activity learning and evolution. A prototype assistive system based on this framework has been developed and deployed in our dedicated smart environment lab where experiments and evaluation have been performed (see Figure 2).

Future work will focus on technical extension and full-scale implementation. We shall examine the more complex use scenarios such as interleaved, concurrent activity modelling and recognition. We shall also investigate temporal reasoning and uncertainty handling

Link:
Smart Environments Research Group:
http://serg.ulster.ac.uk

Please contact:
Liming Chen, Chris D. Nugent
University of Ulster, UK
Tel: +44 28 90368837/68330
E-mail: {l.chen, cd.nugent}@ulster.ac.uk

Robotic Ubiquitous Cognitive Networks

by Mauro Dragone, Sameh Abdel-Naby, David Swords and Gregory M. P. O'Hare

A team of researchers from UCD's Clarity Centre for SensorWeb Technology, Ireland, is leading the newly EU-funded project RUBICON (Robotic UBIquitous COgnitive Network). The project will develop a self-learning, adaptive robotic ecology consisting of mobile robotic devices, sensors, effectors and appliances cooperating to perform complex tasks such as supporting older persons to live independently in their own homes.

The principal goal of the project is to build systems whose components will encourage and teach one another in order to achieve their objectives more efficiently and to adapt to changing requirements and user's needs, as autonomously as possible. This will reduce the need for pre-programming and human supervision, and so will make these systems much cheaper and simpler to install and maintain in a variety of different homes and users.

RUBICON is a joint effort of nine partners from industry, research and the health sector, from five countries all over Europe and comprising about 400 person months at a cost of 3.3M€. The project commenced in April 2011 and its planned duration is three years. Rubicon will demonstrate the real-world value of its technology in two application environments, including an experimental facility for testing AAL applications.

Rubicon's researchers believe that self-learning robotic ecologies will reduce the complexity, and enhance the individual values of the devices involved by enabling new services that cannot be performed by any device by itself. Consider for instance the case of an automatic vacuum cleaner avoiding cleaning when any of the inhabitants are home after receiving information from the home alarm system, or the case of a robot monitoring a wireless sensor before seeking and warning the user that the stove was left on in the kitchen.

In order to effectively assist the user, current approaches strictly rely on models of the environment and of the daily activities they must recognize in order to provide context-aware services. However, they lack the ability to proactively and smoothly adapt to evolving situations, especially when these involve subtle changes in user's habits and preferences, or modifications to the environment. These limitations make such systems difficult to deploy in the

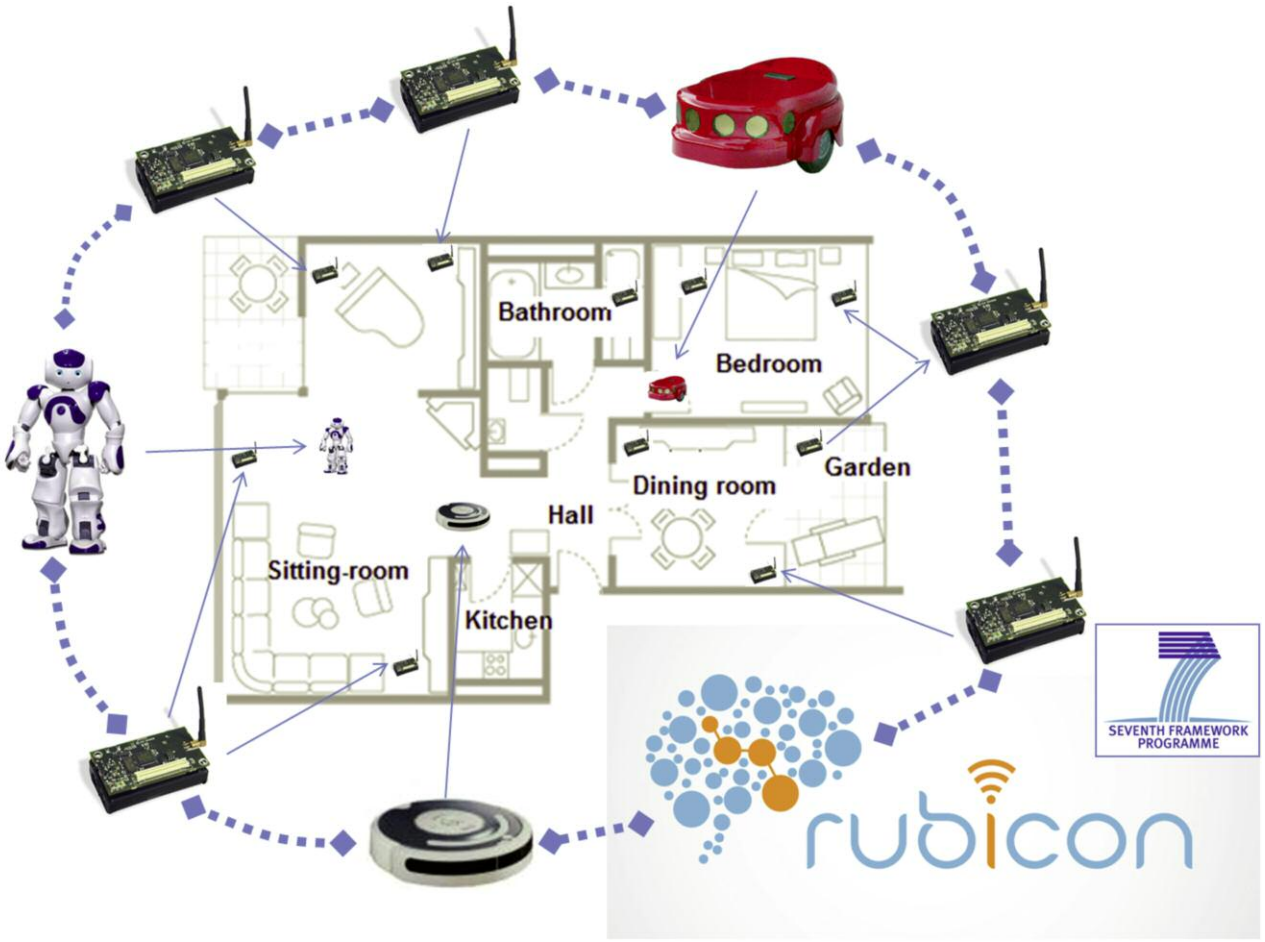


Figure 1: RUBICON will merge robotic devices and sensor networks in a pervasive artificial brain that will autonomously learn to adapt to the environment and perform complex tasks to supporting older persons to live independently in their own homes.

real world, as they must be tailored to the specific apartments, services and users, and they can soon become unmanageably complex and expensive.

RUBICON will tackle these problems by developing self-sustaining learning solutions yielding cheaper, adaptive and efficient configuration and coordination of robotic ecologies.

To achieve its aims, the consortium will use a unique combination of expertise in cognitive robotics, robot and agent control systems, wireless sensor networks and machine learning to integrate planning and distributed control solutions with statistical and computational (neuroscience) methods. Each node of the ecology will contribute to a shared collective knowledge and memory while engaging in collaborative learning with the other nodes by interacting through remote synapses, mimicking those linking neurons in biological nervous systems. Bio-inspired, novelty detection and habituation mechanisms will make the system capable of self-improvement, self-configuration, and pro-activity in helping the user and seeking learning opportunities.

By contributing to the development of novel technologies that combine communication with control and learning for robotic ecologies, the potential impact of RUBICON includes:

- Rubicon will simplify the installation, the use, and the maintenance of robotic ecologies in AAL settings, by supporting self-learning systems which improve their performance over time and autonomously adapt to changes in their environment and in the behaviour and preferences of the user(s) they assist.
- Rubicon ecologies will improve the quality of service offered in AAL settings, without the need for extensive human involvement. The ability to discriminate and to autonomously learn about the environment and the human activities therein will improve the quality of AAL services which can be delivered to the users and promote their large scale adoption.
- RUBICON ecologies will adapt to changes in the resources available, including replacement/updates of robots, added/removed sensing/acting devices and appliances. This will offer improved fault tolerance, service reliability, but also the potential for enhanced performance on the fly.

RUBICON is a three-year project, funded by the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement No.269914 ("RUBICON"). The project commenced in April 2011.

The CLARITY Centre is a partnership between University College Dublin, Dublin City University and Tyndall National Institute, Cork, supported by a CSET grant from Science Foundation Ireland (SFI).

Link:
Rubicon Web Site
http://www.fp7rubicon.eu

Please contact:
Mauro Dragone
University College Dublin, Ireland
E-mail: mauro.dragone@ucd.ie

AALOA - Towards a Shared Infrastructure for Realizing AAL Solutions

by Francesco Furfari, Reiner Wichert, Sergio Guillen and Joe Gorman

Ambient Assisted Living (AAL) has great potential to positively influence the lives of many people. But the impacts so far have been less than hoped, partly due to fragmentation of research efforts and the lack of a standardized approach for developers. To address this, we are forming AALOA (the AAL Open Association), and invite you to join in our efforts.

AALOA (AAL Open Association) is a growing community, officially launched during the AAL Forum held in Odense, Denmark, on September 2010, by researchers from different domains who had subscribed the AALOA Manifesto. The mission of AALOA is to create a shared open framework for developers, technology and service providers, research institutions and end-user associations to discuss, design, develop, evaluate and standardize common service platform(s) in the field of Ambient Assisted Living.

The AALOA Manifesto defines the rationale around which several European projects decided to join their efforts. It is a call for action addressing all stakeholders working in this area. The association is currently in the incubation stage, with the subscribers of the Manifesto organized into two groups: promoters and supporters. Promoters are interested in discussing and contributing to the organizational aspects of the association including the definition of the statutes, funding possibilities, liaisons with other organizations, definition of working groups and collaborations. Supporters are more focused on the scientific and technological challenges posed by AAL. Both groups together offer a good coverage of the multidisciplinary requirements needed for the development of AAL solutions.

A key point of the Manifesto is that transversal cooperation over diverse market segments is really needed to reach the AAL market breakthrough. The proposal is to develop an open and shared software infrastructure to be used as commodity by many stakeholders. To this end, AALOA is following a bottom up process with SMEs and research institutes aimed at reusing legacy software developed in national and international research projects. In order to encourage collaboration, AALOA is organized as a federation of projects, independent as far as design decisions and internal organization is concerned, but sharing infrastructure and resources to increase the visibility and adoption of their own findings. A second important (top-down) process will be the promotion of projects

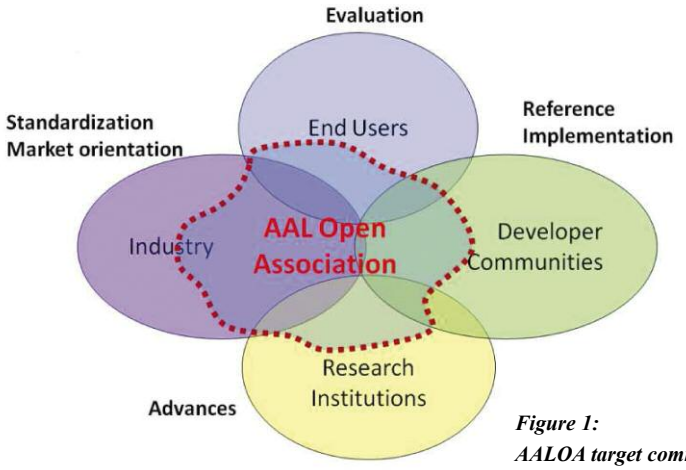


Figure 1: AALOA target communities.

directly proposed by the governance body of AALOA. This process will be initiated as soon as we have achieved a consensus on the needed infrastructure, namely a common set of guidelines, software interfaces and basic components on top of which to realize AAL services. To this end the converging interest of many stakeholders will be pursued in a transparent and open way by shaping AALOA as non-profit organization.

In this initial stage a number of IPR issues must be clarified before the code developed within the international research project can be published. However, a first set of projects has been already proposed. The most mature is probably ZigBee4OSGi, developed in the framework of the European FP6 project PERSONA. ZigBee4OSGi aims at integrating ZigBee based sensor networks with IP applications through a gateway based on the OSGi framework. It can be considered as a reference case for understanding the benefit of a community sharing the same technological infrastructure. Other members of AALOA working in the European FP6 project OsAMI have developed a similar solution based on Ember technology and will now join the ZigBee4OSGi project to extend the available solutions. ZigBee is an important technology for healthcare scenarios and future research projects as well innovative SMEs, providing an open and robust solution for sensor network integration. A community of 40 developers is following the Zigbee project and it is expected to be reused in other AALOA projects like HOMER (HOMe Event Recognition System) and universAAL an ongoing European FP7 project supporting the AALOA initiative.

At present AALOA initiatives are supported by the following European projects: BRAID (FP7), MonAMI (FP6), OASIS (FP7), OsAmI-Commons (ITEA2), PERSONA (FP6) , SOPRANO (FP6), universAAL (FP7) and WASP (FP6) and four European research institutes are actively promoting and allocating resources for AALOA: ISTI-CNR (Italy), Fraunhofer-IGD (Germany), ITACA-UPV (Spain) and SINTEF (Norway). Members of AALOA governing board are coordinating the Lecce Declaration - a call for a set of key measures to promote the market breakthrough of AAL, which will be sent as AAL community input to the high-level steering group preparing a pilot European Innovative Partnership on Active and Healthy Ageing.

Links:
http://www.aaloa.org/
http://www.aaloa.org/manifesto
info@aaloa.org

Please contact:
Francesco Furfari
ISTI-CNR, Italy
E-mail: francesco.furfari@isti.cnr.it

universAAL: an Open Platform and Reference Specification for Building AAL Systems

by Francesco Furfari, Mohammad-Reza Tazari and Vadim Eisemberg

universAAL is a European research project that aims at creating an open platform and standards which will make it technically feasible and economically viable to develop Ambient Assisted Living solutions. The project follows an open source license model and preliminary results are already available.

universAAL is a large research project funded by the EU FP7 program. It started in February 2010 and will run for four years. universAAL aims to reduce barriers to adoption and promote the development and widespread uptake of innovative AAL solutions. It will benefit end-users (ie elderly people and people with disabilities and their caregivers and family members) by making new solutions affordable and simple to configure, personalize and deploy. It will benefit solution providers by making it easier and cheaper to create innovative AAL services or adapt existing ones. The primary users of universAAL outcomes are software developers whose business is to create AAL services. The project will provide them with a platform offering a standardized approach to develop such services and resources to make this easier.

A variety of other projects have been funded in this area in recent years, including PERSONA, MPOWER, SOPRANO, and OASIS. In order to achieve a high acceptance of the emerging open AAL platform, universAAL will consolidate the earlier work by adopting and integrating earlier results where possible and making new developments where needed.

An early result of the analysis and consolidation of different input projects is the universAAL reference model. The

model specifies the project's view on the core set of domain concepts and the essential interrelationships among them. The reference model is described as a set of conceptual maps and the Root Concept Map – see Figure 1 – presents the consolidated understanding of AAL systems in a single picture using the fewest possible set of concepts. AAL systems are all about the provision of AAL Services. The importance of ambient technologies in the provision of such services is highlighted by putting the concept of AAL Spaces (aka Smart Environments) and the underlying technologies (Networked Artefacts) right in this top level map. The AAL Reference Architecture and the compliant AAL Platforms incorporate the engineering challenges beyond single technologies towards modular and interoperable infrastructures. The AAL Reference Architecture identifies the basic building blocks necessary for constructing an AAL Space, such as Home, Supermarkets, Cars or Hospitals. This facilitates the provision of AAL Services with the help of embedded Networked Artefacts that implement (or contribute to the implementation of) those AAL Services. The cooperation between Networked Artefacts distributed in an AAL Space is facilitated by an AAL Platform that implements the previously mentioned reference architecture in order to provide for resource sharing, context-awareness, and personalization.

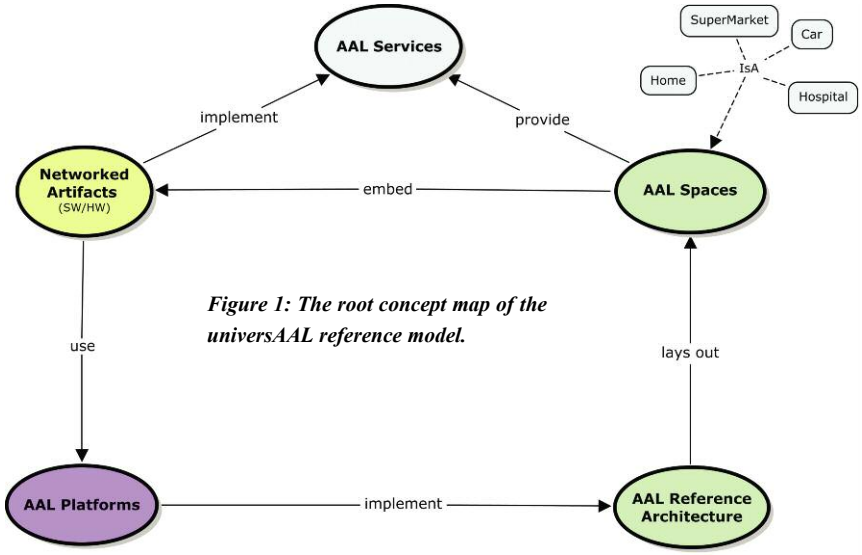


Figure 1: The root concept map of the universAAL reference model.

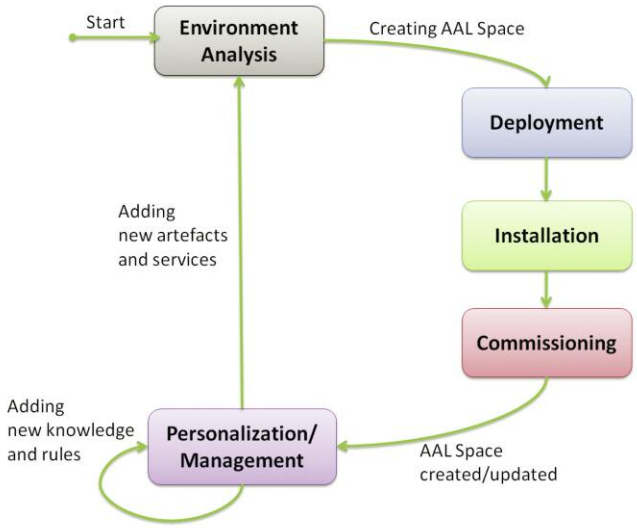


Figure 2: The AAL Space Design process.

AAL space are smart environments centred on human users. The devices embedded in such environments operate collectively using information and intelligence that is distributed in the infrastructure connecting the devices. AAL Spaces are classified in space profiles, each identifying the typical set of devices used in a specific AAL scenario; we distinguish between private space profiles, like homes, versus public space profiles, like supermarkets. Space profiles include industrial standards used by devices that currently populate market segments like e-healthcare, home and building automation (eg ISO/IEEE 11073 standards, IEEE 802.15 standards). The definition of space profiles makes it economically viable to develop heterogeneous products that are still interoperable, thus paving the way to the creation of a promising AAL ecosystem.

Another important aspect of AAL spaces is that they may be remotely managed. This is a typical requirement derived from use cases where a person is assisted by formal and informal caregivers (relatives, neighbors, and friends). Remote access and management of AAL space can be provided only after a design process that involves various professionals. The idea of standardizing the AAL space design according to a specific profile and following a well-defined process – as shown in Figure 2 - is essential to enable the seamless assistance needed by people traversing different environments. In particular, the commissioning of a system is related to the binding of those distributed services that cooperatively guarantee the basic common services characterising every AAL space (eg context information provision, user adaptation). In this way, end-users will experience an integrated world, easy to interact with, and based on natural communication where the complexity of the environment is mitigated and hidden by different ICT solutions (platforms) implementing a shared AAL reference architecture.

Details of the universAAL reference model are already available in public deliverables, which will be issued in multiple versions, as ideas and results in the project mature. The universAAL project is actively supporting the AALOA community (www.aaloa.org) and software results will be available as open source projects incubated by the AALOA organization.

Link:
http://www.universaal.org

Please contact:
Joe Gorman
UniversAAL project leader
SINTEF, Norway
E-mail: Joe.Gorman@sintef.no,
info@universaal.org

EvAAL: Evaluating AAL Systems through Competitive Benchmarking

by Stefano Chessa, Francesco Furfari, Francesco Potortì, Juan Pablo Lázaro and Dario Salvi

Owing to the complexity of Ambient Assisted Living (AAL) systems and platforms, the evaluation of AAL solutions is a complex task that will challenge researchers for years to come. However, the analysis and comparison of proposed solutions is paramount to enable us to assess research results in this area. We have thus organized an international contest called EvAAL: Evaluating AAL Systems Through Competitive Benchmarking. Its aims are to raise interest within the research and developer communities in the multidisciplinary research fields enabling AAL, and to create benchmarks for the evaluation and comparison of AAL systems.

The EvAAL competition is the first project incubated by the AALOA community. It aims at establishing benchmarks and evaluation metrics to compare different AAL solutions and assess advances in the field. In recognition of the complexity of AAL systems, in the early editions of EvAAL only AAL components will be compared. Later, as methodologies and tools of EvAAL become more mature, aggregates of components, services and even complete systems will be evaluated.

Figure 1: A picture of the CIAMI living lab taken from a camera on the ceiling.

EvAAL is organized as a multi-track conference, with each track covering different aspects, components or services of AAL systems. An annual call for ideas solicits track proposals. For each topic selected by the EvAAL steering board, a technical committee writes the call for competition and the rules (including benchmarks and evaluation metrics), and selects the competing teams from the applicants responding to the call for competition.

EvAAL will be run each year in a host living lab offering an environment that simulates every-day life situations. The participating teams are provided with a kit that includes available information about the living lab (including a map and interfaces to access its facilities such as cameras, automatisms etc.), the evaluation criteria and the evaluation software. Competitors are also supported in the adaptation/preparation of their artifacts by the technical committee.

The competition lasts several days with a time slot assigned to each competing team. The results are communicated at an award ceremony in a final workshop in which the status of the experiments is reported.

The first edition of EvAAL was run at the CIAMI living lab in Valencia in July 2011 with a single track entitled "Indoor Localization and Tracking". These topics were chosen because they comprise a very common building block of AAL systems that need to provide their services at the right time in the right place to their users. Seven teams (selected from ten applicants) from six countries (Austria, France, Germany, Spain, Switzerland, Ukraine) participated. The technologies and methodologies covered by the competing teams were extremely heterogeneous, including infra-red, ultra-sound, radio signal strength based on Wi-Fi and ZigBee and radio frequency phase measurements, and capacitive carpets.

During the competition, each system had to track the position of the user (impersonated by an actor) moving around the lab along pre-defined paths and standing in predefined spaces. Figure 1 shows a picture taken from a ceiling camera in the living lab. The red and blue signs on the ground mark the right and left steps along the predefined paths. Each system was subject to two benchmarks: Area of interest and tracking. In the first test, the system had to detect the presence of the user in five different square areas, with 50 cm sides (the areas of interest). In the tracking test, each system had to track the user along five different predefined paths. For each path, systems had to localize the user in real time by providing an updated position every half second. The paths and the area of interest simulated movements corresponding to specific activities of the user (eg cooking, waking up, etc.). In addition to the accuracy of localization information, four other metrics were used to compare the systems: installation complexity (measured as total number of minutes/persons required for the installation of the artifacts), availability (measured as the fraction of available localization data over the number of expected data), user acceptance (a grade given by the members of the evaluation committee), and integrability into AAL systems (a score dependent on the availability of libraries and tools for the integration of the artifact and on the use of standards and open source solutions).

The results of the competition were presented at the EvAAL workshop, an AAL Forum satellite workshop held in Lecce, Italy (26-28 Sept 2011).

We invite all those interested to participate in the process of identification of new topics and ideas (beyond localization and tracking) for the forthcoming editions.

Link: http://evaal.aaloa.org

Please contact:
Stefano Chessa
EvAAL Steering Board Chair
ISTI-CNR and Pisa University, Italy
E-mail:info@evaal.aaloa.org

Lecce Declaration: Towards a List of Proposed Measures

by Francesco Furfari, Antonio Kung and Saied Tarzari

In a move to improve the AAL research program, the AAL community has decided to make suggestions to the EC policy makers who are currently defining a strategic implementation plan for a European innovation partnership dedicated to active healthy ageing. This contribution has taken the shape of a declaration made public during the AAL forum in Lecce (September 2011). The declaration organisation committee explains the context of this initiative.

The necessity to address the societal challenge of ageing in Europe has led to a comprehensive on-going R&D program for AAL, which is now an integral part of the Digital Agenda for Europe: the 7th framework program funds longer-term R&D, the AAL Joint Program is dedicated to market-oriented R&D, and finally the ICT Policy Support Program within the Competitiveness and Innovation framework program supports initiatives related to deployment priorities. One consequence of this has been the emergence of a well structured European R&D community, as exemplified by the growing success of the annual AAL forum event.

The European Commission is also in the process of defining a strategic implementation plan for a pilot European Innovation Partnership on Active and Healthy Ageing that aims to increase the average healthy lifespan in the EU by 2 years by 2020. This plan should be finalised by the end of this year. Since AAL will be an important part of the plan, comments were made by members of AAL community on the need to improve the research program in order to bridge the gap between R&D and products, pointing out that many R&D activities focus on heterogeneous proof of concepts while insufficient attention was put into overall co-ordination.

A workshop organized by the AALOA initiative and the European Commission took place on June 7th in Brussels with the objective to exchange views on issues and discuss the need for funding. It was subsequently proposed to delegate to AALOA the preparation of a declaration that would be made public and discussed in a dedicated workshop during the AAL forum event in Lecce. The governing board of AALOA set up a declaration organizing committee that worked on a draft of such a declaration, initially inspired by a version published by the MonAMI project. This draft was then discussed in the AAL forum website where five consecutive versions were proposed.

The declaration is around the use of an open platform. A platform can be defined as a computing architecture including software and hardware that serves as a foundation to application programmers. Since it separates specific features implemented by a small community of system experts from application features implemented by a larger community of developers, it allows much easier development of applications. The development of the platform was undertaken in several projects of the AAL research program (Soprano, Persona, MPower, MonAMI, OASIS, I2Home, …) until a further project (UniversAAL) was launched with the objective of federating previous efforts. The launching of AALOA was made through UniversAAL.

But the creation of ecosystems based on a common platform involves long term support and coordination issues. For instance:

- There is a need for long term coordination to allow the integration of transversal features such as quality of service, liability, security, privacy, trust, quality of service, scalability. Such features are developed in other R&D programs. In particular coordination with other non AAL platform developments is needed.
- There is a need for long term coordination between research and products. AAL platforms should allow for the integration of novel features that are perhaps not yet ready for deployment. The research program is vast and long term. It has to cope with many research challenges. Two threads of activities are needed at the same time, the integration of research features into a platform that meets research requirements, and the integration of components in a platform that meets industry requirements.
- There is a need for long term coordination on interoperability. Given the complexity and diversity of the domain, interoperability is a challenging feature to integrate into AAL systems. Individual collaborative projects need to be coordinated according to an interoperability framework. Consensus building is needed.

The workshop dedicated to the declaration in the AAL forum will focus on different types of measures: identification of topics and priorities that can be addressed through today's funding instruments, measures which necessitate coordination within the program, and measures which would require changes in the program.

Examples of measures will relate to ecosystem building based on a common platform, definition of an interoperability framework based on this platform, long term support of a recognized body supporting the use of the platform in the future ecosystem, and long term support of a consensus building process.

The members of the declaration organisation committee hope that the contribution made through the Lecce declaration will shape positively the R&D and associated coordination landscape in Europe. They would like to thank the EC for its approach in concertation which has allowed the voice of the AAL community to be made public.

Links:
http://www.aaloa.org
http://www.aalforum.eu/group/leccedeclaration/

Please contact:
Antonio Kung
AALOA Governing Board Member
Trialog, France
E-mail: antonio.kung@trialog.com

Using 3D Digital Technologies in the Restoration of the Madonna of Pietranico

by Marco Callieri, Roberto Scopigno and Elisabetta Sonnino

ISTI-CNR has been involved in the restoration of the Madonna of Pietranico, a terra-cotta statue severely damaged in the 2009 earthquake in central Italy, contributing expertise in 3D scanning and geometric processing.

The Madonna of Pietranico, a Renaissance terracotta statue fragmented in many pieces in the 2009 earthquake in central Italy, has undergone a detailed restoration. The complexity of the task convinced the coordinators of the necessity to set up a multi-disciplinary working group, with different backgrounds and expertise, in order to design and implement the restoration. The work was coordinated by Lucia Arbace (Cultural Heritage Superintendent of the Abruzzi Region) and by the chief restorer Elisabetta Sonnino. Although it was planned to employ traditional materials and methodologies, it was decided that the work should also be assisted by the application of digital technologies. Some innovative procedures were thus designed and developed to manage the reassembly and restoration process.

A first important contribution was to produce a hypothesis for the recombination of the fragments of the statue. This initial phase of study and evaluation was performed on digitized 3D models of the fragments, with the aim of reducing the need to manipulate them physically, thus preventing further damage, and increasing the possibility of testing and evaluating different reassembly options. The accuracy of 3D scanning and the availability of software tools for their manipulation and visualization allowed us to manage this phase successfully (see the digital recombination of fragments in the image in Figure 1).

The next task was the design of the supporting structure (to hold all the fragments together). This phase was again accomplished by the synergic combination of consolidated restoration and mechanical methodologies with digital simulation, visualization and rapid prototyping techniques. This activity was coordinated by Antonio Iaccarino Idelson in cooperation with the restorers and the technical partners. The empty space within the sculpture, between the adjoining fragments, was precisely revealed by the digital reassembly. This visualization allowed us to "print in solid" the shape of the internal cavity and to use this to provide a rigid support for the fragments. 3D digital models were thus used to design and produce an innovative supporting structure, constructed with a rapid prototyping device (a 3D printer) by Tryeco srl.

Another important contribution was the study and virtual restoration of the polychrome decoration of the statue. On the basis of the traces remaining, our aim was to reproduce in the virtual 3D domain the very complex original polychrome decoration,. A side effect of this activity was to obtain insight into the limitations of current technologies in reproducing pictorial decorations over digital 3D models, and the consequent need for further improvements at the level of the digital tools.

A secondary goal of the project was to preserve the knowledge gathered on the artwork, including its history, its religious value and the restoration actions applied; a professional film director, Michele Bevilacqua, has produced a film documentary that presents the entire story in a pleasant and easy to follow manner; this video will be presented in museum exhibitions and, hopefully in the near future, on the web.

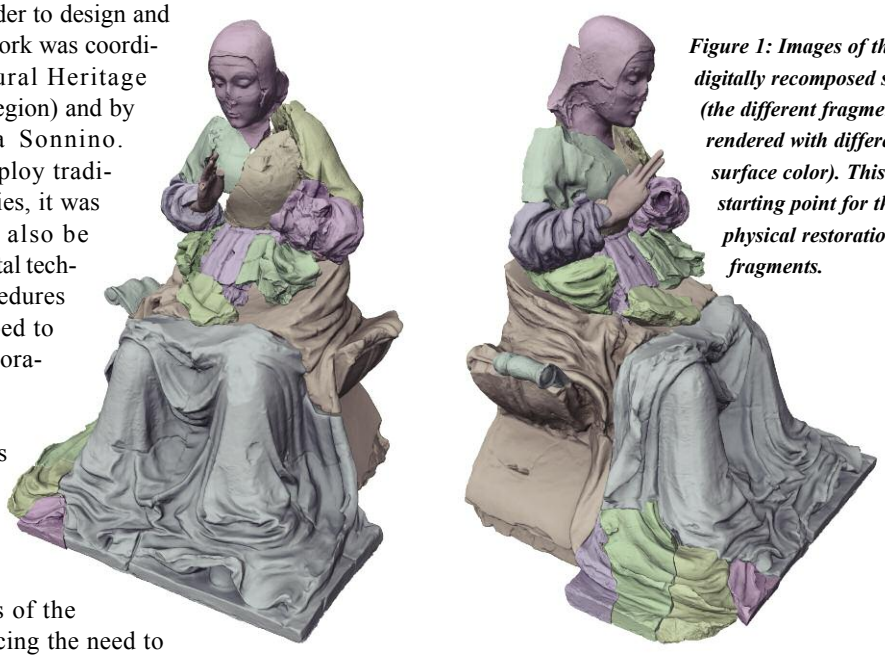


Figure 1: Images of the digitally recomposed statue (the different fragments are rendered with different surface color). This was the starting point for the actual physical restoration of the fragments.

In conclusion, this restoration of the Madonna of Pietranico can be considered as a good example of how a modern restoration project should be planned and implemented. Consolidated solutions and procedures have been linked with a search for new approaches to solve specific problems. In many cases, the new methodologies were designed as a result of a collaboration between partners with very different backgrounds and made an extensive use of the digital media (3D scanning, geometric processing, virtual reassembly, visual analysis, rapid reproduction, and finally computer animation used for purposes of documentation). The work was extremely practical, driven by the specific needs of the restoration, and has allowed us to demonstrate the real effectiveness of new technological solutions.

Please contact:
Marco Callieri or Roberto Scopigno, ISTI-CNR, Italy
Elisabetta Sonnino, Abruzzi Region, Italy
E-mail: roberto.scopigno|marco.callieri@isti.cnr.it, bettasonnino@gmail.com

Inventory and Supply Chain Optimization

by Peter Korevaar, Ulrich Schimpel and Richard Boedi

Imagine, you have to supply your customers from an inventory of several hundred thousand parts, handling tens of thousands of orders per week. Overall, you want these customers to be satisfied with at least 95% service level (number of customer requests that can be immediately satisfied.) Further, imagine your inventory comes from over one thousand suppliers with strongly varying package conditions, price structures and delivery times. At the same time you want to minimize overall costs, consisting of distribution-center inventory, handling and transportation costs. And finally, you want to manage all of this dynamically over time with a limited computational investment.

The challenge

The above described challenge is not new and as a result many inventory and supply-chain management tools exist. In the real world, where so many variables are important, an exact solution is impossible to be calculated within reasonable computation time. For this reason, the authors developed many approximation algorithms. After several years of theoretical investigations, it was time to put these ideas to a real-life test. A German automotive manufacturer proved to be an ideal –albeit most challenging– test opportunity.

There were two main objective goals: maximizing the system-wide service level with a specified cost or minimizing the total cost for a given service level. System-wide means, that the overall service level of a group of parts is reached, though individual parts can have a different service level. The consideration of the system-wide service level makes the task difficult since changing the service level of one part including the option of not storing it changes the requirements of all other parts. Further, stability over time is required: Once the decision has been made to stock a part at the regional distribution center this decision has to be taken into account for future optimization runs.

The first application attempts made by the authors of this study showed erratic results: small changes in some of the parameters resulted in wildly different stocking policies for a

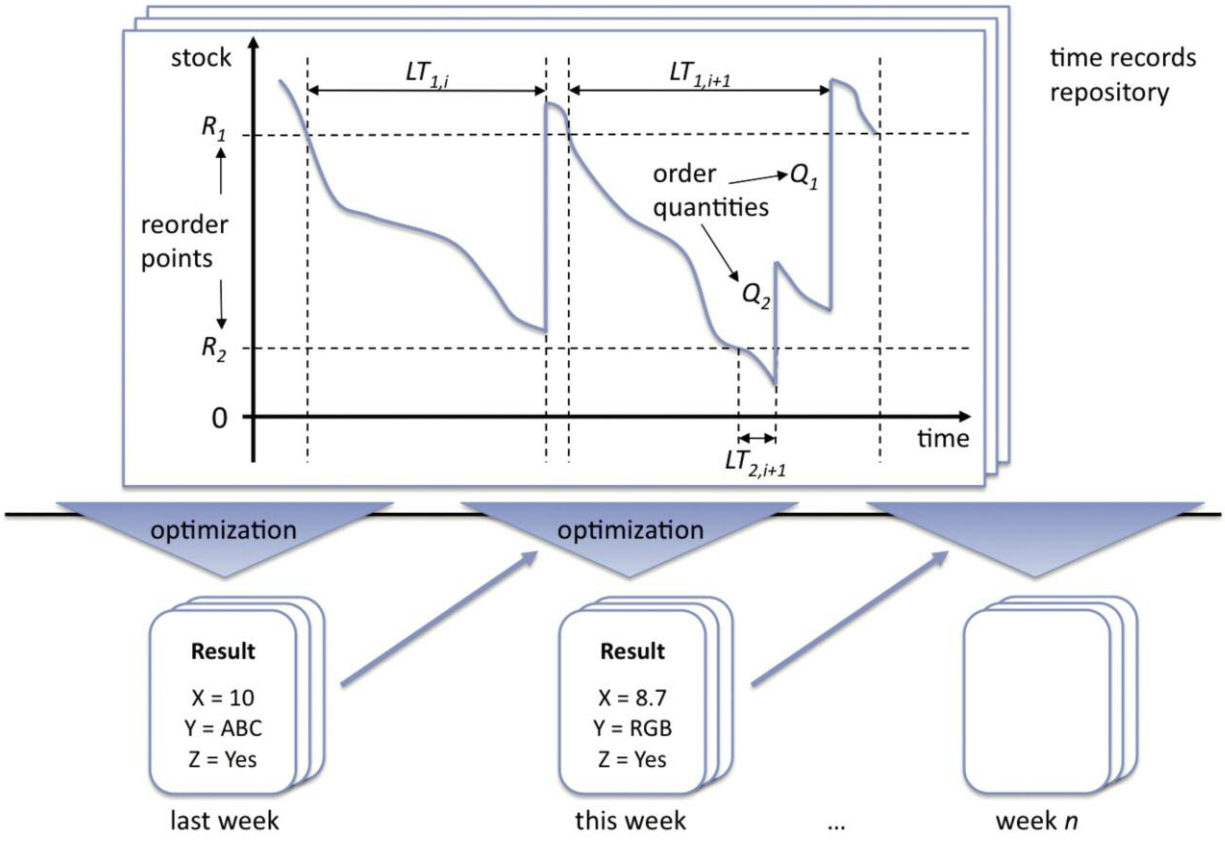


Figure 1: Inventory for one specific item.

large number of parts. This was resolved through a two-step approach. In the first step, extensive simulations for each of the many parts were used to obtain relations between the individual service level and the reorder point. (The reorder point specifies at which inventory level a particular part should be reordered to reach the specified service level.) For each part, the stochastic input for this simulation was the observed history. The resulting relation between service level and reorder point cannot be described by simple distributions, which prohibits using simpler approaches.

The figure shows the inventory for a particular part as a function of time. In the first epoch, the inventory reduces until the calculated reorder point (R_1) is reached. An order is then placed and after a certain amount of time ($LT_{1,i}$), the ordered quantity of items arrives to replenish the stock. In the second epoch, the demand during the lead time $LT_{1, i+1}$ is so large that one expects a stock-out situation before the ordered quantity arrives. In order to avoid this situation, a rush order is placed at the point R_2 (rush order reorder point). Rush orders are more expensive but arrive after a short period of time. The stock is quickly restored above the minimum level, declines, and finally increases above R_1 when the normal order arrives.

Many further restrictions and interactions make the solution even more complicated. This paper glosses over all these details and the interested reader is encouraged to look at the link below for a more complete description.

Please contact:
Ulrich Schimpel
IBM Zurich Research Lab, Switzerland
E-mail: uls@zurich.ibm.com

Link:
http://www-05.ibm.com/de/automotive/downloads/inventory-budget-optimization.pdf

A Natural Interaction System for Neurocognitive Rehabilitation of Neglect Syndrome Patients

by Gianpaolo D'Amico, Lea Landucci and Daniele Pezzatini

We describe the design and development of a natural interaction system which provides a novel solution for neurocognitive rehabilitation in people affected by neglect syndrome.

Experimentation with natural interaction principles and advanced interactive solutions is a new approach in the rehabilitation and evaluation of patients with neglect syndrome. Our work aims at improving on the conventional pen and paper approach used for many years in this field.

This project is the result of a multidisciplinary collaboration between MICC - Media Integration and Communication Centre of the University of Florence (Italy), the Faculty of Psychology of the University of Florence (Italy) and Montedomini A.S.P., an Italian public agency offering welfare and healthcare services for self sufficient and disabled elderly people.

Neglect syndrome

Neglect syndrome is a neuropsychological condition caused by damage to one of the brain's hemispheres. This syndrome causes a deficit in processing and perceiving stimuli on one side of the body and/or the environment. The main symptom is a loss of awareness of one side of the field of view. For example, a stroke affecting the right lobe of the brain can lead to neglect in the left side of the field of view, causing a patient to behave as if sensory space does not exist on this side. Such patients are unable to go through a door without hitting the jamb, or to eat a meal without leaving the left part of the plate completely untouched.

Rehabilitation treatments that have been tested with variable degrees of success include enhancing patients' awareness of their perception issues, for example by teaching them to rotate their heads to receive information on the ignored visual field. Doctors and therapists currently use pen and paper cognitive tests in order to assess the severity of the syndrome and exploit similar conventional techniques in rehabilitation training.

The natural interaction rehabilitation system

Our solution consists of an interactive environment in which patients accomplish different tasks in order to estimate their neurocognitive condition (testing phase) and support rehabilitation activities (training phase). The tasks consist of predefined exercises focused on the following elements: attention, memory, perceptual disturbances, visual-spatial disturbances and difficulties in executive functions.

Training phase: an elderly patient using the interactive tabletop at Montedomini.

Patients interact with an augmented reality system which provides digital content aimed at stimulating gestures and tasks similar to those that would occur in their daily life. A natural interaction multi-touch table is used to simulate a familiar situation: a dirty table to clean. The table supports the manipulation of digital content, letting users interact through natural gestures. Patients are asked to move a real sponge on the interactive table in order to physically erase spots displayed on the screen.

The testing phase consists of gathering information on the severity of the condition and progress of the patient, whilst the training phase encourages the exploration of the neglected hemifield through various procedures. The set of the spots (stimuli) displayed on the table can be configured according to four parameters: number, location, size and nature. Currently it is possible to visualize stains made of coffee, oil, water and dust. Doctors and therapists can create different degrees of difficulty which can be individually tuned to patients according to several parameters (response speed, exposure time of a stimulus, spatial distribution of stimuli, involved sensory channels, audiovisual tasks, number of stimuli to control, etc.).

All the activities during the rehabilitation sessions are monitored and automatically stored in a database so that a personal profile of each patient can be built in order to estimate performances in terms of accuracy (number of erased spots), time spent in accomplishing the task and trajectory of movements. In this way, medical staff can work with a novel diagnostic tool which provides useful information, statistics, charts and high-level data for the evaluation of patients.

The system was installed in the laboratories of Montedomini A.S.P. in Florence in July 2010. During the first year, the Montedomini staff experimented with the system on about 30 patients with different ages and levels of disease. The first results are very promising from both medical and patient viewpoints. The data collected are currently being analysed in order to scientifically validate them.

Future directions of the project will address the design of new training modalities by means of enriched dynamic contents (audio-visual and moving objects, diverse shapes, etc.) and collaborative functionalities involving medical trainers and patients simultaneously.

Acknowledgements
The authors would like to thank Nicola Torpei, Prof. Maria Pia Viggiano, Sergio Costanzo and Monica Dainelli for their invaluable work during the project.

Links:
http://www.micc.unifi.it/
http://www.montedomini.net/
http://www.psico.unifi.it/
http://www.micc.unifi.it/projects/multi-user-interactive-table-for-neurocognitive-and-neuromotor-rehabilitation/
http://marsicanus.free.fr/Publications/2007_Curr_Opin_Neurol.pdf

Please contact:
Gianpaolo D'Amico
University of Florence, Italy
E-mail: damico@dsi.unifi.it

Motorway Traffic Control Benefits from European C4C Project

by Jan H. van Schuppen

To decrease traffic congestion and to facilitate a smooth traffic flow, researchers of the European C4C project developed new mathematics and computer engineering. The associated software made by IT company Trinité will be used by the traffic control centers of Rijkswaterstaat, the Netherlands' motorway authority. The C4C project (Control for Coordination of Distributed Systems), which is coordinated by CWI and in which both companies and research institutes took part, ended on 31 August 2011. Until now, the project was twice evaluated as excellent by independent reviewers.

The traffic control center of the 80 x 50 km motorway network around Amsterdam uses software based on mathematics, and in particular control theory. In the C4C project a new module (a scenario coordination module) has been developed that allows road operators to evaluate interactions of the different control measures like speed control, ramp metering, and routing advisories. Operators were very positive during evaluation interviews.

Other results from the C4C project include case studies, such as the control of underwater vehicles, automatic transportation of containers on a terminal, and control of complex machines. Autonomous underwater vehicles at the University of Porto were able to follow online specified paths and demonstrated cooperation. They were produced by the company Oceanscan. For formation flying of groups of those underwater vehicles, algorithms were developed and tested. For efficient container transport from the quay to a yard on the container terminal of PSA Antwerp, several algorithms were made that were shown to be effective, non-blocking (two parts of the system do not block each other), and efficient. Finally, supervisory control was developed for high-quality printers of Océ Technologies to control the operation of the machines.

The C4C case studies required the solution of several mathematical and computer science challenges. Coordination control of distributed systems was needed to control the joint operation, of, for instance, the different parts of the road network. The interaction of subsystems in a distributed system is handled by a subsystem called the coordinator. A software package - Ariadne – had been made, which provides computer programs that approximate reachable sets of hybrid systems based on the mathematically-rigorous theory of computable analysis. To allow researchers to efficiently use several software packages, other computer programs were further developed that convert the data of a model from the format of one program to that of another program (Compositional Interchange Format).

Coordination control of distributed systems was new developed for the project. In coordination control a coordinator

Information board displaying the location of congested traffic in red on the ringroad of Amsterdam (Source: Trinité).

directs the activities of two or more subsystems and takes care that the subsystems do not interfere with each other. For an example think of the coordinaton of the activities of several underwater vehicles. Developed was a control synthesis method for the controllers of the coordinator and of the subsystems. Coordination control was developed for linear systems, stochastic systems, and for discrete-event systems. In addition, a form of control was developed in which the different controllers at the local subsystems exchange information for the control actions. This form of distributed control with communication between controllers has so far received little theoretical attention. Coordination control has been applied to formation flying of underwater vehicles, airplanes, ramp metering on motorways, and for a paint factory demo of a control laboratory. The perspective is for more research on control of multi-level or hierarchical systems and on coordination control. For communication in distributed systems the concepts of directed information was further developed and applied to the characterization of capacity of communication channels.

The project has been financed by the European Commission (via the FP7 ICT Program; INFSO-ICT-223844) and started on 1 May 2008. The project was so far twice evaluated as excellent by three independent reviewers, in particular for the very effective relation between commercially-motivated technologically-advanced engineering problems and very innovative theory. The participants of the C4C project are: Centrum Wiskunde & Informatica (CWI) in The Netherlands, the Center for Research & Technology - Thessaly (Greece), Delft University of Technology and Eindhoven University of Technology (both from The Netherlands), the Universities of Cyprus, Gent, Porto, and Verona, and the companies Oceanscan - Marine Systems & Technology (Porto, Portugal), PSA Antwerp (Antwerp, Belgium), Océ Technologies B.V. (The Netherlands), and Trinité Automation B.V. (The Netherlands).

Link:
http://www.c4c-project.eu

Please contact:
Jan H. van Schuppen (project coordinator),
Centrum Wiskunde & Informatica (CWI);
J.H.van.Schuppen@cwi.nl

SIDERA - A Simulation based Software Development Environment for Automotive Applications

by Alexander Hanzlik

Simulation based design approaches become more and more important in development processes for automotive embedded systems. The benefits of such approaches in software development processes are, among others, reduced hardware needs during development, better analysis capabilites and reduced time for building and loading resulting in shorter development times. The technical challenge is to switch between the software development and test environment and the real system without modifications of the original code. This challenge is addressed by SIDERA, a Simulation based Integrated Development Environment for Real-Time Applications that supports the development of software modules for FlexRay based vehicle control systems.

Modern vehicle control systems are distributed systems, built from spatially separated electronic control units (ECUs) interconnected via a shared communication resource. ECUs are embedded systems that control one or more of the electrical systems or subsystems in a vehicle. Different ECUs are assigned different control tasks, like engine control, chassis electronics, comfort electronics and more.

For communication between the different ECUs in a vehicle, time-triggered communication systems like FlexRay are particularly suitable due to their deterministic behavior. Time-triggered communication systems guarantee an a-priori known maximum message transmission time using a collision-free access to the shared communication resource.

The FlexRay industry consortium drove forward the standardization of a time-triggered fault-tolerant communication system for advanced automotive applications. With completion and delivery of the final version of the FlexRay specification the consortium disbanded in 2009. Currently, activities are in progress to integrate the FlexRay standard into the ISO catalogue of norms.

AUTOSAR is an open and standardized automotive software architecture, jointly developed by automobile manufacturers, suppliers and tool developers. The AUTOSAR consortium provides standard specifications for the FlexRay communication stack that define the interaction between host application and FlexRay communication controllers via standardized interfaces. These interfaces hide hardware related dependencies from the host application and allow to incorporate FlexRay communication controllers from different vendors without impacts on the application software.

SIDERA architecture

SIDERA is a simulation environment for time-triggered communication systems. It allows the execution of the FlexRay protocol on simulated communication controller networks. It is a pure software solution - simulation is performed on a single computer system without the need of special (communication controller) hardware. A host application interface allows to incorporate and run user provided code on the simulated communication controllers. This mechanism allows analysis and debugging of existing application software modules in a simulation environment as well as development and test of new application software modules prior to integration into the real system.

The SIDERA software architecture consists of a set of layers, namely the host application layer, the kernel interface layer SKERNELAPI and the runtime kernel layer SKERNEL. The AUTOSAR FlexRay module is the protocol-specific part of the software architecture and contains the implementation of the FlexRay Interface for the host application. The mapping of the different software layers to the system model components is shown in Figure 3.

The host application layer contains the host application to be tested. It communicates with one or more communication controllers using the AUTOSAR FlexRay module.

The AUTOSAR FlexRay module consists of the FlexRay Interface (FrIf) that controls one or more FlexRay Device Drivers (Fr). The Fr part hides the vendor specific hardware and implementation details of each communication controller in a set of standardized functions accessible by the FrIf.

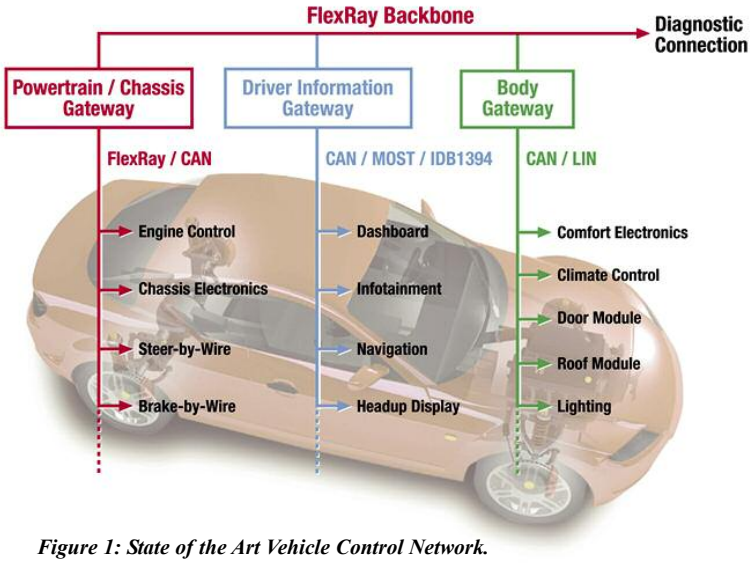


Figure 1: State of the Art Vehicle Control Network.

Last, the SKERNELAPI layer provides access functions for control of the SKERNEL to allow for direct manipulations of the system model (e.g. take a specific ECU out of service for fault injection experiments).

Features

Graphical User Interface (GUI) - The GUI allows control of the simulation process as well as subsequent analysis of simulation results. The user may customize what is logged and how the logged data is presented (see right hand side of Figure 4).

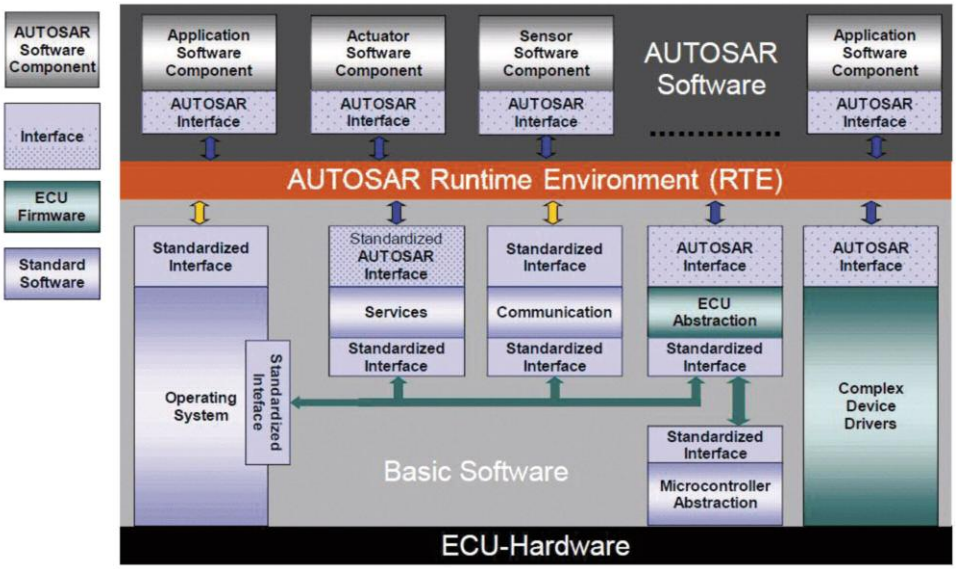


Figure 2: AUTOSAR Software Architecture.

FIBEX file handling - For simulation of FlexRay clusters, a FIBEX file is needed. This file contains all characteristics of the FlexRay cluster, including the hardware structure (the number of ECUs and the number of communication channels) and the communication schedule (the assignment of communication bandwidth to ECUs).

FlexRay Cluster Hardware Simulation - The hardware simulation part includes simulation of the host CPU, the communication controller and the FlexRay communication channel characteristics according to the contents of the FIBEX file.

FlexRay Protocol Simulation - The FlexRay protocol simulation part provides simulation of the FlexRay protocol services (according to the FlexRay Communications System Protocol Specification) including clock synchronization, communication and message frame construction and distribution.

AUTOSAR Software Interface - SIDERA provides implementations of the AUTOSAR FlexRay Interface and of the AUTOSAR FlexRay Device Driver Interface, respectively (according to the AUTOSAR Standards) for communication between a host application and the simulated communication controller(s).

Reference applications

SIDERA has been used for the investigation of synchronization mechanisms in the Time-Triggered Architecture and in FlexRay based communication systems. The latest application of SIDERA was the development of a software module for a driving dynamics controller ECU in a FlexRay vehicle control network. Originating from research in the course of a PhD Thesis at the Vienna University of Technology, SIDERA is an ongoing research and development project, driven forward by the author since 2006.

Link: http://www.sidera.at

Please contact:
Alexander Hanzlik
AIT Austrian Institute of Technology / AARIT Austria
E-mail: ahanzlik@gmx.at, alexander.hanzlik.fl.@ait.ac.at

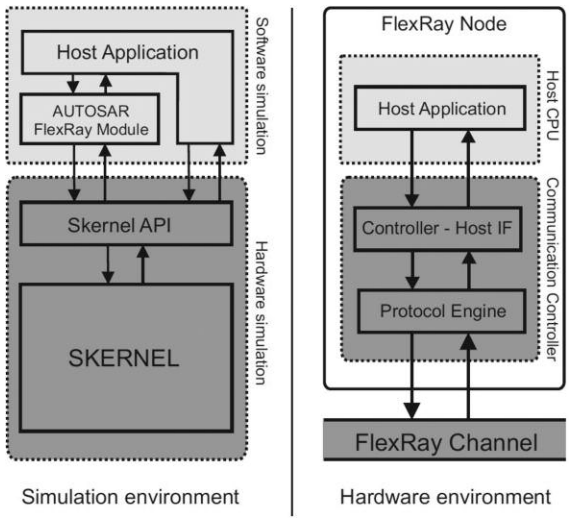


Figure 3: SIDERA Software Architecture.

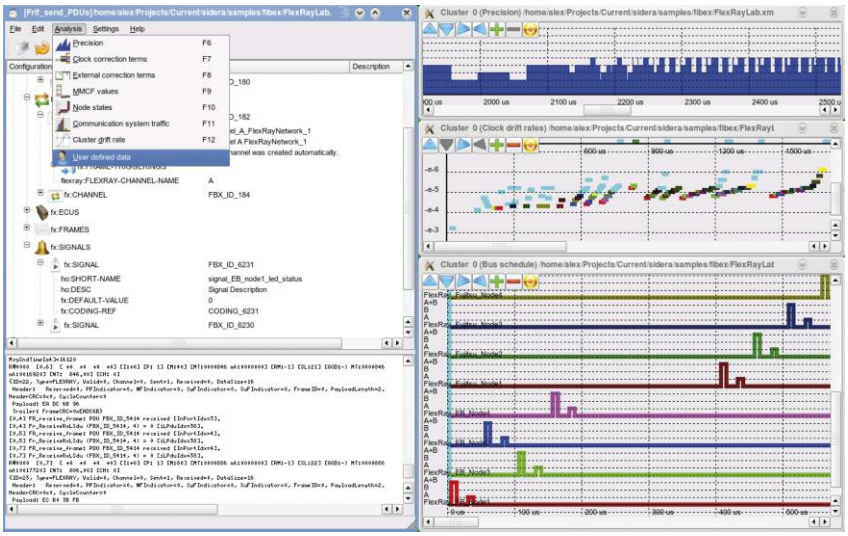


Figure 4: SIDERA Graphical User Interface.

Better Conversations for Better Bones: OsteoLink, the World's First Social Network for Osteoporosis

by Denys A. Wahl, Laurence Triouleyre and Victoria Monti

OsteoLink combines online and in-person activities to bring a new community-based approach to osteoporosis management

Osteoporosis is a disease characterized by low bone mass and deterioration of bone tissue, resulting in an increased risk of fractures. Globally one in three women and one in five men over the age of 50 will suffer an osteoporotic fracture in their remaining lifetime. Importantly, osteoporotic fractures cause pain, deformity, disability, loss of independence and social isolation. The economic burden of osteoporosis in Europe is significant. Total direct medical costs are estimated at €36 billion a year and are expected to double by 2050 with the ageing population. Despite the availability of treatments and educational awareness, there is a problem of low compliance to treatment, leaving the patient a high risk of fracturing a bone.

In 2009, the International Osteoporosis Foundation (IOF) conducted a multinational survey to investigate any existing gaps between physician and patient understanding of osteoporosis. It aimed at understanding barriers to patient compliance and identifying ways to address unmet needs and improve communications. Telephone interviews were conducted with 844 patients and 837 physicians in 13 European countries.

The findings revealed clear disparities in patient and physician perceptions of osteoporosis, indicating a need for increased patient support. Findings also showed that patients feared fractures, yet their compliance to treatment was poor, shedding light on communication shortcomings. Most patients expressed the need for easy-to-understand materials and greater interaction with their physicians and with other patients. In addition, physicians agreed that osteoporosis organizations were among the most credible sources for information [Rizzoli et al. (2010) Arch Osteoporos 5: 145–153].

To help address these communication gaps and respond to needs expressed by patients, IOF, in partnership with the University of Geneva (Switzerland), developed the OsteoLink project, a new community-based initiative. OsteoLink is the first online and in-person social network for people with osteoporosis, their friends, family and healthcare professionals.

The creation of an online and in-person community initiative is supported by data showing that people over 50 were the fastest growing users of the Internet – particularly in Europe. More people at this age are using social networking websites to stay in touch, and to find assistance on medical matters. The OsteoLink project demonstrates that, contrary to popular opinion, an increasing proportion of people over 50 use the Internet on a daily basis to research their health problems and discuss them online. OsteoLink makes it easier for people to share their experience, find credible, up-to-date information about osteoporosis and learn from one another.

OsteoLink is led by collaborative task forces of IOF member National Societies (about 200 societies worldwide, including 87 in the European Union), to ensure each community is relevant to the local needs of people with osteoporosis, to their culture and their language. The task forces create OsteoLink (online and in-person) networks that best suit the needs of the osteoporosis community at the country level. The project is funded by grants from the EU and the Swiss Confederation through the Ambient Assisted Living (AAL) Joint Programme on research, Amgen (Europe) GmbH in collaboration with GlaxoSmithKline (GSK), and other partners.

OsteoLink is currently piloted in Sweden and Austria since December 2010 and recently launched in Switzerland and

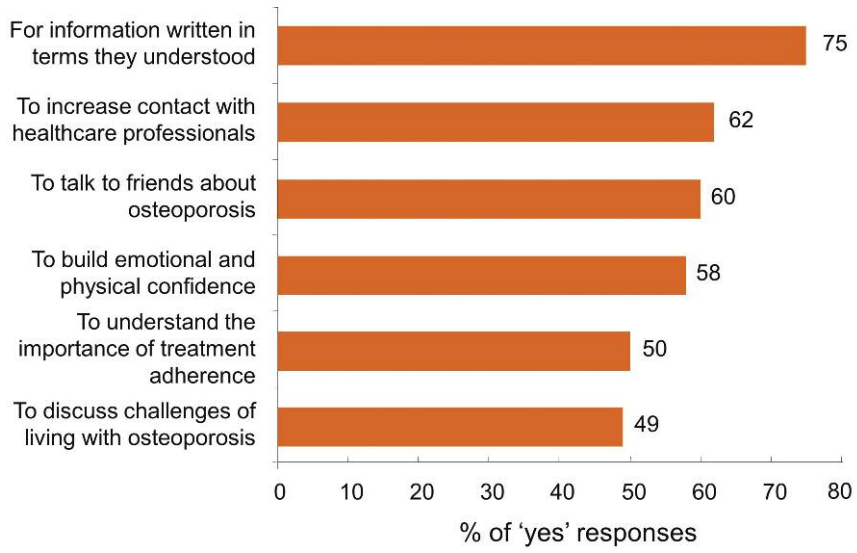


Figure 1: Helpful support for managing osteoporosis; percentage of 'yes' answers from a survey of 844 patients across Europe.

Australia. As of September 2011, Austria counts 1,707 unique visitors and 118 active users who post blogs and comments on the forum. Over 40% of the visitors returned to OsteoLink more than 25 times, suggesting a higher than average quality of experience. Sweden had 1,692 unique visitors and 147 active users and received over 27,237 page views. Discussions focus on prevention, research and healthy living. In order to limit costs and ease the development and management of the OsteoLink platforms, all new platforms will use the free-of-charge open-source content management system Umbraco.

Figure 2: Screen shot of the OsteoLink homepage in Sweden.

OsteoLink's global media launch in March 2011 drew attendance from nearly 200 Osteoporosis Societies and 27 journalists either in person or by webcast. By the end of 2011, OsteoLink platforms will go live in Germany, Greece and Portugal with an expected growth of five more country-based platforms per year in the coming years.

Communities take time to develop. Once a critical number of users is recruited, sites tend to grow exponentially. Encouraging figures from pilot countries show high engagement from those visiting the site, highlighting a real need for a platform like OsteoLink, regardless of whether Internet usage is high (Sweden) or low (Austria). OsteoLink will activate engaged members to identify and motivate others.

Links:
http://www.iofbonehealth.org/patients-public/osteolink.html
http://www.osteolink.org

Please contact:
Denys A. Wahl
International Osteoporosis Foundation
Tel: +41229940128
E-mail: dwahl@iofbonehealth.org

Automated Estimation of Adequate Unloading with Neurally Adjusted Ventilatory Assist (NAVA)

by Dimitrios Ververidis, Mark van Gils, Christina Passath, Jukka Takala and Lukas Brander

When the patient, instead of the caregiver, sets the ventilator.

Identifying a level of ventilatory assist that adequately meets the patient's respiratory needs is not straightforward. While delivering excessive assist may result in de-conditioning and atrophy of the respiratory muscles, an inadequate level of assist may cause respiratory muscle exhaustion. By acquiring the diaphragm electrical activity (EAdi) via electrodes mounted on a modified naso-gastric feeding tube it is possible not only to monitor the patient's respiratory drive but also to control the assist delivered by a ventilator (a technology termed "neurally adjusted ventilator assist", or "NAVA").

With NAVA, the EAdi is multiplied by an adjustable proportionality factor termed NAVA level and the resulting signal is used to control the pressure generator of a ventilator. Thus, with NAVA the airway pressure (Paw) is delivered in synchrony and linear proportionality to the EAdi (Paw = EAdi x NAVA level; Figure 1). We previously demonstrated that the characteristic response in Paw and tidal volume (Vt) (ie, the transition from an initial steep increase to a plateau for both parameters) to systematically increasing the NAVA level allows identification of an adequate level of ventilatory support with NAVA [C. Passath, J. Takala, L. Brander et al., "Physiological response to changing positive end-expiratory pressure during neurally adjusted ventilatory assist in sedated, critically ill adults," Chest., vol. 138, p. 578, 2010].

We developed a software that uses the EAdi, the ventilatory flow, and the Paw recorded during a NAVA level titration procedure to identify an adequate level of ventilatory support with NAVA. A detailed description of the method is provided in our recent publication [IEEE Trans. Biomedical Engineering, 2011]. Briefly, the amplified EAdi and the Paw signals were recorded during systematic increases in the NAVA level and the Vt was calculated off-line on a breath-by-breath basis as the integral of inspiratory airflow (Figure 1). All signals were then fed to the software, which applies a peak tracking algorithm (to the Paw signal) as well as a Gaussian mixture modelling algorithm (to the Eadi and airflow signals) (Figure 2). Two polynomials were then fitted onto the Paw peaks and Vt values to identify the beginning of their respective plateaus, and the average of the two corresponding NAVA levels was assumed to indicate the adequate assist level. The software also provides an option to compare the NAVA level identified post-hoc as adequate by the software to a NAVA level estimated as adequate by visual inspection of the Paw and Vt graphs by physicians while performing the titration procedure on printouts of the trend

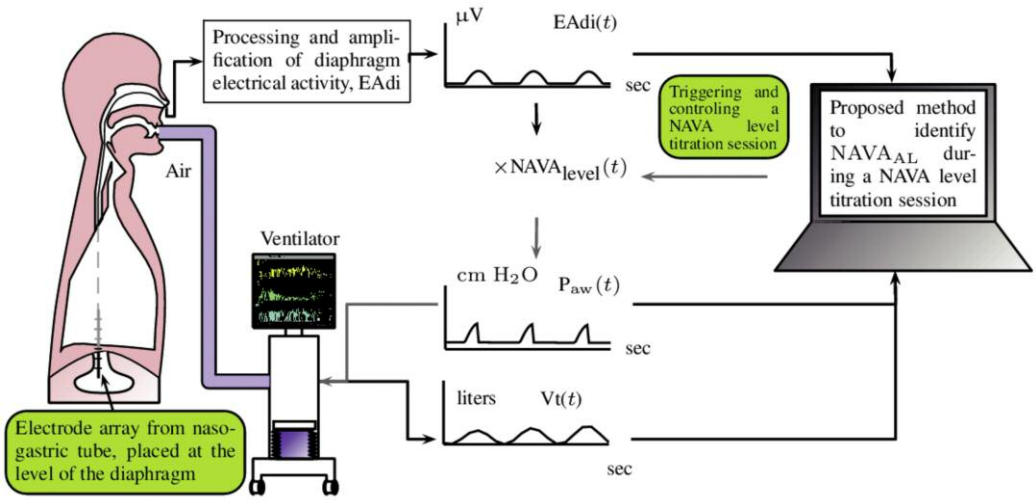


Figure 1: The neurally adjusted ventilation assist (NAVA). Our contribution is the algorithm running in a computational machine in order to estimated the adequate NAVA level.

graphs (Figure 2, upper part with two red transparent stripes that describe the NAVA signal). In our study we found that the adequate NAVA level identified by the algorithm was in good agreement with the adequate NAVA level estimated by 18 physicians, suggesting that our mathematical model has acceptable accuracy for application in clinical routine and research.

This article is based on authors' recent publication: "Identification of adequate neurally adjusted ventilatory assist (NAVA) during systematic increases in the NAVA level" which appeared in IEEE Transactions on Biomedical Engineering, vol. 58, no. 9, pp. 2598-2606, 2011.

This study was carried out in the VTT Technical Research Centre of Finland during the tenure of an ERCIM fellowship awarded to Dimitrios Ververidis for 2009-2010 (http://dimitriosververidis.blogspot.com/). The clinical data were provided by the Department of Intensive Care Medicine at the Bern University Hospital - Inselspital in Bern, Switzerland, supported by grants from the Swiss National Science Foundation (SNF; 3200B0-113478/1) and from the Stiftung für die Forschung in Anästhesiologie und Intensivmedizin, Bern (18/2006) awarded to Lukas Brander.

Please contact:
Dimitrios Ververidis
Researcher, ERCIM Fellow 2009-2011
VTT Technical Research Center of Finland
Tel: +30 6948847063
E-mail: jimver04@gmail.com

Mark van Gils
Senior Researcher
VTT Technical Research Center of Finland
Tel: +358 20 722 3499
E-mail: Mark.VanGils@vtt.fi

Lukas Brander
Senior attending physician
Department of Anesthesia and Intensive Care Medicine
Kantonsspital Luzern, Switzerland
Tel: +41 41 205 1111
E-mail :lukas.brander@bluewin.ch

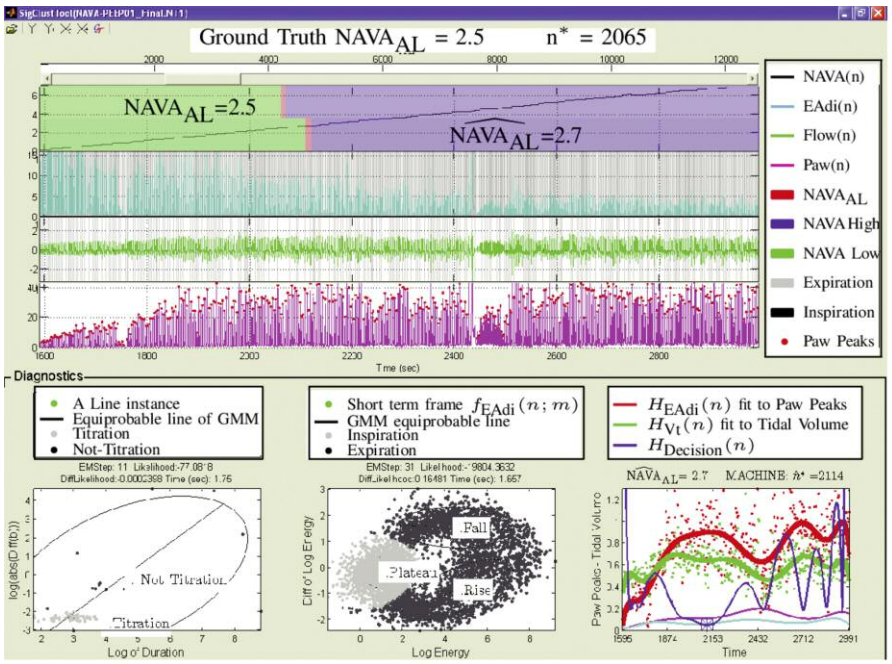


Figure 2: The user interface for the invented algorithm. Machine NAVA estimate is 2.7, whereas physician's choice is 2.5.

SESTEM: Supporting Equality in Science Technology and Mathematics related Choices of Careers

by Stella Melina Vasilaki

The low uptake of Science, Technology and Mathematics (STEM) constitutes a research and policy concern worldwide for some time now. The SESTEM project is built on the premise that the study of the uptake of STEM studies by girls and their retention in the field can benefit from investigation into the triangulation of family-individual and school factors. Under this scope SESTEM is currently conducting four interrelated comparative studies engaging students, pupils, parents and teachers (both secondary and tertiary levels). Both qualitative (in depth interviews, conceptual mapping, tandem based dialoguing and review into existing literature) and quantitative (collection and analyses of data from across the European Union Member States using on-line survey methods, and meta-analyses of existing statistical data) methods are applied.

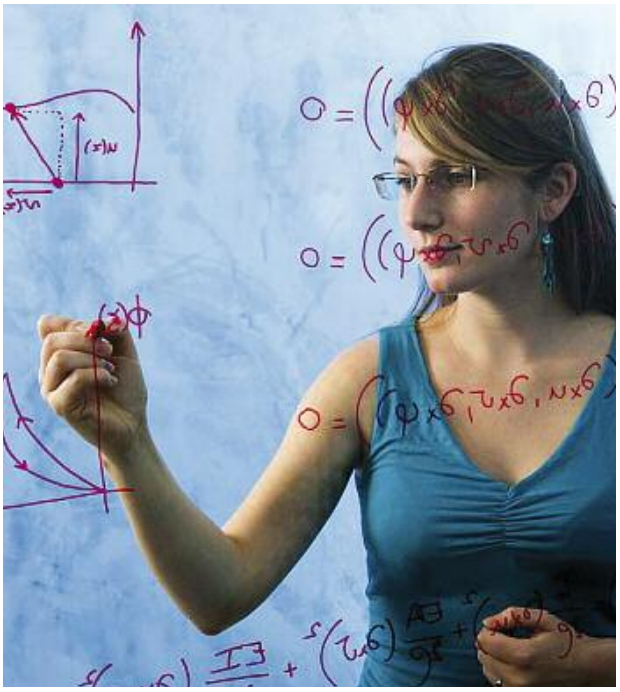


Photo: INRIA

The SESTEM project will help to improve women's uptake of science, technology and mathematics studies.

SESTEM, through its studies aims to deepen understanding into the process of decision making in career choices, the process of enhancing school-family collaboration in support of girls' engagement in STEM and into the contextual, cultural and social conditions that support retention of women in STEM related fields of studies especially beyond the level of a Bachelors' degree. The consolidation of studies results will define a set of composite indicators complemented with parental and teacher good practice guidelines for monitoring progress towards achieving equity in STEM.

The results of the qualitative studies conducted so far support the hypothesis that parents and teachers greatly influence the career decisions of youngsters and form the basis of their social environment. The role of the (charismatic) teacher and the family was found more influential than any other factor. Social class, economic status and the profession of parents seem to play a significant role in most cases. It was generally observed that the gender disparities in relation to STEM were wider in lower classes and rural areas, while there were fewer gender differences in higher classes, urban areas and among youngsters whose parents work in STEM fields.

Regarding the perception of STEM in general, STEM related fields are regarded as more prestigious, interesting, up-to-date with global developments and with higher employment prospects and salaries in comparison with other fields. At the same time these fields are also considered more difficult than other fields, time-consuming, competitive and demanding. In this respect, in most cases it was reported that these characteristics may present obstacles for women who are generally viewed as placing the work-life balance in higher priority than men. Stereotypes that influence the social imaginary and promote the view of STEM as masculine and social sciences and the humanities as feminine are still visible.

According to the findings so far, the issue of enhancing the self-confidence of girls, reversing stereotypes, and using successful women in STEM as role models is placed in the center of our considerations for the design of best practices and guidelines. Finally, the need for more information in relation to STEM studies and careers was stressed in most cases.

The final results of the project will be presented upon completion of the project at the end of December 2011. However, no major deviations from the results gathered so far are expected.

The project is supported by the LLP (Project Number: 505437-LLP-1-2009-GR-KA1-KA1SCR) and is implemented in the period January 2010 –December 2011 by a consortium of six partners coordinated by the Institute of Applied and Computational Mathematics - Foundation for Research and Technology, Greece.

Link:
http://sestem.iacm.forth.gr

Please contact:
Stella Melina Vasilaki, IACM-FORTH
Tel: +30 2810 391584
E-mail: stella@iacm.forth.gr

Dependable Cyber-physical Systems Workshop at SAFECOMP 2011

by Erwin Schoitsch

The annual ERCIM/EWICS DECOS Dependable Cyber-physical Systems Workshop (formerly "Dependable Embedded Systems Workshop"), in conjunction with SAFECOMP 2011, was held in Naples, Italy on 22 September 2011. The workshop was organized by the ERCIM Dependable Embedded Systems Working Group, together with EWICS TC7 (European Workshop on Industrial Computer Systems Technical Committee 7) and the DECOS Interest Group (DIG)(Dependable Embedded Components and Systems, an IP in FP6).

The theme of SAFECOMP 2011 was "Safety and Security of Computer-based Systems and Infrastructures: from Risk Assessment to Threat Mitigation". About 85 participants listened to interesting talks in eleven sessions and a poster session.

Topics of the sessions were RAM Evaluation, Complex Systems Dependability, Formal Verification, Risk and Hazard Analysis, Cybersecurity, Case Studies, Optimization Methods. Key Note speakers were:

- Paulo Verissimo from University of Lisboa (Portugal): Security and Dependability Risks of Critical Information Infrastructures (or why Bang! is different from Crash).
- Gerard J. Holzmann from Caltech and NASA Jet Propulsion Lab (USA): Software Safety and Software Complexity
- Andrea Bondavalli from University of Firenze (Italy): Model based resilience assessment of critical information infrastructures

The last day of SAFECOMP was dedicated to two tutorials and two workshops which were held simultaneously. The full-day ERCIM/EWICS/DECOS Workshop attracted 25 participants; quite a considerable number under the circumstances. The workshop, according to its broad scope, comprised three topics in four sessions:

- Dependable and resilient embedded systems (1) and (2)
- System Safety, Systems-of-Systems
- Autonomous Systems and Robotics.

In the introductory talk, Erwin Schoitsch gave an short overview on ERCIM, EWICS and the ARTEMIS Joint Technology Initiative and Joint Undertaking, focussing on three ARTEMIS projects related to the workshop session topics: MBAT (Model-Based Analysis and Testing of Embedded Systems), SafeCer (Safety Certification of Software-Intensive Systems with Reusable Components) and R3-COP (Resilient Reasoning Robotic Co-operating Systems). In the first two sessions, "work in progress" was reported from several ARTEMIS projects:

- CESAR, which aims at creating an ARTEMIS Reference Technology Platform for safety-critical embedded systems. This project was presented by Roland Mader, company AVL, Austria)
- ACROSS (about Network on Chip (NoC), time-triggered Ethernet based), presented by Oliver Höftberger from company TTTech, Austria), and
- pShield (on SPD – Secure, Private, Dependable Power Node Embedded System, presented by Przemysław Osocha, SESM, Italy).

These presentations were accompanied by two other talks on co-modelling and co-simulation for Dependable Embedded Systems (DESTECS project, presented by Ken Pierce, Newcastle University, UK) and "What UML based mutation testing can tell us about a system (and what not)", by Rupert Schlick (AIT Austrian Institute of Technology).

The session "System Safety, Systems-of-Systems" was driven by industrial experience talks: Martin Waßmuth from EADS presented "Distributed Safety Assessment for Airborne Systems", and by Francesco Sperandio from d'Apollonia SpA presented "A System Approach for the Safety Demonstration of the Main Brake Pipe Recharge Inhibition Command". Erwin Schoitsch concluded the session, highlighting the need for holistic system approaches "What can we learn from regional disasters about holistic risk assessment? The systems-of-systems view of complex cyber-physical systems".

The third session was dedicated to robotics. Reports were from R3-COP presented by Francesca Saglietti from the University of Erlangen-Nuremberg. Her presentation, entitled "Model-based Representation of Cooperative, Autonomous Systems", demonstrated the advantage of using coloured Petri nets to model complex vision- and perception based scenarios in a compact manner. Saglietti's report is complemented by a presentation available on the SAFECOMP Web site on a R3-COP market study concerning "Trends and tendencies for embedded systems in Robotics" from Antonio Feraco, company Innova, Italy. André Dietrich from the Magdeburg Robotic Lab at the University of Magdeburg, Germany, gave a talk on a closely related issue, entitled "Model-based decoupling of perception and processing", focussing on exploiting geometric and behaviour models for improved interaction between robots and their environment, and role-based human-machine interaction. Two presentations were about practical applications including orientation and mapping by fingerprinting methods: "Autonomous Maintenance Robot for Location Fingerprinting Methods" by Janne Merilinna, VTT Finland, and "A modular software system targeted towards embedded applications examplified by UAV usage" presented by Amund Skavhaug (NTNU, Norway), both including videos of the experimental prototypes.

The presentations led, to very lively discussions and raised a high level of interest. Overall, the workshop can be considered a success. The workshop was chaired by Erwin Schoitsch (AIT Austrian Institute of Technology) and Amund Skavhaug, (NTNU, Trondheim, Norway).

Link: http://www.safecomp2011.unina.it/

Please contact:
Erwin Schoitsch, ERCIM DES WG co-chair
AIT Austrian Institute of Technology (AARIT)
E-mail: Erwin.Schoitsch@ait.ac.at

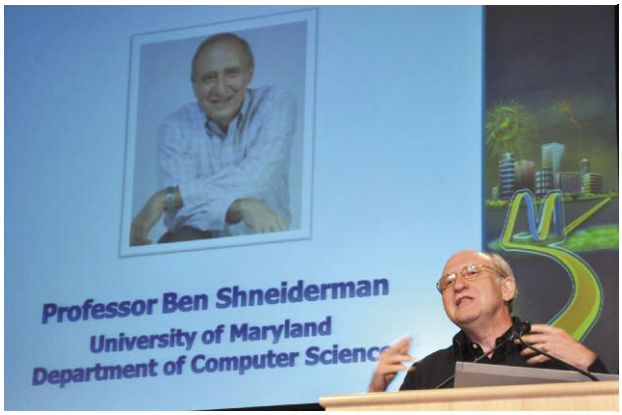
HCI International 2011

by Constantine Stephanidis

HCI International 2011, the 14th International Conference on Human-Computer Interaction, was held in Orlando, FL, USA, 9-14 July 2011.

This year, HCI International and the affiliated Conferences explored a wide variety of new hot topics which reflect and contribute to a paradigm shift towards ubiquitous interaction, intelligent environments and interactive technologies supporting virtually any aspect of human life and activities in a global and social perspective.

Best Paper Award for the HCII 2011 Conference.



Prof. Ben Shneiderman, HCII 2011 Conference Keynote Speaker.

The 23-volume Conference Proceedings are published by Springer. Papers appear in volumes of the Lecture Notes in Computer Science (LNCS) and Lecture Notes in Artificial Intelligence (LNAI) series. Posters are published in the Communications in Computer and Information Science (CCIS) series. All volumes are available on-line through the SpringerLink Digital Library, readily accessible by all subscribing libraries around the world.

An impressive number of nearly 2000 individuals from 61 countries participated in this truly international in scope event, where the work of the world's foremost leaders in the field was presented. The keynote speaker was Prof. Ben Shneiderman (University of Maryland, USA) and the title of his address was "Technology-Mediated Social Participation: The Next 25 Years of HCI Challenges". Furthermore, during the opening session, for the second time in the history of the HCI International Conference series, fourteen awards were conferred. Twelve awards were given to the best papers in each Affiliated Conference / Thematic Area. Among these twelve best papers, one paper was selected as Best HCI International 2011 Conference paper. Finally, the Best Poster also received an award.

Links:
HCI International 2011: http://www.hcii2011.org/
HCI International Conference Series:
http://www.hci-international.org/

HCI International 2013

The 15th International Conference on Human-Computer Interaction, HCI International 2013, will be held jointly with the affiliated Conferences in the Mirage Hotel, Las Vegas, Nevada, USA, 21 - 26 July 2013.

HCI International 2013 will also include two new affiliated conferences on "Distributed, Ambient and Pervasive Interactions" (Chairs: Norbert Streitz, Germany and Constantine Stephanidis, Greece), and on "Human Aspects of Information Security, Privacy and Trust" (Chair: Eugene H. Spafford, USA).

Please visit the conference website for the full list of the Thematic Areas, including Program Board members and the topics for each thematic area.

The program will feature, among others: pre-conference half-day and full-day tutorials, parallel sessions, poster presentations, an opening session with a keynote address, and an exhibition.

The Proceedings, including both papers and posters, will be published by Springer, and will be indexed by a number of services including EI and ISI CPCI-S.

Links:
HCI International 2013: http://www.hcii2013.org/
HCI International Conference Series:
http://www.hci-international.org/

Please contact:
Constantine Stephanidis
General Chair, HCI International Conference
E-mail: cs@ics.forth.gr

Call for Papers

European Conference on Computer Systems

Bern, Switzerland, 10-13 April, 2012

EuroSys'12, the European Conference on Computer Systems, seeks papers on all aspects of computer systems, especially ones that bridge traditionally disjoint areas. All areas of operating systems and distributed systems are of interest, including:

- Systems aspects of:
  - Cloud, grid, and internet/web computing
  - Databases, and information and data management
  - Dependable computing
  - Distributed computing
  - Local and distributed storage
  - Management, autonomics, and control
  - Measurement, monitoring, analysis, and diagnostics
  - Mobile, personal, and pervasive computing
  - Parallel and concurrent computing
  - Programming-language support and runtime systems
  - Real-time and embedded systems
  - Security
  - Sensor nets and tiny devices
- Experience with existing systems
- Negative results / reproduction or refutation of previous results

More information: http://eurosys2012.unibe.ch

CALL FOR PAPERS AND WORKSHOP PROPOSALS

9th International Conference on Integrated Formal Methods and 3rd International Conference on ASM, Alloy, B, VDM and Z

Pisa, Italy, 18 - 22 June 2012

The iFM and ABZ conferences are co-located in order to host a joint conference in honour of Egon Boerger's 65th birthday. The conferences are organized by the Formal Methods & Tools Lab at ISTI-CNR and take place at the Area della Ricerca del CNR in Pisa on June 18-22, 2012.

The iFM conference series seeks to further research on the combination of (formal and semi-formal) methods for system development, regarding modeling and analysis, and covering all aspects from language design through verification and analysis techniques to tools and their integration into software engineering practice.

The ABZ conference is dedicated to the cross-fertilization of five related state-based and machine-based formal methods, Abstract State Machines (ASM), Alloy, B, VDM and Z, that share a common conceptual foundation and are widely used in both academia and industry for the design and analysis of hardware and software systems.

The conferences will be preceded by a day devoted to workshops and tutorials.

Important Dates
Paper submission deadline: 14 January 2012
Paper notification: 1 March 2012
Final version paper deadline: 20 March 2012
Workshop proposals deadline: 30 October 2011
Poster/demo submission deadline: 1 April 2012

More information: http://ifm-abz.isti.cnr.it/

Call for Expression of Interest

ERCIM Members to host Georgian Researchers for a Short Visit

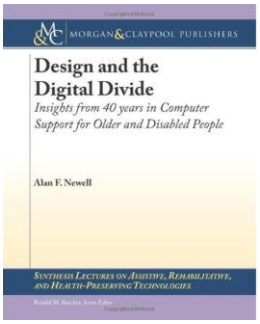
As a partner in the GEO-RECAP project (Supporting Georgia in enhancing the cooperative capacity of its ICT research centres and facilitate scientific cooperation between these centres and the European Research Area), ERCIM's role is to help Georgian researchers to get in contact with European research teams within ERCIM member institutes who can also helping Georgian organisations to get involved in FP7 ICT projects.

Visits are typically of 2-3 days duration, and max. one week including travel time. Expenses of Georgian researchers are supported by the GEO-RECAP project. Fifteen prospective Georgian researchers with the following topics have already been selected:

- Linear central algorithms for the inverse and computerized tomography problems
- Optimization of Development and Control of Regional Power Systems
- Design of unified analytical information space for social and economic environment
- The generalized information model for conflict management
- Construction of new cryptographic systems
- Investigation of Radioactive Fall-outs in Frontier Zones of Nuclear Station in Case of Accident on Atomic Power Station
- Computer Modeling of White Noise and its Application
- Specific Computational Methods for Problems of Quantum Mechanics
- Modeling Complex Software Systems based on Meta Modeling Principles
- Metal Nanoparticle and Organic Dye Incorporated Polymer Nanocomposites as the Novel Thermo Chromic Material with Improved Properties
- Development of an innovation real-time sensor of polarization state of electromagnetic waves on the bases of integral polarization-holographic element.
- Development of the selective tea-gathering robotic system
- Research of hybrid intellectual systems by computer experiments
- Three Layered LC Lasers for UV-Vis-NIR Spectral Range
- Investigation possibility of fabrication III-V compound semiconductor's Quantum Dot's structure for Terahertz technology and Solar cells.

More information:
Although this mobility programme has already started, visits can still be arranged. Members intersted in hosting a researcher with an above mentioned topic should contact Pierre Guisset: **pierre.guisset@ercim.eu**
See also: http://www.georecap.eu

Alan. F. Newell



Design and the Digital Divide: Insights from 40 Years in Computer Support for Older and Disabled People

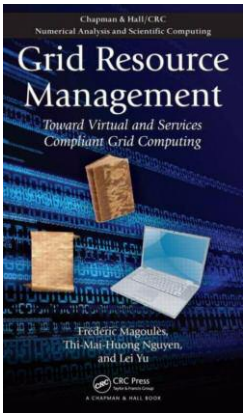
In this monograph Alan Newell recounts the insights he has gained from his research and recommends a philosophy and design practices to reduce the Digital Divide between users of information technology and those who are excluded by the poor design of many current system.

The monograph illustrates the issues surrounding good design by describing the various approaches to research into technical support for older and disabled people that have been developed by his research group over many years.
These include:

- Ordinary and Extra-Ordinary HCI - the parallels between able bodied people using technology for high stress situations and disabled people using standard interfaces,
- Design for Dynamic Diversity - taking into account the diversity and the rapidly changing characteristics of ole people,
- User Sensitive Inclusive Design - an expansion of the methodology of User Centred Design to include older and disabled people, and
- The use of techniques traditionally taught in Art School and professional theatre both for requirements gathering and awareness raising.

Published by Morgan and Claypool, August 2011.
ISBN 9781608457403

Frédéric Magoulès; Thi-Mai-Huong Nguyen; Lei Yu



Grid Resource Management Toward Virtual and Services Compliant Grid Computing

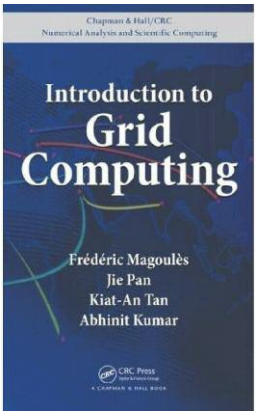
Grid technology offers the potential for providing secure access to remote services, thereby promoting scientific collaborations in an unprecedented scale. Grid Resource Management: Toward Virtual and Services Compliant Grid Computing presents a comprehensive account of the architectural issues of grid technology, such as security, data management, logging, and aggregation of services, as well as related technologies.

After covering grid usages, grid systems, and the evolution of grid computing, the book discusses operational issues associated with web services and service-oriented architecture. It also explores technical and business topics relevant to data management, the development and characteristics of P2P systems, and a grid-enabled virtual file system (GRAVY) that integrates underlying heterogeneous file systems into a unified location-transparent file system of the grid. The book covers scheduling algorithms, strategies, problems, and architectures as well as workflow management systems and semantic technologies. In addition, the authors describe how to deploy scientific applications into a grid environment. They also explain grid engineering and grid service programming.

Examining both data and execution management in grid computing, this book chronicles the current trend of grid developments toward a more service-oriented approach that exposes grid protocols using web services standards.

Chapman and Hall/CRC Numerical Analy and Scient Comp. Series; Hardback: 306 pages;
ISBN: 9781420074048, ISBN 10: 1420074040

Frédéric Magoulès; Jie Pan; Kiat-An Tan; Abhinit Kumar



Introduction to Grid Computing

Poised to follow in the footsteps of the Internet, grid computing is on the verge of becoming more robust and accessible to the public in the near future. Focusing on this novel, yet already powerful, technology, Introduction to Grid Computing explores state-of-the-art grid projects, core grid technologies, and applications of the grid.

After comparing the grid with other distributed systems, the book covers two important aspects of a grid system: scheduling of jobs and resource discovery and monitoring in grid. It then discusses existing and emerging security technologies, such as WS-Security and OGSA security, as well as the functions of grid middleware at a conceptual level. The authors also describe famous grid projects, demonstrate the pricing of European options through the use of the Monte Carlo method on grids, and highlight different parallelization possibilities on the grid.

Taking a tutorial approach, this concise book provides a complete introduction to the components of the grid architecture and applications of grid computing. It expertly shows how grid computing can be used in various areas, from computational mechanics to risk management in financial institutions.

Chapman and Hall/CRC Numerical Analy and Scient Comp. Series; Hardback: 334 pages
ISBN: 9781420074062, ISBN 10: 1420074067

International Mathematical Olympiad 2011

The Netherlands took great pride in hosting the 52nd International Mathematical Olympiad (IMO) from 17 to 23 July 2011. IMO is the largest and oldest Olympiad for the exact sciences. Over 560 very talented young mathematicians from 101 nations visited Amsterdam to solve the hardest mathematical problems. Among them were 57 girls. Eighteen year old German contestant Lisa Sauermann won IMO 2011 with a perfect score of 42 points. She received her fourth golden medal. This makes her the best participant in the history of IMO. The most successful teams were from China, the USA and Singapore.

Tribute to Lisa Sauermann at the closing ceremony, with Robbert Dijkgraaf (left) and Wim Berkelmans (right). Source: IMO.

It was the first time that the contest took place in the Netherlands. Since July 2011 the international IMO Foundation, which supports the organisation of the annual event, is located at CWI. CWI was also partner in the organisation of IMO2011.

More information: http://www.imo2011.nl/
Movies: http://www.imo2011.nl/live

INRIA Hosts W3C Office in France

To strengthen its relations with industry and research activities in France and Europe, the World Wide Web Consortium (W3C) opened a W3C Office in France, hosted by INRIA. To mark the launch, the Office organized a session on Open Data at the Open World Forum on 22 September in Paris, in cooperation with INRIA and Paris City Hall.

"INRIA has a longstanding commitment to the development of free software and open standards," said Michel Cosnard, INRIA chairman and CEO. "We have supported W3C's mission since its inception in 1994, notably by hosting W3C's European branch".

One of the Office's primary activities will be to promote participation by French industry and research leaders in W3C standardization activities. Bernard Odier, manager of the new Office said: "Through W3C Membership industry representatives can do more than follow the rapid evolution of the Web, they can lead it. The W3C environment fosters innovation and creates opportunities for business partnerships. I look forward to working with French companies and research labs to enrich the W3C environment of innovation."

"We are particularly pleased that INRIA, our longtime ally, will be the home of the first France Office," added Dr. Jeff Jaffe, W3C CEO. "Research and industry are closely linked when it comes to the development of Web standards. Through its industry relations in France and Europe, Inria is ideally positioned to help W3C achieve its objectives."

The promotional and recruiting activities of the Office, located in Paris, will complement the technical activities carried out by the W3C staff located at the ERCIM office in Sophia Antipolis. Six of the European W3C Offices are now hosted by ERCIM member institutes.

More information: http://www.w3.org/Consortium/Offices/

3D Mesh Viewer for iPad and iPhone

The Visual Computing Lab at ISTI-CNR has just released MeshLab for iOS, an advanced, yet easy-to-use, 3D model viewer for iPad and iPhone, designed to display complex Cultural Heritage 3D models. This app has been developed by the same team that developed MeshLab, the leading open source mesh processing system.

MeshLab for iOS enables an accurate inspection of 3D models through a precise yet straightforward navigation which makes it possible to:

- read models from a variety of standard 3D formats (PLY, STL, OFF, OBJ)
- open models directly from web pages, email attachments, or DropBox
- efficiently show highly complex models with up to 2,000,000 triangular faces on a iPad (well suited for presenting 3D scanned models).

In follow-up versions, increasingly advanced and innovative features will be added making it an even more powerful tool for the presentation, viewing, and analysis of 3D objects.

More information: http://www.meshpad.org/

ERCIM
European Research Consortium for Informatics and Mathematics

ERCIM – the European Research Consortium for Informatics and Mathematics is an organisation dedicated to the advancement of European research and development, in information technology and applied mathematics. Its member institutions aim to foster collaborative work within the European research community and to increase co-operation with European industry.

ERCIM is the European Host of the World Wide Web Consortium.

AARIT
Austrian Association for Research in IT
c/o Österreichische Computer Gesellschaft
Wollzeile 1-3, A-1010 Wien, Austria
http://www.aarit.at/

CNR
Consiglio Nazionale delle Ricerche, ISTI-CNR
Area della Ricerca CNR di Pisa,
Via G. Moruzzi 1, 56124 Pisa, Italy
http://www.isti.cnr.it/

Crcim
Czech Research Consortium
for Informatics and Mathematics
FI MU, Botanicka 68a, CZ-602 00 Brno, Czech Republic
http://www.utia.cas.cz/CRCIM/home.html

CWI
Centrum Wiskunde & Informatica
Centrum Wiskunde & Informatica
Science Park 123,
NL-1098 XG Amsterdam, The Netherlands
http://www.cwi.nl/

fonds national de la recherche
Fonds National de la Recherche
6, rue Antoine de Saint-Exupéry, B.P. 1777
L-1017 Luxembourg-Kirchberg
http://www.fnr.lu/

FWO
Egmontstraat 5
B-1000 Brussels, Belgium
http://www.fwo.be/

FNRS
rue d'Egmont 5
B-1000 Brussels, Belgium
http://www.fnrs.be/

FORTH
Foundation for Research and Technology – Hellas
Institute of Computer Science
P.O. Box 1385, GR-71110 Heraklion, Crete, Greece
http://www.ics.forth.gr/

Fraunhofer IUK-TECHNOLOGIE
Fraunhofer ICT Group
Friedrichstr. 60
10117 Berlin, Germany
http://www.iuk.fraunhofer.de/

Inria
Institut National de Recherche en Informatique
et en Automatique
B.P. 105, F-78153 Le Chesnay, France
http://www.inria.fr/

IUA
Irish Universities Association
Cumann Ollscoileanna Éireann
Irish Universities Association
c/o School of Computing, Dublin City University
Glasnevin, Dublin 9, Ireland
http://ercim.computing.dcu.ie/

NTNU
Norwegian University of Science and Technology
Faculty of Information Technology, Mathematics and
Electrical Engineering, N 7491 Trondheim, Norway
http://www.ntnu.no/

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Portuguese ERCIM Grouping
c/o INESC Porto, Campus da FEUP,
Rua Dr. Roberto Frias, nº 378,
4200-465 Porto, Portugal

Universitas Varsoviensis
PLERCIM
Universitas Wratislaviensis
Polish Research Consortium for Informatics and Mathematics
Wydział Matematyki, Informatyki i Mechaniki,
Uniwersytetu Warszawskiego, ul. Banacha 2, 02-097 Warszawa, Poland
http://www.plercim.pl/

Science & Technology Facilities Council
Science and Technology Facilities Council,
Rutherford Appleton Laboratory
Harwell Science and Innovation Campus
Chilton, Didcot, Oxfordshire OX11 0QX, United Kingdom
http://www.scitech.ac.uk/

SpaRCIM
Spanish Research Consortium for Informatics and Mathematics
D3301, Facultad de Informática, Universidad Politécnica de Madrid,
Campus de Montegancedo s/n,
28660 Boadilla del Monte, Madrid, Spain,
http://www.sparcim.es/

Swedish Institute of Computer Science
SICS
Swedish Institute of Computer Science
Box 1263,
SE-164 29 Kista, Sweden
http://www.sics.se/

SARIT
Swiss Association for Research in Information Technology
c/o Professor Daniel Thalmann, EPFL-VRlab,
CH-1015 Lausanne, Switzerland
http://www.sarit.ch/

MTA SZTAKI
Magyar Tudományos Akadémia
Számítástechnikai és Automatizálási Kutató Intézet
P.O. Box 63, H-1518 Budapest, Hungary
http://www.sztaki.hu/

University of Cyprus
P.O. Box 20537
1678 Nicosia, Cyprus
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