NEWS

DaaS – Display as a Service

DFKI at CeBIT 2013

Cornerstone Ceremony for New DFKI Building in Bremen

Outstanding Young Researchers
in Leadership Program Software Campus

1/2013

DFKI-SmartFactory^{KL} in Industrial IT 2013 Forum

The DFKI-SmartFactory^{KL} is the central exhibit of the Industrial IT Forum at Hannover Messe 2013.

The HANNOVER MESSE (April 8-12, 2013) sets the focus on the growing integration of all areas of industry. Under the banner of "Integrated Industry," the lead theme of the international trade fair, it presents prime examples of the ongoing 4th Industrial Revolution. Clearly the interest is on key technologies and services for industry, with attention focused on the technological innovations for greater productivity and efficiency in industrial manufacturing.

Smart Product, Smart Machine and Augmented Operator
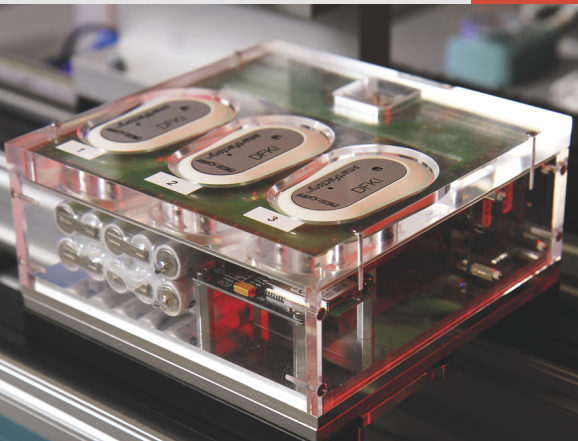
A unique demonstrator system presents a complete production line that illustrates a future oriented model of Smart Product, Smart Machine, and Augmented Operator.

This modularly designed system integrates the latest Information and Communication Technologies (ICT) and serves as a prime example of flexible and efficient production methods for customized product options. This is considered a pioneering achievement in the field of innovative factory technologies and a significant advance for the 4th Industrial Revolution.

A key concept is enabling a rapid and practical transfer of these technologies to the industrial sector.

We look forward to welcoming you at stand D20 in Hall 8!

3D Review links documentation, photos, videos, and websites with the vehicle's engineering design model.

3D Review – The Third Dimension of Web Collaboration

▶ 3D Review promises the possibility of annotating 3D design models in a web browser during the design processes with important multimedia content and then disseminating the image data to multiple monitors. This capability is achieved in connection with Display as a Service (DaaS) technology.

On a display wall consisting of four monitors, visitors to CeBIT 2013 can watch how 3D Review presents a three dimensional model of a BMW Z4 as it undergoes continuous development in a collaborative work process involving different end devices.

Programmers, product designers, illustrators, or graphic artists can link information sources like text documents, photos, videos, or websites directly with the 3D object. The object and data links are stored in a central database. The time consuming searches for information, that is usually scattered about in different media and file formats and filed at various unlinked locations, is a thing of the past. All persons involved in the creative process – even decision makers – can access the current project status at any time from any location and leave a comment. Following the final design process, the results are provided as a data bank for new developments. If components from an existing series are used, all of the linked data such as technical parameters, threshold values, or even known weaknesses – can be reviewed.

Technologies like XML3D, distributed interaction, and Display as a Service ensure the entire process – from posting comments at a personal workstation to the presentation in a process review meeting – requires only a web browser as software.

The 3D descriptive language for the web, XML3D, assumes the main function of presenting the three dimensional model in the browser. For that purpose, 3D objects are inserted in the DOM structural diagram of a website and can then be – as also with photos or text – manipulated and edited using the script language JavaScript. The simple, direct transfer of 3D data from CAD programs in the web application is achieved over various converters.

Mobile devices like tablets or smart phones link directly into the system and, thanks to distributed interaction, can control the web browser, which makes the mouse and keyboard dis-

pensable for presentations. 3D Review is controlled using intuitive smartphone gesture navigation like "Zoom" and "Swipe." It is also possible for employees to use their portable computer to display the image content of their prepared 3D Review scene and other information like tables or presentations via WLAN onto a display wall.

Display as a Service (DaaS) performs the distribution of the generated image data via a network connection to a number of different end devices. DaaS transports pixels via standard networks and enjoys all the advantages of a switched network connection, as it synchronizes the display of pixels from multiple sources on mulitple displays (see page 5). In this way, 3D Review can be centrally operated for large meetings multiple times on a high performance server to show associated image content of the browser on a large screen projection or a display wall. ◀

More information
www.xml3d.org

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CeBIT Hall 9, Stand F50

Display as a Service – A Picture Says More on 1000 Screens

▶ Imagine pixel transport without a video cable, without limit and without distortion. DaaS – Display as a Service – transforms an unlimited number of individual monitors into a virtual display on a gigantic display wall. Acting as service providers in a network, images and monitors of any resolution can supply the pixels or display them for viewing. DaaS establishes peer-to-peer communications between all sources and monitors, ensures the distribution of the video content, and allows synchronized real time presentation of the content on all display devices.

It makes no difference whether such walls are constructed using a uniform grid, for example, liquid crystal displays, or from heterogeneous display devices arbitrarily combined and having various resolutions and pixel densities. Every display in DaaS is registered with its own absolute spatial position and orientation in the system, which ensures proper compensation for display edges and potential gaps, while presenting image data over the entire display wall without any distortion.

The possibility of transporting pixels over standard networks rather than via dedicated video cable connections is the focus of an effort headed by Prof. Philipp Slusallek in a collaborative project conducted by DFKI and Saarland University at the Intel Visual Computing Institute. Project leader Alexander Löffler believes DaaS has all the advantages of a switched network, with the additional flexibility of being able to integrate pixels from many different sources on multiple displays.

Until now, the connection between a pixel source and the monitor intended to display the pixels has mostly been achieved via DVI or HDMI interfaces. Such cables only offer an inflexible point-to-point connection. The ability to connect multiple sources with a monitor, or one source with many monitors, or some combination of both was only possible by adding some very costly, special hardware.

DaaS uses a service-oriented approach: the pixel sources as well as the displays – single or combination – act as service providers in the network, which supply the pixels or display the provided pixels. Third parties are enabled as users of these services and can freely map pixel sources on displays. DaaS establishes a peer-to-peer communication model between all sources and displays, ensures the distribution of the image content based on the current mapping, and allows the synchronized presentation of the content on all display devices. "To receive, process, and display synchronized data from the network using our software, a monitor only requires one additional item of standard PC hardware," explains Löffler. Researchers in Saarbrücken, together with monitor manufacturers, are attempting to eliminate even this last provisional solution, for example, by installing DaaS directly in the televisions. Today, these are no longer simply display devices, but rather have evolved into high performance multimedia equipment with processors and network interfaces that, in principle, can satisfy all of the conditions required by DaaS. The software must have access to the programming interfaces that partially control the hardware, for example, the display refresh rate, which indicates the essential need for close collaboration with the hardware manufacturers.

As generic software, DaaS has the potential to replace highly specialized hardware and revolutionize the world of display services. At CeBIT, visitors can experience the interactive heterogeneous display wall and a dynamic, reconfigurable display built from tablet-PCs. ◀

More information
www.daas.tv
www.intel-vci.uni-saarland.de

Photo: André Mailänder

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Smart visualization and assessment of resource demands

RES-COM – Smart Products From the Sustainable Factory

▶ Under the umbrella of "Industry 4.0 – The Factory of Tomorrow," DFKI and its partners in the Software Cluster present current research findings and technological developments for an innovative, decentralized, networked means of production beyond company boundaries at the CeBIT stand of the Federal Ministry of Education and Research (BMBF).

Innovative Information and Communications Technologies (ICT) form the underlying technological basis of the information and knowledge society and make a major contribution towards increasing the value added by German manufacturing companies. Presently, ICT is offering German industry the chance to take advantage of the technological possibilities of the Internet of Things, for example, Cyber-Physical Systems (CPS), for the 4th Industrial Revolution.

As the basis for new levels of productivity and added value, the 4th Industrial Revolution refers to the development and distribution of autonomous, self-controlled and knowledge based production systems. The digital value added in the means of production, products, and systems will enable continuous improvement in the performance of industrial processes in manufacturing, engineering, supply chain and life cycle management, which as a whole will lead to a new form of resource saving industrialization.

The RES-COM research project – Resource Conservation through Context-activated Machine-to-Machine Communication – investigates how the vision of the Internet of Things and Services and the technological aspects of cyber-physical systems are shaping the Factory of Tomorrow.

The major aspects of the 4th Industrial Revolution come alive at the BMBF stand at CeBIT 2013 as you experience a demonstration using a system prototype of the DFKI-SmartFactory[KL]. The miniaturized manufacturing plant designed with four separate component modules – order picking station, cutting station, automated assembly station, and manual work station – produces a sample smart product, the SmartFinder. The finished product can be mounted on any object and located at any time via a Bluetooth connection from a smartphone.

The production process starts at the order picking station, where the order data from the plant's ERP system is entered in the semantic product memory, the RFID chip on the work piece itself. The data format used is the OMM (Object Memory Model), which was first developed under the BMBF project "SemProM - Semantic Product Memory" and later, further developed as part of W3C.

The next module, the cutting station, is where the housing of the SmartFinder is individually engraved. Order data for this

process originates from the semantic product memory and not, as in conventional production, from a central manufacturing control.

The SmartFinder is then assembled in an automated assembly station, where the semi-finished product is placed by the picking station robot onto an intelligent work piece conveyor. Equipped with its own active digital product memory, the work piece conveyor not only regulates the flow of materials, but rather through the embedded sensors, the local processing intelligence, and the wireless communications with the plant control, also exerts an active influence on the manufacturing processes.

The automated product assembly is performed according to customer preference, i.e., optimized to save either resources or operating time. The processing options required to achieve this are then selected and variably implemented according to the order data for the particular smart product. In this context, the central component in a CPS-based factory is the distributed control system. Implementation is achieved by equipping the industrial control terminals with micro-web servers (Digi-Connects). These smart embedded systems, which are linked to each other over the internet, permit the availability of semantic services. Consequently, these allow flexible control of the systems and dynamic orchestration of the production processes in the future.

Smart and finely granulated capture of resource consumption at each individual component is displayed via a web-based visualization framework. This in turn can be used to evaluate the energy efficiency of alternative production options even during the actual running processes. RES-COM addresses these requirements through a network of local, distributed autonomous systems with central structures that support the future vision of an "Internet for Resource Efficiency."

Before the SmartFinder leaves the production line, it passes the manual assembly station, where in addition to any optional manual assembly it undergoes a quality control inspection. Throughout the process, the operator supported by innovative Information and Communication Technologies for the mobile preparation and visualization of real time information. The technicians call up digital work instructions, which visualize and explain complex work procedures with the aid of the Augmented Reality (AR) technologies. This AR support, for example, permits even the less experienced staff at an assembly station to quickly train and become proficient at the job.

Despite the high degree of automation in the manufacturing industries, manual assembly stations are still widespread, especially, in the SME sector. How business process management can be integrated in future AR-supported production scenarios is demonstrated at the DFKI-SmartFactory[KL] exhibit at the CeBIT stand of Software AG (Hall 4, Stand C11). The connection was implemented on the ARIS business process software to visualize each manual step in the production and the key performance indicators on a separate monitor.

With this concept, SmartFactory[KL] was the winner of the Software AG "Top Innovator" competition. The aim was to develop an innovative exhibit that permits a clear and practical presentation of Software AG's business process management technology at CeBIT 2013. SmartFactory[KL] was awarded a grant of 10,000 euros for the successful implementation of the model. ◀
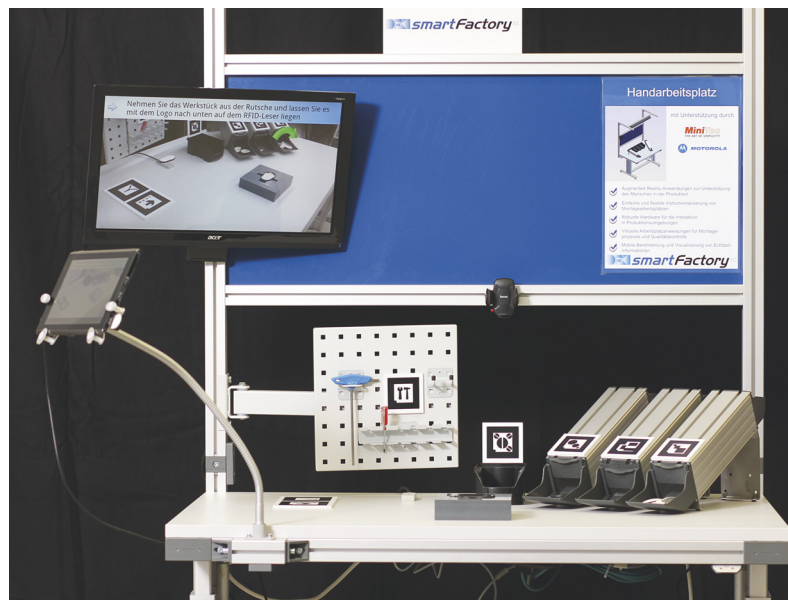
Manual work station for the optional manual assembly and quality control

More information
www.res-com-projekt.de

CeBIT Hall 9, Stand E50 Hall 4, Stand C11

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Software-Cluster at CeBIT 2012

Software-Cluster

Software-Cluster Demonstrates Cross-company Value Adding Chains

▷ Under the umbrella subject "Industry 4.0 – The Factory of Tomorrow," the Software-Cluster uses an example company to show how value adding chains can be IT-based and flexibly coordinated to benefit from the ability to cross company boundaries.

MedIndividual (a fictional company) develops innovative, customizable products for medical systems and in the process, depends on collaboration with specialized companies upstream and downstream along the value adding chain.

All of the production partners involved in the value adding chain are digital enterprises, which means their processes are completely digitized and can be coordinated across company boundaries. This scenario illustrates how the solutions developed in the Software-Cluster fit together to optimize the business processes between the different value adding steps:

▷ Der **Business Model Wizard** (SAP AG/TU Darmstadt) is a computer aided set of modules for the comprehensive and standardized description of business models. A company like MedIndividual can use the software to analyze, configure, and optimize its business model. Furthermore, it is possible to check the model against the business model profiles of similar companies in a reference database in order to compare their own prospects for business success.

▷ **Software Process Wizard** (SAP AG) analyzes and optimizes the software development processes in companies. This solution assists in making business processes leaner, more flexible, and more adapted to current challenges.

▷ **Collaborative Process Modeling** (Software AG) coordinates the integration of all participating partners in the manufacturing process of the product, for example, customized products for medical systems. A social networking platform provides the means for all actors involved in the integrated process i.e.,

MedIndividual employees, partner company employees, and suppliers, to exchange up-to-date process data and to inform each other concerning changes or to recommend improvements. In this way, not only does the flexibility of the manufacturing processes increase, but so does job satisfaction and the level of identification of the employees with the product.

▷ **Governance and Compliance Systems** (TU Darmstadt/Software AG) allow a company like MedIndividual to ensure compliance with the established quality directives throughout the entire value adding chain. In this way, customized product orders can be combined. In this sense, the most suitable third party service providers are selected on the basis of the compliance measures and finally, the entire value added chain is checked for compliance with all directives. Companies can dynamically combine value adding chains and, despite the inherent changes to process characteristics, still ensure compliance with all regulatory and statutory guidelines. ◀

More information
www.software-cluster.org

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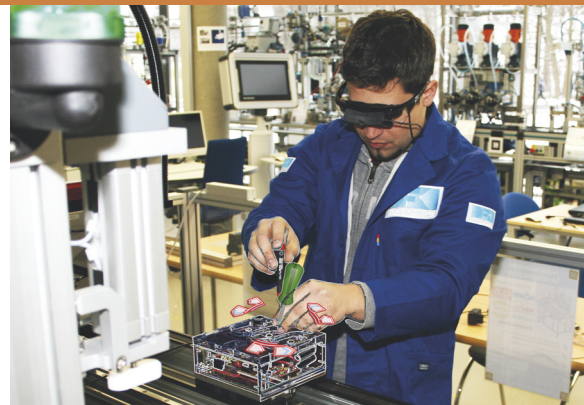
Show Them How it Works –
Intelligent Augmented Reality Handbooks for Industry 4.0

▶ Digital handbooks, presented as step-by-step instructions in a head-mounted display (HUD) directly in the user's field of view, facilitate and accelerate the maintenance, repair, or installation of complex units. They explain precisely and clearly each individual step at the site, can be called up at anytime, reduce the safety risk to the employee, and they contribute to perfect results.

DFKI's Augmented Reality research department is working on simplifying the creation of these AR Handbooks through the integration of AI technologies with the aim of making them fit for actual operations. In the past, this socalled "authoring" was generally performed manually and with the associated high costs. The system often required scripted descriptions of actions that had to be manually prepared; furthermore, expert knowledge of the tracking system in use and how to install tracking assistance was necessary.

At the Federal Ministry of Education and Research (BMBF) exhibit stand at CeBIT this year, DFKI introduces the new AR Handbook System that allows for automated documentation and support of simple work processes by means of a light-weight system. An integrated camera recognizes each manual action performed and superimposes this in the HUD with previously recorded video sequences to effectively show the next work action. This does not require any special marker or other support and – in contrast to many other methods – it recognizes the undefined hand gestures. The job sequences lend themselves to quick and easy recording and require only minimal post-processing. This technology significantly decreases the labor time required for the creation of Augmented Reality handbooks and because it is far less complex, it encourages wide spread use.

The authoring tool independently breaks down the sequence after viewing into its separate distinguishable actions and then combines the separate sections with a stochastic crossover model. An action observed during operation can be assigned in time to the corresponding section and then, pointers can be displayed at the precise point in time for the subsequent section. This kind of learning ("Teach-In") is found in many areas of Artificial Intelligence and is an especially current research subject in the field of robotics. It is also known in the literature as "programming by demonstration." Additionally, the method fully and automatically creates semi-transparent overlays in which a "shadow image" of the pending action is displayed. Important details or supplemental pointers can be emphasized by adding graphic symbols like arrows or lines.

The simplified authoring and teach-in method, which is performed by employees who are trained in the specific operation rather than by software experts, opens up additional fields of application, for example, in quality management. Technicians at an assembly work station can record "reference procedures" to ensure that all future assembly activities follow the same procedural pattern. A limited version of the AR Handbook is now available for Android smartphones and tablets. This means that in the future, even the private user can obtain support when assembling furniture or installing and operating household appliances. ◀

More information
http://av.dfki.de/ar-handbook

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Flexible, Modular Security for Networked Production Systems

▶ Flexibility in the design and operation of production systems, especially with new methods as seen in the research for Industry 4.0 projects, demands high quality, modular components in addition to a strong decentralized control system.

Researchers at CISPA - Center for IT Security, Privacy, and Accountability are investigating questions of security that are caused by modularization and networking and arise in the systems and software architecture: The product being processed and the separate parts of the system exchange not only information about their own abilities and processing details, but they also present different requirements for IT security.

"Security by Design" describes a systematic method for future production systems in relation to higher-level requirements, a global security architecture, and an implementation using interactive security mechanisms. The method accounts for security-relevant system parts separately and uses the high performance middleware KIARA to implement the (semi-) formal specifications and MILS for modular systems (Multiple Independent Levels of Security).

KIARA is an innovative middleware for the transfer of services and messages developed under a framework of several German and European projects. The software supports the efficient transfer through various plug-ins (sometimes automatically selected) and, at the same time, configures security solutions on the basis of specific instructions.

The CISPA demonstrator at CeBIT 2013 shows a visualization of the security features using a virtual system as an example. This facilitates the presentation of the communication channels and the critical security aspects while also specific scenarios are played out under realistic conditions. ◀

More information
www.cispa-security.de

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Xflow – Declarative Data Processing for the 3D Internet

Virtual museum with animated characters

▶ The latest web technologies enable interactive 3D applications directly in the web browsers. The computations required to enable this are complicated and must be performed in real time. Character animation, for example, involves the motion of up to 100,000 individual vertices in a 3D model and up to 10,000 separate points must be animated for an impressive particle effect. In post processing, every pixel of the display is processed.

This creates a very strong demand for ever-faster and more effective data processing software. Such high performance data processing, however, is hardly achievable in JavaScript, the most popular web scripting language, since JavaScript code does not support data-parallelism.

Modern 3D graphic applications make substantial use of parallel hardware (e.g., SIMD, multi-core CPUs, and GPUs) to perform real time calculations. The web even offers partial access to this parallel hardware, either through plug-ins or integration directly in the browser. However, this access is achieved mostly through special programming interfaces that differ significantly from the usual web technologies.

Xflow provides a simpler technology for web developers because it closes the gap between the more efficient, device-oriented computation and more abstract, user-oriented web development. Xflow permits the declaration of data flows within a web document, so they can be inserted seamlessly into the 3D scene and the web document.

The execution of the computation and the storage management functions is generated and optimized automatically, and runs in the background. One advantage of this optimization is the mapping of individual segments of a computation in multiple hardware components (CPU or GPU), which permits even faster data processing. ◀

More information
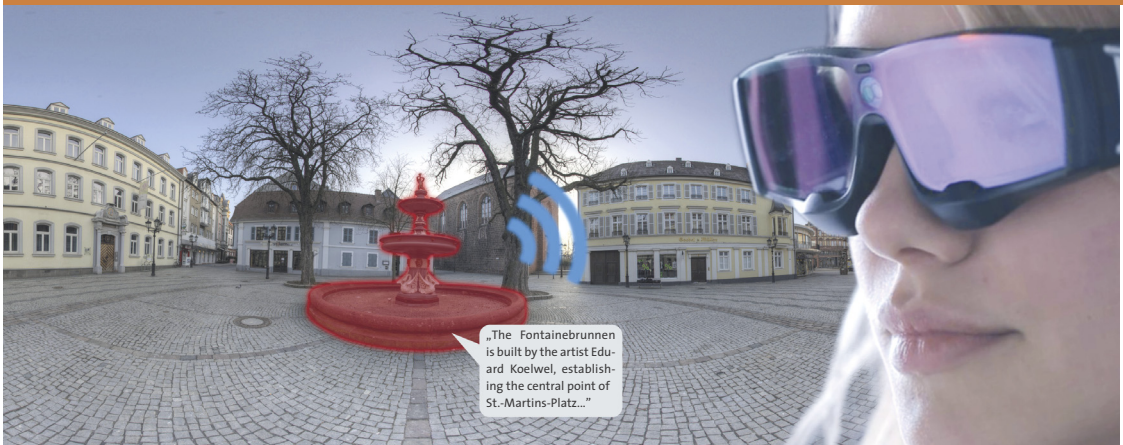www.dfki.de/web/research/asr

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"The Fontainebrunnen is built by the artist Edu-ard Koelwel, establish-ing the central point of St.-Martins-Platz..."

Talking Places provides information about the object of interest. Attractions or shops seem to come alive.

SMI
SensoMotoric Instruments

Talking Places – Looks That Make Objects Talk

▶ Not with mouse clicks, voice controls, touch or gestures, but rather with looks – visitors to the DFKI stand at CeBIT 2013 can call up information about an object – just by looking at it.

In place of explicit interaction via a conventional input device, for example, a touchscreen, this new system tracks and evaluates eye movements and the gaze of the user. The technology basis is the Eyetracker, a powerful mobile device of the latest generation that is fully integrated in the frame of the eye-glasses and manufactured by SensoMotoric Instruments (SMI) in Teltow, Germany. The SMI eye tracking glasses are the most innovative approach to measuring visual interest and are uti-lized in gaze interaction applications in situations that demand mobility or the natural behavior of the test subjects. The glasses film the user's field of vision while simultaneously showing the focus (gaze data) of each eye.

"The Talking Places exhibit demonstrates our vision of a mobile assistance system built on geodata that provides various users with location and context sensitive information – selectively and concurrently based on the point of interest," says Dr. Thomas Kieninger, project leader and senior researcher at the Department of Knowledge Management at DFKI.

Website administrators for organizations and enterprises, but also private persons are increasingly starting to enrich their in-ternet content with geo data. Known as geotagging, it is a process for adding geographical coordinates to the various con-tent. Special services interpret this data and transfer it to a dig-ital map, which enables location-specific searches or augmented reality applications like Wikitude or Layar. Hotels, restaurants, shopping centers, museums, or retail businesses as well as news and information channels are experimenting more and more with such services. For example, Google News uses geodata to aggregate locational data and to provide in-formation to users in the region. Similarly, news and image archives can be enriched with geodata.

DFKI develops processes that recognize the special patterns of human eye movement that indicate a strong interest. This at-tention analysis promises a broad spectrum of new services. The first prototype, Museum Guide 2.0, provides museum visi-tors the audio data of a classic audio guide through a headset as soon as their attention is focused on an exhibit.

Talking Places illustrates the integration of geotagging in the continuation of ongoing development. In contrast to aug-mented reality browsers, which display all tagged objects in the field of view based on the selected information channel, the attention recognition function in Talking Places is used, espe-cially, to reduce the information down to the essentials. Gazing at a restaurant, for example, the daily menu is heard, whereas when looking at a shop, the hours of operation or special offers are displayed.

In addition to audio output, it is also possible to present image data for the location per heads-up display (HUD): historical photos, for example, can be superimposed over the current image as a reminder of the past – perhaps together with the words of contemporary eyewitnesses. It can also be used to vi-sualize the plans of a building project. Data glasses, the com-bination of eye-tracker and heads-up display, are a subject of current research at DFKI. The study includes investigating the extent to which specific interactions are possible through eye tracking control alone. ◀

More information
http://talkingplaces.dfki.de
www.eyetracking-glasses.com

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iGreen – Mobile Decision Assistance for an Efficient Knowledge Transfer in Agricultural Areas

▶ The iGreen research project develops open structures for an effective exchange of knowledge in the agricultural sector. IT researchers and programmers working in an interdisciplinary consortium of business enterprises, agricultural machinery manufacturers, and public institutes are developing the appropriate methods, specifications, vocabularies, demonstrators, and reference implementations under a 3-year project grant by the Federal Ministry of Education and Research (BMBF).

At the CeBIT exhibit of the state of Rhineland-Palatinate, visitors can see a mobile decision assistant for the optimal application of nitrogen-based fertilizers. Rhineland-Palatinate provides the mobile agrar-portal MAPrlp to farmers so they can access and use important geo information from their mobile phones. iGreen is the source of semantic technologies, ontologies, and structured vocabularies for use in mobile decision assistants to achieve a more efficient preparation and communication of agricultural-ecological know how.

The internet based agroConnect/GeoForms, developed by iGreen partner IIS (Competence Center for Innovative Information Systems, University of Applied Sciences Bingen) and implemented in MAPrlp, support not only the regional dialog between citizens and farmers but also between administrative agencies and official agricultural or environmental counselors.

The growing demand for tools for location-related decision assistance is attributed to the widespread use of modern mobile devices like smartphones and tablet PCs. The combined use of wireless internet with GPS for accurate positioning and open data geo information enables diverse services for citizens, businesses, and authorities in the field, who can benefit from location-specific information. The CeBIT scenario illustrates how supported and optimized application of fertilizers can lead to better yields, save costs, improve the counselors' knowledge base over the long term, and reduce the harm to the environment caused by excessive nitrogen input. ◀

More information
www.igreen-projekt.de

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Digital Pen Technology in the Office of the Future –
For Analog Writing, Digital Comprehension, and Secure Identification

▶ DFKI and its technology partners ventuno and bend-IT are introducing a digipen solution for the automatic recognition of handwritten forms and the creation of legally binding digital signatures at CeBIT 2013. The system has been successfully deployed in the Kreissparkasse (district savings bank) in Kaiserslautern since October 2012 and has recently been introduced at the Innovation Congress of Sparkasse. This is the first time anywhere in Europe that a certified Anoto-pen solution has been used for legally compliant customer signatures in the banking sector.

First, the bank employee creates a new form on the computer, for example, a registration form or a financial audit form. Any customer data that is already stored in the bank's system is also printed on the form. Then the form is provided with a so called Anoto dot pattern (a unique, nearly invisible pattern) that makes it possible to recognize those points where the user has marked or written something. Consequently, after the form has been printed, the individual discussion with the customer can begin.

The bank employee or the customer next completes the printed form using a "digipen," a digital pen with an integrated camera. Interacting with the Anoto pattern, the digipen digitally records its own analog font. The digipen registers which fields are selected by the customer or bank employee, records contract signatures, and stores handwritten notes made on the forms.

The pen data is transferred to a computer or company server via a docking station with Bluetooth or USB interface. A handwriting recognition program analyzes and digitizes the data before sending it to the ventuno data processing software. Of course, the software still allows for corrections to the digital text.

The solution represents an advanced electronic signature capability and creates a legally binding digital signature. It is conceivable that in the near future, the automatic signature verification process will be used to identify attempted forgeries. A digital fingerprint of the valid signature, for example, could be stored on a customer card and the new signature could be verified at each business process – more secure than a casual visual inspection by a customer consultant. ◀

System demonstrations are available by appointment. If interested, schedule a demonstration with Volker Schilling or at the info counter of the DFKI stand at CeBIT (Hall 9, F50).
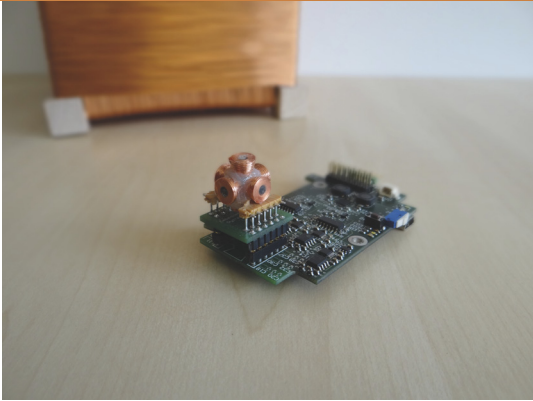
CeBIT Hall 4, Stand C26 (Telekom)
Hall 9, Stand F50 (DFKI)

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Portable receiver units with tri-axial receiver coils are key components in the positioning system.
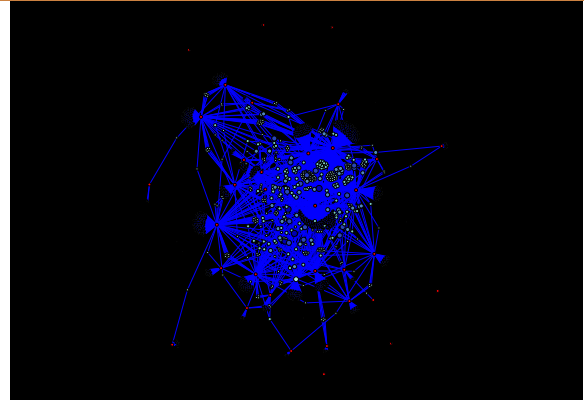
Visualization of Bluetooth topology accumulated during an event

Social Computing – Technologies for Sensor-aided Analysis of Group Interactions

▶ What paths do customers follow in the shop? How long do they stay focused on a specific offer? Does the kitchen help in a large operation have to walk unnecessarily long distances simply because the layout of the utensils is poorly arranged? Does the stream of visitors always get held up at the same place in the concert hall?

The movement patterns of groups of people can supply data that can be used to analyze customer behavior in stores, optimize organizational structures, and improve the safety at major events.

DFKI's Embedded Smart Systems department develops methods for large area, collaborative data acquisition, investigates new basic technologies for interior positioning, and tracks innovative approaches for sensor fusion, to include so called "Crowd Sensing."

Fusion of Different Sensor Modes
At the DFKI stand, the location of employees equipped with receivers can be determined in real-time. The integrated subfloor pressure sensors from the company Future-Shape detect the visitor's steps. From this sensor data, together with the Bluetooth and WLAN signatures from the visitors' smartphones, an anonymized image is created of the movement of the flow of visitors.

Which exhibits attract special interest, which employee has helped how many visitors at what exhibit, and how does the interest in a certain exhibit correlate to the traffic at other stands are all questions that can be answered using this data. The results are visualized on a heat map.

Magnetic Sensors – Magnetic Fields as a Basis for Determining Positions in Closed Areas
The DFKI system functions on the basis of oscillating magnetic fields that allow three dimensional positioning that can locate a portable receiver somewhere inside a building with an accuracy of 30 cm. For example, sensors mounted on a device or car-

ried on a person allow a determination of the position, orientation and state within the room. The positioning system developed at DFKI consists of stationary transmitters and portable receiver units. The magnetic fields produced can penetrate objects, persons, or walls and, are largely immune to interference from metal objects.

One stationary transmitter can radiate out to approximately 60 meters. The receiver units transfer the detected position and orientation data via a USB or radio connection for further processing on a PC. The acceleration and rotation rate sensors integrated in the receivers act to stabilize the ascertained position and orientation values.

Crowd Sensing at Major Events
In addition, researchers are presenting the so called Crowd Sensing System, which anonymously captures the stream of visitors at major events with the aid of mobile phones and can, if necessary, coordinate their movement by sending a message.

"Crowd Sensing" is developed at DFKI in the context of EU Project SOCIONICAL and in cooperation with DFKI spin-off SIS Software GmbH. Among other successes, this technology was deployed for the Olympic Games 2012 in London. ◀

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www.dfki.de/web/research/ei

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VISTRA – Natural Interaction for Virtual Assembly Training

▶ At CeBIT 2013, DFKI's Augmented Reality department in Kaiserslautern is presenting the first prototype of the VISTRA training simulator, which through the use of intuitive, natural gestures, enables user interaction with a virtual training environment.

The simulator is developed as part of the EU research project VISTRA (Virtual Simulation and Training of Assembly and Service Processes in Digital Factories). The aim of the project is the development of a platform for the transfer of product and production data within an innovative, virtual training application for manual assembly processes in the automobile industry.

The need for additional input devices and instrumentation of the trainee becomes expendable thanks to innovative interactive devices and gesture recognition algorithms. By means of simple gestures like the actual gripping and release of a virtual object, a tool for example, the user can enjoy training in the complex assembly sequences of a component while gaining new procedural knowledge.

The VISTRA technology is expected to allow the start-up planning and 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 costly and complex hardware training prototypes and optimizes the ramp-up for new manufacturing and assembly processes.

VISTRA relies on a game based learning approach to convey procedural knowledge of an assembly operation to the user in a recreational manner. This fun way of learning requires a strong immersion on the part of the player. Contributing to the trainees willingness to take the plunge into the virtual world are the natural interactive mechanisms of the VISTRA training simulator.

The combination of a realistic rendering of the component, the simulation of the flexible parts, and a motoric that reflects the actual interactions that take place during the work, further im-proves the efficiency of the learning processes. The Augmented Reality Lab is developing intuitive, interactive concepts that recreate reality and facilitate a natural operation of the virtual training system.

Project Info
VISTRA is funded under the 7th EU framework program for research (Project number ICT-285176) for a term of three years. The project unites seven research and industry partners from Denmark, Germany, England, and Sweden: DFKI, Fraunhofer IGD, Fraunhofer-Chalmers Center, University of Nottingham, Serious Games Interactive, VOLVO, and OPEL. ◀

More information
www.vistra-project.eu

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VISTRA training simulator user during assembly of a motorblock
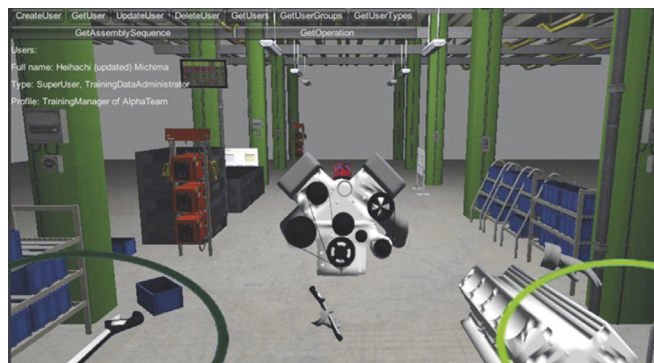
Screenshot of the training environment as seen by the user. Components may be mounted on the object by gripping and release.

GPS

Cellular Network

Smartphone

Server

Vital Data

Training Data
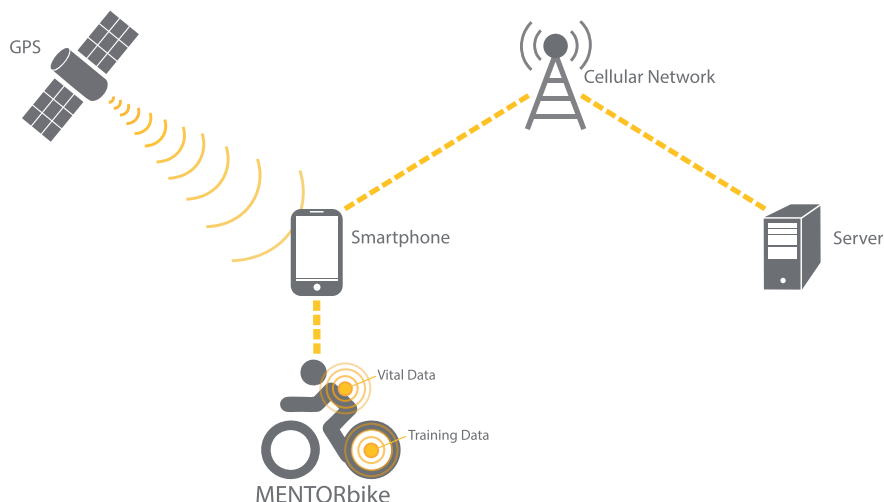
MENTORbike

MENTORbike – On the Road With the Training Consultant

▶ While conventional training equipment can measure an athlete's vital signs like pulse or blood pressure, it is not able to offer any response. When such systems are in use, users must correctly interpret the information presented and adjust their training. Sometimes an illness in the cardiovascular system may, under certain conditions, lead to a serious health risk. MENTORbike supplies the intelligence required to prevent this.

MENTORbike is an intelligent outdoor assistance system for adaptive and mobile training. In essence, MENTORbike is a modified "Pedelec" – a hybrid bicycle powered either by muscle strength or an electric motor. The Pedelec is connected via a smartphone to a sensor network worn on the body and linked to an intelligent internet services platform.

The centerpiece of the system is an intelligent software that captures the current physical situation of the user through body, bicycle, and smartphone sensors. The variety of sensors is what enables MENTORbike to establish a much more accurate assessment of the situation than conventional cardio equipment. Besides heart frequency, an electrocardiogram (ECG) can be recorded, or the position of the user can be determined via the smartphone. The vital signs and performance parameters are not just displayed after recording, but rather are also processed. Furthermore, evaluation mechanisms used in recommender system research that reflect the latest findings in the field of sports medicine are also integrated. On the basis of these evaluation results, training is automatically modified by an increase or decrease in the use of the electric motor. The user is optimally challenged without being overextended.

Besides this physiological support, MENTORbike also provides customized assistance through electronic services. These services may motivate and support the rider psychologically by pointing out, for example, nearby scenic attractions or rest areas. Post training, the users can review the training data collected such as average speed or other data from the activated sensors, and show it to third parties for an expert evaluation

or simply to exchange the route information with other users. This form of personalized training support includes both physiological and psychological aspects and, to date, has not been deployed in this scope for either individual use or for therapeutic aims in the health industry. The fields of application for MENTORbike may expand to include not only prevention, but also rehabilitation programs for cardiovascular patients.

The Project MENTORbike is sponsored by the Federal Ministry of Education and Research (BMBF) (Funding ID: 1IS11034). Project partners: BitifEye Digital Test Solutions, Benchmark Drives, INTERACTIVE Software Solutions, Health Center of the German Sport University Cologne (DSHS-ZFG), and DFKI. ◀

More information
www.mentorbike.de

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DFKI Keynotes, Interviews, and Panel Discussions at CeBIT 2013

▶ With lectures and presentations, DFKI involvement at CeBIT includes lab talk, the annual open conference in the innovation Hall, as well as the Webciety Forum, the BITKOM Smart Home Forum, and Telekom talk. ◀

CeBIT lab talk 2013   Hall 9, J50

March 5   2:15- 3:00 pm
Industrie 4.0 – The Internet of Things in the Smart Factory
Prof. Dr. Dr. h.c.mult. Wolfgang Wahlster,
CEO, DFKI

March 5   3:00 - 3:30 pm
Share Your Service! Internet Standards for the Web of Things and Services: USDL and OMM
Prof. Dr. Felix Sasaki,
DFKI/ W3C, German-Austrian Office

March 6   2:00 - 3:00 pm
CeBIT Innovation Award 2013
Introduction of award winners
Moderation
Reinhard Karger, DFKI

March 6   3:50 - 4:00 pm
Software-Cluster on Stage
Learning in Context:
Intelligent Augmented Reality
Handbooks
Nils Petersen, DFKI

March 8   1:00 -1:30 pm
Voice, Gesture, Touch
eLearning and employee training as interactive experience as part of the High-Tech Strategy, Industry 4.0
Dr. Norbert Pfleger,
SemVox GmbH, DFKI-Spin-off

March 9   10:30 -10:45 am
Software Campus
SINFIO – Searching in the information management systems of tomorrow
Kinga Schumacher, DFKI

CeBIT Webciety Conference
Hall 6, H32

March 6   3:10 - 3:40 pm
Internet of Things
Panel discussion
Reinhard Karger, DFKI

Smart Home Forum
Hall 11, D75

March 9   2:50 - 3:10 pm
From Smart Home to Smart Everywhere
Dr. Jan Alexandersson, DFKI

Telekom talk
Hall 4, C26

March 6   10:45 am
Talking Places – The Virtual City Tour
Prof. Dr. Prof. h.c. Andreas Dengel,
Spokesperson DFKI Kaiserslautern

March 6   12:45 pm
Digipen – The Smart Signature
Prof. Dr. Prof. h.c. Andreas Dengel,
Spokesperson DFKI Kaiserslautern

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and Technology

PeerEnergyCloud – Neighbors Trade Energy

▶ In interregional "smart grids," producers are connected to the operators of distribution systems by high and very-high voltage power lines. Smart Micro Grid, in contrast, is a regional distribution grid operated by public utilities as a medium voltage system with 10,000 volts (10 kV). The Smart Micro Grid operated by the Saarlouis public utility as part of the PeerEnergyCloud project consists of approximately 100 homes and multiple photo-voltaic units.

One home and the adjacent homes form a part of smallest grid segment, a 400 volt low power system. The 260 low power systems in Saarlouis are just one local segment of the public utility's 10 kV system, where transformers convert the medium voltage down to the lower voltage of 400 volts. Fees are incurred for the power transit but also for each transformation step because that also consumes power.

When the load compensation is accomplished between consumer households and private producers within the local, low voltage grid, we call it a Smart Nano Grid.

PeerEnergyCloud enables load compensation in the hyper-local Smart Nano Grids which, in turn, offers several advantages: the grid transit costs are less and there is no conversion from 400 volts to 10 kV.

The first test users are already connected. Homeowners can negotiate with their electricity producing neighbors over the time of the power consumption through a citizens' exchange market. This achieves optimal load compensation while digitally valuing the use of the infrastructure. ◀

More information
www.peerenergycloud.de

peer
energy
cloud

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Dynamic Duo of Robots Search for Life on Jupiter's Moon – Green Light for DFKI Project Launch

A trip below the ice sheet: AUV Dagon during a test run in the frozen Bremen university lake. The successor system should demonstrate the possibility of exploring the icy moon "Europa".
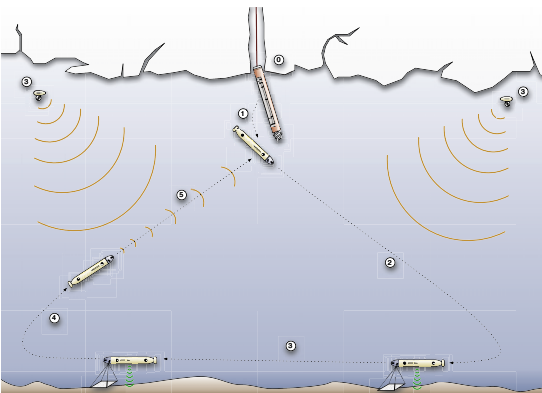
▶ There may be an ocean of saltwater hidden below an ice sheet thought to be up to 10 kilometers thick on the icy Jupiter moon "Europa." If true, there may also be some form of life there. An intelligent navigation system should enable an autonomous underwater vehicle (AUV) to explore this ocean. Transported inside a mobile drilling system, the cylindrical AUV can be transported through the ice and released into the water. Scientists at the Robotics Innovation Center at DFKI Bremen are developing the algorithms for the robot duo and testing them here on earth.
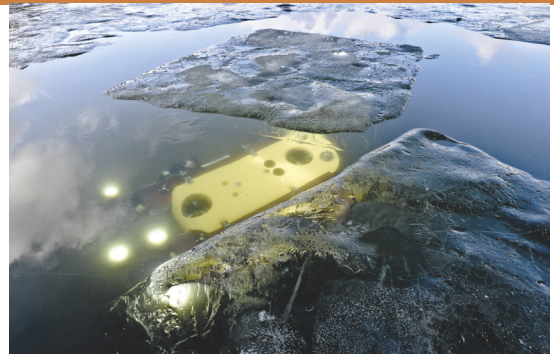
The "Europa Explorer" project is funded with approximately 1.5 million euros by the German Aerospace Center (DLR) for a three-year period. The aim of Prof. Dr. Frank Kirchner's team is to demonstrate that robot teams can autonomously explore the icy moon orbiting in Jupiter's shadow. That possibility is to be proven here on earth by a so called analog mission.

"Our algorithms for the AUV and the ice drill will be tested under the most realistic conditions. The final testing could conceivably be performed at the polar circle," says project leader Marc Hildebrandt. The Max Planck Institute for Solar System Research in Göttingen delivers data about the temperature, gravitation, currents, and background noise that prevail on "Europa" and in its ocean. Theoretically, hydrothermal springs may exist approximately 100 kilometers below the icy surface. When there is a source of warmth and minerals, life is possible – even in dark, cold places. Bio systems are known to exist in such environments in nature. To hunt for such life, an underwater vehicle must first reach the ocean floor.

The focus of the DFKI research effort is on the navigational ability of the AUV: after the dive, it must find its way back to the ice drill/launcher independently in order to transfer the data gathered, like photos and measurements, via an interface to the drill/lauch system for transmission back to earth. The robot duo must manage during the entire mission without any guidance control from earth. A signal sent from the earth arrives with a 33 to 53 minute time delay – too long for a spontaneous response to a new situation.

"Dagon" Autonomous Underwater Vehicle as Development Platform

Scientists are using the Dagon AUV developed at DFKI as the basis for development. One meter long and weighing in at 75 kilograms, the AUV can pinpoint its precise location and create visual maps. Integrated sensors send out sonar signals that allow the vehicle to determine its position, similar to the GPS method. Two cameras mounted in the "head" of Dagon record images of the underwater landscape along its route. Based on the distance to a specific point and the angle of view, the system calculates its own position. Dagon has already been deployed successfully in an industrial setting, for example, to inspect the cooling tubes in a coal power station. The new AUV is significantly more compact (making it one of the thinnest underwater vehicles in existence) so as to fit into the ice drill. Besides an improved navigation performance, there is also an improved drive concept: as with the conventional AUVs there is a propeller for active motion, but like so called "gliders," it will also be able to coast through the water by means of changing its buoyancy. This type of hybrid, energy efficient drive system enables the AUV to travel across long distances. Europa-Explorer is funded by the Space Agency of the German Aerospace Center with funds provided by the Federal Ministry of Economics and Technology on the basis of a resolution of the German Bundestag. Funding ID: 50 NA 1217. ◀

Schematic of the mission sequence. The intelligent drill breaks through the ice sheet on Jupiter's moon and releases the autonomous underwater vehicle into the water. The vehicle propels itself to the ocean floor where it begins the hunt for signs of extraterrestrial life. Then it independently returns to the launch system, which receives the collected data and images and transmits them to the earth.

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Lady Robot With Tactile Sensors

▶ The female robot AILA returns to Hannover to demonstrate a futuristic scenario on the international space station ISS: Human-like hands and a new, innovative software developed at DFKI allow AILA to perform semi-autonomous work requiring fine motor skills. She can switch levers on an instrument panel and activate buttons, for example, to power up specific on-board systems. She can independently and spontaneously support astronauts or even replace them in dangerous situations.

The robot is 170 cm tall with a movable torso with four joints; each arm has seven joints. AILA moves about on a six-wheeled mobile platform. The system is not only controlled on a planned basis, but rather can also respond to external stimuli. Light contact with objects or humans show her where her freedom of action is limited. In this way, she can work together with humans and can always adjust to a changing environment. The necessary hardware for the computations is fully integrated in the robot's body. This feature permits flexible deployment of the robot in any room.

The current focus of scientific effort is on AILA's learning skills: future plans call for a learning platform to enable the robot to mimic and store the human movements of the upper body, arms, and hands. In the event that AILA encounters some unforeseeable task that she cannot solve on her own, human help is available remotely from afar. The operator simply performs the required movement in the lab as so called motion-tracking cameras record the human operator's movements. The system then adopts these movements. The learning platform automatically separates the motion into individual segments. The sequence is reproduced and tested in a simulation and then transmitted to the female robot.

Learning methods, planning techniques, and reflexes are being integrated in a behavioral-based software architecture. The architecture controls the performance of the task at hand, while at the same time allowing for the appropriate reactions to sudden changes in the surroundings. These are "perceived" through various sensors. ◀

DFKI researchers have developed AILA's abilities in the following projects:

SemProm
http://www.semprom.org/semprom_engl

Robofoot
http://robotik.dfki-bremen.de/en/research/projects/robofoot-1.html
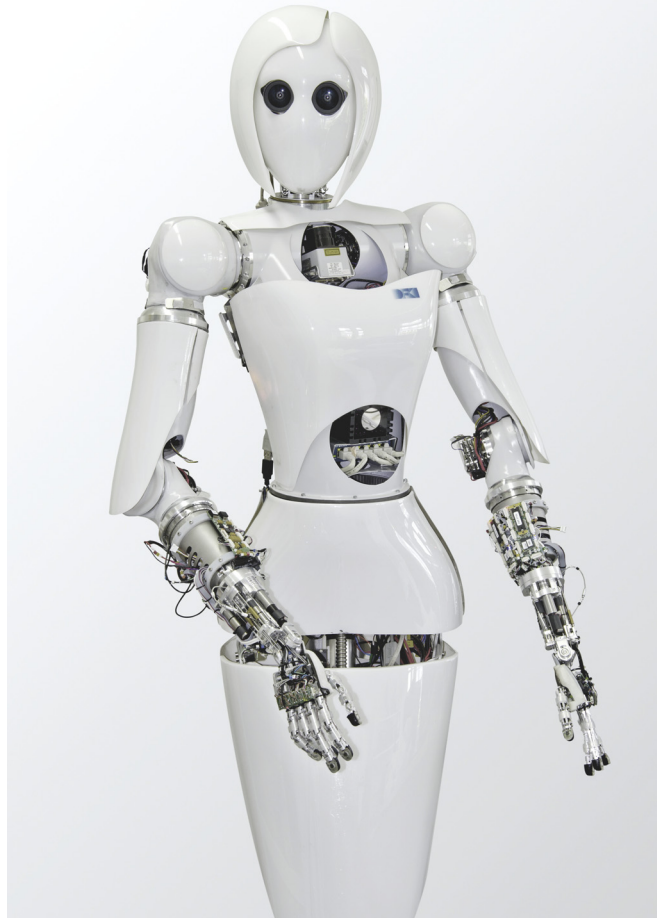
BesMan
http://robotik.dfki-bremen.de/en/research/projects/besman-1.html

More information
http://robotik.dfki-bremen.de/en/research/robot-systems/aila-1.html

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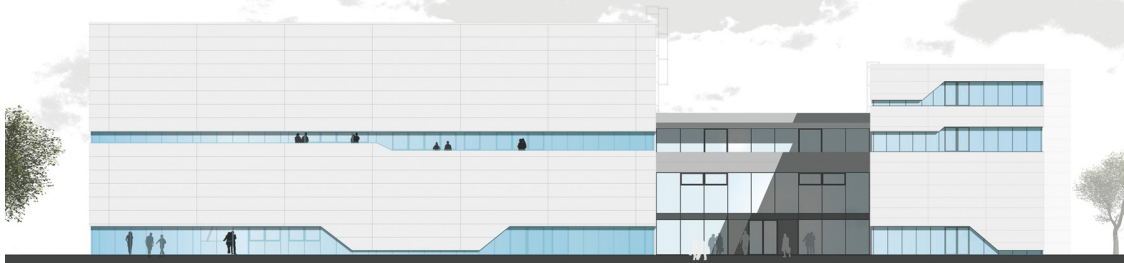
The new four-story building will house state of the art labs and office space. The centerpiece of the new facility in Bremen is the 1,115 square meters underwater exploration hall, the only structure of its kind nationwide.]

Cornerstone Ceremony for New DFKI Building –
A Unique Underwater Test Facility Emerges in Bremen

▶ DFKI is constructing a new building at the company location in Bremen with a unique test facility for deep sea robots – the only one of its kind in Germany. The cornerstone for the new building was placed on November 1, 2012 by Renate Jürgens-Pieper, Bremen's then Science Senator and Dr. Dirk Kühling, head of economics department for Bremen's Senator of Economy, Labour and Ports, together with DFKI CFO Dr. Walter Olthoff and Prof. Dr. Frank Kirchner, spokesperson for DFKI Bremen.

The new building is financed at a cost of 7.1 million euros by the European Fund for Regional Development (EFRE) through the federal state of Bremen for 3.1 million euros and with DFKI assuming 4 million euros. The city-state of Bremen has also made land available for this building site as well as for additional DFKI buildings in the future.

Renate Jürgens-Pieper described the new facility as a major step for ensuring the continuation of the leading edge research being developed at DFKI in Bremen: "The underwater exploration facility at DFKI Bremen represents a testing environment unparalleled in Germany and it is certain to further strengthen its unique characteristics in the field of maritime robotics". Bremen's outstanding success in the Federal Excellence Initiative can be attributed to, among other things, the role of the marine sciences and marine technology and the participation of non-university institutions.

Dr. Dirk Kühling remarked: "As a business location, Bremen's competence and infrastructure in the field of maritime technologies is of critical importance to the future. Today, I am especially pleased to be celebrating another historic milestone in the expansion of Bremen's technology landscape."

The building is being constructed on an open site on Robert Hooke Street in the Bremen Technology Park. Approximately 1,970 square meters divided over four levels will house state of the art labs and offices for roughly 100 scientists and staff. The centerpiece is the 24-meter long, 20-meter wide, and 8-meter deep saltwater basin. The 1,115 square meters underwater exploration hall is visible from the building's entrance through a panorama window, which allows visitors a view of the ongoing research activities. "The concept of providing this show room for the public and researchers has proven itself at the DFKI facilities in Saarbrücken and Kaiserslautern," said DFKI CFO Dr. Walter Olthoff, while adding that "equipping the new building with the latest standards strengthens DFKI's global competitiveness."

A Special Technological Challenge in Underwater Robotics
The development of underwater robots encompasses special challenges. Influence factors like the immense underwater pressure, the continuously changing color spectrum, and water turbidity complicate the deep sea deployment of robots. For these reasons, constant test and evaluation under realistic conditions is indispensable. "Because of its dimensions, its independence from weather conditions, and the controlled environment, the new underwater exploration hall is the perfect test environment for the development of intelligent systems," explained Prof. Dr. Frank Kirchner, spokesperson for DFKI Bremen and head of the research department Robotics Innovation Center.

DFKI Bremen has been a success story since 2006. By the end of 2012, it employed a staff of more than 200 and conducted research in two areas of science. ◀

A milestone for Bremen's leading research (l.to r.): DFKI CFO Dr. Walter Olthoff lays the cornerstone for the new building together with Prof. Frank Kirchner, spokesman of DFKI Bremen and Renate Jürgens-Pieper, Bremen's former Science Senator and Dr. Dirk Kühling, head of economics department for Bremen's Senator of Economy, Labour and Ports.

The comfort assistance opens all doors on the wheelchair's route at BAALL and ensures ample lighting in the traversed area.

An interactive architectural model allows the remote control of BAALL and offers live demonstrations of safety and comfort assistance functions.

SHIP – From Single Systems to Fully Integrated Solutions

▶ The growing feasibility of connecting existing systems to each other via networks is accompanied by the increasing hope of being able to combine various standalone devices and separate sensors in an intelligent integrated platform. SHIP (Semantic Integration of Heterogeneous Processes) is an integration system developed at DFKI's Cyber-Physical Systems Lab that aims at achieving the intelligent combination of heterogeneous separate systems. SHIP makes it possible to combine previously isolated applications in order to control and synchronize the coordination among them all.

The key concept of SHIP is a semantic model, which combines data from the physical surroundings and standalone devices, thereby enabling the automated creation of new knowledge. Descriptions of complex behavior can be written into monitors so as to recognize situations like a malfunctioning device or to enable situation-dependent control over a device.

Safety and Comfort Assistance Realized
At the Bremen Ambient Assisted Living Lab (BAALL) on the premises of DFKI, isolated services and devices have been combined in integrated assistance systems and to facilitate barrier-free living for seniors and the handicapped. The research priority is on mobility assistance: Rolland, the intelligent wheelchair project, the advanced development of ambient assistance – now equipped with instrumentation to improve interoperability and safety – as well as on the implementation of higher-level services.

A specific example is the development of entrance control assistance, which automatically locks and monitors all doors at night. If there is an emergency, for example, when alerted by a smoke detector, all lights in the entire building are turned on and all doors open automatically. Another new comfort assist links the position of the wheelchair to the surroundings and automatically opens all the doors along the route and ensures an appropriate amount of lighting in the area traversed. The new integration platform also enables the coordination of several wheelchairs and the optimization of their routes thereby avoiding conflicts. In this way, BAALL has implemented new safety and comfort assistance - with minimal expense thanks to SHIP.

Quick and Easy Integration of Insular Solutions
The interactive architectural model exhibited at CeBIT allows the remote control of BAALL and makes the assistance real and accessible. Demonstrations of the entrance and emergency assistance functions are performed live in the architectural model and, in parallel, can also be followed via video from the actual BAALL. The integrated coordination and comfort assistance is simulated directly in the architectural model. The exhibit simply illustrates how, by using the innovative integration system, the existing insular systems can be combined quickly and easily to form integrated and coordinated assistance processes.

Another current application of SHIP is the automated monitoring of medical policies in hospitals. This application compares actual patient treatment, which is continuously mirrored in the hospital information system, to the policies and informs staff of any deviations. A future application of SHIP envisions its value in guaranteeing compliance with norms and standards in the field of software development. Monitors watch for changes in the status and relationships between the various development documents and, in case of discrepancies, initiate the appropriate corrective actions. ◀

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New Business Initiative for E-Mobility in Bremen/Oldenburg

DFKI to Serve as Scientific Partner

Enak Ferlemann, Parliamentary State Secretary at the Ministry of Transport, Building and Urban Development (BMVBS) presented the funding approval notice to Peter Hoffmeyer, Chairman of the Board, Nehlsen AG, Bremen.

▶ A green light for UI ElMo – the electric mobility business initiative: over the next three years, more than 80 companies in the metropolitan region Bremen/Oldenburg will test the use of electric cars in daily operations. The goal is to have approximately 160 vehicles and 200 charging stations in operation. DFKI Bremen is providing the scientific oversight of the project.

Enak Ferlemann, Parliamentary State Secretary at the Ministry of Transport, Building and Urban Development (BMVBS) presented the state's grant approval in the amount of 4.7 million euros to lead company Nehlsen AG on November 2, 2012. The amount represents approximately half of the total project volume of 8.9 million euros. Besides Nehlsen and DFKI, grant applications for the UI ElMo project have also been submitted by the firms HWT Wärme- und Tanktechnik, Emigholz, and MoveAbout.

How to optimize the vehicle fleets in large and small companies is a question to be answered at DFKI through a systematic evaluation of the so called data recorders installed in the vehicles.

These devices record the driving times and routes, battery charging cycles, and any technical problems that may occur. Several different electric vehicles produced by well known manufacturers will take part. The charging infrastructure is provided by VENIOX.

The project is supported under the terms of the electric mobility pilot region Bremen/Oldenburg by BMVBS. Coordination for the electric mobility pilot region is performed by the National Organisation Hydrogen and Fuel Cell Technology (NOW). ◀

More information
www.modellregion-bremen-oldenburg.de

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DFKI Participating in Post-graduate Program "System Design"

Young Research Scholars Acquire the Optimal Experience for Future Career Success

▶ DFKI is supporting the post-grad program "System Design" (SyDe) as part of the Excellence Initiative at University of Bremen, in cooperation with the German Aerospace Center (DLR). At the festive kick-off event on January 23, 2013, Prof. Dr. Heidi Schelhowe, vice dean of teaching and learning at the University of Bremen, delivered the welcome address in which she cited the importance of the university collaboration with institutions like DFKI and wished members of the program an exciting, successful, and rewarding time. Following brief introductions of the three collaboration partners by Prof. Dr. Rolf Drechsler, representing the University of Bremen, Prof. Dr. Frank Kirchner, representing DFKI, and Prof. Dr. Görschwin Fey, representing DLR, the doctoral candidates presented their work in poster format and answered questions from an interested audience.

The post-graduate program was launched on November 1, 2012 – perfectly timed to coincide as one of the first activities of the "Excellence Initiative." The program currently has ten doctoral candidates (male and female) enrolled in the structured and research intensive curriculum. In the context of this program, they are involved in the design of electronic systems that are taken for granted in our day-to-day lives – e.g., in mobile phones, automobiles, or airplanes.

DFKI and the university combine their resources to provide an environment where young research scholars can acquire the optimal experience to prepare for the future launch of successful careers. In this sense, DFKI especially values hosting top young scientists. Many talented young researchers at these institutes receive offers from the best universities in the world or are selected for positions with leading business corporations, which attests to the success of the program. ◀

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Collaboration partners: (l.-r.) Prof. Frank Kirchner representing DFKI, Prof. Rolf Drechsler representing the University of Bremen, and Prof. Görschwin Fey representing DLR.

Swoozy – The Intelligent Semantic TV of the Future

▶ A totally normal evening sitting in front of the TV set: you are watching an interesting film or program, and all of sudden you wonder, for example, "How old is this particular actress?", "Didn't I see her in the film XY?", "Is this film or program based on a book?" or "Where was that scene filmed?"

If you are watching "Swoozy," there is no longer any need to go to an additional medium to enter a vague search query which then makes you click through a long list of hits to get the answer. Swoozy provides the desired information immediately. Prompted by simple hand gestures, Swoozy answers these questions directly on the screen. The person, fictional character, legendary props, or even a monument appearing in the background of a report, can be activated as a single selectable element and sent out to search by means of a simple sweeping gesture.

This element is then displayed in the viewing area as a semi-transparent dynamic "grabbable" where it can be selected per Grab and Drop. If the video image changes, the selectable terms also change. The terms – "Swoozy Terms" – are displayed in an information menu bar at the bottom of the TV screen in the context of the entire program, regardless of the image sequence presently showing. If more information is wanted, grab the desired object right out of the film scene or out of the information menu, and drag it per hand gesture to the search categories shown at the right side of the screen. Gesture recognition is achieved through a depth imaging camera or a motion-controller, without any instrumentation of the user being necessary. The subjects can be distributed over a social network or researched in the services offered by various online distributors by the respective optional buttons.

Swoozy initiates a semantic text, image, or video search in the Web 4.0 cloud. The information from structured databases such as DBpedia, Freebase, or other linked data sources is then aggregated to one source, which enables faster access and allows more specific answers.

The Swoozy interactive semantic TV system significantly exceeds the capabilities of current SmartTVs and truly makes the television a central feature of the home; creating a new, interactive source of knowledge where every viewer at anytime has a user friendly and intuitive tool to get facts about the scene currently being broadcast. The new interactive television interface simultaneously heralds a huge interactive potential and the seamless fusion of diverse knowledge channels and the video content just broadcast.

Swoozy is also suitable for use with other video-supported systems, for example, in the area of e-Learning with live-streaming, or video conferences and podcasts of online lectures, or for business-TV programs that are used by corporations for the purposes of internal communications, or in public relations work. ◀

More information
www.swoozy.net

CeBIT Hall 9, Stand E50

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Test Your Limits in the OpenDS Driving Simulator

Standardized Tasks and a High Degree of Realism With OpenDS Simulation Software

▶ Make phone calls, listen to music from the cloud, follow directions from the navigation system, check SMSs and, in the meantime, operate the buttons for the air conditioner and the heated seats. The technological conveniences of today's passenger cars certainly fulfill the requirements for a mobile work environment in comfortable surroundings and not just in the premium class. But how much of all this is actually useful before it distracts the driver from the traffic conditions? Do so many functional options have an effect on the driver's concentration and what operating procedures could reduce the risk?

At CeBIT, DFKI presents OpenDS, a driving simulator that allows the trade show visitors to sit in the driver's seat of a Smart and take a drive around the Saarland University campus. Once underway, in a surprisingly realistic environment, the test driver can check the status of their driving safety.

The basis for the virtual environment is provided by high resolution point clouds, similar to the ones increasingly used in measurement systems and accident research. This process uses a 3D laser scanner to sample the surroundings from various positions with a laser beam and then combines the separate reflections into a gigantic point cloud with several hundred million points.

The visualization of this huge volume of data and the realistic simulation of the physics of driving is made possible thanks to a flexible and expandable driving simulation software called OpenDS, which is designed for industrial research and development and scientific experiments in the field of automotives, mobility, and traffic. Besides traffic and stop light simulations, this platform-independent, Java implementation provides several optional weather conditions, fuel consumption readings based on driving style and the underlying consumption model, and even the chance to influence the objects in the surroundings during operations. The software is developed under an open-source license and includes a series of standard driving tasks or tests, which could only be performed on paper in the past. This intelligent software helps make it possible to safely test new assistance systems.

The realistic feeling of driving – essential for valid studies as well as for user acceptance – is rounded out by the driver being in control of the simulation from inside the vehicle, which is positioned directly in front of a curved screen. A seamless cylindrical projection enables not only presentation of the route in the driver's field of view, but also the view of the simulated surroundings through the side windows.

DFKI presents OpenDS in collaboration with its spin-off company white_c, a supplier of software upgrades and support. ◀

More information
www.opends.eu
www.white-c.com

FUNDED BY

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TrendMiner – Identifying the Latest Trends in Public Opinion

▶ Millions of texts that are published online every day are accessible in real time. The dynamic growth in the data volume being distributed minute for minute over formal messaging channels or Twitter can be used as a barometer of the political and financial climate. TrendMiner enables the semantic, real time analysis of heterogeneous data sources like newstickers, stock exchange reports, or social networks. The platform identifies, extracts, and classifies topics using a machine learning method and can support the evaluation of, for example, current mar-ket trends or political opinion makers in the run-up to an election. TrendMiner is co-financed under the EU 7th Framework Program for Research as Project ID 287863 and has a project duration of three years (2011-2014). ◀

monnet – No Language Barriers When Searching for Financial Reports

▶ In monnet, researchers are developing simple internet tools using XBRL (eXtended Business Reporting Language) to enable the multilingual extraction and automatic translation of structured data from company financial reports.

XBRL is an XML-based, open standard for the technical exchange of the complex financial content in annual reports. XBRL provides a structured presentation of data and permits the direct comparison of balance sheet concepts – independent of source language.

Researchers from the DFKI Language Technology department, in collaboration with its partners DERI (Digital Enterprise Research Institute Galway), XBRL-Europa, and SAP, have analyzed annual reports at the semantic level in multiple languages. The aim is to develop extremely accurate semantic methods for data extraction and translation, without interrupting the established work flows. New technologies and resources have been integrated in such a way that there is no need for users accustomed to XBLR information to learn new procedures.

Project results include a series of software components that extract, integrate, and present financial data from multiple language sources.

A monnet demonstrator exhibit at CeBIT 2013 performs a semantic representation of the XBRL document processing and displays a report of the information. It supports the preparation and translation of the most important information into other languages. In addition, it links the report to taxonomies used in other European countries, especially Germany and Spain. monnet is funded under the EU 7th Framework Program for Research under Project ID 248458. ◀

EXCITEMENT – Multilingual Platform for Textual Inference

▶ The analysis of customer interactions is a large and growing business segment in which diverse channels of communication, e.g., call centers, E-mail contacts, web forums, all play a role. Companies obtain information from the analysis of this data about the advantages and disadvantages of their products, reports of typical customer concerns, or deficits in customer relationships. In view of the huge growth in web-based markets, it is essential to support analysts with automated systems that extend beyond the current keyword based technologies and can concisely and meaningfully express customer interactions. Semantic similarities in customer reports can be automatically identified, classified and used to draw inferences.

The aim of EXCITEMENT is to develop a generic multilingual platform for textual inference, based on the successful model of textual entailment, and made available to the scientific and technical communities. This permits many applications to rely on this open platform for the effective and sustainable develop of a new generation of technologies for the unattended exploration of customer interactions, for the purpose of better capturing the various and often unexpected content and opinions of the customers. EXCITEMENT is funded under the EU 7th Framework Program for Research under Project ID 287923. ◀

More information
www.trendminer-project.eu
www.monnet-project.eu
www.excitement-project.eu

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CeBIT Hall 9, Stand F50

CeLTech – Innovative Technologies for Medical Training and Talent Recruitment

▶ **Virtual Patients and Mobile Technologies for Tomorrow's Doctors**

A first class medical education for physicians demands the integration of patients in the training courses. The length of time a person stays in the clinics has decreased significantly in recent years for economic reasons, which means there are fewer patients available for teaching purposes. Virtual patients, who present with typical illnesses or seasonal health problems, could be of great use in this context. Medical students can learn the diagnostics and treatments without the risk to real patients. For medical lecturers and medical students without any computer science skills to appreciate the advantages of virtual patients, user friendly and high performance software systems like CAMPUS are required. The virtual patients created in this way can be em-

ployed in a variety of teaching scenarios. Furthermore, it is possible to perform examinations under conditions approximating reality.

The topic "eLearning in Medicine" is one of the priorities of the Center for e-Learning Technology (CeLTech) and is presented at CeBIT 2013. In addition to the virtual patients, mobile developments in the field of medicine, for example, Project MoLE (Mobile Learning Environment) are also on exhibit at the CeLTech stand. MoLE, the multinational technological research project, investigates how mobile learning technologies can be used to improve the effectiveness of humanitarian help projects. CeLTech is one of partners participating in the translation of the app interfaces and evaluation layers into German. ActiveMed is another project being presented for the first time as part of the medical focus of CeBIT 2013. The aim of this collaborative project, which is funded by the Federal Ministry of Education and Research (BMBF), is to improve the practical clinical skills of the physicians – from medical students to practicing doctors – through the use of systematic, technology-aided teaching methods and reinforced through more professionalism on the part of the instructors. The AI learning system that builds the foundation for ActiveMed is the intelligent-adaptive learning system ActiveMath, which was also developed at DFKI. The system is

being adapted for the first time also for use on mobile devices, especially, tablet computers.

Online Assessment for Today's Talent Recruitment

Before students decide whether or not to study, medicine for example, they must be aware of their interests, preferences, and natural abilities. In the context of making the right educational or career choice, CeLTech is developing computer and internet based self-assessments that support personnel managers as well as prospective students and entry level recruits in their information search and in their decision making processes.

This effort includes the design and validation of personality tests, which serve to document the standardized capture of relevant psychological characteristics. Subsequently, all findings are implemented in computer aided self-assessment tools with automated evaluation algorithms and adaptive feedback. Specifically, whether choosing an education or a career, this means improving the degree of concordance between the profiles of the potential student or worker, and the organization. The PROFILE project enables this in two different ways. Using online-based self-assessments, participants in the aptitude test receive
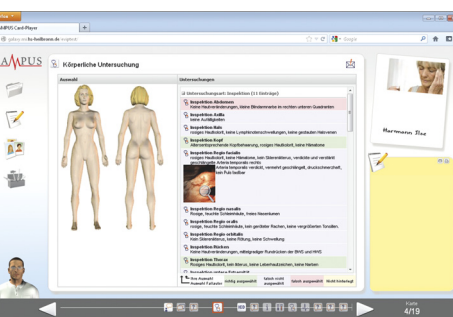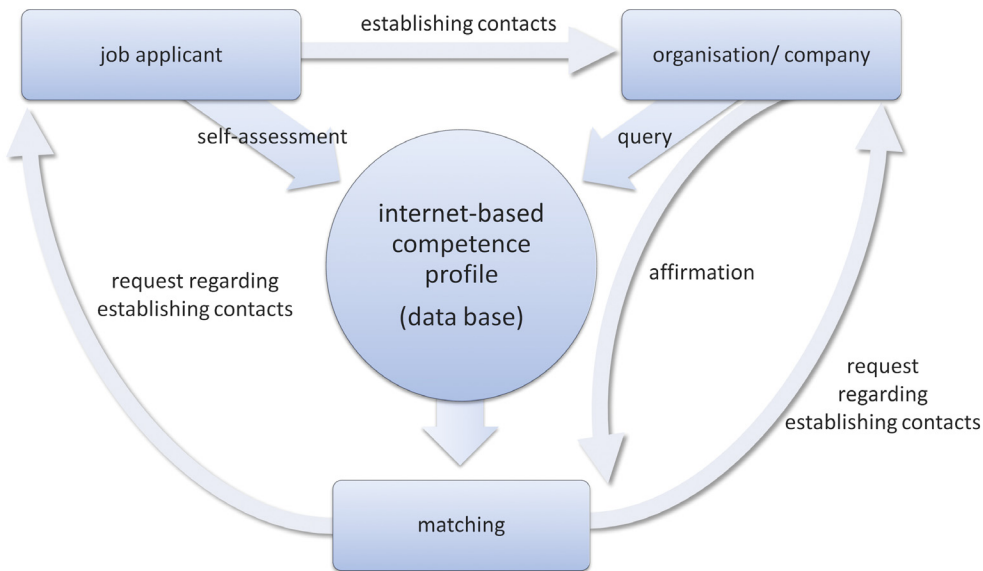
well-founded feedback about their skills profile and what activities they are especially well-suited for and, in this way, are receiving help in making a general decision. Those seeking work can participate in the project and when there is a match between the position requirements profile and the participant's skills profile, an opportunity is provided for interested companies to contact the assessed person through the system.

Consequently, Germany possesses an unique internet service, not only based on state of the art diagnostic tools for aptitude profiling, but on intelligent innovation and education technology as well. The internet-based information, knowledge, and training service can be used from anywhere via smartphones and tablet computers and may also be inte-

grated into online-based self-assessments. For the first time, social media technologies are being employed to reach interested target audiences.

Even before the job search, a huge challenge for university entrance qualified graduates is selecting an appropriate course of study – in view of the large number of subjects and degree programs. As part of the Saarland government's innovative "Study Finder" program, an online portal was developed at Saarland University to assist students with the choice of an appropriate course of study. The first step is to test for personal interests, which is used to determine an individual profile and as a basis for making recommendations of suitable courses of study. The second step is to check course-specific expectations. This

CeLTech

Centre for e-Learning Technology

step provides the chance to identify and correct false expectations of the course requirements, content, and job opportunities offered by a particular degree program.

The self-assessment service for study and career choices is presented at CeBIT at the Center for eLearning Technology stand where it can also be tried out by visitors. ◀

CeBIT Hall 9, Stand F50
Hall 9, Stand F34

Contact

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Plenary session attendees

BIG Project First Plenary Session – DFKI Develops a European Strategy for Big Data

▶ The first plenary session of "Big Data Public-Private Forum (BIG)" took place recently at DFKI Kaiserslautern on 11-12 February 2013.

Big Data – very large data volumes – will play a decisive role in the society and economy while ushering in a new era, where data is an economic commodity.

Aggregated data from customer queries leads to assumptions about changing future needs and new market segments. The data from climate, environmental, or traffic sensors permits the forecasting of risk situations like icy roads or increased concentrations of pollution and ozone. Traffic control systems can redirect the flow of traffic at the first indication of increased air pollution. Joint international projects like Open Street Maps aim to provide open access to huge data volumes. The integration, analysis, and use of such ever-increasing data sets can reveal entirely new insights. Now is the time to realize the social benefits and the economic opportunities. DFKI, together with ten other partners, launched the BIG project in September 2012 with funding provided for a two-year period under the 7th EU

Framework Program for Research. BIG aims to provide a platform where industry, research, and interest groups will be able to discuss the new flood of data (Big Data) and the challenges presented by the new digital economy and to develop effective management guidelines. After two intensive days at DFKI Kaiserslautern, initial findings were achieved in technical working groups and sector forums. ◀

More information
http://big-project.eu | http://data-forum.eu

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Shopping in the World of Tomorrow – The Innovative Retail Laboratory

▶ After shopping with the intelligent shopping cart, you pay without cash and without touching a key pad from your mobile phone. This or something similar to this is how supermarket shopping will be in the future, thanks to intelligent assistance systems. DFKI's Innovative Retail Laboratory (IRL) and GLOBUS Warenhaus Group present their vision of future retailing at CeBIT.

SmartCart
SmartCart is an instrumented shopping cart that can store and display the shopping list you made at home. Customers simply identify themselves to the smart shopping cart touch-free using their NFC capable smartphones. SmartCart recognizes the products already loaded into the cart and shows them on the display or drops them from the customer's shopping list. SmartCart determines its own position in the market and suggests the way to the next product. To start the navigation function, you just have to click the appropriate product on the shopping list. The navigation view ends automatically when the destination is reached. Imagine all the products you are looking for just before shop closing time and having your SmartCart guide you quickly to them.

Mobile PayPOS – Smart, Direct Payment at the Point of Sale
The latest mobile telephones, equipped with Near Field Communication (NFC) technology, allow the operators to perform faster, more secure, and more convenient payments from a mobile phone. The product data is entered by simply scanning the NFC tags and the product appears directly in the virtual basket displayed on the phone. The payment amount is calculated by scanning "cash tags," which may be located at every conceivable place in the supermarket, or directly on the smart shopping cart. The financial transaction is accomplished directly on the mobile phone: sensitive user data must no longer be transferred at the cash register. ◀

More information
www.innovative-retail.de

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CeBIT Hall 9, Stand F50

(l.-r.) 1st row: Jochen Frey, at the monitor: Kinga Schumacher (Software Campus student 2011) and Sebastian Krause, Kathrin Eichler, Prof. Wolfgang Wahlster, Christian Kurz, Matthias Böhmer, Sandro Castronovo (Software Campus student 2011). 2d row: Mohammad Mehdi Moniri, Quan Nguyen, Christina Di Valentin, Gerrit Kahl, Jens Haupert. 3d row: Dr. Dominikus Heckmann (DFKI coordinator for Software Campus), Sabine Janzen (Software Campus student 2011), Yecheng Gu, Andrey Krekhov, Tom Thaler, Alexander Löffler, Daniel Porta

DFKI PhD Candidates Selected for Software Campus as Elite Performers

▶ Software Campus is an IT leadership program sponsored by the Federal Ministry of Education and Research (BMBF) and German IT companies. The admissions committee has chosen application oriented projects submitted by 14 DFKI candidates from the departments of Intelligent User Interfaces, Language Technologies, Agents and Simulated Reality, and the Institute for Information Systems. Together with the DFKI pilot candidates from 2011, 16 of the 80 Software Campus students have been from DFKI. Saarbrücken further confirmed its excellent reputation as an ICT center with the selection of additional applicants from Saarland University and the Max Planck Institute for Computer Science.

The topics submitted by the successful DFKI applicants reflect the broad scope of DFKI research and address, in substance, the integration of computers into the daily living environment and working worlds through the improvement of the Human-Machine Interface (HMI).

The Software Campus projects explore, for example, what innovative interactive techniques might look like and how the user acceptance of mobile application scenarios might be improved.

The submissions from the DFKI candidates deal with semantic analysis, extraction of information in domain-specific data volumes, or the question of how to draw conclusions about the underlying concerns automatically from customer E-mail queries. They investigate the impact of driver assistance systems customized for the driver and study ways to identify the activities associated with use and consumption patterns of private electricity users.

In the area of industry and enterprise software, DFKI staff has prevailed through remote maintenance concepts for produc-

tion facilities using graphic user interfaces, or the study of a planned data standard called Object Memory Modeling (OMM) that enables the integration of production lines across company boundaries. Both of these approaches advance the feasibility of implementing the latest production logistics in so called "Smart Factories," in which intelligent devices, storage systems, and operating equipment independently exchange information, initiate actions, and autonomously control each other. BMBF sponsors these future-oriented projects as part of the "Industry 4.0" initiative.

In the area of conventional business process analysis, one project explores new approaches and technologies for Business Process Optimization (BPO) and their business applications.

The studies of Display as a Service (DaaS) systems will revolutionize the rigid point-to-point connection of computers and monitors. DaaS is an internet service that provides a wireless connection of the computer and the display device. It enables the screen content to be displayed via a pixel server on any number of devices, even if these are used at different locations.

The program runs for a maximum of two years and participants are supported within the framework of a mentor program by their academic and industry partners as they implement innovative IT ideas and develop their management skills in leadership training. The industry partners for the DFKI candidates are: Deutsche Post, Deutsche Telekom, Robert Bosch, SAP, Scheer Group, and Software AG. The funding is evenly split between the participating industry partners and BMBF. ◀

More information
www.softwarecampus.de

▶ DFKI Interview – Alexander Löffler

Since 2011, Alexander Löffler has been employed as a researcher in the department of Agents and Simulated Reality, headed by Prof. Dr. Philipp Slusallek and as a principal investigator at the Intel Visual Computing Institute.

What is the application potential of your research?
In addition to parallel and distributed 3D rendering, my focus is on the transfer of traditional display architectures to networks. While a computer is only able to supply pixels to a single display over an HDMI cable, a network cable enables the simple distribution of the pixels to several monitors, wireless devices, or integrated display walls. It makes no difference if the display device is at the other side of the building or even at the opposite end of the world. The open and cost efficient distribution and replication of content in the network shows enormous promise, for example, in the field of home entertainment and digital signage.

When did your interest in Artificial Intelligence begin and how have AI processes changed since that time?
At the university, I did basic research in visual computing and now, at DFKI, the focus of my activity has switched to application oriented research. The intelligent patterns of software architecture play a much larger role when confronted with "real" users, i.e., the need to guarantee intuitive understanding and simple operation despite the complex capabilities of software.

Technical and AI methods currently reflect a trend towards ubiquitous computing, which brings with it an increasing miniaturization and, as the name implies, the presence of computers everywhere. All the things I can accomplish today with my smartphone and all the routine assistance I get from intelligent sensor systems in my environment were not technologically possible and simply unimaginable just ten years ago.

What are the greatest challenges and opportunities for AI systems?
The future opportunities are to be found in the ubiquitous access to data captured in real time, for example, the positioning, light, and status sensors in mobile phones, RFID tags, or smart beacons as digital representations of actual things or places, and no less promising is information created and provided by users for users.

The technical possibility to process and evaluate the huge amount of data and the sensitive handling of it are the greatest challenges for future research. Personal data is simple and accessible and therefore offers huge exploitation potential. All responsible researchers have to know and respect the limitations.

Photo: Sven Michel
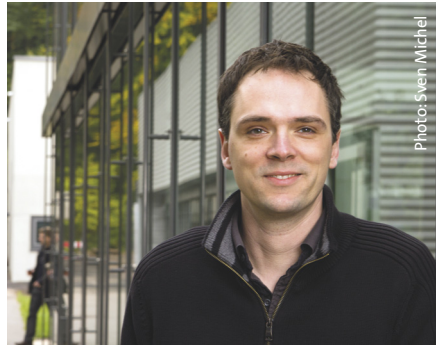
What do you enjoy doing when you are not working as a research scientist?
I love to travel, to eat great vegetarian food, to listen to music, to read, and often go to the movies. I enjoy time with my friends and family. Closely related to my work as a researcher, my personal interests lie with new technologies and modern design.

Are there parallels with your professional life?
My private life is an important balance to my work and, as far as possible, I keep them separated. That is why I intentionally do not look for parallels.

What are your current projects?
I am currently concentrating on our Display as a Service (DaaS) project, a network virtualization platform for graphic image displays on stationary and mobile screens and display walls. DaaS has met with great interest and is being exhibited at CeBIT 2013. It is funded under the Software Campus Program of the Federal Ministry of Education and Research (BMBF). We are presently implementing the new technologies in several industrial projects and in funded projects in the "Software-Cluster."

Meeting With Dr. Ehler, MEP at EIT ICT Labs Co-Location Centre, Berlin

On December 10, 2012 (l.-r.) Dr. Udo Bub, Director of EIT ICT Labs Germany, Prof. Dr. Willem Jonker, CEO of EIT ICT Labs, Dr. Christian Ehler, Member of the Committee for Industry, Research and Energy of the European Parliament, and Prof. Dr. Wolfgang Wahlster met at the Co-Location Centre Berlin for discussions of current topics related to research funding at the European level.

More information
www.eitictlabs.eu

Photo: Oliver Heerde

DFKI Scientist Ronny Hartanto Honored by FBTI

Dr. Ronny Hartanto, researcher at DFKI Robotics Innovation Center (RIC) in Bremen, was recently awarded by the Fachbereichstag Informatik 2012 (FBTI - National association of computer science faculties at German universities) for his dissertation. The scientific paper proposed an innovative approach to robotic action planning and use in solving complex problems.

The PhD work was supervised by Prof. Dr. Joachim Hertzberg, University of Osnabrück and since 2011, Head of the RIC-affiliate in Osnabrück and Prof. Michael Beetz, formerly of the Technical University of Munich and currently Head of Research Group Artificial Intelligence at the Center for Computing and Communication Technologies (TZI) in Bremen. While working on his doctorate thesis, Mr. Hartanto taught at Bonn-Rhein-Sieg University of Applied Sciences. FBTI represents more than 60 computer science departments and faculties of universities of applied sciences. Each year, FBTI hosts a competition for outstanding final papers and theses in the subject areas of computer science, information engineering, and media and business information systems to motivate young people towards exceptional achievement.

More information
www.fbti.de

(l.-r.) Prof. Manfred Krause (FBTI, Member of the Executive Board), Thomas Steckenborn (CEO, CEMA AG), Andreas Nautisch (Laureate Best Bachelor Thesis), Sebastian Otte, Dr. Ronny Hartanto, Prof. Ulrich Bühler (FBTI, Chairman of the Board)

Dr. Faisal Shafait Offered New Position

Dr. Faisal Shafait, senior researcher at DFKI Competence Center for Multimedia Analysis and Data Mining, has accepted a position as Research Assistant Professor, at the University of Western Australia in Perth.

Dr. Shafait has worked at DFKI Kaiserslautern since May 1, 2005, most recently under the supervision of Prof. Dr. Andreas Dengel. He earned his PhD at TU Kaiserslautern with the highest honors in 2008. His research interests lie in the field of machine learning and pattern recognition with a focus on document image analysis and computational forensics.

Dr. Shafait is the author of 13 journal articles and 77 conference papers. Starting on January 16, 2013 the new position acknowledges his outstanding research and his dedicated involvement on numerous committees, both major factors in his being selected.

▶ Intel Doctoral Student Honor Award for Sven Gehring

Sven Gehring was recognized with the Intel Doctoral Student Honor Award for his work in the field of interactive media walls and urban displays while working at the Intel University Program Office of Prof. Dr. Antonio Krüger. This prize is endowed with $35,000 and is awarded every year by Intel to excellent PhD candidates, who distinguish themselves through special performance and outstanding research results. The award was presented under the framework of the Intel European Research & Innovation Conference 2012 in Barcelona.

▶ Research Prize to Tim Althoff for Trend Analysis in Online Media

Tim Althoff, staff member at the DFKI Competence Center for Multimedia Analysis and Data Mining, is the winner of one of six PiCloud Academic Research Grants 2013 for his entry on the topic of trend analysis in online media.

PiCloud is based in San Francisco and is a supplier of cloud-based platforms for high performance computing and batch processing. The trend analysis system "LookappAds" aggregates trends from various media channels and characterizes their importance and length of serviceability. Advanced development of the system is being funded by PiCloud in the form of computing performance valued at 10,000 hours.

More information
http://lookappads.appspot.com

▶ Prof. Dr. Markus Gross Receives "Tech-Oscar"

Academy of Motion Picture Arts and Sciences Honors a Member of DFKI's Scientific Advisory Board.

Markus Gross, Professor for Computer Graphics, Director of Disney Research Zurich, and member of the Leopoldina Academy received the "Technical Achievement Award" on February 9, 2013 from the Academy of Motion Picture Arts and Sciences in Beverly Hills at the Pre-Oscars Award ceremonies. Prof. Gross was recognized, together with a former post doc and two other researchers from the USA for the wavelet turbulence software, which is capable of rapidly computing and creating richly detailed smoke and explosions in film. "The award truly came as a surprise," said Markus Gross. "I knew that our technology was deployed in many Hollywood productions, but I never expected this recognition," said a thrilled ETH professor.

▶ USEWARE 2012 – Annual VDI Symposium at DFKI Kaiserslautern

On December 4-5, 2012, DFKI Kaiserslautern hosted the 6th VDI USEWARE symposium. The specialist conference was instituted by Prof. Dr. Detlef Zühlke, Head of the Innovative Factory Systems department in 2002 and is now considered among experts to present a unique and practical form of symbiosis at the frontier of diverse professional disciplines in the field of Human-Machine Interaction (HMI) research.

At USEWARE, experts from industry and research reported on such topics as "Serious Games" in the context of training in automotive assembly plants, gesture-based control of mobile robots, or the usability of medical systems in OR-applications. In the DFKI showroom, the Knowledge Management department presented HMI technologies like Eye-Tracking and Touch&Write. The department of Innovative Factory Systems exhibited an HMI project demonstrator for the model based development of automotive infotainment systems. Additional presentations and interactive demonstrators in the DFKI-SmartFactory[KL] attracted a lively exchange and detailed discussions among the guests.

DFKI Service Offering

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

▶ Technology transfer of the award-winning research results of DFKI

▶ Innovation coaching and start-up consulting in the Public-Private-Partnership sector

▶ Individual design, development and implementation of innovative application solutions

▶ Market studies, expert surveys, feasibility analysis and empirical user studies

▶ Component development with AI-functionality, enhancing the performance of complex software systems

▶ Scientific advice on the selection and implementation of complex software solutions

▶ Customization, implementation, deployment and maintenance of our AI-solutions

▶ Scientific evaluation and benchmarking of software solutions

▶ Application-oriented basic research

▶ Independent assessment of IT-security and privacy

▶ Technology workshops, training and practice

▶ Scientific monitoring of data collections and their evaluation

▶ Business engineering: Process analysis and development

▶ Innovation coaching and turnaround management

▶ Strategic and technical Due Diligence consulting for companies in the ICT sector

▶ Technical and organizational support for the standardization in the IT sector (including W3C, ISO)

▶ Design, construction and operation of Living Labs

Kaiserslautern Site

Saarbrücken Site

Bremen Site

Project Office Berlin

German Research Center for Artificial Intelligence
Company Profile

▶ **Established**
1988

▶ **Legal Form**
Non-profit organization
(public-private partnership)

▶ **Executive Board**
▷ Prof. Dr. Dr. h.c. mult. Wolfgang Wahlster, CEO
▷ Dr. Walter Olthoff, CFO

▶ **Supervisory Board**
▷ Prof. Dr. h.c. Hans-Albert Aukes, Chairman
▷ Heinz-Josef Mentges, Department Head, Ministry of Education, Science, Further Education and Culture of Rhineland-Palatinate, Vice Chairman

▶ **Locations**
Kaiserslautern (registered office), Saarbrücken, Bremen, Berlin (project office). Further operating sites in Osnabrück and St. Wendel

▶ **Shareholders**
Astrium GmbH, BMW Group Forschung und Technik GmbH, Daimler AG, Deutsche Messe AG, Deutsche Post AG, Deutsche Telekom AG, Empolis Information Management GmbH, Fraunhofer Gesellschaft e.V., Harting KGaA, Intel Corporation, John Deere European Office, KIBG GmbH, Microsoft Deutschland GmbH, RICOH Company Ltd., SAP AG, Software AG, University of Kaiserslautern, Bremen University, Saarland University

▶ **Equity Holding**
Center for the Evaluation of Languages and Technologies Srl (CELCT), Trento - Graphics Media.net GmbH, Kaiserslautern - Ground Truth Robotics GmbH, Bremen - PMC e.G., Bremen - SemVox GmbH, Saarbrücken - Yocoy Technologies GmbH, Berlin

Intelligent Solutions for the Knowledge Society

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

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

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

DFKI is actively involved in numerous organizations representing and continuously advancing Germany as an excellent location for cutting-edge research and technology. Far beyond the country's borders DFKI enjoys an excellent reputation for its academic training of young scientists. At present, 409 highly qualified researchers and 266 graduate students from more than 60 countries are contributing to more than 232 DFKI research projects. DFKI serves as a stepping stone to leading positions in industry and successful careers as founders of spin-off companies. Over the years, more than 60 staff members have been appointed professors at universities in Germany and abroad. ◀

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Research & Development

▶ **Research Departments and Research Groups**

Kaiserslautern Site
▷ Prof. Dr. Prof. h.c. Andreas Dengel:
  Knowledge Management
▷ Prof. Dr. Paul Lukowicz:
  Embedded Intelligence
▷ Prof. Dr.-Ing. Hans Schotten:
  Intelligent Networks
▷ Prof. Dr. Didier Stricker:
  Augmented Vision
▷ Prof. Dr.-Ing. Detlef Zühlke:
  Innovative Factory Systems

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

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

Project Office Berlin
▷ Projects and cooperation in the German capital region

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

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

Key Figures

▶ **Annual Budget 2011**
€ 39.2 million

▶ **Total Assets 2011**
€ 123.6 million

▶ **Employees**
409 professional staff, 266 graduate student staff

As of February 13, 2013

Scientific Excellence and Transfer

▶ **International Scientific Advisory Board**
Bi-annual evaluation of publically funded projects
▷ Prof. Dr. Horst Bunke, University of Bern, Switzerland, Chairman

▶ **Leading-Edge Research**
DFKI is the only German institute for computer science to participate in each of the three leading-edge research clusters
▷ Cluster of Excellence "Multimodal Computing and Interaction" funded by the German Research Foundation (DFG)
▷ Leading-Edge Cluster "Software Innovations for the Digital Enterprise" funded by BMBF
▷ European Institute of Innovation and Technology - Information and Communication Technology Labs (EIT ICT Labs)

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

▶ **Promoting Young Talent**
DFKI is a founding member and core partner of the Academy Cube and the Software Campus to promote managerial talent in the IT industry

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

▶ **Spin-offs**
Over 60 spin-off companies have created approximately 1,700 highly skilled jobs

Committees and Academies

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

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

▶ **Business Committees**
International SAP Research Advisory Board, Governance Board of the Intel Visual Computing Institute, Advisory Board of the NEC Computers and Communication Innovation Research Lab, and others

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

Intelligent Solutions for the Knowledge Society

▸ Knowledge management and document analysis

▸ Virtual worlds and 3D internet

▸ E-Learning and e-Government

▸ Development of provably correct software

▸ Innovative factory systems

▸ Intelligent networks

▸ 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

DFKI
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eiT ICT Labs

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PROSPERITY
The High-Tech Strategy for Germany

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