

NEWSLETTER



GERMAN RESEARCH CENTER FOR ARTIFICIAL INTELLIGENCE

2/2011

RESEARCH LABS

KNOWLEDGE MANAGEMENT

ROBOTICS INNOVATION CENTER

SAFE AND SECURE COGNITIVE SYSTEMS

INNOVATIVE RETAIL LABORATORY

INSTITUTE FOR INFORMATION SYSTEMS

EMBEDDED INTELLIGENCE

AGENTS AND SIMULATED REALITY

AUGMENTED VISION

LANGUAGE TECHNOLOGY

INTELLIGENT USER INTERFACES

INNOVATIVE FACTORY SYSTEMS



New DFKI Branch in Osnabrück

New Research Department „Embedded Intelligence“

RES-COM – Resource-Efficient Production for Industry 4.0



365 Selected Landmarks in the Land of Ideas

Digitally Refined – Software-Cluster Offers Innovations for Businesses



l.-r.: Prof. Lutz Heuser, Spokesman Software-Cluster; Prof. Wolfgang Wahlster; MinDir Prof. Wolf-Dieter Lukas, BMBF

In the Software-Cluster, the European Silicon Valley connecting the cities of Darmstadt, Kaiserslautern, Karlsruhe, and Saarbrücken, there exists a research and development alliance of leading companies and research facilities – including DFKI – that is building the next generation of enterprise software as an "operating system"



Software-Cluster strategy workshop, March 2011

for every company, whether a supplier or master craftsman, a small business owner or a global leader. The digital upgrade of business processes creates alternative business models and improves the economic performance of the company. That is the reason the Software-Cluster was honored in the federal government's Leading Edge Cluster competition. And that is why the Software-Cluster became a Selected Landmark in the Land of Ideas 2011.

Germany Land of Ideas



How does the Software-Cluster turn ideas into innovations that are used worldwide and in all sectors while strengthening the German software industry? That is the theme of the evening event and presentation ceremony for the Selected Landmark in the Land of Ideas 2011 award on November 14, 2011 at the Software-Cluster Coordination Office in Darmstadt.



Prof. Johannes Buchmann, member of the Software-Cluster strategy board

November 14, 2011

from 5:00 p.m.

Software-Cluster Coordination Office

Mornwegstr. 32

D-62493 Darmstadt

www.software-cluster.org



Federal President Wulff Introduced to the Fourth Industrial Revolution Software Innovations at DFKI Saarbrücken

Industry 4.0 and visions of the 4th industrial revolution were the main topics presented to Federal President Wulff during his visit to DFKI. The tour highlighted live systems and current trends in the IT sector. The presentations included the 3D Internet and the Internet of Things and Services, which connects the material and digital worlds through wireless sensors and digital product memories. Similar to social media services in which people exchange information, now manufactured products and everyday objects can communicate information about their status, their environment, production processes, or maintenance schedule.



l.-r.: Minister Christoph Hartmann, Prof. Volker Linneweber, Minister President Peter Müller, Prof. Lutz Heuser, Federal President Christian Wulff, Prof. Wolfgang Wahlster

As part of his inaugural visit to each of the Federal German States, President Wulff was accompanied on May 17, 2011 by Saarland's then Minister President Peter Müller. The visit to Saarbrücken included DFKI where President Wulff was welcomed by Dr. Christoph Hartmann, Minister for Economic Affairs and Science of the Saarland, Prof. Dr. Volker Linneweber, President of Saarland University, and Prof. Dr. Wolfgang Wahlster. In his welcome remarks, Prof. Wahlster described the path from cutting edge research to innovation. Prof. Dr. Philipp Slusallek explained the opportunities and the market potential of the 3D Internet at the DFKI Visualization Center: "XML3D makes interactive 3D graphics an integral part of the World Wide Web and opens a world of new experiences."

Prof. Wahlster added: "The DFKI staff is very proud to welcome President Wulff. He honors us as the second German head of state to visit DFKI Saarbrücken, the first being Johannes Rau in the year 2002. We appreciate this high-level recognition of our research activities, the DFKI business model, and its innovative results."

DFKI staff and Ph. D. candidates showed the President various systems that illustrate intelligent driver assistance systems, manufacturing in the digital factory of the future, products that have their own memory and how we will shop in the future. The Internet of Things and Services will integrate business, production, mainte-

nance, and service processes, but it will also change our daily lives, in our homes, while shopping or doing leisure activities and travel.

The material and digital worlds will be linked through the use of a new generation of wireless sensor chips, which will eliminate any ambiguity in the identification of objects and provide comprehensive information about their usage or refer to more extensive online sources of information. Products will be equipped with a "memory" that stores manufacturing data, downstream processing as well as its own transport or maintenance history. These active, digital product memories operate autonomously and are installed in the immediate vicinity of the local activity in the production processes and supply chain. This enables faster response times in the event of interruption and the optimal resource use at every phase of the process.

No longer centrally controlled, but rather the workpiece itself "says" what the next step should be in its manufacturing process. The emergent product controls its own production process and monitors its embedded environmental sensors for all relevant parameters.

The latest generation of smartphones can already download data from wireless sensor chips. This access to information on a personal, mobile phone is possible in such a way that matching on the basis of individual profiles can be accomplished without threatening data protection or privacy. The supermarket customer has access to all the ingredients in a product and can compare similar products prior to purchase, or review the temperature history, or find out if a certain food is appropriate for a required nutrition plan or a traditional recipe.



The Internet of Things and Services introduces a brand new quality to networking and brings with it new business opportunities for the German economy. The transformation process is nothing less than the fourth industrial revolution. As such, these cyber-physical systems will ensure the long-term wellbeing of the German industrial base.

▶ New Perspectives for Cutting-Edge Robotics Research at Osnabrück University

Festive opening of the DFKI Robotics Innovation Center (RIC) branch with the Minister for Science and Culture Prof. Johanna Wanka - "An important step forward"



l.-r.: Prof. Joachim Hertzberg, Lord Mayor Boris Pistorius, Minister for Science and Culture Prof. Johanna Wanka, Prof. Frank Kirchner, Prof. Wolfgang Wahlster and University President Prof. Claus Rollinger

In the future, the Osnabrück University will collaborate closely with a first-class, internationally highly recognized partner on the area of innovative software technologies. On September 29, 2011, the DFKI branch was inaugurated on the Campus Westerberg in the presence of the Minister for Science and Culture of Lower Saxony, Prof. Johanna Wanka, and numerous honored guests. The minister judged the establishment of the DFKI branch as a good opportunity to further define the University's profile. "The intense collaboration with the world's biggest research center in the field of Artificial Intelligence will have positive effects on the University. The location Osnabrück will be strengthened through innovative projects and will be more attractive for businesses and researchers."



Minister for Science and Culture Prof. Johanna Wanka

"In recent years, DFKI has grown rapidly, and with our new branch at the Osnabrück University we want to continue this success story," said Prof. Dr. Wolfgang Wahlster, CEO of DFKI, in his opening speech. "We want to show that top level research and business-related innovation projects with the regional economy can be combined in an ideal manner in Osnabrück, too. With Professor Hertzberg, we were able to win over another international elite researcher for our RIC. Furthermore, Professor Rollinger is the only University President in Germany from the area of Artificial Intelligence."



University President Prof. Claus Rollinger

For University President Prof. Dr.-Ing. Claus Rollinger, the establishment of the RIC branch is the fulfillment of a long-cherished wish: "The development of the scientific periphery with external research institutes is a strategic core objective of the University and an important step forward. We have been aiming at this moment for a long time." According to him, the branch will facilitate the access of regional businesses to the excellent research results of DFKI and will strengthen application-oriented research and development in Osnabrück.



ASGUARD V2: Robot for outdoor security deployment

The Osnabrück branch of the DFKI Robotics Innovation Center (Bremen) will receive a funding of 180,000 Euro for each of the next three years from the Federal Country of Lower Saxony. Further funding of the branch, which is a non-commercial Public-Private-Partnership, must be solicited through research sponsorships and development assignments. After three years, there will be an evaluation of the branch's work.

The researchers in Osnabrück deal with plan-based robot control and the semantic interpretation of sensor data. "In the future, robots shall recognize objects and facts in their surroundings, draw conclusions, and then plan their actions autonomously according to their predefined goals," said the scientific director of the branch, Prof. Dr. Joachim Hertzberg from the Osnabrück University. "These issues are highly topical in the international science community. Even small progress in the scientific work can have huge impact on possible technical accomplishments in economy and society."



Prof. Joachim Hertzberg, head of the DFKI branch Osnabrück

The head of the DFKI Robotics Innovation Center in Bremen, Prof. Dr. Frank Kirchner, added: "One of the goals of the branch is to facilitate access to the outstanding re-



Prof. Frank Kirchner



Minister Wanka tests an electric vehicle

search and development potential of DFKI for local enterprises. The research results shall be deployed especially in the areas of agricultural engineering and electric mobility."

The first joint projects have already started. The "marion" project (mobile, autonomous, cooperative robots in a complex value adding chain) involves autonomous mobile machinery that can independently react to changes in the environment and is being developed under the lead management of the Claas Selbstfahrende Erntemaschinen company.

Sensors and a higher-level planning system form the technical foundation of the project. "For example, the sensors capture the situation when a grain crop is harvested. Accordingly, the transfer vehicles into which the combine harvesters empty their grain stores are controlled automatically," explained Prof. Hertzberg. In this way, a partially autonomous harvesting and transport system is created, from the harvesters to the grain transport vehicles at the edge of the field, and this integration of the entire process chain saves time, fuel, and equipment costs.

"The implementation utilizes tools from the field of Artificial Intelligence," the computer scientist added. "The project results are generally industry-independent and are transferable, for example, to harbor and construction site logistics."

Agricultural Technology

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Automotive Industry

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► **automotiveHMI at IAA 2011**

German manufacturers and suppliers have made Germany a global leader in the automobile industry. The major innovations can be found in the area of the so called "hidden technologies", for example, driver assistance, communications and infotainment as well as new power train concepts. Acceptance depends on human-machine interfaces (HMI) that take into account the requirements of the user relative to operability.

At the International Motor Show IAA 2011 in Frankfurt/Main, DFKI presented "automotiveHMI", the joint project with Elektrobit, the lead manager of the project. The big names in the German automobile industry are working together in automotiveHMI with the goal of improving the development process for operating interfaces in the field of automobile manufacturing.



automotiveHMI stand at the IAA 2011

An integrated approach based on standard languages, models, and interfaces delivers improved efficiency to all participating companies, from automobile manufacturers to suppliers as well as tool and equipment manufacturers. The technical descriptions based on abstract models further allow the convergence of new media and multimodal forms of interaction in innovative operating control systems. Such systems provide an additional technological advantage to the German automobile industry.

A key element of innovative human-machine interfaces is the development of a domain-specific modeling language, a common exchange format that enables a standard specification of cross-process HMI development data. The modeling language facilitates the data interface between the individual players in the process (e.g., suppliers and OEMs) and creates a "bridge" to eliminate the digital gaps that occur in paper-based data exchange. Based on this modeling language, machine readable specifications allow the automatic extrapolation of test cases and the identification of equipment needs for the tests required for certain product

versions and options. The aim is to supplement manual testing with automated methods in the interest of ensuring top quality in the ever more complex HMI solutions.

Another aim of the project is to create a middleware platform to facilitate the communication between HMI and the underlying vehicle systems in the future. This gap is bridged today by the manual creation of program code, which involves additional labor costs and carries the potential for errors that are hard to locate. Automatic code generation that takes its information directly from the specification increases efficiency in implementation.

automotiveHMI is sponsored as a strategic individual project by the Federal Ministry of Economics and Technology (BMWi).

More information
www.automotive-hmi.org
www.elektrobit.de

Automotive Industry

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Smart Products: Professor Lukowicz to Head New DFKI Research Department "Embedded Intelligence"



Prof. Dr. Paul Lukowicz

DFKI has expanded its research competence in the area of embedded systems with the appointment of Prof. Dr. Paul Lukowicz as scientific director and head of the new area of research, starting October 1, 2011 at the Kaiserslautern location. The research focus is primarily in the area of networked sensor-actuator systems and energy-efficient systems. Three new lines of re-

search will study cyber-physical systems, pervasive computing, and social interactive systems.

The recent advances in microelectronics, wireless communications, and sensor technologies are huge and enable the ubiquitous use of intelligent IT systems and their networking in all aspects of everyday life and work activities. Products with new, integrated applications and functions can intelligently support these activities. Prof. Lukowicz is internationally acknowledged as one of the outstanding experts in this area. The establishment of this new research department at DFKI highlights his role as a leading partner for top information systems research with a view towards new products in Germany.

Prof. Dr. Wolfgang Wahlster, Chairman of the DFKI Executive Board, remarked: "The addition of Prof. Lukowicz to the staff, in combination with our SmartFactory and our ongoing work on resource conservation through M2M communication for "Industry 4.0" now gives us, together with our partners, the chance to assume a leadership position in the field of cyber-physical systems. We are very proud that Prof. Lukowicz, who had three further offers from excellent institutions, decided to accept the position at DFKI."

Prof. Dr. Andreas Dengel, scientific director and site spokesman at DFKI-Kaiserslautern, added: "Prof. Lukowicz and the new research lab are an ideal complement to the DFKI competence catalog. Besides the substantial synergistic effects with our existing research labs, we receive another boost to our most important motor of innovation: the development of specific applications for the industry and the economy."

Paul Lukowicz studied computer science and physics at the Karlsruhe Institute of Technology. After obtaining his Ph.D in 1999, he was employed at the Swiss Federal Institute of Technology Zurich (ETH) and the Health and Life Sciences University (UMIT) in Hall/Tyrol. In April 2006, he accepted an appointment to the Chair for Embedded Systems at the University of Passau.

In summer 2011, he accepted a research grant to visit Qualcomm, the wireless communications R&D enterprise in San Diego. Prof. Dr. Lukowicz certainly has an international resume: Born in Poland, he lived from the age of twelve in Nigeria where he attended and graduated from the German School in Lagos. After that he lived in Germany for ten years, six years in Switzerland, two in Austria and now, he is back in Germany.

More information

www.dfki.de/web/research/ei

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▶ VISTRA – European Research Project Successfully Launched with DFKI as Lead Manager



The EU research project VISTRA (Virtual Simulation and Training of Assembly and Service Processes in Digital Factories) was inaugurated at a two-day event at the Opel plant in Rüsselsheim in September 2011. The aim of the project is the development of a platform for the transfer of product and production data to innovative, virtual training applications for manual assembly processes using the automobile industry as an example.

The VISTRA technology is expected to allow ramp-up planning and, especially, the employee training for manual or semi-automated assembly lines to begin significantly earlier than ever before. For this purpose, existing product and production data are modified for use in interactive, user-oriented training scenarios. This innovative approach reduces the need for expensive and complicated hardware training prototypes and optimizes the ramp-up times for new manufacturing and assembly processes.

VISTRA is funded under the EU's 7th Framework Program for Research (FP7) for a term of three years. The project combines seven partners in research and industry from Sweden, England, Germany, and Denmark: Volvo, Opel, Fraunhofer IGD, the University of Nottingham, Serious Games Interactive as well as the Fraunhofer-Chalmers Center. The DFKI research department Innovative Factory Systems (IFS) performs the role of project coordinator and works on the semantic enrichment of product and production data, while the Augmented Vision depart-



„VISTRA“-project team

ment develops the interactive concepts for the virtual training to facilitate intuitive and near to real-life handling with the system.

More information
www.vistra-project.eu

Automotive Industry

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▶ Hand Tracking on Camera Images



Hand and finger tracking, the use of sensor data to continuously determine the positions of the hands and hand motions, makes hand gestures and finger pointing direct input devices for your computer.

Robust hand tracking enables more intuitive human-machine interfaces, especially in new forms of presentation such as Augmented Reality, for which the options available for interactive purposes haven't been limited so far. The same is true for new game concepts, programming by example (PBE) for robot control, user context capture, and many other fields of application in which capture of the hand motions can aid the computer in gaining a deeper comprehension of the scene.

The major challenge in hand tracking on camera images is that a significant number of the parameters required for an algorithm to describe the hand position have to be estimated. Depending on the model of the hand, this can reach up to 30 parameters, for example, to position the hand in 3-D space or to capture the angle of the wrist.

The human hand itself exhibits no characteristic features across all hand postures. The systems presently in use solve this problem using optical markers as tracking aids. The increased installation and calibration time for these extra instruments lessens the acceptance, affects the ergonomics, and prevents ad-hoc applications right from the outset.

Robust, markerless tracking that is capable of continuously capturing the hands of the user is still a complex research subject. The Augmented Vision research department of DFKI Kaiserslautern is intensively developing solutions that are already appropriate for industrial use today.

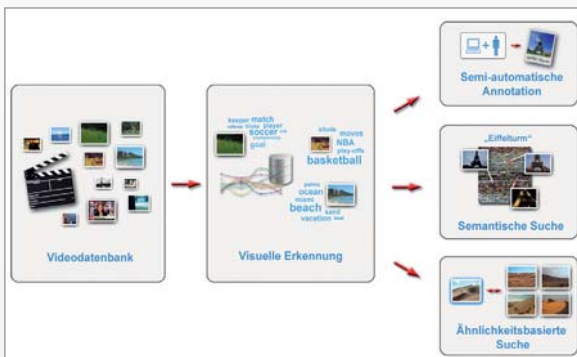
More information
<http://av.dfk.de/gallery>

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Next Generation of Edutainment Understands Video Content

It is with good reason that our era is called the "information age." Stored data is experiencing such a rapid growth process worldwide – with the greatest increase being in digital video content – that by the year 2013 this content will account for more than 90% of the worldwide Internet data traffic. This flood of information is drowning not only the private user but also the professional editor. This implies that efficient search, recommendation, and indexing technologies will be increasingly important.



Efficient access to multimedia data by visual distinguishing marks: semantic concepts are recognized automatically and used for semi-automatic annotation, text-based semantic search, and for similarity-based search

Project Edutainment 3.0 has stepped up to this challenge with the development of an educational portal for multimedia data that uses an innovative editing system to link professional content with web-based "user-generated content." It equally supports the professional editor in the conduct of research and creation of high-quality documentation as well as the end users in their search for interesting content.

The DFKI Competence Center MADM (Multimedia Analysis and Data Mining) develops innovative technologies for the automatic visual identification of semantic concepts

found in photo and video content. Large volumes of video material can be automatically analyzed and semantic concepts (for example, "soccer" or "beach") can be identified. This makes it possible to search for specific locations, events, or activities. Valuable information, which so far have been buried in large video archives, can now be discovered with this system. At the same time, a user can contribute own content that can be seamlessly inserted in the portal, similar to YouTube – but more structured.

Concept recognition in Edutainment 3.0 is able to differentiate up to 50 different concepts, with a major focus area being archived material from the time of the Second World War. The screen shot shows four examples of recognized visual concepts: The unrelated classifications produce the respective probabilities for the individual concepts. The third example illustrates that usually several concepts appear to be nearly the same in an image (skyline, clouds, river, wide-open spaces).

DFKI is developing the interactive educational platform in cooperation with taglicht media, a production company based in Cologne, and the new media full service provider nacamar. The project is funded by the "Central Innovation Program SME" (Zentrales Innovationsprogramm Mittelstand, ZIM) of the Federal Ministry of Economics and Technology.

More information
<http://madm.dfki.de>
www.nacamar.de
www.taglichtmedia.de

Media Industry

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Screenshot: Edutainment 3.0 recognizes and differentiates visual concepts

▶ German University in Cairo on Expansion Path

Since 2008, DFKI's Knowledge Management Department has provided the opportunity for selected students at German University Cairo (GUC) to complete an internship or bachelor degree during the summer semester at DFKI. The number of participants has grown from the initial two to currently 14 students, two of which are being sponsored by the Augmented Vision Department at DFKI Kaiserslautern.

The first master thesis by a GUC student to be supervised at DFKI was in the winter semester 2010/11. "Considering the excellent reciprocal experience, we have expanded the master program for winter semester 2011/12. Among the ten candidates welcomed in Fall 2011 at DFKI Kaiserslautern, two have already participated in the bachelor degree program," said Prof. Dr. Andreas Dengel, Head of the Knowledge Management Department at DFKI Kaiserslautern.

Prof. Dr. Slim Abdennadher, initiator of the exchange program and Dean of the Computer Science Department at GUC, adds: "Our top students consistently assess their stay at DFKI with high ratings in all criteria. The available subjects are innovative and demanding, with a maximum of practical relevance; the atmosphere is open and friendly. In our scheduling of exchange visits, DFKI has quickly earned the No. 1 position on the students' preference lists."

Abdennadher, who is a computer science graduate of TU Kaiserslautern and an ex-graduate at DFKI, was actively involved from the beginning in the establishment of the GUC computer science department, which opened only in 2003 and operates with private fund-



Participants of the exchange program in the Summer semester 2011

ing. The support provided to GUC is one of Germany's largest foreign projects in the area of education. The instruction is in English, German is a required subject. The curriculum is comparable to that of a German University.

The visit of the interns in Germany was co-financed with 20,500 euros in 2010 and 2011 from the German Academic Exchange Service (DAAD).

More information
www.guc.edu.eg

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▶ RADAR Makes Kaiserslautern Come Alive Interactively



With the new RADAR system developed at DFKI, the City of Kaiserslautern offers future mobile access to various multimedia content about places, attractions, and events.

A smartphone taken on a tour of the city shows all the nearby points of interest, guides the user to the place, and supplies the relevant photos, texts, 3D models, videos, or audio tracks.

While attending an event, one can check out what is happening, who is appearing where, and what others are saying about it. This is possible because of RADAR, a system that allows simple administration of data linked to places (geo content) and makes it available to numerous augmented reality browsers and operating systems widely

used on mobile phones. RADAR is an open social media system for the convenient playing, swapping, and providing of geo content from various sources like the social and semantic web or digital libraries. RADAR is developed by the Knowledge Management research department at DFKI Kaiserslautern and is sponsored by the Foundation Rhineland-Palatinate for Innovation.

In cooperation with the City of Kaiserslautern, the system is being deployed in two variants: With an augmented reality browser installed on the mobile device, the user can choose between the channels RADAR-KL and RADAR-StadtKL. RADAR-KL is designed especially for participatory scenarios in and around Kaiserslautern. This is the entity where event organizers can publicly announce their programs for formats like the annual "Nacht, die Wissen schafft" ("Night that Creates Knowledge") or "Die Lange Nacht der Kultur" ("The Long Night of Culture"). There is also a comment function for interested guests and tourists.



RADAR-StadtKL is the official RADAR entity of the City of Kaiserslautern. It provides extensive content that includes photos, texts, audio guides, or historical tourist attractions and other points of interest to visitors of the city.

Both channels were introduced to the public at the town hall on June 22, 2011 in a joint press conference of DFKI and the City of Kaiserslautern. The Lord Mayor, Dr. Klaus Weichel, was enthusiastic about RADAR and could imagine additional potential for more applications in the future, for example, adding historical information like old images of the city or 3-dimensional reconstructions of prominent buildings.

RADAR was also adapted for Berlin in conjunction with "An Evening of Science 2011."

As an open and generic social media platform, RADAR also offers opportunities for "inductive monitoring." Currently, DFKI and the "Computer Aided Planning and Design Methods" (CPE) department at TU Kaiserslautern are implementing a collaborative project under the framework of the research topic "Urban Sensing".

More information

<http://radar-project.de>
www.kaiserslautern.de/radar

Leisure and Tourism

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On May 25, 2011, the participating partners came together in Spelle, Lower Saxony, for a joint review session at the mid-point of the iGreen project. The current status of the project was briefed using presentations and practical demonstrations.

Machinery from various manufacturers demonstrated services such as surface reporting, land navigation, data collection, and order management under real conditions. The trouble-free, supplier-independent communication among the various agricultural machines and with other integrated systems represented a milestone for iGreen by satisfying one of the most important requirements of the project.

The potential of the iGreen infrastructure and the usefulness of semantic technologies for complicated data integration tasks have once again been clearly demonstrated using the agricultural sector as an example. The optimal supply of data and information to all parties in the agricultural processes allows optimal planning and allocation of resources, which raises outputs and, last but by no means least, protects our environment.

DFKI is the lead manager and scientific coordinator of the iGreen project. The project is funded by the Federal Ministry of Education and Research (BMBF). The responsible agency is the Rheinhausen-Nahe-Hunsrück regional service center for rural areas.

Successful iGreen Project Review



Ingo Ruhmann, BMBF; iGreen system demonstration

More information

www.igreen-projekt.de

Agricultural Technology

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► **Research Project: RES-COM**
The First Step Towards Resource Efficiency for Industry 4.0



The industrial sector is undergoing a major paradigm change that is altering the fundamentals of production. The traditional, centrally controlled production hierarchy is being replaced by decentralized, self-organizing products. Cyber-physical systems with digital value added now bridge the gap between the material and digital worlds and are turning products into smart products that actively support the manufacturing processes. The conservative use of energy and resources will become a constraint for the successful manufacturing centers of the future. Industry 4.0 is a forward-looking project that integrates current trends in information technology for the fourth industrial revolution.

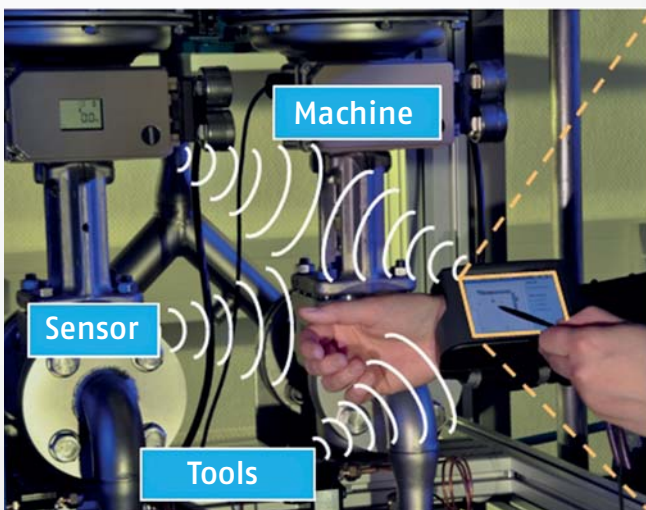
Similar to social web services like Facebook and Twitter in which people interact, industrial products and everyday objects will have the capability to communicate their status, their environment, the stage of production or maintenance, and to do this either on demand or self-initiated. Cyber-physical systems give products the ability to communicate and thus link them to the online data world, creating an Internet of Things. The development of these cyber-physical systems, which connect integrated memory and communication capabilities, sensors, actuators, and digital product memories, rests on the results of several successful research projects in Germany that had as their goal the study and use of technological trends for innovative products and solutions. A good example is the collaborative project called SemProM (Semantic Product Memory) sponsored by the Federal Ministry of Education and Research (BMBF) in the





context of the "Digital Product Memory" innovation alliance.

Products and their individual components will play a key role in manufacturing and logistics processes: The products know which components have been integrated, what transport and storage is required, and they transmit the critical signals for the downstream production processes, which is stored in their digital product memories. The product under construction controls its own manufacturing process and monitors over the embedded sensors the relevant environmental parameters and initiates an appropriate response to a fault signal – it is both an observer and an actuator at the same time. The production always maintains the pace of the human who can step in at any time.

The business potentials of Industry 4.0 are not only due to the optimization of operational processes, but also lie in new services in a variety of application areas. A complement to the Internet of Things is the Internet of Services, where smart products offer their functions as intelligent services. This new generation of products can use machine-to-machine communication (M2M) to mutually exchange information, initiate actions, and interactively control each other via the Internet.

Dynamic, decentralized production processes offer an approach to a more efficient use of resources: Events like interruptions in the production cycle, raw materials of varying quality, energy or material bottlenecks are detected and corrected in a timely manner by decentralized sensors. Friction losses from the flow of information through a central control unit are minimized. The resource requirements can be determined and planned dynamically: Resources like water, power, or raw materials can be delivered on demand, thereby reducing



<p>Object to be serviced</p> 	<p>Actual consumption</p> 
<p>Parts and tools required</p> 	<p>Service history and documents</p> 

Machine-to-Machine communication and radio sensor networks support resource efficiency in production and maintenance

excess capacity. Information and Communication Technologies (ICT) become a catalyst for a more conservative use of resources in production. For example, it is possible to better satisfy not only economic requirements, but also the special environmental need for CO₂ neutral, energy efficient, urban production.

One of the first elements along the path to the efficient use of resources in production and services is the BMBF-sponsored RES-COM research project. In the RES-COM project, prototype scenarios for context-activated resource efficiency are being implemented by means of highly networked and integrated sensor-actuator systems, from embedded systems to cyber-physical systems. This challenging scientific undertaking is getting ever closer to a solution thanks to the pioneering role of Germany in the field of the Internet of Things.

The digital product memory, embedded systems, and software service agents make up the basic technologies. Networked by machine-to-machine communication, distributed systems make holistic decisions in consideration of what resource-relevant parameters have been set by the managers, the component units, and the individual product specifications. Resource waste becomes a unit failure, which can be quickly diagnosed on the basis of detailed records – including the decision criteria. The standardization of communication structures permits efficient resource use to be offered as a service – as a flexible platform which links employer and contractor and supports decision makers as well as implementing technicians in using resources more efficiently. This culminates in material and energy-efficient, resource-friendly technologies and processes.

The major challenge for product-controlled manufacturing is the adjustment of the ICT structures for communication between data sources, units, and products. Products are often inseparably merged into more complex units; they are defined by physical proximity, or simply logically belong together as elements of a process. The future IT systems must facilitate the communication of these interim or permanent data collections in order to enable a comprehensive and detailed overview of resource use in the associated processes. They will provide not only opportunities for the innovative use of resources in automation, production, and maintenance, but will further create the basis for a holistic cross-industry view of the cost-efficient and responsible use of resources. The RES-COM approach is based on a completely new type of core technology, which consists of a combination of active digital product memories and software service agents with embedded sensors and actuators. An example for the benefits of RES-COM is the transparency and optimization of the operating infrastructure in terms of an "Energy-Supply-Chain", the use of materials to support the vision of "no waste" production, as well as for intelligent process management, perhaps by adopting a technology like the automatic start-stop mechanism used in automobiles



Prof. Willem Jonker, Chief Executive Officer for EIT ICT LABS, visits the SmartFactory[®] in Kaiserslautern

for the field of urban production. Active product memories capture and analyze the resource use in a decentralized manner and communicate among themselves for the autonomous optimization of the underlying process. RES-COM addresses these requirements through a network of local, distributed, autonomous systems with key structures that support the vision of a future "Internet of Resource Efficiency." RES-COM was launched in June 2011 and is funded by the BMBF, department 514 IT-Systems for a period of three years with about 9 million Euro. DFKI is the consortium manager; overall project supervisor is Prof. Dr. Wolfgang Wahlster. The other partners are SAP, Siemens, IS Predict, and 7x4 Pharma.

More information

www.res-com-project.org
www.sempro.org

Energy Industry

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Engineering

► Sustainability in IT Service Management

IT services today are based on globally distributed infrastructures that rely, in particular, on computer centers. According to recent studies, these centers represent the concentration points of energy consumption in the IT sector. To decrease this energy consumption, the efficiency of the computer centers must be improved and IT services must be designed so as to be sustainable. Past approaches for improving the resource efficiency of the computer centers have generally focused on the infrastructure and include, for example, improvements to air conditioning or the virtualization and consolidation of servers.

Today, IT Service Management (ITSM) processes represent a promising new approach to achieving more efficient use of resources. The aim of the Green RoSe (Resource-oriented engineering of IT Service management processes) project is to study and expand the IT Infrastructure Library (ITIL), the defacto global standard (representing the IT Service Management processes) in terms of its potential for an environmentally sustainable design.

Improved resource efficiency can best be achieved by the coupling of economic and environmental goals. The aim is to develop a system solution that integrates a sustainability-based reference model of IT Service Management with software-based management tools. As a consulting product with long term implications, such a concept should lead to the development of new markets. Beyond this, it can contribute not only to reduced energy use by IT itself, but also to the use of IT as a means to further reduce general energy use by customers. There is a competitive advantage for future users because of the lower costs and better public image.

The project kick-off date is January 1, 2012 and the project has a term of 2 years. It is funded under the framework of the KMU Innovativ initiative of the Federal Ministry of Education and Research (BMBF). Interested partners are always welcome and should contact Dr. Peter Fettke or Markus Reiter (contact information below).

1) Service Strategy	2) Service Design	3) Service Transition	4) Service Operation	5) Continual Service Improvement
1a) Strategy Generation	2a) Service Catalogue Management	3a) Transition Planning and Support	4a) Event Management	5a) 7-Step Improvement Process
1b) Financial Management	2b) Service Level Management	3b) Change Management	4b) Incident Management	5b) Service Reporting
1c) Service Portfolio Management	2c) Capacity Management	3c) Service Asset and Configuration Management	4c) Request Fulfillment	
1d) Demand Management	2d) Availability Management	3d) Release and Deployment Management	4d) Problem Management	
1e) Organizational Development	2e) IT Service Continuity Management	3e) Service Validation and Testing	4e) Access Management	none to little influence
	2f) Information Security Management	3f) Evaluation		little to medium influence
	2g) Supplier Management	3g) Knowledge Management		medium to high influence

Impact of ecological goals on the IT Service Management according to ITIL

Potential areas for the integration of environmental sustainability can be found in nearly all sub-processes of ITIL. Specifically, a significant need for modification is expected within the sub topics Service Design and Service Operation. In the future, service descriptions should be written using "green" Service Level Agreements and "incidents" should be triggered not just when there is a system crash, but also whenever an environmentally relevant threshold is exceeded. Equally relevant is the intelligent management of resources, which can take the form of demand forecasting methods or dynamic demand management through an appropriate tariff system.

More information

www.dfki.de/web/research/iwi

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Simply Unbeatable: Bremen's RoboCup Team B-Human Defends World Championship Title

A clear victory as Bremen's Team B-Human wins the Robot Soccer World Cup for the third consecutive year. The final match of the RoboCup 2011 in Istanbul was won with a score of 11:1 against Dortmund's Nao Devils.

The robots from Bremen enjoy a huge lead over an international field of robot soccer teams as indicated by the team's overall scoring balance for this year's tournament (62:1). The team has won every game it has played by at least five goals for the past three years. This is particularly remarkable because following every RoboCup series, B-Human release their software used in the robots and allow it to be downloaded from their homepage.



Bremen's RoboCup Team B-Human defends world championship title in Istanbul

In Istanbul, 27 teams from 18 countries competed against one another in the Standard Platform League. New rules implemented this year increased the number of robot players per team from three to four, which meant the players had to coordinate more and the playing field was more crowded. B-Human prepared for this tight coverage by developing an innovative route planner, which enabled its players to maneuver through the other teams' defenders. Also new this year was the common game ball model, which not only lets each player know the location of the ball at all times – even if not within sight – but, also enables the players to agree on who will keep an eye on the ball for the moment. Furthermore, the agility of

locomotion was substantially improved and was put to good use in the passes and shots embedded in the game motion, whereby the robots of B-Human usually won the one-on-one duels for possession of the ball.

Team B-Human is a joint project between DFKI's Safe and Secure Cognitive Systems department headed by Prof. Dr. Bernd Krieg-Brückner and the computer science department at the University of Bremen. B-Human plays in the Standard Platform League of RoboCup Soccer, the pinnacle of the RoboCup competition. The league uses standard hardware, the humanoid robot "Nao", manufactured by the French company Aldebaran Robotics. Hence the biggest challenge for the teams is in the software engineering.

The RoboCup event is an annual event organized by the Robot Soccer Federation. The higher-level, long-term aim of the competition is the advanced development of AI and robotics. The rules for the RoboCup are constantly under review in order to present new and appropriate challenges to the ever-improving capabilities and sophistication of the robots. For example, the size of the playing field in the TeenSize class has been substantially enlarged to accommodate the faster robots and to provide enough room to perform the complex maneuvers now possible. The bar was also raised in the Home Robot League. These robots must understand complex instructions and tidy up an apartment. This year, for the first time, the Rescue Robots included airborne devices that can autonomously generate a map of a simulated disaster area.

More information

www.robocup2011.org
www.b-human.de

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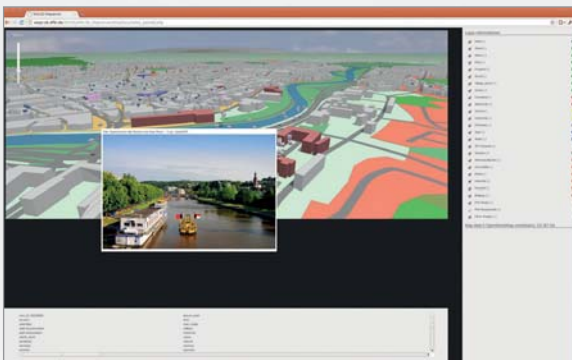
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▶ Surfing the Third Dimension

Today, the hardware for the interactive presentation of three-dimensional scenes can be found in every PC, every smartphone, and yes, even in every recently purchased TV set. However, until now the corresponding content could only be enjoyed by those who play PC games or someone who uses CAD software on a workstation to design buildings or other products.

This changes dramatically with XML3D. This extension of the HTML web language developed by DFKI and the Intel Visual Computing Institute (Intel VCI) at Saarland University makes it quick and easy to create 3D applications for any web browser. XML3D enables web developers to embed and work with 3D content in web pages just as easily as they are currently doing with YouTube videos.



Visualization of geographical data from OpenStreetMap combined with images from Flickr

The typical uses of XML3D besides in 3D configurators for kitchens and automobiles also include interactive infographics, learning and computer games. In the future, a user will be able to "try out" the theater seats of a certain price class in the virtual world, including the stage setting, before purchasing the tickets. Another example is designing a customized cabinet before manufacturing and delivering the cabinet. The integration of three-dimensional, virtual worlds in standard online browsers opens new markets with a variety of new applications. The 3D Internet thus implies a huge fundamental change of the "Internet experience."

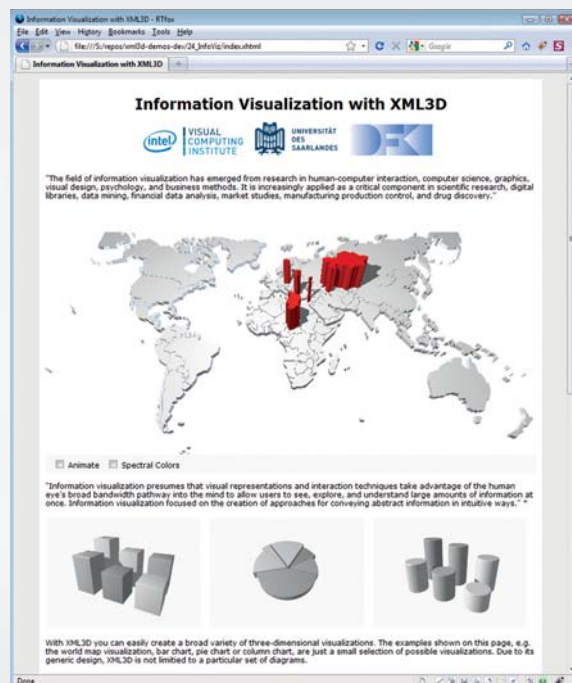
The visualization of geographic data is one specific application area where XML3D is already in use. In collaboration with Caigos, a company based in Kirkel, Germany, the "RealGIS" project is developing a system that permits the preparation of geographic data from a database for presentation in three dimensions viewable in a web browser. Just imagine something like Google Earth directly in the browser, making it possible to interactively move through 3D models of cities, for example. Beyond this functionality, users can retrieve, and authorized users even can edit data from a server with just a mouse click. The use of web standards facilitates the combination of XML3D applications with other Internet services. For example, Flickr images provided

with GPS data can be displayed directly at the appropriate places in a 3D model of a city.

Not only are these XML3D applications available wherever there is an Internet connection and a browser installed, but with the combination of the Internet and a browser even small and medium sized companies can afford the technology and will be able to create their own 3D applications. These can then be used on a traditional PC, but also on a mobile end device like a tablet PC.

Efficient Development

XML3D expands the HTML5 standard by a few new (3D) elements and, in the process, re-uses the existing elements and concepts to the maximum extent possible. All 3D objects are part of the HTML code with which the web page is written. Every web developer knows how this is programmed, i.e., the learning curve is minimal. The user can use a small JavaScript program to manipulate 3D scenes – just as easily and quickly as HTML functions for the markup language. In this way, when both text and images as well as 3D content appear in the web page, it is easy to link them and actually enable interaction between 2D and 3D: Clicking the links in the text on the web page alters the 3D scene, showing it from a different angle or starting an animation, whereas the opposite action of clicking on a linked 3D object will lead to the display of a descriptive text. Just as easily, the components of a 3D scene can be downloaded from the Internet as required using the AJAX transfer standard



Visualization of information: One of the many possible application areas for the 3D Internet

or the design can be adjusted with the help of Cascading Stylesheets (CSS), a supplemental language to HTML.

Because XML3D is an extension of HTML5, the existing framework for web applications can be employed without modification even for web pages with 3D content. On the server side, the 3D scenes embedded in HTML can be generated dynamically from databases and modified, for example, with the widely used script language PHP. Programming in a browser is much simpler thanks to the many existing libraries such as jQuery.

Implementations

Numerous projects at DFKI and Saarland University already use XML3D. Three demonstrators (implementations) of XML3D have already been developed: Both the Mozilla Firefox browser as well as Google's Chrome browser have been modified to support XML3D. These implementations, depending on the application area, use either graphic cards or real time ray tracing to compute the images from the 3D descriptions. Ray tracing involves a light simulation based on the laws of physics that ensures shadows and reflections are shown correctly. This technology has been made ready for the market by Prof. Philipp Slusallek and his team over the past few years and now enables users to create high-quality 3D scenes and, thanks to XML3D, publish them on the Internet.



Interactive 3D map of the Saarland University campus on an Android Tablet

The third implementation is based on the JavaScript programming language. A script interprets the XML3D content of the web page and uses WebGL to display the 3D scene. WebGL is a new JavaScript interface for graphics hardware. It is provided in the new versions of Firefox, Google Chrome, Apple Safari, and Opera browsers. Theoretically, XML3D is already available in more than 54% of the browsers used. All implementations are provided free of charge on the project web-sites. There are also several demo applications available here.



Toyota car configurator, designed for the „RTT Excite 2011“

Standardization

Working with Fraunhofer IGD and the Web3D consortium, DFKI established a W3C Community Group to standardize a 3D description on the basis of HTML. This open platform was presented by the W3C in August 2011 as the first phase of the W3C standardization process and, as such, replaces the earlier incubator groups. The "Declarative 3D for the Web Architecture", co-founded by DFKI, was one of the first Community Groups of W3C. In its initial weeks, the group welcomed many new members, including several of the W3C staff. Mozilla, Google, and Khronos Group have indicated their interest. All conditions indicate that in the future, every standard browser will directly support the concept and functionalities of XML3D.

More information
www.xml3d.org

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Media Industry

► Auto-Drive Shopping Carts, Electronic Price Tags, and QKies – Innovative Retailing Technologies

Innovative Retail Laboratory (IRL), the joint application-oriented research lab of GLOBUS SB-Warenhaus Holding and DFKI, is where today's innovative retailing technologies are developed, implemented, and tested in specific application scenarios. Included are many complex issues related to intelligent shopping assistants, smart items with digital product memories (the next advanced development in RFID technology), interior positioning and navigation as well as innovative logistic concepts that are tested for everyday use and optimized to benefit the customer.

In 2011, the infrastructure of the IRL was redesigned, new application scenarios outlined, existing system demonstrators were revised and new ones developed. Two prototypes and an original product idea were also introduced: the auto-drive shopping cart, price tags with electronic ink, and cookies with a QR code.

Auto-drive shopping carts

At the "Innovative Retailing Technologies" Conference ITH on September 8-9, 2011 in St. Wendel, IRL presented for the first time its new auto-drive shopping carts, which can be controlled via smartphone and no longer have to be pushed by hand.



Control of the auto-drive shopping cart with a smartphone

In a prototype, new technology has been implemented on a "pick-up trolley," a design on wheels that transports as many as two shopping baskets or beverage cases. The wheels are driven by two motors that are normally used to power the electric windows in a car. In addition, there is an ultrasound sensor for determining distance, an electronic compass as well as sensors for measuring the wheel revolutions. All components are linked to a computer over a CAN bus system (Controller Area Network), similar to the one used to network the control devices in an automobile.

Control is achieved using both a touch screen fitted on the shopping cart as well as the location sensor of a smartphone connected with the trolley over WLAN. The user can adjust the speed of the cart in the direction of travel by simply running a finger over the display in one direction or the other. To change direction, tilting the mobile phone to the right or left is interpreted by the acceleration sensors as a turn in the respective direction and executed by the trolley.

This intuitive remote control allows the user to navigate the cart to any desired point or to bring the cart to the user's position anywhere in the supermarket. The appropriate adjustments could be made to the shopping cart's power train if required to transport heavier purchases. The system is under continuous development so that the shopping cart will be able to visually identify its owner and automatically follow them. Students enrolled at the University of Applied Sciences in Saarbrücken are assisting in the development of the auto-drive shopping cart.

Electronic price tags

The weekly update of price tags in supermarkets required by special sales offers and changing prices is costly and prone to errors. Electronic price tags can prevent errors and optimize the process. Coupling the electronic displays to the supermarket's management system enables automatic price updates and the display of current information without the need for manual input. The concept has already been developed and tested on a prototype implementation of an intelligent fruit stand at the Innovative Retail Laboratory.

The high-contrast display technology functions with electronic ink, something already familiar from e-Book readers – active display lighting is no longer necessary. Electrical power is only used when the displayed content is changed. Presently, these displays are static and show only product names and prices as well as the associated barcodes. However, further developments are planned for the display that will reflect dynamic, detailed product information, promotions, or even aid in navigation. An appropriate framework for the display interface has already been developed in the context of a master's thesis.

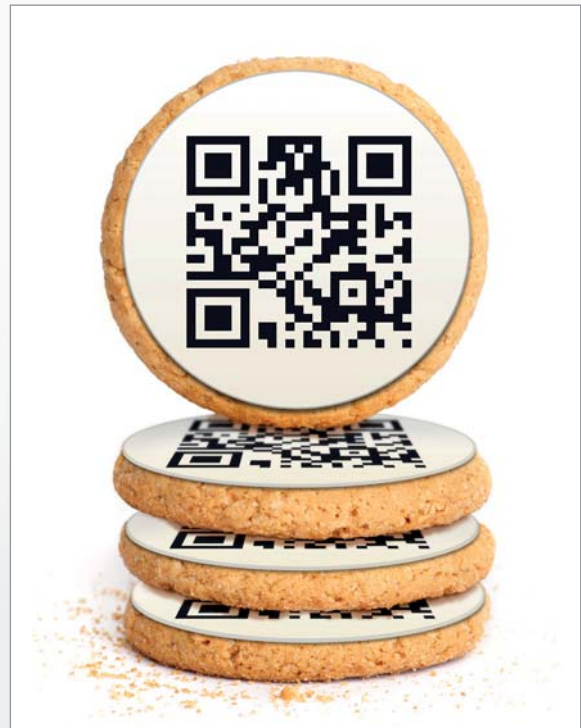
Say it with cookies!

A joint project between DFKI and the food producer Juchem Food Ingredients is making the Internet edible thanks to QKies. QKies is a baking mix for cookies with customizable QR codes. These codes are a tasty way to encrypt any message the sender wishes to convey, for example, an invitation to a birthday party or a special promotion action. These cookies communicate with that certain digital something. QKies have been available since the successful market launch in June 2011.

QKies conceal a secret. Each package of the baking mix contains twenty edible QR codes printed with food coloring on edible paper. In addition to the cookie mix, already prepared QKies can also be purchased in quantities starting at 100 pieces. The two-dimensional barcodes direct the reader to a particular URL. In this way, the cookies are the perfect trade fair giveaway or make a unique invitation to a major event.



A video clip at www.qkies.de provides step-by-step instructions on how to prepare the cookie mix. The preparation and cut out of the dough are just the same as for traditional baking mixes. This is not at all complicated and is easily mastered even by inexperienced hobby bakers. The QR codes are put onto the cookies after baking and, from that moment on, the small treat is something special. Use the password supplied in the package to login to www.qkies.de and customize the QR codes with your own message or add a specific link. The two-dimensional barcodes store individual messages or links, which are then readable to smartphones with the appropriate app. The finished cookies are then distributed to the addressees, who can



read the QR code. Once that is done, the cookies, including the QR code, are ready to eat. The edible Internet has arrived.

The idea of integrating information technology in cookies is attributed to Dr. Johannes Schöning, former DFKI staff member at the Innovative Retail Laboratory. QKies were brought to market in collaboration with Juchem Group based in Eppelborn, and the raum3 agency from Saarbrücken.

More information
www.innovative-retail.de
www.qkies.de

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Retail and Logistics

► EIT ICT Labs Establish German Hub in Berlin – DFKI Is Core Partner

There were many hurdles to be overcome during a period of four years before finally, on September 9, 2011, EIT ICT Labs was able to officially open the Co-location Center (CLC) in Berlin. Berlin has played a key role since the initial founding of EIT ICT Labs. As early as April 23, 2007, Prof. Dr. Wahlster, acting on the authority of the European Commission, headed an international working group in Berlin for the subject "The role of ICT in a future EIT." This resulted in a policy paper that eventually led to the solicitation of applications for an ICT Knowledge and Innovation Center (KIC). At the 2nd National IT Summit in Hannover on December 10, 2007, the Federal Chancellor stated her support to the idea of a Knowledge and Innovation Cluster in the IT sector for Germany, which was reflected in the official closing declaration of the IT Summit. Even the first meeting of the successful application committee took place in Berlin. By invitation of Prof. Dr. Wahlster, the representatives met on January 16, 2009 at the Telekom offices in the German capital.

In addition to Berlin, the European-wide research network EIT ICT Labs has established four other CLCs – Eindhoven, Helsinki, Paris, and Stockholm. An additional CLC is planned to open on January 1, 2012 in Trento, Italy. These hubs perform a strategic function – the promotion and support of European excellence in education, research, and ICT innovation.



l.-r.: Dr. Heinrich Arnold, T-Labs; Prof. Wolfgang Wahlster; MinDir Prof. Wolf-Dieter Lukas, BMBF; Dr. Udo Bub, EIT ICT Labs

The core partners at the German hub in addition to DFKI are Deutsche Telekom, Siemens, SAP, Fraunhofer Gesellschaft, and Technische Universität Berlin. Dr. Udo Bub is the head of EIT ICT Labs in Germany. Currently, DFKI is represented in 14 activities, which include the subject areas: Smart Spaces, Smart Energy Systems & Green ICT, Health & Wellbeing, Digital Cities of the Future, Future Media, and Content Delivery. The subject area Intelligent Mobility and Transportation Systems is under the European lead management of Dr. Christian Müller at DFKI.

Located at the heart of the TU Berlin campus, the new Co-location Center provides inspirational surroundings and the appropriate atmosphere to bring together creative people in the ICT sector from different countries throughout Europe. In very adaptable and transparent office space covering the entire 6th floor of the TU Tower, rich in tradition and a direct neighbor to innovators in industry such as the Deutsche Telekom Laboratories (T-Labs), there are new products, services, and innovative business ideas being jointly developed. As one of three European KICs, EIT ICT Labs is part of the European Institute of Innovation and Technology (EIT). The aims of EIT ICT Labs are to become a key enabler for innovation in the field of modern Information and Communication Technologies in Europe and to strengthen Europe's position as a global leader in Information and Communication innovation.

The European Institute of Innovation and Technology (EIT) is a recent, independent, joint initiative established by the European Union in March 2008 headed by Commission President José Manuel Barroso in cooperation with leading scientific and research institutes as well as leading industrial partners. With the establishment of the three KICs, the EU has created an instrument designed to close what appears in international comparisons to be Europe's growing innovation gap.

At the core of the EIT approach is the close integration of research and science with industry and the economy. For example, this includes the promotion of entrepreneurial thinking and activity as well as mobility for students and young researchers between research institutes and the corporate world at institutes of higher learning. The effort will cross the boundaries between science and business and significantly accelerate the flow of knowledge and ideas, which are the building blocks for innovation.

More information
<http://eit.europa.eu>
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"Intelligent Environments 2011" – Double Success for DFKI Research Scientists

The Lights are still on in the bathroom or the family room? One gesture on the tablet-PC or smartphone and they are turned off. Touch sensors measure whether the doors and windows are open. The resident keeps this all within view using a mobile phone.



l.-r.: Dr. Ahmad Lotfi, Nottingham Trent University; Prof. Juan Carlos Augusto, University of Ulster; Prof. Wolfgang Wahlster

DFKI scientists have developed and miniaturized "SmartCase: A Smart Home Environment in a Suitcase" as an appropriate demo scenario. This complete, actively controlled scale model of a residential apartment (1:20) in a suitcase on wheels, equipped with doors, windows, stove, lights, thermometer, and multimedia devices was awarded the Best Demo Award at the international scientific conference on "Intelligent Environments 2011" in Nottingham.

The interactive assisted living residence for senior citizens in mini-format is impressive: Intelligent user interfaces enable customized use of home technology tailored to the individual's needs while contributing to reduced energy consumption. The smartphone serves as the control panel, which permits the user to monitor and regulate the intelligent infrastructure of the home. The universal, widely used standard URC (Universal Remote Console) allows devices, regardless of supplier, to be connected to the household unit, linked to one another, and controlled remotely. SmartCase was created within the framework of the SmartSenior project, sponsored by the Federal Ministry of Education and Research (BMBF) and the SensHome project, sponsored by the Saarland Ministry of Economic Affairs and Science.

Responsible for the project demonstrator and winners of the "Best Demo Award" are Jochen Frey, Ehsan Gholamsaghaee, Dr. Jan Alexandersson, Dr. Norbert Reithinger, Simon Bergweiler, and Dr. Christoph Stahl.

The Best Video Award, the second of three prizes awarded at "Intelligent Environments 2011" went to "Supporting Persons with Special Needs in Their Daily Life in a Smart Home" (www.youtube.com/watch?v=86GOV31pq4E). The prize-winning video was created by the staff of the DFKI Intelligent User Interface department in the "Smart Kitchen" demonstration environment at DFKI and presents the advantages of assistance

systems in supporting the elderly and cognitively impaired persons. The project is sponsored in part by the SemProM (BMBF), i2home (European Commission FP6), and SensHome projects. Responsible for the implementation are Robert Neßelrath, Jens Hauptert, Jochen Frey, und Dr. Boris Brandherm; camera and film editing by Renato Orsini.

DFKI, with six different presentations, was the most represented of all research institutes worldwide at the conference for the intelligent environments of the future. The featured keynote address "Connected Cars Create Smart Spaces" by Prof. Dr. Wolfgang Wahlster and the two award winning exhibits demonstrate DFKI's strength in this important area of future IT research: Linking cyber-physical systems and multimodal assistance systems in the Internet of Things to smart homes, smart cars, smart factories and smart cities. "These awards confirm the leading position of German scientists in this field of innovative research, a fact that we attribute in no small way to the German government's HighTech Strategy in the area of ICT and the focus on the Internet of Things and Services. Our colleagues around the world envy us for the intensive support given by the BMBF to the lighthouse projects SemProM and SmartSenior," explained Prof. Wahlster.



Interactive control of the miniature home via tablet computer or smartphone

More information

<http://ccaal.dfki.de>
www.smart-senior.de
www.dfki.de/senshome
www.sempro.org
www.i2home.org
www.intelligentenvironments.org

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Healthcare Management

► e-Surgery, Mobile Learning, and Professional Profiling

Current CeLTech projects enter their second year: "Science and Technology for the Future of Education"

The Centre for e-Learning Technology (CeLTech), operated by Saarland University, the University of Applied Sciences, and DFKI, is now entering its second year and continues to investigate current and future projects that cover a broad range of topics concerning state-of-the-art educational technologies. Four of these projects are introduced in the following short portfolio summaries.



Learn & Go

Learn & Go is a development contract project for IMC AG to develop a specific, value added hybrid application for the mobile use of the functions of the CLIX Campus Learning Management System at public and corporate universities. In the future, for example, registered members of Saarland's universities will be able to use the mobile application with an iPhone, iPod Touch, or iPad for an efficient organization of their studies as well as for customized and cooperative learning. Independent from browser technologies and in consideration of the growing importance of mobile teaching, learning, and testing scenarios for the "digital natives" generation, this app provides a variety of opportunities to obtain information and learning. For example, it enables creative communication and collaboration on the basis of RSS technologies, XML, and web services. Following the planned launch in the winter semester 2011/12, it will be possible to answer the following questions with just a brief look at the smartphone or tablet PC: Which courses are currently being offered? What is the class location and how can I find it? Where is the best food on campus today? In addition, class schedules can be integrated and exported to the calendar tool of a mobile device, events and news displayed, and course-related teaching/learning materials in common formats can be accessed and downloaded. Web2.0 features enable cooperative learning. Geographic content updates facilitate orientation on campus.



PROFILE

While the Learn & Go-app is designed primarily for students, the PROFILE (Professional Profiling in Intelligent Learning Environments) project also addresses the issues and interests of human resources managers: The focus of this project, sponsored by the Europrofession Foundation, is to develop and implement a concept for information, raising awareness, and advanced qualification training for interested parties from industry, research, chambers of commerce and associations on the subject of staff selection and staff training.

An online solution that is based on state-of-the-art aptitude diagnostic tools as well as intelligent innovation technologies and educational technologies, is being developed for practical application in various job markets in commerce and trade, information and communication technologies as well as in the automotive and metal processing industries.

The project is deliberately accompanied by a strategic advisory board as well as a board of experts from politics, economics, professional associations and organizations and pursues a contemporary, cross-media approach. It organizes information and advanced education sessions on the theory and practice of staff selection and training, which can later be downloaded as a "Lecture on Demand" via the Internet. In combination with practical aids, these will be useful for conducting aptitude testing, podcasts as well as online self-assessments also via smartphones and tablet PCs. Social media technologies are initially employed to reach interested target audiences.

Training network e-Surgery

In the area of medical training significant progress has been made regarding the usage of e-Learning. Over the next few years, under the lead management of Prof. Dr. Felix Walcher, Chairman of the Surgical Working Group Teaching (CAL), and in cooperation with the Department Trauma-, Hand- and Reconstructive Surgery at the Medical Center of Saarland University (Prof. Dr. Tim Pohlemann, Director and Prof. Dr. Werner Knopp, Senior



Consultant), CeLTech will be developing the Training Network for e-Surgery. The effort, which so far is unique in Germany, is also supported by the German Society for Surgery and the German Society for Trauma Surgery. The aim of the project is to build an interfaculty network of existing and planned e-Learning programs for training and advanced education in the field of surgery at university and outpatient clinics, and the resident doctors. Some programs such as the MEC.0 Online under the lead management of the University Clinic Homburg/Saar, or the audiovisual program on operating techniques, soft skills, and the skill lab of the Surgical Working Group Media(CAM), or the program offered at the Technical University of Munich, already exist and are now widely used at the respective locations and, in the future, these programs will be available nation-wide at the 36 university and outpatient clinics. CeLTech is under contract to perform the role of the innovation technology partner for the establishment of the e-Learning network, as previously announced in July 2011 at the "Training network e-Surgery" workshop at the Johann-Wolfgang-Goethe University Hospital, Frankfurt am Main.

Adaptive Tutorial Feedback

Besides new challenges, work continues on proven projects and advanced development, for example, the AtuF (Adaptive Tutorial Feedback) project funded by the DFG for the purpose of providing system users with individually tailored support in fractional computation problems. The aim of the recently extended project is the development and empirical evaluation of such adaptive tutorial feedback components (AtuF components) and concepts. In an interdisciplinary cooperation with the chair for "Psychology of Teaching and Learning" at TU Dresden, fundamental questions are being studied: What is the effect of AtuF components and concepts in relationship to exercise problems and learner characteristics? Which adaptive strategies ensure that the appropriate AtuF components will be selected for the relevant exercise problems and learner characteristics? To what degree does the adaptation promote learning and motivation in fractional math computations? To answer such questions, we are using and expanding the adaptive intelligent learning platform ActiveMath, which is under development at the CeLTech Lab "Intelligent e-Learning Technology."

More information about CeLTech, planned events and current R&D-projects, training, and continuing education as well as consulting and services is provided at: www.celtech.de

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Experience CeLTech –

Event Calendar 2011/2012

Technology Enhanced Learning in Mathematics and Science

Dedicated to the Memory of Dr. Erica Melis

September 20-23, 2011 Palermo

▶ www.telmas.celtech.de

Innovative In-House Personal Training

October 25-26, 2011 Otzenhausen

▶ www.forum.celtech.de

Campus Innovation

November 24-25, 2011 Hamburg

▶ www.campus-innovation.de

Future e-Learning Technologies in Medicine and Healthcare

April 23-24, 2012 Saarbrücken

▶ www.cbt-ag.de

Healthcare Management

▶ Talking Robots

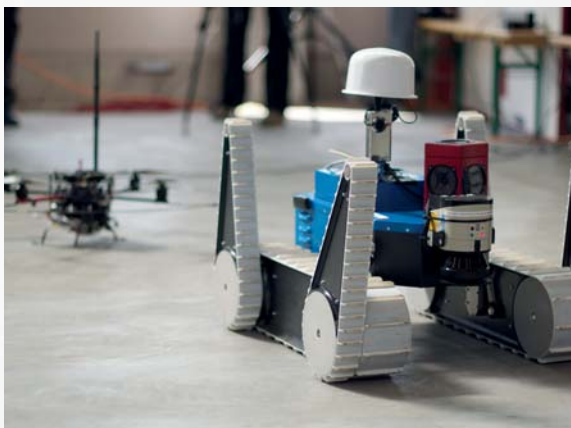
Since 2004, the DFKI Language Technology Lab has been involved in developing talking robots. These robots can talk to normal people, for example, about what is happening in the world around them, or what they are to do, alone or together with humans. In such an interaction, understanding dialog is about more than just understanding words. Robots need to figure out how to act upon what was just said: Dialog is crucial for acting in the real world.

Over the years, we have made this kind of acting in a real world more and more realistic. We mix fundamental research and applied projects on human-robot interaction, involving close cooperation with end users. This has resulted in a broad range of talking robot systems, from robot office gophers to robots that help hospitalized children and robots that assist firemen in assessing a disaster site.

Robots that help us

Back in 2004, we got involved in a new, EU-funded project in which we aimed for robots that would help out people around the house (CoSy, EU FP6 IP). This turned out to be a hard challenge at the time: A robot has no perfect idea of the world around it, and this limits what it can do and talk about. Its experience is uncertain, and incomplete. Moreover, robots were (and are) not capable of doing everything fully autonomously.

Yet, the project provided important first insights into building intelligent, talking robots. Key is the integration across different forms of inference and representation. To facilitate this, we have worked with our project partners on a framework that combines logical and probabilistic methods to structure uncertain and incom-



The robot system „NIFTI“

plete experience. These methods connect what the robot perceives to knowledge repositories such as ontological domain knowledge, or planning models - using models that can be learnt offline or online. These methods operate in an integrated fashion to determine optimal courses of action in a given context - for example,

how the robot should interpret situated dialog and formulate responses that make sense to a human in that context.

Since 2008, we have taken this into the direction of more fundamental research. In CogX (EU FP7 IP), we look at how to overcome the problem that a robot cannot be provided with a complete model of the world. It needs to learn as it goes, and next time, know what to do and how to do it better. This holds as much for dialog as for everything else. If the robot learns about a new object, or where that kind of object is typically found around the house, it should also be able to talk about it. This kind of learning also applies to dialog per se: if over time it finds out better ways of asking questions, of saying what it means and what it is after, it should remember these strategies and use them next time. We have been actively developing such approaches, combining again logical and probabilistic models to provide structural, ontology-based forms of inference over uncertain information. Now we are at a point where a robot can have sensible dialogs about doing things around the house. Whatever rooms there may be, or whatever objects it may find, the robot can talk or ask about these things now.



Since 2010, we have complemented this fundamental research with new projects, in which we closely work together with end users, moving out of well-controlled lab environments. This provides a whole range of new challenges that cover issues you find only when working in real-life environments. For example, how can a robot communicate with firemen when those firemen are performing under stressful, dangerous circumstances?

In ALIZ-E (EU FP7 IP), we focus on developing robots that can interact with hospitalized children over a longer period of time, in order to make the child feel at ease, helping it to familiarize with the treatment it is undergoing, play games, even talk about things that happen. Challenges for us include developing approaches that can dynamically determine how much communication needs to be understood in order to keep the interaction going - and how to combine spoken dialog with how the robot physically 'says' something using gestures, nods, or posture. Furthermore, as the robot and the

child build up a social relationship, the robot needs to memorize previous events, and connect the current context to earlier episodes. In ALIZ-E, we work closely with a major hospital in Milan, Italy, and the children who are being treated there. Real-life interactive robots are rapidly becoming a genuine possibility – we can actually have a real impact.



The robot system „NIFTI“ assesses the situation after a car accident

Another example of real-life impact is the deployment of robots in Urban Search & Rescue. In the NIFTI project (EU FP7 IP, coordinator DFKI), we work closely with several European rescue organizations to develop the possibility for humans and robots to team up and jointly explore a disaster area. This is a dangerous task that any emergency service needs to undertake at the beginning, in order to find out how and where to go about rescuing people. This is particularly dangerous in the presence of smoke, toxic fumes, or gases. Robot sensors can help to form a comprehensible picture of what the situation is like. We investigate this as a complex team effort, in which multiple humans and robots are active in the exploration. They communicate to coordinate their actions, or request actions from others, and to build up a distributed, yet shared situation awareness. Robots talk with people, and display their interpretations of the

environment in advanced multi-modal interfaces to show what the area explored looks like. This is challenging, as we are developing, experimenting with, and evaluating our systems under realistic circumstances (training areas of fire departments), in situations in which everybody is performing under stress.

Intelligent robots are not a Hollywood story anymore. Within the appropriate niches, like helping firemen, we are close to make talking robots that can assist us a reality.

More information

<http://talkingrobots.dfki.de>
www.cognitivesystems.org
<http://cogx.eu>
www.aliz-e.org
www.nifti.eu

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Healthcare Management

Security Technology

META-FORUM 2011 in Budapest



Europe is multilingual and it should stay that way. The international conference series META-FORUM features technologies for a multilingual Europe and makes a contribution towards ensuring that people understand each other nevertheless. Following the successful META-FORUM 2010 in

Brussels, the Conference in 2011 was held as an official event of the Hungarian EU Council Presidency on June 27/28 in Budapest. It was organized by the DFKI Project Office in Berlin, Language Technology department.

In his opening address, Zoran Stančić, Deputy Director-General of the Directorate-General for the Information Society and Media (DG INFSO) in the European Commission, emphasized that access to information in all languages is a necessary condition for the effective circulation of products and services and for the introduction of a consistently digital single market. "I strongly believe that Europe can further expand its leadership in the area of language technology and deliver new solutions. The only way to achieve this, however, is through strong partnerships among all stakeholders," said Stančić.



Prof. Dr. Hans Uszkoreit, Head of DFKI's Language Technology Department and coordinator of META-NET, referred to a common powerful vision: "With the right actors and a responsible research agenda, we can secure the future of Europe's languages and the future competitiveness of European Industry in this key area of technological growth. The public costs for the planned large-scale research and innovation effort might not be higher than the expense of 100 kilometers of new highway in one of the new EU member states."

Thomas Hofmann (Google) and Bran Boguraev (IBM) reported in their keynote addresses on the technological advances in language technology and plans of the international IT-corporations. European scientists summarized the current state of the art in language technology and shared their findings and success stories. Several presentations summarized the develop-

ment plans and the deficits in today's language technologies from the viewpoint of major users such as the European Commission, Daimler AG, or Vodafone. This year's META-Prize was awarded to the developers of the machine translation system Moses, an open-source software.



META-FORUM 2011 was organized by META-NET, a competence network composed of 47 research centers in 31 countries, and funded by the European Commission. META-NET is forging the "Multilingual Europe Technology Alliance" (META) – an open alliance of language technology developers and users from research, industry, and public administration. The common goal is the preparation of a research and technology effort to realize a multilingual European information society. Although the alliance was just established in November 2010, representatives from approximately 300 organizations have already joined.

The initiative will not only focus on automatic translation software,

but sees language technology as an enabling technology for many other innovative ICT applications. Besides the large international IT corporations like Google, Microsoft, and IBM, there are many small and medium enterprises in Europa that have specialized in certain applications and services in the area of language technology. "In the near future these companies will supply solutions that will allow people to communicate with computers, household devices, other machines as well as with other people in any language," according to META-NET manager Georg Rehm.

More information

www.meta-net.eu

www.statmt.org/moses/?n=Public.Demos

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Dr. Georg Rehm

Manager, META-NET



Dr. Feiyu Xu is a Senior Researcher and project leader in the Language Technology department.

What do you see as the application potential of your research?
My current research includes the study of new applications that can locate and analyze complex information and can be used, for example, in media monitoring

and online searches, or also for research and analysis in business, technology, and policy.

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

As a student, I already worked on the development of programs that could understand texts and instructions in the human language. Back then we had to use rule-based methods borrowed from linguistics and logic. Today, we have algorithmic learning processes that can automatically "learn" relevant patterns and rules from huge text volumes.

What are the greatest challenges and opportunities for AI systems?

It is not the quantity of online data that is the challenge, but rather the meaning of the data. This is why

DFKI Interview: Dr. Feiyu Xu

the greatest challenge is still linking the digital world to the human spirit and not to the terabytes of data.

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

In addition to my job at DFKI, I am the interim manager of a DFKI spin-off. The company develops mobile apps that assist tourists to China from around the world to communicate with the people in my native country despite the language and cultural differences. Besides that, I am also very interested in the culture, history, and development of my former home in comparison to the European culture.

Are there parallels to your professional life?

Absolutely, I can use many of the insights into the different languages and cultures in the development of new applications, for example, programs that facilitate learning a foreign language.

What are your current projects?

One of my projects has embedded the technologies for automated questioning and answering as well as simple dialogs in a 3D online game, so that real players can communicate with our virtual characters.

News in Brief

Research Excellence Award 2011 for DFKI Fellow Bob Kowalski

Professor Robert Anthony Kowalski, a DFKI Fellow since 1998 and a founding member of the Scientific Advisory Board of DFKI before that, was accorded the highest recognition in the field of Artificial Intelligence at the International Conference on Artificial Intelligence (IJCAI-11) in Barcelona on July 21, 2011 where he received the Research Excellence Award. He joins other distinguished prizewinners like John McCarthy, Herb Simon, Allen Newell, Judea Pearl, Nils Nilsson, as well as Alan Bundy, who is still active on the DFKI Scientific Advisory



Board. Bob Kowalski, Emeritus Professor of Computer Science at Imperial College London, was recognized for his contributions to logic programming and the logic of knowledge representation. In his book "Computational Logic and Human Thinking: How to be Artificially Intelligent!" he examines the psychology of logic.

Appreciation Award for Prof. Zühlke

For his many years of service to the executive board of the International Federation of Automatic Control (IFAC), Prof. Dr. Detlef Zühlke was honored with the IFAC Outstanding Service Award. The award was presented at the 18th IFAC World Congress from August 28 - September 2, 2011 in Milan, Italy. Prof. Zühlke was also re-elected for another three-year term as head of the Coordinating Committee on Mechatronics, Robotics, and Components.



IFAC is a multinational association of national member organizations that deal with automation and control engineering issues in the respective countries. The aim of the association is the advancement of theoretical and practical automation engineering. The IFAC Outstanding



Service Award is presented by the IFAC Council to veteran functionaries for outstanding achievement and service. Dr. Zühlke is a Scientific Director at DFKI and head of the Innovative Factory Systems department.

▶ **Honorary professorship for Hans Uszkoreit at TU Berlin**

In April 2011, the head of the DFKI Language Technology research department, Prof. Dr. Hans Uszkoreit, was appointed as an Honorary Professor for Computer Science at the Technische Universität Berlin. Prof. Uszkoreit also holds the chair for Computer Linguistics at Saarland University. In addition to the DFKI Project Office opened in 2007, the institute is now also represented in Berlin's higher education community.

▶ **Honorary professorship for Stephan Busemann at Saarland University**

Dr. Stephan Busemann, deputy department head of DFKI Language Technology, was awarded an honorary professorship for Computer Linguistics at the University of Saarland in March 2011.

▶ **Society for the Advancement of Technology Transfer (GFFT) honors Profs. Wahlster and Scheer**

Professors Wahlster and Scheer are both from the Saarland, both are pioneers in the field of IT, and both have made outstanding contributions in their professional careers to the transfer of research findings to commercial products and services. The Society presented the awards in the context of the 5th Annual Meeting on March 18, 2011. Members of the Selection Committee included Wolfgang Bibel (Chairman), José Luis Encarnação, and Hartmut Raffler. Prof. Wahlster is the second computer scientist, after Andreas von Bechtolsheim, founder of Sun Microsystems, to receive this prestigious award.

▶ **Design Award for head joystick**

The head-joystick to control electric wheel chairs, developed by DFKI Ph. D. candidate Christoph Budelmann, won the first prize in the EFM32 Design competition at the Embedded World in Nürnberg in March 2011.

The head-joystick provides even persons with a high-grade paraplegia with a simple, intuitive, and independent means to control the wheel chair. The movements of the head are converted into drive commands via a Bluetooth link to the wheel chair controls. The head-joystick is an innovative input device that extends the safety and driver assistance systems being developed for electric wheel chairs at the DFKI Safe and Secure Cognitive Systems department. These systems can recognize obstacles and apply the brakes at the appropriate times or assist the patients to negotiate narrow spaces.

▶ **Trade Exhibit and Conference for Electric Mobility: Bremen/Oldenburg pilot region shows current trends**

Electric mobility is one of the key technologies of tomorrow. Private and commercial users are already testing electric cars in the electric mobility pilot region Bremen/Oldenburg, coordinated by DFKI and Fraunhofer

IFAM (Institute for Manufacturing Technology and Advanced Materials).

How to develop a public charging infrastructure and the strategic perspectives offered by electric mobility were discussed by approximately 160 experts at the Trade Exhibit and Conference for "Electromobility, Experiences – Trends – Expectations" on September 14–15, 2011 in Bremen. The speakers included Dr. Joachim Lohse, Senator for Civil Engineering, Environment, and Transportation for the Free Hanseatic City of Bremen, who reported on the subjects of car-sharing, data collection, fleet trials, electrical storage systems, the energy industry, and supporting socio-economic research.

More Information

www.personal-mobility-center.de

▶ **"Green Light" for Math Bridge**

The EU-Project Math-Bridge, supported since May 2009 by the European Commission as part of the eContentplus program, has passed its second year project evaluation on July 7, 2011. It received the top score and was given "green light" to continue. During the period under review, the system implementation steadily advanced and the collection of learning objectives with mathematical content was translated into English and even partially into other European languages. The consortium, which consists of 12 project partners, succeeded in working effectively together to develop the exercise problems, exceeding the defined performance objectives.

More information

www.math-bridge.org

▶ **CeLTech winner of "Companies in Saarland: Active & Engaged 2011" competition**

At an official ceremony organized by the Chamber of Industry and Commerce (IHK) Saarland on September 27, 2011, four local companies and their project partners were recognized for outstanding social engagement. The Center for e-Learning Technology (CeLTech) was chosen in the category of middle-sized enterprises for the project "KinderZeit – Opportunity through Education." The project was a joint implementation together with the public all-day school Saarbrücken Weyersberg, which promotes highly gifted and talented students.

▶ **Newest DFKI Spin-off: AVIDENCE**

AVIDENCE is a service provider for intelligent solutions in the financial sector and is based in Saarbrücken and Düsseldorf. Using a method of automated recognition of anomalies in annual financial figures and accounts, the company develops a self-learning system with outstanding accuracy, especially in recognizing manipulations. The system has been tested using more than 8000 audited annual reports and will be commercially available at the end of the year.

More Information

www.avidence.de

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



▶ **DFKI – Simply Innovation**



Kaiserslautern Site

The German Research Center for Artificial Intelligence GmbH (DFKI), with facilities in Kaiserslautern, Saarbrücken, Bremen and a project office in Berlin, is the country's leading business-prone research center in the area of innovative software technology. In the international scientific community, DFKI is recognized as one

Research at DFKI takes place in these areas:

- ▶ **Knowledge Management**
(Prof. Dr. Prof. h.c. Andreas Dengel)
- ▶ **Robotics Innovation Center**
(Prof. Dr. Frank Kirchner)
- ▶ **Safe and Secure Cognitive Systems**
(Prof. Dr. Bernd Krieg-Brückner)
- ▶ **Innovative Retail Laboratory**
(Prof. Dr. Antonio Krüger)
- ▶ **Institute for Information Systems at DFKI**
(Prof. Dr. Peter Loos)
- ▶ **Embedded Intelligence**
(Prof. Dr. Paul Lukowicz)
- ▶ **Agents and Simulated Reality**
(Prof. Dr. Philipp Slusallek)
- ▶ **Augmented Vision**
(Prof. Dr. Didier Stricker)
- ▶ **Language Technology**
(Prof. Dr. Hans Uszkoreit)
- ▶ **Intelligent User Interfaces**
(Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster)
- ▶ **Innovative Factory Systems**
(Prof. Dr.-Ing. Detlef Zühlke)

of the most important „Centers of Excellence“ in the world for its proven ability to rapidly bring leading edge research to commercially relevant application solutions.

DFKI was founded in 1988 as a non-profit organization by several renowned German IT companies and two research facilities. Since then, DFKI GmbH has established a reputation for proactive and customer oriented work and is known both nationally and internationally as a competent and reliable partner for commercial innovation.

Because of the increasingly short cycles of innovation in the field of information technology, the lines between research, application related development, and conversion to products are becoming blurred. This is why DFKI projects typically include the entire spectrum from basic application-based research to market and customer oriented development of product functions. DFKI GmbH is managed by Professor Wolfgang Wahlster (CEO and Scientific Director) and Dr. Walter G. Olthoff (CFO).

The official opening of the DFKI project office Berlin in 2007 and the establishment of the Osnabrück branch of the DFKI Robotics Innovation Center in 2011 strengthen our endeavor to implement innovative solutions together with our industry partners. Another focus of the Berlin project office is to further expand existing partnerships within Berlin's research community.



DFKI project office Berlin

At the DFKI competence centers, where the focus is on technological and expert know-how, the aim is the management of research problems that transcend the individual labs.

The purpose of the DFKI Transfer Center is to make the scientific findings of DFKI available to commercial applications.

DFKI is the only German research institute for Computer Science being a member in the three leading research clusters and the co-founder of Software Campus. With an overall annual budget in 2010 of approx. EUR 36 million, the previous year's record result has been surpassed once again.

DFKI – Simply Innovation

Innovations you can touch

In the Living Labs, innovative technologies are being tested, evaluated, and demonstrated:

- ▶ Virtual Office Laboratory
- ▶ Robotics Exploration Laboratory
- ▶ Bremen Ambient Assisted Living Laboratory – BAALL
- ▶ Innovative Retail Laboratory
- ▶ SmartFactory Laboratory

Currently, DFKI has 431 main job employees and 284 secondary job employees. The circle of DFKI industrial partners comprises among others (partially through associated companies) Attensity Europe GmbH, BMW Group, Daimler AG, Deere & Company European Office, Deutsche Messe AG, Deutsche Post AG, Deutsche Telekom AG, EADS Astrium GmbH, Fraunhofer Gesellschaft e.V., Harting KGaA, Intel Corporation, KIBG GmbH, Microsoft Deutschland GmbH, Ricoh Ltd., SAP AG, Software AG, University of Kaiserslautern, Bremen University and Saarland University.



Saarbrücken Site

All work is organized in projects that have a clear objective, are scheduled to last for a specific period of time, and that lead, among other things, to patented solutions, prototypes, or new or improved product functions. At the present time, there are about 139 ongoing projects. Project progress is checked once a year by an independent, international group of respected experts. In addition to federal funds and EU grants for large, joint research projects, substantial contracts from business enterprises could also be acquired in 2010.

The successful transfer of DFKI research results to functional products is continuing. The DFKI model of a non-

profit Public-Private-Partnership (PPP) was positively received at numerous presentations and is often recommended as a role model structure. January 2010 marked the most recent review of DFKI in the 5-year evaluation circle by the Federal Ministry of Education and Research (BMBF). Also, in May 2010, the Federal Government has evaluated the DFKI-model very positively in a report to the budget committee of the German Bundestag. There is even an effort to incorporate the PPP organizational structure into the Federal Grant Handbook and the text of relevant laws.



Bremen Site

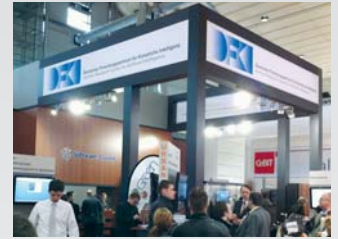
DFKI has membership rights in the Center for the Evaluation of Languages and Technologies (CELCT), based in Trento, in Yocoy Technologies GmbH (Berlin), in SemVox GmbH (Saarbrücken) and in GraphicsMedia.net GmbH (Kaiserslautern).

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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