

NEWSLETTER



GERMAN RESEARCH CENTER FOR ARTIFICIAL INTELLIGENCE

2/2007

RESEARCH LABS

IMAGE UNDERSTANDING AND PATTERN RECOGNITION

KNOWLEDGE MANAGEMENT

DEDUCTION AND MULTIAGENT SYSTEMS

LANGUAGE TECHNOLOGY

INTELLIGENT USER INTERFACES

ROBOTICS

SAFE AND SECURE COGNITIVE SYSTEMS

INFORMATION SYSTEMS



Innovative Retail Laboratory (IRL) Opened

DFKI Opens Project Office in Berlin



Deutsche Messe
Hannover · Germany

Astrium and Deutsche Messe AG – New DFKI Shareholders



Empower Germany – Saarland Shines



The Innovation Conference, "Empower Germany - From strength to strength through Innovation" focuses on the chain reaction between education, research, and industry, the point where ideas are successfully converted into products. This chain has the capacity to create new value. The Conference provides answers to the question of how Germany can make more out of a good idea and how innovations can be successful in the global markets. Well known representatives of industry, science and politics will be there to inform guests about the trends and strategies of the future.

The concomitant exhibition "Empower Science - Saarland Shines" offers a view into Saarland's 50 year history of innovation and brings important new technological products and inventions to life for the visitor to experience first hand.

The DFKI participation at the exhibition "Empower Science - Saarland Shines" on November 13, 2007, will feature innovations in Human-Machine Interaction in the area of intelligent shopping assistants, smart-items with digital product memories as the next advance in RFID technology, and new platforms and tools for eLearning and media assisted learning.

DFKI will present an eLearning project called WISDOM along with other topics from the Innovative Retail Laboratory, the joint research lab of DFKI and Globus SB Warenhaus Holding Company in St. Wendel.

The IRL is where innovative trade and logistic solutions are researched, developed and tested. "Smart products" control their own status by means of sensors in the immediate vicinity and onboard sensors that record various data and document a product history: data about temperature, humidity, location, acceleration, vibration, light exposure and pressure can be measured and recorded. The registered data are combined with a general product description and stored in a so-called "digital product memory". These memories can be read by various assistant systems in order to supply the customer with product-specific value added services. This includes such products as the intelligent ice box that permits quality control of temperature sensitive foods and many other products that provide information about themselves and their status.

WISDOM is a training project designed for use at schools, educational facilities, and the SME businesses. Multipliers are enabled that can flexibly pass on their knowledge via an eLearning platform.

The learning solution "ILIAS" allows the independent creation and update of content; at the same time, the platform serves as a communications forum for researchers and information seekers. For the duration of the project, DFKI is offering information seminars on the strategic integration in the business processes and corporate culture, training on the design of learning materials, as well as software support and customization. Subsequently, you can take advantage of various service offers through membership in the „SaarlernNetz“. No investment costs are incurred in the installation of "ILIAS". More than 35 small and middle size firms in Saarland are already conducting successful eLearning and benefit from numerous variants to modernize and improve the quality of their educational undertakings. „SaarlernNetz“ is a network of various organizations in the field of education, established in parallel with the WISDOM Project. In 2007, it was chosen as one of the 365 "Selected Places in the Land of Ideas" sponsored by the Federal President.



l.-r. Reinhard Karger, Minister President Peter Müller, State Secretary Dr. Christian Ege, Prof. Wolfgang Wahlster

Organizers view the Conference Exhibit as a continuation of the successful presentation of Saarland's scientific community on the innovation mile created for the 50-year celebration of Saarland. Saarbrücken's center city became a showcase for important innovations, products, and inventions "made in Saarland".

Additional information
<http://wisdom.dfki.de>
www.saarlernnetz.de
www.empower-deutschland.de

Artificial intelligence in the self-service warehouse of the future – Globus and DFKI establish joint research lab

DFKI and Globus jointly announced the opening of their new research lab – Innovative Retail Laboratory – IRL located at the Globus Coordination Center in St. Wendel, Germany. Innovative trade and logistic solutions will be researched, developed, and tested with the aim of bringing further purchasing advantages to the customer. Here, the latest research results in the areas of innovative software systems, Artificial Intelligence, Human Computer Interaction, wireless sensor networks, mobile broadband communications as well as Internet topics and services, will be linked together with new types of sales and purchasing assistance systems. The operating budget for the new lab with approx. 500 sqm of floor space is provided by Globus and will fund an endowed professorship and a team of DFKI researchers for the following three years.



l.-r. Joachim Rippel, Saarland's Minister of Economics and Science; Prof. Wolfgang Wahlster; Thomas Bruch

Thomas Bruch, CEO of Globus SB-Warenhaus Holding, is convinced the integration of information and communication technologies with the needs of merchandise marketing promises to yield greater potentials beyond just sales alone: "IT is the motor of innovation and provides the opportunity to further improve our trade processes and our customer services. The establishment of a research lab at our head office allows us to get more young programmers excited about the topic of IT for the retail trade and helps us to do something about the shortage of skilled staff."

Joachim Rippel, Saarland's Minister of Economics and Science assessed the cooperation between Globus and DFKI as an important part of the state's official innovation strategy: "The joint Globus and DFKI Lab is the perfect example of the targeted mesh of business and research. I am convinced that IRL will become a beacon among the IT cluster in our own innovation strategy, as it pools the strengths of the Saarland in information systems, trade, and logistics all into one application area."

The Innovative Retail Laboratory – IRL will examine and test all sorts of complex concepts in intelligent marketing for their suitability in daily use and customer value. Such topics range from virtual allergy or weight loss assistants to digital sommeliers, individualized



cross and up selling, smart-items with digital product memory as an advanced development in RFID technology, to floor space positioning and navigation as well as many other new logistic concepts. New forms of customer interaction, from individualized sales consulting via "talking" products to intelligent shopping carts, which can use the shopping list to plan and then display the most efficient path through the store will be further developed and tested for daily use. Other possible innovations are the shopping cart that suggests the required ingredients for a recipe and performs product comparisons or gives personalized alerts to promotions and sales offers, while providing additional information about the products.

"DFKI has established an international reputation in recent years for its work on intelligent shopping environments and with Globus has found the perfect partner to speed the implementation of results and innovation all along the sales value adding chain," said Prof. Dr. Wolfgang Wahlster, CEO of DFKI. "The cooperation and the continuing dialog between our researchers and the experienced experts at Globus sharpens our focus on specific requirements and potentials of future self-service warehouses and accelerates the transfer of research findings into practice. In this way, inventions can more quickly become innovations with real customer value. The new lab is also an important platform for future project planning at DFKI within the high-tech strategy framework and top cluster competition of the Federal Ministry of Education and Research (BMBF)".

The initial plans call for a team of up to 10 DFKI scientists to work together with the marketing and logistics experts of Globus. The public will be invited to selected events and exhibits and provided with various opportunities to view the demonstrators, developments, and experience for themselves the future of shopping.

Contact

Dr. Dietmar Dengler
 Research department: Intelligent User Interfaces
 E-mail: Dietmar.Dengler@dfki.de
 Phone: +49 (0)681 302-5259

▶ THESEUS – from searching to finding

DFKI is a participating partner in THESEUS and is developing the base technologies and application scenarios. This research project initiated by the Federal Ministry of Economics and Technology (BMWi) has the aim of developing a new, internet based knowledge infrastructure in order to facilitate the use and exploitation of knowledge resident in the internet.



Under the auspices of THESEUS, application oriented, base technologies and technical standards are to be developed and tested. The findings are expected to lead to the products, tools, services, and business models for the World Wide Web as well as the service and knowledge society of tomorrow.

"The combination of trends in information systems, the 'semantic Web' and 'Web 2.0' provides THESEUS with the opportunity to create an innovative knowledge infrastructure, as Web 3.0, a completely new way to access knowledge and knowledge management as well as web based services, applications and business models," said DFKI CEO Prof. Wolfgang Wahlster.

At the Core Technology Cluster "Situation sensitive dialog processing", DFKI researchers are working on flexible components for dialog processing, which are specially configured according to the needs of the use scenario. These components are the main functional building blocks used to implement systems that can realize interactive dialog between humans and computers. The project partners develop text, graphic, language, and gesture-specific analysis and generation algorithms for multimode interfaces that can be operated by voice or gesture. The users formulate their questions intuitively and then refine them in free speech dialog with the system. Conversational behavior is modeled using a special ontology to describe general dialog patterns. The multimode interaction enables semantic navigation, which supports the user by providing various suggestions and associative notes.

The application scenario TEXO supports development of the infrastructure for new company-wide, web-based service and services on the basis of service oriented architecture (SOA), which in turn enables the flexible, semantic-oriented switching between service providers and service customers. TEXO develops semantic technologies for so-called "Business Webs" that will permit market participants to find Internet based web services

safely and efficiently, combine them with higher value services and execute them. DFKI is preparing a mobile version for the platform that will provide access to selected functions via smartphone and other mobile end devices. In this way, the users of a combined service have the possibility at any time from any location to check the working status of the service and gain access to the results.

Another use case called MEDICO is working on a universal-deployable search engine for medical images. It is expected to enable the direct semantic access to medical imagery databases to assist with the individual diagnosis and treatment planning as well as biomedical and epidemiological research. The main target users are doctors, researchers as well as application developers in the area of medical information systems and healthcare.

DFKI is also working on a semantic search in heterogeneous medical data bases of images, diagnoses, expert articles, and video data. Users will be able to search under concepts like organs or diseases and obtain a listing of all data sources that contain the concept. The cross-modal search of medical texts employs techniques from Natural Language Processing (NLP) to enable joint searches for texts with image and video data. In addition, object recognition methods for medical images are being enriched with formal background knowledge in order to improve object recognition and facilitate the transition to semantic, ontology based annotations.

Additional information

www.theseus-programm.de

Contact

Dr. Anselm Blocher

Research department: Intelligent User Interfaces

E-mail: Anselm.Blocher@dfki.de

Phone: +49 (0)681 302-5262

CASCOM – Intelligent agents for medical emergencies

The aim of the EU research project CASCOM is to accomplish the intelligent, context sensitive coordination of medical services, in order to insure their availability at any time from any location. This requires the integration of a several innovative technologies: multi-agent systems, semantic web services, peer-to-peer, and mobile telecommunications.



The CASCOM project is working on the integration of application-specific services from intelligent software agents capable of efficiently solving highly complex tasks in dynamic environments. The ability to safely communicate sensitive personal data independent of an established stationary infrastructure opens a whole new range of possibilities in efficient communications.

Application scenarios in electronic trading, tele-monitoring, and health services were examined during the previous project period. The underlying structural design for a mobile P2P network as well as the components and methods for coordinating semantic services were also defined and developed. From the three applications mentioned above, the "Emergency Assistance Scenario" was implemented with the goal of helping tourists who become ill while away from home.

A traveler can access the data base of the attending doctor or insurance agency using a PDA and the personal CASCOM agents in order to pass on information about prior existing illnesses to the local doctors. The local medical team is provided with detailed information faster and more accurately than when dependent on a personal description by the affected patient. Expensive and repetitive diagnostic procedures that have already been performed at the patient's home can be avoided; risks and costs are minimized. The information transferred in this way is evaluated to determine whether the patient should be given immediate treatment or whether the decision should be made to transport the patient back to their attending doctor. Emergency medical personnel who answer a call for assistance from a completely unfamiliar patient also benefit from the CASCOM architecture through ad hoc communications and access to relevant data while on the move.

CASCOM has been undergoing practical testing since the beginning of 2007. The equipment and software is being subjected to usability tests and field testing in a hospital environment began in the spring. In this way, the CASCOM system could be tested under the real conditions involving doctors, rescue services, and patients. The Tiroler - Landeskrankenanstalten GmbH (TILAK) in Innsbruck, Austria has agreed to be the test partner. Lessons learned in the process are now being implemented and the software is undergoing additional field tests.

A CASCOM system demonstrator reflecting the current state of software development has been presented at the SYSTEMS 2007.

Long range plans call for the entire CASCOM technology to be released as "open source" on the internet. The underlying processes are to be kept generic to permit other uses of the system apart from the medical applications used in our examples.



Field test of the Cascom system

This is a sponsored project within the 6th EU Framework Program Agreement and has a total budget of € 2.69 million and has an active term from September 2004 to December 2007. The participating partners include 8 other institutes and companies from Germany, Finland, Italy, Portugal, Switzerland, and Spain. The lead project coordinator is DFKI.

Additional information
www.ist-cascom.org

Contact
 Dr. Oliver Keller
 Research department: Deduction and Multiagent Systems
 E-mail: Oliver.Keller@dfki.de
 Phone: +49 (0)681 302-5327

How Conceptual Modeling Is Used in Practice

The practice of using conceptual models in the development of high quality software systems has been around for a long time. Nevertheless, little is really known about how the practitioners actually use conceptual modeling. This leads to the following problems and questions:

- ▶ It is difficult to estimate the practical relevance of various approaches to modeling because of the wide proliferation of methods.
- ▶ It is not easy to focus selection and modification of appropriate modeling approaches on the state of the art technology.
- ▶ There is no consensus as to the scope of investment to be made in modeling tools.
- ▶ The proliferation of different methods complicates the exchange and reuse of the models.
- ▶ Training and teaching the approaches to modeling is more difficult.

This is a brief description of the situation facing the Institute for Information Systems at DFKI as it researches the actual use of conceptual modeling in practice. For example, one study has provided answers to the following questions:

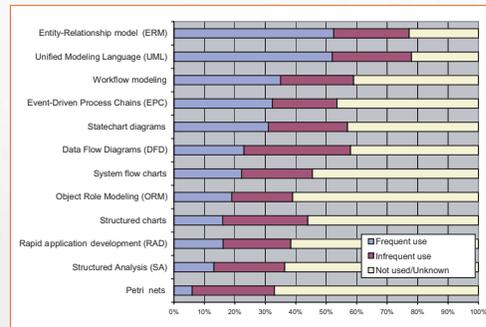
- ▶ How relevant is conceptual modeling to various application purposes?
- ▶ To what extent do practitioners use the methods and tools of conceptual modeling?
- ▶ What barriers and factors for success are common when using conceptual modeling?

A web survey was conducted to find the answers to these questions and more than 300 modelers across Germany responded. The results of the study reveal the following:

1. Besides its use in software development, conceptual modeling is especially common in data base development as well as data base management with business process improvement being another area of employment.
2. Even though numerous modeling methods are known, only a few approaches are commonly used. A surprising result of the study was that over 50 percent of the participants reported frequent use of the Entity Relationship Model (ERM), a method first introduced over thirty years ago. This fact puts ERM at the top of the rankings, ahead of the Unified Modeling Language (UML) in terms of frequency of use. Of special significance for

the Institute for Information Systems was the high ranking of the Event-driven Process Chain (EPC) developed here for modeling business processes.

3. The Microsoft Visio program is used frequently by nearly 50 percent of the survey participants. 20 percent reported their frequent use of the ARIS Toolset and Rational Rose. Other tools proved to be less significant.



Use of modeling methods

4. Several barriers and success factors were identified. For example, two factors essential for the success of a project are the use of an adequate modeling methodology and the support of the company's top management.

Further studies conducted by the Institute for Information Systems have revealed other results as well in the area of conceptual modeling for the introduction of Enterprise Resource Planning (ERP) systems and for the understanding of different data languages and process modeling languages. Our current research projects include: an examination of requirements for business process management in technical support, the practical advantages of methods engineering, and the success factors in using the Supply Chain Operations Reference Model (SCOR) for supply chain management.

Additional information
<http://iwi.dfki.de>

Contact
 Dr. Peter Fettke
 Institute for Information Systems (IWi) at DFKI
 E-mail: Peter.Fettke@iwi.dfki.de
 Phone: +49 (0)681 302-5142

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Address: Stuhlsatzenhausweg 3, Campus D3_2, D-66123 Saarbrücken, E-mail: uk@dfki.de,

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First eGovernment Symposium SaarLorLux

TAKING INVENTORY – ADMINISTRATION, POLICY, AND SCIENCE



SaarLorLux is a dynamic region in the heart of Europe. The idea behind the "eGovernment Symposium SaarLorLux" is to strengthen relationships in the area of public admini-

stration among the regional governments of SaarLorLux, with a special focus on the future of "eGovernment". State of the art information and communication technology in public administration is a recurring theme in the political debate over the use of a modern, strategically based system for administrative reform. The governments are mainly concerned with improved efficiency and effectiveness and the convenient provision of citizen services through the use of the latest technologies. The research community assists by delivering innovative ideas, methods, and technologies. The first eGovernment Symposium should provide a forum and support for the exchange of information between administrative, policy, and scientific communities.

The aim is to profit from joint discussions of current and future eGovernment initiatives with partners from neighboring

scientific institutes and administrative agencies in the SaarLorLux region. The discussions will be moderated to:

- ▶ Identify synergies
- ▶ Establish and support a network of responsible players
- ▶ Exchange knowledge and experience

The symposium is devoted to current and future modernization and eGovernment. The symposium is scheduled for March 11, 2008 from 9:30 – 18:00, at DFKI Saarbrücken.



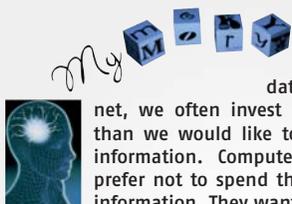
Additional information
<http://iwi.dfki.de>

Contact
 Jörg Zwicker
 Institute for Information Systems (IWi) at DFKI
 E-mail: e-government-cc@iwi.dfki.de
 Phone: +49 (0)681 302-3106

Here's looking at you, kid!

MYMORY OBSERVES, UNDERSTANDS, AND INFORMS ITS OPERATOR

Mymory, is the name of a system being developed at DFKI that automatically provides users with information about the current content of their work.



"In the permanent bombardment of e-mails, documents, databases, and the Internet, we often invest more time and effort than we would like to in finding the right information. Computer users would really prefer not to spend their time searching for information. They want programs to takeover this task and automatically present the relevant information to them," explained Prof. Dr. Andreas Dengel, Head of the Research Lab Knowledge Management, in describing today's situation.

Mymory analyses the individual data requirements of the reader: An eyetracker looks directly into the reader's eyes and follows their movement while reading. The computer recognizes which sections are read thoroughly and which are skimmed over or not even considered. Mymory can recognize, for example, what section of a document is of particular interest to the reader. In the background, the system searches for information that matches the context of this section, for example, in an online encyclopedia or an expert data base and then

provides the findings to the reader as a sort of suggestion list.

Researchers promise additional indications of specific information needs may be derived from the interaction between the users and their documents: What areas are clicked, which instructions are followed, which are ignored? Which passages are highlighted or lined through with digital markers? In this way, additional conclusions may be drawn about the contextual interests of the user and sharpens the focus of the information profile.

Mymory is sponsored by the Federal Ministry of Education and Research (BMBF). The project began on 01/01/2006 and runs for three years.

Additional information
www.dfki.de/mymory

Contact
 Ludger van Elst
 Research department: Knowledge Management
 E-mail: Ludger.van_Elst@dfki.de
 Phone: +49 (0)631 20575-110

▶ IVIP – An intelligent integration of source information for business specific, location based planning for the production of energy crops



Decision making in crop farming depends essentially on location based or spatially oriented information. This is the case for the production of food crops as well as for renewable resources. Nevertheless, the present interest

in cultivating bio-resources at the farm or regional level can lead to significant interventions in the configuration of crop rotations or, the cultivation systems. Consequently, farmers and the responsible regional crop consultants are especially reliant on the development of new tools, based on geo-data to help them with decision making in the area of renewable resources.

A DFKI research project called RAPR, developed a prototype in partnership with the agricultural machinery producer John Deere and the responsible state officials (geologic and agricultural support agencies) of Rhineland Palatinate. The project used digitized geo-data of the cultivated areas and soil resources available in Rhineland-Palatinate. This prototype is able to make production forecasts for the management of bio-resources.

The state of Rhineland-Palatinate has commissioned the follow-on project IVIP involving DFKI, John Deere, and Agricultural Management Solutions (AMS) of Zweibrücken. The IVIP Project is intended to serve as a bridge between the offer of digital soil data and the



GPS on board

impact specific consulting services now being established. Land use management, i.e., the business and location-specific planning of crop rotation for energy crops, can be optimized by the intelligent integration of various information sources.

In order to estimate the yield capacity, the model biomass planner developed in the RAPR project requires official geo-data and the technology to integrate GPS supported sensor data into the information cycle. In addition to on board computers with sensors that mea-



sure soil composition and yield volume, the agricultural machines of John Deere also have a GPS transmitter on board that can determine the exact location at any time. In this way, sensor data can be purposefully entered and transmitted. The consultant receives feedback about the quality of their data. For example, in the event the soil consistency changes, the consultant can check his values and make the appropriate changes.

The aim of IVIP is to operationalize this decision support system for use statewide by regional farm consultants. This includes, to the maximum extent possible, the automation of the farm-specific acquisition of spatial data and providing for the legal as well as organizational needs.

Another goal of the project is to check the quality of the forecasts, for example, in this practical example: Farmer Smith harvests wheat with his combine. The sensors in his John Deere machine record the exact yield and transmit it to the consultant. The consultant compares the data against his predicted yield and uses these ratios to control the quality of the forecasts. All participants expect the deployment of this new technology will improve the forecasting, so that over the long term, both the yield quantity as well as quality will increase.

Contact
 Christopher Tuot
 Research department: Knowledge Management
 E-mail: Christopher.Tuot@dfki.de
 Phone: +49 (0)631 20575-127

DFKI opens project office in Berlin

As Germany's leading research facility in the area of innovative software technologies, DFKI has strengthened its presence in the "Capital of Talent" by the establishment of a new project office in Berlin.



Berlin is one of the most intensive research regions of Europe and offers numerous scientific and economic linkage points. Among the many prominent guests on July 9, 2007 at the official opening of the project office, was Prof. Dr. E. Jürgen Zöllner, Berlin's Senator for Education, Science and Research. He commented, "The exceptionally successful development of DFKI as a conceptual partnership of research and business is extremely satisfying to me. This is an important and proper signal for DFKI and for the scientific community of Berlin."

The main activities of the project office are aimed at further expanding our cooperation in this excellent environment and, on the implementation of innovative solutions with principals in industry. Prof. Dr. Wolfgang Wahlster, CEO of DFKI GmbH remarked: "Berlin interested us for the opportunity it offers to intensify our cooperation with the Deutsche Telekom Laboratories, which is an associated research institute of the TU Berlin and works with the best international researchers on topics that belong to the core competencies of DFKI. We also realized the advantage of being able to demonstrate the solid benefits of our research results directly to government decision makers in the capital at our own lab facilities and also, to facilitate a more direct implementation of policy consulting on IT subjects."

Dr. Wolf-Dieter Lukas, responsible for Information and Communications Technology at the Federal Ministry of Education and Research (BMBF), welcomed the opening of the new DFKI project office in Berlin and praised Prof. Wahlster and DFKI as a prized element of good fortune for the information sciences in Germany. Prof. Dr. h.c. Hans A. Aukes, Deutsche Telekom and Chairman of the Supervisory Board of DFKI, explained: "DFKI is a Public-Private-Partnership with a unique structure and a very impressive balance of performance. International partners representing diverse industries all cooperate with

the research scientists of DFKI all along the entire value added chain of innovation - from the invention to the innovative product functions." Meanwhile, four of the DFKI spin-off companies have chosen Berlin for their business headquarters: three of these, Acrolinx, Semantic Edge, and Yocoy operate in the field of language technologies and the other, called PantAion, is in entertainment and intelligent games.

The opportunities for the DFKI project office in Berlin as stated by Prof. Dr. Hans Uszkoreit, Scientific Director at DFKI: "In Berlin, we are already working together with other companies on a series of exciting new applications. These include several in the field of cognitive technologies, an area that was lacking in the excellent Berlin research environment until now. The business spectrum represented by our Berlin industrial partners range from avant-garde startups to global corporations." Intelligent dialog management and dynamic information extraction are only two of the topics being developed at DFKI's new project office.

Prof. Dr. Martin Kay, Professor at Stanford University and internationally respected researcher in the field of language technology, in discussing the background, aims, and future of the work of DFKI explained: "Computers will become much more useful to us when we are able to talk to them as we do to humans. To provide computers with this ability is a challenge in the



Ministerialdirektor Dr. Wolf-Dieter Lukas, Head of Division at BMBF

extreme, perhaps in itself, more difficult than any other single application developed to date. Meanwhile, the signs are apparent that the work carried on in the last decade is starting to bear fruit. One of the places where this is most clearly visible is DFKI, which since its founding has had a pioneering role in the international effort to build computers that are capable of understanding human language."

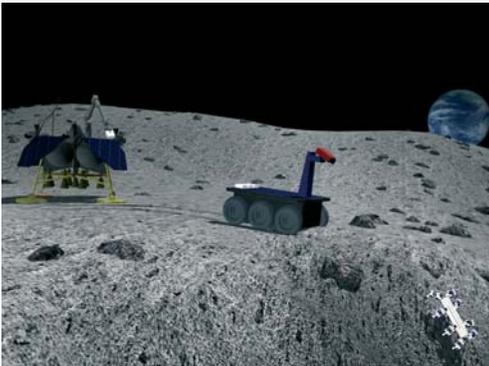
On the occasion of this event, DFKI also presented systems and research prototypes in the areas of Human Computer Interaction, Semantic Internet Services, cross-reality or tangible interfaces, Digital Product Memory, multilingual travel guides, speech synthesis, or information extraction.

► **LUNARES – Intelligent robot team for lunar missions**

DFKI, EADS subsidiary Astrium, and OHB Systems have begun cooperation on an interdisciplinary robot team designed to explore the nature of the moon.

The objective of LUNARES is to make use of the existing robot technologies to investigate various celestial bodies and, in particular, to explore the lunar craters. In an exploration scenario designed to resemble the surface of the moon, a robot team is being investigated in an effort to prove that the versatility and greater functionality of a team is superior to that of individual robot systems. The robot team, consisting of a landing craft (OHB Systems), a manipulator arm and a rover (Astrium) and a walking robot from the DFKI Robotics Lab in Bremen, is designed for local autonomous operations as well as for remote control from an existing control center. This scenario is designed to prove that the individual elements can be combined to form an overall robotic system that can cooperate efficiently on extraterrestrial missions. The project got underway in July 2007 and is to run until 2009 with a total budget of 2.2 million euros.

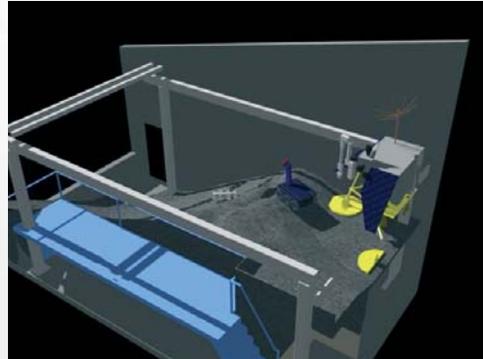
The components of the robot team undergo a complete lunar mission in a realistic test environment, where the system is able to self-organize appropriately for the task at hand: with the aid of the manipulator arm, the individual systems can reconfigure themselves, and there on the moon's surface, be fitted with the various equipment required. The rover serves as the long distance transporter for the necessary research equipment and



Design concept of LUNARES

for the SCORPION walking robot, which it carries from the landing craft to the deployment site, e.g., the targeted moon crater. Once there, the eight legged SCORPION makes its way over the crater rim and takes soil samples. Scientists hope that the crater walls will reveal different sediment layers and allow an exogeologic examination. A special object of interest on the moon are the asteroid craters at the poles, where ancient, interstellar dust particles as well as frozen water can be expected. "The continued exploration and perhaps more importantly, the commercial exploitation of space, will

depend on the use of teams of mobile robots that employ methods of artificial intelligence to cooperate and solve complex tasks in space together. However, robots can only perform these tasks when, in addition



Computer drawing of the LUNARES exploration scenario

to the extraordinary durability needed to meet the challenges of an unfriendly environment, they also possess local autonomy and sophisticated sensors," explained Prof. Dr. Wolfgang Wahlster about the project.

Project LUNARES is funded by the German Aerospace Center (DLR) and Bremer Investitions Gesellschaft (BIG).

The cooperation between DFKI, Astrium, and OHB Systems on this joint project is a result of the decision to locate the DFKI Robotics Lab in Bremen. Together with the DFKI model for Public-Private-Partnership the city offers an excellent environment for such interdisciplinary projects for industry and research involved in space exploration. The EADS subsidiary Astrium took advantage of the Public-Private-Partnership opportunity to acquire shares of DFKI.

Additional information
www.dfki.de/robotik

Contact
 Dr. Dirk Spenneberg
 DFKI-Bremen – Robotics Lab
 E-mail: Dirk.Spenneberg@dfki.de
 Phone: +49 (0)421 218-64102

Two new DFKI shareholders: Deutsche Messe AG and Astrium



Deutsche Messe
Hannover · Germany

Under the auspices of the 41st Meeting of the Supervisory Board on May 9, 2007, DFKI welcomed Deutsche Messe AG as a new DFKI industry partner. The share purchase further intensifies many years of close cooperation. Since 2002, DFKI has been active in the coordination and moderation of the CeBIT future talk series. Since 2005, Prof. Wahlster has served as Chairperson of the TOP jury, an esteemed body which selects the winners of the "HERMES AWARD – The International Technology Prize of the HANNOVER MESSE". This coveted award is endowed with 100,000 euros and is presented as part of the festive, official opening ceremony of the HANNOVER MESSE.

The decision of the EADS subsidiary to become the newest shareholder in DFKI was announced at a recent joint press conference on September 27, 2007.



l. – r. Prof. Frank Kirchner; Prof. Wolfgang Wahlster; Evert Dudok, CEO Astrium; Dr. Heiner Heseler, Bremen government

"Our investment in DFKI marks the start of a promising cooperation in scientific research and development activity here in Bremen. The existing competencies of each partner are the perfect complement to each other while cooperating in the development of new intelligent systems for future space missions", said Evert Dudok, CEO of Astrium Deutschland.

"We are every proud of the fact that since February 2006, Bremen has been a member of the DFKI family of sites alongside Kaiserslautern and Saarbrücken. The lab's broad range of research activity fits well within our scientific landscape. The LUNARES project which is sponsored by the state of Bremen and the German Aerospace Center (DLR), pools the expertise of science and industry, and serves to illustrate the excellent collaborative research for which Bremen is so well known far beyond its own borders," said Dr. Heiner Heseler, State Council to the Senator for Economics and Ports in the Free Hanseatic City of Bremen.

Astrium, is a wholly owned subsidiary of EADS and is specialized in civil and military space systems and services. In 2006, Astrium has sales of 3.2 billion euros and employs a staff of nearly 11,000 people in France, Germany, the United Kingdom, Spain, and the Netherlands. Its core business are composed of three main areas: the two business units Astrium Space Transportation for launchers and orbital infrastructures, and Astrium Satellites for spacecraft and ground support, and finally, the wholly owned subsidiary Astrium Services for the development and delivery of satellite based services.



DFKI at the Bremer Forum for Scientific Journalism – „WISSENSWERTE“

The Bremer Trade Conference for Journalists scheduled for November 26–27, 2007, will feature exhibits and demonstrators from the following research labs: Image Understanding and Pattern Recognition, Knowledge Management, Language Technologies, and Intelligent User Interfaces. An excursion is also planned for participants to visit the DFKI–Bremen Labs on 28 November.

Researchers at DFKI Bremen Labs are working on mobile and autonomous robot systems that can be deployed on land, under the sea, or in the air – or space. Robotic designers profit from nature's diversity: e.g., building four or eight legged climbing or walking robots, and a snake shaped underwater system. These biomimetic systems borrow from models found in the natural environment and combine the advantages of new materials with evolutionary successful patterns and forms of movement.

The climbing robot, Aramies, will demonstrate its ability to climb up and down wall bars having a slope of 70 degrees without any problem. For those who want to join in on the action, they can issue the control commands to the walking robot, Scorpion, or even help build one by exchanging individual robot components. At the Research Lab for

Secure Cognitive Systems, Rolland, the intelligent wheelchair invites you to take a test drive.



The aim of Project CManipulator is to investigate manipulator arm controls that will someday master deep sea plug connections at 6000 meters below the ocean surface. Construction of an underwater test lab will allow simulation of the deep sea conditions. Similarly, a simulated lunar surface for the evaluation of an extraterrestrial robot team is being built as part of Project LUNARES (see page 10).

Additional information
www.dfki.de/robotik
www.wissenswertes-bremen.de

Contact
Franziska Martin
DFKI Bremen Lab
E-mail: Franziska.Martin@dfki.de
Phone: +49 (0)421 218-64121

► **DFKI Interview: Dr. Dirk Spenneberg**



Dr. Dirk Spenneberg is Deputy Head of the research team Robotics.

What do you see as the application potential in your research?

My work is primarily with the development of robots that will someday be used to explore other planets or to support safety and rescue teams here

on earth, for example, rapid detection of people trapped after a catastrophe.

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

Over ten years ago. Great advances in the field of robotics have been made in this period, for example, the autonomous navigation and self-positioning. Generally speaking one can say in robotics that the mechatronic possibilities have advanced faster than the AI methods needed to control them.

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

If we can succeed in developing adequate AI concepts for such robots, which are ever more complex mechatronically, we will be able to realize maximum benefit from this huge potential.

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

I get real enjoyment from spending time with my three small children.

Are there parallels there to your professional life?

Interesting. When you observe childhood development, it becomes obvious how far we have yet to go with our AI approaches to imitate the human ability to learn and adapt. There is still a great amount of research required and we have a lot to learn.

What are your current projects?

First and foremost, the two space projects LUNARES (see article pg. 10) and Spaceclimber. In Spaceclimber, we are working with DLR and ESA to develop a semi-autonomous climbing robot for steep crater rims and other places where existing robots are incapable of going.

E-mail: Dirk.Spenneberg@dfki.de

Phone: +49 (0)421 218-64102

► **OFFIS Honorary Membership for Prof. Wahlster**

On July 13, 2007 before an audience of 150 scientists, research directors from IT companies, and Lower Saxony's Minister for Science and Culture Lutz Stratmann, OFFIS Chairman, Prof. Dr.-Ing. Wolfgang Nebel, presented the honor with the words: "We are honoring Prof. Wahlster, one of the most prominent information scientists, who for over 15 years has provided outstanding strategic advice in the establishment and development of OFFIS, and who has contributed substantially to the success of this institute."



l.-r. Prof. Wolfgang Wahlster and Prof. Wolfgang Nebel

The OFFIS Institute for Information Technology, as an "An-Institut", is a facility set up as a private company and attached to the Oldenburg University. It conducts research into new forms of computer aided information processing in hardware and software systems and the implementation of results into application development projects.

The selection as an honorary member is the highest form of recognition that such an institute can bestow and has only been awarded five times since the establishment of OFFIS 16 years ago. It is conferred upon special, long term companions of the institute, in recognition of many years of cooperation in the establishment and expansion of OFFIS. "This distinct honor encourages me to continue my strong advocacy and support of associated, but independent institutes like OFFIS, as the third leg of the German research landscape next to universities and state run facilities," said Wahlster at the honors ceremony. "Centers of Excellence such as OFFIS are an essential factor in building the close ties between the research and business communities essential to the high-tech strategy of the German government. Such organizations successfully combine top international research with a regional presence and also promote cooperation with SMEs."



InViRe-InFiRe – A Content-Based Video Retrieval System

The popularity of digital video cameras, online-video portals (www.youtube.com, www.revver.com) as well as digital TV reception enable user's today to quickly create, store, and distribute large volumes of digital video material. Unlike with digital photos, it is very difficult to gain an overview of the content, which is often only possible at the original frame speed and is therefore, very time consuming.

In the InViRe project, DFKI researchers are developing a prototype system that is able to search the content of large video databases (Content-Based Video Retrieval). In building the prototypes for InFiRe, the scientists from the Research Lab, Image Understanding and Pattern Recognition have drawn upon their work on the image retrieval system FiRe, which was introduced at CeBIT 2007. InViRe searches according to the visual properties of the video materials – an approach that selectively replaces or expands today's conventional text-based methods.

The search for similar videos begins with the selection of a key frame from the video database. A comparison of the database content is accomplished upon request using a series of visual properties like color, texture, or movement. The user can influence the search results by varying the properties applied and assigning relative weights among the properties. Results can be further improved by weighting individual search findings in terms of their relevance. An online demo can be retrieved at: <http://demos.iupr.org/cgi-bin/infire.cgi>. The application of special video properties and distance measurements permits an explicit search for identical video content, a function that is very useful, for example, for detecting copyright protected material in video databases. In particular, with its resilience to slight alterations of the material, this application is sure to become more important as the pace of expansion picks up in the spread and use of video portals.



At the present time, the development effort focuses on the automatic partitioning of key words for video data from online video portals. The system is able to learn the visual properties of a keyword (e.g., football) automatically, in that it automatically downloads videos



from the online portals and studies their properties. The key words are then suggested automatically to the user for selection (<http://demos.iupr.org/cgi-bin/videotagging.cgi>). In combination with other properties, the key words are again used for video retrieval.

Besides focusing their main research effort on intelligent searches of videos, the project team is also working on the development of a user interface to display the contextual relationships within a video database. Here, the focus is on intuitive operations and the logical and structured display of database content. The chosen display shows the correlation of the video data within the database.

The Rhineland-Palatinate Foundation for Innovation is funding the work on content-based video retrieval under the framework of Project InViRe.

Additional information
www.iupr.org

Contact
 Prof. Dr. Thomas Breuel
 Research department: Imaging Understanding and Pattern Recognition
 E-mail: Thomas.Breuel@dfki.de
 Phone: +49 (0)631 20575-400

**SmartFactory^{KL}:
Task-oriented user interfaces in an intelligent production environment**

The time when several people had to share a few computers, has long since passed in many areas of life and work. The PC is losing its position of dominance in the workplace. Equipped with mobile telephones, personal digital assistants (PDAs), navigation units, and notebooks, most people now own a multitude of electronic helpers. This trend is continuing its march into production environments as well.

A greater distribution of processors, for example, in operating panels or in integrated systems is leading to more frequent and more complex interactions between humans with technical equipment or their surroundings. It is observable that these increasingly complex systems are no longer being operated only by experts, but rather by users from every level of education and age, who are mastering a variety of tasks in many different ways. The diversity of use situations requires software that is just as flexible. It is already obvious today that, in the future, we will be unable to develop all required software in advance, especially when unforeseen situations for use may arise at any time.

A model-based method, which can be used to generate the new software, is a suitable way to avoid the necessity of having programmers code every possible use situation beforehand.



Test Production in the SmartFactory^{KL}

Adequate models are needed not only for the technical systems and their status, but also for the entire socio-technological system, i.e., to include the human-machine interface as well as the users and their situation. The research being conducted for the project "Creating task-oriented user interfaces for intelligent production environments" is pushing humans and their tasks as well as the corresponding interactions and information requirements to the forefront of the development effort for operation systems and aims at the



SmartFactory^{KL} Development Unit

optimal task-orientation of automatically generated user interfaces.

The key to this work is a use model, where the tasks of each potential user can be organized and structured. Individual peculiarities and preferences flow into a personal use model. Then, the environment, the interaction device, and the context of use are analyzed and modeled. This produces a reference model of the use situation, which is then applied to generate the appropriate user interfaces.

The selection of interactive elements, presentation forms, input methods, etc., is achieved with the help of a database of usability patterns. In effect, this is a standard solution of frequently occurring problems that can be flexibly adjusted and expanded as required. For example, a simple table can be given a special header format so the content can be sorted alphabetically by the first column. In this manner, a set of basic interaction elements can be used to generate even highly complex user interfaces.

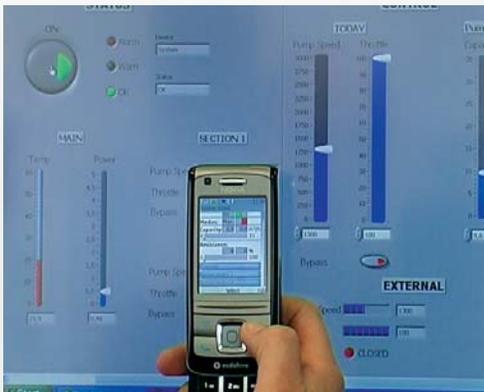
Additional information
www.zmmi.de
www.smartfactory-kl.de

Contact
 Prof. Dr.-Ing. Detlef Zühlke
 Center for Human Machine Interaction
 E-mail: Zuehlke@mv.uni-kl.de
 Phone: +49 (0)631 205-3570

SmartFactory^{KL}: ▶ A universal remote control for the intelligent factory of the future

Modern industrial plants use innumerable field devices supplied by different manufacturers to measure and transfer a variety of physical data. Most of these devices are equipped with proprietary operator devices and user interfaces. Tiny sensors and complex mechatronic units introduce stationary, inflexible control elements that range from single buttons or blinking lights up to completely Windows-based industrial PC's.

The lack of standards and an ever increasing palette of functionalities results in an ever-growing multitude of highly complex operator devices and user interfaces. In spite of significant training and long ramp-up times, the risk of operating error remains high. Furthermore, just installing an operator device on a field device raises the development and production costs, and places an additional burden on maintenance, repair and training.



Mobile operator devices

Here, the de-coupling of field device and operator device can generate significant value added: By employing wireless technologies like Bluetooth, WLAN, or ZigBee, series manufactured operator devices that are less expensive and more easily replaceable can be used to communicate wirelessly to field devices of various manufacturers. A widely accepted, standard operating concept is conducive to faster learning of such systems and reduces the number of operating errors. Freedom of location, additional computing power as well as extended possibilities for display and interactive operation can make a major contribution to the flexibility of plant operations.

As part of the multi-year Universal Operation System project, the Center for Human-Machine Interaction (ZMMI) has developed a demonstrator for the Smart Factory^{KL} which illustrates the adaptability of commercially available mobile telephones in wireless parameterization of factory components. Using Java software that runs on mobile telephones of different vendors, up to 20 field devices of varying degrees of complexity can be

monitored and parameterized in the SmartFactory^{KL}. All of the available field devices and radio links are identified automatically.

A standard operation philosophy facilitates the interaction with field devices and permits easy access to any of these 20 devices from any location on the production floor of the SmartFactory^{KL}. Rapid switching from one operated device to another is possible without a change in location.



At the present time, the ZMMI is adapting a tablet PC with a touchpen and touchscreen to the existing communications architecture. The aim is to develop a portable Windows program that runs on a personal digital assistant (PDA) and Tablet PC. Within an ongoing, joint project with reputable developing companies of control panels and Bluetooth solutions, the ZMMI aims to develop a dedicated wireless operation system based on Bluetooth, which provides an adequate response to the needs of the production environment.

Plans for other projects are underway, addressing, among others, the evaluation of additional wireless technologies, a study of the configurability of individual control surfaces, and the use of the self-descriptive capabilities of today's field devices.

Additional information
www.zmmi.de
www.smartfactory-kl.de

Contact
 Prof. Dr.-Ing. Detlef Zühlke
 Center for Human Machine Interaction
 E-mail: Zuehlke@mv.uni-kl.de
 Phone: +49 (0)631 205-3570

News in brief

NEWS FROM THE RESEARCH DEPARTMENT KNOWLEDGE MANAGEMENT

Prof. Andreas Dengel has been appointed as the DFKI representative to the steering committee for cross border cooperation with a focus in the area of information systems within the multinational region encompassing Wallonia, Luxembourg, Saarland, Lorraine, and Rhineland-Palatinate.

He has also been elected to serve an additional 4-year period on the ICDAR Advisory Board (International Conference on Document Analysis and Recognition).

The Science Alliance Kaiserslautern elected Prof. Andreas Dengel to serve as vice chairman of the cooperative network.

Prof. Andreas Dengel was the keynote speaker at the annual meeting of the Advisory Board of the German Association for Law and Informatics (DGIR).

Siegfried Wirth, with his article "Semantic MFP" has won the German round of the SUN/Ricoh Java Programming Contest 2007.

The award for "Best Paper" submitted to the Doctoral Consortium of the international ACM SIGIR Conference was presented to Georg Buscher for his paper, "Attention-Based Information Retrieval".

Ralf Biedert, a graduate student working at DFKI Research Department Knowledge Management has won the COGAIN Student Competition on Creative Gaze Award for his work on the "eyeBook" system. The competition focuses on the areas of innovation and accessibility for disabled users as well as on the pure entertainment value. The system functions as interactive book. When certain passages are read, corresponding sounds and images are activated.

NEWS FROM THE RESEARCH DEPARTMENT INTELLIGENT USER INTERFACES

Dr. Michael Kipp received the award for "Best Paper" at the IVA 2007 - International Conference on Intelligent Virtual Agents for his contributions to the realization of natural gestures in animated characters. The winner of the GALA Award, which is also presented as part of the conference agenda was Martin Strauss for his virtual sports reporter ERIC, which he developed at DFKI.

Prof. Wolfgang Wahlster, as Chairperson of the VOICE Awards Jury, spoke the laudation at the Annual VOICE Awards ceremony. This was the fourth time the prizes were awarded under the auspices of VOICE Days at the former parliament building in Bonn. The awards recognize the best German language applications in four categories. The nominations are based on a comprehen-

sive and objective test procedure, which is performed in cooperation with DFKI. As part of the non-competitive agenda at VoiceDays 2007, DFKI displayed the "Ligabot", an anthropomorphic agent that responds, in dialog with the user, to all sorts of questions concerning the First German National League. Ligabot knows the actual match locations, results, next meetings, and the team standings for the current National League Soccer season. Ligabot is a joint development project with the companies, Sympalog Voice Solutions and Charamel.

ARAMIES AND SCORPION FLY HIGH AT THE PARIS AIR SHOW 2007 IN LE BOURGET

The walking robots ARAMIES and SCORPION from the DFKI Robotics Lab were displayed from June 18-24, 2007 at the 47th International Paris Air Show - Le Bourget 2007. Both systems were set up at the ESA Pavilion (European Space Agency) under the motto "L'Europe de l'Espace - Europe in Space", as part of the simulated lunar landscape.

ARAMIES, funded by ESA and DLR, demonstrated its abilities to maneuver over difficult, steep terrain by climbing up and down wall bars having a slope of 70 degrees with ease. SCORPION proved that it can spontaneously adapt to various surfaces and continue its advance without interruption.



ARAMIES and SCORPION at the Paris Air Show

The two robots ARAMIES and SCORPION were specially designed for movement over rough terrain. They are to be employed on extraterrestrial missions when the destinations are beyond the reach of the powered wheel systems of the rovers. Such terrain includes the boulder and debris fields in the canyons and craters of the moon or Mars.

The live demonstrations of the robots were a big hit among the visitors to the ESA Pavilion. Some days when the pavilion was open to the public, the number of interested visitors was so large that the presentations had to be relocated to the outside of the ESA Pavilion.



Publications

WE ARE PLEASED TO PRESENT THE FOLLOWING PARTIAL LISTING OF OUR STAFF'S RECENT SCIENTIFIC PUBLICATIONS

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Saarbrücken Site

The German Research Center for Artificial Intelligence (DFKI GmbH), with facilities in Kaiserslautern, Saarbrücken, Bremen and a project office in Berlin, is the country's leading research center in the area of innovative software technology for commercial application. In the international scientific community, DFKI is recognized as one of the most important „Centers of Excellence“ in the world for its proven ability to rapidly bring leading edge research to commercially relevant application solutions.

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as well as the associated Center for Human-Machine Interaction (ZMMI) (Prof. Dr.-Ing. Detlef Zühlke).

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72 ongoing projects. Project progress is checked once a year by an independent, international group of respected experts. In addition to the BMBF grants for large, joint research projects substantial contracts from business enterprises could also be acquired in 2006. The successful transfer of DFKI research results to functional products is continuing. The DFKI model of a non-profit Public-Private-Partnership (PPP) was positively received at numerous presentations and is often referenced as the recommended structure.

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Deutsches Forschungszentrum für Künstliche Intelligenz
German Research Center for Artificial Intelligence

Kaiserslautern Site

Trippstadter Straße 122

D-67663 Kaiserslautern

Phone: +49 (0)631 20575-0

Fax: +49 (0)631 20575-503

Saarbrücken Site

Stuhlsatzenhausweg 3

D-66123 Saarbrücken

Phone: +49 (0)681 302-5151

Fax: +49 (0)681 302-5341

DFKI-Lab Bremen

Robert-Hooke-Straße 5

D-28359 Bremen

Phone: +49 (0)421 218-64100

Fax: +49 (0)421 218-64150

www.dfki.de

info@dfki.de

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