



OrcaM – 3-D Digitalization of Objects  
META-NET – Multilingual Europe Technology Alliance  
Industry 4.0 at Hannover Messe 2012

# Smart Home, Smart Grid, Smart Market –

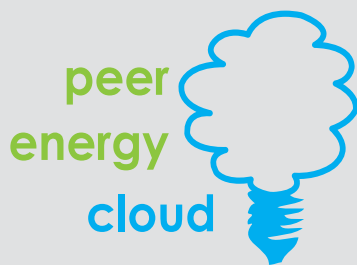
The PeerEnergyCloud project is a “Landmark in the Land of Ideas 2012”



## Germany Land of Ideas

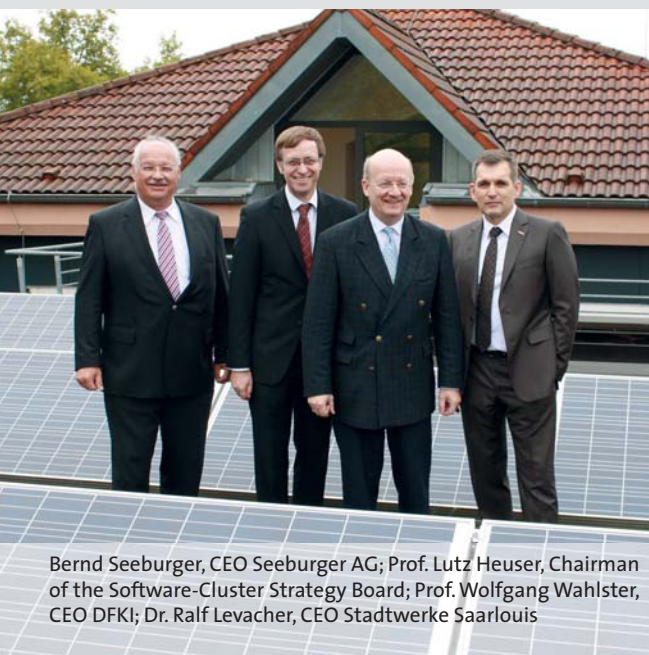


Selected Landmark 2012



Distributed power generation for local usage, alternative energies intelligently combined with conventional power stations: ICT (Information and Communication Technology) can bring together supply and demand with pinpoint accuracy and enable value-added services and energy trading among neighbors via a digital citizen's marketplace.

**Saarlouis – October 9, 2012**



Bernd Seeburger, CEO Seeburger AG; Prof. Lutz Heuser, Chairman of the Software-Cluster Strategy Board; Prof. Wolfgang Wahlster, CEO DFKI; Dr. Ralf Levacher, CEO Stadtwerke Saarlouis

DFKI, together with venture partners Karlsruhe Institute of Technology (KIT), AGT Germany, SEEBURGER AG, and the Municipal Utilities (Stadtwerke) Saarlouis under the framework of the PeerEnergyCloud project, presents an innovative energy management system for the intelligent use of alternative energies.

Peer Energy Cloud is sponsored by the Federal Ministry of Economics and Technology (BMWi) and was one of the winners of the 2011 Trusted Cloud Competition. The PeerEnergyCloud project will celebrate its selection as a “Landmark in the Land of Ideas” on October 9, 2012 in Saarlouis.

[www.peerenergycloud.de](http://www.peerenergycloud.de)



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## Imprint

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## KI 2012 – 35th Annual Conference on Artificial Intelligence



### International Conference on Artificial Intelligence Demonstrates Changing Applications

▶ **KI 2012 is the 35th German Conference on Artificial Intelligence and once again brings together leading academic and industrial researchers from all sub-areas of AI. The program of KI 2012 includes paper and poster presentations and a variety of workshops and tutorials.**

KI 2012 is a premier forum for the exchange of news and research results concerning all aspects of AI theory and applications. The conference invites currently significant and previously unpublished results from all areas of AI: fundamentals, algorithms, history, and applications.

**The major areas of interest at the 35th edition of the German Conference on Artificial Intelligence in Saarbrücken include:**

- ▶ Knowledge Acquisition, Representation, Reasoning and Ontologies
- ▶ Combinatorial Search, Configuration, Design and Deduction
- ▶ Natural Language Processing, Statistical NLP, Semantics
- ▶ Planning and Scheduling, Spatial and Temporal Reasoning
- ▶ Reasoning under Uncertainty, Probabilistic Inferences
- ▶ Non-Monotonic Reasoning and Default Logics
- ▶ Constraint Satisfaction, Processing and Programming
- ▶ Embodied AI: Robotics, Vision and Perception
- ▶ Intelligent Information Retrieval, Semantic Search, Semantic Web
- ▶ Evolutionary and Neural Computation
- ▶ Machine Learning, Computational Learning Theory and Data-Mining
- ▶ Distributed Problem Solving and Multi-Agent Systems
- ▶ Game Playing and Interactive Entertainment, AI for Graphics
- ▶ Game Theory and General Game Playing, Generalized Intelligence
- ▶ AI for Human-Computer-Interaction and Adaptive Communication
- ▶ Mobile Solutions with Textile, Semantic and Spatial Media
- ▶ Augmented Reality, Smart Cities, Smart Traffic, Smart Hardware
- ▶ Assistance Systems in Living and Working Environments
- ▶ Software-Engineering, Model Checking and Security in AI
- ▶ Distributed Computation and Swarm Intelligence
- ▶ Cognitive Modeling, AI and Psychology
- ▶ History and Philosophical Foundations of AI
- ▶ Applications including Logistics, Production and Health Care

The organizing committee especially welcomes the numerous submissions that provide new insights into the interplay of AI and the real world as well as the papers and posters that integrate useful technologies into AI from other areas of computer science. The review process was very selective. Of the 58 papers submitted this year, the program committee accepted 22 full papers (acceptance rate of 37%) and 8 short papers.

DFKI's contributions to this year's "KI" conference are extremely interesting. In addition to several presentations and a seminar, DFKI scientists exhibit a variety of live demos of in-house research prototypes, posters, and prototypes developed in international joint research projects.

**The following DFKI contributions are among those selected by the KI 2012 review committee:**

#### DFKI KI 2012 Papers

Tatjana Scheffler, Rafael Schirru and Paul Lehmann: "Matching Points of Interest from Different Social Networking Sites"

Alexander Volokh and Günter Neumann: "Dependency Parsing with Efficient Feature Extraction"

Ben Hennig and Norbert Reithinger: "Developing of a Multimodal Interactive Training System in Therapeutic Calisthenics for Elderly People"

Christian Federmann: "A Machine-Learning Framework for Hybrid Machine Translation"

Marvin Schiller and Fernand Gobet: "A Comparison between Cognitive and AI Models of Blackjack Strategy Learning" (CeL-Tech paper)

Together with the main conference, a small number of high-quality workshops in the areas of emotion and computing, planning and scheduling, human reasoning and automatic deduction, model-based intention recognition, and speech dialog systems have been invited. Several DFKI workshop papers complete the competitive KI 2012 main contributions.

#### DFKI KI 2012 Tutorial

Jens Hauptert, Alexander Kröner, Boris Brandherm: "Object Memory Tools: Tailoring a Thing's Data Collection and Communication Behavior"

#### DFKI KI 2012 Live Demos

Benjamin Adrian, Markus Ebbecke and Sebastian Ebert: "Auto Classifier: Explaining Customers a Machine-Learning Model"

Daniel Sonntag and Christian Husodo Schulz: "Using a Discourse and Dialogue Infrastructure for Collaborative Radiology"

Ivana Kruijff-Korbayova, Heriberto Cuayahuitl, Bernd Kiefer, Stefania Racioppa, Piero Cosi, Giulio Paci, Giacomo Sommavilla, Fabio Tesser, Hichem Sahli, Georgios Athanasopoulos, Wei-Yi Wang, Valentin Enescu, Werner Verhelst, Lola Canamero, Aryel Beck, Antoine Hiolle, Raquel Ros and Yiannis Demiris: "A Conversational System for Multi-Session Child-Robot Interaction with Several Games"

Christian Federmann: “An Open-Source Toolkit for Manual Evaluation of MT Output”

#### DFKI KI 2012 Posters

Wolfgang Schlauch, Darko Obradovic and Andreas Dengel: “Organizational Social Network Analysis – Case Study in a Research Facility”

Paul Baxter, Heriberto Cuayahuitl, Rachel Wood, Ivana Kruijff-Korbayova and Tony Belpaeme: “Towards Augmenting Dialogue Strategy Management with Multimodal Sub-Symbolic Context”

Christian Rauch, Tim Köhler, Martin Schröer, Elmar Berghöfer and Frank Kirchner: “A Concept of a Reliable Three-Layer Behaviour Control System for Cooperative Autonomous Robots”

Markus Goldstein: “Histogram-based Outlier Score (HBOS): A Fast Unsupervised Anomaly Detection Algorithm”

Matthias Reif, Faisal Shafait and Andreas Dengel: “Dataset Generation for Meta-Learning”

Matthias Reif, Faisal Shafait and Andreas Dengel: “Meta<sup>2</sup>-Features: Providing Meta-Learners More Information”

#### DFKI KI 2012 Industrial Project Posters

Jochen Setz, Gianluca Quercini, Daniel Sonntag and Chantal Reynaud: “Facetted Search on Extracted Fusion Tables Data for Digital Cities” (Project with the European Institute of Innovation and Technology)

Jochen Frey, Boris Brandherm and Jörg Baus: “Trading Renewable Energies” (Project PeerEnergyCloud)

Constantin Houy, Peter Fettke, Peter Loos, Iris Speiser, Maximilian Herberger, Alfred Gass and Ulrich Nortmann: “Towards Computer-supported Analysis, Retrieval and Synthesis of Argumentation Structures in Humanities Using the Example of Jurisprudence” (Project ARGUMENTUM)

Julian Krumeich: „Collaborative Process Assistant – Towards a Context-sensitive Business Process Support Based on Emails“ (Project COMMIUS)

Ivana Kruijff-Korbayova, Tony Belpaeme, Lola Canamero, Piero Cosi, Yiannis Demiris, Remi Humbert, Marco Nalin, Mark Neerincx and Hichem Sahli: “Adaptive Strategies for Sustainable Long-Term Social Interaction” (Project ALIZ-E)

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Thierry Declerck and Stefania Racioppa: “Multilingual Lexical and Grammatical Resources for Sentiment Analysis” (Project TrendMiner)

The poster and demo session with over 40 international contributions takes place in the DFKI lobby in Saarbrücken on September 25.

#### Conference Organizing Committee

*General Chair* Antonio Krüger (Saarland University and DFKI)

*Program Chair* Birte Glimm (University of Ulm)

*Local Chairs* Boris Brandherm (Saarland University),

Ralf Jung (Saarland University)

*Workshop Chair* Gabriele Kern-Isberner (TU Dortmund)

*Tutorial Chair* Wolfgang Maaß (Saarland University)

*Poster and Demo Chair* Stefan Wöfl (University of Freiburg)

*Doctorial Consortium Chair* Carsten Lutz (University of Bremen)

*Publicity Chair* Daniel Sonntag (DFKI) ◀

**More information**  
[www.dfki.de/KI2012](http://www.dfki.de/KI2012)



**Publish your paper in the scientific journal  
 „KI – KÜNSTLICHE INTELLIGENZ!“**

The journal is published by the AI department of the German Informatics Society (Gesellschaft für Informatik, GI). Specialists in all areas of AI may contribute articles in the category “AI Market,” to put more focus on current developments that have made their way out of research labs and into applications, thereby allowing readers to gain a better understanding of current practical applications in the field of AI. Submissions are accepted at all times.

For more information please contact  
 Dr. Daniel Sonntag, DFKI.



# KI 2012

## International Conference on Artificial Intelligence Demonstrates Changing Applications

► Language recognition in smart phones, rapid search engines for the internet, robotic cleaners in the living room – all these developments incorporate Artificial Intelligence. In recent years, this has contributed much toward making our everyday lives easier. Artificial Intelligence (AI) will also play a major role in many more innovations to come. To discuss the current state of research and the outlook for the future, experts meet at the “35th German Conference on Artificial Intelligence” held on the university campus in Saarbrücken on September 24-27, 2012. The event is being organized by Antonio Krüger, professor for AI in Retail at Saarland University and Scientific Director at DFKI.

Artificial Intelligence has its roots during the 1950s and 60s. “At that time, people had great expectations about what computers could do,” says Antonio Krüger, Professor at Saarland University and speaker for the AI department at the German Informatics Society (Gesellschaft für Informatik, GI). “The scientists tried to recreate the cognitive functions of humans in a computer.”

To build intelligent machines using human beings as the model – today’s research has come a long way from that dream. Recent years, in particular, have witnessed great advances: continued development has given us new methods for AI research that are considerably different. “Larger storage capacity, more computing capacity, and good sensors are now merged with modern methods of informatics. For example, computers are now able to recognize standard situations much better,” explains Krüger. “Research has significantly driven innovations in automobile technology, logistics, or even in the medical technologies.”

Artificial Intelligence will also play a major role in the future of many new developments. “Considering the aging society, there is a great need for technical innovations with simple and intuitive operations,” continues the Professor. These include, for example, car assistance systems that identify when the driver is having some sort of health problem and can then control the car to a safe parking position. There may be refrigerators that warn you when the yogurt has expired and the milk carton is

empty. “There are also promising developments in the area of medicine like wireless sensors that monitor the human heart-beat or sensors that can use the movement patterns to identify the early stages of dementia,” states Krüger. The scientists in Saarbrücken are convinced that the networking of AI, for example, with medical, mechatronic, and other disciplines will increase in the near future. “There are already some interdisciplinary projects today,” he adds. “My working group, for example, works very closely with psychologists.”

The “German Conference on Artificial Intelligence” at Saarland University provides an opportunity for German and international AI experts to exchange views. One of the focus topics is the social interaction between humans and computers, which includes how computers recognize human facial expressions and gestures and what potential applications may originate from this. Also on the agenda: how computers can read human bio-signals, for example, how they can measure stress or be controlled by thought. In addition, workshop and seminar subjects include useful information for intelligent dialog systems or the presentation of spatial environments in the computer. ◀

**More information**  
[www.dfki.de/KI2012](http://www.dfki.de/KI2012)

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## iGreen at the DLG Field Days 2012

► In the tent city of the DLG Field Days in Bernburg-Strenzfeld (Saxony-Anhalt), DFKI and several project partners jointly presented the research results of the iGreen project. At the various exhibits organized under the categories "production cycles" and "public-private information cycles" (see graphic below), partners explained how iGreen's open structures empower a fruitful exchange of knowledge in agriculture. Organized every two years by the German Agricultural Society (Deutsche Landwirtschaftsgesellschaft, DLG), "DLG Field Days" is considered to be the most important meeting place for plant production experts.

The iGreen project presentation focused on public-private knowledge management and the communications infrastructure for a comprehensive data exchange among all participants in the agriculture sector. The interfaces, data formats, terminology, and communication structures form the basis of an extensive data network of knowledge and services. All of the players in agricultural production benefit from the exchange and, especially, from the new opportunities that public-private ventures provide.

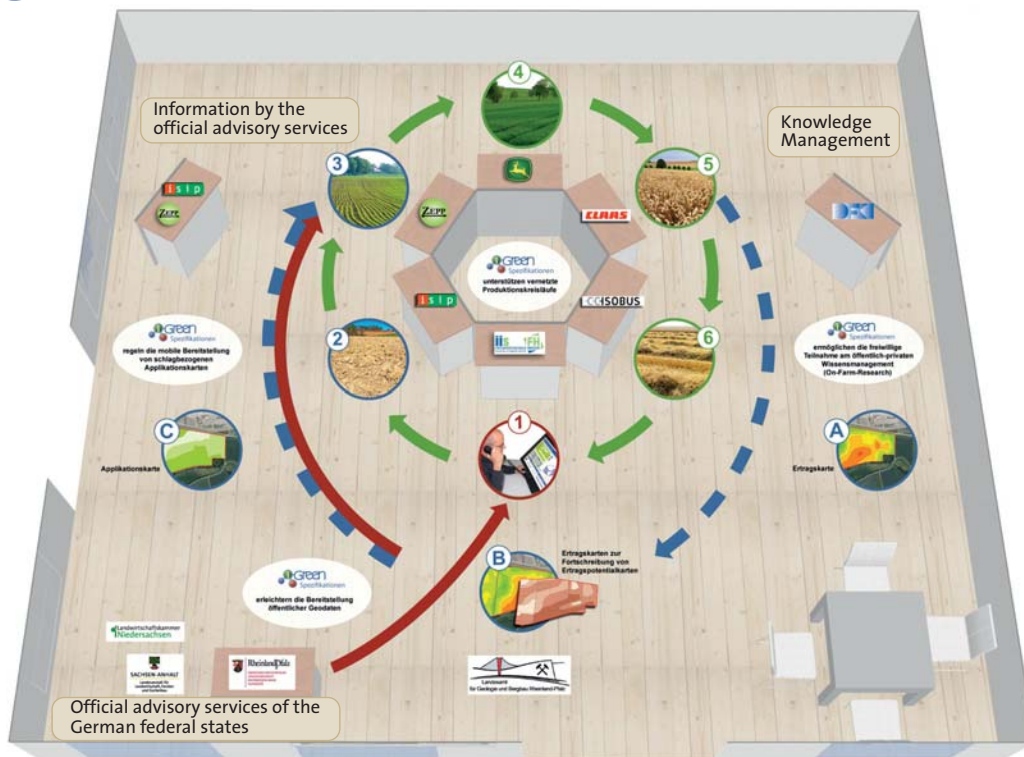
An example of the communication between farmer and official advisory services illustrates the benefit of such joint ventures:

When government authorities publicly provide – as made possible by the iGreen results – their soil data and advisory data in a format accessible to the public, and when individual operational farm data is disclosed in an open source format, then an effective exchange can begin between both sides. The farmer can transfer the current growing conditions of a field to the experts electronically as needed and then, in return, receive an optimal recommendation tailored to the specific situation. In this way, both can use the basic data now publicly available. ◀

More information  
[www.igreen-projekt.de](http://www.igreen-projekt.de)

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The knowledge cycle in iGreen: The inner loop (green) represents the flow of data in agricultural production. The outer loop highlights how the cooperation between public and private participants improves and expands the available information.

Graphic: Corinna Treitz, DLR R-N-H, Bad Kreuznach

## The 4th Industrial Revolution Is Gathering Steam

▶ Modern Information and Communication Technologies (ICT) including smartphones, mobile web, and cloud computing have permitted a vision proposed more than two decades ago – the “Internet of Things” – to become reality in our everyday lives. The arrival of these technologies into the manufacturing environment opens the door for industry to significantly improve the productivity, quality, and flexibility and to introduce a paradigm change in the area of industrial manufacturing. In the context of the High Tech Strategy ICT-2020, the German government is supporting national companies and research institutes in their efforts to implement of the so called Industry 4.0.

The presentation of the DFKI *SmartFactory*<sup>KL</sup> system demonstrator at the Hannover Messe 2012 is an example of how this topic is currently gaining real traction. If you had “googled” Industry 4.0 just six months ago, you would have had relatively few hits – today, the number of hits for information on this subject is substantially higher.

This system demonstrator illustrates for the first time the core aspects of the 4th Industrial Revolution. The major element is the cyber-physical production system (CPPS). Cyber-physical systems are distributed, smart objects, networked together via internet technologies. In the area of production engineering this may include everything from individual processing modules to plant equipment and systems as well as the individual smart products. CPPS will revolutionize factories of the future from the ground up and include the following typical aspects:

- ▶ **Smart objects** – the extension of technical devices by decentralized intelligence
- ▶ **All-embracing networks** – the networked ability of all such smart objects to communicate
- ▶ **Use of internet standards** – the adaptation of existing and proven standards for cable connected and wireless communication
- ▶ **Convertible, agile production systems** – the aggregation of smart objects into mostly self-configuring production systems
- ▶ **Vertical network integration** – the transition from strictly hierarchical control architectures to stronger vertical integration and integrated network structures
- ▶ **Changing role for humans** – the stronger support of the user through improved and mobile access to production data and facilities, combined with a user-focused and context-adaptive, interactive design

These subjects have been actively pursued at the DFKI-*SmartFactory*<sup>KL</sup> since its establishment and today are already well integrated in the product and process development activities of a number of partner enterprises. DFKI, in collaboration with well-known names in industry, developed and implemented the fundamental technologies such as the digital product memory in the earlier projects SemProM and RES-COM, sponsored by the Federal Ministry of Education and Research (BMBF). The foundation for new levels of productivity and added value is the development and marketing of autonomous, self-controlled, and knowledge based production systems, which are in turn based on cyber-physical systems. The arrival of the Internet of Things and the Internet of Services into the world of industrial manufacturing will facilitate continuous improvement in the performance of industrial processes in manufacturing, engineering, supply chain and life cycle management, which, in sum, will lead to a new and integrated form of industrialization. ◀

### More information

[www.dfki.de/ifs](http://www.dfki.de/ifs)  
[www.hightech-strategie.de/en](http://www.hightech-strategie.de/en)  
[www.forschungsunion.de](http://www.forschungsunion.de)  
[www.sempro.de](http://www.sempro.de)  
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## DFKI-SmartFactory<sup>KL</sup> Visionary Factory of the Future at Hannover Messe 2012 – The 4th Industrial Revolution Is Gaining Traction

► Each work piece in a cyber-physical production system determines for itself the factory processes that it will undergo. The rigid, central factory control, familiar from traditional industrial production, will be replaced by a new kind of decentralized manufacturing architecture. Equipped with sensors and wireless networks, the system components can recognize and react to complex events and critical states, and then adjust downstream plans accordingly.

At the Industrial-IT Forum at the Hannover Messe 2012, DFKI presented a prototype system which showed a smart product passing through a complete production line in the factory of the future. Created together with well-known partners from industry, the complete, prototypical production line is used to produce a smart “key finder” that, in conjunction with a smartphone, tells the user the location of some everyday object, for example, a key ring.

The production process for the key finder begins at the order picking station, where the order data from the enterprise master data system is loaded into the product memory of the key finder. Each individual manufacturing station throughout the plant has access to the data, which is interoperably stored in a standardized data format, the so called Object Memory Model (OMM). The OMM was developed at DFKI under the framework of the BMBF SemProM project and is currently being defined as a W3C standard.

Now that the semi-finished product knows what manufacturing steps still lie ahead, the casing is custom engraved at the milling station as requested by the customer. The product-specific engraving program is created from the order data by orchestrating modular sub programs dynamically into a higher-level processing program. As soon as the machining process is finished, the casing is removed by a robot at the order picking station. The current operational data at the milling station can be accessed from a mobile tablet PC.

Next, the automatic assembly of the smart key finder is accomplished at an assembly station, where the order picking robot places the semi-finished product on a smart work piece transporter.

The transporter controls more than the material flow. Equipped with embedded sensors, local processing intelligence, and wireless communication with the plant process control unit, it can actively influence the manufacturing process.

The automated product assembly can be performed according to customer specification, i.e., optimized for resource savings or operating times. The process variants required to achieve this are selected and implemented according to the order data of the smart product. For a smart display and assessment of the resources consumed, the operator can access a web-based visualization framework developed in the context of the BMBF RES-COM project.

After passing through this cyber-physical production process, our sample key finder product is subject to quality control at a manual inspection station. Optionally, product assembly can also be performed manually with workers supported by digital operating instructions and assembly instructions. Information and handling instructions for the current situation are displayed with the aid of Augmented Reality (AR) technology in a camera image, which provides a very clear explanation of the complex operations and work activities to be implemented. In its entirety, the prototype of the DFKI *SmartFactory*<sup>KL</sup> illustrated for the first time an actual implementation of the core aspects of the 4th Industrial Revolution. ◀

More information  
[www.dfki.de/ifs](http://www.dfki.de/ifs)

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Awards ceremony honoring the “marion” project as a “Landmark in the Land of Ideas 2012”



The intelligent cone scanner, guardian angel of autonomous vehicles: Prof. Dr. Christoph Lüth from the DFKI Cyber-Physical Systems department introduced Project IGEL at the Hannover Messe 2012



## New Technologies from DFKI Bremen at Hannover Messe 2012

► The e-car of the future is changing its traditional form, a “cone scanner” as the guardian angel of autonomous vehicles, and agricultural machines working hand in hand. These were some of the innovative IT solutions at the Hannover Messe in April 2012.

At the government's stand at the trade fair, the Robotics Innovation Center demonstrated how the EO smart connecting car can alter its shape to adjust to the specific mobility requirements. The driver's compartment of the EO smart connecting car is raised and the chassis is contracted. The vision: Modules such as passenger compartments or loading ramps combine and connect to other vehicles to form “road trains.” Data and energy transfer from one vehicle to the other in the chain of cars. This opens new perspectives for mobility in rural areas, i.e., energy savings when traveling identical routes. Each of the four wheels can turn 90° if required, for example, to park sideways into a tight parking spot. Besides the EO smart connecting car, DFKI scientists explained how using an interactive charging post with e-vehicle fleet trials, the driving and charging data was collected and analyzed in the electric mobility pilot region Bremen/Oldenburg. The vehicles are equipped with special recorders that, among other things, store the actual mileage data. The data is used in the development of an intelligent infrastructure for electric mobility.

A smart scanner protects autonomous industrial vehicles from collisions by predicting them in advance: In the project IGEL at the Cyber-Physical Systems department, software was developed in collaboration with Götting Company for a laser scanner that scans a cone pattern in lieu of the usual two-dimensional scan. The software uses measured distance data to compute a reference level so that obstacles like potholes and ditches can be identified just as accurately as obstacles on the surface. Visitors experienced first-hand a demonstration at the Götting stand at the trade fair.

Agricultural value chains can be optimized by plan-based robotic controls. This is the promise of the logistics platform “marion,” which was honored on April 23, 2012 at the HMI by the initiative “365 Landmarks in the Land of Ideas 2012.” It is based on a planning system that enables the machinery to respond to changes in the environment and coordinate their routes. This makes harvesting processes more productive. Researchers at the DFKI Robotics Innovation Center are developing “marion” in a joint venture with agricultural equipment manufacturer Claas and the companies Still and Atos C-LAB, in a project sponsored by the Federal Ministry of Economics and Technology (BMWi). In Hannover, the visitors to the BMWi stand saw a Still company forklift further developed in “marion”. ◀



At the German government's stand: Prof. Dr. Frank Kirchner, head of DFKI Robotics Innovation Center (right) introducing the EO smart connecting car to Stefan Schmitt, division head at the Federal Ministry of Transport, Building and Urban Development (center)

## Prof. Wahlster Presents Hermes Award 2012 at the Hannover Messe

► The coveted technology award of the Deutsche Messe was presented in the context of the official opening ceremonies of the Hannover Messe on April 22, 2012. Prof. Dr. Wolfgang Wahlster, chairperson of the independent jury, announced the winner of the Hermes Award 2012 in the presence of German Chancellor Angela Merkel, Wen Jiabao (Premier of the State Council of the People's Republic of China), Education and Research Minister Annette Schavan, and Lower Saxony's Minister President David McAllister.

The Hermes Award 2012 was presented by Prof. Dr. Schavan, Minister for Education and Research, to Phoenix Contact Company (established in 1923 and based in Blomberg, North Rhine-Westfalia), for the innovative LM-S lightning current measuring system. Phoenix Contact developed a system that measures power surges in lightning conductors and makes operational evaluations immediately available to the remote maintenance center via the internet. Lightning strikes are responsible for most incidents involving damage to the rotor blades of modern wind turbines. The award winning system facilitates continuous monitoring and ensures that maintenance work subsequent to a lightning strike is initiated quickly. The system is based on the electro-optical Faraday effect and measures the full course of the lightning surge as well as the impact on each of the individual rotor blades. The deployment of this system improves unit availability and increases the reliability of the electrical power supply. Maintenance work can be targeted more effectively and implemented with greater cost savings.

“Now in its ninth round, the Hermes Award has established itself worldwide as the ‘Oscar’ for engineering. The intensity of research in industry has increased sharply over the last three years and, correspondingly, an excellent pool of applicants provided the jury with an exciting nose-to-nose race among the 46 submitted entries competing for one of the five sought after nominations. New instruments in the High Tech Strategy such as the Clusters of Excellence, future concept projects, and their



Prof. Wahlster honoring prize winner Phoenix Contact



Conferring of the Hermes Award 2012: (l.-r.) Prof. Annette Schavan, Federal Minister of Education and Research; Roland Bent, Phoenix Contact, Prof. Wolfgang Wahlster, Chairperson of the Jury; Dr. Martin Wetter, Phoenix Contact; David McAllister, Prime Minister of Lower Saxony, Dr. Wolfram von Fritsch, CEO Deutsche Messe AG

coordination through the Science and Industry Research Union have given an enormous boost to the innovation process in Germany,” explained DFKI CEO Prof. Dr. Wolfgang Wahlster during the opening ceremony at the Hannover Messe. “This year focused on a technology megatrend: cyber-physical systems, which stand for the connection of the physical world of manufacturing to the information-engineering cyber world of the internet. Such cyber-physical systems form the basis for the 4th Industrial Revolution, now on the advance in Germany with the Federal Government's decision to sponsor the future oriented project Industry 4.0. Smart sensors record the operating environment, measured values are made available in real time via the internet anywhere in the world, valves and other actuators in the plant are controlled by the Internet of Things, and industrial assistance systems facilitate even the employment of elderly workers with power enhancing exoskeletons.”

In addition to the winning Phoenix Contact, the other firms nominated for the award were: ContiTech AG, Hannover; Festo AG, Esslingen; Linz Center of Mechatronics, Linz, Austria; and Pepperl + Fuchs, Mannheim. ◀

**More information**  
[www.hannovermesse.de/en/hermesaward](http://www.hannovermesse.de/en/hermesaward)



## Crowd Monitoring Provides Greater Safety at Major Events – Deployed at London Olympics

► Large crowds of people can generate a risk situation: the interactions of crowds can be predicted only with great difficulty, security personnel are rarely able to respond and control a critical situation fast enough. DFKI's Department of Embedded Intelligence has developed a method for identifying critical proportions and influencing the situation in large gatherings of people.

The design approach was supplied by a ubiquitous technology – sensors on smart phones: the visitors to a major event use an app that anonymizes and transmits their position data while at the same time supplying them with safety-relevant information. The data transmitted by the users on a voluntary basis is aggregated and visualized on a map. The process makes the situation visible, showing in what direction and at what speed the crowd is moving and where the crowd could perhaps reach a critical mass. This kind of “Crowd Monitoring” allows early estimation of situational risks and can provide event organizers with timely information. If the system identifies, for example, a bottleneck, it can recommend the next available alternative via a push-message.

The technology was created in the context of the four year EU project SOCIONICAL, in which various universities and research institutes studied the relationship of technology and social interaction. The system was officially deployed at the London Olympic Games 2012 and integrated in a smart phone app for the City of London Police Department and the City of Westminster. While thousands of sports fans streamed into the city center, authorities could observe and analyze the mass flows of people in real time. Fortunately, there were no security incidents during the Games, but still the system proved the value of direct communication with the users, for example, when the

underground lines were cancelled and detour routes could be recommended promptly. The great benefits for personal safety and the integration of diverse data, for example, schedules of events during the Olympic Games, resulted in thousands of visitors contributing their anonymized data, adding to the representative total values.

### Data privacy emphasized

The scientists at DFKI place special emphasis on data protection in this technology and ensure that the project is accompanied by the appropriate consulting and assessment measures. On one hand, the validity of Crowd-Monitoring via mobile phones depends on the number of people who are willing to contribute their position data, on the other hand, such collaborative activity surveillance raises judicial and ethical issues. Accordingly, the users always remain anonymous when using the app and their position data is encoded before it is sent to the server. The transfer of data is restricted to a specific area and is activated only in critical situations for a predefined period of time and only with the explicit approval of the user. The user specifies if, when, and which data is made available.

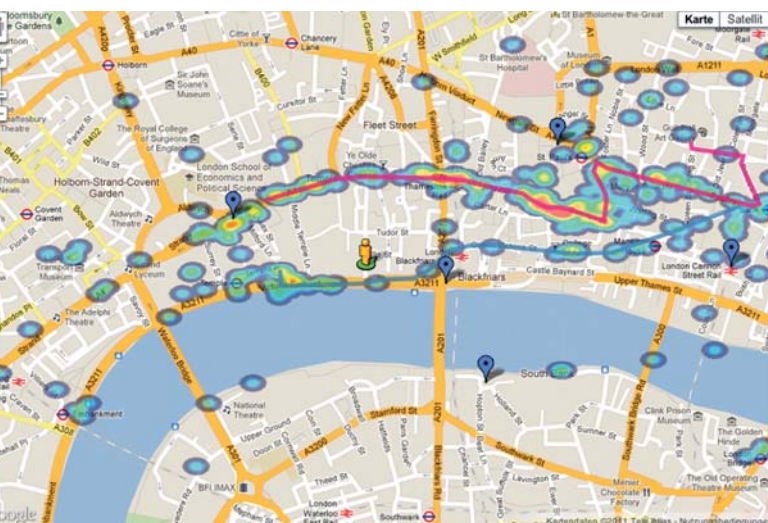
The smart phone app of the City of London Police is listed under the name “City Police” in the App-Stores and provided for free download. The technologies used at the Olympics have been successfully tested several times before: in 2011, at the open air festival “Notte Bianca” in Malta, at the “Lord Mayor’s Show” in London in the context of the London Cultural Festival “West End Live” in early 2012, and also at the “Vienna Marathon.” After the Olympic Games 2012, the technology will be supplied for use at other major events. ◀

More information  
[www.dfki.de/ei](http://www.dfki.de/ei)

### Contact

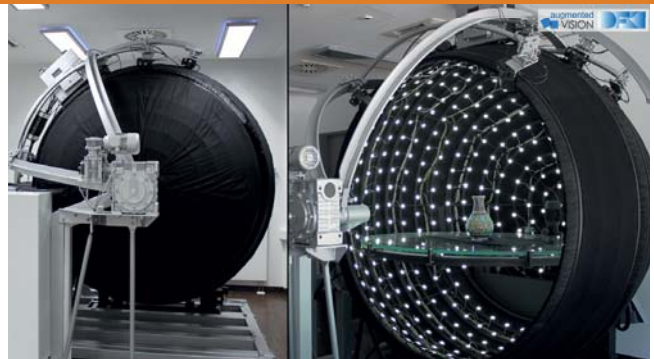
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Reconstruction: Wilhelm Lehmbruck's "Female Torso" made available by the Museum Pfalzgalerie, Kaiserslautern



OrcaM – Orbital Camera System



## OrcaM – 3-D Digitalization of Objects

► OrcaM – *Orbital Camera System* – is both hardware and software for the automated, three-dimensional recording and reconstruction of real objects. The high resolution, spherical scanner was planned and implemented by researchers at DFKI's Augmented Vision department and engineers from NEK GmbH (Sustainable Energy Systems and Plant Construction, Kaiserslautern).

The process has already been rolled out in an exemplary manner in cooperation with the Museum Pfalzgalerie, Kaiserslautern. The non-invasive scanning process recorded and digitally reconstructed Wilhelm Lehmbruck's sculpture "Female Torso" (1918, 67 x 40 x 25 cm, bronze) and Hermann Scherer's "Little Girl" (1924/25, 76 x 38 x 40,5 cm, Swiss pine), presented to the public as a digital 3-D model in November 2011.

The 3-D reconstruction of the richly detailed statuette "Allegory, given to Prince Heinrich of the Netherlands by the grateful citizens of Luxembourg" was possible in cooperation with Lion Systems based in Luxembourg and the Musée d'Histoire de la Ville de Luxembourg.

In contrast to traditional laser scanners, the system developed at DFKI's Augmented Vision Department is much more capable of producing precise color and texture data of the object. This allows an almost natural looking 3-D reconstruction, which in the total of individual reconstructed features has never before been possible and sets a new standard for quality. The possibility of adding subsequent lighting, for example, to allow a seamless embedding of the object into a video recording of actual scenes, as well as the precise geometry of the reconstructions, which lies in the sub-millimeter range, give an indication of the diverse range of potential application of the system:

whether for designing virtual museums, creating object repositories for digital worlds in computer generated films or PC games, for internet applications like shops, catalogs, auctions, or simply to convert a hand made model into a digitally useful representation.

### How OrcaM works

In order to digitally reconstruct an object in three-dimensions, it must first be possible to optically scan it from all sides. For the 3-D scanner OrcaM, the object is positioned on a glass plate and photographed from various angles by multiple cameras with a resolution of 175 pixels per square millimeter, under defined lighting conditions. The data obtained in this way permits a reconstruction of form, color, and texture of the object. Tiniest surface imperfections, as in Lehmbruck's sculpture, are captured and reproduced, which contributes substantially to the photorealistic appearance of the 3-D model. ◀

### More information

[http://av.dfki.de/projects\\_recent/orcam](http://av.dfki.de/projects_recent/orcam)  
[www.nek-kl.de](http://www.nek-kl.de)  
[www.lionsystems.lu](http://www.lionsystems.lu)

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Comparison of photograph and reconstruction: Hermann Scherer's "Little Girl" made available by the Museum Pfalzgalerie, Kaiserslautern



Digital 3-D model of "Allegory" (l. – r.) Geometry, computed material properties under neutral lighting, HDR lighting, and ambient light reflection



## XML3D in Practice – Visualization Terminal for the Fortified City of Saarlouis

► Since June 2012, the digital models of the historic fortified city of Saarlouis have been available to the public at the Municipal Museum where it is possible to wander virtually through the city on the touch screen terminal. “The challenge was in integrating the 3-D models with the information and photo images of the individual structures. This was only possible through the use of our new XML3D technology,” said Prof. Slusallek, head of the research department Agents and Simulated Reality. The 3-D internet technology “XML3D” developed in Saarland extends the existing HTML standard to declarative, interactive 3-D content. The visualization terminal is its first real practical deployment.

XML3D is designed from the point of view of the web application developer and represents a minimal and seamless expansion of the current standards. Because well-known and proven methods may continue to be used, there is no need to learn a complicated, special graphic programming language. One set of elements for the specification of geometric structures, materials, light, or camera perspectives is sufficient to embed three dimensional content. To a large extent, the re-use and expansion of familiar HTML elements allows a draft architecture to be proposed that increases the HTML standard only by what is absolutely required. This ensures that the introduction of this new technology will not be burdened with insurmountable difficulties.

This strategy has already met with high acceptance. W3C, the international standardization authority for the web, has created a “Community Group” for the advanced development and establishment of a new 3-D internet technology. DFKI and Fraunhofer Institute for Graphic Data Processing are among the original founders of this group and DFKI has provided Kristian Sons to serve as the co-chair of the group. “Germany is a leader in the development of declarative 3-D internet technology. We have an opportunity to establish a global standard and to create a brand new realm of possibilities for internet applications,” said Kristian Sons, head of the XML3D research group at DFKI.

In addition to application development and the standardization of the technology, deliberations have already begun on the next step in web technology. Every modern smart phone has a



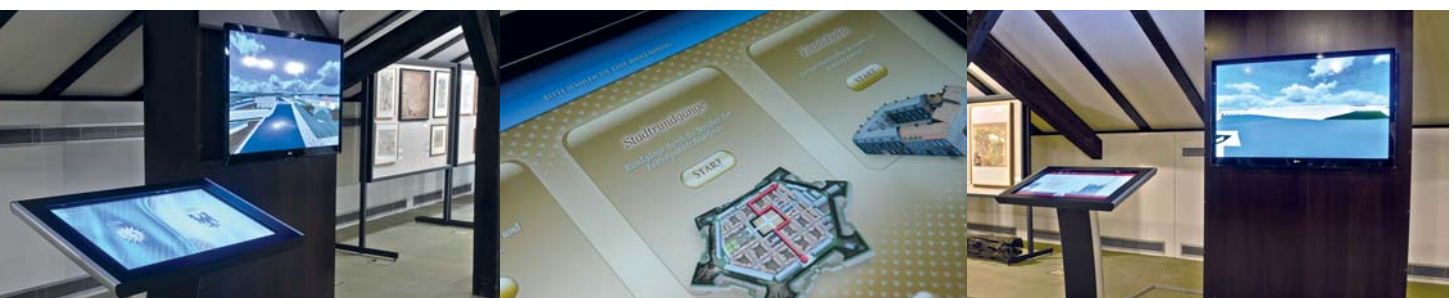
3-D chip with huge computing power, which can be used not only for the display of 3-D content, but also for computing complex simulation models. Investigating how the new browser technologies can be further improved and how they reveal new use concepts are the subjects of the EU research agenda for the future internet, subjects which Prof. Slusallek and his team are actively contributing: “The visualization terminal project for Saarlouis offered us the chance to prove the performance of our design approach. Our vision is that, with the help of our technology, this model can be made available to everyone on the web in the coming years, similar to the way texts, photos, or videos can be called up on the web pages of Saarlouis today.” ◀

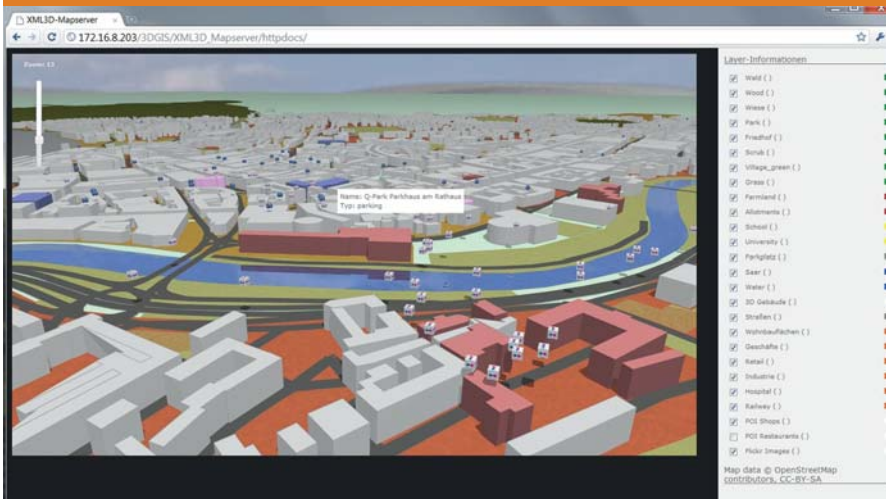
More information  
<http://staetisches-museum.saarlouis.de>  
[www.xml3d.org](http://www.xml3d.org)

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3-D view of Saarbrücken based on OpenStreetMap data. Tooltips on the individual objects provide additional information

## Out and About in the Virtual World – Geodata in the 3-D Internet

► Whether a personal location reference on Facebook, exact directions from a route planner, or precise information about the traffic situation from a navigation system – geodata is a fact of everyday life for the private user.

The geodata combined, prepared, and presented in a Geo-Information System (GIS) provides information about the infrastructure of an entire city district or serves as a tool for the city and urban planners, for example, for information about whether or not a given location is suitable for development as a technology park or for a corporate relocation. Simulated scenarios of rescue operations at the scene of a disaster or the impacts of climate change on protected land areas and large cities are created on the basis of GIS data.

Three-dimensional representations of this data play an ever-increasing role. 3-D models of cities or landscapes provide more plasticity for more flexible access options if integrated in a web-GIS.

“RealGIS” is a joint venture of DFKI Simulation and Visualization Group and CAIGOS Company for the purpose of developing DFKI's XML3D visualization platform as an extension to the “CAIGOS-GIS” geo-information system. Using XML3D it is quite easy to connect 2-D and 3-D web content by means of standard technologies seamlessly with one another in a single web application and to create new applications. This is facilitated by the declarative approach for a simple introduction for programmers to start working with 3-D models as well as by the availability of WebGL capable browsers for a user friendly use of the technology.



Visualization of a section of the downtown Saarbrücken. The generated store fronts are based on the data recorded in OpenStreetMap

The software allows the user to automatically create a virtual model of a real city or landscape on the basis of the available geodata and present it interactively in a web browser. Through the direct interaction possibilities with the 3-D geometry, a model is created that not only allows a three dimensional representation of GIS data, but also refers 3-D objects back again in relationship to the stored expert data.

The visualization options developed for this are not limited to use in commercial geo-information systems, rather they can also access open source geodata like OpenStreetMap (OSM) in order to generate interactive 3-D city models, which can then be presented in the web browser. OSM is probably the best known data source for open source geodata and supplies a variety of information about land use, road networks, building floor plans, and points of interest.

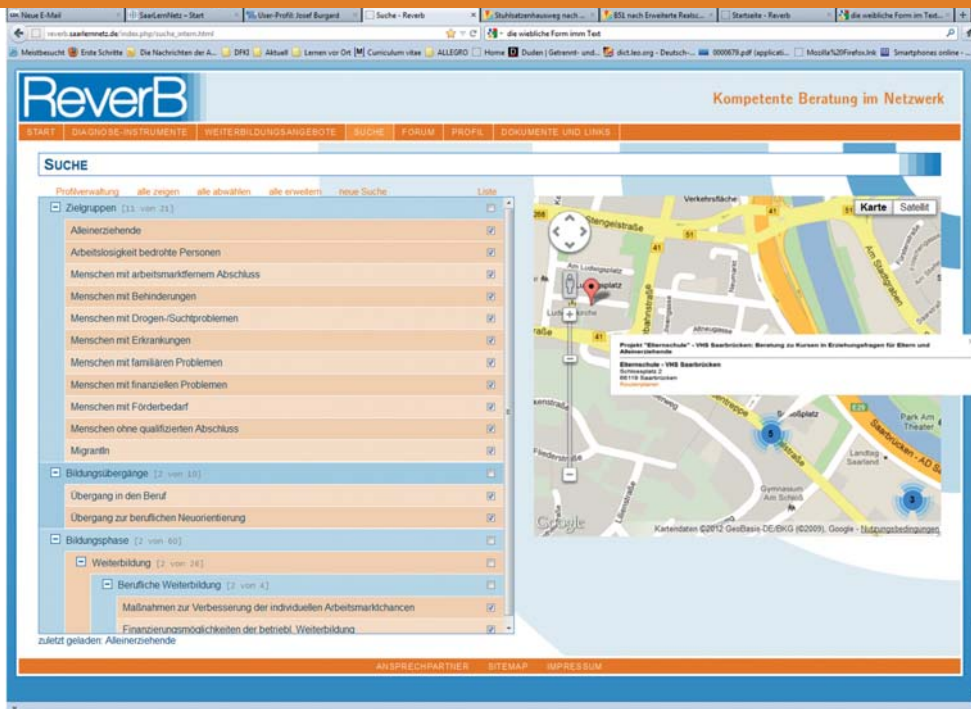
The global expansion of the data sets is a special challenge that places specific requirements on the administration of the 3-D objects like trees, street signs, street lamps, or detailed models of prominent landmark buildings that are used for the representations. This is the issue currently being examined in the development of a database-aided administration system for XML3D scenes.

The RealGIS project is funded by the SMEs innovation program (Zentrales Innovationsprogramm Mittelstand, ZIM) of the Federal Ministry of Economics and Technology (BMWi). ◀

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ReverB search concept supports selection of educational counseling services in the region

## CeLTech Developments Used in Educational Counseling and Innovative Teaching Methods in Medical Schools

### BMBF Project “ReverB” Enables Technology-based Educational Counseling in Saarland

► The Regionalverband (Regional Association) Saarbrücken and a network of foundations in collaboration with CeLTech (Centre for e-Learning Technology) have been developing “Regional Association Makes Educational Management” – a project known as “ReverB.” They have created a brand new type of online portal in Germany, which is now entering the statewide trial phase as scheduled at the end of the project.

ReverB provides a platform for educational counseling in support of life-long learning, which is not only useful for institutional consulting, but also for individual consults regarding continuing personal development. Funded by the Federal Ministry of Education and Research (BMBF) under the “Learning in Place” program, ReverB aims to develop a coherent educational management system to include associated communication and network structures based on an educational monitoring approach.

The priority lies on the establishment and coordination of an educational counseling network with expanded online infrastructure for counselors and end clients, innovative training concepts, e.g., e-Learning modules for specific target groups and finally, improved engineering science skills for youths.

The online portal conceived and implemented at CeLTech is a key component of the educational counseling system, which provides local support to counselors as they perform daily work and, quite possibly, improves their efficiency. The portal is based on a comprehensive database containing an overview of regional and nationwide educational guidance centers and services and enables the networking of various counselors. On the basis of a differentiated rights management system, education providers can place their service offers on the portal and, in this way, make them available to the nationwide consulting net-

work. Currently there are more than 25 counselors using the network being able to access over 160 educational service offers in the Regional Association Saarbrücken.

This is possible due to the development of an intelligent search concept. Using pre-defined categories and free keywords, individual living situations can be taken into consideration while searching for the appropriate educational opportunities and the corresponding institutions. Details regarding the counseling services are also displayed along with the addresses. The map location closest to the client can be selected and, with the appropriate function, the exact route to that location can be determined, printed, and handed directly to the client to take along. This provides a local, competent, regionally networked education guidance service for people of all ages and in all walks of life.

The functionalities of ReverB will be expanded by a self-assessment service to be developed at CeLTech’s “Psychological Assessment Technology Lab” under the management of Prof. Dr. Frank M. Spinath. The self-assessment service consists of tests to determine interests, motivation, work habits, and personality traits. The questionnaires prepared by the counselors can be easily completed prior to the meeting from a mobile tablet PC. Clients and counselors are provided individual feedback in advance of the counseling session. ◀

**More information**  
<http://reverb.saarlernnetz.de>



## AI-based Learning System “Active Med” to Be Deployed in All Hessian University Clinics

► In the latest BMBF collaborative project, the aims are to promote the practical clinical skills of medical personnel – students and practicing doctors – by systematic, technology-aided teaching and to strengthen the professionalism of the teachers.

In addition to CeLTech, technology partners in this project include: the medical faculties and corresponding university clinics of Goethe University Frankfurt, Justus Liebig University Gießen, Philipps-University Marburg as well as the German Society for Surgery, the Society for Medical Training, and the German Association of Medical Students.

The initial project phase is dedicated to the development of the authoritative national learning objectives under the lead management of the Working Group “Teaching” of the German Society for Surgery (Chirurgische Arbeitsgemeinschaft Lehre der Deutschen Gesellschaft für Chirurgie) in cooperation with various professional associations. The teaching materials necessary to achieve these learning objectives are stored in the AI-based learning content management system developed at CeLTech. The system identifies the user’s level of knowledge and adjusts the course content with appropriate learning objects, for example, texts, films, and photos. Thanks to the integration of the so called Digital Imaging and Communications in Medicine Viewer, it is possible to display the DICOM standards frequently used in medicine as well as, for example, x-ray images.

Furthermore, testing includes the use of multiple-choice problems to evaluate professional knowledge. In parallel, the curricula at the participating universities are being expanded in terms of the learning objectives, teaching methods are being systematically reviewed in terms of the evidence, and proposals for a restructuring are being made as well as the coordinating of their implementation. New training programs and career paths for doctors will be demonstrated at the participating universities, which should optimize teaching in a clinical environment as well as raise the level of interest in professional teaching careers. A “Train-the-Teacher” program, which will be provided to all 36 German medical faculties, exposes younger doctors to the necessary teaching skills. The AI learning system from Active Med, which is based on DFKI’s intelligent-adaptive learning system “Active Math,” is now designed to operate with mobile devices, especially Tablet PCs. ◀



Student closing a wound under the supervision of a doctor

**The Centre for e-Learning Technology would be pleased to discuss these and other topics with you. Visit CeLTech at one of the following conferences, trade fairs, and events:**

- **September 17 – 22, 2012: Science Week 2012.** Saarbrücken
- **September 18 – 21, 2012: EC TEL 2012 – European Conference on Technology Enhanced Learning.** Saarland University. Saarbrücken Campus.
- **September 19 – 21, 2012: Technologies of Play – Game-Based Aesthetic Education.** Between Performative Practice and Institutional Design, College of Fine Arts, Saarbrücken.
- **September 24 – 27, 2012: KI 2012.** Saarland University, Saarbrücken Campus.
- **September 25, 2012: Innovation in HR Development.** Macromedia University for Media and Communication, Hamburg.
- **September 25 – 26, 2012: “Abitur” then what?** Conference Hall Saarbrücken, Saarbrücken.
- **November 13 – 14, 2012: Social Media and Personnel Development in Companies.** Economics and Technology in Dialog, European Academy Otzenhausen.
- **November 22 – 23, 2012: Campus Innovation 2012.** Multimedia Kontor Hamburg, Hamburg.
- **February 4 – 8, 2013: e-Learning@UniGR.** University of the Greater Region, Luxembourg.

First course in Active Med: Teaching the theoretical basis of wound treatment

More information  
[www.celtech.de](http://www.celtech.de)

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## Excellence Accompanies DFKI – Support for the Universities in Bremen and Saarland

In the government's "Excellence Initiative," universities in Bremen and Saarland have posted an impressive record

► In the third round of the Excellence Initiative for Cutting-Edge Research at Institutions of Higher Education, the University of Bremen was ranked among the top German universities. The north German university is one of eleven elite "universities of excellence" in Germany and took the top honors with its entry "Ambitious and Agile" in the funding line "Future Concepts." Successes all along the line: the university also prevailed in two other funding lines - "Clusters of Excellence" and "Graduate Schools." Overall, it will receive 98 million Euro. Of this amount, 50 million Euro is for the implementation of future concepts. 39 million Euro is for the excellence cluster "The Ocean as an Earth System - Center for Marine Environmental Sciences (MARUM)," an area in which DFKI Bremen collaborates in the field of underwater robotics. The grad school "Bremen International Graduate School of Social Sciences" (BIGSSS) will receive nine million Euro. Prof. Rolf Drechsler, Head of DFKI Research Department Cyber-Physical Systems since October 2011, can honestly say at the end of his term of office in Bremen that he is handing over an "excellent university" to his successor as Deputy Head of Research and Young Scholars. In the future, under the framework of a tri-lateral cooperations agreement, DFKI Bremen will have closer ties to the Computer Science Faculty of the university and the German Aerospace Center (DLR) in Bremen: the aim is the expansion of the graduate program "System Design." In 2014, plans call for the establishment of the interdisciplinary chair of "Intelligent Cinematics."



June 15, 2012 – The University of Bremen is one of 11 institutions classed as an "Elite university" in Germany. (r.-l.): Professors Wilfried Müller, Rector of the University of Bremen, Rolf Drechsler, Deputy Head of Research and Young Scholars at University of Bremen and Head of DFKI Department Cyber-Physical Systems, and Joachim Treusch, President of Jacobs University Bremen



Banners unfold as University of Bremen celebrates its success after being named one of Germany's elite "Universities of Excellence"

At Saarland University, the "Multimodal Computing and Interaction" Cluster of Excellence was extended for five years in this second phase of the Excellence Initiative. The successes of the information science institutions in Saarbrücken will bring funding support over the next five years amounting to nearly 59 million Euro and provide jobs for numerous highly qualified scientists. Furthermore, Saarbrücken's Graduate School of Computer Science will receive about seven million Euro in continued funding from the German Research Foundation (DFG). "This is about 60 percent more than the previous funding amount, which is a financial acknowledgement of the past achievements and the convincing plans for continued expansion," said Prof. Raimund Seidel, Director at the Max-Planck Institute for Computer Science and speaker for the Saarbrücken Excellence Cluster. Besides Saarland University, the other organizations participating in the Cluster of Excellence and the grad schools are Max-Planck Institute for Computer Science, Max-Planck Institute for Software Systems, and the German Research Center for Artificial Intelligence.

An important aspect of the future concept is the close cooperation with respected institutes external to the university like DFKI: "Excellence accompanies DFKI," said Prof. Wolfgang Wahlster while adding: "All of the proposals submitted by the Saarland and Bremen universities were successful! This is a reinforcement to the required basic research at DFKI and plants a seed for future success in application oriented research." ◀

More information

[www.dfg.de](http://www.dfg.de)

[www.mmci.uni-saarland.de](http://www.mmci.uni-saarland.de)

<http://gradschool.cs.uni-saarland.de>

[www.bmbf.de/en/1321.php](http://www.bmbf.de/en/1321.php)



Federal Minister Schavan and Minister President Kramp-Karrenbauer with Software Campus PhD. candidates Sandro Castronovo and Sabine Janzen



Prof. Wolfgang Wahlster and Prof. Annette Schavan with the "Industry 4.0" report, an "Investing in the Future" project

## Federal Minister Prof. Annette Schavan Visits DFKI Saarbrücken

► Prof. Dr. Annette Schavan, Federal Minister of Education and Research, together with Saarland's Minister President Annegret Kramp-Karrenbauer and Andreas Storm, head of the state chancellery at the time, visited DFKI-Saarbrücken on March 20, 2012. The focus of discussion was on the promising opportunities of Industry 4.0, the 4th industrial revolution, using specific examples from Saarland.

Industry 4.0 stands for a paradigm shift in industrial manufacturing and is one of the key technology projects in Germany's High-Tech Strategy 2020. In digitally upgraded production facilities, the so-called "smart factories" new types of cyber-physical systems are linked via IP-based wireless protocols and semantic technologies and are integrated with industrial assistance systems for employees. Products and manufacturing plants become active system components that control their own production and logistics. This means that quick product changeovers and a greater number of options, even for the smallest of lot sizes, can be efficiently produced.

The digital upgrade of the business processes creates alternative business models and improves the economic performance of the company. Whether supplier or master craftsman, small business or global market leader, this is the next generation of business software and is being researched and developed in the "Software Cluster" – Europe's Silicon Valley, bounded by the cities of Darmstadt, Kaiserslautern, Karlsruhe, and Saarbrücken.

One of the Software Cluster's living labs, the Innovative Retail Laboratory (IRL) established by DFKI and GLOBUS Warehouse Holding, presented company-wide software solutions for the retail trade and some specific application examples that are being tested and brought to market. For example, an intelligent fresh foods counter that can recognize gestures, a payment model for mobile phones based on near-field-communication (NFC), and QKies – cookies with QR-Codes for a web link that contains information, for example, about an invitation to a company event or key product information. QKies is the result of Software-Cluster joint venture of DFKI with Saarland's

medium-sized food company Juchem Food. Juchem celebrated the age of digital cookies and its selection as a "Landmark in the Land of Ideas 2012" on September 10, 2012 in Eppelborn.

In the DFKI Visualization Center, Prof. Dr. Philipp Slusallek presented sample applications of XML3D, the extension of the web language HTML, which enables development and display of 3-D content on the Internet quickly and easily without any browser plug-ins. Example applications include 3-D Wikipedia pages about Venice, or a virtual reconstruction of the historic walled city Saarlouis with defensive fortifications (p. 14), three-dimensional enriched tours of virtual museums, or 3-D design configurators for the automobile industry.

The system demonstrator "IT in the context of resource conservation and alternative energies" showed the initial results from the BMBF project "RES-COM: Resource conservation through context activated machine-to-machine communication." The prototype demonstrates the possibility for intelligent energy monitoring in private homes, which helps the consumer to root out hidden power guzzlers and reduce the monthly electrical bills.

The Minister was introduced to Sandro Castronovo and Sabine Janzen, two doctorate students completing post-grad IT projects at the "Software Campus", funded by the Federal Ministry of Education and Research. Each year, approximately 80 to 100 students will be accepted into the Software Campus and their projects will be funded with up to 100,000 Euro over a maximum of two years. ◀

**More information**  
[www.innovative-retail.de](http://www.innovative-retail.de)  
[www.qkies.de](http://www.qkies.de)  
[www.res-com-projekt.de](http://www.res-com-projekt.de)  
[www.softwarecampus.de](http://www.softwarecampus.de)

## Learning Space Robots with Manual Dexterity – Software from DFKI

► Adaptive software will give robots the capability of human-like movement of the upper body, the arms, and the hands. Robots of the future will be capable of learning, capable of solving tricky problems on foreign planets with precision and sensitivity – for example, erecting a solar sail for power supply generation. The learning platform is being developed by researchers of the Robotics Innovation Center at the German Research Center for Artificial Intelligence (DFKI) and the Robotics Working Group at the University of Bremen.

Project BesMan (“Behaviors for Mobile Manipulation”) is a new project with about 3.8 million Euro in funding from the German Aerospace Center (DLR) for a term of four years. Prof. Dr. Frank Kirchner and his team are developing methods for single and double arm handling, which robots can learn via a human interface. In parallel, scientists are writing new planning algorithms to allow the robots to act without human intervention.

It all functions according to the building block principle: the robot already carries into space a series of learned abilities such as grasping, lifting, and turning in its travel bag. It is aware of changes in its environment and can react independently to them. It can create a new plan for each situation. The robot should be able to free itself from a difficult situation or master a new task. Failing at this, the learning platform comes into play: back on earth, a human performs the required movements in the lab, which should help the robot to get itself out of trouble (programming by demonstration). This data is transmitted into space via a port and executed by the robot.

“The software has to work in robots of different designs – for example the multi-legged climbing robots or the more humanoid systems,” explains project leader Dr. José de Gea Fernández. Scientists first tested their algorithms on a humanoid robot named AILA.

### Human is the learning standard

Scientists take humans as the example for creating the efficient series of movements of the arms and hands: so called motion-tracking-cameras record the motions of a person in the lab environment. The learning platform then separates the motion automatically into individual segments. A simulation reproduces the series and transmits it to the robot in space. The robot then performs the series of movements, taking over each movement and entering them into its repertoire of behaviors.

The construction of an infrastructure requires robots – even in unexpected situations – that are motorically fit: crates have to be lifted, solar panels erected, and small plugs connected. “We have to build systems that come close to replicating the abilities of humans,” says Prof. Dr. Frank Kirchner, Head of the DFKI Robotics Innovation Center and the Robotics Group at the University of Bremen. Immense cost savings are possible through the employment of intelligent robots because, compared to manned space missions, significantly less weight must be transported into space.

BesMan is sponsored by the Space Agency of the German Aerospace Center with funds from the Federal Ministry of Economics and Technology as provided by resolution of the German Parliament. ◀

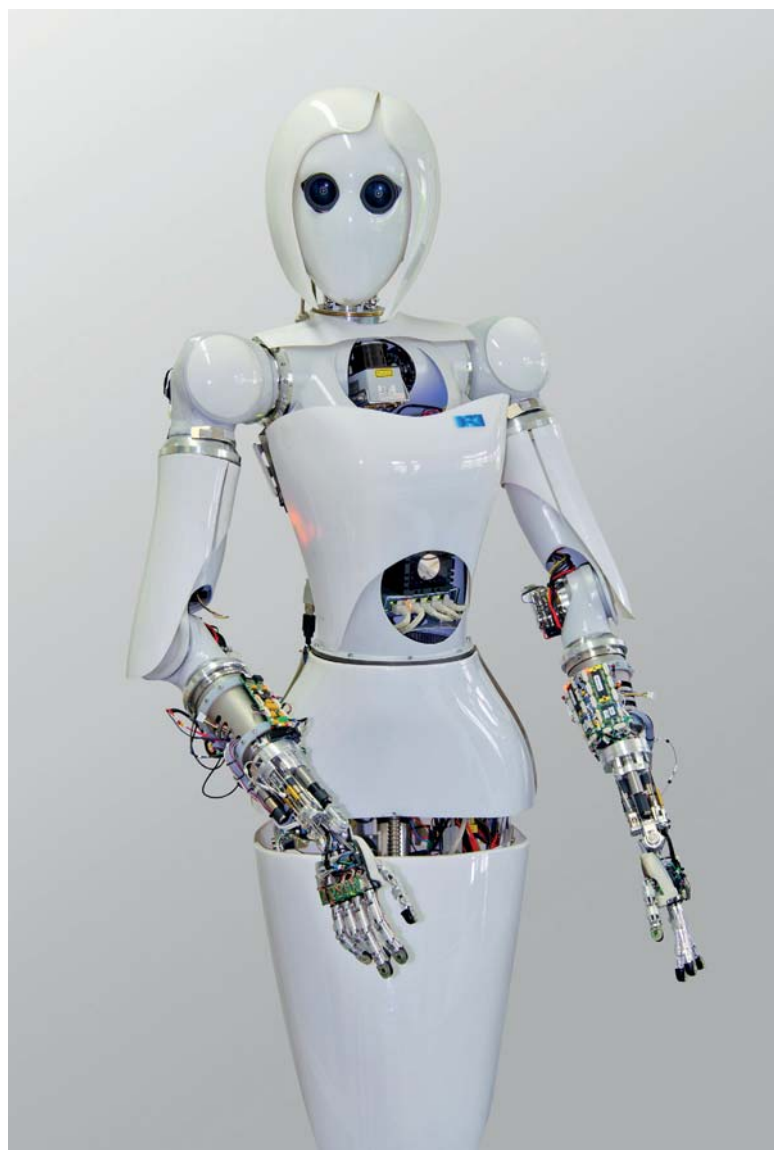
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DFKI scientists test adaptive software and algorithms for fine motor skills on the AILA model. In the future, this technology will be integrated in space robots



## ► DFKI Interview – Dr. José de Gea Fernández

Dr. José de Gea Fernández is Deputy Head of Department Mobility and Manipulation at the DFKI Robotics Innovation Center

### What do you see as the application potential of your research?

My research area is robotic manipulation, specifically the area of so called mobile manipulation, which involves performing complex manipulation actions in unstructured and dynamically changing environments. In general terms, this research area aims at getting robot manipulators out of typical industrial, pre-determined and enclosed environments and deploy them in real-world scenarios and conditions. That for example would mean to have robots helping at home, at hospitals, closely cooperating with humans in industrial environments.

### When did your interest in Artificial Intelligence begin and how have AI processes changed since that time?

The interest arose as soon as I started working at the Robotics Group of the University of Bremen headed by Prof. Kirchner back in 2003. It was very motivating to hear about “behaviors” when referring to robots or the use of biologically inspired concepts for controlling them. Having an engineering degree in which we studied cumbersome classical robotics, it was very refreshing to see how control methods used by simple biological systems could be also used to robustly control robots. And after studying simple biological systems, nowadays we look to higher vertebrates and humans to understand how to master more complex operations.

### What are the greatest challenges and opportunities for AI systems?

It is always difficult to know exactly where we are in AI. At the famous Dartmouth conference more than 50 years ago, they already thought that a machine as intelligent as a human would be available within one generation. We do not have it yet, but in the last decades we have seen important advances in the area of robotics. We can now make use of extremely compact and miniaturized components: from sensors to powerful actuators through highly powerful computational resources, all available in the robot itself. This gives us new possibilities to truly integrate very complex control algorithms within highly complex mechanical robotic systems that could innervate a new category of intelligent systems.



Dr. José de Gea Fernández, Senior Researcher and Project Leader of BesMan and Robofoot

### What do you enjoy doing when you are not working as a research scientist?

Travelling as much as I can afford has been always on top of my list. On a daily basis, cooking and discovering new restaurants or playing football and going to the gym are other activities to disconnect for a few hours. On a more cultural level, I like reading about neuroscience and the brain, which actually started as a hobby and ended up being useful in my job.

### What are your current projects?

I am currently leading the four-year DLR-funded project BesMan and the European Project ROBO-FOOT. In the recently started project BesMan, we will develop generic software to allow robots of different morphology to learn and autonomously perform complex manipulation actions. Keywords of this project are whole-body manipulation in which we integrate tasks, external forces, and body constraints into a single control framework; autonomous manipulation planning, and programming by demonstration in which the robot will learn new skills after observing a human operator performing a task.



Insect raptor arms as inspiration: the “Mantis” robot does more than just walk on its forelegs – it can manipulate objects as well

## The Praying Mantis Is the Model for a Six-legged Robot Designed to Build Infrastructure in Space

► A mantis for the moon, Mars, and meteorites: The “Mantis” robot, with the arms similar to its namesake in the insect world, is designed to independently explore the planets and build an infrastructure using its gripper arms. The hardware and software is developed by scientists at the DFKI Robotics Innovation Center and the University of Bremen.

Thanks to a bio-inspired body and various walking patterns, it can master steep craters and debris fields as well as manipulate objects with its front legs. Capable of learning from experience, it should be able to take goal-oriented actions. The new LIMES project is funded for a term of four years with about 3.7 million Euros from the German Aerospace Center (DLR). The name LIMES stands for “Learning Intelligent Motions for Kinetically Complex Legged Robots for Exploration in Space.”

The robot is named after the praying mantis – a member of the order of Mantodea (raptorial legs). The robot’s body form is borrowed from nature: The system uses the front two of its six legs for more than walking, also using them to grasp objects. It stands with upraised forelegs – like its namesake – to securely grasp and hold things.

“The challenge is to learn walking patterns for a variety of different surface conditions, in which all six legs work in harmony despite performing different tasks,” explained Prof. Dr. Frank Kirchner, Head of the DFKI Robotics Innovation Center and the Robotics Group at the University of Bremen. The many joints distributed across multiple legs enable many different patterns of movement. In this way, the robot can adapt its body position to the conditions and maneuver safely on unfamiliar territory.

### Robot makes situational selections from its “repertoire of behaviors”

The aim of the project is to give the robot sufficient algorithms for various maneuvering modes. These could be, for example, an energy saving or a cautious movement mode. Stumbling blocks, craters and inclines are navigated by Mantis with the help of tactile sensors built into the soles. The camera mounted in the head provides a 3-D image of the surroundings. The data

are transmitted via satellite to Earth. Humans then give the robot instructions about what target is to be approached. “Mantis chooses the appropriate motion pattern from the data in its so called behavior repertoire. It identifies obstacles and automatically avoids them,” said Sebastian Bartsch, DFKI computer scientist and project leader. After each action, the robot evaluates its decision. “For example, it questions: Was my action efficient in terms of energy consumption? If not, future actions when facing a similar situation will be different,” explained Bartsch. In this way, the robot is continuously expanding its range of know-how.

The movement patterns are pre-learned in simulations that reproduce extraterrestrial conditions: gravitation, light conditions, slopes and gradients. Actual tests follow in the Space Exploration Hall at DFKI, a 288 sqm test area with an artificial, cratered landscape.

LIMES is sponsored by the Space Agency of the German Aerospace Center with funds from the Federal Ministry of Economics and Technology as provided by resolution of the German Parliament. ◀

**More information**  
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Vice world champion in the World Cup: Bremen's robot soccer team B-Human



RoboCup 2012

## Bremen's Team B-Human Vice World Champion in Robot Soccer World Championships

► The student team B-Human from Bremen captured the vice world champion title at RoboCup 2012. The three time world and four time European champions lost in the final match on June 23, 2012 to the US-Team Austin Villa 2:4 in Mexico City.

B-Human has dominated the Standard Platform League for the past three years: The team from the University of Bremen DFKI had been undefeated. This year several competitors were able to narrow the performance gap to the defending champion. 25 teams from 17 countries competed for the title. In the Standard Platform League, teams use the same standard hardware, the two-legged NAO robot built by the French company Aldebaran Robotics.

Team B-Human had a fairly easy time in the early rounds. A 10:0 win over the Portuguese team and another 10:0 score against the Greek team Kouretes easily brought B-Human to the second round. The next victims for the B's were the Chinese Team TJArk with 8:0 and the Austrian Kangaroos with a 9:1 result. Things were a little tighter in beating the rUNSWift team from Australia 4:3, who finished the tournament in third place overall. The energy picked up after the quarter finals when the 10:0 win over Team Edinferno from England advanced B-Human into the semi-finals. It came down to the penalty kicks in overtime before B-Human was able to take the match 4:3 from Leipzig's Nao-Team HTWK.

The World Cup 2012 was plagued by technical problems. The uneven, vibrating playing floor let the robots sense the motion of their teammates and threw the NAOs off their own timing. The radio network used for robot communications was frequently interrupted, which resulted in very little team play being possible. On the positive side, the robots were well served by their new cameras considering the poor lighting on the playing field.

"In the end the construction of the field was what sealed B-Human's fate in the final match," said Team Manager Dr. Thomas Röfer: "Our opponent Austin Villa was more successful on this surface because they use smaller strides." Austin Villa's motion algorithms were created by B-Human, which released its last year's software to the public. Six other teams also rely on the B-Human technology - including Edinferno and the Austrian Kangaroos.

### Background: B-Human and the RoboCup

B-Human is a student project for the computer science degree program at the University of Bremen. It is supervised by scientists from DFKI's Department of Cyber-Physical Systems, managed by Professor Rolf Drechsler. Every year it competes in the RoboCup.

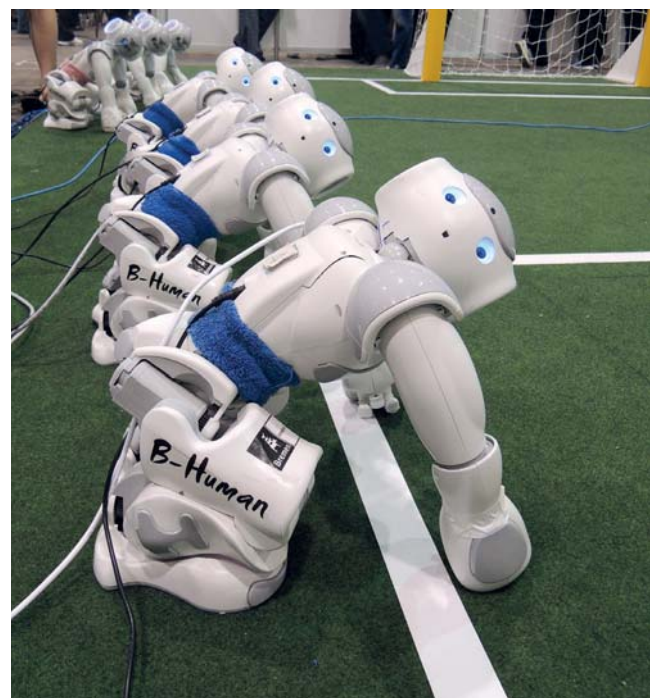
The RoboCup is an international initiative aimed at promoting research in the areas of artificial intelligence and robotics. The long term goal is to develop a team of autonomous, humanoid robots that can defeat the reigning human soccer champions in the year 2050. In order to achieve this vision, five different leagues have been established, each with a different major focus of research. In the Standard Platform League, for example, the challenge is in the software development – i.e., the artificial intelligence of the robots.

Thanks to support from the economic development initiative "Bremen Innovative" (WFB) and the University of Bremen, Team B-Human was able to work with a team of six robots of the latest NAO version 4. This new version has a much higher computing capacity. ◀

**More information**  
[www.b-human.de](http://www.b-human.de)  
[www.robocup2012.org](http://www.robocup2012.org)

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Smart assistants: "iWalker" and "Rolland"

## Navigation, Warnings, Braking – Safer Mobility Assistance Systems for Seniors

► Mobility assistants like walkers or wheelchairs are essential to many seniors in order to stay healthy and enjoy mobility in daily routines. In case of deficits in motor abilities such as unsteady gait, problems with balance, or dizziness, the support provided by such equipment is appreciated. However, these aids do not provide further safety to the user: they cannot identify obstacles, adjust the tempo to the surface conditions, or find the right path. The research project known as ASSAM (Assistants for Safe Mobility) develops assistance systems for seniors to help them compensate for cognitive impairments such as impaired vision or early stage senile dementia.

As a technology partner in ASSAM, DFKI developed a modular assistance concept that is oriented on the needs of the individual user. The navigation aid extends a standard platform by GPS and odometry (wheel sensors) for accurate positioning and provides the user with navigation instructions. The driving aid further improves safety by introducing an obstacle warning system that uses a laser scanner on the immediate surroundings to identify gates, curbstones, or potholes. In the most advanced configuration, the navigation assistant can assume control of a platform with electric drive and can by-

pass obstacles by automatically applying specific steering and braking actions. Completely autonomous movement is even possible indoors if the interior is mapped.

ASSAM is funded jointly by the Federal Ministry of Education and Research (BMBF) and the EU under the Ambient Assisted Living Joint Program for a term of three years under the lead management of DFKI. The navigation component is developed in collaboration with partner companies Budelmann Elektronik and Neusta Mobile Solutions. The Spanish partners Universitat Politècnica de Catalunya, Lifante Vehiculos, and Ecobike develop the new platforms for walkers and safer 3-wheeled electric vehicles. ASSAM relies on a User Centered Design approach, which is supported by the Utrecht School of the Arts and the chari-

table organizations Johanniter Unfall Hilfe, Bartiméus Foundation (Netherlands), and the Centre de Vida Independent in Spain. ◀

### More information

[www.assam-project.eu](http://www.assam-project.eu)

[www.baall.net](http://www.baall.net)



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Users test their self-designed running apps under real-life conditions

## uRun Successfully Tested – New Sport and Health Apps

► In the town of Bad Lippspringe, a group of experienced therapists at the German Active Running and Therapy Center have tested a prototype of a mobile training assistant in real-life conditions. The participants used uRun to develop and test their own mobile applications especially for runners.

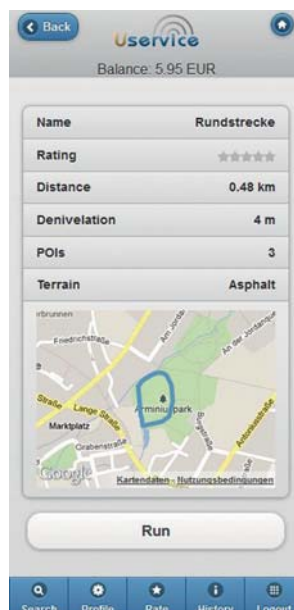
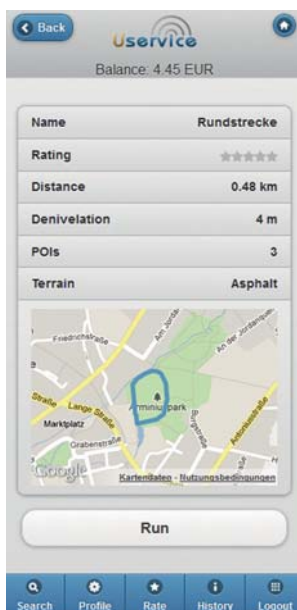
uRun is a product of the uService project (funding ID 01S09020D) supported by the Federal Ministry of Education and Research (BMBF) and successfully completed in 2012.

“Mobile services for the people and by the people” is the vision that was followed in uService. uRun provides users with the option to develop innovative sport and health apps for runners. The major difference to other apps like Runkeeper or miCoach Mobile is the integrated recommendation system developed at DFKI that adapts to the runner's individual situation. uRun takes into consideration the individual preferences of the jogger and the training plan, recommending the optimal route with respect to the surface conditions so that even on unfamiliar

terrain the best possible training can be performed. Using integrated body sensors, uRun knows when the runner is overtraining and recommends a break at a nearby café. If the runner wants to quit the course, uRun will show the location of the next bus stop and the times of departure.

One important requirement in the development of uRun was the intuitive access for users who may not be technically inclined. The integrated recommendation system offers assistance in all functionalities, even for the creation and sale of independent running apps as well as for searching for the appropriate apps for individual training. This support was positively received by all participants in the field tests in Bad Lippspringe.

The successful development of the recommendation system and the positive feedback from the testers demonstrates the feasibility of uRun and affirms the utility and market relevance of the application. This points the way for a rapid transfer to the commercial industry. The project clearly shows that the innovative idea of mobile apps for the people and by the people can be applied in practical application solutions. ◀



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## The Shopping World of Tomorrow at the “ThyssenKrupp IdeenPark 2012”



► Simply point to the desired goods at the cheese counter, compare the ingredients and nutritional values of similar products on your screen, ask your intelligent shopping cart the way to the smart cookies with QR-Code, and, when finished, pay for it all from your mobile phone – without unloading the cart and without cash. This, or a similar scenario, is how you could do your shopping in the supermarket of the future thanks to intelligent assistance systems for customers and employees. This is the vision of retailing introduced by DFKI at the Thyssen Krupp IdeenPark 2012 located at the fairgrounds in Essen.

The visitors to the “StadtLabor” (City Lab) in Hall 3 experienced how innovative technologies can support the increased mobility of the user while, at the same time, allowing a natural and intu-

itive use of assistance systems. It takes the fusion of information from various data sources and a semantic interpretation of it to generate knowledge from information.

Such systems are being developed and tested at the DFKI Innovative Retail Lab (IRL), established at the headquarters of GLOBUS Warehouse Holding in St. Wendel, Germany. These close ties to the subject matter experts from Globus allow the alignment of individual projects to the specific requirements and future potential of the DIY warehouses and accelerate the transfer of research results to the marketplace. ◀

## The “Digital Age of Cookies” Featured in “365 Landmarks in the Land of Ideas” Competition

► The food producer Juchem, distributor of “QKies”, was chosen as one of “365 Landmarks in the Land of Ideas” in the nationwide competition on September 10, 2012. The “QKies” – cookies with QR codes and custom messages – are marketed as a baking mix in a joint venture with the DFKI Innovative Retail Laboratory. The QR-Codes are printed on edible paper with food coloring and encode any message the sender wishes to convey in the most delicious way. Anyone can link the code to digital content, for example, web pages, videos, photos, invitations to a company event, or key product information. The two-dimensional barcodes can be read by nearly every type of smart phone with an appropriate free, standard application.

The competition “365 Landmarks in the Land of Ideas” has been part of the government initiative “Germany – Land of Ideas” since 2006 and is co-sponsored by Deutsche Bank. Sylvia Leiner, corporate customer business manager at Deutsche Bank Saarbrücken, presented Andrea Juchem, managing director of Juchem Foods, the award as a “Selected Landmark 2012” with the words: “Juchem is a good example of the innovative spirit of mid-sized enterprises. In a country lacking in raw materials like ours, it is ideas, above all, that bring us progress.”

Andrea Juchem expressed her appreciation for the award: “We are very proud to have been selected as a Landmark in the Land of Ideas. The cookies with QR codes are an example of how a very traditional product can be positioned to an entirely new segment when people from very different areas depart from their traditional and often entrenched ways of thinking, and open their minds to work with other disciplines.” ◀

### More information

[www.qkies.de](http://www.qkies.de)  
[www.land-der-ideen.de/en](http://www.land-der-ideen.de/en)  
[www.juchem.de/en](http://www.juchem.de/en)

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(l.-r.): Prof. Antonio Krüger, Andrea Juchem, Sylvia Leiner, Emanuel von Bodmann (Initiative „Germany – Land of Ideas”)



## Exciting Times for the Web – HTML5 Is Changing the World

W3C Events presents the ultimate web platform of the future at Xinnovations 2012

► The W3C German-Austrian office organized “W3C Events” on September 10-11, 2012 in Berlin with the aim of presenting and discussing the latest developments regarding the technology standard called HTML5. To further this purpose, HTML5 organizers invited expert Michael<sup>[TM]</sup>Smith from the World Wide Web Consortium (W3C), who gave a keynote address filled with first hand information about the newest browser technologies. In addition to the usual lecture program in the framework of the W3C Days, this year for the first time there was also a W3C Start-Up Day, which provided young entrepreneurs a platform for the exchange of ideas, options, and requirements concerning HTML5. By expanding the program, the German-Austrian W3C office continues its long-term cooperation with the organizers of Xinnovations, the Berlin Forum for Internet, Politics, and Innovation.

HTML5 will change the World Wide Web, now widely used in nearly every industry: from the automobile industry to publishing to logistics, communications, and entertainment. Never before was it so easy for a web developer to create and distribute multimedia content in the WWW and to develop intuitive user interfaces that are both easy to operate and wireless-friendly. What will change in the current apps market? What new web products will arise?

In an effort to answer these and other questions, W3C organized “W3C Events” in the context of Xinnovations 2012 in Berlin. Michael Smith is the HTML5 expert of W3C and, as the guest speaker and contact person for this event, made this his first visit to Berlin. Visitors heard from him first hand about the latest HTML5 developments, related technologies, and current opinions from industry concerning HTML5.

**Mike Smith had this to say about the importance of HTML5 for the web of the future:**

“These are really exciting times. We’re in the midst of a generational change to the Web, and that change is at least as transformative as the early days of the Web. HTML5 is the buzzword that many have come to use to describe the change, but really the change is about making the Web a fully-featured application and communications platform – what we’re calling simply the Web Platform. And we really are just at the beginning of building it. It’s the platform that our children and our children’s children are going to be using for their lifetimes, and the platform they’re going to keep building on further. It’s the platform for the future.”

Dr. Feiyu Xu, research scientist and project leader at DFKI, founder and managing director of Yocoy Technologies, delivered a talk about “Language Technologies for Semantic Web and their Applications.” “The web today is far away from the semantic web,” said Dr. Feiyu Xu. “Language technologies have to be considered as core technologies that are transforming the web as we know it into a semantic web.” To underscore this,



Mike Smith, HTML Activity Lead in W3C

Feiyu Xu presented key applications developed at DFKI and Yocoy for the future semantic web. These include: semantic search engines, Q&A engines, and social media monitoring tools.

The World Wide Web Consortium created W3C Day and W3C Start-Up Day to serve as a platform for the web industry to present current HTML5 developments, share ideas, and discuss further requirements to advance HTML5. Of major importance to W3C was to hear varied opinions regarding the current status of HTML5 technologies and debate further strategies concerning the future and advanced development.

W3C Events was organized by Dr. Felix Sasaki, professor at the University of Applied Sciences Potsdam, Senior Researcher at DFKI-Berlin, and Head of W3C German-Austrian Office. ◀

**More information**

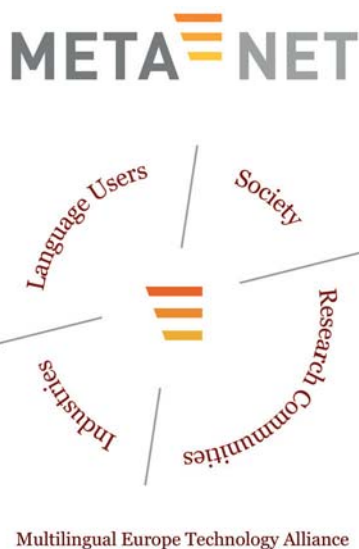
[www.xinnovations.de/w3c-events.html](http://www.xinnovations.de/w3c-events.html)  
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## At Least 21 European Languages Facing Digital Extinction



► A recent study by Europe’s leading language technology experts warns: most European languages are unlikely to survive the Digital Age as they are in danger of digital extinction. This is the finding of the study “Languages in the European Information Society” that assessed the levels of language technology support available for 30 of the approximately 80 European languages. The experts conclude that digital support for 21 of the 30 languages investigated is “non-existent” or “weak” at best. The study was carried out by META-NET, a European network of excellence that consists of 60 research centers in 34 countries.

The study, prepared by more than 200 experts and documented in 30 volumes of the META-NET White Paper Series, assessed language technology support for each language in four different areas: automatic translation, interactive speech, text analysis, and the availability of language resources. A total of 21 of the 30 languages (70%) were rated by the experts at least once in the worst category, “support is weak or non-existent.” Several languages, for example, Icelandic, Latvian, Lithuanian and Maltese, received the lowest score in all four areas. While no language was considered to have “excellent support”, at the other end of the spectrum, only English was assessed as having “good support”, followed by languages such as Dutch, French, German, Italian and Spanish with “moderate support”. Languages such as Basque, Bulgarian, Catalan, Greek, Hungarian and Polish exhibit “fragmentary support”, placing them also in the set of high-risk languages.

“The results of our study are most alarming. The majority of European languages are severely

under-resourced and some are almost completely neglected. In this sense, many of our languages are not yet future-proof,” says Prof. Dr. Hans Uszkoreit, coordinator of META-NET, scientific director at DFKI, and co-editor of the study. The study’s other co-editor, Dr. Georg Rehm (DFKI), adds: “There are dramatic differences in language technology support devoted to the various European languages and technology areas. The gap between ‘big’ and ‘small’ languages is continuously widening. We have to make sure that we equip all smaller and under-resourced languages with the needed base technologies, otherwise these languages are doomed to digital extinction.”

Although Europe has succeeded in removing almost all physical borders between its countries, one border still exists and it seems to be impenetrable. This is the invisible barrier of language and it hinders the free flow of knowledge and information. It is also an obstacle to the long-term goal of establishing a single digital market with free flowing goods, products, and services. Modern language technology has the potential to eliminate language barriers through machine translation systems. However, the results of the META-NET study clearly show that many of the European languages have not been prepared. There are significant gaps in technology because of the English-language focus of most R&D, the lack of commitment and financial resources, and also the absence of a clear research and technology vision.

A coordinated European effort of sufficient scale has to be made to transfer the technology to the majority of languages as well as to develop missing technologies. There are a number of rea-



sons to approach this immense challenge as a community effort involving the European Union, its member states and industries. This approach is justified, for example, by the high per-capita financial burden to smaller language groups, the required technology transfer between languages, the lack of interoperability of resources, tools, and services and, the fact that linguistic borders often do not coincide with political borders. Europe must take action to future-proof its languages for the digital age. They are a precious component of our cultural heritage and must not be neglected in the effort to remove the restrictions on future digital markets.

#### The META-NET White Paper Series

The META-NET Language White Paper series “Languages in the European Information Society” reports on the state of 30 European languages with respect to language technology and explains the most urgent risks and chances. The series covers all official EU Member State languages and several other languages spoken in Europe. While there have been a number of valuable and comprehensive scientific studies on certain aspects of language and technology, until now there has been no generally understandable compendium that presents the main findings and challenges for each language with regard to a technology-supported multilingual Europe. The META-NET White Paper Series fills this gap. META-NET shows why most languages face serious problems and identifies the most threatening gaps. In total, more than 200 authors and contributors helped in preparing the Language White Papers.

The white papers (available both online and in print) have a length of about 100 pages each and were written for the following European languages: Basque, Bulgarian, Catalan, Croatian, Czech, Danish, Dutch, English, Estonian, Finnish, French, Galician, German, Greek, Hungarian, Icelandic, Irish, Italian, Latvian, Lithuanian, Maltese, Norwegian (Bokmål and Nynorsk), Polish, Portuguese, Romanian, Serbian, Slovak, Slovene, Spanish, and Swedish. Each Language White Paper is written in the language reported on and includes a complete English translation.

#### About META-NET and META

META-NET, a Network of Excellence consisting of 60 research centres from 34 countries, is dedicated to building the technological foundations of a multilingual European information society. META-NET is forging META, the Multilingual Europe Technology Alliance. More than 600 organizations from 55 countries have already joined this open technology alliance.

The META-NET Network of Excellence is co-funded by the 7th Framework Program of the European Commission through the following grant agreements: T4ME Net (no. 249119), CESAR (no. 271022), METANET4U (no. 270893) and META-NORD (no. 270899). ◀

#### More information

[www.meta-net.eu](http://www.meta-net.eu)  
[www.meta-net.eu/whitepapers](http://www.meta-net.eu/whitepapers)

**“Europe’s inherent multilingualism and our scientific expertise are the perfect prerequisites for significantly advancing the challenge that language technology poses. META-NET opens up new opportunities for the development of ubiquitous multilingual technologies.”**

*Prof. Dr. Annette Schavan,  
 Federal Minister of Education and Research*

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Software-Cluster exhibits “Emergent technologies and services for the workplace” at CeBIT 2012

## Software-Cluster

### Enterprise Software of Tomorrow – Cross-company Integration of Value-added Chains in Food Industry

▶ In July 2012, the successes of the collaborative research projects in the Software Cluster were officially acknowledged: The international jury for the German government’s Leading-Edge Cluster Competition made the recommendation after the second interim evaluation to continue the funding of the Software Cluster research projects. Since the initial designation in 2010, many renowned companies and research institutions in the region in and around the cities of Saarbrücken, Kaiserslautern, Darmstadt, and Karlsruhe, have been studying the foundations of the future business software – “emergent software.” The key factor is the dynamic integration of various services from different suppliers, to permit rapid and customized responses to individual customer requirements. Emergent software will enable the simple and secure integration of systems, processes, and components beyond corporate boundaries and lead to real innovations in the digital enterprise. Three research findings from Software Cluster partners were specifically referenced as exemplary:

▶ The Intelligent Views GmbH, together with Software AG and TU Darmstadt, is developing the topic of “Governance and Compliance Solutions” for emergent software systems. Considering the dynamic combination of a number of components from different suppliers, the big challenges for emergent software systems are the administration of these components and ensuring compliance with the regulatory and legal provisions. Partners have created a demonstrator that facilitates this with the aid of a semantic search feature. In this approach, changing requirements can be received with more flexibility and the value-added chain can be adjusted accordingly.

▶ In the value-added chains that are controlled by emergent software and extend beyond the corporate boundaries, the protection of sensitive customer data and the implementation of security guidance is an entirely new challenge. Researchers at Fraunhofer Institute for Experimental Software Engineering (Kaiserslautern) and TU Darmstadt have built a demonstrator that shows how

control over private and personal data can be achieved through appropriate security guidance even in integrated value-added chains extending beyond corporate borders, without having to change the services delivered or the underlying software.

▶ The third area cited is the emergent knowledge system developed at DFKI’s Innovative Retail Lab together with imc company that offers a cross application, context sensitive, and customizable user assistance function. Dependent on user and situation, the system makes specific data for business processes, company products, or organizational background information available in the respective software. Traditional help information for standard applications like Office, SAP, or internet applications can be extended by emergent software.

What do these individual results look like when combined in practice? The food industry provides a good example:

Increasingly, one of the selection criteria for many customers is the level of carbon dioxide emission in the production and transport of the product. Consequently, a retail chain of bio-supermarkets decided to add its own brand of blueberry yogurt to the product line, which features an especially favorable carbon footprint. The purchasing department of the chain looked for a food producer to supply a yogurt with the appropriate CO<sub>2</sub> balance for an acceptable price and then concluded an exclusive supply contract with the winning company.

In terms of integrated business process management, this results in a multitude of challenges for the food producer: The carbon footprint is a complex value that can be influenced by nearly every step along the value-added chain, not just whether the yogurt comes from a regional producer or not. There are already big differences in agricultural farming and its preliminary outlays – milk products, in fact, produce an especially large amount of CO<sub>2</sub> associated with the high emissions of methane by the cows. There are also many variables even in the subsequent steps in the supply chain for blueberry yogurt – dairies, transport, packaging, storage, refrigeration – that can influence the CO<sub>2</sub> balance: is the raw yogurt shipped for fermentation elsewhere or are the blueberries imported based on season?

A producer that needs to develop a CO<sub>2</sub> optimized blueberry yogurt reaches for the aspects of an emergent software system described here for the management of the production processes. He employs a governance and compliance system that monitors all of the value-adding stages as well as the compliance with the defined CO<sub>2</sub> threshold value in addition to the costs of each stage in one integrated process. In this way, the suppliers – dairies, agricultural enterprises, transport companies, etc. – that best satisfy the overall minimization of the carbon footprint can be selected and integrated in the value-added supply chain. If a bottleneck arises with one supplier, it will be sidestepped and another appropriate supplier gets the order. The high degree of complexity in an emergent software system remains manageable because dif-

ferent components can be dynamically integrated and it permits a fast and flexible response to changing requirements.

In the example application scenario used here, to ensure that manufacturing and marketing are always provided with the most current information about production, the emergent knowledge system is integrated at the work stations. The system is adaptive and makes cross-process information available selectively to the respective user: whether the employee is in purchasing, logistics, or in quality management, they can view the evaluations of a specific supplier in the internal social networks or display information on the CO<sub>2</sub> related certifications.

The embedded security guidance in the emergent process management software guarantees that sensitive data is always displayed exactly and only where it is required in the cross-company value-added chain. In this way, it is assured that neither the individual supplier nor the buyer can know the total process that leads to the favorable CO<sub>2</sub> balance. Emergent software can be used to create new products, retain competitive advantage, make a profit, and satisfy customer demand. ◀



Software-Cluster at CeBIT 2012 “lab talk”

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Software-Cluster exhibit booth at CeBIT 2012



## ► Underwater Robots at SMM in Hamburg

DFKI Robotics Innovation Center presented current projects in the area of underwater robotics as part of a special exhibit at the 25th Shipbuilding, Machinery & Marine Technology International Trade Fair (SMM) on September 4-7, 2012. The SMM is the world's leading trade show for shipbuilding and maritime technologies. The special exhibition is dedicated to the subjects of offshore oil and gas, offshore wind energy and marine technology. In the "SeeGrip" project, a deep sea manipulator hand is being developed that can withstand the pressure at 6,000 meters below the surface. Another project is the underwater vehicle "Dagon", a product of the "CUSLAM" project, which aims to create a stand-alone map of the sea floor one day. Both projects are sponsored by the Federal Ministry of Economics and Technology (BMWi).



The space robot Aramies

## ► "Adventurer, Explorer, Researcher" Exhibit in Bremen – Robots Present DFKI

Space robots Aramies and Cesar are guests at Bremen's Übersee Museum starting in October. The special exhibit "Adventurer, Explorer, Researcher" is scheduled to last until March 2013 and shows pioneers in the history of research. Discovery trails to James Cook, Charles Darwin, Marie Curie, and others lead the visitors to the "Future Lab" where they meet the DFKI robots and other exhibits that explain current as well as future research approaches. More information: [www.uebersee-museum.de](http://www.uebersee-museum.de)

## ► Best Paper Award for Lisa Ollinger

Lisa Ollinger, staff member of DFKI's Innovative Factory Systems (IFS), was given the Best Paper Award at the "Symposium on Information Control Problems in Manufacturing (INCOM-2012)" in Bucharest for her submission on "Service-oriented process control with Grafchart and device profiles for web services." INCOM is one of the world's most respected conferences for the promotion of research projects in the field of mechanical engineering.

## ► Parliamentary Committee for Media and Network Policy Visits DFKI Kaiserslautern

Parliamentarians were informed about the innovative technologies at DFKI in combination with modern media and the internet in an external session held on August 16, 2012. The committee controls the media policy and advises the government of Rhineland-Palatinate on matters relevant to the state concerning public broadcasting and net policy.

At DFKI Kaiserslautern, a team of researchers lead by Prof. Dr. Andreas Dengel demonstrated selected projects to parliamentarians, for example, a software-aided video analysis, a "Crowd Monitoring" method to promote greater safety at major events (p.12) and the "PAMAP" project, a sensor based training system for senior citizens. The Mobile Agricultural Portal Rheinland-Pfalz (MAPrlp) and Project iGreen clearly explained how modern cloud-structures and map based positioning data can be employed to promote environmentally friendly production as well as for quality-related declaration of origin on food products.

## ► Wahlster Is Chairperson of the Highest EU Advisory Board for Research on the Future Internet

At the EU-summit on the Future Internet held in Helsinki, Prof. Dr Wolfgang Wahlster was chosen by unanimous vote to serve as the chairperson of the advisory board for the Future Internet Public-Private Partnership (FI-PPP). The aim of the FI-PPP Initiative is to ensure that the European share of the global internet economy steadily increases. FI-PPP is Europe's flagship research program. The goals are to explore the fundamentals and applications of the future internet, to create the necessary technological platforms and implement them on an industrial level, to advance the competitiveness of Europe in the area of future internet technologies and systems, and to support the emergence of new internet applications.



1<sup>st</sup> row: (l.-r.) Dr. P. Turkama, Prof. W. Wahlster, P. Lyons, Dr. R. E. Kahn, Dr. P. Gatellier, Prof. A. Oliveira;  
2<sup>nd</sup> row: (l.-r.) D. Carter, G. Persival, Prof. Y. Neuvo, Prof. W. Jonker, P. Fatelnig, Prof. A. Azcorra, Dr. J.-C. Hourcad





## DFKI Service Offering

As an internationally renowned Center of Excellence for innovative software systems based on Artificial Intelligence (AI) methods, DFKI is offering the following services with more than 20 years of experience in basic and applied R&D:

- ▶ Technology transfer of the award-winning research results of DFKI
- ▶ Innovation coaching and start-up consulting in the Public-Private-Partnership sector
- ▶ Individual design, development and implementation of innovative application solutions
- ▶ Market studies, expert surveys, feasibility analysis and empirical user studies
- ▶ Component development with AI-functionality, enhancing the performance of complex software systems
- ▶ Scientific advice on the selection and implementation of complex software solutions
- ▶ Customization, implementation, deployment and maintenance of our AI-solutions
- ▶ Scientific evaluation and benchmarking of software solutions
- ▶ Application-oriented basic research
- ▶ Independent assessment of IT-security and privacy
- ▶ Technology workshops, training and practice
- ▶ Scientific monitoring of data collections and their evaluation
- ▶ Business engineering: Process analysis and development
- ▶ Innovation coaching and turnaround management
- ▶ Strategic and technical Due Diligence consulting for companies in the ICT sector
- ▶ Technical and organizational support for the standardization in the IT sector (including W3C, ISO)
- ▶ Design, construction and operation of Living Labs



Kaiserslautern Site



Saarbrücken Site



Bremen Site



Project Office Berlin

## German Research Center for Artificial Intelligence Company Profile

- ▶ **Established**  
1988
- ▶ **Legal Form**  
Non-profit organization  
(public-private partnership)
- ▶ **Executive Board**
  - ▷ Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster, CEO
  - ▷ Dr. Walter Olthoff, CFO
- ▶ **Supervisory Board**
  - ▷ Prof. Dr. h.c. Hans-Albert Aukes, Consultant to the Management Board, Deutsche Telekom AG, Chairman
  - ▷ Heinz-Josef Mentges, Department Head, Ministry of Education, Science, Further Education and Culture of Rhineland-Palatinate, Vice Chairman
- ▶ **Locations**  
Kaiserslautern (registered office), Saarbrücken, Bremen, Berlin (project office). Further operating sites in Osnabrück and St. Wendel
- ▶ **Shareholders**  
Astrium GmbH, BMW Group Forschung und Technik GmbH, Daimler AG, Deutsche Messe AG, Deutsche Post AG, Deutsche Telekom AG, Empolis Information Management GmbH, Fraunhofer Gesellschaft e.V., Harting KGaA, Intel Corporation, John Deere European Office, KIBG GmbH, Microsoft Deutschland GmbH, RICOH Company Ltd., SAP AG, Software AG, University of Kaiserslautern, Bremen University, Saarland University
- ▶ **Equity Holding**  
Center for the Evaluation of Languages and Technologies Srl (CELCT), Trento - Graphics Media.net GmbH, Kaiserslautern - Ground Truth Robotics GmbH, Bremen - PMC e.G., Bremen - SemVox GmbH, Saarbrücken - Yocoy Technologies GmbH, Berlin

### Intelligent Solutions for the Knowledge Society

▶ The German Research Center for Artificial Intelligence (DFKI) was founded in 1988 and has research facilities in Kaiserslautern, Saarbrücken, Bremen and a project office in Berlin. In the field of innovative commercial software technology using Artificial Intelligence, DFKI is the leading research center in Germany.

Based on application oriented basic research DFKI develops product functions, prototypes and patentable solutions in the field of information and communication technology. Research and development projects are conducted in eleven research departments, ten competence centers and five living labs. Funding is received from government agencies like the European Union, the Federal Ministry of Education and Research (BMBF), the Federal Ministry of Economics and Technology (BMWi) and the German Federal States as well as from cooperation with industrial partners. Twice a year, a committee of internationally renowned experts (Scientific Advisory Board) audits the progress and results of publically funded projects. In addition, BMBF evaluates DFKI every five years. The most recent assessment was again very successfully concluded in 2010.

Apart from the state governments of Rhineland-Palatinate, Saarland and Bremen, numerous renowned German and international high-tech companies are represented on the DFKI supervisory board. The DFKI model of a non-profit public-private partnership (ppp) is nationally and internationally considered a blueprint for corporate structure in the field of top-level research.

DFKI is actively involved in numerous organizations representing and continuously advancing Germany as an excellent location for cutting-edge research and technology. Far beyond the country's borders DFKI enjoys an excellent reputation for its academic training of young scientists. At present, 424 highly qualified researchers and 252 graduate students from more than 60 countries are contributing to more than 160 DFKI research projects. DFKI serves as a stepping stone to leading positions in industry and successful careers as founders of spin-off companies. Over the years, more than 60 staff members have been appointed professors at universities in Germany and abroad.

In 2011 the total annual budget of € 39.2 million once again exceeded the previous year's record result. ◀

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## Research & Development

### ▶ Scientific Directors and Research Departments

#### Kaiserslautern Site

- ▶ Prof. Dr. Prof. h.c. Andreas Dengel:  
Knowledge Management
- ▶ Prof. Dr. Paul Lukowicz:  
Embedded Intelligence
- ▶ Prof. Dr. Didier Stricker:  
Augmented Vision
- ▶ Prof. Dr.-Ing. Detlef Zühlke:  
Innovative Factory Systems

#### Saarbrücken Site

- ▶ Prof. Dr. Antonio Krüger:  
Innovative Retail Laboratory, St. Wendel
- ▶ Prof. Dr. Peter Loos:  
Institute for Information Systems
- ▶ Prof. Dr. Philipp Slusallek:  
Agents and Simulated Reality
- ▶ Prof. Dr. Hans Uszkoreit:  
Language Technology
- ▶ Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster:  
Intelligent User Interfaces

#### Bremen Site

- ▶ Prof. Dr. Rolf Drechsler:  
Cyber-Physical Systems
- ▶ Prof. Dr. Frank Kirchner:  
Robotics Innovation Center
- ▶ Prof. Dr. Joachim Hertzberg:  
Robotics Innovation Center, Branch Office Osnabrück

#### Project Office Berlin

- ▶ Projects and cooperation in the German capital region

### ▶ Living Labs

Testing, evaluation, and demonstration of innovative technologies in comprehensive application scenarios  
Bremen Ambient Assisted Living Lab, Innovative Retail Lab, Robotics Exploration Lab, Smart Factory Lab, Virtual Office Lab

### ▶ Competence Centers

Coordination of research activities in particular areas  
Ambient Assisted Living, Case-Based Reasoning, Computational Culture, e-Learning, Human-Centered Visualization, Language Technology, Multimedia Analysis & Data Mining, Semantic Web, Safe and Secure Systems, Virtual Office of the Future

## Key Figures

- ▶ **Annual Budget 2011**  
€ 39.2 million
- ▶ **Total Assets 2011**  
€ 123.6 million
- ▶ **Employees**  
424 professional staff, 252 graduate student staff

## Scientific Excellence and Transfer

### ▶ International Scientific Advisory Board

Bi-annual evaluation of publically funded projects  
▶ Prof. Dr. Horst Bunke, University of Bern, Switzerland, Chairman

### ▶ Leading-Edge Research

DFKI is the only German institute for computer science to participate in each of the three leading-edge research clusters

- ▶ Cluster of Excellence “Multimodal Computing and Interaction” funded by the German Research Foundation (DFG)
- ▶ Leading-Edge Cluster “Software Innovations for the Digital Enterprise” funded by BMBF
- ▶ European Institute of Innovation and Technology - Information and Communication Technology Labs (EIT ICT Labs)

### ▶ Networks of Excellence

At present, DFKI is a coordinator or core partner in four European Networks of Excellence

### ▶ Promoting Young Talent

DFKI is a founding member and core partner of the Software Campus to promote managerial talent in the IT industry

### ▶ Academic Chairs

More than 60 former staff members have been appointed professors at universities in Germany and abroad

### ▶ Spin-offs

Over 60 spin-off companies have created approximately 1,700 highly skilled jobs

## Committees and Academies

DFKI is represented by its scientific directors on numerous committees and academies

### ▶ Scientific and Government Committees

Research Alliance of the German Federal Government, Feldafinger Kreis, Münchner Kreis, Technology and Innovation Council Berlin, Advisory Board of the Future Internet Public-Private Partnership Programme of the European Union (FI-PPP), Coordinator of the European Alliance Multilingual Europe Technology Alliance (META-NET), Management Board of the International Computer Science Institute in Berkeley, and others

### ▶ Business Committees

International SAP Research Advisory Board, Governance Board of the Intel Visual Computing Institute, and others

### ▶ Scientific Academies

Royal Swedish Academy of Sciences, German National Academy of Sciences Leopoldina, Berlin-Brandenburg Academy of Sciences, Academy of Sciences and Literature, National Academy of Science and Engineering, European Academy of Sciences, and others

# Intelligent Solutions for the Knowledge Society

- ▶ Knowledge management and document analysis
- ▶ Virtual worlds and 3D internet
- ▶ E-Learning and e-Government
- ▶ Development of provably correct software
- ▶ Innovative factory systems
- ▶ Information extraction from text documents
- ▶ Intelligent web retrieval and web services
- ▶ Multi-agent systems and agent technology
- ▶ Multimodal user interfaces and language understanding
- ▶ Visual computing
- ▶ Multimedia analysis and data mining
- ▶ Augmented vision
- ▶ Mobile robotic systems
- ▶ Shopping assistance and intelligent logistics
- ▶ Semantic product memories
- ▶ Safe and secure cognitive systems
- ▶ Semantic web and Web 3.0
- ▶ Ambient intelligence and assisted living
- ▶ Intelligent solutions for safety and security
- ▶ Driver assistance systems and Car2X communications
- ▶ Cyber-physical systems



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