

Fraunhofer Institut Graphische Datenverarbeitung

# Achievements and Results Annual Report 2007



Achievements and Results Annual Report 2007

Fraunhofer Institute for Computer Graphics Research IGD



IGD, the Fraunhofer Institute for technologies and applications of visualization, interaction and communication in the field of information and communication technology

#### Address

Fraunhofer Institute for Computer Graphics Research IGD Fraunhoferstrasse 5 64283 Darmstadt Germany

Phone: +49 6151 155-0 Fax: +49 6151 155-199 E-Mail: info@igd.fraunhofer.de www.igd.fraunhofer.de



Fraunhofer Institute for Computer Graphics Research IGD is certified according to DIN ISO 9001:2000.



Prof. Dr. techn. Dieter W. Fellner

In a sense, all annual reports are alike: a collection of facts, a com-pilation of the successes, and a ret-rospect of the performances of the previous year. This one, however, is not just the next one in a long se-ries of reports. For me, it is the first annual report after a complete year as director of Fraunhofer IGD.

This report gives me the opportu-nity to take stock. Has IGD achieved the objectives set a year ago? Has the institute successfully started to address the new strategic research challenges? Have the organizational modifications in the institute al-ready born fruit? Do we advance with the expansion of basic re-search?

The annual report 2007 will give you the answers to these questions and I hope that you, too, will agree that Fraunhofer IGD presents very good results.

# Establishing new strategic research lines

To identify new research topics and to develop a new strategy is actually not the most difficult part of the process: it is the adoption of the strategy by each member and living up to it from day to day which makes the success. This is why it is one of the greatest achievements of the past year how quickly the departments adapted to the new research lines. In addition to that, they used the opportunity to reshape their profile and focus on the core competence of the institute, the application of computer graphics in different application areas.

In the process of defining the new research directions, the demand for an increased basic research capacity onsite became evident.

### Expansion of basic research at our Darmstadt location

An essential component of the new strategy of Fraunhofer IGD is the increased emphasis on basic re-search and on close interaction with the researchers of the collaborating universities.

Consequently, two new so-called junior professorships and two post-doc groups were set up at TU Darmstadt last year. The topics of the new research groups include e.g. medicine, visual analytics, visual inference, computing reality, and 3D model retrieval. As a result, the university institute GRIS has become a full-sized institute with an excellent blend of core competences in visual computing making it an ideal partner to support the research lines of Fraunhofer IGD.

#### ... and beyond!

In 2007, IGD started its activities in Graz and was one of the driving elements to establish a Fraunhofer legal entity in Austria. The project team is located directly on the campus of Graz University of Tech-nology, right next to its partner in-stitute CGV.

In Singapore, too, Fraunhofer IGD is preparing the extension of its activities.

#### Changes in the institute

In research institutions diploma the-ses are finished, doctoral candidates are successfully completing their PhDs, and longtime department heads are envisaging new challenges. We cordially thank Daniel Holweg for leading his department so successfully and wish him con-tinued success for his future. At the same time, we welcome Dr. Eva Klien as his successor. With her ex-pertise in the field of semantics she will further develop this subject in her department and at Fraunhofer IGD as a whole.

Regarding organizational aspects, more control has been moved from the level of the institute's director into the departments.

Further to the departments' autonomy, we started to improve the organizational framework within the institute so that cooperation be-tween the different depart-ments/sites would increase and be-come more efficient. With the »De-velopers Day« we have created an-other discussion platform to en-courage a more intensive exchange among our researchers about their work and the identification of possible synergies. Colleagues of all sites presented current project results and discussed the possibilities of a cross-departmental and cross-location usage.

#### Social responsibility

The future of our society lies in our youth, and we as a research institution see ourselves in a responsible role. To cope with this role we ad-vocate events that will fascinate young people giving them an im-pression of innovative develop-ments and future technologies.

To this day, attracting women to the natural and engineering sci-ences with both fields quantitatively dominated by men, is still an unsolved problem. To win more women for our research and work areas and to increase the percentage of women in the natural sciences and professions we opened our demonstration labs in 2007 at the national »Girls' Day«. Young people passionate about and involved in natural sciences do need the adequate opportunity to give room to their ideas and let them jell. In order to create the ap-propriate environment for them to present their ideas we decided in late 2007, together with the two other Fraunhofer Institutes in Darm-stadt, to sponsor the regional con-test of »Jugend forscht« (a young researchers' competition).

#### 20-year existence of IGD

In the course of a year there are, of course, times when you have to put your work aside to celebrate with your colleagues. The highlight of the year certainly was the 20-year anniversary of Fraunhofer IGD we celebrated in August. Many longtime team members and partners came to Darmstadt to ascertain that even after 20 years the ideas have not run short and that the institute has never ceased to produce new exciting developments.

I hope that reading this annual re-port will convince you, too, and that you will be able to gain for yourself creative and innovative ideas for the use of computer graphics.

Dieter W. Fellner Prof. Dr. techn.

#### Preface

The Institute in Profile Computer Graphics Computer Graphics for Pleased Customers Structure of Fraunhofer IGD Fraunhofer Institute for Computer Graphics	<b>5</b> 6 7 10
Research IGD Fraunhofer Institute for Computer Graphics	12
Research IGD – Branch Office Rostock Centre for Advanced Media Technology CAMTech,	13
Singapore Fraunhofer IGD Project Office at the Technical	14
University of Graz Advisory Board	15 18
Research and Development Departments Interactive Multimedia Appliances Virtual and Augmented Reality 3D Knowledge Worlds and Semantics Visualization Cognitive Computing and Medical Imaging Security Technology for Graphics and	<b>19</b> 20 23 25 26
Communication Systems Service Centre SC Interactive Document Engineering CAMTech Fraunhofer IGD Project Office at TU Graz	27 28 29 30 31
Applications	33
Simulated Reality VR. AR. Interaction in (Semi)Immersive Environments	34
and Cultural Heritage Semantics and Geographic Information	42
Systems (2D, 3D, and Mobile) Business Intelligence and Visual Analytics Knowledge Visualization and Visual	46 52
Semantics Management	58
Interactive Document Engineering	64
Usability and Utility Engineering	70
Medical Information Technology	74
IT for Security in Our Society	80
Ambient Intelligence and Ambient Assisted Living	86

2	Dates & Events	93
5	Networks and Cooperation Partners	103
6	The Fraunhofer-Gesellschaft	104
7	Fraunhofer Information and Communication	
0	Technology Group ICT	105
	Participation in Committees	107
2	Customers and Cooperation Partners	108
3	Scientific Publications	113
	Library News	115
4	Papers	116
	Graduations	122
5	Monographs and Series	123
8	Bachelor, Master, Study, and Diploma Theses	123
	Lectures	126
9	Patents	128
20		
23	Contact	129
25	How to Find us in Darmstadt	130
26	How to Find us in Rostock	131
	How to Find us in Singapore	132
27	How to Find us in Graz	132
28	Directory	134
9	Imprint	136
20		

The profile relates Fraunhofer IGD to the definition of Computer Graphics under scientific and economic aspects and defines its position in the research community. This chapter gives an overview of the competencies, locations, and structures of the institute, and answers questions about the history and development of Fraunhofer IGD.

#### **Computer Graphics**

Computer Graphics is a term that has changed with the progress of electronic information processing and is commonly used by a steadily growing number of users. Computer Graphics is constantly finding new application areas and techniques, devices, and methods, and entering all facets of modern society.

Computer Graphics is the technology with which pictures in the general sense (synthetic graphics as well as greyscale and color images) are generated or acquired, managed, displayed, and processed in an application-oriented manner by means of computers, and with which pictures are also correlated with nongraphical application data. The term »Computer Graphics« also implies the computer-aided integration and handling of these pictures synchronized with other data types, e.g., audio, text, and video (multimedia systems), and the advanced dialogue techniques associated with these data types.

The fusion of computers, broadband telecommunication, and entertainment opens up a variety of new applications and services-in industry and business as well as in education, the arts, culture, leisure time, and science. The basis for this innovative change in society is the continuously developing networking of the world. The digital future is coming into existence together with trendsetting technologies such as computer-supported visualization of data, information, and knowledge, with human-centered communication and interaction in intelligent IT environments, as well as with visual, multimedia-based, and multimodal communication.

But despite all dynamics in the area of information and communication technologies, there is a real danger of a digital division of society into »IT literates« and »others«. One of the most important tasks in terms of a productive and balanced community is to enable disadvantaged groups and minorities to participate in the digital future on an equal footing. Neither in the application of software systems nor in the utilization of hardware should the »digital divide« become reality.

The users of modern systems therefore increasingly expect qualified support in their »everyday computer life«. Computers and network infrastructures are going to be usable in a ubiquitous and human-centered (intuitive) way. They are going to be at the user's disposal in any desired location at any time-at home, when traveling, or in the office. At the same time, this increasing mobility requires new possibilities to request information and knowledge via the most diverse media. Tomorrow's IT world therefore also includes a new multimodal form of multimedia.

Within this context, society is currently part of a powerful economic restructuring and adaptation process, and we are facing a major change as this unstoppable evolution requires innovations on all levels. Methods, technologies, and systems are necessary to transform the modern requirements into market-driven, usable products. Parallel test and analysis environments as well as their underlying infrastructures are necessary to guarantee this process. Only in this way is it possible to develop applications and services that satisfy the requirements of the modern information and knowledge society while delivering a reasonable price/performance/benefit ratio. Tests and evaluation of their operability and

usefulness have to be possible at a very early stage, i.e., as early as the development phase (user participation).

In the digital world of tomorrow, new interfaces and forms of humanmachine interaction or communication will come into existence that unite the manifold expectations with regard to these products and the various needs of their user groups. In this process, the computer has to be oriented towards the needs of the human, and not vice versa. Not only disadvantaged groups and minorities will be included, but the cornerstone for the central main idea will also be laid. IT is the new infrastructure and basic provisioning of a modern, human-centered society.

### Computer Graphics for Pleased Customers

It is the ambition of Fraunhofer IGD to supply its customers with adequate and modern means and methods of computer graphics. This can be achieved only on the basis of scientific excellence in strategic research areas, technical know-how, organization in departments and closely acquainted teams, a certified quality management system, and a secure and reliable infrastructure.

#### **Customer Profile**

Computer Graphics is one of the most important components for this development towards a modern information and knowledge society. Fraunhofer IGD takes part in the development of the IT future. It provides advanced technology for success on the market.

By applied research in the area of Computer Graphics, Fraunhofer IGD provides significant support for the strategic development of industry and economy with applied research, in particular for small and medium-sized businesses (service centers). We offer services for all requirements, ranging from large-scale projects to standard products, and from industrial applications to private usage.

The digital division of society shall be prevented by all means. Fraunhofer IGD research shall contribute to this process by developing systems that can be used by everyone.

#### Scientific Excellence

With regard to creativity and research performance, Fraunhofer IGD counts among the leading institutions Europeand world-wide. Fraunhofer IGD belongs to the »best in class«. We do not need to fear our competitors.

The competencies of the institute are the foundations of computer graphics. Its employees contribute general IT competencies and knowledge in various application areas. Cooperations with university partners complete the spectrum.

The research areas of the Fraunhofer Institute for Computer Graphics Research IGD can be condensed to three Research Focus Areas.

#### Semantics in the Modeling Process

Established methods and the process chain in computer graphics are affected by the problem that the preservation of semantics is neglected or cannot be ensured either when generating the model or throughout the whole process chain. Often, highlevel primitives are approximated with triangles and the like too early.

High-quality visualization based on these approximations is a challenge, due to the tremendous complexity of the models. And the interaction with these models cannot meet the precision requirements of a complete virtual engineering process.

In addition to the quality of visualization and interaction, the issue of protection of intellectual property rights and the inhibition of an unrestricted distribution of product details in the context of business relationships between ordering party and supplier attracts notice.

All these issues require a new approach to modeling including a semantic level-of-detail besides the classical level-of-detail.



Scientific excellence, expert craftsmanship and certified quality management as well as a secure and guaranteed infrastructure make a stable basis for pleased customers.

#### Confluence of Graphics & Vision

Looking at the core expertise of Fraunhofer IGD in the broader field of »Visual Computing«, almost all the current challenges in research and industry appear at the interface and in the interdependency of graphics and vision.

Well-known examples are tracking in Augmented Reality and Virtual Reality applications based on computer vision, the vision-based acquisition of object geometry, and also the model-based computer vision which tackles unanswered vision problems by applying computer graphics models.

The international attention on this topic and the industrial impact is demonstrated, for instance, by the recommendation of an international selection group and the following decision of the Austrian Ministry of Transport, Innovation and Technics (BM-VIT) for establishing a new funding line for visual computing.

#### **Generalized Digital Documents**

In the context of classical documents, we address questions which cannot even be worded clearly in the context of multimedia data.

A so-called »thumbnail« might be agreed upon as the »abstract« of an image. But the definition of the »Abstract« of a complex 3D model or a video is not clear in an applicationindependent sense. And while the whole CAE community has long been noticing the tremendous increase of »digitally born artifacts«, i.e., objects completely generated by computers, sustainable concepts for the phrasing of search requests or for indexing these objects are still missing-if not by manually applying keywords to the objects beforehand. The approach was pursued in the beginning. For lack of alternatives, it is still applied when the hours of work for keyword application is not an issue. With the increasing speed of constructing variants, the hours of work for indexing the models will no longer be available. The data will become untraceable.

The problems are not limited to engineering. The Theseus initiative shows that efficient archiving, indexing, and retrieving of multimedia objects is one of the big challenges of information technology. The research focus area will deal with indexing, searching, abstracting, and the phrasing of domain-specific search requests as well as the transport and storage of images, videos, models, and volume data.

#### **Business Areas**

The business areas of Fraunhofer IGD comprise the following fields. They will each be described in a separate chapter.

- Software for Virtual Product Development and Simulated Reality
- VR, AR, Interaction in (Semi)Immersive Environments and Cultural Heritage
- Semantics and Geographic Information Systems (2D, 3D, and Mobile)
- Business Intelligence and Visual Analytics
- Knowledge Visualization and Visual Semantics Management
- Interactive Document Engineering
- Usability and Utility Engineering
- Medical Information Technology
- IT for Security in Our Society
- Ambient Intelligence and Ambient Assisted Living

### Expert Craftsmanship and Certified Quality Management

As the employees of Fraunhofer IGD have excellent qualifications, projects and assignments can be carried out on schedule and in a reliable, professional, and technically accurate way. We work in a motivated and customer-oriented fashion.

Excellent research, development, and further education performance only result from contented and motivated employees, as well as from a cooperative and trustful atmosphere. Fraunhofer IGD builds on its employees' motivation and contentment.

In the institute's quality management system, employees have a sustainable tool at hand, which is visible to the outside as well since it has been certified according to DIN ISO 9001:2000 in December 2005. It contributes to the standardization of the internal processes, and on the other hand secures and increases the quality of our research and development results for our customers.

#### Secure and Guaranteed Infrastructure

The certified quality management system as well as the IT security rules of Fraunhofer-Gesellschaft contribute to the reliability of the infrastructure in two aspects. The research and development performance is supported by an infrastructure group that operates on its part in a customer-oriented fashion. It guarantees short-term and longterm availability of data, equipment, and communication channels. And, it provides for the security of the data, equipment, and customer data, and precludes malicious assaults.

	C		
CERT	<b>FIF</b>	I C	ΑΤΕ
3 243 5	DQS Gmb	н	:72
Deutsche Gesell	hereby certifizierung	t von Manageme e company	ntaystemen
Fraunhofer-Instit	tut für Graphisch	e Datenvera	arbeitung IGD
			Institutated Bostock
Fraunhofer Institut Graphische Dataowirarbeitung	Fraunhoferstras 64283 Darmst	ue 5 adi	Joachim-Junghus-Strasse 11 18059 Rostock
	for the scope	c	
Exec developm	ution of application onen ent projects and custom	ted research and er specific adaptat	ione
	has implemented and r	nantens a	
Qu	ality Manageme	nt System.	
An audit, quality	documented in a report, management system full of the following sta	, has varified that t its the requirement indext:	tris ts
	DIN EN ISO 900	1:2000 dition	
This	certificate is valid until	2009-01-15	
Cen	ficate Registration No.	066765 QM	
Fran	idurt am Main	2005-01-17	
Officers	el u	Her	:6h
IQNet **	1433 Frankat am Man, Augu	t Schure Studie 73	

The Fraunhofer Institute for Computer Graphics Research IGD is certified according to DIN ISO 9001:2000 by DQS GmbH, Deutsche Gesellschaft zur Zertifizierung von Managementsystemen.

#### Structure of Fraunhofer IGD

The figure clarifies the structure of the institute in different research and development departments.

On the following pages, short descriptions of the locations of Fraunhofer IGD are provided. The individual research and development departments present themselves in a separate chapter beginning on page 19.

Are you looking for a contact person for a specific topic or a department? Please take our structuring diagram as an orientation or find your contact in the reports on our business areas.

The personal contact data for the employees responsible are presented at the very end of this publication.

Institute Director									
Prof. Dr. D. Fellner Deputy Director: Dr. M. Unbescheiden									
Darmstadt	Rostock	Singapur	Graz						
Interactive Multimedia Appliances <i>Dr. R. Wichert</i>	Interactive Document Engineering Prof. Dr. B. Urban	CAMTech Prof. Dr. W. Müller-Wittig	Fraunhofer IGD Project Office at TU Graz Dr. E. Eggeling						
Industrial Applications Dr. A. Stork									
Real-time Solutions for Simulation and Visual Analytics <i>Dr. J. Kohlhammer</i>									
Virtual and Augmented Reality Dr. D. Stricker									
Graphic Information Systems Dr. E. Klien									
3D Knowledge Worlds and Semantics Visualization Dr. Ch. Hornung									
Cognitive Computing and Medical Imaging Prof. Dr. G. Sakas									
Security Technology in Graphics and Communication Systems <i>A. Nouak</i>									
Service Center W. Puchtler									

### Overlapping Projects, Labs, Demonstration and Service Centers

- Biometrics Laboratory
- ViPro Demonstration Center
- Enteraction Laboratory
- Firewall Technology Center
- Fraunhofer eLearning Lab
- Fraunhofer Electronic Business Innovation Center
- GIS Laboratory
- XyberScout Laboratory
- Laboratory for Mobile
- Interaction and Applications
- Parallel Visualization Laboratory
- d Applications Virtual Engineering zation Laboratory
  - Visual Analytics LaboratoryVR Technology Laboratory

- Multimedia Development

Workshop

- NextLearningLab

**Research Partners** 

Technische Universität Darmstadt Universität Rostock

Nanyang Technological University

- GIS Services
- IT Security
- Visualization and Simulation
- Network Engineering Training Center

Technische Universität Graz

### Fraunhofer Institute for Computer Graphics Research IGD

Since 1987, Fraunhofer IGD has evolved from a small working group to an institute with eight thematically varying departments in Darmstadt, a branch office in Rostock, an office in Singapore, and a project office in Graz, Austria.

The Fraunhofer Institute for Computer Graphics IGD was formed in 1992 from the Workgroup for Computer Graphics Darmstadt AGD, which was founded by the Fraunhofer-Gesellschaft in 1987. Since its foundation, Fraunhofer IGD has cooperated closely with the Technische Universität Darmstadt. The number of employees has increased, and the expertise spectrum has continuously expanded.

Besides the expansion of the institute in Darmstadt, a new external division was opened in Rostock in 1992. The founding of the Centre for Advanced Media Technology CAMTech in Singapore followed in 1998 and ensured representation in the important markets in Asia. Finally, in 2007, the project office of Fraunhofer IGD in Graz, Austria, was founded.

The spectrum of work conducted by Fraunhofer IGD involves applicationspecific basic research (i.e., algorithmic and system concepts) as well as realization of prototypes of applications and systems (hard- and software) and their adaptation to the specific needs of customers. The research and development activities of Fraunhofer IGD help establish computer graphics in Germany and abroad as a technology, toolkit, and development basis and pursue it and mold it with specific products and methods. Fraunhofer IGD is directed by Prof. Dr. techn. Dieter W. Fellner. In October 2006, he took over this task from Prof. Dr.-Ing. José L. Encarnação, who was director of the institute since its founding. Together, they will be in charge of the Graphical Interactive Systems Department of TU Darmstadt in the future.

Fraunhofer IGD Darmstadt employs more than 100 members of staff in eight areas of operation, who are supported by approx. 250 research fellows. More than 8,000 sqm of offices and labs can be used to process the research tasks.

Fraunhofer IGD Darmstadt is organized thematically into eight research departments.

With this structure and additional departments in Rostock, Singapore, and Graz, the Fraunhofer Institute for Computer Graphics Research IGD is committed to the challenges arising from the use of computers privately, and in industry, commerce, transport, and service sectors.

In all fields, the Fraunhofer Institute for Computer Graphics strives to focus on people as users and help them to simplify and make work with computers and with other people more efficient. The simple and intuitive use of new technologies is the core task of the Fraunhofer Institute for Computer Graphics, which is realized in the form of research and development projects within the single departments.

#### Contact

Prof. Dr. techn. Dieter W. Fellner institutsleitung@igd.fraunhofer.de



Fraunhofer IGD building in Darmstadt

#### Fraunhofer Institute for Computer Graphics Research IGD – Branch Office Rostock

In Mecklenburg-Vorpommern, Fraunhofer IGD has been represented by a branch office with a broad range of topics since 1992.

The branch office Rostock of the Fraunhofer Institute for Computer Graphics Research IGD was opened on January 1, 1992 as one of 19 Fraunhofer Institutes in the New Länder. Twenty-five employees and more than 40 research assistants (five full-time equivalents) work in the institute with an annual budget of €2 million.

Since its foundation, Fraunhofer IGD Rostock has established competencies in the following areas:

- Knowledge Engineering Technologies (i.e., e-Learning and Knowledge Management)
- User Interface Design and Usability
- Emotion Recognition and Adaptive User Interfaces
- Mobile Interfaces and Mobile Assistance
- Game-Based User Interfaces, Game-Based Learning & Training, and Serious Games
- Virtual Reality (VR) and Augmented Reality (AR) applications

A close scientific cooperation is maintained with the University of Rostock.

Fraunhofer IGD Rostock is aiming at the prospective improvement of its position in the national research market. To this end, the institute has recently concentrated its research activities on a more narrowly defined subject area and on selected key branches. These are primarily the key branches of the federal country Mecklenburg-Western Pomerania with regard to their economic potential throughout Germany, the Baltic Region, and the Eastern European countries.

Regional key branches are the maritime industry, tourism, information technology, and software development, as well as agriculture. Additionally, biotechnology and health care, as well as service centers and aerospace, are growing branches which also enjoy strong political support.

Based on its competencies, Fraunhofer IGD Rostock will focus its future research on the subject »Interactive Document Engineering«. Interactive documents are multimedia-based information objects accompanied by texts, pictures, videos, audios and interactive 3D objects. But Document Engineering not only addresses the production of such documents-it also explores their efficient management, and, particularly, their situation- and demand-related supply. Here, an essential subtopic is »Semantic Enrichment of Content« as a basis for the adaptation and demand-oriented presentation of content.

This subject is closely related to some of the main research areas of Fraunhofer IGD, e.g., »Generalized Digital Documents« and »Semantics in Modelling Processes«, and is of special relevance for the target branches maritime and aerospace industry.

Beyond this, we look forward to bringing in our competencies and our new core subject »Interactive Document Engineering« into the service center branch, the health care industry, as well as information technology and software development. In this context, keywords are Interactive Documentation in service centers, Interactive and Adapted Documents such as training plans and service protocols, and Software Documentation and Software-ReUse.

Contact Prof. Dr.-Ing. Bodo Urban bodo.urban@igd-r.fraunhofer.de



Fraunhofer IGD. Branch Office Rostock

#### Centre for Advanced Media Technology CAMTech, Singapore

In 1998, the Centre for Advanced Media Technology CAMTech was established as a joint research and development center of the Fraunhofer Institute for Computer Graphics Research IGD, Darmstadt, Germany, and Nanyang Technological University (NTU), Singapore. Currently, the center is located on the campus of NTU. It represents the expansion into the fastgrowing markets of the Asia-Pacific region. CAMTech is an example of the good cooperation between Singapore and Germany in the areas of education and research.

The center continues to demonstrate the reality of the high level of collaboration in education and technology that exists between Singapore and Germany. These efforts draw upon the strengths of both organizations in the fields of Computer Graphics and advanced media technology to build a center that meets the Asia-Pacific region's demands for R&D, technology, innovation, and training in the fastgrowing and changing IT industry.

CAMTech is to be seen as a link between university-based research and industrial application as well as an international bridge between Singapore and Germany. In the Nanyang Technological University (NTU), listed among the best 20 technical universities worldwide, CAMTech has a partner which is a research-dedicated university with worldwide-reknowned strengths in science and engineering. In particular, CAMTech is closely associated with the College of Engineering, one of the world's biggest technical colleges, and the School of Computer Engineering (SCE) as well.

CAMTech's overall goal is to conduct research and development activities in the broad technology area of advanced media. The focus lies on the realization of applied R&D projects that are relevant to the immediate and future needs of Germany, Singapore, and the Asian region. Close collaboration with the INI-GraphicsNet provides instant access to years of R&D effort and leading-edge technology. The center is contributing to the realization of Singapore's vision of becoming a world-class center of innovative technology with strong R&D capabilities.

The market for CAMTech's products and services includes multinational corporations, local companies and SME's, government departments and agencies, statutory boards and their affiliated companies, as well as educational and research institutions. CAMTech will primarily address the Singapore and Asian markets and will work with INI-GraphicsNet on international projects.

The director of CAMTech is also involved in regular teaching activities at the NTU, including supervising undergraduate and postgraduate research work projects. At the School of Computer Engineering, CAMTech has been significantly involved in the master's program since its introduction. The program yields a Master of Science in Digital Media Technology. In addition, CAMTech facilitates the exchange of students between Germany and Singapore. Each year, CAMTech hosts several students from Germany carrying out their diploma thesis (equivalent to a master's thesis) during their six-month stay in Singapore.

Contact

Prof. Dr.-Ing. Wolfgang Müller-Wittig mueller@camtech.nt.edu.sg



CAMTech on the campus of NTU, Singapore

# Fraunhofer IGD Project Office at the Technical University of Graz

Within the new presence of the Fraunhofer-Gesellschaft in Austria, Fraunhofer IGD set up a project office at the Technical University of Graz.

For the Fraunhofer-Gesellschaft, Europe's largest organization for applied research, Austria is the most important partner for international contract research within Europe. Through an enhanced presence onsite, the Fraunhofer-Gesellschaft wants to expand the successful cooperation to reach new synergies for science.

With the Technical University in Graz, the right partner was chosen. In close cooperation with the Visual Computing Cluster of the faculty of Computer Science, Fraunhofer IGD has accomplished the first step by building up a working group on Computer Graphics. Colleagues of the working group and the Technical University of Graz will work together in academic research projects and contract research for industry. Joint projects and activities strengthen the knowledge transfer between academic and nonacademic research and development.

The location Graz offers a professional environment with highly qualified students and scientific employees. In seven faculties with over one hundred institutes, scientists do research and development at the highest level. With 2,400 employees the Technical University of Graz is also one of the largest employers and a motivating force for the region. Excellent contacts to industry and economy are reflected in the collaboration with numerous competence centers and research networks. Cooperations with scientific partner institutions serve as the driving force for further success.

Contact Dr. rer. nat. Eva Eggeling eva.eggeling@fraunhofer.at



Project Office on the Campus of TU Graz

The Institute in Numbers

The development of the institute over the years is best documented in the budget and staff charts.

The personnel and financial development of Fraunhofer IGD, its institute section in Rostock, and its office in Singapore have further stabilized. A total of 148 staff members were administered in Darmstadt, Rostock, and Singapore, resulting in a costeffective quota of 131 staff years. The personnel is distributed to the locations by 78 percent in Fraunhofer IGD Darmstadt, 15 percent in Fraunhofer IGD Rostock, and 7 percent in Camtech, Singapore.

According to the plans, capacity is expected to increase by 5 percent in 2008.

Additionally, external staff members (research assistants, student assistants, guest researchers, and trainees) were employed at the respective institutions, corresponding to 49 full-time equivalents in 2007. In 2007, the sum of the operating budgets amounted to 14.9 million euros. Eighty-one percent thereof went to Fraunhofer IGD in Darmstadt, 13 percent to the branch in Rostock, and 6 percent to CAMTech in Singapore. According to plan, in 2008 the sum of the budgets with 17.3 million euros should follow the stabilized economic basic condition as well as the new alignment of the institute.







Development of staff contingents at the Fraunhofer IGD locations

Development of cost-effective capacity at the Fraunhofer IGD locations

Development of part-time staff contingents at the Fraunhofer IGD locations

The budget of Fraunhofer IGD in Darmstadt is financed by 63 percent from external revenue and by 37 percent from basic funding of the Fraunhofer-Gesellschaft. The main part of external financing comes from the industrial sector, with approximately 25 percent, as well as from EC, with about 24 percent. The revenues from national public projects amount to about 12 percent. The development at Fraunhofer IGD Rostock shows a slight decrease in 2007. The share of basic funding amounts to 19 percent. To the external funding, industrial revenues contribute 23 percent, EC projects about 3 percent, and projects with national public funding about 48 percent.







Total budget development at the Fraunhofer IGD locations

Financing structure of Fraunhofer IGD Darmstadt

Financing structure of Fraunhofer IGD Rostock

#### Advisory Board

The Advisory Board of the Fraunhofer Institute is an important advisory group for matters concerning the research orientation and any structural changes to the institute.

The advisory group is comprised of the Executive Board of the Fraunhofer-Gesellschaft and a selection of well-known representatives of science and business.

Chairman Dr. rer. nat. Hans-Peter Kohlhammer KPC Kohlhammer & Partner Consulting

Assisting Chairman Prof. Dr. Reiner Anderl TU Darmstadt

Prof. Dr. techn. Horst Bischof TU Graz

Ekkehart Gerlach deutsche medienakademie köln GmbH

Prof. Dr. Markus Gross ETH-Zürich

Prof. Dr. rer. nat. Andreas Heuer Universität Rostock

Alfred Katzenbach Daimler AG

Professor Dr. rer. nat. Reinhard Klein Universität Bonn

Dr. Gunter Küchler Lufthansa Systems AG



Advisory Board after the annual meeting on December 12, 2007

Dr. Ulrike Mattig Hessisches Ministerium für Wissenschaft und Kunst – HMWK

Dr. h. c. mult. Hartmut Raffler Siemens AG

Gerhard Rauh Xchanging Transaction Bank GmbH

Prof. Dr. Bernt Schiele TU Darmstadt

Dr. h. c. Otto G. Zich Past Chairman & CEO Sony Europe

Central Advisory Contact Volker Tippmann Fraunhofer-Gesellschaft

01

The Fraunhofer Institute for Computer Graphics Research IGD has a total of 12 research and development departments at the different locations. The following pages introduce the fields of activity of the research departments, their expertise, and their key aspects in development and research.

00

Õ

10

0

0

0

0

0

0

C

С

#### Interactive Multimedia Appliances

Under the term »Ambient Intelligence« (Aml), the department »Interactive Multimedia Appliances« pursues the vision of an environment proactively and intelligently adapting to the needs of the people moving about in it and supporting them.



Dr.-Ing. Reiner Wichert reiner.wichert@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a1

#### Ambient Intelligence

Ambient Intelligence is understood as the provision of individualized information and assistance by miniaturized electronic equipment as well as networked services. Aml thus designates a new paradigm of interaction between the actors and their environments. It serves to enable people to handle a greater variety and multitude of technology and interact with it more easily. Possible application areas are production, service and maintenance, habitation, office, emergency assistance, leisure activities, games, logistics, car and traffic, as well as health assistance.

In the foreground is the combination of approaches from the fields of hardware, software, and human factors, which are among the core competencies of Fraunhofer IGD. Thus, AmI opens up new markets for products and services.

#### Ambient Assisted Living

Ambient Assisted Living (AAL) is considered as one of the most promising domains of AmI, concentrating on the support of people with special needs. Health and demographic change will be commanding challenges for our society in the years to come. Especially health aspects of a population increasingly getting older play a significant role. Here the focus lies on the rehabilitation, the prevention, and the maintenance of autonomy of patients, persons in need of care, or handicapped persons, but also on the supply of comfort functions and user support in the fields of habitation, home care, and office environments.

#### System Concepts

Fraunhofer IGD pursues these aims by developing an integrated system concept:

- Inclusion of contactless intuitive and multimodal interaction
- Provision of distributed SW infrastructures for spontaneously networking systems for the generation of self-organizing device ensembles
- Acquisition of semantic context information by monitoring techniques
- Use of knowledge-based systems for deriving appropriate assistance strategies
- Development of assistance systems including sensors and actuators

Future systems must be able to assure this process chain of ambient intelligence so that the required quality and efficiency of future assistance systems are allowed for. For this aim, it is reasonable and necessary to involve the industry and the user groups in the product development from the very beginning. Dr. Wichert is also pursuing this aim as spokesman of the Fraunhofer Ambient Assisted Living Alliance.

#### Industrial Applications

The interdisciplinary team of the department »Industrial Applications« is developing software supporting the different stages of the product development process with state-of-the-art virtual and augmented engineering technology.



Dr.-Ing. André Stork andre.stork@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a2

The pursuit of better and better products in shorter and shorter development cycles is the mainspring for the development of software supporting the product and production development. The interdisciplinary team of the Industrial Applications department is developing solutions (innovative softand hardware) supporting the virtual product development process with state-of-the-art computer graphics technology.

The focus of the business field »Software for Virtual Product Development and Simulated Reality« is mainly on computer-supported product development, i.e., Computer Aided Design (CAD) and Computer Aided Engineering (CAE). Among the most important tasks are visualization, data management, information and knowledge management, as well as all areas of construction analysis and simulation. The department is developing software, i.e., the tools to support these product development tasks as successfully as possible.

The application areas of these developments are both those of end customers, using this software for product development, and of software providers, distributing the developed software to end customers. The main industrial focus is on the automotive industry and subsuppliers, but also in the architecture and construction industry more and more application areas are opening up. In the future, we will continue to provide all product developers with the tools for an efficient product development. The target group basically includes all product developers working with development software including industrial design, automotive design, and many other engineering and simulation disciplines,

such as crash simulation or simulation of aerodynamics in the aerospace industry.

Technologies like modeling, interaction, visualization, rendering, and mixed reality in styling (CAS), construction (CAD), and engineering (CAE) help to optimize processes and to make products more innovative. Interaction of visualization and simulation/optimization (simulated reality), knowledge management in engineering and design, as well as cooperative applications are further methods for improving virtual product development processes.

### Real-time Solutions for Simulation and Visual Analytics

Large amounts of multidimensional data, and physically based simulation, such as textile simulation, are challenging efficient manipulation and visualization. This makes them a topic for the »Real-time Solutions for Simulation and Visual Analytics« department.



- Interactive visualization of very large amounts of multidimensional data
- Textile and physically based simulation
- Adaptive transmission, visualization and efficient rendering of 3D data

Our current applied research projects cover:

- Visual Analytics
- Virtual Prototyping of Garments
- Adaptive Transmission and Visualization of large amounts of 3D data on mobile devices

#### **Visual Analytics**

A major part of our research efforts is focused on the research topic of Visual Analytics. It denotes the interactive processing and visualization of very large, complex, and multidimensional amounts of data and information. The basic idea is to interactively present the data in a visual form, allowing the user to get insight into the data, draw conclusions, and directly interact with the data. We develop technologies that can fulfill the processing demands for such large amounts of data. These technologies are in particular targeted at the financial industry and various industries in the area of business intelligence.

#### Mobile High-End Graphics

Our mobile technology TRAVO offers real-time transmission and interactive visualization of 2D and 3D graphics on various mobile device types. It enables mobile applications to display high-end real-time graphics on mobile devices, e.g., smartphones or PDAs, without being restricted by the processing capacity or the operating system of the specific mobile device. This technology can be used for various mobile applications, such as mobile business applications or mobile gaming.

#### Simulation and Virtual Prototyping

Virtual prototyping is one of the currently most industry-relevant applications of visualization and interaction. Within this field, our department focuses on textile simulation that is currently marketed and further developed in collaboration with a major industry partner. This technology is capable of a real-time simulation of the garment fit around a virtual avatar in a virtual try-on scenario supported by a realistic rendering system. Please contact us for further information or to make an appointment for a demonstration of our technologies.



Dr.-Ing. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a3

#### Virtual and Augmented Reality

If you are interested in application-oriented research work, product-mature software solutions, and customer-specific services, the department »Virtual and Augmented Reality« is available as technology and competence partner for the following areas:

- Realistic Rendering,
- Virtual Reality (VR),
- Augmented Reality (AR).



Dr.-Ing. Didier Stricker didier.stricker@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a4

The services offered by the department comprise the development of software systems in the fields of virtual and augmented reality, the integration of innovative hardware and software technologies, the prototypical implementation of new application concepts, and consulting for the practical use of innovative visualization solutions. The department focuses on the following three topics:

- Realistic and verifiable rendering: The aim is to secure the photometric correctness of VR and AR visualizations. This includes a calorimetric and geometric record of the real world, image synthesis and hybrid rendering based on ray tracing and shaders as well as the rendering on calibrated displays. This technology is especially important for the automotive industry (design review) and media production.
- Real-time integrated simulation: The VR system is not only applied as visualization software but comprises numerous simulation components. This includes physical simulations and the description of complex behavior (e.g., virtual avatars).
- Context-sensitive augmented reality: Augmented reality is beginning to emerge in industry as a promising technology. Further developments must focus on the user and give more attention to the real environment. Thus the AR system will automatically adjust to different basic conditions and provide the user with the adequate contextsensitive information. The technical challenges lie in the realization of markerless tracking, scene analysis, and information filtering. Contextsensitive AR is a substantial link of visualization solutions to technologies from the field of ambient intelligence.

The software developments are integrated into the mixed-reality system »Instant Reality« (www.instantreality.org) and saved for the longterm application. The developed software systems are, for example, used in the following application areas:

- Automotive and mechanical engineering, shipbuilding: The topics of this field are AR-supported maintenance, photorealistic real-time rendering, assembly, mounting, and lighting simulation. Model projects are the tiled VR projection system »HeyeWall« (www.heyewall.de) or augmented reality for maintenance (www. arvika.de, www.artesas.de, www.vivera.org).
- Exhibitions and museums: For this purpose, mobile information systems for the presentation of cultural heritage and historical reconstructions as well as VR-based museum exhibits are developed.
  Projects are, e.g., AR Telescope (www.ar-telescope.de) and iTacitus (http://itacitus.org).
- Medicine: VR and AR technologies are developed for surgical training and computer-based therapy. Here especially the »Taurus Necktrainer« project (www.taurus-necktrainer.de) has to be mentioned.

#### Graphic Information Systems

The work of the »Graphic Information Systems« department is under the motto »Efficient cooperation and successful communication using spatial information«.



Dr. rer. nat. Eva Klien eva.klien@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a5

The focus of the department is on the areas of spatial data infrastructure, 3D GIS, and mobile use of geographic information. The cooperation includes the exchange of geographic information across different limits of applicability. The particular aim is to make the data once acquired available for use in different application areas, in different contexts, at different aggregation levels, and for different end devices. The communication domain includes the presentation of geo-information for the user. To this end, the geographic information provided for an application domain is collected from different sources, integrated, and processed for an optimal presentation in view of the user and his intentions.

As for the strategic development of the department, we can say that the greater part of the executed projects and services focused on the core area spatial and metadata and spatial data infrastructures, increasingly including projects around the special area 3D geo-information. The special field of mobile use of geographic information has been strategically realigned, and now aims at general access to spatial data under special, limited conditions.

In addition to publicly funded research projects, the department generally addresses public facilities and their suppliers, the users of public data, and information providers. In 2007, the majority of the projects were directly or indirectly executed for public authorities. The main focus was on the utilization of the existing know-how in consultancy and service projects. Since the end of 2006, the department has pursued and advanced technological developments for the conception and use of spatial data infrastructures, especially in the Humboldt project with Fraunhofer IGD as project coordinator.

In the project GDI-WSV executed in 2007, the focus was on the introduction of a use-driven spatial data infrastructure. Furthermore, the exchange of expertise in the field of spatial data infrastructures has been intensified on an international level with the research network eSDI-Net+ started in 2007.

Based on the existing know-how and the experiences in the area of 3D GIS, different projects and services were carried out in 2007. The services data processing and visualization were encapsulated on our own technological basis of the CityServer3D, leading to different projects. Furthermore, the expertise resulting from the utilization of the CityServer3D technology could successfully be used in consultancy and implementation projects. The technology has continuously been further advanced, especially in the Net-Connect project started last year and, based on a diversification of the customer structure in the 3D GIS domain also started last year, by a more focused orientation of the technological developments.

#### 3D Knowledge Worlds and Semantics Visualization

In 3D Knowledge Worlds, heterogeneous networks of people communicate with each other and perform knowledge-based activities. Based on innovative visualization techniques, the relation between the concepts involved can be presented, visually edited, and semantics annotated to raw data.



Dr.-Ing. Christoph Hornung christoph.hornung@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a6

The core competencies of the department »3D Knowledge Worlds and Semantics Visualization« are in the areas of e-learning management systems, client/server architectures, Web architectures, rich Internet applications (RIA), and game technologies. The basis of these competencies is the profound know-how in the areas of object-oriented software design, Java, XML, Flex- and Flash-Technologies.

The department is actively involved in industrial projects as well as in Europewide research projects. One main competency is the development and deployment of large scale commercial e-learning platforms with thousands of online users.

#### 3D Knowledge Worlds

3D Knowledge Worlds combine virtual multi-user worlds with innovative Web 2.0 techniques like social networks. These groups of people communicate and perform knowledge-based activities. Fraunhofer IGD will broaden this field through the integration of semantic Web technologies, herewith leading to »eKnowledge 3.0«, and by the integration of consumer game consoles.

#### Semantics Visualization

Semantic structures, as described by ontologies, highly structured and interconnected schemas, as well as large sets of multimedia data, are the material to be visualized. In addition, semantic structures consist of schemas and instances. The department concentrates in this field on the concept »visual semantics management«, an integrated suite for the visualization, navigation, editing, and annotation of semantics. Another import research focus in this area is the development of adaptive systems, supporting aspect- and role-specific views as well as the usage of low-cost game environments.

The research foci of the department contribute to the research lines of Fraunhofer IGD as follows: in »Semantics in Modeling«, visualization techniques will be developed that allow the presentation of meaning and the semantic relation between different modeling artifacts. In »Generalized Digital Documents«, concepts for the visual management for the integration of machine-extracted semantics as well as manual-edited semantics will be developed.

The »3D Knowledge Worlds and Semantics Visualization« department is the leading research and development partner in the business area »Knowledge Visualization and Visual Semantics Management«. Target branches are the education and training as well as human resource management. Target groups are enterprises and organizations having large un-structured data sets that need to be structured and semantically annotated. The corresponding industry includes banks, insurance companies,, IT, and production companies.

## Cognitive Computing and Medical Imaging

The »Cognitive Computing and Medical Imaging« department is working on innovative technologies and prototypes using state-of-the-art methodologies from digital image processing and computer vision. One of its main goals is the extraction and processing of image-based information in different application contexts. The main targeted business areas are medical imaging, industrial image processing, as well as digital broadcast and media.



The main R&D topics of the department are:

- Medical Imaging
- Telemedicine
- Dental CAD
- 3D Reconstruction
- Multimedia Processing

There are different areas in the medical imaging domain that are addressed by the department, including applications from cardiology, cancer treatment, dental CAD, as well as telemedicine. The main motivation for the development of new, innovative prototypes in this domain is to support medical practitioners in the process of planning, simulation, and navigation in clinical surgery.

The department's dental CAD software covers a broad range of functionalities: Starting from the automatic detection of preparation lines (also for inlay preparations), to the construction of full crowns, tooth caps, inlay reconstructions, bridges/bridge frameworks with up to 14 elements, telescopes, and even database software for handling patient and teeth data in the lab.

In the area of 3D scanning and reconstruction, the main focus is on surface inspection but also more and more on surface reconstruction. The goal here is to minimize the acquisition and processing time using a fully automatic scanning approach based on a software-controlled robot.

The Media Systems Group is focusing on various applications based on the creation, semantic analysis, as well as consumption of multimedia content. In recent years, the research group has worked on tools and technologies in the area of multimodal semantic content analysis, visual information retrieval, as well as immersive video environments, where the potential of array-based processing has been exploited to provide an advanced media experience.



Prof. Dr.-Ing. Georgios Sakas georgios.sakas@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a7

### Security Technology for Graphics and Communication Systems

The department »Security Technology for Graphics and Communication Systems« is doing research in the field of security technology in information technology, especially in the context of computer graphics and its applications. For this aim, we are continuously developing and extending competencies to assure a sustained reliability, integrity, and confidentiality of graphics and communication systems at any time.



Alexander Nouak alexander.nouak@igd.fraunhofer.de www.igd.fraunhofer.de/igd-a8

Security in this capacity means that resources and systems are in a state free of risks and undesirable influences, providing protection against attacks and risks, and assuring a sustained reliability, integrity, and confidentiality at any time.

The department has identified the following subject areas as being of particular relevance:

- 3D face recognition
- Protection mechanisms for biometric data
- Simulation and automated analysis of human behavior

The subject biometrics has gained in importance in recent years not least due to the modified Passport Act and the inclusion of digital biometric identification properties. Nevertheless, numerous security-relevant areas can still be identified, justifying further research work. So the issue of aliveness detection remains, to a large extent, unresolved. Also, the protection of the reference samples in biometric systems (template protection), as well as the inclusion of depth information into the face recognition system have only recently been established as research topics.

Being an independent research institution, Fraunhofer IGD is the ideal contact for interested parties from the industry as well as from the press complying with the growing information need. This is why a demonstration center has been opened, equipped with a great number of devices of different producers, giving visitors the possibility to inform themselves of the functionality and the performance of the biometric technology. The active participation in the standardization bodies both on a national (DIN) and an international level (ISO/IEC JTC1 SC37) and the significant involvement in the formulation of the »Evaluation Criteria for Biometric Systems« of the BSI (Bundesamt für Sicherheit in der Informationstechnik, Federal Office for Security in Information Technology) speak in favor of Fraunhofer IGD as the ideal partner for testing biometric systems.

The increasing number of existing monitoring cameras is already allowing a belated analysis of critical events, including accidents, attacks, or criminal acts. The aim of surveillance scenarios must, however, be to detect such situations in time, to categorize them correctly, and to take the appropriate actions. This can be the prosecution or thwarting of a crime by a timely intervention of the public security forces but also the prevention of a crowd panic in a stadium by an early opening of the security gates. This topic adds to the application area of biometric recognition systems and has thus given rise for the department to develop new competencies.

The department considers the areas of mobile security and information assurance as an important service area for the support of diverse in-house projects. Due to the increased performance of the data networks and visualization systems, computer graphics plays an increasing role in communication systems. The distribution of highly sensitive visualization data requires a greater focus on the security of the data communicated in networks, whether in mobile ad-hoc networks or in ubiquitous computing.

#### Service Centre SC

The Service Centre offers central services for the institute. This not only includes the securing of the IT operation and the infrastructure but also a participation in projects of the research departments. Due to the highly qualified staff and the proven expertise in some areas, the SC also offers services throughout the Fraunhofer-Gesellschaft.



Wolfgang Puchtler wolfgang.puchtler@igd.fraunhofer.de www.igd.fraunhofer.de/igd-sc

The SC operates the infrastructure of Fraunhofer IGD. The spectrum of covered responsibilities ranges from building services to the receipt of goods and the operation of the telephone system to complex IT subject matters.

Special competences have been acquired in the field of the management of local networks and video conferences. From the planning and installation to the monitoring of the operation flow, there is an in-depth know-how made available to the entire Fraunhofer-Gesellschaft. This is done through the competence centers CC-LAN and CC-Video (see below).

Within Fraunhofer IGD, the SC is closely cooperating with the research departments. This especially applies to the IT security domain, where we are jointly advancing the development of a test laboratory.

On the level of operation systems, the SC has increasingly developed their expertise in the field of virtualization and cluster technologies to be able to meet the requirements of the research departments. This is especially true concerning the know-how in the areas of simulation and visual analytics, interactive visualization of great amounts of multi-dimensional data, as well as high-quality rendering.

The administrative processes are supported by the adoption of a new document management system allowing a support of the electronic workflow processes. Especially the redevelopment of the PKI (public key infrastructures) allows replacing paper-based processes.

This all is due to the marginal conditions of the Green-IT: Reduction of the energy input by virtualization, creation of synergy effects by optimal resource utilization, and a minimal energy input. Optimized energy concepts for the air-conditioning of the computer rooms are also a focus of the current work of SC.

#### Competence Centre CC-LAN

The special competencies in the field of LAN are:

- Systems for recording the operating status, an automatic evaluation, and a long-term analysis
- Design of WLAN networks
- Configuration and start-up of firewall and security appliances

The CC-LAN is jointly operated by Fraunhofer IGD and Fraunhofer SIT.

#### Competence Centre CC-Video

The Fraunhofer-Gesellschaft maintains an all-encompassing network of video conference systems. The CC-Video has the central task to maintain these systems, to advance them, and to provide the necessary infrastructure for the execution of multipoint telephone and video conferences. The CC-Video is an institute-spanning institution of Fraunhofer IAO and the IGD.

#### Interactive Document Engineering

The main focus of research at Fraunhofer IGD Rostock addresses the development and application of technologies for the production of multimedia-based documents and for their situation-related supply in the working process. »Interactive Document Engineering« supports modern concepts of an Interor intranet-based knowledge infrastructure. Actual challenges are the development of mechanisms for the detection of semantics in digital documents and, resulting from that, for the semantic processing of multimediabased documents up to automated reasoning.

In its latest R&D projects, Fraunhofer IGD Rostock focuses on the application field e-Learning and Knowledge Management and, on the other hand, the technology field Usability and Assistive Systems. Both fields are represented by IGD's two main competence ranges.

# Knowledge Engineering Technologies

The central subject of the competence range »Knowledge Engineering Technologies« is teaching and learning with the Internet and means of new media. In this context, we develop procedures and tools for open learning environments, educational offers, or even quite concrete contents. They are aligned with the respective personal learning demands and, via Internet, the user has free access to them, anytime and anywhere. Research in this competence range is conducted by our interdisciplinary team of computer scientists, pedagogues, and designers. In different projects, they develop and apply new technologies and concepts for learning and teaching with means of digital media, for the computerbased handling of information and knowledge, as well as for the systematic development of learning and knowledge contents or educational offers.

#### Usability and Assistive Technologies

The central subject of the competence range »Usability and Assistive Technologies« is the development of perceptive and affective applications which support people in their job or in their spare time. For this purpose, we develop innovative technologies and methods in the area of User Behavior Tracking and Analysis which enable us to draw reliable conclusions for current applications. Subsequently, the results are used for the development of affective and perceptive applications. With the methods of Usability Engineering and User-Centered-Design, we ensure the development of user-friendly applications. Furthermore, we extend the model of User-Centered Design to support the development of adaptive and perceptive applications.



Prof. Dr.-Ing. Bodo Urban bodo.urban@igd-r.fraunhofer.de www.igd-r.fraunhofer.de

#### CAMTech

The focus of the research and development activities of the Centre for Advanced Media Technology in Singapore is on the integration of complex, computationally intensive simulation worlds with interactive, high-quality visual 3D real-time environments.



- Modeling and animation
- Real-time rendering
- Scientific-technical visualization
- Virtual and augmented reality
- Scientific computing (GPU, Cell, Cluster, etc.)

Some of CAMTech's current research projects are, e.g.:

- Rapid-prototyping environments for cockpit design
- General purpose computation on GPUs (GPGPU) for solving computation-intensive problems from the life sciences
- Visualization of micro-, meso-, and macro-scale circulation and climate models

#### **Real-time Rendering**

CAMTech especially contributes to Fraunhofer IGD's research line >Mutual Impact of Graphics & Vision< with its expertise in the real-time rendering engine OpenSG. The advancement of the portable scene graph system OpenSG (www.opensg.org) is one of the R&D focuses of CAMTech. Furthermore, CAMTech has successfully used OpenSG as a general purpose rendering engine for its projects for many years.

In this realm, the change of paradigms that can presently be seen in the graphics hardware domain and the constantly growing data flood require a re-evaluation of existing concepts, data structures, and algorithms. Challenges in this field are, e.g., the provision of new data structures for the representation of geometries as well as the development of new algorithms for the exploitation of current parallel architectures. These aspects will be allowed for in the next-generation real-time rendering engine.

#### Scientific Computing

The programmability and performance of today's graphics hardware also allows the computation of non-graphic algorithms by means of graphics cards. For years, CAMTech has been working in this field (GPGPU) to use the rapidly developing graphics processing units (GPUs) for the processing of general computation-intensive processes. It could be demonstrated, e.g., that relevant algorithms from bioinformatics could efficiently be displayed on graphics hardware. In this way, bioseguences can be processed many times faster and similarities can be observed. Besides graphics processors, other modern processor architectures (e.g., Cell, Many-Core) are analyzed and evaluated with respect to their performance.



Prof. Dr.-Ing. Wolfgang Müller-Wittig mueller@camtech.ntu.edu.sg www.camtech.ntu.edu.sg

### Fraunhofer IGD Project Office at TU Graz

Building a link between simulation and high-quality visualization is the basic idea behind the development of skills of the emerging Fraunhofer Group in Graz. The project group at TU Graz will focus in particular on establishing and strengthening the following competencies:

- Physical-based Modeling and Simulation
- Integrated Simulation Environments
- Analysis and Visualization of Scientific Data

Each of these issues will be enriched in a natural way by the existing visual computing know-how at TU Graz, in particular in the areas of computer graphics and knowledge visualization. Combining simulation and visualization helps to open up high-quality markets and application areas more easily and more effectively.

Since the automotive sector is strongly developed in Graz and Styria, the project group will concentrate on technology development skills, which are most attractive for this sector.

Together with partners from academia and non-academic institutions, the group will approach the Austrian entrepreneurship to support the technology transfer in the region by close cooperation projects.



Dr. rer. nat. Eva Eggeling eva.eggeling@fraunhofer.at www.igd-g.fraunhofer.at

Research and Development Departments

### Applications

The Fraunhofer Institute for Computer Graphics is structured thematically in ten Business areas. They cover the core competencies of the institute and reflect the scientific and technological know-how of the institute. The following pages show the activities of the research departments, their competences as well as their developments and research projects.

A C. St. Martin Constant of the State of the

### Software for Virtual Product Development and Simulated Reality

Product development and the development of production methods continue to be the driving force in an economic world shaped by the change from an industrial society to a knowledge and service society. The pursuit of better and better products in increasingly shorter development cycles is at the same time the mainspring for the development of software supporting product and production development.

The internal processes of today, both in the development domain and the management domain, are shaped by a great number of computer-based applications, such as CAD, CAE, DMU, PLM, CRM, ERP<sup>1</sup>, Digital Factory, etc. In spite of the remarkable progress achieved within recent years in software support, the field of product and production development continues to be of strategic importance for research and development activities, especially in view of the following questions and their integration:

- Interaction and modeling
- Visualization, simulation, and optimization
- Cooperation and mobility
- Information and knowledge management

The use of these technologies in the different stages of the product development process and a cross-stage approach are of vital importance in efficient and effective product development.

#### Contact

Dr. André Stork andre.stork@igd.fraunhofer.de

<sup>1</sup>Computer Aided Design, Computer Aided Engineering, Digital Mock-Up, Product Lifecycle Management, Customer Relationship Management, Enterprise Resource Planning
## FunctionalDMU

Digital MockUps (DMU) serve to secure overall product concepts concerning geometry. FunctionalDMU is their extension by behavior models, allowing early physically based simulations.

Today, products are shaped by mechatronic components, where software runs on electronic units and controls mechanical processes. Products becoming more and more complex and growing competitive pressure are leading to the use of most different simulation tools for securing product features by Digital MockUps (DMU) at a very early stage. For the following domains, a great number of special simulators are employed:

- Mechanics and its subdisciplines, e.g., hydraulics, pneumatics
- Electronics
- Software

The virtual securing of mechatronic products requires an integrative simulation of product properties across the domains. What is missing is a platform allowing the inclusion of different simulators from the mechatronic disciplines and the ability for them to communicate with each other. The Digital MockUp technology for securing overall product concepts presently shows the following restrictions:

- The technical realization of DMU is restricted to geometric questions;
- DMU does not simulate functions of software control and electronics;
- Often they are not based on physically based behavior models in animated simulations;
- It lacks support of an early integratively mechatronic simulation;

- In part, the domains are not integrated before the physical stage.

For these reasons, the Fraunhofer-Gesellschaft has started an initiative with four institutes from the fields of mechanics, electronics, (embedded) software, and visualization, working together to overcome the above-mentioned restrictions.

The basic approach of »Functional DMU« lies in an extension of DMU (Digital MockUps) around behavior models that can exist in different modeling languages for different simulators such as SimPack, Dymola, Matlab/Simulink, AdvanceMS, and Rhapsody.

Objectives and advantages are:

- To make development processes more efficient and significantly faster;
- To extend DMUs by functional aspects;
- To develop interdisciplinary integration tools;
- Possibility to quickly »experience« the system behavior.

Besides a FDMU framework presented in the following, an introduction methodology is also being developed.



Methodic approach to the Functional DMU

# FDMU Framework and Runtime Environment

Challenges are:

- Variety of the tools, data formats, interfaces,
- Usability and acceptance,
- Performance of the co-simulation.

The FDMU framework features the following draft decisions:

- Service-oriented architecture (implementation in the form of Web services)
- Producer independence



Challenges of FunctionalDMU [FunctionalDMU Challenges in English?]

- Openness to extensions and use of different programming languages
- Network-transparent distribution of services

The runtime environment consists of three major components:

- Simulation bus and master simulator
- Simulators and wrappers
- Interactive visualization

FDMUs can be used in many application scenarios, e.g.:

- Development of sunroofs
- Machine tools
- Satellite systems
- Mechatronic chassis components

### Application Scenario Electric Window Lifts

A scissor mechanics maneuvers a car door pane. It is driven by an electric motor via a gear mechanism. An engine control unit (ECU) determines the motor voltage and controls the motor current. If it goes beyond a threshold value, the control unit disconnects the voltage. Furthermore, the ECU gets a signal from a switch (feel-



The runtime environment of a FDMU application scenario



Electric window lift scenario

er) for opening and closing the windows. The signals are evaluated in the ECU by the software.

The realization of this scenario is carried out by means of three conceptually different simulators:

- The control software runs as compiled code.
- The electric engine is represented in its behavior in Modelica. The Modelica model has been compiled with Dymola.
- The mechanic model has been constructed in SimPack. Previously, simulation results were generated and stored in tabular forms.

The user can check whether the overall system and each single component behave as expected. He can, e.g., examine:

- How fast the window is moving;
- Whether the window is still functioning with different friction coefficients;
- How the torque runs at the motor axis;
- What the intensity profile of the current is in the course of time.

Contact Dr. André Stork andre.stork@igd.fraunhofer.de

### Im Wissensnetz – Networked Information Processes in Research Groups

So far, classical (process-oriented) knowledge management approaches have been used in very few cases. The main reason for this is, on the one hand, the high variability of scientific work processes and thus the hardly predictable knowledge needs and, on the other hand, the fact that structures in research, such as a shared vocabulary, are always just in the process of formation.

The project »Im Wissensnetz« (In the Knowledge Network), funded by the BMBF (German Federal Ministry of Education and Research), aims at supporting efficient interdisciplinary knowledge value creation processes by means of an eScience Semantic Desktop.

On the basis of the application domain »Rapid Prototyping«, methods and tools were developed based on semantic technologies supporting knowledge value creation processes and making them more efficient: social network platforms, collaborative ontology



Indexing of a local document by applicationintegrated annotation interfaces. The document can be downloaded and viewed by other researchers using a collaborative file sharing protocol.

development and annotation tools, as well as cooperative search surfaces, each supported by »intelligent methods« running in the background as, e.g., for the identification and advancement of communities. These methods and technologies are bundled in a social semantic desktop that is especially in line with the needs of researchers supporting their activities like literature research, annotation of different resources, but also the development of shared vocabularies. The focus is especially on the integration into the working processes of the different researchers, e.g., by an application-integrated annotation method often neglected by existing technical approaches.

Contact Neyir Sevilmis Neyir.Sevilmis@igd.fraunhofer.de



Context-based ontology visualisation as decision support for the selection of suggested concepts

# Extension of the »Immersive Module« of RTT (Realtime Technology AG)

»DeltaGen« supports professional users in processing complex 3D data for the real-time visualization in highend quality for fixed images and videos. The software will be extended by elements of virtual reality up to the »Mixed Mock-up«

The software »DeltaGen« of the Munich company RTT addresses professional users supporting the processing of complex 3D data for a real-time visualization in high-end quality. In addition to geometric processing, data can also be provided with high-value visual effects and be staged in a real environment.

The user can in a very simple way define animations and different model versions and render high-resolution images, videos, and interactive Quick-Time VR films. In addition, the user can, thanks to the most recent illumination and shadowing technologies and a well-equipped look library, draw from a highly developed feature set.

The basis of the project was the extension of RTT DeltaGen by virtual reality features for the user interaction as well as the interaction with virtual



RTT (Realtime Technology AG) is supporting real-time visualisation in high-end quality.

objects. Furthermore, a semiautomatic calibration of virtual objects onto real objects was planned to enable a socalled »Mixed Mock-up« so that virtual models merge with real objects, e.g., the model of a seat with the real seating buck in a cockpit mock-up.

It was the target of the project to extend the DeltaGen »Immersive Module« by defined features for interaction and to develop methods and an extension or application for the semiautomatic calibration of mixed reality scenes. Altogether the researchers have successfully realized four tasks:

- Navigation
  - Object grabbing
- Seating buck calibration
- Floor matching

#### Contact

Thomas Gierlinger thomas.gierlinger@igd.fraunhofer.de

Info The following terms are	recomized as already existing concepts.					
Please select a suggest	on or select a new concept to be submitted to SOBOLEO.					
• Use my term:	rapid					
O Use suggested term:	rapid manufacturing 👻	Visualize				
🖲 Use my term:	rapid manufacturing rapid tooling					
Use suggested term:	Indirect Rapid Manufacturing					
Status report Waiting for selection	Plapid Mansfacturing (is synonym of 'rapid mansfacturing') Rapid Anwendungsgebiet (is synonym of 'RP application field') Indirektes Rapid Manufacturing (is synonym of 'Indirect Rapid Manufacturing')					
	Cancel Sutmit Open SOBOLEO					

Intelligent process assistant for the support of the annotation process. Concrete suggestions are made even if the entries are uncertain / incomplete concerning the indexing.

### ArchiLight

Within the scope of the project, a software component will be developed to facilitate the light design for architecture models.

The »Lightdesign« issue is an important and difficult job within the design process in the architecture domain. Applications Software for Virtual Product Development and Simulated Reality

The central question is always: What effect does the combination of artificial and natural light have in different lighting situations?

The task is as follows: You would like to visually assess in advance-as correctly as possible in terms of quality-the lighting situation in an architecture model. Today's software systems are rather inadequate in this respect: The handling is cumbersome, they only



generate fixed images (you cannot interactively access the scenes), you cannot ad hoc modify the lighting situation, and the presentation quality is limited.

The computation methods for lighting effects traditionally used in computer graphics are ray tracing and radiosity. Ray tracing requires PC clusters for a real-time realization, which is a big investment hurdle for small and medium-sized enterprises (typical for the architecture sector). Radiosity is limited to parts of diffuse light, and this method used alone does not meet the demands on presentation quality.

The latest developments in the field of computer graphics have the potential to overcome these problems and limitations. These developments primarily include image-based lighting methods and precomputed radiance transfer.

Contact Dr. André Stork andre.stork@igd.fraunhofer.de





Real-time rendering of the augmented reality renderer. We are using Pre-computed Radiance Transfer (PRT) for the calculation of soft dynamic shadows. The lighting of the scene is generated from the environment map displayed in the background (image based lighting). Above: In the reflecting areas of the building parts of the environment are reflected. Middle: The same building in a mountainous glacier region

Below: The sunset is reflected in the panes.

Virtual Prototyping of Garments

The sequence of operations for the production of new garments is not yet completely digitized and is comprised of a long process chain. Especially for verifying the correct fit, a great number of prototypes must be manually designed, serving to determine whether the designed piece of clothing will be modified or not. A reduction of this number by virtual prototyping results in enormous time and cost savings.

This is why a virtual product development method for a complete CADbased 2D pattern construction and 3D fit simulation of garments is realized in



Virtual try-on in an adequate environment

this project. In this system, the evaluation of the fit and the optical look can be made as early as during the construction stage without requiring a manufacture of physical prototypes.

The special advantage of the developed system lies in the manifold interaction possibilities with the garments. The drape and fit of the clothing can be checked and modified interactively. By means of virtual »pins«, points of the fabric can be connected with each other or with the avatar. Both the texture of the garments and appliqués like buttons, imprints, or patches can be exchanged in real time or moved on the simulated clothing.

For the optimization of the workflow of the design of new garments, the close connection of the developed system to a 2D CAD program is of special importance. So modifications carried out in the pattern parts can directly be transferred to the simulation.

The project is realized in cooperation with Assyst Bullmer, the German market leader in the field of CAD-CAM solutions for the textile industry. The project results were presented with great success at the China International Sewing Machinery & Accessories Show (CISMA), the worldwide largest fair of the textile industry. Presently, the system is being tested, e.g., by S. Oliver. As planned, the market introduction took place at the end of 2007.

#### Contact

Martin Knuth martin.knuth@igd.fraunhofer.de Dr. Ing. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de

#### bauma 2007

In Munich, the visitors of the 28th International Trade Fair for Construction Machinery, Building Material Machines, Mining Machines, Construction Vehicles, and Construction Equipment bauma were able to view the VAR Trainer from April 23 to 29, 2007. It allows secure work with construction machines in the real-time simulator.

The building industry is one of the most dangerous workplaces in Europe. There are more than 830,000 accidents per year, of which 1,200 are fatal. Often the use of heavy construction machinery is to blame. If excava-



If a crane loses its load, a digger slides down or rolls backwards this can become perilous for the workers. FritzmeierSystems in Großhelfendorf have established a VAR trainer in their entrance hall with a virtual training programme helping the drivers to gain better experience and avert accidents

tors, cranes, etc. are operated improperly, life-threatening situations can quickly arise. Nevertheless, there is often not enough training in the correct handling of the machines. Researchers of the Fraunhofer Institute for Computer Graphics Research IGD are therefore developing, in collaboration with 13 European project partners, the VAR Trainer. This innovative simulation platform enables training in the safe operation of construction machinery.

The real-time simulator »VAR Trainer« (Versatile Augmented Reality Simulator for Training in the Safe Use of Construction Machinery) is a computerbased training tool. Due to the combination of mechanics, electronics, automation technologies, computer sciences, and augmented reality, workers can learn the use of different construction vehicles under realistic conditions. For this aim, the trainee sits in a driver's cab. This cab is especially prepared for the so-called mixed-reality environment. This component has been developed by researchers of Fraunhofer IGD. The panes of the cab are varnished in blue. The trainee wears video glasses replacing all blue parts of the image visible to him with a virtual scene. For this mix of simulation and reality, blue box technology, mainly known from film production, is used.

In this way, Fraunhofer IGD ensures with their developments that environmental conditions such as weather, buildings, or people are displayed as naturally as possible. The worker can completely dive into the training scenario. In contrast to conventional training devices, expensive and unwieldy projection systems are no longer necessary for the representation of the training scenario. Contact Thomas Henn thomas.henn@igd.fraunhofer.de

### iFX Postprocessor

Researchers of Fraunhofer IGD have developed the iFX Postprocessor especially for the visualization of very extensive simulation results. This visualization tool enables product developers to work without any problem cooperatively and across distributed locations on simulation models-in spite of huge amounts of data.

Today, the development of products more and more involves virtual reality (VR) technologies. Virtual simulation models allow for the prediction of the material behavior or the interactive simulation of the different design options within a very short time. Using these technologies will allow enterprises to save a great deal of time and cost.

An important step within the process chain is the regular exchange between developers, designers, and customers, for the best product version possible can only be found in cooperation. Ideally, the partners can analyze a simulation model from different locations and work on it interactively in real time. In practice, however, this cooperative work is often difficult. The computer hardware often reaches its limits when the enormous amounts of data accruing, e.g., during the simulation of crash tests or flow simulations have to be transferred.

The iFX Postprocessor of the Fraunhofer Institute for Computer Graphics Research IGD sidesteps this problem. With only minimal demands on bandwidth, several users from different locations can simultaneously and collaboratively work via a network and jointly analyze and evaluate the simulation models. The simulation data, which in some cases may be several gigabytes in size, are sent via secure communication channels, e.g., DVD.

In contrast to other post-processors, only control commands and no sensitive data are exchanged between the cooperation partners via the network during their cooperative work. For the visualization of the data, the researchers focus on the latest graphics hardware, allowing the interactive display of simulation models with 20 million elements and more.

## Hanover Fair Industrie 2007

At the shared stand of the Fraunhofer Alliance Numerical Simulation of Products, Processes NuSim, various Fraunhofer institutes showed their current project results in the field of simulated reality from April 16 to 20. In addition to the major projects SR-PRO (detailed description in the Annual Report 2006) and iFX Postprozessor, Fraunhofer IGD presented three other modules from the process chain of the virtual product development CAD2Vis, SHREg, and the Realtime Remote Desktop.

Contact Dr. André Stork andre.stork@igd.fraunhofer.de

### From CAD Conversion to High-Quality Rendering – Efficient and Independent

Product developers are increasingly integrating virtual reality (VR) technologies into the process chain, generating clear visualization models based on CAD construction data. The software CAD2Vis of Fraunhofer IGD enables the conversion of CAD raw data into visualization data-independent of the source CAD system.

In most cases, conventional CAD converters are only available together with expensive VR data processing tools. The Fraunhofer Institute for Computer Graphics Research IGD has therefore developed the conversion software CAD2Vis. For data conversion, the user does not need a license environment for a particular CAD or VR sys-

Joint simulation competence: Fraunhofer theme booth tem. For in contrast to other products available on the market, CAD2Vis allows to convert the data independent of a special provider.

CAD2Vis supports the CAD input formats ACIS SAT, CATIA V4 and V5, IGES, Pro/E, STEP, and VDA-FS. The output can be converted either into the visualization formats OpenInventor 2.1, VRML 2.0, and OpenSG or the CAD formats ACIS SAT, CATIA V4, IGES, STEP, and VDA-FS. Different from conventional tools, CAD2Vis can store the geometries contained in the CAD data on request also as a NURBS model, provided that it is supported by the target data format. Furthermore, CAD2Vis offers the possibility of closing gaps between adjacent surfaces by





Simulation in product and process development

»sewing up«. Thus a time-consuming post-processing of the data is no longer necessary.

The software is especially suited for product developers who want to integrate VR technologies or digital mockups (DMU) into their process chain, and are looking for an independent solution for the conversion of CAD into VR data. It is also useful for service providers processing VR or Web presentations on the basis of CAD data as well as for VR providers offering CAD imports.

### Contact

Sebastian Pena Serna sebastian.pena.serna@igd.fraunhofer.de

# Rendering Module SHREg for a Realistic Visualization

Using the rendering module »SHREg« (Spherical Harmonics Rendering Engine), high-quality design reviews become possible. The module allows the display of data converted with CAD2Vis physically based and in real time.

On the basis of the realistic representation of the models by SHREg, deciders can, e.g., interactively test different materials or lighting situations, better assess product quality, and save valuable time searching for the best solution.

SHREg not only supports dynamic soft shadows but also image-based lighting. On the basis of the lighting conditions, on an environment photo the software computes how a virtual object is lighted. For this purpose, SHREg uses so-called High Dynamic Range Images (HDRIs). In contrast to the use of conventional digital photos, the rendering module can by means of HDRIs correctly record all details in a



real scene both in the dark and in the bright areas of an image. The same technique is used to display reflections with a high amount of dynamics. Due to these properties, SHREg is especially interesting for augmented reality applications.

### Application Sharing - Video Transfer Quickly and in High Quality

The application sharing tool »Realtime Remote Desktop« allows an easy exchange particularly of graphicsintensive data and applications with remote project partners.

No matter whether the transferred data come from office packages, CAD applications, or visualization systems, the Realtime Remote Desktop (RRD) continuously records any screen content of the source computer, and then forwards it to the target computer. The data must not be modified. So the RRD software is not limited to textbased applications but also supports all graphic applications using OpenGL or DirectX.

The Realtime Remote Desktop features a high transfer speed, exceeding any software available on the market. With a comparably low network load, it also delivers an extraordinary image quality with a high image frequency. So even Dominik Acri at a press interview

most complex computer games can be played on remote computers in real time. The Realtime Remote Desktop runs without any problem on all commercial PCs and Microsoft operating systems, adapting to any bandwidth. Particula rly visualization-intensive industries, such as the automobile sector, the oil and gas industry, the construction sector, and the chemical and pharmaceutical industry, benefit from the software.

A test version of the Realtime Remote Desktop as well as further information on the license conditions are available on the Internet at http://www.igd.fraunhofer.de/igda2/rrds/.

Contact Dominik Acri dominik.acri@igd.fraunhofer.de

# VR, AR, Interaction in (Semi)Immersive Environments and Cultural Heritage

Rapidly improved performance in the field of microprocessors and graphics cards has shaped recent decades in information and communication technology. The use of so-called shaders today allows the real-time display of complex, computer-generated 3D models with photo-realistic image quality. The shader technology contains software and hardware modules responsible for the coloring of virtual 3D models and for the display of reflection features.

These developments form the prerequisites for modern mixed-reality systems characterized by complete immersion and permanent interaction of the users. Mixed-reality systems connect the areas of virtual and augmented reality; in virtual reality applications, the user is shifted by projection systems and intuitive interaction devices into a digital 3D world, whereas in the augmented reality domain, light mobile systems are used.

An augmented reality system is linked to a miniature video camera recording the environment of the user. The live picture of the video camera is superimposed by rendered 3D objects. The biggest technical challenge of the development of augmented-reality applications is »tracking«, i.e., the exact registration of sight positions and orientation in relation to the environment. The sight of the user is caught with the mini camera and the live pictures of the video camera are processed in real time. From the pictures, features are extracted, enabling the identification of landmarks (characteristic properties in the real environment). This landmark identification is based on the use of point and edge detectors. By means of the landmarks identified by the two-dimensional camera pictures, the position of the camera is reconstructed in the threedimensional space. Landmarks are either set in relation to previous video pictures (frame-to-frame tracking) or they are correlated with a digital 3D model of the real environment. The tracking is the precondition for the accurate superposition of virtual and real 3D models.

These technologies of the virtual and augmented reality are used in the automotive sector, in machinery and plant engineering, especially in product development, but also for the presentation of cultural goods.

Contact Dr.-Ing. Ulrich Bockholt ulrich.bockholt@igd.fraunhofer.de

# Touch Table for Interactive 3D Environments

With an effective image area of 150 x 90 cm, the touch table is presently one of the first larger multitouch systems that can be freely placed and positioned. The table is therefore a unique tool in plant engineering. The user selects objects, documents, or components by touch to have a closer look at them.

Within the scope of a joint project, a multitouch table for the interaction in and with virtual environments has been developed at Fraunhofer IGD. The system was used by order of the company Coperion to visualize bulk material plants in an immersive environment. For this aim, new interaction forms were developed for navigation and interaction. The interaction is based on an optical method for capturing the movement of the fingers. Via a camera, the surface is monitored and perceived fingers tracked and processed by the internal VisionLib software. New algorithms were developed especially suited for multifinger tracking. With an effective image area of 150 x 90 cm, the touch table is

presently one of the first larger multitouch systems that can be freely placed and positioned. So far, most of the existing systems have had to be firmly fixed. For the display of the application, the VR system AVALON of IGD is used. On the one hand, the system provides the presentation of the virtual world and, on the other hand, it is the basis for the used interaction elements and interfaces of the multitouch application.

This presentation and navigation method enables a user to touch the virtually offered content and to interact with it. The table is thus a unique tool for presenting and explaining the value chain in process engineering:



The multi-touch table allows per flow simulation the view inside a conveying machinery for synthetic granules.



Multi-touch table for the interaction in and with virtual environments elements can be selected by touch to have a closer look at them. In addition, the elements can be freely rotated and steplessly scaled, allowing an unparalleled view into the plant elements and components. The form of interaction is very intuitive, easy to learn, and the complexity intentionally kept low to ensure simple and smooth access to the new medium.

Contact Michael Zöllner michael.zoellner@igd.fraunhofer.de

## IMPROVE

Particular attention of the IMPROVE research work on the improvement of displays was given to big, stereoscopic tile projection displays.

IMPROVE is an EU project with the aim to develop technologies for advanced displays. Both lightweight, near-eye displays and big, stereoscopic tile projection displays are considered. The improvement is achieved by new production, calibration, rendering, and interaction methods. On the software level, the quality of the rendering is enhanced and new, innovative interaction techniques developed. On the hardware level, a new head-mounted display with OLEDs and Light-Blocker Alpha Channel was developed.

The current task of Fraunhofer IGD was the development of an automatic calibration system for the color correction of a tile projection display. In this context, new methods were developed to achieve a spatial unity of the colors within a projector and also between different projectors, and to provide a geometric calibration of the display. These methods were integrated into an automatic calibration process using



a conventional digital camera as colorimeter and could successfully be tested at the HEyeWall (rich). The algorithms for color and geometry correction were integrated into OpenSG.

The project was successfully completed in October 2007. The project partners were Technische Universität Darmstadt, TriVisio Prototyping GmbH, I.S.I., MicroEmissive Displays Ltd., VICOMTech, STT Ingenieria y Sistemas, GraphiTech, Elasis, Page & Park Architects, Lighthouse, INESC/IST.

Contact Dr. Ulrich Bockholt ulrich.bockholt@igd.fraunhofer.de

### PERSONA

The EU project PERSONA investigates scenarios around ambient-assisted living, but also needs new methods of object recognition in video data for the development of the assistance systems.

PERSONA – PERceptive Spaces prOmoting iNdependent Aging – aims at providing an open technological platform offering elderly citizens a large bandwidth of services to maintain and support social integration, personal independence, and a wholesome lifestyle. Consequently, the technological challenge is to supply the aging population with systems which support the quality of life, facilitate their independence, enhance social contacts, intensify the connection with the environment, and improve the mental and physical state of a person.

One of the subtasks of Fraunhofer IGD is to identify for PERSONA patterns of situations and activities and store the most probable ones as guidelines for the automatic triggering of actions. For this purpose, it is necessary to develop methods to recognize comparable situations and to integrate the feedback of the user. This is realized by object recognition in video data.



Virtual-reality scenario for the transfer of expert skills to laypersons, here: machine maintenance.

Contact Dr. Ulrich Bockholt ulrich.bockholt@igd.fraunhofer.de

# SKILLS – Multimodal Interfaces for Capturing and Transfer of Skills

The best way of learning is from a role model. This idea will be realized in the SKILLS project, in which movements and reactions of experts are collected and evaluated. The results can be imparted to laypersons as an optimal approach.

The EU project SKILLS deals with the collection, storage, and transfer of human skills by technologies from the fields of multimodal interfaces, robotics, and virtual environments.

Human skills are captured and analyzed including cognitive aspects and motion sequences. Based on the findings, a digital representation of the skills is defined and techniques for rendering the skills are developed and evaluated. The aim of the project is the development of a system that gathers expert skills, deduces from the data optimal procedures, and imparts these to laypersons. From each of the areas sports and entertainment, surgery and rehabilitation, as well as industry and fabrication, a demonstrator is produced.

Besides the development of technologies in the field of camera tracking, the visual representation (visual rendering) of skills is also one of the tasks of IGD within this project. In this context, e.g., new methods of image-based lighting and real-time raytracing are evaluated. The newly gained insights are integrated into the computer-vision library »VisionLib« and the mixed-reality system »Avalon« (both developed by IGD, www.instantreality.org).

# Contact

Dr. Ulrich Bockholt ulrich.bockholt@igd.fraunhofer.de

iTACITUS – Intelligent Tourism and Cultural Information through Ubiquitous Services

Mobile computer systems open up great potential for the illustration of cultural sites and museums. This potential will be developed in the EU project »iTACITUS – Intelligent Tourism and Cultural Information through Ubiquitous Services«.

For this aim, augmented-reality systems are connected with locationbased services. The augmented-reality visualizations are used, e.g., to visualize reconstructions of destroyed frescos or to display historic architectural models.

The tasks of Fraunhofer IGD focus on developing the augmented reality software for mobile computers. This development work also includes tracking



By holding a mobile computer in front of the object he is interested in the user gets further augmented-reality information onto the screen.

technologies serving to register the position of the user. Several approaches are combined, e.g., a »bluetooth proximity sensor« and also a computer vision-based tracking method. The technologies are evaluated at two different cultural sites.

Contact Michael Zöllner michael.zoellner@igd.fraunhofer.de

# VIVERA – Competence Network for Technologies for Virtual and Augmented Reality

The competence network »VIVERA -Technologies for Virtual and Augmented Reality« includes five Fraunhofer Institutes. The focus of Fraunhofer IGD is on the development of basic technologies and applications from the medical engineering domain.

The development work of this project was incorporated into the mixed-reality system »Instant-Reality« (www.instant-reality.org). One focus of the developed technologies is on the independence of the operating system (Windows, Linux) and of the used platform (PC, Apple, etc.). In the last part of the project, the development work of the mixed-reality system was rounded off and extensively tested and documented. The system is not only used by ViVERA partners, it is also licensed by numerous customers from industry. Based on the mixed-reality system »Instant-Reality«, surgery training simulators for bronchoscopy and an endoscopic diagnosis of the nose was also developed.

Contact Dr. Ulrich Bockholt ulrich.bockholt@igd.fraunhofer.de Semantics and Geographic Information Systems (2D, 3D, and Mobile)

Geographic Information Systems shape our everyday life in many ways. Applications like navigation systems and virtual globes (mainly Google Earth and MS Virtual Earth) have already reached a mass audience.

The increasing complexity of predefined political targets (e.g., climate change) and economic questions (e.g., site management) in a globalized world require the use of highly networked instruments and structures across administration levels and department boundaries. These infrastructures must open up access to spatial data as a central resource of our time.

In addition, special significance is attached to critical applications in terms of space and time, such as civil protection, disaster management, and mission planning. This includes the integration and adapted visualization of 2D and 3D spatial data also in limited end devices (e.g., mobile devices).

The multitude of application areas requires an adequate processing of and access to the desired information. One of the great challenges consists in making the once acquired 2D and 3D geodata utilizable in different application areas, in different contexts, at different aggregation levels, and for different end devices. To achieve this aim, interoperability must be secured not only at the syntactic but especially also at the semantic level. The research work of Fraunhofer IGD in the field of »semantics and geographic information systems« focuses on an effective and user-friendly provision of geospatial information. Current research and development topics are therefore:

- Semantic annotation of geospatial information
- (Semantic) interoperability in geographic information infrastructures
- Maintenance of semantics in the modeling process of 2D and 3D geodata
- Visualization techniques for 2D and 3D geodata
- Quality of 3D city models

### Contact

Dr. rer. nat. Eva Klien eva.klien@igd.fraunhofer.de

### HUMBOLDT

HUMBOLDT is a project sponsored by the EU with the overall goal of the Europe-wide harmonization of spatial data, thus facilitating the spatial data supply for various application areas.

Spatial data have grown in importance as never before, especially in view of large-scale environmental analyses and the monitoring and planning of protective measures. The corresponding environmental factors are independent of possible political, linguistic, or cultural borders. This is why such barriers must be overcome, which also applies to digital data, e.g., different language worlds, data structures, or object definitions.

A Europe-wide harmonization of the spatial data does not yet exist. This is where the EU project HUMBOLDT starts. Its aim is to facilitate a harmonization of the spatial data and to support the data supply in different application areas. The processes necessary for the integration of the spatial data

The HUMBOLDT framework and the influences taken into account during its development



are formalized and automated as much as possible to reduce the expenses related to harmonization.

Under the direction of Fraunhofer IGD, 27 partners from 14 European countries are jointly dealing with this objective during a term of four years, involving a total of 110 full time equivalents for the preparation and testing of the solutions. A crucial aspect is the development of realistic sceneries (e.g., border protection, water quality, and land use) for testing the developments provided as an open source framework. In the scope of the project, especially Fraunhofer IGD is referring to different research areas from information visualization to data transfer to the use of semantics for spatial data. Using the system in practice will also lead to further developing it, and a commercial use will assure the sustainability of the results after the end of the project runtime.

Comprehensive insight into the project can be gained by reading the article »Naturschutz ohne Grenzen« (»Nature Protection without Borders«) published in the magazine »GIS Business« (issue 06/2007, p. 14-17) or the project Web site, www.esdi-humboldt.eu.

Contact

Dr. rer. nat. Eva Klien Eva.Klien@igd.fraunhofer.de



Partner from 14 European countries are contributing to the Humboldt project on European harmonization of spatial data.

Applications Semantics and Geographic Information Systems (2D, 3D and Mobile)

#### ESDI-Net+

ESDI NET+ is a network of excellence for monitoring and consulting projects that aims to establish a European spatial data infrastructure (ESDI).

The goal is to gather methodic knowledge of constructing the necessary operation and visualization services in a library and to coordinate the common utilization of successful projects. Especially the Humboldt project running in parallel will play a major role.

Contact Dr. rer. nat. Eva Klien Eva.Klien@igd.fraunhofer.de

### **GDI-WSV**

The project comprises the conception of a spatial data infrastructure for the German Water and Shipping Authority (WSV), which will be developed within the WSV.

The aim was to adapt the general idea of a spatial data infrastructure to the needs of the WSV, especially to the different types of usage and the demands on spatial data the particular departments have, and to identify possible implementations.

Contact Heiko Blechschmied Heiko.Blechschmied@igd.fraunhofer.de

### VESUV

Instead of walking from office to office within the authorities, a software agent can be sent along the stations in the eGovernment process. Another one serves as a Dynamic Tour Guide in an unfamiliar city. VESUV is a research project investigating the advantages of secure and bindingly acting agents.

VESUV is an application project that purposefully extends the core technologies »Agents«, »IT Security«, and »Legally Binding Delegation« developed within the lead project of the Federal Government, »Multimedia Workplace of the Future – MAP«, making use of it in two important application areas.

The software agents used for these applications handle these tasks autonomously and collaboratively, taking into account the situative context and the preferences of the customers. This leads to an efficient, fast, and top-quality junction of supply and

an individual route

litz.

demand, relieves the human users, and enables them to address other. more significant tasks.

The application areas are the coordination of distributed administrative processes in eGovernment and intelligent, context-sensitive assistance in eTourism. In the eGovernment domain, the Hanseatic City of Rostock is exemplarily implementing the special process »registration, deregistration, and change of a business«. In the field of eTourism, a dynamic tour guide is being developed and tested in the Görlitz region.

As a whole, the two applications eGovernment and eTourism have a broad potential for a successful piloting of the VESUV technologies. Testing in two application areas allows a spatially and, in terms of content, disjunct anchoring of the research results in Germany. The collaboration with other (research) projects serves to strengthen the position of all participating projects in the market. In the field of eGovernment, there are, e.g., links to results of the Media@Komm projects.





The project has a total volume of approx. 5 million  $\in$  and is funded by the Federal Ministry of Economics and Technology.

Contact Alexander Nouak Alexander.Nouak@igd.fraunhofer.de

### MobileChase

MobileChase, a modern variant of a paper chase, realizes a location-based game that can be played by means of mobile phones within a town. Location-based games merge the real world surrounding the player with the virtual world of the game. Real places like a town become the playing field and other persons in the town teammates. A simple example is the popular GeoCaching, where a player can locate an object hidden in an unknown place by means of GPS devices. Based on the typical, cyclic elements of location-based games, a framework has been developed containing the basic elements of locationbased games, thus giving the game developer a framework that can fit the objects to the special scenario. Basic game elements are already premodLeft: Start screen;

Middle: The PDA guides through Görlitz on the base of the information assembled by the Dynamic Tour Guide Planner. The destination is »Kaisertrutz« (the emporer's castle in the back):

Right: En-route throughout Görlitz: mobile and provided with multimedia Information thanks to the Dynamic Tour Guide.

eled so the game developer can concentrate on his core business, i.e., the special design of the game. The first game on the basis of the platform is a modern form of the well-known paper chase: MobileChase.

Contact Markus Etz Markus.Etz@igd.fraunhofer.de



Mobile Chase. A game like a paper chase using mobile phones Applications Semantics and Geographic Information Systems (2D, 3D and Mobile)

### CityServer3D

CityServer3D is a 3D data management system supported by a database. It provides the administration and supply of three-dimensional spatial data for the purposes of a variety of applications.

Innovative information systems based on 3D models play an increasing role in areas such as tourism, cultural heritage, city planning and traffic, as well as knowledge transfer. The commercially available spatial information systems, however, do not yet sufficiently include these development lines. The Graphic Information Systems department of the Fraunhofer Institute for Computer Graphics Research IGD is realizing numerous projects where a space-related processing of threedimensional data using spatial information systems is a core component. By means of the developed solutions of CityServer3D, big city and landscape models can be analyzed and visualized in real time. The CityServer3D technology offers the possibility of making three- and four-dimensional spatial data stored in an object-relational database available via Internet channels to various client platforms for different purposes.

Based on 3D database managing models of different levels of detail, various presentation types, personalization, and attributive data, the CityServer3D provides numerous features for manipulation (dynamic triangulation, generation of DGM, LOD mechanisms, profiling, display, access control) of data and for conversion. In addition to a Web-compatible viewer and an admin-



A 3D model of »Mathildenhöhe« in Darmstadt in the CityServer3D viewer.

istration tool, interfaces to ESRI systems or ArchiCAD offer numerous options to access the server.

#### Contact

Heiko Blechschmied Heiko. Blechschmied@igd.fraunhofer.de

#### Coburg3D

The City of Coburg is concerned with the development and use of a 3D city model for diverse applications, and different tools are already used for data acquisition and visualization.

In this project, Fraunhofer IGD is contributing several software components for the administration of geometric data. One of the major components is the CityServer3D based on an Oracle database for the administration of the 3D city model. Another tool has been provided to control the data quality of the 3D city model of the City of Coburg, performing a quality test for triangulation errors, degenerated areas, gaps in geometry, as well as faulty area orientation. Another component in addition to the Web-based 3D viewers is a data exporter for the adoption of data stocks from the CAD software ArchiCAD. The exporter offers the possibility to export the geometry of selected objects (such as buildings and vegetation) from the ArchiCAD software into the CityGML format. The exported 3D data are then imported into the CityServer3D and can thus be integrated without any difficulty into the existing 3D city models.

## Contact Heiko Blechschmied Heiko. Blechschmied@igd.fraunhofer.de

# INTERGEO 2007 September 25-27, 2007

The congress and special fair INTER-GEO is the largest event and communication platform in the field of geodesy, spatial information, and land management worldwide. At INTERGEO 2007 in Leipzig (September 25-27, 2007), Fraunhofer IGD was represented in the Open Source Park.

The approaches to open source software development in the EU project HUMBOLDT were presented and discussed with great interest. In the HUMBOLDT project, Fraunhofer IGD has the role of coordinator. The Open Source Park was organized under the auspices of the Open Source Geospatial Foundation (OSGeo).

Besides other project presentations from the community, the Open Source Park also offered exhibition space for commercial service providers of free software solutions. The INTERGEO 2007 was visited by more than 17,000 visitors and delegates from more than 80 countries.

### Echo in the Media

The research projects of the business area generate a broad echo in printed press as well as television.

# Interview »My mobile phone knows where I am«

The magazine of Deutsche Bahn »DB mobil« interviewed Heiko Blechschmied (Graphic Information Systems department) on the future development of mobile phones. The interview was published in the March issue 03/07 (p. 50).

# Report »3D Navigation of the Future«

In the »neues« program of 3Sat about »IAA 2007 - Mobility without Limits?«, Heiko Blechschmied was invited to speak about the challenges in visualizing 3D navigation systems. He presented 3D animations developed on the basis of the CityServer3D (3Sat, »neues«, 09/16/2007). 0996051870

Business Intelligence and Visual Analytics

The path from data to decision is often long and complex. Without computer systems, human users are not able to analyze the large amounts of data which are generated today in many industries. Informed decision making is hardly possible anymore without today's business intelligence solutions. However, purely automated analyses designed by analysts do not expose comprehensible information about the path from data to decision to the actual decision maker. The goal of visual analytics research is to integrate the decision maker into the analysis loop.

Yesterday's problem was the efficient acquisition of large amounts of data from various sources. Today's problem is the efficient and reliable utilization of these acquired data to turn it into usable and relevant knowledge. The increasingly noticed approach of visual analytics focuses on a combination of business intelligence, perception, and visualization. Visual analytics research offers new concepts and methods of interactive data presentation and analysis. The human capability to understand graphical displays visually and to process data and information intelligently is not adequately utilized in today's business intelligence products.

After all, the combination of statistical methods with the human perception and experience offers many opportunities to quickly gain new insights from the data. The objective is a more interactive analysis of large amounts of data-in other words, visual business intelligence. These concepts are currently applied to the financial industry and various industries in the area of business intelligence. The Visual Analytics group of Fraunhofer IGD offers excellent research results, the required experience, and research capacities for developing customer-tailored solutions in the area of information visualization and visual analytics.

Contact

Dr. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de

### Visual Analytics for Financial Industries

The economic success of financial institutions is based on precise, rapid, and well-founded analysis and projections of market development. Internally available and externally provided datasets stand in the center of the processes that have become increasingly time-consuming and complicated due to the complexity and heterogeneity of the data.

The data have to be presented in new formats that enable efficient data analysis. Such an analysis, based on an efficient conversion of available data into useful information, is offered by visual analytics approaches. They use new methods of interactive data presentation and data processing, which incorporate technologies from various other scientific fields to create better analysis and decision-making tools.

### The Applications

Visual analytics approaches can be applied to various fields of the financial business:

- Financial market analysis and financial investment;
- Market oversight;
- Risk management;
- Fraud detection;
- Consumer profile analysis;
- Marketing, market segmentation;
- Economic analysis, etc.

With the help of new presentation techniques, results such as product analysis, projections, and business plans can be displayed in an easier-tounderstand form to customers, business partners, and higher management. Moreover, the results can be transferred in real time to mobile devices (e.g., smartphones and PDAs).

### The Solution

An appropriate visual presentation combined with powerful interaction functionality reduces cognitive burdens by allowing the user to analyze from different perspectives. Through the interactive presentation, the »passive viewer« becomes an »active discoverer«. It combines human visual capabilities and the computer's performance to enhance the analysis and decisionmaking process. Data visualization alone does not offer powerful tools for

RelaNet is an interactive tool for the visual analysis of stakeholder structures.

the most tedious steps in the analysis process: model- and hypothesis-making and model validation. Visual Analytics enables these steps in software products by creating useful visual representations of hypotheses for manipulation and comparison of different models. Large amounts of data are not a problem, but an opportunity. Fraunhofer IGD offers excellence, experience, and research capacities for developing customer-tailored solutions in visual analytics for financial institutions and insurance corporations.

### Contact

Dr. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de





The combination of different tools for graphical analyses enables an interactive discovery of very large data sets.

# Visual Analytics Aspects in THESEUS/ORDO

ORDO-Organizing digital informationis one of the application scenarios in the joint project THESEUS, and one of the work packages researched at Fraunhofer IGD. The goal for the user is the effortless organization of digital documents, based on automated means to process huge information sources.

In the project THESEUS, funded by the German Ministry of Education and Research, basic technologies in the core technology cluster »User Interfaces/Visualization« are compiled to visualize and process semantic information. The objectives of the application scenario ORDO in the field of the visual analytics complement the goals in the field of semantic visualization, particularly with regard to the creation and utilization of semantic information. The basic approach is creating a connection between the raw data and its semantic description: On one hand, the raw data gets a conceptual order; on the other hand, these semantic descriptions have to be adapted to the raw data, its domain, vocabulary, and associated tasks.

The strategy is to apply analysis technologies for data volumes that allow for the grounding of semantic (highlevel) information in the raw data. Technologies from data and information mining for the efficient process of huge data volumes are adapted as well as technologies from the area of information visualization for the integration of humans and their specific competences.

The process allows the identification of patterns and features within the data that contain information that can be formatted semantically through the analysis. These technologies bridge the »semantic gap« which separates the raw data (i.e., »low level« representations) from the semantic information in every complex domain. Search technologies may benefit from these techniques by demonstrating and exploring the raw data space in order to relate and evaluate these representations.

Contact Dr. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de

# Analytics Day January 23, 2007

Technologies for the support of financial analysts were presented at the »Science Meets Business« Workshop at Fraunhofer IGD called »Graphical Display of Financial Data – To strike a new path out of the jungle of data«. The Workshop showed which computer applications play a role in the financial analysis and how the future of computer-aided data analysis may look.

The economic success of finance institutes is based on precise, quick, and funded market analyses and forecasts. Finance analysts have to handle huge data volumes within shorter times. To find ways out of this jungle of data and to provide successful analysis, you need software that is able to support the user effectively in his tasks. New opportunities are offered by Visual Analytics, a section of the computer graphics division. It enables the user to effectively process and analyze complex data and to interactively gain knowledge and structure from the presentation of the results.

The workshop concentrated on the chances and risks for banks and insurance companies that these new developments result in, and on the challenges associated with computer graphics and analysis in the financial sector.

Famous experts from economy and science, among them Arnold Wagner (Director Finance of the Gartner Deutschland GmbH), Stefan Ott (Reuters), Dr. Bjoern Fischer (EZB), Gerhard Rauh (Xchanging Transaction Bank GmbH), and Jens Quadbeck (Interactive Data), gave a review of IT trends in the financial industry, talked about their own experiences with the graphically supported analysis, and explained the consequences within different financial areas. The presentation was concluded with exciting technology demonstrations and interesting discussions.

Contact Dr. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de

## ConWeaver – The Semantic Search Engine

To make corporate knowledge generally available and retrievable, it does not suffice just to connect databases and document servers via intranets and portals to one shared surface. Without a logical integration of the data and document stocks and an intelligent search, the desired information can only be identified with knowledgeable questions for each data source and time-consuming strategies for comparing the search results. This fact has been recognized by an increasing number of companies. This is where the semantic search technology of ConWeaver starts.



At the workshop Science meets Business of the Analytics Day, January 23, 2008 we had interesting discussions with participants from industry and science.

ConWeaver allows an intelligent search in the corporate portal or intranet by integrating data and document stocks by means of a knowledge network, also called semantic network or ontology. ConWeaver uses this knowledge network as a logic search index for all connected data sources. Addressing all data and document stocks with just one question, the user gets a complete, aggregated, and structured answer. ConWeaver includes analysis services for the automated development of knowledge networks and components for the semantic search. Furthermore, the ConWeaver technology allows a rapid prototyping.

### Automated Development of Knowledge Networks

To make data and documents accessible in terms of content and to network and integrate the gained knowledge, different data models, structured facts, and unstructured text content from the source systems must be projected onto a consistent scheme. For this aim, ConWeaver uses knowledge networks as correlation schemes. These knowledge networks are developed and maintained automaticallythis being the innovative achievement of ConWeaver-using methods of artificial intelligence and machine learning.

# Knowledge Networks

Knowledge networks are formalized schemes serving to describe knowledge about business objects like customers, providers, products, or projects. A knowledge network consists of concepts that are connected via semantic relations. They form the socalled schematic level, i.e., the model for the concrete individuals (entities) connected at an individual level and the relations between them. The manual development and maintenance of knowledge networks require, however, much in-depth knowledge and time, making it very cost-intensive. This is why ConWeaver uses, on the one hand, innovative technologies of statistical and linguistic information extraction and categorization if the data sources consist of texts. On the other hand, best-practice approaches from data integration are used if we have structured data from relational databases. Also, machine translation methods for the development and the maintenance of multilingual knowledge networks and methods for an automatic terminology extraction from Internet sources are used. This complete spectrum of tasks is handled by the analysis services, the semantic middleware of ConWeaver.

# Automatic Information Extraction and Indexing

With linguistic and statistical text-mining methods, ConWeaver gains information, e.g., about the concepts, person, organization, project, or subject, from text documents of different formats. Using methods of categorization and classification, ConWeaver relates documents to existing categories of subjects or organizes them in new categories. Methods of automatic translation solve the multilingualism problem, and the inclusion of professional terminologies ensures a terminological access.

## Linguistic and Statistical Methods

Using additional linguistic analysis methods, the thesaurus from the text mining, categorization, and translation steps is further evaluated. Novel approaches identify logical relations, such as hypernym or hyponym relations between concepts, and determine whether concepts, such as person, or concrete individuals, such as the person Tom Smith, are involved. Due to these characteristics, a concept can be positioned in a semantic network and automatically included in the knowledge network.

### Semantic Search

Concerning the semantic search, Con-Weaver makes use of the knowledge network as integrated index to search in distributed data stocks. The terminological, colloquial, and language connections of concepts in the knowledge network allow a semantic, multilingual, and formulation-flexible search. Due to the meaning attached to the concepts and relations, on the one hand, and the logical formalization, on the other hand, inferential and language-recognizing searches on the concrete individuals in the knowl-



System architecture of ConWeaver

edge network are possible. Thus, relevant information can be found even if it is only implicitly included in documents and data entries. Making suggestions for context-specific limitations or extensions of the search, the »guided search« especially allows the inclusion of unstructured data sources. Of course, the intelligent ConWeaver search also includes all characteristics of a linguistically processed full-text search, including truncation, basic form reduction, literal error tolerance, or logical operators.

### **Rapid Prototyping**

The graphical interface and modular character of ConWeaver for the definition of workflows for an automated development of knowledge networks allow a fast implementation of a prototypical search application in the enterprise. It is done on the basis of an exemplary dataset previously defined with the customer. The resulting prototype gives a first impression of the comprehensive possibilities of a semantic corporate search developed with ConWeaver and can be used as a basis for a subsequent project realization.

Contact Dr. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de

# Visual Analytics for Security Applications

Many future security scenarios, such as pattern recognition and computer vision, tend to downplay the strong and important role of the human decision maker in many vital aspects of security. The automatic processing and classification of multisensory data, e.g., of video data, can only be a part of the process that has to be combined with the experience and knowledge of human security experts. Information technology, visualization technology, and sensor technology have to be combined to have a truly advanced impact on future security applications. Just as algorithms have been developed in the past to enhance the detection of tumors in medical CTs, we need algorithms that support the person in detecting unusual security situations and their causes.

This challenge lies at the heart of visual analytics. Security is one of the most important application areas where visual analytics can contribute with advanced solutions. Decision makers need to monitor huge amounts of heterogeneous information streams, correlating information of varying degrees of abstraction and reliability, assessing the current level of public safety, triggering alerts in case of critical situations being detected. Data integration and correlation combined with appropriate analysis and interactive visualization promises to develop more efficient tools for analysis in this area.

## SoKNOS

With regard to the goals of the security research program of the German Federal Government, the SoKNOS project (Service-orientierte ArchiteKturen zur Unterstützung von Netzwerken im Rahmen Oeffentlicher Sicherheit) has set itself the target to develop and pilot concepts that are valuable in supporting governmental organizations, private companies, and other organizations active in the domain of public (homeland) security. On the one hand, it concerns their day-to-day work, and on the other hand, their work in exceptional cases of major events.

SoKNOS strives for solutions that allow foresighted, fast, secure, and efficient action. By this means, the project is able to make a long-term contribution to public security in Germany. processes. Thereby, the focus is on the specific demand for usability, interoperability, safety/security, and robustness of the infrastructure.



# Real-world scenario as the project's framework

The creation of a real-world scenario of managing a long-lasting thunderstorm and flood with national support constitutes the framework of the project. It emphasizes the complexity of an emergency situation and represents the entire chain of rescue services. A systematic and comprehensive improvement of the scenario is carried out on the basis of the actual threat situation and the current stage of development.

At the same time, it has to be guaranteed that the developed solutions comply with the specific challenges in the domain of public security. Moreover, the users' and customers' needs have to be taken into consideration during all research activities. For this purpose, the users' and customers' requirements, experience, and expertise have been integrated into the development of the scenario.

In the course of the scenario, we collaborate with further users, such as the fire department of Cologne, the German Police Training Academy (DHPol), and the THW (Technical Relief Agency).

# Service platform as the result of the research activity

The result of the research activity is supposed to be a service platform based on the scenario. It will serve as a technical basis for the cooperation of different roles across national borders, as well as for the integration of Contact Dr. Jörn Kohlhammer joern.kohlhammer@igd.fraunhofer.de

# Knowledge Visualization and Visual Semantics Management

The visualization of knowledge/semantics builds the third generation of visualization techniques, following the visualization of data and information. Semantics visualization is characterized by the integrated visualization of the three layers raw data, metadata, and concept data.

From a technological point of view, the main innovations in semantics visualization are the aspects of the definition and provision of visualization concepts for ontology structures, the separation of layout and presentation, and the aspect-oriented visualization to fit the different user needs. While the layout level defines the positioning of the semantic structures in an abstract space, the presentation layer determines the visual appearance on concrete devices. The aspect orientation provides the user different rolespecific so-called »perspectives«. These aspects adapt themselves continuously to the behavior of the user, and, herewith, support an optimal human computer interaction.

From an applications point of view, the visualization of semantics structures is of special interest for all branches where complex semantics information has to be presented and managed. Even more important is the processing of unstructured or weakly structured data, where automatic semantics extraction techniques and manual semantics annotation techniques can be successfully combined. Application fields are the production industry, banks and insurance companies, and large IT companies. Here it should be emphasized that semantics can be available in an explicit manner, but can also be harvested from raw data and metadata. Especially in the latter cases, semantics visualization techniques are very important because they give the user a intuitive look inside the underlying data.

To manage semantics structures effectively, additional tools for the navigation, exploration, and processing of semantics structures have to be provided. Moreover, the implicit and explicit knowledge of users involved in semantics management has to be integrated into the management cycle; this then leads to the concept of visual knowledge management.

One application area of visual knowledge management systems is the producers of non-graphical semantic management systems. Here, the coupling of these systems can easily be done using standardized interfaces, and the visual tools provide a significant added value. Another application field are branches, where complex, text-based semantics management systems already exist. Here, again, visual techniques improve usability in collaboration with the already existing in-house systems.

Contact Dr. Christoph Hornung christoph.hornung@igd.fraunhofer.de

### THESEUS

THESEUS is a research program initiated by the Federal Ministry of Economy and Technology (BMWi), with the goal of developing a new Internet-based infrastructure to exploit and utilize the knowledge available on the Internet.

Under the umbrella of THEUSEUS, application-oriented core technologies and technical standards should be developed and tested. The expected results are novel products, tools, services and business models for the World Wide Web as well as future service and knowledge society.

The THESEUS Program consists of the Core Technology Cluster and six use cases, which are realized as subprojects of the program. The Fraunhofer Institute for Computer Graphics Research (IGD) leads the Core Technology Cluster for semantic visualization and innovative user interfaces (CTC-WP5) and is participating in the use case »TEXO«.

### THESEUS – Core Technology Cluster for Semantic Visualizations and Innovative User Interfaces

Semantic technologies and semantic annotated information enable new opportunities to acquire and transfer knowledge. Each information unit is related to other information units of a certain domain. This enriched information is faster, more easily searchable, and more suitable for human needs regarding human information processing.

One of the challenges of semantic information is the visualization of the annotate information. How could semantic information be presented in a ways that supports the efficient work of the user? How could the characteristics of ontology be used to support the acquisition of knowledge?

The THESEUS Core Technology Cluster (CTC) for semantic visualization and innovative user interfaces researches techniques and concepts for the effective presentation of semantic data to the user. Particularly, attributes and characteristics of ontologies which are relevant for visualization of information are investigated. The research in CTC is based on user-centered approaches, where the users are provided with user-adapted intuitive interfaces on the basis of the developed core technology.

Being the face of the THESEUS program, the Core Technology Cluster provides adaptable knowledge visualization approaches for the several use cases of the THESEUS program. These approaches provide the ability to adapt the visualization to specific contexts or users. Therefore, a modular graphical user interface (GUI) for the different users and their individual characteristics and needs will be developed. This will provide a basis for the configuration and personalization of the several graphical user interfaces, as foreseen in the requirements of THESEUS.

To achieve this goal, a modular GUI (Graphical User Interface) framework will be the basis for the different requirements of the project. Furthermore, a user experience (UX) design methodology for the visualizations and the interfaces will be suggested to enable a systematic, user-centered, and standardized adaptation to the components.



Challenges of the THESEUS Core Technology Cluster (CTC)

Another important aspect of the Core Technology Cluster is the automatic adaptation of the semantic visualization to the user. The system asks and registers from different perspectives the user's behavior, precognition, and learning aptitudes. The results of the user interaction analysis are used for the appropriate visualization or orchestration of different visualizations as a knowledge cockpit. This special representation of knowledge will enable the adaptation of complex semantic structures and information to the user, supporting effective work and research.



Semantic Visualisation of information in CTC

The THESEUS Core Technology Cluster for semantic visualization researches and defines in conjunction with automatic adaptation to the user different graphical primitives, which, on the one hand, are relevant for the user and his perception and, on the other hand, take the semantic character of information into account.

The design and concept of the several user interfaces and visualization for THESEUS are critical for the acceptance of the developed technologies. The user interface can be seen as the most important aspect of an information system. The user interface is typically evaluated on different contents, business goals, supported context, user needs, and user behavior.

### Contact

Dr. Christoph Hornung christoph.hornung@igd.fraunhofer.deN adeem Bhatti nadeem.bhatti@igd.fraunhofer.de

TEXO – Business Webs in the Internet of Services

TEXO, a research project within the THESEUS program, aims to supply a service-oriented architecture for the integration of Web-based services in the next generation of Business Value Networks.

The research focuses of TEXO address the full life cycle »from innovation to consumption« of business services via intuitive interfaces and technical systems, and provide a new Internetbased infrastructure to support development, use, retrieval, and access of services, as well as improve their value of knowledge. Additionally, TEXO takes advantage of semantics and Web 2.0 technologies, such as Community and Mashups, to support the search and use of services on the Web.

To the use case TEXO, the Fraunhofer Institute for Computer Graphics Research (IGD) contributes research and development (R&D) of semantic visualization techniques for services in the form of »Service Maps«. For accomplishing this R&D vision, IGD research's efforts address the employment of a suitable User Experience methodology and the modeling of innovative interfaces within the service engineering business. This methodology should support the studies of, for example, how services and their complicated semantic structures can be easily and intuitively visualized in an aspect-oriented and roles-based semantic visualization tool.

In collaboration with SAP AG and the German Research Centre for Artificial Intelligence (DFKI), Fraunhofer IGD has designed and implemented a prototype which offers an innovative user interface and multimodal interaction for visualizing and searching services on the Internetof services. This prototype built on available Web 2.0 technologies, e.g., Google Maps, Social Web, and Semantic Visualization shows how these technologies can be used and combined to create the next generation of Web technologies and graphic user interfaces.

The prototype follows an approach that pursues two main objectives. The first is to realize Web 3.0 as a combination of Web 2.0 and the Semantic Web, and the second is to boost the use of »Programmable Webs« by exploiting the benefits of collective intelligence. The realization of Web 3.0 technologies will enable users to easily search and find information on the Internet, and the combination of the »Programmable Webs« and collective intelligence will enable developers and the community to use and combine existing solutions like Google Maps to easily realize their innovative ideas and build new services for the Web.

The prototype »Repair Shop Search« allows users to search for, quickly navigate along special features of, and select repair shop services. If, for example, the user searches for a certain repair shop, she can determine, with the help of Google Maps, the region where it is situated. In the semantic map view, all services situated in the given region are displayed. Likewise, the user can start the search navigating along the group of services displayed in the semantic visualization view. The service map view displays



Demonstrator »Repair Shop Search«. Google Maps (1) as a mashup combined with Web 2.0 community panel information (2) on contact data and overall rating score and the like, and (3) the semantic map. not only the services but also special features related to them, such as their know-how, the product they offer, the kind of technology they use, etc. This information helps the user to find the suitable repair shop for her needs. Furthermore, if the user clicks on the link for one repair shop on the semantic map view, in the community panel, information about the overall rating score provided by the community is presented. Once the user finds the repair shop she is looking for, she can directly subscribe it and use its services offered, e.g., order auto parts, make an appointment for auto service, etc.

Furthermore, the user interface design developed for this prototype follows a user-centered design methodology (User Experience methodology) which provides comprehensive process for designing Web-based user interfaces composed by Web 2.0 components (Mashups) and »Programmable Web« components.

#### Contact

Renata Dividino renata.dividino@igd.fraunhofer.de

### TM-Viewer – A tool for TopicMapbased Visualization of Complex Knowledge Domains

The TopicMap-Viewer »TM-Viewer« visualization tool enables companies to visualize and graphically manage business knowledge. The »TM-Viewer« uses knowledge maps to display complex data sets and the interrelations between these data sets in an easy-tounderstand way. The aspect-oriented visualization techniques used by the »TM-Viewer« enable users to visualize their data according to their perspective, needs, and wishes, i.e., the manager's or the employer's perspective. Additionally, the use of the level of detail techniques offers optimal presentation of and effective navigation through the knowledge map. »TM-Viewer« enables users to extract the information effectively, which makes it an optimal tool for all knowledgeintensive applications, including organization of e-learning content and the creation of knowledge repositories.

The purpose of »TM-Viewer« is to create an interactive graphical management system for complex knowledge domains. »TM-Viewer«'s target customers are big enterprises, including banks and insurance companies, as well as large providers of e-learning software. The most important features of »TM-Viewer« are:

- Easy-to-use interactive visualization and navigation techniques for the knowledge map
- Direct access to information and data
- Role-specific visualization of data
- Visualization of inter- and intrarelation between data sets
- Adaptable graphical metaphors
- Clear arrangement of complex information
- Increasing the efficiency of problem solving

An example of a possible knowledge visualization using the »TM-Viewer« is shown in the figure. It exemplifies the knowledge expertise of a company composed of 4 interrelated groups: experts, technologies, projects, and research topics. When a user is looking for information about a specific employee or resource, then he is also able to visualize context information related to it, such as the employer's expertise. By clicking on the icon representing the employee, the user can extract contact details as well as further information, such as links to proj-



Visualisation of the expertise of a company with the TM Viewer.

ects the employer is involved in. This approach increases the effectiveness of the information search and problem solving. For the application purpose, topic-maps technology (www.topicmaps.org) was used to generate metadata provided by the knowledge management system.

In cooperation with SAP AG, the visualization tool »SAP-TM-Viewer« based on the »TM-Viewer« technology was developed to define and implement visualization and navigation techniques for business models. Furthermore, topic-maps technology was used to model the business structures. Modern technologies like Web-Services and Rich-Clients enable employers to use the »SAP-TM-Viewer« on the Internet. The use of such Web-based tools enables employers to get access to contextspecific documents at their workplace



SAP-TM-Viewer for the visualisation of business models.

as well as when they're traveling to clients. The visualization tool »SAP-TM-Viewer« is being tested by SAP.

### Contact Nadeem Bhatti nadeem.bhatti@igd.fraunhofer.de

## APOSDLE - Advanced Process-Oriented Self-Directed Learning Environment

Frequently switching work contexts, faster process and product cycles, and continuously changing requirements of employees is the usual situation at today's workplaces in the knowledge era. This demands life-long learning, and new ways to learn, work, and collaborate. APOSDLE tries to combine the different roles of a user-worker, learner, and expert-to enable (informal) learning at the workplace.

Workplace-embedded learning often takes place during social interaction, e.g., while collaboratively editing a document or having bilateral conversations. APOSDLE tries to provide resources and knowledge artifacts suitable for the current working context of the knowledge worker. Besides static documents, this also includes helpful experts.



Collaboration tool ConcertChat

The collaboration tool ConcertChat is a vital contribution for the interrelationship of the different roles at the workplace. It offers not only standard chat functionalities, but also the possibility to explicitly reference past messages or designate objects or regions in whiteboard or other context-related PDF documents. This enables a type of interaction which goes beyond today's chat functionalities.

In addition, the course is stored as a transcript together with appropriate metadata. This allows the user to access specific collaboration results in similar contexts and will enrich the companies' pool of information and documents. This new information will make the pool more complete and helpful for all users.

Within APOSDLE, Fraunhofer IGD Rostock worked on the fields of »Collaboration« and »Usability«. Their results are described in the context of the business areas of »Interactive Document Engineering« and »Usability and Utility Engineering«, respectively.

### Contact

Eicke.Godehardt eicke.godehardt@igd.fraunhofer.de

### UNITE - Unified e-Learning Environment for the Schools

The European project combines different disciplines with the background of pedagogy, technology, and teacher's expertise working in schools. The aim of the project is the design and establishment of an e-learning environment, based on a pedagogical framework.



For meeting the requirements and expectations of the schools, 14 schools from 11 countries were involved from the beginning of the project.

In an iterative process, e-learning scenarios have been developed and adapted to schools' curricula. The technical platform provides functionalities to perform a sustainable installation in schools and the Network of Schools.

UNITE performs as a holistic approach to the topic of e-learning. The approach builds on the following results:

- Pedagogical Framework: The pedagogical framework offers teachers guiding documents for establishing e-learning scenarios.
- e-learning scenarios:
   During the project, over 40 scenarios were developed and achieved.
   This collection of examples is a foundation for future activities, also for new users.
- UNITE Platform: The technical platform supports the whole process of planning, preparation, and execution.

As a whole system, UNITE offers an enhancement for teachers, pupils, and parents of the traditional lesson methods.

The UNITE platform as a technical interface combines the following components:

 InfoPool is a central repository to store and share e- and m-learning contents: InfoPool offers distributed authoring and virtual structures for e- and m-learning content, and supports the SCORM metadata standard.

- Microcosmos is a collaboration and communication environment, allowing teachers, pupils, parents, and school visitors to communicate through a unique schooling »entry point.« Along with the platform's built-in features, which include a customizable visual interface, a robust user permissions system, and various user communication tools, Microcosmos is intended to fit any specific educational environment, supporting ease and flexibility of use.
- The m-learning resources include tests and instant feedback by SMS, authoring tools for creating your own quizzes on Pocket PCs, and the mediaBoard, an innovative approach to mobile learning, combining the use of the UNITE platform and mobile phones.



Work in the classroom

During the lifetime of UNITE, over 40 e-learning scenarios were developed and tested in the day-to-day school routine and evaluated. The scenarios described here were established in a Greek gymnasium. This e-learning scenario planned to recapitulate what had been taught within the framework of Rhetoric Texts, with questions and assignments covering material taught from the beginning of the school year, i.e., a preparatory course for the exams that followed. The scenario took place in the school's library; pupils worked on the library's PCs, where Internet access was available; an online meeting was arranged during which pupils posted their queries real time to their teacher, asked for clarifications with regards to the given assignment, and worked with their classmates on a task through online collaboration.

Pupils not physically in the classroom also participated in the learning activities from their home, by using the online communication tools of the UNITE platform (chat, e-mail via the UNITE platform).

Within the framework of this educational scenario, the whole classroom participated in two educational visits: after an introductory field trip to Ancient Agora (its significance and role in the Athenian city, transformation of architecture throughout the centuries, and the functionality of buildings), pupils accompanied by their teacher, a Virtual Reality Theatre, had the chance to participate in a guided tour to the Ancient Agora of Athens, and vote in favor or against the ostracism of an Athenian civilian. Tholos resembles a planetarium regarding its natural and morphological characteristics. However, their only common characteristic is the semicircular shape of the projection surface. The tour is interactive, controlled by the spectator, and not static.

On the other hand, pupils visited the Ancient Agora of Athens and had a guided tour to the nearby monuments



Collecting material on the excursion

with the view to connecting what they had already seen in the Virtual Reality Theatre with what they could see in front of their eyes.

The scenario was related to curricular activities, as both the thematic axes of the scenario and the selected sites are often chosen for a field trip, and the UNITE platform was used both as an educational material repository and as a communication medium. Within the framework of the scenario, pupils had the chance to work as a group, to participate actively in the design and implementation of project-based work.

### Contact

Johanna Dechau johanna.dechau@igd.fraunhofer.de

# Interactive Document Engineering

Today, digital documents play an important role in almost every application field, from information systems to the situation-related assistance in working processes. Now, these documents are not merely textual, but they are multimedia-based-with texts, pictures, videos, audio, simulations, and 3D worlds-and interactive.

The business segment »Interactive Document Engineering« addresses the production, identification, and situation-related delivery of documents in specific application fields. It provides methods for the explicit and implicit generation of documents during working processes, for Semantic Enrichment, and for the context-sensitive supply and adaptation of documents for different application scenarios. Actual applications are conventional elearning as well as workplace-integrated and situation-related learning or training applications and Electronic Job Performance Support. One special application is the support of communication in complex process chains by integrated documents which consider situation- and job-specific dimensions (different access, information extent, functionality, etc.). Further fields of application are maintenance processes, especially the use of Interactive Maintenance Manuals with multimodal interfaces and integrated options to communicate with experts.

Research topics range from the effective production of documents (multimedia documents, interactive simulation, Augmented Reality Documents) explicitly by experts or as User Generated Content, semiautomatic Semantic Enrichment, situation-related supply, and adaptation. In terms of Semantic Enrichment, three different aspects are examined: first, the documents themselves (abstracting, semantic analysis, information mining, etc.); second, the authoring/creation process (explicit ontology-controlled definition, derived from the context, etc.); and, third, the process of utilization (derived from context of utilization, by communication and collaboration, etc.).

Adaptation strategies consider content, technical, and individual aspects related to roles and duties, to available technical resources, as well as to personal preferences, to load states, or to the history of utilization.

In 2007, we developed solutions for the management of learning contents, for the support of work-process integrated communication and cooperation, and for Augmented-Reality Maintenance Manuals. Furthermore, in the context of learning and training applications, we developed interactive games as special types of documents.

#### Contact

Prof. Dr. Bodo Urban bodo.urban@igd-r.fraunhofer.de

### APOSDLE – Collaboration

To collect information, to process it into knowledge, and to transmit the result is the everyday job of knowledge workers. For these jobs, the project APOSDLE provides IT-based support.

The known concept of a »Knowledge Society« already indicates the fact that knowledge is becoming more and more important for the development of the society in general and for the life of every single person. The term »knowledge worker« thus describes those people who, on the one hand, dispense broadly diversified expertise and interdisciplinary competence. On the other hand, the concept refers to people who constantly work with information. Knowledge workers retrieve information; they filter and collect, check, and structure it; they process information about knowledge, share this knowledge with others, and document and publish it. However, neither the working routines or workplaces of knowledge workers, nor, above all, the methods and tools required for appropriate IT-based support of knowledge workers have been scientifically investigated or developed, yet.

Together with research and application partners from seven European countries, Fraunhofer IGD Rostock addresses the scientific investigation of knowledge work. Within the scope of »APOSDLE - Advanced Process-oriented Self-directed Learning Environment«, new software, for the support of knowledge workers, will be developed. IGD's particular task is to develop concepts and technologies which accompany knowledge workers during the initiation, realization, and evaluation of collaborations. Furthermore, it will support them in the documentation of knowledge emanating from cooperations, and facilitate its preparation for other knowledge workers.

### Contact

Dr.-Ing. Sybille Hambach sybille.hambach@igd-r.fraunhofer.de

### **Content Sharing**

In the future, the comprehensive use of eLearning by enterprises or providers of advanced training courses will decisively depend on one question: How can didactically valuable, high-quality eLearning products-adapted to the particular needs of different target groups-be offered at economically attractive costs?



Market place Content Sharing for selling and purchasing digital eLearning material: simplified view of the Content Sharing exploitation chain

In the past, the generation of mediabased learning materials turned out to be one of the most important factors in determining the costs in the production of e-learning offers. Against this background, the multiple use of modularized high-quality learning contents marks a promising option for the further propagation of e-learning.

Within the project Content Sharing, Fraunhofer IGD Rostock developed an integrated solution for Content Sharing in heterogeneous user groups, based on already existing approaches. This solution was supplemented with other innovative components and practically tested. In 2007, parts of the system were reimplemented and test-

Communication Waard	× ×	Communication Waard XX	Communication Waar	4 X X	Communication Waard 🛛 🕹 🗙	
() Hercent () Cooperate () Reflect Ask Question		Request (Convents (Difference)     Convents with Expert	Prequest      Converse     Converse		Request (E)Cooperate (Endour)  Reflect your Cooperation	
Preside static yood respect to Harin Carlo. Therefore Mill fails fails and recently		Organise with Jonath you Frauncism. Une the Head ballow to Black the Longeration and enter reflection.	Cooperate will accept our fragminism. Use the Nord subscript third the acceptention and entry reflection		Thus comparator to thatever, this can tow give tendence on E. A reflection state over predest to the APOSELE Corporative Authority Spece	
When contribution have pay		Request Context Notes	Pequest Task Science	Context Notes	Give bedieck or your occupation	
Present Cognitizer	Joseph von Fraucholer	Nameuran Experts		Induction station APOSICLE Cooperative Authority Spice		
I know eventting about optics Barress I don't know which contribution you Designed Onei	- pest	Present	Document 3	Carl Predents Gauls  Josepher Jangue  Josepher Enclus  Josepher Frauduste	Lone a time to your admittant state. Development of comme X Take over the rules of your competition Robert over competition in	
1 Sched	uie Sent> Cancel	2 Next * Case	3	Next * Close	4 head a Case	

APOSDLE – a so called Communication Wizard supports communication and cooperation: 1. the knowledge seeker puts his question; 2. question and questioner are displayed again; 3. the context of the partner is displayed; 4. the cooperation is finished. Now, the expert and the knowledge seeker have the possibility to reflect the entire collaboration with the given tools.

ed in cooperation with partners from the practice in order to transform it into a marketable product.

### Contact

Dr.-Ing. Sybille Hambach sybille.hambach@igd-r.fraunhofer.de

### alph@bit

In the project »alph@bit - Game-Based Training in the Basic Education«, a digital learning game was developed and tested together with several partners. Designed as an »Adventure«, the prospective learning game playfully practices and improves abilities including reading, writing, calculation, and interaction with the computer.

At the same time, the »adventure of alphabet« considers the demands of daily life and work. The acceptance of the learning game is guaranteed due to lasting training effects, the narrative integration of the user, and excellent usability. In the first instance, the learning game will be tested in adult education centers in Mecklenburg-Western Pomerania. Subsequently, it will be introduced to the entire federal territory.

Besides the coordination of the several subprojects between the involved partners, IGD's major task in alph@bit is to develop the technical and creative concept for, as well as the implementation of, the digital learning game. For this, the researchers resort to the extensive firsthand experience of Fraunhofer IGD Rostock. A special feature of IGD's work is its strong interdisciplinary and systematic approach in the development of the learning game. In addition, following the approach of »Lightweight Game Development«, the researchers are also investigating possibilities for the development of highquality learning games with only small budgets.

alph@bit is funded by the Federal Ministry of Education and Research (BMBF) within the scope of the federal priority research program »Literacy/Basic Education for Adults« from November 2007 till October 2010.

Contact Dipl.-Päd. Steffen Malo steffen.malo@igd-r.fraunhofer.de

### EgoTrainer

An important presentation is being planned today. Once again, some practice would not hurt. But there is not enough time to prepare by, for example, attending a seminar or training course. Playing some EgoTrainer is just the solution!

The EgoTrainers, developed by Fraunhofer IGD Rostock, are a set of short digital games which can be used for soft skill training (e.g., presentations, communication, moderation, body language, etc.). Conventionally, such training is offered temporarily in attendance seminars based on multiple indi-

vidual exercises. Henceforward, IGD's EgoTrainers enable participants to repeatedly practice single aspects of their training, and to regularly refresh their knowledge under use of explorative access.

The EgoTrainers thus help the user to remember and to consolidate the methods learned in the training. From the perspective of an employee of a fictitious enterprise, the player has to carry out realistic working tasks. The duties demand the use of the acquired skills in order to bring about or, at least, to ease the self-determined work with the contents. Among others, these duties comprise:

- The preparation and realization of a presentation (EgoPresenter);
- The planning and realization of different talks (EgoCommunicator);
- The sales of products and services (EgoSale).

All games are designed for a short play time, so they can be played occasionally during the workday (e.g., as preparation for a presentation). Due to their entertaining character, they also offer many incentives for the learner to engage with the contents in his spare time. Moreover, to make them also applicable in restricted environ-

EgoTrainer – Presentation training with the EgoPresenter <Ego-Trainer – Vortragsübung mit dem EgoPresenter.



ments (e.g., secure company networks, etc.), the games are Web-based and do not make high demands on the technical equipment.

Contact Dipl.-Math. Holger Diener holger.diener@igd-r.fraunhofer.de

### VIVERA

The project VIVERA is a competence network in the fields of Virtual and Augmented Reality (VR, AR). Two of the pParticipants are Fraunhofer IGD Rostock and the Fraunhofer Institute for Factory Operation and Automation (IFF). The project is promoted by the Federal Ministry of Education and Research (BMBF). The aim is to link up the competencies and practical experiences of developers and users of VR or AR, to identify further research needs, to transmit them into other application sectors, and to develop prototype demonstrators.

In the area of shipbuilding, Fraunhofer IGD Rostock robustly enhances already existing VR and AR technologies as well as interaction technologies in order to make them also applicable within the ship realm. The results of the project are demonstrated with the »Interactive Maintenance Manual«.

Ships are highly complicated machine systems. They comprise different and complex subsystems which mutually depend on one another in their function. Therefore, in daily maintenance processes, it is a substantial advantage to command a quick and trouble-free technical documentation.

Additional possibilities to support operating processes by means of interactive media arise from the systematic



VIVERA - Virtual Maintenance Manual

post-use of integrated product models generated in the preceding design and planning phase.

Contact Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de

#### **XyberScout**

On the basis of mobile phones, smartphones, or PDAs, the mobile trade fair assistance system XyberScout offers visitors the latest exhibitor and event information. Besides textual and hierarchical information, the geographic position of targeted booths is also graphically visualized on the mobile device. XyberScout presents exhibitor information, on the one hand; on the other, it is able to communicate with the user interactively. Thus, traditional printed fair catalogues are displayed as interactive, electronic documents. But XyberScout goes far beyond the scope of digital ePapers, such as PDFs. This is not only due to the fact that it supports multidimensional forms of information access, but also because it easily features personalization services.

By other means of sensors, the presentation of area-specific information is also possible. This not only makes the display of the trade fair information more transparent, but it also enables the electronic medium to guide and assist the visitor during his round tour. In 2007, XyberScout was field-tested 25 times at the exhibition venues in Munich, Frankfurt, Düsseldorf, and, for the first time, also in Nuremberg at the International Toy Fair.

Contact Dr.-Ing. Erhard Berndt erhard.berndt@igd-r.fraunhofer.de



Exhibition guide on the Smartphone solution of XyberScout

# WESSP – Web-Suitable, Scalable Simulation Platform

Interactive simulations are important components of virtual learning and training environments. The project »WESSP - Web-Suitable, Scalable Simulation Platform« focuses on a ship machine simulator.

The aim of WESSP was the adaptation and enlargement of a ship machine simulator for dual-use purposes developed by the Marinesoft Logistics and Development mbH, Rostock. The aim was the supply of a Web-suitable modular simulator which is applicable as a complex simulation within SCORM-compatible Learning Management Systems (LMS).

For this purpose, several questions were asked:

- How can we achieve a secure, highperformance, highly scalable transformation of simulator components on the Internet?
- How can simulations, 3D worlds, and games be included in the established e-learning standard SCORM?
- Which special demands arise from the consideration of the multiuser's aspect of games or simulations?
- How can HLA-based simulations interoperate with SCORM-compatible learning contents?

The interconnection of simulations, games, and SCORM extends the possibilities of learning and training in standard-compliant learning environments. Furthermore, it provides an innovative form of Electronic Job Performance Support. Contact Dr.-Ing. Sybille Hambach sybille.hambach@igd-r.fraunhofer.de

# МСМ

In the project »Multimedia Content Management in Mobile Environments« (MCM), visual tools for the support of knowledge acquisition are developed and adapted to mobile application contexts as part of the Electronic Job Performance Support.

The project MCM is promoted within the scope of the 4th Mecklenburg-Western Pomerania State Priority Research Program IuK. Besides Fraunhofer IGD Rostock, different chairs of the University of Rostock and the Hochschule Wismar participate in it. The project examines aspects of the design, development, and application of information and communication technologies in mobile contexts. In 2007, Fraunhofer IGD Rostock worked on the development of visual tools for the support of knowledge acquisition by internal experts of an enterprise (e.g., maintenance worker) and their adaptation to the mobile application context. Furthermore, we developed visual tools for the assessment and processing of knowledge.

These tools support the externalization and combination of knowledge and allow an active, process-integrated inclusion of the employee's knowledge. This knowledge acquisition is an important step towards a situationrelated support in working process, i.e., one integral part of Electronic Job Performance Support.

### Contact

Dr.-Ing. Sybille Hambach sybille.hambach@igd-r.fraunhofer.de



Mobile maintainance management as an application of MCM

## KET Lab – Laboratory for Knowledge Engineering Technologies

In the KET Lab, methods and technologies for e-learning and knowledge management are investigated. Here, we test concepts and instruct users in the application of e-learning. So, on the one hand, the KET Lab functions as a service center for IGD's researchers, and as a »production plant« for customer-related services, on the other hand.

These services are based on the technical equipment composed of multimedia technologies and computer-based communication. Thus, we are able to investigate, explain, and develop the interaction of different means of new media as well as the computer-based exchange of information. We profit from it in our research on e-learning concepts, from the computer-aided group work, and from authoring tools for multimedia-based e-learning environments.

The main focuses of our scientific work and services in the KET Lab are:

 eLearning service with specific consulting for e-learning and demonstration of possibilities for e-learning in special use cases



Dr.-Ing. Sybille Hambach

- planning, development, and production of educational offers and media-based learning materials
- training and coaching for technical solutions developed by us, but also for other subjects in the form of telecourses like »Multimedia Design«, »Co-operative Work with Coop-MV«, or »Java Introduction«
- contract research for new tools and applications for teaching and learning with the Internet and new media.

### Contact

Dr.-Ing. Sybille Hambach sybille.hambach@igd-r.fraunhofer.de

## Systematic Development of Modular e-learning Offers - Action Model and Development Environments

In November 2007, Sybille Hambach defended her doctoral thesis on the subject »Systematic Development of Modular e-learning Offers - Action Model and Development Environments« at the Faculty for Informatics and Electrical Engineering of the University of Rostock (tutors: Prof. Dr. Bodo Urban, Prof. Dr. Uwe Sander, Prof. Dr. Barbara Grüter).

In her dissertation, Sybille Hambach addresses the efficient development of media-based educational offers. Today, economic development in the education market is still hampered by the high expenditures that come along with (a) the production of high-quality digital learning contents and (b) their integration into multivariant education concepts. An aggravating factor is that the required effort is not limited to the mere programming of complex simulations, interactive applications, or cooperative training solutions. In many cases, high capital costs quite often result from the coordinated collaboration of professional experts, information scientists, and designers, which is indispensable in safeguarding a high quality standard.

With ROME (The Rostock Model for the Systematic Development of Modular e-learning Offers), Mrs. Hambach has presented a solution concept for this problem. Therein, she views the subject not only from the perspective of informatics, but pursues an interdisciplinary approach which, besides informatics, also considers the disciplines educational theory and design. Furthermore, this holistic approach contemplates the entire development process, beginning with the scheduling of an educational offer up to the adjacent assessment of conducted training measures.

The action model that has emerged is an important and interesting resultfrom both the scientific point of view (structuring of an ideal type development process, instantiation in development projects, and derivation of a software-based development environment) and the user's practical point of view (instruction and support of the development of modular e-learning offers).

Sybille Hambach has been working at Fraunhofer IGD Rostock since 1996, heading the competence range »Knowledge Engineering Technologies«.

#### Contact

Dr.-Ing. Sybille Hambach sybille.hambach@igd-r.fraunhofer.de

# Usability and Utility Engineering

Every year, scientists from all over the world develop new technologies for users of interactive devices, be they desktop computers or user interfaces of other computer-controlled systems. Today, these technologies enable the display of large volumes of information and support the user in his interaction with the respective devices. This is not limited to increasingly complex software applications for office networks, but it encompasses new technologies for the visualization of information in application fields in which it might be-under certain circumstancesof vital importance for the user to grasp and process the displayed information in time. This holds true, especially, for computer-based accident warnings in passenger cars. These warnings, resulting from the continuous analysis of traffic data, are visualized on so-called Head-Up-Displays to make sure that they are, at least, perceived by the driver.

One aspect of Usability and Utility Engineering is to enhance the effectiveness of new visualization and interaction technologies in different application areas. Other aspects of this scientific field focus on efficient and user-friendly system interaction with special regard to respective application contexts and target groups. So, Usability and Utility Engineering investigates the methods which are implemented during the different stages of industrial product development to guarantee the usability of new interactive systems.

In 2007, we concomitantly implemented Usability and Utility Engineering methods in several state-funded research projects, e.g., »In the Knowledge Web« or the EU project »Aposdle«. The purpose was to ensure the user-friendliness of the software developed in these projects. Fraunhofer IGD Rostock also conducted usability checks in different industrial projects. Here, we evaluated the user-friendliness of several Internet and software applications and made qualified optimization proposals.

### Contact

Dr. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de
#### In the Knowledge Web

Supporting knowledge-based work by concepts and systems of information technology requires that the respective software applications be intuitively manageable and promising.

The project »In the Knowledge Web«, funded by the German Federal Ministry of Education and Research (BMBF), basically aims at the transfer of the methodology of proactive, context-oriented knowledge provision in cooperative working processes (business process-oriented knowledge management) in the field of e-science, i.e., on network-based innovation and cognitive processes.

To this end, we analyze patterns of cooperation processes, of information and knowledge exchange, as well as the relevant artifacts for knowledge preservation, its metadata, and their mutual correlations. This results in the development of assistive software which records, instructs, and offers active support during cooperative processes of research and innovation.

Within the project, Fraunhofer IGD Rostock is responsible for the Usability Engineering and, thus, ensures the operability of the newly developed software applications.

#### Contact

Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de

#### **Emotions while Driving**

Which car is more fun? Is it possible to measure »driving pleasure«? To explore the general measurability of driving pleasure, Fraunhofer IGD Ros-



Left: Measurement of emotions while driving. The test car is equipped with a microphone, a video camera, a GPS recorder and other recording devices. In addition, the driver wears the so called »EmoGlove«. Right: Model of the test route for the comparison of »driving pleasure«.

tock took part in the pilot study »Emotions while Driving«, which examined relevant measuring methods.

Comparative tests were conducted with the new and the 25-year-old Mercedes Benz C-class. Whether the new C-class offers more driving pleasure than the old model was investigated in terms of the emotions experienced by the test driver en route. For this purpose, IGD researchers recorded and analyzed a multitude of physiological and linguistic data.

Eight test persons (four male, four female) had tested both vehicles (W201 and W204) on the exclusive Bosch test area chosen by the study's client. Before and after the tests, the participants were interviewed using different questioning methods regarding their expectations and driving experiences.

About four weeks before the final test, the technical monitoring and the subsequent revision of the test design had been checked by a pretest.

The results of the study showed that it is indeed possible to measure driving pleasure and to obtain objective results. For example, the voice analysis indicated a clear discrepancy between the emotional experiences in the different car models: The portion of positively experienced routes was twice as large in the new C-class as in the 25year-old model (72 percent versus 36 percent).

Contact Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de

#### USE-VR

The usability of technical solutions (hard- and software) is a decisive factor for the acceptance of innovative technical services. Still, no standards have yet been developed for humancentered interaction in virtual environments. It is necessary, therefore, to carefully analyze and optimize the usability of the solutions developed in the project »USE-VR«.

The research project »USE-VR - Usability-Evaluation and Interaction Consultation in VR«, funded by the German Federal Ministry of Education and Research (BMBF), focuses on the development of multimodal interaction technologies for shipbuilding purposes. IGD's task in this project is to investigate proper methods for the evaluation of a multimodal interaction in virtual environments. Subsequently, the institute will carry out such an evaluation in practice under use of the developed methods. Fraunhofer IGD Rostock offers a unique combination of competencies which are fundamental for the successful realization of this part of the project. This is due to its internationally accepted research projects in the field of Usability Engineering, its own Usability Lab, its substantial portfolio in proprietary developments for the efficient realization of usability studies, as well as its own preliminary works for the application of Virtual Reality.

The aim is to examine and to analyze the interface design as well as the user support of the developed system. Furthermore, problem areas in the process of interaction, which are used to compile qualified solution proposals, will be outlined.

#### Contact

Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de

#### Usability Evaluation UNICEF

The aim of the project, commissioned by UNICEF Germany, was to evaluate parts of the internal administrative software which was to be introduced at UNICEF. Focal points were the interface design and the dialogue behavior. The evaluation was based on existing sets of rules and on the experts' empirical experiences, on the one hand, and on typical future user duties, on the other. In close cooperation with UNICEF, evaluation criteria and typical settings of future user tasks were compiled and a system inspection was conducted. Two usability experts from Fraunhofer IGD Rostock evaluated a prototype of the user interface, identified possible problem areas, and compiled optimization proposals. The results of the evaluations were summarized in a priority list of open points. Furthermore, they were presented and discussed in a workshop for users and developers. The results of the workshop serve as a road map for developers for further software development, from prototypes to the productive application.

#### Contact

Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de

The work packages of »Aposdle« for the software based support of knowledge workers

## APOSDLE – Usability

»APOSDLE - Advanced Process-oriented Self-directed Learning Environment« is an integrated EU project comprised of Fraunhofer IGD Rostock as well as research and application partners from seven European countries. Jointly, we are developing new software which supports knowledge workers. The aim of the project is to enhance the productiveness of knowledge workers. This is done by the development of a socio-technical infrastructure for the intrainstitutional integration of working and learning processes.

Beyond the scope of cooperation, Fraunhofer IGD Rostock is evaluating the usability of the complete system, i.e., the usability of the developed technical systems, and supporting the





In the »EnterAction

Lab«, the Laboratory

for Usability, Entertain-

ment and Interaction, new methods of man-

machine interaction

and entertainment

person wears IGD's

»EmoGlove« for the

measurement of his emotional state during

the test.

ly. In the picture: a test

technologies are explored experimental-

developers in this respect. In 2007, the first Aposdle prototype was evaluated by a team of experts. Based on preliminary defined testing tasks, the researchers carried out »Walk Throughs« within the system and checked it against different usability heuristics. By making the results of the analysis available for the development partners, they were directly incorporated into the technical advancement of the 2007 prototype. Furthermore, the results support the project partners in their analysis of the requirements for the second prototype.

#### Contact

Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de

# EnterAction Lab – Laboratory for Usability, Entertainment, and Interaction

Since 2002, Fraunhofer IGD Rostock has run the so-called »EnterAction Lab« on its premises. It emanated from two of the institute's former research departments, the »Human-Centered Interaction Technologies« and the »Entertainment Technologies«. As an experimental laboratory, it provides the necessary requirements to explore and review new methods in the areas of man-machine interaction and entertainment technologies (hence, the name »EnterAction«, a merger of »entertainment« and »interaction«).

Activities in the »EnterAction Lab« focus on:

- Usability technologies and usability tests (RealEYES, usability services);
- Theoretical aspects and the development of technologies for the recognition and consideration of emotions in the configuration of



user interfaces and computer applications (as in the projects Face?Me, EiS - Emotion in Speech);

- Innovative interaction technologies for immersive virtual environments;
- Data mining technologies;
- The development of Game-Based User Interfaces for intuitively operable software applications which are becoming more and more complex, today.

#### Contact

Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de

# Usability and Utility Services

Since markets are increasing and narrowing in focus today, the usability of consumer products is, in turn, increasingly becoming an important competitive advantage. Therefore, Fraunhofer IGD Rostock offers qualified usability services for the development of new products on the basis of its extensive research expertise and its in-house Usability Laboratory (»EnterAction Lab«).

Whether it is information systems on the Internet, crosslinked systems of consumer electronics in private households, outdoor sales systems and information terminals, or navigation systems in our private cars, usability increasingly forms a determining key criterion for their economic success or failure.

At Fraunhofer IGD Rostock, methods of Usability Engineering are applied to render man-machine interaction taskoriented, barrier-free, and user-friendly.

Our usability services generate higher customer acceptance and market success for our clients' products. In this context, we offer the following services:

- Support in the analysis of requirements and utilization context;
- Elaboration of strategies for user participation and prototyping;
- Development-accompanying verification and evaluation of usability;
- Consulting for relevant norms and Standards.

#### Contact

Dr.-Ing. Jörg Voskamp joerg.voskamp@igd-r.fraunhofer.de Medical Information Technology

New software solutions have strongly changed medicine in the last few years. Imaging procedures above all form a solid part of medical diagnoses and therapy planning as well as increasingly even in treatment: physicians can get important views into the human body with X-rays at first, then by means of computer tomography (CT), ultrasound and magnetic resonance tomography (MRT), but after that, the three-dimensional presentation of imaging divided in layers has been established, enabling fast and accurate diagnoses and specific therapies.

Any surgeon is able to interpret threedimensional anatomic data-there is no longer any need for specialized radiologists with years of experience in diagnoses of images in layers. In addition to three-dimensional models, time can be virtually shown as a fourth dimension. For this purpose, many single images melt into a film, whereby there is quite a number of gigabytes of data per second. Fraunhofer IGD has developed software solutions to handle these large amounts of data.

Cardio-CT and -MR is an example in which the blood flow in single vessels is visible. The physician can recognize which regions of the myocardial muscle are not fully working and which blood vessels might be »plugged«. Another important method for diagnosing heart diseases is the analysis of dynamics of the left ventricle. Abnormal motion patterns are searched in order to analyze the position and size of wall troubles.

Software research in the medical area concentrates on computer simulations to ensure better planning of therapiesa sort of operation on trial. In case of irradiation of a tumor, for example, the irradiation has to be dosed in the correct relation to size, form, and position of the tumor to save healthy tissue. Too much or too little irradiation rapidly jeopardizes the success of the whole therapy.

Ultrasound, the fastest growing imaging method, has also managed to jump to the fourth dimension. This is of great importance, as ultrasound is the sole method used during an operation and which most clinics can afford. New imaging procedures increasingly are to be applied besides diagnosis and therapy planning. Thus, the surgeon above all is interested in the matter of transferring graphic information from diagnosis and planning to the anatomy of the patient, and making sure treatment is proceeding according to the plan. This is of particular importance for the »keyhole-OP«, which is occurring more and more.

These minimally invasive interventions save costs and reduce exposure for the patient, though the surgeon has to cope with higher requirements. Software solutions enable him not only to plan the operation in advance and possibly even try different alternatives, but also to be led (navigated) by graphic information in the course of an operation.

Contact Prof. Dr. Georgios Sakas georgios.sakas@igd.fraunhofer.de

#### **Batista-Operation**

The research project concentrates on optimizing the surgical therapy of heart failure. Dynamic (3D + time) MR data are used to enable a morphologic and physiological simulation of the operation in advance.

This research project started in the fourth quarter of 2007 and is supported by the Deutsche Herzstiftung e.V. Clinical project partners are the Klinik für Thorax- Herz- und Thorakale Gefäßchirurgie as well as the Institut für Diagnostische und Interventionelle Radiologie des Klinikums der Johann-Wolfgang Goethe Universität in Frankfurt/Main.

The research project concentrates on optimizing the surgical therapy of heart failure. Dynamic (3D + time) MR data are used to enable a morphologic and physiological simulation of the operation in advance.

The main objective is the clinical introduction and evaluation of a softwaresupported simulation of ventricle geometry for planning of reconfiguring procedures. In the framework of the project, a computer simulation will be developed and clinically evaluated, enabling the advance calculation, out of dynamic 3D imaging data of a patient, besides position and extent of the regional ventricle deformation and ventricle size, the contraction characteristics, the myocardial thickness and elasticity of the myocard in single seqments, the required kind and extent of the ventricle reduction, and optimal





The Society of Imaging Informatics in Medicine (SIIM) awarded the Cardio Analysis Tool for automatic analysis of CT data.

A main reason for cardiovascular diseases are calcifications of the coronary blood vessels. The earlier the recognition, the better the prognosis for the patient. Up to now, the diagnosis of calcifications has been extensive and straining for the patient.

Scientists of Fraunhofer IGD in cooperation with physicians of the Universitätsklinikum Frankfurt have developed a new procedure to diagnose calcifications of the arteries in a faster and gentler way. The software developed by the researchers automatically detects the constrictions due to the CT image.

In June 2007, this procedure was awarded with the »JDI Best Paper Award 2006, 2nd« of the Society of Imaging Informatics in Medicine (SIIM) [Wesarg, Stefan; Khan, M. Fawad; Firle, Evelyn: Localizing Calcifications in Cardiac CT Data Sets Using a New Vessel Segmentation Approach. In: Journal of Digital Imaging 19 (2006), 3, pp. 249-257]

Contact Prof. Dr. Georgios Sakas georgios.sakas@igd.fraunhofer.de



3D-imaging of increasing wall thickness of the left ventricle with overlaid view of the cicatrice

#### Automatized Analysis and Visualization of the Coronary Arteries and Big Cavities of the Heart for Clinical Application

In the framework of his dissertation, Stefan Wesarg realized different procedures for an automated analysis of the coronary arteries and of the right and left ventricles. By its combination, he reached a new quality of computersupported imaging analysis for cardiology.

The main point of focus in developing his improved and new technologies was their clinical application. Very special algorithms are required. Besides the most exact reproduction of anatomic conditions when extracting the structures to be examined, a small input from the user and a fast execution of the algorithm is required. Given the fact that the spatial as well as the temporal resolution of the recorded medical imaging data is steadily increasing, but the time of inspecting these data remains more or less constant, it becomes apparent that automation of the analysis is indispensable.

Therefore, this work focused on achieving a new quality of computersupported imaging analysis for cardiology by combination of automated analysis procedures in combination with adequate methods for visualization of the corresponding results. This was achieved by developing new and improved procedures for the extraction of anatomic structures, based upon automatic analysis of regarded body regions and finally the introduction of new, intuitive methods of visualization.

#### Contact

Prof. Dr. Georgios Sakas georgios.sakas@igd.fraunhofer.de



Analysis of wall motion for a patient after heart attack in basal inferolateral region (red region down right)

#### MISS – Minimally Invasive Smart Suture

Almost all surgically invasive interventions require a mechanical anchorage and connection of above all (but not exclusively) soft tissue. Therefore, »surgical connection technology« is an immense market where numerous medical technology companies have been active.

MISS is a project supported by BMBF and realized together with two further Fraunhofer Institutes and French partners.

Suturing is traditionally the most commonly used method to connect tissues due to its great robustness and various applications for most different regions of the human body. Manual suturing, however, is combined with risks and disadvantages:

- Time required is relatively high, even for experienced surgeons;
- Procedure is difficult when intervention is minimally invasive (e.g., with telemanipulators);
- Risk of tearing tissues in case the suture is not done optimally exists;
- Unintended anchorage of neighbor tissues is possible.

The main objective of this project is the development of a system for automated and sensor-controlled manufacture (»closed-loop«) of surgical sutures in the area of minimally invasive surgery (MIS). A system for bypass-anastomoses (surgical-operative connection of the ends of blood vessels) is being developed exemplarily for different applications, which can be used as a basic system for further applications due to the high technical standard. Hereby the development of instrument and measurement technology required for this purpose is focused, as well as the necessary software components, on operation planning, process, and quality control.

The result of this project among the involved institutes will be a prototype of such a system which can be tested at preparations and phantoms of vessels. Testing this system on animals or human beings is not realistic, due to the short project time. The prototype to be developed will enable, however, the evaluation of the followed approach in context with subsequent clinical studies and estimate the potential for applications in clinical life. In case of success, contacts for numerous research projects and cooperations with regard to concrete development of instruments will result.

#### Contact

Dipl.-Inform. Klaus Drechsler klaus.drechsler@igd.fraunhofer.de

#### Dental-CAD

The construction of tooth reconstructions by CAD methods is a quickly growing market and still an important research topic. In this area, the IGD looks back on a long history of experience with several industry partners.

In 2007, two projects with the partners Hint-ELs and Zirkonzahn were successfully completed. Furthermore, a new industry customer-Argudent GmbH from Parchim-was gained.

The focus of research and development in this area lies in the development of a new method for automatic construction of crown and inlay reconstructions, to ensure the robustness expected by the market, even for difficult data sets. Additionally, new tools for manual deformation of organic surfaces were created, to allow interactive and intuitive post processing of the software's design suggestions according to the individual wishes of the dental technician.

Contact

Dipl.-Ing. Tillmann Steinbrecher tillmann.steinbrecher@igd.fraunhofer.de

#### SHAPES – Scalable Software Hardware Architecture Platform for Embedded Systems

The SHAPES project, European-funded since 2006, aims atthe development of a scalable hardware/software solution for future CMOS technologies. Many high-performance interconnected »tiles« enable high-grade parallelization and scaling of the system.

The SHAPES project (Scalable Software Hardware Architecture Platform for Embedded Systems) investigates a groundbreaking hardware/software architecture paradigm. The SHAPES platform is composed of multiple highperformance hardware modules, socalled tiles, which can be connected to each other and thus enables a high-



Framework bridge with three elements, designed in Hint-Els vißus

grade parallelization and scaling of the system. The SHAPES project investigates a layered system software for providing a simple and efficient programming environment for such a tiled architecture. The software does not destroy algorithmic and distribution info provided by the programmer and is fully compatible with the hardware paradigm.

Fraunhofer IGD's part in this project is the development of a benchmarking application for the SHAPES platform. Therefore, a software-based ultrasound system is being developed in cooperation with ESAOTE Europe. The mapping of large parts of an ultrasound scanner in software is of high importance, particularly with regard to future development of portable handheld ultrasound systems. Moreover, it allows additional measurements, such as the generation of M-mode images.

Whereas ESAOTE Europe is responsible for beam-forming and echo-processing algorithms, Fraunhofer IGD is responsible for importing, analyzing, and visualizing the ultrasound RF raw data. The architecture based on the SHAPES platform will dramatically speed up the computation in such a software-based ultrasound system.

For more information, visit http://www.shapes-p.org.

Contact Dipl.-Inform. Christina Lacalli christina.lacalli@igd.fraunhofer.de

## **THESEUS Medico**

Under the research program THESEUS, the use case »Medico« aims at developing an intelligent, scalable, and robust search engine for the medical area.

THESEUS is a research program initiated by the Federal Ministry of Economy and Technology (BMWi), with the goal of developing a new Internet-based infrastructure in order to better use and utilize the knowledge available on the Internet.

The use case »Medico« building up an intelligent, scalable and robust search engine for the medical area, in particular includes applications in the areas Clinical Decision Support and Computer Aided Diagnosis. The search engine targets direct semantic access to medical imaging databases to support individualized diagnoses and therapy planning as well as biomedical and epidemiological research. Target groups are physicians, researchers, as well as application developers in the areas of medical informatics and Health Care IT.

The contribution of Fraunhofer IGD within Medico includes research and development in the areas of semantic image annotation, automatic organ segmentation, as well as semantic computer-aided diagnosis (semantic CAD and DSS).

Establishing an imaging syntax and semantic-based imaging vocabularies (graphic and textual) for efficient annotation of medical data is required for developing the Medico search engine. The result will be a semiautomatic annotation tool enabling physicians to annotate medical image data like CT or MR images at a structural, anatomical, and disease-oriented level. The annotation tool will be used to develop a »ground truth« database that is required for developing the Medico search engine.

Organ segmentation with deformable surfaces



Within Medico, Fraunhofer IGD also focuses on developing a system for automatic organ segmentation in volume data with the help of deformable surfaces. Segmentation of the human body allows for the extraction of detailed information regarding position, neighborhood, and extent of diseases. The semantic information gained in this way will be used to enable complex queries, e.g., what kind of disease is present in a region marked by the user.

#### Contact

Dipl.-Inform. Marius Erdt marius.erdt@igd.fraunhofer.de

# T@HIS

T@HIS is a telemedical network connecting physicians and hospitals over a new-generation satellite network, based on DVB-RCS on the recently launched AmerHis satellite.

Within the project, three remote clinics in Amazonas, Pará states in Brazil, have been connected to a referral hospital in Belém, the capital city of Pará. The dominant type of images transferred over the system is ultrasound images, acquired from portable or stationary ultrasound devices. The medical applications include general examinations as well as obstetrics and gynecology. However, the applied platform handles any imaging modality and particularly DICOM-formatted data.

The developments are established in the province of Pará in the northern part of Brazil. The province features a relatively high mortality rate, caused by blood circulation diseases and birthassociated diseases. Travelling from the remote Amazonas regions to the hos-



Medical Imaging Collaboration Anwendung

pitals of the capital city of Belém by boat or plane is tedious and expensive, and takes up to 24 hours. The aim of the current medical implementation will be improved access to medical resources for the rural cities in isolated regions.

Contact Ilias Sachpazidis ilias.sachpazidis@igd.fraunhofer.de

# IT for Security in Our Society

The incidents in the USA, Madrid, and London accompanying us into the new millennium carried one message: The security issue affects all of us, in all areas. Vandalism, theft, espionage, and terrorism cannot be abolished, which is why all the more we must direct our attention to the protection against attacks or unforeseeable incidents. Both resources and systems must be in a condition free from risks and undesirable influences. Reliability, integrity, and confidentiality must be granted at any time and durably.

These principles are generally applicable, but in particular in information technology, today ubiquitous in nearly all areas of life. Computer graphics can contribute to a higher degree of security, so biometrics and the use of biometric methods are increasingly gaining importance. On the one hand, they are suited to secure authorized access to systems and, on the other hand, they facilitate the use of them.

Fraunhofer IGD is currently developing special algorithms for face recognition concentrating on the three-dimensional capture and evaluation of the face. The resulting extension of the feature space can lead to a significant gain in security. But the protection of the data stored in such a system is a special concern of the department. So methods of making it not only harder to misuse stored data but also allowing for the renewability of the biometric comparative data are being investigated. Template protection and biometric encryption can thus serve to improve data protection.

Digital media, such as images, audio and video files, and complex 3D models play an increasing role in our everyday life. They can be copied and reproduced without any quality loss. In only a minority of cases, this is done with the consent of the owner. Computer graphics is also used for the protection of intellectual property, when, e.g., by means of digital watermarks or fingerprinting methods in connection with digital rights management (DRM), control of the material is ensured. Thanks to the enhanced performance of the data networks and visualization systems, computer graphics plays an increasing role in communication systems. The distribution of highly sensitive visualization data requires a greater concentration on the security of the data communicated in networks and securing their authenticity.

#### Contact

Alexander Nouak alexander.nouak@igd.fraunhofer.de

#### 3D Face

While since 2006, according to the recommendations of the International Civil Aviation Organisation ICAO, biometrically supported customs control was focusing on 2D face recognition, the difficulties of this method can already be foreseen: 2D face recognition systems have no mechanisms to verify whether a living object is being checked or if there are manipulation attempts. So, a reliable use of the technology in unattended environments cannot be guaranteed.

The project »3D Face« is based on research in the field of 3D face recognition, also including the technologies and application of 2D face recognition in secured environments. The project thus benefits from the voluminous feature space provided by the face geometry. This will not only lead to a significant increase in performance, but also to the development of new forgeryproof sensor technologies. The latter in particular is a prerequisite for cost reduction and improved reliability at unattended border controls.

Another main area is the research of data protection mechanisms in connection with the biometric 3D templates. Since biometric methods are being used in more and more applications, attacks on biometric templates are an increasingly serious danger. Based on former studies, we can expect that developments in this domain will set new technological standards by preventing templates from being compromised by crossrelations and the related targeted data mining allowing renewal in the case of an attack on the biometric features.

In a broad field test in different European airports, the technologies developed in the project were evaluated to

»3D Face« uses the voluminous feature space of the face geometry.

test the performance of the systems and to analyze social and operational concerns.

The volume of the 3D Face project amounts to approximately 12 million euros. It is funded by the European Commission within the 6th Framework Programme.

Contact Alexander Nouak alexander.nouak@igd.fraunhofer.de





Unattended border controls require robust methods for the analysis of the biometric features.

## Supporting the BSI With the Standardization Project Biometrics

Within the scope of the international standardization in the field of biometrics, there is a considerable demand for active German participation. Due to the political framework, the standardization activities with presently nearly 30 standardization projects have to be affected on a large scale and, additionally, in a narrow time frame: the first ISO standards in the field of biometrics were adopted in 2005.

In connection with the introduction of digital passports and ID cards, including quality assurance aspects, there are still extremely short time limits for the review of the design in the running projects and the necessity of a parallel annotation of the sometimes very comprehensive standard design documents.

The Fraunhofer Institute for Computer Graphics Research IGD is supporting the German Federal Office for Information Security - Bundeamt für Sicherheit in der Informationstechnik (BSI) by being actively involved in the following committees:

- National standardization body of DIN-NI37
- International standardization body ISO/IEC JTC1/SC37
- CEN/ISSS Focus Group on Biometric Standardization

Furthermore, the Security Technology department provides the convener of the JTC1/SC37 body.

Contact Alexander Nouak alexander.nouak@igd.fraunhofer.de

# Demonstration and Evaluation Lab Biometrics

Due to our good reputation as a producer, independent research institutions in the biometrics domain, reporters, and interested individuals from the industry often address the Fraunhofer Institute for Computer Graphics Research IGD asking if we can demonstrate biometric systems and methods.

For this purpose, a demonstration center for biometrics, which allows experimenting with different methods, has been established. Besides traditional methods of face, fingerprinting, and iris recognition, it also covers less known methods like signature recognition or vein pattern recognition. Due to the size and the equipment, shooting dates can also be offered now.

In addition, an evaluation lab has been launched. Here, biometric algorithms or devices can be tested as to recognition performance or security. This can be done-depending on the requirements-comparatively concerning different providers, but particular devices can also be tested. This service is not only offered to producers of biometric devices and systems but also to potential users interested in a producer-independent, in-depth study of the candidates to test whether a system will prove its value.

# Contact

Alexander Nouak alexander.nouak@igd.fraunhofer.de

# iDetective – Automated Search for Brand Piracy on the Internet

The copying or counterfeiting of products is called brand or product piracy. Brand, patent, property, and other commercial copyrights are often violated and used illegally. The automated search for brand misuse on the Internet is an urgently needed means to counter the distribution of plagiarisms and the violation of trademark protection.

The control and analysis tool will enable Internet detectives to retrieve Internet content efficiently and analyze it on the basis of customer-specific criteria. In several steps, the data are processed in parallel in flexibly configurable modules. Different aspects are analyzed. The search space includes Internet auctioneers (e.g., eBay, hood.de), price search engines (e.g., guenstiger.de, preissuche.de), and URLs mentioned in chat rooms.



Data extraction and evaluation at the automatic search for plagiarisms in the Internet

Of special importance are the basic technologies used dealing with text analysis and watermarking and fingerprinting methods. Watermarking methods allow extracting copyright information from company logos and product pictures. Current fingerprinting methods offer the possibility to identify similar multimedia data by their fingerprint. Also, modified and scaled pictures can be located.

#### Contact

Claudia Nickel claudia.nickel@igd.fraunhofer.de

#### AXMEDIS – Automating Production of Cross Media Content for Multichannel Distribution

Industry and armed forces have long regarded security for content and documents as a critical task. In connection with the increasing digitization of content, the associated new security problems have attracted the attention of a greater number of users and led to active research activities.

In AXMEDIS, technologies for the reduction of production and distribution costs and for the protection of digital content are being developed. AXMEDIS provides an infrastructure enabling producers, processors, and distributors of digital content to access a broad spectrum of digital content (using AXEPTool, a tool for the exchange of multimedia objects on a peer-to-peer basis in the business-tobusiness area) and to open up new markets by means of innovative technologies (AXMEDIS framework). AXMEDIS allows IT companies to benefit from innovative technology and tools and thus improve their potential

for the production, protection, and distribution of content using the open AXMEDIS technology.

AXMEDIS is funded by the European Commission in the scope of the 6th Framework Programme.

Contact Peter Ebinger peter.ebinger@igd.fraunhofer.de

#### **Digital Watermarks CAD Models**

The use of digital watermarks for tracing and controlling the distribution paths of CAD models shows high market potential. A permanently growing number of enterprises provides suppliers and external service providers with their business critical know-how in everyday processes in the form of CAD models. Although the enterprises are quite aware of the related risks, only a few countermeasures have been taken so far.

Within the scope of the MEF project »Digital Watermarks for CAD Models«, the GEOMARK system for digital watermarks in polygon models already existing at Fraunhofer IGD will be extended to CAD models by an advancement and robust implementation of a novel algorithm.

The project, funded by Fraunhofer-Gesellschaft, will result in a component for digital watermarks in CAD models which can be integrated in industry projects into production environments for CAD data. So, for the first time, a system will be available for digital watermarks in valuable CAD models as being used in production processes. Target markets are those industries where the transfer of high-value digital CAD models is part of the necessary daily work routine. Small- and medium-sized businesses in particular are interested in the protection of their know-how because their success is based on a high level of innovation and short product cycles.

Contact Alexander Opel alexander.opel@igd.fraunhofer.de

#### VESUV

VESUV is an application project that purposefully extends the core technologies »Agent«, »IT Security«, and »Legally Binding Delegation« developed within the lead project of the Federal Government, »Multimedia Workplace of the Future - MAP«, making use of it in two important application areas. The software agents used for these applications handle these tasks autonomously and collaboratively, taking into account the situative context and the preferences of the customers.

Application areas are the coordination of distributed administration processes in e-government and intelligent, context-sensitive assistance in e-tourism. In the field of e-government, the Hanseatic City of Rostock is exemplarily implementing the special process registration, change, and deregistration of a business. In the field of etourism, a dynamic tour guide has been developed and pilot tests have been carried out in the Görlitz region.

As a whole, the two applications egovernment and e-tourism possess extensive potential for a successful piloting of the VESUV technologies. Testing in two areas of application allows the disjunctive (as to space and content) positioning of research results in Germany. Due to the cooperation with other (research) projects, all projects involved will be better anchored in the market. In the e-government domain, there are, e.g., connecting factors to the results of the Media@Komm projects.

The project has a total volume of about 5 million euro and is funded by the Federal Ministry of Economics and Technology.

Contact Peter Ebinger peter.ebinger@igd.fraunhofer.de

# MITE – MANET Intrusion Detection for Tactical Environments

The idea of networked operation control has a strong impact on the electronic infrastructures of the armed forces. Wireless networks in the tactical domain are in notable need of protection. So, important and sensitive sensor data are identified and transferred. Protection of the infrastructure against different threats should be guaranteed not only on a preventive but also on the detective, active, and reactive levels.

A good solution would be to adequately transfer the concept of the intrusion detection systems (IDS) and intrusion response systems to the field of wireless tactical networks and to extend them by specific elements for the particular application area.

Here, the mobile ad hoc networks (MANETs) are of special importance, as they can work dynamically and without fixed infrastructure elements. To realize efficient and effective intrusion detection systems for tactical MANETs a number of special questions must be answered. To prepare the realization of an IDS for such an application environment, threats as well as methods to integrate extended sensors in IDS and defensive measures are identified and analyzed in a study.

Contact Peter Ebinger peter.ebinger@igd.fraunhofer.de

# SicAri – A Security Architecture and its Tools for Ubiquitous Internet Use

The potential of modern information technology can only be exploited if the IT security aspect is adequately permitted in the underlying infrastructure and the applications used.

The superordinate research target of the SicAri project is the development of a security architecture with the corresponding tools to make use of the information technology secure. For the realization of the infrastructure, a modular kit with the corresponding operation guidelines is being developed. The modular principle is the basis for a broad application area.

The SicAri project is executed in cooperation with several departments of Technische Universität Darmstadt (Darmstädter Zentrum für IT-Sicherheit), Fraunhofer Institutes SIT and IGD, as well as several partners from industry.

Contact Peter Ebinger peter.ebinger@igd.fraunhofer.de

## Security Day – Science Meets Business: Products out of Control?! February 28, 2007

For enterprises, the search for product piracy and the protection of their digital content is fighting a losing battle. However, modern information and communication techniques are increasingly coming to the rescue. Software companies and research institutions are working at full steam on tools that will make life as hard as possible for product counterfeiters.



MANETs: Dynamic structure of mobile ad.hoc networks

In the scope of the Science Meets Business workshops, »Security Day -Products out of Control?!«, on February 28, 2007, at the Fraunhofer Institute for Computer Graphics Research IGD, we were able to, on the one hand, point out to visitors the damages resulting from the violation of the product, brand, and copyright protection and how enterprises can deal with this threat. On the other hand, we wanted to show possible solutions. For this aim, we presented tools for the protection against brand and product counterfeiters science and industry are currently working on. In addition, the workshop offered a platform for an exchange of ideas.

Contact Alexander Nouak alexander.nouak@igd.fraunhofer.de

#### Business Field Security in the Media

The interest of the media in the developments of the business field and especially in the area of biometrics has been exceptionally great. Numerous interviews for film, radio, and TV were held. Here are some of them:

2057 – Unser Leben in der Zukunft (Our Life in Future), part 2: The City; ZDF, expedition, documentation, Broadcast on March 25, 2007

http://www.zdf.de/ZDFde/inhalt/31/0,1 872,5253599,00.html?dr=1

3-D Gesichtserkennung (Face Recognition); thematic focus of ARD morgenmagazin »Inner Security«; Broadcast on August 21, 2007

http://www.daserste.de/moma/livebeitrag\_dyn~uid,mren42f3g8giypd2~c m.asp Terrorfahndung - mit Kameras auf Verbrecherjagd (Terror Dragnet - with Cameras on Manhunt); SAT1, Planetopia, Broadcast on August 26, 2007

http://www.planetopia.de/archiv/2007/ planetopia/08\_26/11\_text.html

Annabelle Schott-Lung: Einsatz mit Augenmaß. Wie leistungsfähig sind aktuelle Biometrie-Systeme (Operation with sound judgement. How effective are current biometric systems?); Interview with Prof. Dr. Christoph Busch in: W&S - Das Sicherheitsmagazin, 29th volume, 8-9 2007

Verbrecherjagd per PC - Den Kriminellen auf der Spur (Manhunt by PC); SAT1, Planetopia, Broadcast on October 14, 2007

http://www.planetopia.de/archiv/2007/ planetopia/10\_14/11\_text.html

# Ambient Intelligence and Ambient Assisted Living

Ambient Intelligence (AmI) is the vision of an environment that proactively and intelligently adapts itself to the needs of the objects moving within it, thereby providing support in fulfilling these needs. AmI provides customized information and support through miniaturized electronics, as well as crosslinked intelligent services. The realization of the vision of »Ambient Intelligence« requires a turning away from current devices-or rather from operation-dependent device usage paradigms-to a goal-oriented, context-sensitive environment, in which all available devices come together as a coherent ensemble to benefit the individual players within the intelligent environment. Possible application areas include production, servicing and maintenance, home and office, emergency assistance, recreation, gaming, logistics, automobile and transportation, and assisted health care. The core principle of this vision is that the devices are invisible, embedded in the user's day-to-day living environments. Aml thus marks a new paradigm for the interaction between the individual players and their environments.

One of the most promising areas of Aml is Ambient Assisted Living (AAL), which concentrates on providing support for persons with special needs. Health care concerns and demographic change will pose overriding challenges for our future society. A shrinking population and an aging society are core characteristics of a development which poses new problems for pension systems, among other things. The health-related issues of an aging population play a predominant role, especially in the ever-increasing costs for health care. A further focus lies in the areas of rehabilitation, preventative care, and maintaining a level of independence for patients, those in need of care. But also disabled persons, and in the provision of convenience functions and user support in the areas of home care, home or office solutions, and inpatient care in

nursing homes are other focal points. Thereby, the following general goals are being pursued:

- Further development of Aml technologies, e.g., communication technology, energy supply technology, and sensor and actuator technology;
- Development of novel middleware technologies for spontaneous networking systems;
- New system cooperation strategies to support the self-organization and selfconfiguration of device ensembles;
- Capturing of current situations as well as summary of integrated contextual information;
- Use of knowledge-based systems and interpreters, in order for these systems to »understand« the contextual information.

Up until now, health care-related assistance systems have only considered small sections of the health care supply chain. Therefore, future systems must secure the supply chain in its entirety-from the users and their social environment to the medical facility, to the various healing professionals, health insurance companies, associations, social workers, and psychologists. Thereby, the patient will actively participate in the therapy process. The cost-bearers and the insurance companies will be included in the supply chain through the authorized transfer of data and information. This is necessary to develop new conforming health care system business models that ensure balanced improvements in medical care in terms of quality and efficiency. Hence, it would be prudent to integrate the medical industry into the product development process from the outset.

#### Contact

Dr. Reiner Wichert reiner.wichert@igd.fraunhofer.de

# VitOL – Distributed Intelligent Objects in Logistics

The increasing complexity of logistical processes-increasing amount, dynamic sampling, and individualization of production processes and the combination of real and virtual goods-presents a significant challenge for the supporting software systems. VitOL aims at the introduction of self-organizing radio networks, distributed application software and its integration into existing business software, as well as an innovative technological platform for distributed automatic control and selfmonitoring of objects in the logistics sector.

A Fraunhofer study verified that the German economy spends around 170 billion euros per year on logistics, which is equivalent to 26 percent Europe-wide. More than 2 million workers in this sector generate a profit of 90 billion euros each year.

The Fraunhofer Project VitOL (»Crosslinked intelligent objects in logistics«) has the goal of solving known problems of logistics applications regarding transparency and security in the flow of goods. For this purpose, six Fraunhofer Institutes under the direction of the Fraunhofer IML are currently developing new concepts and technologies to shift the logistical operational processes away from centrally operated systems to self-organizing and autonomous logistical objects.

Based on the scenarios of production order commissioning, the securing of goods, and the flow of material, software infrastructures which enable individual logistical systems (e.g., containers, high-bay warehouses, goods) to communicate with one another and to collectively make decisions and plan future actions are conceptualized and implemented.

In 2007, the Fraunhofer IGD developed a concept and specification for the self-organization of the individual logistical nodes for VitOL.

Contact Ali A. Nazari Shirehjini ali.nazari@igd.fraunhofer.de

# WASP – Wirelessly Accessible Sensor Populations

The market for wireless sensor networks is still in its infancy. The EU-IST project WASP, under the consortium leadership of Philips (the Netherlands), has as its objective the development of the necessary protocols and service specifications, as well as the models' underlying hardware and software, from dynamic sensor networks. In 2005, this sector generated revenues totaling \$159.9 million, with an annual growth rate of 25 percent. Even though the current market is relatively small, it is, nonetheless, very promising due to its high growth potential. As early as 2012, it is projected that the market will achieve total revenues of \$1,853,900 billion. This is the equivalent of a 42 percent annual growth rate.

The emphasis of the WASP project will lie in the support of the self-organization of the services provided by the various nodes, as well as in the support of the corresponding application generation for the development of dynamic sensor networks. Consequently, WASP aims to increase the acceptance of collaborative objects in the industrial field and to demonstrate them through select scenarios. The requirements for dynamic sensor networks will be formulated based on scenarios from the automotive, agricultural, and elderly care sectors, and the necessary protocols and software



VitOL – Self organizing objects

technologies will subsequently be developed based on these requirements.

Together with 18 partners, the Fraunhofer Society initiated the project WASP in September 2006 with three of its institutes. As part of the project management team, the Fraunhofer Institute for Computer Graphics Research IGD is responsible for the organization of the operations as regards training and dissemination. In the course of these operations, the first WASP workshop for the integration of SMEs took place on September 27, 2007, in Darmstadt. As initiator of this event, the IGD is living up to its role as the authority in business innovation transfer. In 2007, the Fraunhofer IGD also researched programming models for the implementation of autonomous ensembles and graphics tools for the configuration and control of numerous sensor networks. The first prototypes are expected during the second half of 2008.

#### Contact

Michael Hellenschmidt michael.hellenschmidt@igd.fraunhofer.de

PERSONA – PERceptive Spaces prOmoting iNdependent Aging

The change in demographics represents one of the greatest challenges facing Europe. PERSONA is researching scenarios and developing semiautomatic systems for them which support the special needs of elder people, in particular for social integration and habitation, and for independence, security, and well-being in their living environment. Of the population over 65, 10 percent have cognitive problems, often as a result of a heart attack. Half of all 85year-olds require assistance in their home environment on a regular basis, notwithstanding the fact that there are approximately 2 million Germans in the care of nursing homes. The costs associated with this care have almost doubled to 17.6 billion euros in the last seven years.

The goal of the EU project PERSONA is to research and prototype Ambient Assisted Living (AAL) scenarios to support the special needs of all human beings for social integration and habitation, and for independence, security, and well-being in their living environment. In PERSONA, daily life assistants are used to help the elderly carry out everyday tasks, such as cooking or shopping. Such assistants will also remind the individual of appointments or routine medication schedules. To achieve these goals, PERSONA aims to develop semiautomatic systems that will step in and offer assistance based on the individual's needs and abilities. Hereby, the individual's personal

autonomy and self-determination are an absolute priority. To make this vision a reality, PERSONA is developing the following prerequisite technologies:

- A reference architecture for Ambient Intelligence environments that describes the essential functional components and their communication and cooperation;
- An intelligent middleware for Ambient Intelligence systems that provides the components with necessary decentralized self-organization and context-aware services to support user goals;
- Intelligent and intuitive user interfaces that hide the complexity of the applications from the user and that make an Ambient Intelligence system useable as a whole;
- The provision of AAL services that support the individual's social integration, his feeling of security, his daily activities, and his need for mobility.



PERSONA AAL-Scenario

PERSONA is an integrated project of the EC in the 6th Framework Program and is spearheaded by Vodafone Italy as consortium leader. The Fraunhofer IGD is significantly involved in the corresponding technological work packages and is integrating the preliminary work rendered by the DynAMITE Proiect. The Fraunhofer IGD is responsible for the specification of the reference architecture and the realization of the intelligent middleware. First versions of the middleware based on OSGi and UPnP are already available. The Fraunhofer IGD is also researching methods of context management, of the interpretation of environmental variables in user goals, and of the realization of interaction paradigms in intelligent environments. The PER-SONA project was initiated in January 2007 and was planned for three and a half years.

#### Contact

Mohammad-Reza Saied Tazari saied.tazari@igd.fraunhofer.de

### InterLink – International Cooperation Activities in Future and Emerging ICTs

The identification and definition of new areas of emphasis for future ICT research and the development of corresponding roadmaps require a heightened worldwide cooperation by the respective experts. Interlink has created a forum for this exchange and has defined possible areas of emphasis for future research.

The European Union-sponsored project »InterLink« provides support for the exchange between European researchers and their colleagues worldwide. Collectively, they are joining forces to discuss and work through a series of research questions that are linked to the projected information society of the next 10-15 years. Important subject areas were carefully selected for further research. These include:

- Software-intensive systems and new computing paradigms;
- Ambient computing and communication environments;
- Intelligent and cognitive systems.

These research areas are very closely related to a series of ongoing projects by the 6th and 7th Framework Program of the European Union. The strategic goal of the Interlink project is the establishment of worldwide research cooperations and the development of research roadmaps for future programs and initiatives. Inter-Link's objectives will be tracked in publications and cooperative workshops.

The Fraunhofer IGD spearheads the second research team, which essentially focuses on the study of intelligent environments and the interaction within such environments.

Contact Dr. Reiner Wichert reiner.wichert@igd.fraunhofer.de

# EMSIS – Energy Recovery and Management Systems for the Intelligent House

Global heating and limited energy resources have been dominating headlines for several years. Households and transportation contribute 75-85 percent to the production of greenhouse gases. EMSIS is looking for solutions leading to a significant decrease in energy expenses and a sustainable improvement of the CO2 balance. At the end of 2007, the project EMSIS was initiated in a cooperation between the Fraunhofer Society and the Francebased Carnot Institutes. The project focuses on energy management systems in the intelligent house. Within the framework of this project, six Fraunhofer Institutes are working intensively with the French institutes of the Carnot Alliance. The strategic objective of the EMSIS project is the linking of complementary solutions created by the Carnot and Fraunhofer Institutes for various domains. EMSIS is divided into five subprojects, which conduct research on different levels of the primary topic: energy systems for the intelligent house. These subprojects cover a wide technological spectrum of concepts and software for energy management, from the use of electrical storage systems to production processes for energy conversion modules.

The Fraunhofer IGD is in charge of the research on the interaction with devices and systems and an intelligent energy management system for an »intelligent house«. To this end, research work on the software infrastructure that interconnects all systems, as well as in the area of application logic and in the interaction with these intelligent environments, is necessary in order to provide a total integrative system.

## Contact

Michael Hellenschmidt michael.hellenschmidt@igd.fraunhofer.de

# MEG-AAL-2015

Europe's population is growing proportionally older. Against this backdrop of demographic development, an increasing need for assistance in the management of everyday tasks in the home environment, especially for the elderly and disabled, can be assumed. Simultaneously, current ICT technologies in combination with other technological innovations offer a variety of relevant support options.

The average life expectancy has increased from 55 years in 1920 to more than 80 years today. When the baby boomers go into retirement from 2010 to 2030, the number of people aged 65 to 80 will increase almost 40 percent.

A study explores how the elderly, the sick, or the disabled can be supported in leading an independent and fulfilling life as long as possible. The study is the goal of the project »Market Potential, Development Opportunities, Social, Health and Economic Effects of the Future Use of Ambient Assisted Living (AAL) Technologies« (MEG-AAL-2015), spearheaded by Fraunhofer IGD Rostock. Building upon existing knowledge and case studies on AAL technologies, as well as continuing surveys on the need for-or preferences offuture users and on viable technological options, this project will focus on concrete application scenarios. Thereby, technical support in daily activities, including security-related aspects, medical monitoring of vital parameters, and mobility insurance, will be paramount.

The elderly are often no longer capable of pursuing customary activities and are, therefore, dependent upon outside assistance. Currently, this assistance can only be ensured through admission into a nursing home, which leads to considerable additional health care costs. It can be assumed that there is a potential health care savings in the billions of euros if these individuals can remain in their homes just one year longer with technological assistance. The developed scenarios will be evaluated according to their social and health aspects, as well as their health care- and welfare-economic aspects.

The market potential for producers and providers of AAL technologies and services in Germany will be assessed. If possible, these assessments will be quantified. The strengths and weaknesses, as well as the risks and options, associated with these scenarios for the participating players will be assessed in the manner of a SWOT analysis. Finally, any further need for development, or perhaps need for governmental support, will be specified. Contact Erhard Berndt erhard.berndt@igd-r.fraunhofer.de

#### Ambient Intelligence Lab

In 2030, approximately one-third of all Germans will be over 65. Therefore, our goal must be to enable this everincreasing portion of the population to lead independent, active, and enjoyable lives within the comfort of their own four walls with the help of Ambient Intelligence Technologies. For realistic testing of such technologies, Fraunhofer IGD is further extending its Aml lab.

The vision of Ambient Intelligence (AmI) requires that IT be integrated in all everyday objects and that these objects communicate with one another via interfaces. This results in a dynamic, total crosslinked system that enables continuous, integrated support throughout the entire course of



Intelligent carpet at the AmI lab

the individual's day. For the development of such intelligent products, extensive testing in realistic environments is necessary to study the complex interplay of the various applications.

To support this development, the Fraunhofer IGD has plans for the construction of the Ambient Intelligence Lab. A cooperation with the Fraunhofer IESE has already enabled the second stage of laboratory expansion. The existing laboratory, which served to evaluate and test localization technologies and scenarios in the office environment, is being expanded by the realization of a home environment. The new environment will consist of a living room, a bedroom, and a kitchen, and will thus support the realization and assessment of Ambient Assisted Living scenarios. The PERSONA project will be the overriding inspiration for this environment (e.g., PERSONA's kitchen assistant). Other projects, however, will also benefit from the construction of this laboratory.

An additional focal point of the laboratory's work will result from the activities of the WASP project. Methods of end-user programming, as well as the application of communicating sensors in the intelligent household, will be studied. For the EMSIS project, the laboratory will also be available for application logic research, as well as research on the interaction with these intelligent environments.

Contact Dr. Reiner Wichert reiner.wichert@igd.fraunhofer.de



# ARTEMISIA General Assembly on December 11, 2007 in Paris

With its exponential growth, Embedded Systems remains one of the fastest-growing economic sectors. In 2003, there were approximately 8 billion embedded programmable microcomponents worldwide. Conservative estimates project a two-fold increase to 16 billion in the year 2010.

In March of 2005, the EU heads of state enacted a restart of the Lisbon Strategy with a new partnership for growth and employment. The development of the information society and knowledge and innovation as the driving force for growth lay at the heart of this new strategy. The commission's suggestion for the 7th Framework Program (2007-2013) will play a key role in achieving the new goals of the Lisbon Strategy. So-called »European technology platforms« (ETP) will play a decisive role in this endeavor.

European technology platforms concentrate on strategic questions, upon which Europe's future growth, its competitiveness, and its sustainability of great technological advances are dependent. Embedded Systems (ARTEMIS) is one of the ETPs suggested by the EU for promotion as a Joint Technology Initiative (JTI).

The objective of these JTIs is to accelerate the development of important technologies. Thereby, they should serve to ensure the contiguous realization of European research efforts in future strategic technology domains.

In 2007, ARTEMIS was granted the status of a JTI and founded an ARTEMIS Industrial Association (ARTEMISIA) with its improved legal status. ARTEMISIA is now subsidized by the EU and the individual states. The EU and European computer and chip manufacturers have a budget of 2.6 billion euros allocated for research initiatives. Therefore, an ARTEMISIA general assembly was held on December 11 in Paris. The focus of the event was the writing of the first Call for Proposals. Thereby, an applicant could decide on eight different research areas in which projects were being assigned. The EU has a promotion quota of 16.7 percent. The individual countries currently have a quota of 30-40 percent.

The proposed timetable calls for the Call for Proposals to be finalized at the beginning of 2008 and for the first call to be released for the Brokerage Event also early 2008. Prof. Fellner is representing the Fraunhofer Society on the Steering Board of the ARTEMISIA consortium.

Contact Dr. Reiner Wichert reiner.wichert@igd.fraunhofer.de

Software Infrastructure and Development Environment for Self-Organizing Multimedia Ensembles in Ambient Intelligence Environments

In June 2007, Michael Hellenschmidt was awarded his PhD (Doktor-Ingenieur) in Computer Science from the Technische Universität Darmstadt for his work on »Software Infrastructure and Development Environment for Self-Organizing Multimedia Ensembles in Ambient Intelligence Environments«. His advisors were Prof. J. Encarnação and Prof. D. Rombach.

The focus of his work is the relatively new research domain of »Ambient Intelligence«. The primary concept



Dr.-Ing. Michael Hellenschmidt

involves changing how one deals with technology. The user no longer waits on technology, after first becoming aware of his goals, then converting these goals into functions, and finally individually assigning these functions to different devices, but rather the technology will serve to relieve the user as much as possible in carrying out his goals and desires. Ambient Intelligence concepts place the human being at the center of new technological developments.

The first part of the work specifies a distributed implementable software infrastructure, which enables a dynamic device orchestration and realizes the self-organizing communication and cooperation of autonomous units through conflict resolution strategies.

A component topology for Ambient Intelligence scenarios for the realization of multimodal interaction in intelligent environments and the required self-organizational strategies form the basis of the multimodal and assistive applications in the consumer electronics and automotive domains introduced and discussed.

Subsequently, various development tools for the control of the information flow within the component ensemble are described based on three-dimensional visualizations. Control interpreters are introduced for the configuration of intelligent environments, and their application will be described.

The presented work thus encompasses the key technologies described by ISTAG for an expanded infrastructure, functional coordination and intelligent planning, as well as for user-based assistance and reflexive systems.

#### Contact

Dr. Michael Hellenschmidt michael.hellenschmidt@igd.fraunhofer.de

# Dates & Events

IGD

67

In 2007, Fraunhofer IGD organized or co-organized a variety of events. Most events have a connection to one of the business fields and are described there. Following are the events of a more general nature. An overview of all the events in which the institute was involved can be found directly after the abstracts.

#### At CeBIT 2007 March 15 to 21

In 2007, the scientists of Fraunhofer Institute for Computer Graphics Research IGD presented some of their latest developments at the Fraunhofer shared booth: »BERNIE - Shopping Cleverly Made Easy«, »CONFUO(©O -Secure, Legal, Peer-to-peer«, and »Track'n'Trace for CAD Models«. The more than 500-square-meter-sized Fraunhofer booth proved to be a magnet to visitors.

#### BERNIE – Shopping Cleverly Made Easy

RFID (Radio Frequency Identification) allows an automatic identification of objects even from a distance. RFID chips are, for example, used for access control, for storing data on tickets, and in stock and goods management. The researchers of Fraunhofer Institute for Computer Graphics Research IGD have now realized a new scenario: BERNIE, the consultant for nutrition and intelligent shopping.

BERNIE is a program that helps the user to create his own personal nutrition profile. He can specify whether he is diabetic or vegetarian. During shopping, BERNIE compares the ingredients of the goods in the shopping cart with the personal profile of the user and warns him if he chooses a product that does not match his profile.

»As a prerequisite for this scenario's realization, it is necessary that all goods be provided with RFID tags that include the ingredients of the products. By means of these tags, the product »knows« itself and informs the user of its ingredients«, explains Michael Hellenschmidt, responsible scientist at Fraunhofer IGD. »In addition, the carts must be equipped with an



RFID reader and the buyer must bring his mobile device, such as a PDA or smartphone, with the installed software.« As soon as the user puts the products into the cart, the RFID reader reads the data stored on the chips and forwards it to the mobile device. The software then compares the data with the profile of the user. »As the profile is stored on the personal device of the shopper, his choice is personalized and, at the same time, remains absolutely anonymous«, Hellenschmidt explains, highlighting one of the advantages of the technology. Especially these properties make the application attractive for supermarkets, since it allows them to offer their customers a brand new service.

Prior to a mass application, a last decisive hurdle must be overcome: »The RFID tags are still too expensive to be widely used in supermarkets«, says Hellenschmidt. If this problem is solved, the provision of the products with RFID tags will offer the supermarkets many advantages: So, due to the self-disclosure of the products, stocktaking can be automated and finished in a matter of minutes. Also, the commodities management and the logistics of the products are considerably facilitated by this new technology. In addition, new service offers like BERNIE can be realized.

## Secure, Legal, Peer-to-Peer

For years now, digital media of all kinds, such as videos, podcasts, or music, have been exchanged via peerto-peer networks (P2P networks), though often illegally and outside the control of the rights owners. That there is another alternative is shown by CONFUO©O. The software allows users to exchange digital content securely, legally and under control of the rights owners via P2P networks.

P2P networks are networks in which all computers are on a par. At the same time, each computer serves as a server contributing memory and bandwidth. Users often use P2P networks to exchange music files or videos. But for many enterprises, such as record labels or stock photography agencies, the networks are a thorn in their side. Once the contents have entered such a P2P network, the owners lose any control over their distribution. It is, however, nearly impossible for users to ascertain whether the exchanged data are proprietary and determine if they risk a penalty.

This is different with the software CONFUO©O, developed by Fraunhofer IGD. »CONFUO©O is as easy to use as any other P2P software. For the rights owner, however, CONFUO©O has the advantage that it allows him to retain control of his contents at any time«, Alexander Opel, scientist at Fraunhofer IGD, says. This means that the rights owner can always have in view who is exchanging his content and he can at any time withdraw his contents from CONFUO©O. »Content can only be exchanged after registration. If a user wants to exchange a song without owning the rights, the exchange is stopped automatically. So both users and providers can be sure that all their actions are legal«, Opel continues. To provide for a high security standard, the content and user registration is outsourced to trusted third parties. These central servers compare the songs on the basis of certain characteristics, such as the melody. In this way, it is assured that content that is compressed or converted into another format is still recognized.

These properties of CONFUO©O permit a wide range of business models: »CONFUO©O can, for instance, be used by stock photography agencies to provide their users with photos or by cell phone providers to allow their customers to exchange ring tones or music files«, Alexander Nouak, head of the Security Technology Department of Fraunhofer IGD, explains.

#### 3D Watermarks – Data under Control

Digital Watermarking is the art of embedding additional information into a digital work, so that it can be used in exactly the same way as the original. The watermark is imperceptiblethat is, the user is not able to detect whether a digital work contains a digital watermark. The information encoded by the digital watermark is useful in a wide range of application scenarios, such as track and trace, resolving copyright disputes and augmenting a work with metadata.

NURBSMARK is a system for embedding a reversible digital watermark into high quality 3D surface models that are represented as Non-Uniform Rational B-Splines (NURBS). The digital watermark introduces slight imperceptible changes to the geometry of the original data such that additional information is encoded by these modifications. As the digital watermark is interwoven with the original data, it is not destroyed by moving data between different systems and file formats, and is also robust against various processing operations. In some application scenarios, even the slight modifications introduced by the NURB-SMARK algorithm may not be acceptable. Due to the reversibility property of the algorithm, the original geometry of the model can be restored based on a secret key.

#### Track and Trace

By using a specific digital watermark for each point of delivery, the watermark can be used to track and trace the distribution paths of models. Each item that is sent out is made unique by carrying a watermark that is specific to the person or institution that receives the data. If the model turns up at a point outside the predefined workflow, it can be linked and traced back to its point of delivery.

#### Copyright

A digital watermark that encodes the creator can be used to prove ownership of the model. In addition, it may also establish a link to a database for looking up the copyright designation and further information about the model.

## Fraunhofer IGD Rostock Is a »Selected Location«

In 2007, as one of »365 Landmarks in the Land of Ideas« Fraunhofer IGD Rostock was awarded in the presence of Lord Mayor Roland Methling the roll of honor as selected German think tank. On September 13, the Institute and the Hanseatic City of Rostock celebrated this occasion with the motto »Enjoy IT - Working and Relaxing with the Computer«.

They puzzle, research, and experiment in the land of poets and thinkers. Many good ideas from business and science originate from here and are turning the country into a multiple export world champion. But the good idea alone does not suffice. It must also be put into practice!

The Fraunhofer Institute for Computer Graphics Research IGD Rostock is one of the think tanks in Germany that makes visions become concrete prototypes. Therefore, the Institute has been selected from about 1,500 candidates as one of the 365 landmarks of the national initiative »Germany - Land of Ideas«, presenting this year the Federal Republic of Germany as a modern and creative location for business and science.

On June 12, Fraunhofer IGD was awarded a roll of honor distinguishing the house as »Selected Landmark 2007«. The reason for the application was not mere image cultivation. »Far from it, our concern was to support the national publicity for Rostock and Mecklenburg-Vorpommern as the IT center of Germany. Especially the rapidly developing market in the Baltic Sea region offers Rostock a unique opportunity to distinguish itself, also internationally, as the gateway to the land of IT ideas. We want to benefit from that«, said Prof. Dr. Bodo Urban, head of Fraunhofer IGD Rostock and member of the board of the IT-Initiative Mecklenburg-Vorpommern.



Bodo Urban (middle) receives the cup for the selected landmark.

On September 13, the scientists of Fraunhofer IGD therefore bridged the local IT research and the good local conditions of Rostock. Under the motto »Enjoy IT - Work with the Computer and Relax« they presented jointly with partners from the Rostock University and the ZGDV e.V. (Computer Graphics Center) to the inhabitants of Rostock and surroundings IT developments from the sectors of health, tourism, culture, and recreation. »We want to show that IT research is not disconnected from our daily life but is geared to the needs of people to support them in their day-to-day life«, Prof. Dr. Urban said, thinking of innovations like the EmoHandschuh serving to make the computer recognize the emotions of the user, or the mobile »DiaTrace« measuring body activities in the daily routine, thus encouraging more exercise.

The initiative »Germany – Land of Ideas« was created in 2006 on the occasion of the FIFA World Cup by the Federal Government together with the German industry. After the big success of the previous year, the series of events was continued in 2007. In the scope of a competition, the organizers were again looking for »365 landmarks in the land of ideas«, one for each day of the year. From more than 1,500 candidates-private and public institutions, cultural and church organizations, memorials, museums, social projects, companies, research centers, or university institutes-an expert jury selected the 365 winners. The project is realized in cooperation with Deutsche Bank.

# Fraunhofer IGD Encouraging Young Talents

To get young people, especially young women, interested in technical study programs and education, Fraunhofer IGD also organized events in 2007 to arouse interest in them.

Conference among Children: German-French Promotion of Young Talents at Fraunhofer IGD Rostock The promotion of young talents cannot start soon enough: In a visual video conference in July 2007, preschool children from Rostock and France met at Fraunhofer IGD. Via Internet, they exchanged thoughts in the video lab of Fraunhofer IGD about »Life in Progress«, thus playfully learning to handle the new media. »It's like in kindergarten«, Christian Peter, researcher at Fraunhofer IGD Rostock, says with a little smile. He talked about the conference room, where the children of the AWO daycare center »Rappelkiste« virtually exchange their view with French peers from Blois in Northern France. Peter, father of one of the daycare children himself, adds: »I am always amazed by how quickly the children are able to communicate in spite of their different native languages.«

The video conference of the children first took place in 2006, in a small media room at the daycare center. It has since been a regular meeting event for the children across the frontiers. »In the scope of the EU project COMENIUS, the children will be introduced to the new media and, at the same time, develop first foreign-language competences« explains Marion



The children of the Rostock AWO daycare center »Rappelkiste«

Hornke, one of the two project coordinators in Rostock. The »Rappelkiste« in the southern part of Rostock is one of the few bilingual daycare centers of the Hanseatic city. Luc Abot, the second project coordinator, gives the children first-hand lessons in French. »The young learners soak up new words like a sponge«, the native Frenchman explains.

Fraunhofer IGD supports the virtual globetrotters with the necessary technology in its nearby institute rooms. »It is important to teach children the use of new media early and in a sensible way. That is why we are very pleased to support the users and perhaps even the computer scientists of tomorrow technically and functionally«, Professor Bodo Urban, director of Fraunhofer IGD Rostock, says. The institute is an especially child-friendly employer. »Our employees can organize their working time flexibly and can also work from home. So there is no problem if a child suddenly falls ill and requires the care of his or her parents«, Urban continues.

# Girls' Day 2007 – Computer Science is not »For Men Only«

Even though the lines between classical men's and women's jobs are much more blurred than some years ago, young women disproportionately often choose »typically female« professions. For years, professions such as medical assistants or administrative assistants have been at the top of the popularity scale for young girls. But companies increasingly lack junior staff, particularly in technical and technology-related areas. Therefore, they can and should not do without qualified young women. At the Girls' Day 2007, the Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt again showed interested girls that

information technology is not »for men only«. In the field of information technology, there are quite a number of attractive professions with good potential earnings and career opportunities. All the same, this area has so far been dominated by men.

Therefore, on April 26, 2007, Fraunhofer IGD opened its doors to 20 young girls from the ages of 12 to 15 years. Under the motto »Virtual and Augmented Reality at Fraunhofer IGD« the schoolgirls were informed about one of the most interesting facets of computer science: computer graphics. In dialog with the scientists of Fraunhofer IGD, they could learn all about training facilities and newcomer offers in this domain. Furthermore, lots of live presentations showed the many application areas of computer graphics. A highlight of the event was the demonstration of the CAVE, a projection cube in which the user can directly immerse into the presented virtual scene.

»Qualified and motivated junior scientists are extremely important for German research institutions«, Monika Frank, coordinator of the Girls' Day at Fraunhofer IGD, explains. »By participating in the Girls' Day, we want to present to the young women the possibilities they have in the so-called male professions and to support them actively in their decision for a scientific-technical profession. The girls unanimously gave their visit with us the mark »«very good««, Frank points out: »And an enthused mother wrote that



Virtual and real: The visitors of the Girls' Day let themselves be inspired by the 3D worlds.

her daughter was now eager to study computer science. If that is not a success...! «

The Girls' Day is a nationwide campaign aiming at arousing interest with young girls for occupational and study areas beyond the »typical female« professions. Started in 2001 in close cooperation with the ministry for social affairs and the ministry of education and cultural affairs, the annual future day for young girls became a great success all over Hesse due to a statewide commitment of the cooperation partners.

#### **Developers Day 2007**

On August 29, 2007, Fraunhofer IGD organized the first »Developers Day« in Darmstadt. The purpose of this event was to give scientists of the different departments and locations the possibility of a more intensive exchange about their work.

The scientific-technical presentations enabled scientists from Darmstadt, Rostock, Singapore, and Graz to present their own projects and to inform themselves about current technologies of their colleagues. Discussions about shared development platforms spontaneously laid the foundation stone for further crossdepartmental work on particular topics and the use of synergies. To pick up the overall positive resonance of the scientists, the »Developers Day« will take place regularly.

#### 20 Years of Fraunhofer IGD – Visualizing the Invisible

On August 30, 2007, Fraunhofer IGD celebrated its twentieth anniversary with a special event. Since 1987, scientists have been researching the transformation of figures and formulae into pictures, having contributed in this way to the development of computer graphics from a niche discipline to a basic technology and to a field of computer science.

Whether you think of the Internet, computer tomography, or CAD, without computer graphics many of our everyday applications would not have been possible. Computer graphics is so deeply ingrained in our everyday life that we are often not even aware of it. Twenty years ago, this was quite different: Computer graphics was rather a niche subject, disregarded by a great part of the world.

Fraunhofer Institute for Computer Graphics Research IGD, founded in Darmstadt in 1987, has made history of science. In the early stages, primarily two-dimensional representations had to be generated interactively and integrated into documents, but, later on, three-dimensional data models increasingly gained in importance. Rendering techniques, 3D interaction, multimedia systems, and the distribution and collaborative work in networks were central steps in the following years. Developments like 3D



ultrasound, providing in the nineties the first three-dimensional pictures of fetuses in the womb, have become standard in many medical practices today. And, gradually, also our everyday life has been penetrated by the applications of Fraunhofer IGD. Professor José L. Encarnação, founder of Fraunhofer IGD, explains: »In the mideighties computer graphics was still in its infancy. To speed up the development, the foundation of a Fraunhofer Institute for Computer Graphics was a logical step. The time was ripe for a more precise knowledge transfer; after years of skeptical distance, academia and industry could agree on new fields of work and new possible applications and, at the same time, open up new partnerships and investment opportunities«, Professor José L. Encarnação explains.

Today, Fraunhofer IGD has become one of the leading addresses for applied research in the field of computer graphics. During this time, about 140 scientists have realized their ideas for the future in numerous projects. A number of successful spin-offs are proving the economic relevance of their ideas and concepts.

The change in the direction of the institute in October 2006 also implied a new focusing of the research competence at Fraunhofer IGD. Under the direction of Prof. Dr. Dieter W. Fellner, the institute will mainly focus on three large research lines. So the researchers will increasingly deal with transferring »library« questions to the information and communication area in technology and construction. »There are so far no tools available enabling to classify the models and animations used in technology in a reasonable way, to identify their content, to generate abstracts, or to archive them in the long term. We now want to realize these things that



Filled tiers at Fraunhofer IGD in Darmstadt



Professor Fellner welcoming the visitors of the anniversary celebration



Professor Encarnacao, the founder and longtime director of Fraunhofer IGD

are a matter of course with classic libraries, also for the digital world«, Prof. Fellner explains. Another research focus will be the acquisition, the preservation, and the utilization of semantics in the whole process chain of modeling. Furthermore, the researchers will address the overlap area between computer graphics and computer vision, providing the technical basis for the highly topical application field of ambient intelligence.

»Of course, we will continue to make use of the competences acquired so far in the institute«, Fellner says. »But we are also addressing new issues today the industry will only face in some years.«



Mobile interludes: The »Walking Act« of the Hot Sax Club accompanies the evening event.

#### Events

In 2007, Fraunhofer IGD organized or co-organized quite a number of events.

20 Jahre Fraunhofer IGD, Darmstadt, Germany, Aug 30, 2007

25. Messe-Fachtagung, Stuttgart, Germany, Nov 20-21, 2007

Analytics Day. Science Meets Business - Graphische Einblicke in Finanzdaten - Neue Wege durch den Datendschungel, Darmstadt,

Germany, Jan 23, 2007

BAUMA 2007, Munich, Germany, Apr 23-29, 2007

CeBIT 2007, Hannover, Germany, Mar 15-21, 2007

Deutschland - Land der Ideen. Fraunhofer IGD ein Ausgewählter Ort 2007, Rostock, Germany, Jun 12, 2007

Developers Day, Darmstadt, Germany, Aug 29, 2007

Discover Europe 2007 (European Commission to Singapore), Singapore, Oct 10, 2007

Enjoy IT - Mit dem Computer arbeiten und entspannen, Rostock, Germany, Sep 13, 2007

EuroMold 2007, Frankfurt, Germany, Dec 5-8, 2007

FDMU Forum, Darmstadt, Germany, Apr 18, 2007

FDMU Forum, Darmstadt, Germany, Sep 12, 2007

Girls' Day, Darmstadt, Germany, Apr 26, 2007

HMI – Hannover Messe Industrie, Hannover, Germany, Apr 16-20, 2007

IGAS 2007, Tokyo, Japan, Sep 18-28, 2007

Intergeo 2007, Leipzig, Germany, Sep 25-27, 2007

Joint PERSONA/SOPRANO Workshop@AmI-07, Darmstadt, Germany, Nov 7, 2007

Konferenz unter Kindern: Deutsch-französische Nachwuchsförderung, Rostock, Germany, Jul 17, 2007 Kunststoff-Messe , Düsseldorf, Germany, Oct 20-22, 2007

L.I.F.E @ NTU 2007, Singapore, Mar 10, 2007

Medica, Düsseldorf, Germany, Nov 14-17, 2007

Ministry of Education Principals Forum - Learning Journey Program, Singapore, May 8, 2007

Semantics Day. Science Meets Business, Darmstadt, Germany, May 20, 2007

Semantics Day. Science Meets Business,

Darmstadt, Germany, Nov 15, 2007

Symposium OCTLog, Soesterberg, The Netherlands, Nov 6-7, 2007

Virtual and Augmented Reality in shipbuilding EDB - Marine Local Industry Upgrading Programme @ NTU, Singapore, Jan 12, 2007

Workshop on Industry Challenges in Geometric Modeling, CAD and Simulation - 2007, Darmstadt, Germany, Mar 22-23, 2007 Networks and Cooperation Partners

The Fraunhofer Institute for Computer Graphics Research IGD is embedded in a variety of research networks. Synergies with partners within the Fraunhofer-Gesellschaft contribute to the success of the institute. Our staff members are involved in the scientific community participating in research, business, and standardization committees.

12

13

14

15

16

17

#### The Fraunhofer-Gesellschaft

The Fraunhofer Institute for Computer Graphics Research IGD is part of the Fraunhofer-Gesellschaft; thus it is embedded in an extensive network of research institutes of all fields.

Research of practical utility lies at the heart of all activities pursued by the Fraunhofer-Gesellschaft. Founded in 1949, the research organization undertakes applied research that drives economic development and serves the wider benefit of society. Its services are solicited by customers and contractual partners in industry, the service sector, and public administration. The organization also accepts commissions from German federal and Länder ministries and government departments to participate in future-oriented research projects with the aim of finding innovative solutions to issues concerning the industrial economy and society in general.

Applied research has a domino effect that extends beyond the direct benefits perceived by the customer: Through their research and development work, the Fraunhofer Institutes help to reinforce the competitive strength of the economy in their local region, and throughout Germany and Europe. They do so by promoting innovation, accelerating technological progress, improving the acceptance of new technologies, and not least by disseminating their knowledge and helping to train the urgently needed future generation of scientists and engineers.

As an employer, the Fraunhofer-Gesellschaft offers its staff the opportunity to develop the professional and personal skills that will allow them to take up positions of responsibility



Locations of the Fraunhofer-Gesellschaft in Germany.

within their institute, in other scientific domains, in industry, and in society. Students working at the Fraunhofer Institutes have excellent prospects of starting and developing careers in industry by virtue of the practical training and experience they acquire.

At present, the Fraunhofer-Gesellschaft maintains more than 80 research units, including 56 Fraunhofer Institutes, at 40 different locations in Germany. The majority of the 13,000 staff are gualified scientists and engineers, who work with an annual research budget of 1.3 billion euros. Of this sum, more than 1 billion euros is generated through contract research. Two-thirds of the Fraunhofer-Gesellschaft's contract research revenue is derived from contracts with industry and from publicly financed research projects. Only one-third is contributed by the German federal and Länder governments in the form of institutional funding,

enabling the institutes to work ahead on solutions to problems that will not become acutely relevant to industry and society until five or ten years from now.

Affiliated research centers and representative offices in Europe, the USA, and Asia provide contact with the regions of greatest importance to present and future scientific progress and economic development.

The Fraunhofer-Gesellschaft is a recognized nonprofit organization which takes its name from Joseph von Fraunhofer (1787-1826), the illustrious Munich researcher, inventor, and entrepreneur.

Contact Fraunhofer-Gesellschaft info@fraunhofer.de

# Fraunhofer Information and Communication Technology Group ICT

In alliance with the other ICT Institutes of the Fraunhofer-Gesellschaft, Fraunhofer IGD is tuned to the challenges of research and development for tomorrow's information technology.

Shorter innovation cycles have turned IT knowledge into a perishable commodity. The Fraunhofer Information and Communication Technology Group ICT provides support in the form of customized studies, technology consulting and contract research for new products and services. In addition to feasibility studies, it also investigates end-user acceptance and produces market analyses and cost-benefit assessments. The Fraunhofer ICT Group comprises thirteen institutes as full members and three associated members, representing a workforce of roughly 2,800 employees. Its central office in Berlin serves as a one-stop shop, referring customers to the appropriate contacts. Research results are jointly communicated and marketed by the ICT Group, focusing on specific application areas, industries, etc.

The complementary focal fields of the participating institutes cover the entire value chain of the Fraunhofer ICT industry. The Fraunhofer ICT Group conducts activities within a wide range of business fields, including information and communication technologies for:

- Medicine and life sciences
- Traffic and mobility
- Culture and entertainment
- E-business
- E-government
- Production
- Digital media
- Software

- Security
- Communication systems
- Financial services

The member institutes possess considerable experience in the innovative development of new technologies, particularly mobile networks and data transmission, information security, software engineering, knowledge management and information logistics, e-learning, embedded systems, electronic commerce, and virtual and simulated reality.

**Chairman of the ICT Group:** Prof. Dr. Dieter Rombach

#### Deputy chairman:

Prof. Dr. Matthias Jarke

Contact Fraunhofer Information and Communication Technology Group Business manager Dipl.-Inform. Boris Groth Friedrichstrasse 60 10117 Berlin Phone: +49 (0) 30 7261566-0 boris.groth@iuk.fraunhofer.de



The Institutes of the Fraunhofer Information and Communication Technology Group ICT

- Fraunhofer Institute for Computer Architecture and Software Technology FIRST, Berlin
- Praunhofer Institute for Applied Information Technology FIT, Sankt Augustin
- Fraunhofer Institute for Open Communication Systems FOKUS, Berlin
- Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS, Sankt Augustin
- Fraunhofer Institute for Industrial Engineering IAO, Stuttgart

- Fraunhofer Institute for Digital Media Technology IDMT, Ilmenau
- Fraunhofer Institute for Experimental Software Engineering IESE, Kaiserslautern
- 8 Fraunhofer Institute for Computer Graphics Research IGD, Darmstadt, Rostock
- Fraunhofer Institute for Information and Data Processing IITB, Karlsruhe
- Fraunhofer Institute for Software and System Engineering ISST, Dortmund, Berlin

- Fraunhofer Institute for Industrial Mathematics ITWM, Kaiserslautern
- Fraunhofer Institute for Algorithms and Scientific Computing SCAI, Sankt Augustin
- Fraunhofer Institute for Secure Information Technology SIT, Darmstadt, Sankt Augustin

Cooperating Institutes of the Fraunhofer Alliance Microelectronics:

- Fraunhofer Institute for Communication Systems ESK, München
- Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institut HHI, Berlin
- Fraunhofer Institute for Integrated Circuits IIS, Erlangen
- Business Office:
  Fraunhofer ICT Group,
  Berlin
### Participation in Committees

The crosslinks of the researchers with the international scientific community are essentially significant. Therefore, the director and the staff members of Fraunhofer IGD are involved in a multitude of national and international societies and associations, and their boards, sometimes in leading positions.

American Telemedicine Association

Beratungsausschuss von vascoda, einem interdisziplinären Internetportal für wissenschaftliche Information

CAST e.V.

CAST-Förderpreis – Gutachter

CIP4 Organization

CURAC – Deutsche Gesellschaft für computerund roboterassistierte Chirurgie e.V.

DDGI – Deutscher Dachverband für Geoinformation

DFG-Ausschusses für Wissenschaftliche Bibliotheken und Informationssysteme (AWBI)

DIN - Deutsches Institut für Normung

- NI 36
- NI37 (Biometrische Systeme)
- Referat Entwicklungsbegleitende Normung, Arbeitsgruppe »Modularisierung«

E-Security-Zentrums der Fraunhofer-IuK-Gruppe

EUROGI – European Umbrella Organisation for geographic information

EUROGRAPHICS

Eurographics Executive Committee

Expert Group »Seamless Connectivity and Middleware« in ARTEMIS - the European Technology Platform on Embedded Systems

Facharbeitskreis Informations- und Kommunikationstechnologien der Innovationagentur Mecklenburg-Vorpommern

Fachbeirat der Technischen Informationsbibliothek Hannover (TIB)

#### FDMU Forum

Fernseh- und Kinotechnische Gesellschaft (FKTG)

Forum für Virtual Reality-Technologien im Schiffbau des ZGDV e.V. (ProVR Forum)

GDI-DE

German Chapter of the ACM

Geschäftsführung des Forum für Informations-Services Mecklenburg-Vorpommern ISMV

- GI Deutsche Gesellschaft für Informatik
- Erweiterter Vorstand
- FB GDV Graphische Datenverarbeitung
- Arbeitskreis Computergraphik & eLearning
- Arbeitskreis Computerspiele
- FG BIOSIG und STEWA
- FG eLearning
- FG Graphische Simulation und Animation (ANIS)

Gutachter für den Deutschen Wissenschaftsrat

Gutachtergremium eCommerce Award Mecklenburg-Vorpommern

IEEE SMC Section Germany Chapter

InGeoForum – Informations- und Kooperationsforum für Geodaten des ZGDV e.V.

**INI-GraphicsNet Stiftung** 

ISO/IEC JTC1 SC37 (Biometrics)

ISTAG, der Beratergruppe der Europäischen Kommission in Bezug auf die Gesamtstrategie für die IKT-Forschung im europäischen Forschungsrahmenprogramm FP7

JT User Group

KHRONOS

Kompetenzzentrum für Multimedia-Technologien des Landes Mecklenburg-Vorpommern

Forum des ZGDV e.V. (KOMM-MV Forum)

Lenkungskreis Forschungsverwertung und des Regionalprogrammes RIS++MV (Seed Fonds) in Mecklenburg-Vorpommern

Multimediabeirat des Landes MV

NAFEMS

NUSIM

Open Geospatial Consortium

#### ProSTEP iViP

Prüfungskommission für den Masterstudiengang »Medien & Bildung« an der Universität Rostock

Revisionsausschuss der Deutschen Exzellenzinitiative

Steering Committee der ISMAR (International Symposium on Mixed and Augmented Reality)

Stiftungsrat des Leibniz-Informationszentrum Wirtschaft - Zentralbibliothek der Wirtschaftswissenschaften (ZBW)

Technischer Fachgutachter für die Europäische Forschungsgemeinschaft (ESF) im Komitee für Physik- und Ingenieurswissenschaften (PESC)

Unternehmerverband Rostock und Umgebung

VDI

Vorstand der Innovationsagentur Mecklenburg-Vorpommern

Vorstand der IT-Initiative Mecklenburg-Vorpommern

Wissenschaftlichen Beirat ScienceNet MV

Wissenschaftlicher Beirat für Weiterbildung, Fernstudium und Studienberatung (der Universität Rostock)

Wissenschaftsverbund Informations- und Kommunikationstechnologien der Universität Rostock

X3D CAD Working Group

## Customers and Cooperation Partners

Over 130 renowned universities, colleges and institutes in Germany, Europe and the world support our work in collaborations. We cooperate closely with many of the Fraunhofer Institutes, even beyond the ICT Group.

Our most important partners, however, are the companies and institutions that are our project customers or cooperate with us in research projects.

3D Sales GmbH, Darmstadt, Germany

3Dims GmbH, Frankfurt, Germany

A&C2000 s.r.l., Rom, France

A.R.T. GmbH, Weilheim i.OB, Germany

ABB Forschungszentrum Ladenburg, Ladenburg, Germany

AD Solutions srl, Torino, Italy

Adam Opel GmbH, Rüsselsheim, Germany

Advanced Realtime Tracking GmbH, Weilheim i. OB., Germany

AECOPS, Lisbon, Portugal

AEP, Leca da Palmeira, Portugal

Aesculap AG & Co. KG, Tuttlingen, Germany

Alessi spa, Crusinallo, Italy

Altair Engineering srl, Orbassano (TO), Italy

ANCE, Roma, Italy

Angles Textil, Anglès (Girona), Spain

ANMOPYC, Zaragoza, Spain

Arbeitsgemeinschaft industrieller Forschungsvereinigungen »Otto von Guericke« e.V., Berlin, Germany

ARCADIS ASAL Ingenieure GmbH, Kaiserslautern, Germany

AR-Tracking GmbH, Germany

ask - Innovative Visualisierungslösungen GmbH, Messel, Germany

Asociación Centro de Interacción Visual y Comunicaciones VICOMTech, San Sebastian, Spain

ASOCIATIA PATRONILOR SI MESE-RIASILOR CLUJ (APM), Cluj Napoca, Romania

ASSYST - Gesellschaft für Automatisierung, Software und Systeme mbH, Aschheim-Dornach, Germany

ATB - Advanced Technologies in Business Ltd, Großbritannien, United Kingdom

ATC Athens Technology Center, Athens, Greece

Athens Technology Center S.A., Athens, Greece

Australian Wool Innovation, Sydney, Australia

AutoForm Engineering GmbH, Zurich, Switzerland

B2M Software AG, Karlsruhe, Germany

BARSKIDESIGN, Frankfurt, Germany

Baumüller Anlagen-Systemtechnik GmbH, Nuremburg, Germany

### BBC

Bekleidungsphysiologisches Institut Hohenstein e.V., Bönnigheim, Germany

Bentley Systems Germany, Ismaning, Germany

Berliner Feuerwehr, Berlin, Germany

Bilfinger Berger AG, Mannheim, Germany Bivolino.com, Diepenbeek, Belgium

B-K Medical, Dänemark, Danmark

Blohm + Voss GmbH, Hamburg, Germany

BMT Limited, Teddington, Middlesex, TW11 8LZ, United Kingdom

BMW AG, München, Germany

Braun + Resler Architects, Erzhausen, Germany

Bundesanstalt für Arbeitsschutz + Arbeitsmedizin, Dortmund, Germany

Bundesanstalt für Wasserbau, Ilmenau, Germany

Business Objects, Levallois-Perret, France

C.E.R.T.H., Thessaloniki, Greece

Canamet Inc., Kanada, Canada

CAPCom AG, Darmstadt, Germany

Carl Zeiss GmbH, Oberkochen, Germany

Carmeq GmbH, Berlin, Germany

CAS Software AG, Karlsruhe, Germany

Castello di Belgioioso, Italien, Italy

Ceetron AS, Trondheim, Norway

Centexbel, Brussels, Belgium

Centro de Computação Gráfica (CCG), Coimbra, Portugal, Guimarães, Coimbra, Portugal

CETA RS, Porto Alegre, Brazil

CIP4 Organization, Zurich, Switzerland

Citeve, Vila Nova de Famalicao, Portugal

City of Venice, Venezia, Italy

CLS, Ramonville Saint-Agne, France

CNC, Madrid, Spain

CNR-IMATI-GE, Genova, Italy

CoCreate Software GmbH & Co. KG, Sindelfingen, Germany

Color-Web GmbH, Lichtenwalde, Germany

Coperion Waeschle GmbH & Co. KG, Weingarten, Germany

CS Systèmes d'Information, Toulouse, France

CST GmbH, Darmstadt, Germany

Cyprus State Fairs Authority, Zypern, Cyprus

D.VASILIADIS & SIA EE, Athens, Greece

DAI Labor, Berlin, Berlin, Germany

Daimler AG, Germany

Danet GmbH, Weiterstadt, Germany

D'Appolonia, Genova, Italy

Darmstädter Echo, Verlag und Druckerei GmbH, Darmstadt,

Germany

DeguDent GmbH, Hanau-Wolfgang, Germany

Delphi Automotive Systems Deutschland GmbH, Wuppertal, Germany

DESY - Deutsches Elektronen-Synchrotron, Hamburg, Germany

Deutsche Forschungsanstalt für Luft- u. Raumfahrt e.V., Weßling / Oberpfaffenhofen, Germany

Deutsches Forschungszentrum für Künstliche Intelligenz GmbH, DFKI, Kaiserslautern, Germany

Deutsches Kommitee für Katastrophenvorsorge, Bonn, Germany

Deutsches Krebsforschungszentrum (DKFZ), Germany

Deutsches Schifffahrtsmuseum, Bremerhaven, Germany

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany

digital IMAGE, Overath, Germany

DIMEC, Genova, Italy

Dolmar GmbH, Hamburg, Germany

E.+H.Faerber Büro für Architektur, Mainz, Germany

E.Pecci & C.S.p.A., Prato, Italy

EADS Deutschland GmbH, München, Germany

EDAG, Fulda, Germany

Effebi Multimedia, Genova, Italy

EHF GmbH, Duesseldorf, Germany

eHotel AG, Berlin, Germany

Eisenbahnbundesamt, Bonn, Germany

ÉLASIS S.C.p.A., Pomigliano D'Arco, Italy

Elettra, Basovizza-Trieste, Italy

ELKEDE - Techology and Design Centre SA, Metamorphosis, Greece

El-Op Electro-Optics Industries Ltd., Rehovot, Israel

Elsag Datamat, Genova, Italy

Empolis, Kaiserslautern, Germany

ENEA, Bologna, Italy

Engiarte, Sao Mamede, Portugal

EON Reality, Inc., Irvine, CA, US

EPFL - Geodetic Engineering Lab, Lausanne, Switzerland

ESA / ESOC, Darmstadt, Germany

Esaote Bracco Information Technology Sanita, Italien, Italy

ESRI Geoinformatik GmbH, Bonn, Germany

EST - Engineering Systems Technologies, Kaiserslautern, Germany

ETRA Investigacion y Desarrollo, Valencia, Spain

EURATEX, Brussels, Belgium

European Commission, Brussels, Belgium

European Surgical Institute, Norderstedt, Germany

Federal Institute for Drugs and Medical Devices, Bonn, Germany

Federal Ministry of Economics and Technology, Berlin, Germany

Federal Ministry of Education and Research, Berlin, Germany

Filli Corneliani, Mantova, Italy

fleXilution GmbH, Köln, Germany

Fomenta de San Sebastian, Spain

Fondazione GraphiTech, Povo (TN), Italy

FORD-Werke AG, Cologne, Germany

Forschungsinstitut Technologie-Behindertenhilfe der Evangelischen Stiftung Volmarstein, Wetter/Ruhr, Germany

Forschungszentrum Design und Systeme, Würzburg, Germany

»Forschungszentrum Jülich GmbH

Technologietransfer + Unternehmensgründung, Berlin, Germany«

Forschungszentrum Karlsruhe, Germany

Fratelli Piacenza, Pollone, Italy

French Research Institute for Exploitation of the Sea, Paris, France

Fresenius Medical Care Deutschland, Bad Homburg, Germany

Fritzmeier Systems GmbH & Co.KG, Grosshelfendorf, Germany

FTB Forschungsinstitut Technologie-Behindertenhilfe der ev. Stiftung Volmarstein, Wetter/Ruhr, Wetter/Ruhr, Germany

FZI Research Center for Information Technology, Karlsruhe, Germany

Gaetano Rossini, Costamasnaga, Italy GEA Happel Klimatechnik Produktions- und Servicegesellschaft mbH, Herne, Germany

GeCo Business Consulting, Genova, Italy

Genias Graphics GmbH, Regenstauf, Germany

GeoData GmbH, Westhausen, Germany

GeometryFactory Sarl, Grasse, France

Gerry Weber Services, Halle/Westfalen, Germany

Gesellschaft für Medizintechnik (GFM), Germany

GISIG-Geographical Information Systems, Genova, Italy

Giunti Multimedia, Minano, Minano, Italien

Grado Zero Espace, Empoli, Italy

Groupe FLORY, Cholet, France

GSI Gesellschaft für Schwerionenforschung mbH, Darmstadt, Germany

Haption, Soulgé-Sur-Ouette, France

Heinle, Wischer und Partner Freie Architekten GbR, Stuttgart, Germany

Heinz Nixdorf Stiftung, Munich, Germany

HELLA KGaA Hueck & Co., Lippstadt, Germany

Hellenic Broadcasting Corporation, Griechenland, Greece

Hellenic Centre for Martine Research, Anavyssos, Greece

Help Remote Sensing, Benesov, Czech Republic

Hessische Zentrale für Datenverarbeitung, Wiesbaden, Germany

Hessisches Landesamt für Bodenmanagement und Geoinformation, Wiesbaden, Germany Hessisches Ministerium für Wirtschaft Verkehr und Landesentwicklung, Wiesbaden, Germany

Hessisches Ministerium für Wissenschaft und Kunst, Wiesbaden, Germany

Hint-Els GmbH, Griesheim, Griesheim, Germany

Hitachi Medical Systems, Japan, Japan

Hitech, Griechenland, Greece

Howaldtswerke-Deutsche Werft GmbH, Kiel, Germany

Human Solutions GmbH, Kaiserslautern, Germany

ICEM Technologies, Hannover, Germany

ICEP Portugal, Lisbon, Portugal

IDMK, Fulda, Germany

IFN Finance GmbH, Aachen, Germany

IFTH, Ecully, France

Ikerlan, Arrasate-Mondragón, Spain

ILOG S.A., Gentilly, France

ImpactXoft Europa, Busto Arsizio -Varese, Italy

INCDTP, Bucuresti, Romania

INESC-ID, Lisbon, Portugal

INFN, Frascati, Italy

InfoRoad GmbH, Nürnberg, Germany

Ingenhoven Architekten GmbH, Duesseldorf, Germany

InGeoForum, Darmstadt, Germany

INI-GraphicsNet Stiftung, Darmstadt, Germany

INI-Novation GmbH, Darmstadt, Germany

INOTEX SPOL SRO, Dvur Kralove Nad Labem, Czech Republic INPG, Grenoble, France

INRIA, Sophia Antipolis, France

INRIA-LORIA, Vardoeuvre-lés-Nancy Cedex, France

Insight Right, Großbritannien, United Kingdom

Institut für Kommunikationstechnik, Zürich, Swisse

Institut Geographique National, France, Paris, France

Institut Image / ENSAM, Chalon sur Saone - cedex, France

Institute of Geodesy, Cartography and Remote Sensing , Budapest, Hungary

Instituto Geografico Portugues, Lisbon, Portugal

Interactive Institute, Stockholm, Sweden

Intergraph (Deutschland) GmbH, Ismaning, Germany

Intersense, Inc., Bedford, MA 01730, USA

INTRACOM S.A., Peania, Greece

IRIS, Mariano Comense, Italy

isi Deutschland GmbH, Köln, Germany

ISPESL DIPIA, Monteporzio Catone, Italy

»IST GmbH

Instron Structural Testing Systems, Darmstadt, Germany«

ItalDesign - Giugiaro S.p.A. , Moncalieri, Italy

ITC, Enschede, The Netherlands

itCampus Software- und Systemhaus GmbH, Leipzig, Germany

ITI Techmedia, Glasgow G2 5SG, United Kingdom

ITI-CERTH, Hellas, Greece

ITV Denkendorf Produktservice GmbH, Denkendorf, Germany

110 Fraunhofer IGD Annual Report 2007

J.S.K. Architekten und Ingenieure GmbH, Frankfurt/Main, Germany

Jemtex, Lod, Israel

Jeppesen GmbH, Neu-Isenburg, Germany

John P. Robarts Research

K.O.M.S.-Consulting, Neumagen-Dhron, Germany

Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany

Klinikum Nürnberg , Nürnberg, Germany

KPNQWest Norway AS, Oslo, Norwegen, Oslo, Norway

Krauss-Maffei Wegmann GmbH & Co. KG, Kassel, Germany

KUKA - Roboter Gmbh, Augsburg, Germany

LAAS-CNRS, France

labein tecnalia, Derio, Spain

Land Mecklenburg-Vorpommern, Kultusministerium, Schwerin, Germany

Land Mecklenburg-Vorpommern, Wirtschaftsministerium, Schwerin, Germany

Land Transport Authority, Singapore

Lectra, Paris, France

Legarra, Irurzun, Spain

Lichttechnik und Systeme Thomas Baum, Aschaffenburg, Germany

LightWork Design Ltd., Sheffield, United Kingdom

Limburgs Museum, BX Venlo, Netherlands

LiNK MV e.V., Germany

Listesso, France

Loewe Opta

LogicaCMG, London, United Kingdom London Health Science Center, London, Kanada, London, Canada

Lufthansa Systems AG, Kelsterbach, Germany

Marine Information Service 'MARIS' BV, Leidschendam, Netherlands

Marineamt Kiel, Germany

MarineSoft Entwicklungs- und Logistikgesellschaft mbH, Germany

Marshals' Corporate Group, India

Mastercard Europe

Materna GmbH, Germany

Maxon Computer GmbH, Friedrichsdorf, Germany

Max-Planck-Institut für Informatik -MPII, Saarbrücken, Germany

MED, Edinburgh, UK

MedCom GmbH, Darmstadt, Germany

MEDEOCOM Gesellschaft für Informations- und Kommunikationssysteme mbH, Germany

mediaman GmbH, Mainz, Germany

MediaSec Technologies

Medintec GmbH, Germany

Megatech Software GmbH, Berlin, Germany

Mercury Computer Systems

Messe Düsseldorf GmbH, Germany

Messe Frankfurt GmbH, Germany

Messe München GmbH, Germany

Meticube, Ldt., Portugal

mica - music information center austria, Austria

Microsoft Deutschland, Germany

Mimundo TV

Ministerium für Umwelt, Forsten und Verbraucherschutz Rheinland-Pfalz, Mainz, Germany Ministry of Manpower, Singapore

Minusplus Architects, Budapest, Hungary

MIRALab, Geneva, Switzerland

MMB Institut für Medien- und Kompetenzforschung, Germany

Moll GmbH, Aachen, Germany

Moscow Engineering Physics Institute, Russian Federation

MOTOROLA GmbH, Germany

MSO concept, Chemnitz, Germany

MTS - Modern Testing Services (Germany) GmbH, Augsburg, Germany

mu:d GmbH, Köln, Germany

Multiple Image Tools GmbH, Germany

MVweb GmbH & Co. KG, Germany

National Research Council, Rome, Italy

Natural Environment Research Council, Swindon, United Kingdom

NEC Deutschland, Germany

Nemetschek Technology GmbH, Munich, Germany

Nemomedia Mainfeld, Frankfurt am Main, Germany

NetCommunity GmbH, Germany

Netherlands Forensic Institute, Den Hague, Netherlands

Netlab GmbH, Germany

NOKIA Corporation, Finland

NORDEX Energy GmbH, Germany

Nucletron BV, Netherlands

OD2, United Kingdom

(Corren), Sweden

oefox\*architectural design, Öblarn 11, Austria

Oestgoeta Correspondenten AB

Ogilvy Interactive, Greece

OKTAL, Toulouse, France

OMG plc, Oxford, OX2 0JB, United Kingdom

On Air s.r.l., Genova, Italy

Ontoprise GmbH, Karlsruhe, Germany

OTLO VR Systeme GmbH, Germany

Oy Arbonaut, Finland

Page & Park Architects, Glasgow, United Kingdom

ParaRede Information Communication Technology, Lissabon, Lissabon, Portugal

Paregos Mediadesign AB, Stockholm, Sweden

PartMaster GmbH, Germany

Partners 4 Management, Germany

Patent- und Verwertungsagentur Mecklenburg-Vorpommern AG (PVA-MV), Germany

Peranakan Association, Singapore

PERCRO - Scuola Superiore di Studi, Pontedera (Pisa), Italy

Personal/Power Dienstleistungs GmbH & Co. KG, Darmstadt, Germany

Philips Research Laboratories, Netherlands

PIE, Pie Medical BV, Maastricht, Niederlande, Maastricht, Netherlands

Pininfarina S.p.A., Torino, Italy

Planet internet commerce GmbH, Germany

Planquadrat, Darmstadt, Germany

Politecnico di Milano, Italy

Polydimensions GmbH, Bickenbach, Germany

Porsche AG, Stuttgart, Germany

Preisendörfer GmbH, Mörfelden-Walldorf, Germany

PRO Management GmbH, Germany

PRO, Nicosia, Cyprus

ProSTEP GmbH, Darmstadt, Germany

ProSTEP iViP Verein, Darmstadt, Germany

Qyte GmbH, Eschborn, Germany

Regierungspräsidium Darmstadt, Germany

RIGEL, Italy

Rittal GmbH & Co. KG, Herborn, Germany

RMV Rhein Main Verkehrsverbund, Hofheim am Taunus, Germany

Robert Bosch GmbH, Stuttgart, Germany

ROMANA SCAVI, Roma, Italy

Römisch-Germanisch Kommission des Deutschen Archäologischen Instituts, Frankfurt, Germany

Round Table Geographic Information Systems, München, Germany

RTT Realtime Technology AG, Munich, Germany

Safety Footwear Industry MARI Ltd, Keratea, Greece

SAP AG, Walldorf, Germany

Scheller Systemtechnik GmbH, Germany

Schlumberger Systemes SA, France

School of Architecture at the School of Art, Glasgow, United Kingdom

Scottish Screen, Glasgow, United Kingdom

SEB AG, Frankfurt/Main, Germany

SEMA Group

Semantic Systems, Derio, Spain

Shishoo Consulting, Askim, Sweden

SHP, Darmstadt, Germany

Siemens AG, Munich, Germany

Siemens Business Services GmbH & Co OHG, Germany

Silent Bay Studios S.L.C., Genova, Italy

Silicon Graphics Pte Ltd, Singapore

Singapore Police Force, Singapore

Singapore Science Centre, Singapore

Singaporean-German Chamber of Commerce & Industry, Singapore

SINTEF, Oslo, Norway

Sintégra S.a.r.l., Meylan, France

Sirona Dental Systems GmbH, Germany

SIV AG, Roggentin

Slezan Frydek-Mistek a.s., Frydek-Mistek, Czech Republic

Softeco Simat, Genova, Italy

SoftwareAG, Germany

Sonopress2D3

Sony NetServices GmbH, Germany

SpheronVR AG, Waldfischbach-Burgalben, Germany

St. Petersburg Institut for Informatics and Automation, Russian Federation

Städtische Kliniken Offenbach, Offenbach, Germany

Stadtverwaltung Görlitz, Germany

STAM, Genova, Italy

Steinbeis-Transferzentrum Datenbanken, Suchmaschinen und Digitale Bibliotheken, Germany

StepONE Sportsmarketing GmbH, Germany

Steria Mummert Consulting AG, Berlin, Germany

Stichting Bedrijfsregio Kop van Nord-Holland, Netherlands

Stichting Blender Foundation, Amsterdam, Netherlands

STS srl, Torino, Italy

STT Sim Techniques, San Sebastian, Spain

Studiobraun, Darmstadt, Germany

Swedish Meteorological and Hydrological Institute, Norrköping, Sweden

Symah Vision

Synectics, Nicosia, Cyprus

Tarakos GmbH, Magdeburg, Germany

TBI Technologie-Beratungs-Institut GmbH, Germany

Technion, Haifa, Israel

Thales Information Systems

the agent factory

The Lighthouse, Glasgow, United Kingdom

The Open Group, United Kingdom

think3 GmbH, Casalecchio di Reno, Italy

Thomson Multimedia R&D, France

Tiscali

TLC Transport-, Informatik-und Logistik-Consulting GmbH, Germany

T-Mobile, Germany

Tobii, Sweden

Toshiba Medical Systems

Tourismusverband Mecklenburg-Vorpommern, Germany

Toyota Motorsport GmbH, Köln, Germany

TRACASA, Pamplona, Spain

Fraunhofer IGD Annual Report 2007

111

Triangle Venture Capital Group, St. Leon-Rot, Germany

TRIVISIO GmbH, Dreieich, Germany

Trivisio Prototyping GmbH, Dreieich, Germany

TS Tecnospamec srl, Genova, Italy

T-Systems International GmbH, Germany

TTX Tecnotessile Società di Ricerca Tecnologica r.l., Prato, Italy

TU Darmstadt, Darmstadt, Germany

Typografik Werbeagentur, Unterhaching, Germany

UNESCO, United Nations Educational, Scientific and Cultural Organization, Paris, Frankreich, Paris, France

Union des Industries Textiles, Clichy, France

UNITEC Informationssysteme GmbH, Hanau, Germany

University of Gävle, Gävle, Sweden

USD AG

VAG-Armaturen GmbH, Mannheim, Germany

VDMA - Verband Deutscher Maschinen- & Anlagenbau e.V. , Frankfurt/Main, Germany

VENIS S.p.A., Venezia, Italy

Verein zur Förderung Krebskranker Kinder, Rostock e.V., Germany

VICOMTech, Donostia / San Sebastian, Spain

Viisage AG

VilauMedia S.L., Germany

Vinematin, Hanoi, Vietnam

visionapp GmbH, Frankfurt/ Main, Germany

VISUAL DIMENSION, Oudenaarde (Ename), Belgium

Visual Space, Lissabon, Portugal

Vodafone D2 GmbH, Berlin, Germany Zenon SA, Athens, Griechenland,

Zentrum für Graphische Datenverarbeitung e.V. (ZGDV), Darmstadt,

Z-Laser Optoelektronik GmbH, Ger-

Athens, Greece

Rostock, Germany

ZSPS, Bratislava, Slovaki

many

Volkswagen AG, Wolfsburg, Germany

VRCOM / ICIDO GmbH, Darmstadt, Germany

vrcom GmbH, Darmstadt, Germany

VREC GmbH, Darmstadt, Germany

VR-Solutions Europe, Neu-Isenburg, Germany

VRVis Research Center for Virtaul Reality and Visualization, Ltd., Vienna, Austria

VTT TECHNICAL RESEARCH CEN-TRE OF FINLAND, Espoo, Finland

VULKAN Kupplungs- und Getriebebau GmbH & Co KG, Germany

vwd Vereinigte Wirtschaftsdienste GmbH, Frankfurt am Main, Germany

Weizmann Institute of Science, Rehovot, Israel

woutersontwerpers, JM Eindhoven, Netherlands

WTA Private Wirtschafts- und Technikakademie GmbH, Rostock, Germany

XIM Limited, United Kingdom

X-Pulse E-Learning GmbH, St. Ingberg, Germany

Xsens Technologies B.V., AN Enschede, Netherlands

Yabadu GmbH, Efringen-Kirchen, Germany

YAGER Development GmbH, Berlin, Germany

ZDF, Mainz, Germany

ZDK (Zentralverband des Deutschen Kraftfahrzeuggewerbes), Germany

zeitform Internet Dienste OHG, Germany

Zeitreisen Erlebnisagentur, Berlin, Germany Scientific Publications

Manifold publications reflect the broad spectrum of research of Fraunhofer IGD and its partner institutes at local universities. The following pages show an overview of the scientific publications, the graduations, monographs and series, an overview of all bachelor, master, study and diploma theses, a list of lectures, and the new patents and patent applications of 2007.

Q.

### Scientific Publications

The results of research activities of our staff are represented in the year 2007 by numerous publications and lectures, patent applications, bachelor, master, study and diploma theses, and eight successful graduations. These results reflect the wide spectrum of research done around Fraunhofer IGD.

At this year's ninth Darmstadt »Computer Graphik Abend«, held December 6, 2007 at the Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt, outstanding achievements of researchers again were recognized.

The »Patent Award« showed the importance of securing innovative developments. Professor Fellner honored successful patents and patent application of different application areas of computer graphics and presented awards and certificates.

Again this year, Ali Asghar Nazari Shirehjini is among the laureates. His »Steuerung einer steuerbaren Einrichtung« (Controlling a Controllable Installation) extends the assistance system »Personal Environment Controller« PeCO. The system is based on the 3D visualization of the environment and allows the intuitive manipulation of complex infrastructures. »We all know of the problem of having a remote control for every device. This solution allows for the control of the lot as a whole«, Professor Fellner illustrated with the invention. Georgios Sakas, from Fraunhofer IGD, Stefan Wesarg, currently a staff member of TU Darmstadt, and Bernd Schwald from Zentrum für Graphische Datenverabeitung e.V. realized the second patent in collaboration with Werner Rösch from the Gesellschaft für Medizintechnik mbH. The »Semitransparent

screen for AR applications« is an approach to a solution for controlling medical instruments more efficiently during an operation, e.g. a biopsy.

Subsequently, this year's PhDs at Fachgebiet Graphisch-Interaktive Systeme (GRIS) of the Technische Universität Darmstadt were recognized. The broad spectrum of Computer Graphics was demonstrated by topics such as Geometric Algebra, Digital Storytelling, Knowledge Management, Ambient Intelligence, and Medical Information Technology. Stefan Wesarg, who received another award in this category, commented on his work in the area of visualization for clinical applications: »One of the main goals was to develop an application as user-friendly as possible for everyday use in the hospital«. This emphasizes the importance of computer graphics for practical purposes.

The »Best Thesis Award« follows the tradition of recognizing excellent diploma and study theses and thereby motivating young researchers. Bastian Linneweber won the prize with his diploma thesis on »Coupled Simulation of Clothes and their Deformation on a Virtual Human«. Dietmar Hildenbrand, member of the jury, confirmed this success: »The results of this thesis are relevant for the production process in the clothing industry with immediate effect«.

A further highlight was the »Best Paper Award« that honored three teams of authors from institutions of the INI-GraphicsNet for their outstanding scientific publications. The team of university experts around Professor Markus Gross had the difficult task to nominate the top papers of around 170 scientific publication of the last year. Gabriele Bleser, Harald Wuest and Didier Stricker from Fraunhofer IGD received the first prize in the category of »research« for their publication on a stable real-time tracking system in an augmented reality system. The second-ranked author team, Christian Peters, Fraunhofer IGD Rostock, and Antje Herbon, Humbold Universität Berlin, was honored for their study on emotion representation and categorization, which allow the use of emotions in adaptive human-computer interaction. With their novel approach, »Using Graphics Hardware to Accelerate Multiple Sequence Alignment«, Wei Guo Liu, Bertil Schmidt, Gerrit Voss, and Wolfgang Müller-Wittig from the Centre for Advanced Media Technology CAMTech, Singapore, excelled in the category of »systems«.

A lecture of Reiner Kunz from ColdQuanta Inc. concluded the award ceremony. The former Darmstadt student, today living in the USA, gave an overview of his diversified career. He talked about valuable experiences and the profit he gained from creative thinking and action. Most important in his opinion is to keep faith in one's own goals.

The »Computer Graphik Abend« has been celebrated since 1998, and, with its awards, documents among other things the successful synergies of the international research network INI-GraphicsNet. Its contributors are the Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt, Rostock, Singapore, and Graz, the Computer Graphics Center ZGDV in Darmstadt and Rostock, the Interactive Graphics Systems department at the Technische Universität Darmstadt, the department Computer Graphik und Wissensvisualisierung CGV of TU Graz, and other institutions in Germany and abroad (USA, Singapore, Portugal, Spain, Italy, Korea).

The following pages show an overview of the scientific publications, the PhD theses, monographs and series, an overview of bachelor, master, study and diploma theses, and a list of lectures as well as the collection of patent applications from the year 2007.

### Library News

Since the end of 2007, the Eurographics Publications Archive has been located at the Fraunhofer IGD.

# EG Archive as a special library collection

The EG Archive consists of about 450 books, brochures and CD/DVD-ROMs so far. These are conference materials from the Eurographics Conference (Proceedings, Tutorials, and State-of-the-Art-Reports), Eurographics Workshop Proceedings, Partner Event Proceedings, all volumes of the

»Computer Graphics Forum« journal, and the »EurographicSeminars« book series.

The materials have been recorded in the library catalogue to make them visible in the IGD intranet. The Eurographics Association will deliver all new publications to be added to the archive being maintained by the Fraunhofer IGD library in the future.

All materials are available to the staff of the Fraunhofer IGD as well as to the public for reference in the library.

Y. EUROGRAPHICS PRINT ARCHIVE



The new location of the Eurographics Archive at Fraunhofer IGD

#### Papers

The articles published in conference proceedings and journals of the current year may be found up-to-date on the website of Fraunhofer IGD. In 2007, we published the following papers.

Antoni, Torsten; Bühler, Wilhelm; Dres, Helmut; Grein, Günter; Kamps, Thomas; Kupsch, Rainer; Roth, Michael; Stenzel, Richard:

Global Grid User Support Building a Worldwide Distributed User Support Infrastructure.

In: German e-Science Conference 2007. Proceedings [online]. [cited 13 July 2007] Available from:

http://edoc.mpg.de/display.epl?col=100&grp=14 14, 2007, 9 p.

Antoni, Torsten; Bühler, Wilhelm; Dres, Helmut; Grein, Günter; Kamps, Thomas; Kupsch, Rainer; Roth, Michael; Stenzel, Richard:

# Knowledge Management and Semantics in Global Grid User Support.

In: German e-Science Conference 2007. Proceedings [online]. [cited 13 July 2007] Available from:

http://edoc.mpg.de/display.epl?col=100&grp=14 14, 2007, 9 p.

#### Audersch, Stefan; Flach, Guntram; Peters, Jan: Integration von mobilen Agenten und Webservice-basierten Workflows innerhalb komplexer eGovernment-Prozesse

In: Höpfner, Hagen (Ed.) et al.; Gesellschaft für Informatik (GI), Fachbereich Datenbanken und Informationssysteme: 19. GI-Workshop Grundlagen von Datenbanken. Proceedings. Bruchsal, 2007, S. 17-21 (Technical report / International University in Germany, School of Information Technology).

Baltas, Dimos; Sakas, Georgios; Steckenreiter, O.; Karabis, A.; Giannouli, S.; Sauvonet, B.; Zambolgou, N:

# 2D-3D and 3D-3D Fusion Imaging (US & CT/MR): Interventional US Applied to Prostate Brachytherapy.

In: Zoumboulis, P. (Ed.); Hellenic Society for Ultrasound in Medicine and Biology: 80 Panellinio Synedrio Yperixografias = 8th Greek Ultrasonography Conference. MD Congress Press, 2007, pp. 239-240 Basdogan, Cagatay; Sedef, Mert; Harders, Matthias; Wesarg, Stefan: VR-Based Simulators for Training in Minimally

Invasive Surgery. In: IEEE Computer Graphics and Applications 27

(2007), 2, pp. 54-66

Becker, Mario; Bleser, Gabriele; Pagani, Alain; Stricker, Didier; Wuest, Harald:

An Architecture for Prototyping and Application Development of Visual Tracking Systems.

In: Institute of Electrical and Electronics Engineers (IEEE) et al.: Proceedings of 3DTV-CON 2007 [CD-ROM]: Capture, Transmission and Display of 3D Video. 2007, 4 p.

Behr, Johannes; Dähne, Patrick; Jung, Yvonne; Webel, Sabine:

Beyond the Web Browser – X3D and Immersive VR.

In: IEEE Computer Society et al.: IEEE Virtual Reality 2007. VR Tutorial and Workshop Proceedings [CD-ROM]: IEEE Symposium on 3D User Interfaces. Piscataway, NJ: IEEE Service Center, 2007, 5 p.

Bertacchini, Pier Augusto; Beusing, Ruth; Bursche, Aleksander; Conti, Giuseppe; Amicis, Raffaele de; Etz, Markus; Holweg, Daniel; Linaza, María Teresa; Maver, Thomas W.; Posluschny, Axel; Pritchard, Douglas; Sievers, Susanne; Tavernise, Assunta:

Netconnect – Connecting European Culture Through New Technology.

In: Bowen, Jonathan P. (Ed.); University of the Arts London, College of Communication: EVA London 2007 Conference Proceedings. EVA Conferences International (ECI), 2007, pp. 36.1 – 36.11

Bieber, Gerald; Abd Al Rahman, Emad; Urban, Bodo:

Screen Coverage: A Pen-Interaction Problem for PDA's and Touch Screen Computers. In: Proceedings of the Third International Conference on Wireless and Mobile Communications: ICWMC 2007. New York: IEEE Press, 2007, pp. 87-92

Bieber, Gerald; Kirste, Thomas:

Untersuchung des gruppendynamischen Aktivitätsverhaltens im Office-Umfeld. In: Rötting, Matthias (Ed.) et al.: Prospektive Gestaltung von Mensch-Technik-Interaktion: 7. Berliner Werkstatt Mensch-Maschine-Systeme. Düsseldorf: VDI Verlag, 2007, 4 S. (VDI Fortschritt-Berichte. Reihe 22: Mensch-Maschine-Systeme 25). Bieber, Gerald; Tominski, Christian; Urban, Bodo:

#### TiDi Browser: A Novel Photo Browsing Technique for Mobile Devices.

In: Creutzburg, Reiner (Ed.) et al.; The International Society for Optical Engineering (SPIE) et al.: Multimedia on Mobile Devices 2007. Bellingham: SPIE Press, 2007, 8 p. (Proceedings of SPIE 6507).

Blechschmied, Heiko; Etz, Markus; Holweg, Daniel:

# MobileChase – Das Mobilphone als spielerischer Zugang zu Kulturinformationen.

In: Mangold, Michael (Ed.) et al.: Vom Betrachter zum Gestalter: Neue Medien in Museen – Strategien, Beispiele und Perspektiven für die Bildung. Baden-Baden: Nomos Verlagsgesellschaft, 2007, S. 147-160

Bleser, Gabriele; Becker, Mario; Stricker, Didier: Real-time Vision-based Tracking and Reconstruction.

In: Journal of Real-Time Image Processing 2 (2007), 2-3, pp. 161-175

Braun, Simone; Hefke, Mark; Schmidt, Andreas; Sevilmis, Neyir:

# Im Wissensnetz: Linked Information Processes in Research Networks.

In: German e-Science Conference 2007. Proceedings [online]. [cited 13 July 2007] Available from:

http://edoc.mpg.de/display.epl?col=100&grp=14 14, 2007, 10 p.

#### Brunetti, Gino; Stork, André:

**Constraint-based Virtual Conceptual Design.** In: International Journal of Product Development 4 (2007), 6, pp. 646-661

#### Busch, Christoph; Nouak, Alexander: Das EU-Projekt «3D Face«. 3-D-Gesichtserkennung für die unbeaufsichtigte Grenzkontrolle.

In: Bundesamt für Sicherheit in der Informationstechnik (BSI): Innovationsmotor IT-Sicherheit. Gau-Algesheim: SecuMedia Verlag, 2007, S. 199-212

Busch, Christoph; Nouak, Alexander; Zhou, Xuebing; van der Veen, Michiel; Deravi, Farzin; Suchier, Jean-Marc:

# Towards Unattended and Privacy Protected Border Control.

In: Institute of Electrical and Electronics Engineers (IEEE) et al.: Biometrics Symposium 2007. 2007, 6 p. Busch, Christoph; Pinsdorf, Ulrich: Mobile Agenten im elektronischen Geschäftsverkehr.

In: Gitter, Rotraud (Ed.) et al.: Sicherheit und Rechtsverbindlichkeit mobiler Agenten. Wiesbaden: Deutscher Universitäts-Verlag, 2007, S. 9-19 (DUD-Fachbeiträge).

Bustos, Benjamin; Fellner, Dieter W.; Havemann, Sven; Keim, Daniel A.; Saupe, Dietmar; Schreck, Tobias:

# Foundations of 3D Digital Libraries: Current Approaches and Urgent Research Challenges.

In: Castelli, D. (Ed.) et al.; DELOS Network of Excellence on Digital Libraries et al.: Foundations of Digital Libraries: Pre-Proceedings of the First International Workshop on «Digital Libraries Foundations«. 2007, pp. 7-12

Chandaria, J.; Thomas, G.; Bartczak, B.; Koeser, K.; Koch, R.; Becker, Mario; Bleser, Gabriele; Stricker, Didier; Wohlleber, Cedric; Felsberg, M.; Gustafsson, F.; Hol, J.; Schön, T.B.; Skoglund, J.; Slycke, P.J.; Smeitz, S.:

# Realtime Camera Tracking in the MATRIS Project.

In: SMPTE Motion Imaging Journal 116 (2007), 7/8, pp. 266-271

Chandaria, Jigna; Thomas, Graham A.; Stricker, Didier:

#### The MATRIS Project: Real-time Markerless Camera Tracking for Augmented Reality and Broadcast Applications.

In: Journal of Real-Time Image Processing 2 (2007), 2-3, pp. 69-79

Chen, Chen; Singh, Aarti; Lui, Weiguo; Müller-Wittig, Wolfgang K.; Mitchell, W.; Schmidt, Bertil:

# Phenotype Genotype Exploaration on a Desktop GPU Grid.

In: Yan, Lee Hing (Ed.) et al.: GCA 2007: Proceedings of the 3rd International Workshop on Grid Computing and Applications. Singapore; New Jersey: World Scientific, 2007, 154-166 pp.

Crane, Elizabeth; Shami, N. Sadat; Peter, Christian:

# Let's Get Emotional: Emotion Research in Human Computer Interaction.

In: ACM SIGCHI: CHI 2007 Conference Proceedings [DVD-ROM]. New York: ACM Press, 2007, pp. 2101-2104 De Beni, S.; Grimm, Marcus; Maccio, M.; Sakas, Georgios; Solbiati, L.:

2D-3D Fusion Imaging (US & CT/MR): Interventional US Applied to Liver RF Ablation. In: Zoumboulis, P. (Ed.); Hellenic Society for Ultrasound in Medicine and Biology: 80 Panellinio Synedrio Yperixografias = 8th Greek Ultrasonography Conference. MD Congress Press, 2007, pp. 241-242

Dold, Christian; Bockholt, Ulrich; Roth, Marcus; Heussel, Claus Peter; Gosepath, Jan; Sakas, Georgios:

#### Segmentation and Navigation Support of Clinical Data Sets to Simulate the Bronchoscopy and Rhinoscopy.

In: Buzug, Thorsten M. (Ed.): Advances in Medical Engineering. Berlin, Heidelberg, New York: Springer Verlag, 2007, pp. 145-150 (Springer Proceedings in Physics 114).

Dold, Christian; Bockholt, Ulrich; Roth, Marcus; Heussel, Claus Peter; Gosepath, Jan; Sakas, Georgios:

#### Simulations- und Trainingsystem für die Bronchoskopie / Rhinoskopie durch klinische Datensätze.

In: Deutsche Gesellschaft für Biomedizinische Technik im VDE (DGBMT): BMT 2007. Proceedings [CD-ROM]. 41. Jahrestagung der Deutschen Gesellschaft für Biomedizinische Technik (DGBMT) im VDE: Biomedizinische Technik – Biomedical Engineering, Vol. 52 (2007) Ergänzungsband. Berlin: de Gruyter, 2007, 2 S.

Dose, Michael; Fischer, Kai; Pinsdorf, Ulrich; Reininger, Herbert:

Technische Ergebnisse und Beobachtungen. In: Gitter, Rotraud (Ed.) et al.: Sicherheit und Rechtsverbindlichkeit mobiler Agenten. Wiesbaden: Deutscher Universitäts-Verlag, 2007, S. 163-183 (DUD-Fachbeiträge).

#### Dose, Michael; Pinsdorf, Ulrich:

Technische Gestaltungsvorschläge. In: Gitter, Rotraud (Ed.) et al.: Sicherheit und Rechtsverbindlichkeit mobiler Agenten. Wiesbaden: Deutscher Universitäts-Verlag, 2007, S. 229-242 (DUD-Fachbeiträge).

Encarnação, José L.; Mühlhäuser, Max; Wichert, Reiner:

#### Ambient Intelligence – Forschung und Anwendung.

In: Thema Forschung 13 (2007), 1, S. 4-10

#### Fetter, Mirko; Etz, Markus; Blechschmied, Heiko: MOBILE CHASE: Towards a Framework for Location-Based Gaming.

In: Braz, José (Ed.) et al.; Institute for Systems and Technologies of Information, Control and Communication (INSTICC): GRAPP 2007. Volume AS/IE [Animation and Simulation / Interactive Environments]: Proceedings of the Second International Conference on Computer Graphics Theory and Appilications. INSTICC Press, 2007, pp. 98-105

#### Firle, Evelyn; Keil, Matthias:

#### Multi-volume Visualization Using Spatialized Transfer Functions: Gradient- versus Multi-intensity-based Approach.

In: Lemke, Heinz U. (Ed.) et al.; International Society for Computer Aided Surgery (ISCAS) et al.: CARS 2007. Computer Assisted Radiology and Surgery: Proceedings of the 21st International Congress and Exhibition: International Journal of Computer Assisted Radiology and Surgery, Vol. 2 (2007), Supplement 1. Berlin, Heidelberg, New York: Springer Verlag, 2007, pp. S121-S123

#### Fuhrmann, Arnulph:

Interaktive Animation textiler Materialien. In: Wagner, Dorothea (Ed.); Gesellschaft für Informatik (GI): Ausgezeichnete Informatikdissertationen 2006. Bonn: Köllen, 2007, S. 79-88 (GI-Edition – Lecture Notes in Informatics (LNI) D-7).

#### Funk, Wolfgang:

# Reversible Watermarking of NURBS-based CAD Models.

In: Camenisch, Jan L. (Ed.) et al.: Information Hiding: 8th International Workshop, IH 2006. Berlin, Heidelberg, New York: Springer Verlag, 2007, pp. 172-187 (Lecture Notes in Computer Science (LNCS) 4437).

#### Gierlinger, Thomas; Santos, Pedro; Stork, André: Augmented Reality for Visualization of Architectural Design.

In: Bowen, Jonathan P. (Ed.); University of the Arts London, College of Communication: EVA London 2007 Conference Proceedings. EVA Conferences International (ECI), 2007, pp. 35.1 – 35.10

Gitter, Rotraud; Laue, Philip; Peters, Jan; Pinsdorf, Ulrich:

#### Die zweite Simulationsstudie.

In: Gitter, Rotraud (Ed.) et al.: Sicherheit und Rechtsverbindlichkeit mobiler Agenten. Wiesbaden: Deutscher Universitäts-Verlag, 2007, S. 243-256 (DUD-Fachbeiträge). Godehardt, Eicke; Doehring, Markus; Faatz, Andreas; Goertz, Manuel:

#### Deploying YAWL for Workflows in Workplace-embedded Learning.

In: Tochtermann, Klaus (Ed.) et al.: I-Know '07. Proceedings: 7th International Conference on Knowledge Management. Graz: Know-Center, 2007, pp. 281-288 (J.UCS Journal of Universal Computer Science Special Issue).

#### Gone, Moses; Schade, Sven:

#### Towards Semantic Composition of Geospatial Web Services – Using WSMO in Comparison to BPEL.

In: Probst, Florian (Ed.) et al.: GI-Days 2007 – Young Researchers Forum. Münster: Institut für Geoinformatik, 2007, pp. 43-63 (IfGIprints 30).

#### Graf, Frank; Nickel, Claudia; Nouak, Alexander: iDetective: Ein Suchwerkzeug für den Copyright-Schutz.

In: Datenschutz & Datensicherheit 31 (2007), 06, S. 459-463

#### Graf, Frank; Nouak, Alexander: Lösung in Sicht: Suchmaschine für Markenrechtsverletzungen im Web. In: Sicherheitsforum (2007), 2, S. 63-64

#### Graf, Frank; Nouak, Alexander:

Markenrechtsverletzungen im Web suchen: Fraunhofer arbeitet an Spezialsuchmaschinen.

In: WIK: Zeitschrift für die Sicherheit der Wirtschaft (2007), 1, S. 25-26

Graf, Holger; Peña Serna, Sebastian; Stork, André:

# Towards Conceptual Simulations within Highly Interactive Environments.

In: Arabnia, Hamid R. (Ed.): Proceedings of the 2007 International Conference on Modeling, Simulation & Visualization Methods: MSV 2007. Las Vegas: CSREA Press, 2007, pp. 108-114

Haist, Jörg; Figueiredo Ramos, H.M.; Reitz, Thorsten:

#### Symbology Encoding for 3D GIS – An Approach to Extend 3D City Model Visualization to GIS Visualization.

In: Coors, Volker (Ed.) et al.: Urban and Regional Data Management: UDMS Annual 2007. Leiden, The Netherlands: Taylor & Francis Group, 2007, pp. 121-131

#### Hambach, Sybille: Developing Products and Services for Elearning.

In: Ercim News (2007), 71, pp. 14-15

#### Havemann, Sven; Fellner, Dieter W.: Seven Research Challenges of Generalized 3D Documents.

In: IEEE Computer Graphics and Applications 27 (2007), 3, pp. 70-76

Havemann, Sven; Settgast, Volker; Lancelle, M.; Fellner, Dieter W.:

# 3D-Powerpoint – Towards a Design Tool for Digital Exhibitions of Cultural Artifacts.

In: Arnold, David (Ed.) et al.; European Association for Computer Graphics (Eurographics): VAST 2007. Proceedings: The 8th International Symposium on Virtual Reality, Archaeology and Intelligent Cultural Heritage. Aire-la-Ville: Eurographics Association, 2007, pp. 39-46; 145 [Color Plate]

#### Hellenschmidt, Michael:

#### An Adaptive Rule-based Inference Engine for Realising Reasonable Behaviour of Smart Environments.

In: Olivier, Patrick (Ed.) et al.; The Society for the Study of Artificial Intelligence and the Simulation of Behaviour (SSAISB): AISB' 07. Proceedings: Artificial & Ambient Intelligence. 2007, pp. 84-89

#### Hellenschmidt, Michael; Wichert, Reiner: Selbstorganisation: Dinge in eigenverantwortlicher Kooperation – eine Systemanalyse.

In: Bullinger, Hans-Jörg (Ed.) et al.: Internet der Dinge: www.internet-der-dinge.de. Berlin; Heidelberg: Springer, 2007, S. 91-105

#### Hellenschmidt, Michael; Wichert, Reiner: Rule-Based Modelling of Intelligent Environment Behaviour.

In: Künstliche Intelligenz: KI (2007), 2, pp. 24-29

Hirschbach, Henning; Steinbrecher, Tillmann; Gerth, Maik:

#### Tangential anliegene Verbinder für Brückengerüste.

In: Deutsche Gesellschaft für Biomedizinische Technik im VDE (DGBMT): BMT 2007. Proceedings [CD-ROM]. 41. Jahrestagung der Deutschen Gesellschaft für Biomedizinische Technik (DGBMT) im VDE: Biomedizinische Technik – Biomedical Engineering, Vol. 52 (2007) Ergänzungsband. Berlin: de Gruyter, 2007, 2 S.

Hopp, Armin; Fellner, Dieter W.; Havemann, Sven:

#### Cube3D – Ein Single Chip DLP Stereo Projektor.

In: Schenk, Michael (Ed.); Fraunhofer-Institut für Fabrikbetrieb und -automatisierung (IFF): 10. IFF-Wissenschaftstage 2007. Tagungsband [CD-ROM]: 15 Jahre Fraunhofer IFF. Magdeburg: Fraunhofer IFF, 2007, VR-Teil, S. 77-86 Hopp, Armin; Havemann, Sven; Fellner, Dieter W.:

#### A Single Chip DLP Projector for Stereoscopic Images of High Color Quality and Resolution.

In: Fröhlich, Bernd (Ed.) et al.; European Association for Computer Graphics (Eurographics) et al.: Virtual Environments 2007. IPT-EGVE 2007: Short Papers and Posters. Aire-Ia-Ville: Eurographics Association, 2007, pp. 21-26

#### Hutter, Marco; Fuhrmann, Arnulph: Optimized Continuous Collision Detection for Deformable Triangle Meshes.

In: Skala, Vaclav (Ed.); European Association for Computer Graphics (Eurographics): Journal of WSCG Vol. 15 No. 1-3, 2007. Proceedings. Plzen: University of West Bohemia, 2007, pp. 25-32

lurgel, Ido; Marcos, Adérito: Employing Personality-Rich Virtual Persons – New Tools Required. In: Computers & Graphics 31 (2007), 6, pp. 827-836

Jung, Yvonne; Franke, Tobias; Dähne, Patrick; Behr, Johannes:

#### Enhancing X3D for Advanced MR Appliances.

In: ACM SIGGRAPH et al.: Proceedings WEB3D 2007: 12th International Conference on 3D Web Technology. New York: ACM Press, 2007, pp. 27-36

### Jung, Yvonne; Knöpfle, Christian:

Real Time Rendering and Animation of Virtual Characters.

In: International Journal of Virtual Reality 6 (2007), 4, pp. 55-66

Jung, Yvonne; Weber, Christine; Webel, Sabine; Knöpfle, Christian:

Exploration einer virtuellen Stratigraphie mit Hilfe von Verfahren des Interaktiven Designreviews.

In: Latoschik, Marc Erich (Ed.) et al.; Gesellschaft für Informatik, GI-Fachgruppe Virtuelle Realität und Augmented Reality: Virtuelle und Erweiterte Realität: 4. Workshop der GI-Fachgruppe VR/AR. Aachen: Shaker, 2007, S. 47-54 (Berichte aus der Informatik).

Khakzar, Karim; Blum, Rainer; Kohlhammer, Jörn; Fuhrmann, Arnulph; Maier, Angela; Maier, Axel:

#### Interactive Product Visualization for an Instore Sales Support System for the Clothing Retail.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4557, pp. 307-316 (Lecture Notes in Computer Science (LNCS)). Koch, Reinhard; Evers-Senne, Jan-Friso; Schiller, Ingo; Wuest, Harald; Stricker, Didier:

# Architecture and Tracking Algorithms for a Distributed Mobile Industrial AR System.

In: International Association for Pattern Recognition (IAPR) et al.: ICVS 2007 – Vision Systems in the Real World: Adaptation, Learning, Evaluation [online]. [cited 14 June 2007] Available from: http://www.icvs2007.org/programme.php, 2007, 10 p.

#### Krämer, Michel; Haist, Jörg; Reitz, Thorsten: Methods for Spatial Data Quality of 3D City Models.

In: Amicis, Raffaele de (Ed.) et al.; European Association for Computer Graphics (Eurographics) et al.: 5th Italian Chapter Conference: Eurographics Italian Chapter Proceedings. Aire-la-Ville: Eurographics, 2007, pp. 167-172

Krottmaier, Harald; Kurth, Frank; Steenweg, Thorsten; Appelrath, Hans-Jürgen; Fellner, Dieter W.:

#### PROBADO – A Generic Repository Integration Framework.

In: Kovács, László (Ed.) et al.: Research and Advanced Technology for Digital Libraries. Proceedings: 11th European Conference, ECDL 2007. Berlin; Heidelberg: Springer International, 2007, pp. 518-521 (Lecture Notes in Computer Science (LNCS) 4675).

#### Laue, Philip; Maidl, Monika; Peters, Jan: Zweckbindung in ämterübergreifenden Verwaltungsworkflows: Zugriffsschutz durch feingranulare Verschlüsselung auf XML-Basis.

In: Datenschutz & Datensicherheit 31 (2007), 11, S. 810-815

Leeb, Robert; Settgast, Volker; Fellner, Dieter W.; Pfurtscheller, Gert:

#### Self-paced Exploration of the Austrian National Library Through Thought. In: International Journal of Bioelectromagnetism 9 (2007), 4, pp. 237-244

Liu, Weiguo; Müller-Wittig, Wolfgang K.; Schmidt, Bertil:

# Performance Predictions for General-Purpose Computation on GPUs.

In: Li, Jiandong (Ed.) et al.; IEEE Computer Society: 2007 International Conference on Parallel Processing [CD-ROM]: ICPP 2007. Los Alamitos, Calif.: IEEE Computer Society, 2007, 8 p.

#### Liu, Weiguo; Müller-Wittig, Wolfgang K.; Schmidt, Bertil:

Performance Analysis of General-Purpose Computation on Commodity Graphics Hardware: A Case Study Using Bioinformatics. In: Journal of VLSI Signal Processing-Systems for Signal, Image, and Video Technology 48 (2007), 3, pp. 209-221 Liu, Weiguo; Schmidt, Bertil; Voss, Gerrit; Müller-Wittig, Wolfgang K.:

# Streaming Algorithms for Biological

Sequence Alignment on GPUs. In: IEEE Transactions on Parallel and Distributed Systems 18 (2007), 9, pp. 1270-1281

Madeira, Joaquim; Silva, Samuel; Stork, André; Peña Serna, Sebastian:

Principal Curvature-Driven Segmentation of Mesh Models: A Preliminary Assessment. In: Santos, Luís Paulo (Ed.) et al.; Associação para o Desenvolvimento das Telecomunicações e Técnicas de Informática (ADETTI) et al.: 15° EPCG – Encontro Português de Computação Gráfica. 2007, pp. 189-194

#### Mader, Steffen; Voskamp, Jörg: WLAN-Abdeckung und -Durchsatzraten in Schiffsmaschinenräumen.

In: Schenk, Michael (Ed.); Fraunhofer-Institut für Fabrikbetrieb und -automatisierung (IFF): 10. IFF-Wissenschaftstage 2007. Tagungsband [CD-ROM]: 15 Jahre Fraunhofer IFF. Magdeburg: Fraunhofer IFF, 2007, VR-Teil, S. 209-215

#### May, Thorsten:

Working with Patterns in Large Multivariate Datasets – Karnaugh-Veitch-Maps Revisited. In: Banissi, Ebad (Ed.) et al.; IEEE Computer Society: 11th International Conference on Information Visualization. Proceedings: IV 2007. Los Alamitos, Calif.: IEEE Computer Society, 2007, pp. 277-284

#### Müller-Wittig, Wolfgang K.; Voss, Gerrit: Challenges for Modern Scene-Graph Systems.

In: Amicis, Raffaele de (Ed.) et al.; European Association for Computer Graphics (Eurographics) et al.: 5th Italian Chapter Conference: Eurographics Italian Chapter Proceedings. Aire-la-Ville: Eurographics, 2007, pp. 45-49

Müller-Wittig, Wolfgang K.; Zhu, Chao; Voss, Gerrit:

# Cultural Heritage as Digital Experience: A Singaporean Perspective.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4563, pp.680-688 (Lecture Notes in Computer Science (LNCS)).

#### Nazari Shirehjini, Ali A.:

A Multidimensional Classification Model for the Interaction in Reactive Media Rooms. In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4552, pp. 431-439 (Lecture Notes in Computer Science (LNCS)). Nazari Shirehjini, Ali A.:

#### A Qualitative Usability Evaluation of a Mobile 3D-based Environment Controller.

In: The Institution of Engineering and Technology (IET): 3rd IET International Conference on Intelligent Environments: IE 07. London: The Institution of Engineering and Technology, 2007, pp. 459-465

#### Nazari Shirehjini, Ali A.; Movahedi, Jafar: An Evaluation of Mobile 3D-Based Interaction with Complex Multimedia Environments.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4556, pp. 108-115 (Lecture Notes in Computer Science (LNCS)).

#### Nazemi, Kawa; Bhatti, Nadeem; Godehardt, Eicke; Hornung, Christoph: Adaptive Tutoring in Virtual Learning Worlds.

In: Montgomerie, Craig (Ed.) et al.; Association for the Advancement of Computing in Education (AACE): Proceedings of ED-Media 2007: World Conference on Educational Multimedia, Hypermedia & Telecommunications [CD-ROM]. Chesapeake, 2007, pp. 2951-2959

### Nickel, Claudia; Graf, Frank:

# Ein System zur effizienten Identifizierung von Farbbildern.

In: Hans, Wolfram (Ed.) et al.; Institut für Computervisualistik, Universität Koblenz-Landau et al.: 13. Workshop Farbbildverarbeitung. Tönning, Lübeck, Marburg: Der Andere, 2007, S. 111-120

Oertel, Karina; Kaiser, Robin; Voskamp, Jörg; Urban, Bodo:

# AFFectIX – An Affective Component as Part of an E-Learning-System.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNAI 4565, pp. 385-393 (Lecture Notes in Computer Science (LNCS)).

#### Pagani, Alain; Stricker, Didier: Spatially Uniform Colors for Projectors and Tiled Displays.

In: Journal of the Society for Information Display 15 (2007), 9, pp. 679-689 Peter, Christian; Schultz, Randolf; Voskamp, Jörg; Urban, Bodo; Nowack, Nadine; Janik, Hubert; Kraft, Karin; Göcke, Roland: **EREC-II in Use: Studies on Usability and Suitability of a Sensor System for Affect Detection and Human Performance Monitoring.** In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4552, pp. 465-474 (Lecture Notes in Computer Science (LNCS)).

#### Peters, Jan; Audersch, Stefan; Laue, Philip: Datenschutzgerechte Vorgangsbearbeitung im eGovernment.

In: Horster, Patrick (Ed.): D-A-CH Security. Proceedings: Bestandsaufnahme, Konzepte, Anwendungen, Perspektiven. syssec, 2007, S. 166-177 (IT Security & IT Management).

Peters, Jan; Pinsdorf, Ulrich; Roth, Volker: Sicherheitsaspekte mobiler Agenten. In: Gitter, Rotraud (Ed.) et al.: Sicherheit und Rechtsverbindlichkeit mobiler Agenten. Wiesbaden: Deutscher Universitäts-Verlag, 2007, S. 21-39 (DUD-Fachbeiträge).

Peters, Jan; Rieke, Roland; Rochaeli, Taufiq; Steinemann, Björn; Wolf, Ruben: A Holistic Approach to Security Policies – Policy Distribution with XACML over COPS. In: ter Beek, Maurice (Ed.) et al.: Proceedings of the Second International Workshop on Views on Designing Complex Architectures: VODCA 2006. Amsterdam: Elsevier Science, 2007, pp. 143-157 (Electronic Notes in Theoretical Computer Science 168).

#### Pinsdorf, Ulrich:

#### Bildsuchmaschine.

In: Gitter, Rotraud (Ed.) et al.: Sicherheit und Rechtsverbindlichkeit mobiler Agenten. Wiesbaden: Deutscher Universitäts-Verlag, 2007, S. 131-145 (DUD-Fachbeiträge).

#### Ramparany, Fano; Poortinga, Remco; Stikic, Maja; Schmalenströer, Jörg; Prante, Thorsten: **An Open Context Information Management Infrastructure the IST-Amigo Project.** In: The Institution of Engineering and Technology (IET): 3rd IET International Conference on Intelligent Environments: IE 07. London: The Institution of Engineering and Technology, 2007, pp. 398-403

#### Reidt, Steffen; Wolthusen, Stephen: Efficient Distribution of Trust Authority Functions in Tactical Networks.

In: Proceedings of the Eighth Annual IEEE Systems, Man and Cybernetics Information Assurance Workshop: IAW 2007. New York: IEEE Press, 2007, pp. 84-91 Reidt, Steffen; Wolthusen, Stephen: An Evaluation of Cluster Head TA Distribution Mechanisms in Tactical MANET Environments.

In: US Army Research Laboratory et al.: Annual Conference of ITA: ACITA [online]. [cited 23 November 2007] Available from: http://www.usukita.org/?q=node/13, 2007, 8 p.

### Reiners, Dirk; Voss, Gerrit: Climbing Longs Peak: The Steep Road to

the Future of OpenGL. In: IEEE Computer Graphics and Applications 27 (2007), 4, pp. 84-89

#### Ruiz, Oscar E.; Peña Serna, Sebastian: Aspect Ratio- and Size-Controlled Patterned Triangulations of Parametric Surfaces.

In: Gobbetti, E. (Ed.); The International Association of Science and Technology for Development (IASTED): Proceedings of the Ninth IASTED International Conference Computer Graphics and Imaging [CD-ROM]. Anaheim, CA, USA: Acta Press, 2007, 6 p.

Rust, Matthias; Peter, Christian; Beikirch, Helmut:

#### emoVIRAT: Emotionserkennung und Videoanalyse.

In: Institut für Multimediatechnik (IFM): Mensch – Maschine – Interaktion: 2. Kongress Multimediatechnik Wismar 2007. Boizenburg: Hülsbusch, 2007, S. 115-121

#### Sakas, Georgios; Grimm, Marcus: Freehand 3D/4D Ultrasound: Extending Existing U/S Devices.

In: Zoumboulis, P. (Ed.); Hellenic Society for Ultrasound in Medicine and Biology: 80 Panellinio Synedrio Yperixografias = 8th Greek Ultrasonography Conference. MD Congress Press, 2007, pp. 243-244

#### Sakas, Georgios; Muller, M.:

MiniPACS Implementation in Telemedicine. In: Zoumboulis, P. (Ed.); Hellenic Society for Ultrasound in Medicine and Biology: 80 Panellinio Synedrio Yperixografias = 8th Greek Ultrasonography Conference. MD Congress Press, 2007, pp. 245-246

Santos, Pedro; Buaes, Alexandre; Pereira, Carlos Eduardo; Binotto, Alecio:

#### An Innovative Geometric Pose Reconstruction Approach for Marker-based Single Camera Tracking.

In: Brazilian Computer Society (SBC): 9th Symposium on Virtual and Augmented Reality. Proceedings 2007. 2007, pp. 324-326

Santos, Pedro; Gierlinger, Thomas; Stork, André: Ein kollaboratives Mixed Reality Design Review System.

In: Gausemeier, Jürgen (Ed.) et al.: Augmented und Virtual Reality in der Produktentstehung: Grundlagen, Methoden und Werkzeuge. Paderborn: Heinz Nixdorf Institut, 2007, S. 159-174 (HNI-Verlagsschriftenreihe 209).

Santos, Pedro; Gierlinger, Thomas; Stork, André; McIntyre, Don:

Display and Rendering Technologies for Virtual and Mixed Reality Design Review. In: Proceedings of the 7th International Conference on Construction Applications of Virtual Reality: CONVR 2007 [Online]. [cited 7 March 2008] Available from:

http://www.engr.psu.edu/convr/Proceedings.htm , 2007, pp. 165-175

Santos, Pedro; Stork, André; Gierlinger, Thomas; Pagani, Alain; Araújo, Bruno; Jota, Ricardo; Bruno, Luis; Jorge, Joaquim; Pereira, João Madeiras; Witzel, Martin; Conti, Giuseppe; Amicis, Raffaele de; Barandarian, Iñigo; Paloc, Céline; Hafner, Maylu; McIntyre, Don: IMPROVE: Advanced Displays and Interaction Techniques for Collaborative Design Review.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4563, pp. 376-385 (Lecture Notes in Computer Science (LNCS)).

Santos, Pedro; Stork, André; Gierlinger, Thomas; Pagani, Alain; Araújo, Bruno; Jota, Ricardo; Bruno, Luis; Jorge, Joaquim; Pereira, João Madeiras; Witzel, Martin; Conti, Giuseppe; Amicis, Raffaele de; Barandarian, Iñigo; Paloc, Céline; Machui, Oliver; Jiménez, Jose M.; Bodammer, Georg; McIntyre, Don: IMPROVE: Collaborative Design Review in Mobile Mixed Reality.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4563, pp. 543-553 (Lecture Notes in Computer Science (LNCS)).

Santos, Pedro; Stork, André; Gierlinger, Thomas; Pagani, Alain; Araújo, Bruno; Jota, Ricardo; Bruno, Luis; Jorge, Joaquim; Pereira, João Madeiras; Witzel, Martin; Conti, Giuseppe; Amicis, Raffaele de; Barandarian, Iñigo; Paloc, Céline; Hafner, Maylu; McIntyre, Don: **IMPROVE: Designing Effective Interaction for Virtual and Mixed Reality Environments.** In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4551, pp. 689-699 (Lecture Notes in Computer Science (LNCS)). Santos, Pedro; Stork, André; Gierlinger, Thomas; Pagani, Alain; Paloc, Céline; Barandiarán, Iñigo; Conti, Giuseppe; Amicis, Raffaele de; Witzel, Martin; Machui, Oliver; Jimenez, Iván; Araújo, Bruno de; Jorge, Joaquim; Bodammer, Georg: IMPROVE: An Innovative Application for Collaborative Mobile Mixed Reality Design Review.

In: IJIDeM – International Journal on Interactive Design and Manufacturing 1 (2007), 2, pp. 115-126

Santos, Pedro; Stork, André; Linaza, María Teresa; Machui, Oliver; McIntyre, Don; Jorge, Elisabeth:

# CINeSPACE: Interactive Access to Cultural Heritage While On-The-Move.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4564, pp. 435-444 (Lecture Notes in Computer Science (LNCS)).

Schreck, Tobias; Tekusová, Tatiana; Kohlhammer, Jörn; Fellner, Dieter W.:

# Trajectory-Based Visual Analysis of Large Financial Time Series Data.

In: ACM SIGKDD Explorations Newsletter 9 (2007), 2, pp. 30-37

Schröder, Marc; Devillers, Laurence; Karpouzis, Kostas; Martin, Jean-Claude; Pelachaud, Catherine; Peter, Christian; Pirker, Hannes; Schuller, Björn; Tao, Jianhua; Wilson, Ian:

# What Should a Generic Emotion Markup Language Be Able to Represent?

In: Paiva, Ana M. (Ed.) et al.: Affective Computing and Intelligent Interaction. Second International Conference: ACII 2007. Berlin; Heidelberg: Springer, 2007, pp. 440-451 (Lecture Notes in Computer Science (LNCS) 4738).

Schultz, Randolf; Oertel, Karina; Peter, Christian; Wimmer, M.; Voskamp, Jörg; Urban, Bodo: Emotionale Aspekte in Produktevaluationen.

In: Institut für Multimediatechnik (IFM): Mensch – Maschine – Interaktion: 2. Kongress Multimediatechnik Wismar 2007. Boizenburg: Hülsbusch, 2007, S. 103-114

#### Schultz, Randolf; Peter, Christian; Blech, Michael; Voskamp, Jörg; Urban, Bodo: Towards Detecting Cognitive Load and Emotions in Usability Studies Using the RealEYES Framework.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4559, pp. 412-421 (Lecture Notes in Computer Science (LNCS)). Segura, Álvaro; Moreno, Aitor; Brunetti, Gino; Henn, Thomas:

#### Interaction and Ergonomics Issues in the Development of a Mixed Reality Construction Machinery Simulator for Safety Training.

In: HCI International 2007. Proceedings and Posters [DVD-ROM]: With 8 further Associated Conferences. Berlin, Heidelberg, New York: Springer Verlag, 2007, LNCS 4566, pp. 290-299 (Lecture Notes in Computer Science (LNCS)).

#### Selby, Peter; Sakas, Georgios; Walter, Stefan: 3D Alignment Correction for Proton Beam Treatment.

In: Deutsche Gesellschaft für Biomedizinische Technik im VDE (DGBMT): BMT 2007. Proceedings [CD-ROM]. 41. Jahrestagung der Deutschen Gesellschaft für Biomedizinische Technik (DGBMT) im VDE: Biomedizinische Technik – Biomedical Engineering, Vol. 52 (2007) Ergänzungsband. Berlin: de Gruyter, 2007, 2 p.

Selby, Peter; Sakas, Georgios; Walter, Stefan; Groch, W.-D.; Stilla, Uwe:

# Detection of Pose Changes for Spatial Objects from Projective Images.

In: Stilla, Uwe (Ed.) et al.; International Society for Photogrammetry and Remote Sensing (ISPRS) et al.: PIA07 – Photogrammetric Image Analysis: Part A, Papers Accepted on the Basis of Peer-Reviewed Full Manuscripts. München: Institute of Photogrammetry and Cartography, 2007, pp. 105-110 (The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences 36, Part 3/W49A).

Selby, Peter; Sakas, Georgios; Walter, Stefan; Groch, W.-D.; Stilla, U.:

# Pose Estimation of Eyes for Particle Beam Treatment of Tumors.

In: Horsch, Alexander (Ed.) et al.; Gesellschaft für Informatik (GI): Bildverarbeitung für die Medizin 2007: Algorithmen, Systeme, Anwendungen. Heidelberg: Springer, 2007, pp. 368-374 (Informatik aktuell).

Selby, Peter; Sakas, Georgios; Walter, Stefan; Stilla, Uwe:

# Geometry Calibration for X-Ray Equipment in Radiation Treatment Devices.

In: Tavares, João Manuel R.S. (Ed.) et al.: Computational Vision and Medical Image Processing: VipIMAGE 2007. London: Taylor & Francis, 2007, pp. 247-252

Settgast, Volker; Ullrich, Torsten; Fellner, Dieter W.:

Information Technology for Cultural Heritage. In: IEEE Potentials 26 (2007), 4, pp. 38-43

#### Stikic, Maja; Van Laerhoven, Kristof: Recording Housekeeping Activities with Situated Tags and Wrist-Worn Sensors: Experiment Setup and Issues Encountered. In: First International Workshop on Wireless Sensor Networks for Health Care: WSNHC 2007 [CD-ROM]. 2007, 6 p.

#### Stork, André; Danch, Daniel: Mobile Presence – a Computer Graphics

Ville: Eurographics, 2007, pp. 135-138

Utopia? In: Amicis, Raffaele de (Ed.) et al.; European Association for Computer Graphics (Eurographics) et al.: 5th Italian Chapter Conference: Euro-

graphics Italian Chapter Proceedings. Aire-la-

#### Svendsen, Nils Kalstad; Wolthusen, Stephen: Analysis and Statistical Properties of Critical Infrastructure Interdependency Multiflow Models.

In: Proceedings of the Eighth Annual IEEE Systems, Man and Cybernetics Information Assurance Workshop: IAW 2007. New York: IEEE Press, 2007, pp. 247-254

#### Svendsen, Nils Kalstad; Wolthusen, Stephen: Graph Models of Critical Infrastructure Interdependencies.

In: Bandara, Arosha K. (Ed.) et al.: Inter-Domain Management: First International Conference on Autonomous Infrastructure, Management and Security. Proceedings: AIMS 2007. Berlin, Heidelberg, New York: Springer Verlag, 2007, pp. 208-211 (Lecture Notes in Computer Science (LNCS) 4543).

#### Svendsen, Nils Kalstad; Wolthusen, Stephen: Multigraph Dependency Models for Heterogeneous Infrastructures.

In: Goetz, Eric (Ed.) et al.; International Federation for Information Processing (IFIP): Critical Infrastructure Protection. Berlin, Heidelberg, New York: Springer Verlag, 2007, pp. 337-350 (IFIP International Federation for Information Processing 253).

Svendsen, Nils Kalstad; Wolthusen, Stephen: Connectivity Models of Interdependency in Mixed-type Critical Infrastructure Networks. In: Information Security Technical Report 12 (2007), 1, pp. 44-55

#### Tekusová, Tatiana; Kohlhammer, Jörn: Applying Animation to the Visual Analysis of Financial Time-Dependent Data.

In: Banissi, Ebad (Ed.) et al.; IEEE Computer Society: 11th International Conference on Information Visualization. Proceedings: IV 2007. Los Alamitos, Calif.: IEEE Computer Society, 2007, pp. 101-108 Tischler, Martin A.; Peter, Christian; Wimmer, Matthias; Voskamp, Jörg:

#### Application of Emotion Recognition Methods in Automotive Research.

In: Reichardt, Dirk (Ed.) et al.: Proceedings of the 2nd Workshop Emotion and Computing – Current Research and Future Impact [Online]. [cited 27 February 2008] Available from: http://www.emotion-and-computing.de/emotion-and-computing-2007.pdf, 2007, pp. 55-60

#### Ullrich, Torsten; Fellner, Dieter W.: Robust Shape Fitting and Semantic Enrichment.

In: International Society for Photogrammetry and Remote Sensing (ISPRS): CIPA 2007: Heritage Documentation [online]. [cited 06 March 2008] Available from:

http://cipa.icomos.org/index.php?id=393#top, 2008, 6 p.

Ullrich, Torsten; Fellner, Dieter W.: Client-Side Scripting in Blended Learning Environments.

In: Ercim News (2007), 71, pp.43-44

Ullrich, Torsten; Fünfzig, Christoph; Fellner, Dieter W.:

Two Different Views on Collision Detection. In: IEEE Potentials 26 (2007), 1, pp. 26-30

#### Ullrich, Torsten; Settgast, Volker; Krispel, Ulrich; Fünfzig, Christoph; Fellner, Dieter W.: Distance Calculation between a Point and a Subdivision Surface.

In: Lensch, Hendrik P. A. (Ed.) et al.: Vision, Modeling, and Visualization 2007. Proceedings: VMV 2007. Saarbrücken: Max Planck Institut für Informatik, 2007, pp. 161-169

#### Wald, Diana; Wesarg, Stefan; Nowak, Stefanie: Quantifizierung und Visualisierung von Narbenbereichen des Myokards.

In: Horsch, Alexander (Ed.) et al.; Gesellschaft für Informatik (GI): Bildverarbeitung für die Medizin 2007: Algorithmen, Systeme, Anwendungen. Heidelberg: Springer, 2007, S.323-327 (Informatik aktuell).

Webel, Sabine; Becker, Mario; Stricker, Didier; Wuest, Harald:

# Identifying Differences Between CAD and Physical Mock-ups Using AR.

In: IEEE Computer Society et al.: ISMAR 2007: Proceedings of the Sixth IEEE and ACM International Symposium on Mixed and Augmented Reality. Los Alamitos, Calif.: IEEE Computer Society, 2007, pp. 281-282 Webel, Sabine; Bockholt, Ulrich: Immersive Annotation – Ein Annotationssystem für immersive Umgebungen.

In: Schenk, Michael (Ed.); Fraunhofer-Institut für Fabrikbetrieb und -automatisierung (IFF): 10. IFF-Wissenschaftstage 2007. Tagungsband [CD-ROM]: 15 Jahre Fraunhofer IFF. Magdeburg: Fraunhofer IFF, 2007, VR-Teil, S. 193-200

#### Wolthusen, Stephen:

# Defensive Information Warfare and the Protection of Critical Infrastructures.

In: Consiglio Nazionale delle Ricerche: XVI Amaldi Conference on Problems of Global Security. Proceedings 2004. Rom: Bardi Editore, 2007, pp. 93-106 (Atti dei convegni Lincei 167).

#### Wolthusen, Stephen:

# The Role of Mathematics in Information Security Education.

In: Futcher, Lynn (Ed.) et al.: Fifth World Conference on Information Security Education. Proceedings: WISE 2007. Berlin, Heidelberg, New York: Springer Verlag, 2007, pp. 129-136 (IFIP International Federation for Information Processing 237).

#### Wolthusen, Stephen:

#### Automated Extraction of Behavioural Profiles from Document Usage.

In: BT Technology Journal (2007), 1, pp. 192-200

#### Wolthusen, Stephen:

### Vertrauenswürdige Protokollierung: Protokollierung mittels nicht-deterministischer nebenläufiger wechselseitiger

Überwachung.

In: IT-Sicherheit & Datenschutz 31 (2007), 10, S. 740-743

#### Wu, Meng-Da; Wolthusen, Stephen: Network Forensics of SSL/TLS Encrypted Channels.

In: Remenyi, Dan (Ed.); Defence College of Management and Technology, UK et al.: ECIW 2007. The 6th European Conference on Information Warfare and Security. Reading, UK: Academic Conferences International, 2007, pp. 303-312

#### Wuest, Harald; Pagani, Alain; Stricker, Didier: Feature Management for Efficient Camera Tracking.

In: Yagi, Yasushi (Ed.) et al.: Computer Vision – ACCV 2007. Berlin; Heidelberg: Springer, 2007, LNCS 4843, pp. 769-778 (Lecture Notes in Computer Science (LNCS) 4843).

Wuest, Harald; Stricker, Didier: **Tracking of Industrial Objects by Using CAD Models.** In: Journal of Virtual Reality and Broadcasting 4 (2007), 1, 9 p. Wuest, Harald; Wientapper, Folker; Stricker, Didier:

# Adaptable Model-Based Tracking Using Analysis-by-Synthesis Techniques.

In: Kropatsch, Walter G. (Ed.) et al.: Computer Analysis of Images and Patterns. Proceedings: CAIP 2007. Berlin, Heidelberg, New York: Springer Verlag, 2007, pp. 20-27 (Lecture Notes in Computer Science (LNCS) 4673).

#### Zhou, Xuebing:

# Template Protection and its Implementation in 3D Face Recognition Systems.

In: Prabhakar, Salil (Ed.) et al.; The International Society for Optical Engineering (SPIE): Biometric Technology for Human Identification IV. Bellingham: SPIE Press, 2007, 8 p. (Proceedings of SPIE 6539).

#### Zlatanova, S.; Holweg, Daniel; Stratakis, M.: Framework for Multi-Risk Emergency Response.

In: Tao, Vincent C. (Ed.) et al.: Advances in Mobile Mapping Technology. London: Taylor & Francis, 2007, pp. 159-171

Zoellner, Michael; Stricker, Didier; Bleser, Gabriele; Pastarmov, Yulian:

### iTACITUS – Novel Interaction and Tracking Paradigms for Mobile AR.

In: Arnold, David (Ed.) et al.; The European Research Network of Excellence in Open Cultural Heritage (EPOCH): Vast2007 – Future Technologies to Empower Heritage Professionals: Short and Project Papers from VAST 2007. Budapest: Archaeolingua, 2007, pp. 110-117

## Graduations

The Interactive Graphics Systems Group (GRIS) of Technische Universität Darmstadt recorded six graduations in 2007.

Yuridia Oriana Gonzalez-Castillo Selected Quality Metrics for Digital Passport Photographs Supervisors: Prof. Dr.-Ing. J. L. Encarnação Prof. Dr-Ing. S. Wolthusen Graduation: TU Darmstadt, FB Informatik, FG

GRIS, Dezember 2007

#### Matthias Grimm

Kontextbezogenes mobiles Wissensmanagement auf Basis multimedialer Wissensinhalte

Supervisors: Prof. Dr.-Ing. J. L. Encarnação Prof. Dr.-tech. F. Lehner, Universität Passau Graduation: TU Darmstadt, FB Informatik, FG GRIS, Juli 2007

#### Michael Hellenschmidt

Software-Infrastruktur und Entwicklungsumgebung für selbstorganisierende multimediale Ensembles in Ambient-Intelligence-Umgebungen Supervisors:

Prof. Dr.-Ing. J. L. Encarnação

Prof. Dr.-rer. Nat. H. Dieter Rombach, Universität Kaiserslautern Graduation: TU Darmstadt, FB Informatik, FG GRIS, Juni 2007

#### Ido Iurgel

#### An Authoring Framework for Interactive Narrative with Virtual Characters Supervisors:

Prof. Dr.-Ing. J. L. Encarnação Prof. Dr.-Ing. M. Alexa, Technische Universität Berlin Prof. Dr.-Ing. A. Marcos, Univ. de Minho, Guimarães, Portugal

Graduation: TU Darmstadt, FB Informatik, FG GRIS, September 2007

#### Kai Richter

#### Methoden zur Unterstützung bei der Entwicklung plattformübergreifender Benutzerschnittstellen Supervisors:

Prof. Dr.-Ing. J. L. Encarnação

Prof. Dr. rer. nat. H. Wandke, Humboldt-Universität Berlin Graduation: TU Darmstadt, FB Informatik, FG GRIS, Mai 2007

#### Stefan Wesarg

#### Automatisierte Analyse und Visualisierung der Koronararterien und großen Kavitäten des Herzens für die klinische Anwendung Supervisors:

Prof. Dr. techn. Dieter W. Fellner

PD Dr. med. Evangelos Giannitsis, Universitätsklinikum Heidelberg

Graduation: TU Darmstadt, FB Informatik, FG GRIS, Oktober 2007



The staff members of Fraunhofer IGD were involved in series and monographs as editors and authors.

Amicis, Raffaele de (Ed.); Conti, Giuseppe (Ed.); European Association for Computer Graphics (Eurographics) et al.: **5th Italian Chapter Conference: Eurograph** 

ics Italian Chapter Proceedings. Aire-la-Ville: Eurographics, 2007 ISBN 978-3905673-62-3

Bullinger, Hans-Jörg (Ed.); Encarnação, José L. (Mitarb.); Unbescheiden, Matthias (Mitarb.); Nouak, Alexander (Mitarb.); Hahn, Volker (Mitarb.):

#### Technologieführer: Grundlagen – Anwendungen – Trends.

Berlin, Heidelberg, New York: Springer Verlag, 2007

ISBN 3-540-33788-1; ISBN 978-3-540-33788-1

Encarnação, José L. (Publisher); Fellner, Dieter W. (Publisher); Schaub, Jutta (Ed.); INI-GraphicsNet:

#### Selected Readings in Computer Graphics 2006. CD-ROM: Veröffentlichungen aus dem INI-GraphicsNet.

Darmstadt: INI-GraphicsNet Stiftung, 2007 (Selected Readings in Computer Graphics. CD-ROM 17)

ISBN 978-3-8167-7495-2; ISSN 1611-0234

Encarnação, José L. (Publisher); Fellner, Dieter W. (Publisher); Schaub, Jutta (Ed.); INI-GraphicsNet:

# Selected Readings in Computer Graphics 2006: Veröffentlichungen aus dem INI-GraphicsNet.

Stuttgart: Fraunhofer IRB Verlag, 2007 (Selected Readings in Computer Graphics 17) ISBN 978-3-8167-7494-5

Fellner, Dieter W. (Ed.); Hansmann, Werner (Ed.); Purgathofer, Werner (Ed.); Sillion, Francois (Ed.):

#### Eurographics Workshop and Symposia Proceedings Series.

Aire-la-Ville: Eurographics Association

#### Gitter, Rotraud (Ed.); Lotz, Volkmar (Ed.); Pinsdorf, Ulrich (Ed.); Roßnagel, Alexander (Ed.): Sicherheit und Rechtsverbindlichkeit mobiler Agenten.

Wiesbaden: Deutscher Universitäts-Verlag, 2007 (DUD-Fachbeiträge) ISBN 978-3-8244-2173-2 Reichl, Feh (Ed.); Fraunhofer-Institut für Graphische Datenverarbeitung IGD: houseart: Ausstellungen am Fraunhofer IGD 2006-2007.

Darmstadt, 2007

Schaub, Jutta (Red.); Fraunhofer-Institut für Graphische Datenverarbeitung IGD: Leistungen und Ergebnisse – Jahresbericht 2006: Fraunhofer-Institut für Graphische Datenverarbeitung IGD. Darmstadt, 2007 ISSN 1433-0733; ISSN 01433-0733

Schiele, Bernt (Ed.); Dey, Anind K. (Ed.); Gellersen, Hans (Ed.); Ruyter, Boris de (Ed.); Tscheligi, Manfred (Ed.); Wichert, Reiner (Ed.); Aarts, Emile (Ed.); Buchmann, Alejandro (Ed.): **Ambient Intelligence: Aml 2007**. Berlin, Heidelberg, New York: Springer Verlag, 2007 (Lecture Notes in Computer Science (LNCS) 4794) ISBN 978-3-540-76651-3

Schröder, Marc (Ed.); Zovato, Enrico (Ed.); Pirker, Hannes (Ed.); Peter, Christian (Ed.); Burkhardt, Felix (Ed.); Fraunhofer-Institut für Graphische Datenverarbeitung IGD, Institutsteil Rostock et al.:

W3C Emotion Incubator Group: W3C Incubator Group Report 10 July 2007 [online]. [cited 25 January 2008] Available from: http://www.w3.org/2005/incubator/emotion/XG R-emotion-20070710, 2007

Tritsch, Bernhard; Kohlhammer, Jörn: Cash Code: Mit kreativer Software zum kommerziellen Erfolg. München: Hanser, 2007 ISBN 3-446-40755-3; ISBN 978-3-446-40755-8

Bachelor, Master, Study, and Diploma Theses

In 2007, students prepared 55 students' theses at the Fraunhofer IGD for their respective curricula.

Arrieta Larrea, Aitor; Pinsdorf, Ulrich (Supervisor); Graf, Frank (Supervisor): Extending a Framework for Automated Discovery of Brand-Piracy on the Internet. Mondragon, 2007 Mondragon, Univ., Diplomarbeit, 2007 Becker, Sonja; Schmucker, Martin (Supervisor): Zweidimensionale Merkmale zur Identifikation von Musiknoten anhand des Notensatzes. Würzburg, 2007

Würzburg, Univ., Diplomarbeit, 2007

Berning, Lars; Tandler, Peter (Supervisor): A Tagging Based Tool for Clustering of Large Idea Collections in Computer Supported Facilitation. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Berthold, Peter; Peters, Jan (Supervisor): Validierung und Erweiterung des Sicherheitskonzepts einer auf Web Services basierenden Infrastruktur. Fulda, 2007 Fulda, Hochschule, Master Thesis, 2007

Böhne, Bert; Peter, Christian (Supervisor): Development of a Full-fledged USB-Interface for an Existing Microcontroller System. Enschede, 2007 Enschede, Saxion Hogescholen, Bachelor Thesis, 2007

Börner, Dirk; Ebert, Mirko (Supervisor): Integration von Spiel-basierten Lernprogrammen in SCORM-konformen Lernumgebungen unter besonderer Beachtung des Multi-User Aspektes. Dresden, 2007

Dresden, FH f. Technik u. Wirtschaft, Diplomarbeit, 2007

Bratke, Christoph; Urban, Bodo (Supervisor); Deistung, Eik (Supervisor): Kontextunterstützte Erzeugung von Inhalten für Multimedia-Anwendungen. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Buchien, Oliver; Urban, Bodo (Supervisor): **Moderne Methoden der Geländedarstellung im Cockpit.** Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007 Combé, Tobias; Ebinger, Peter (Supervisor): Signaturbasierte Erkennung von Angriffen in mobilen Ad-hoc-Netzen. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Dehghani, Siamak; Stork, André (Supervisor); Peña Serna, Sebastian (Supervisor): Interactive Mesh Modification Keeping Surface Quality. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007 Fröhlich, Marion; Diener, Holger (Supervisor): A Mobile Music Device for Runners. Bremen, 2007 Bremen, Hochschule für Künste, Master Thesis, 2007

Gabriel, Benjamin; Henn, Thomas: Optimierung visueller Simulationen zur Beschleunigung des Produktentwicklungsprozesses. Darmstadt, 2007 Darmstadt, Hochschule, Bachelor Thesis, 2007

Georgi, Matthias; Tekusová, Tatiana (Supervisor): Semantisch unterstützte interaktive Visualisierung von Finanzdaten. Darmstadt, 2007 Darmstadt, TU, Bachelor Thesis, 2007

Göhler, Stefan; Malo, Steffen (Supervisor); Diener, Holger (Supervisor): Lightweight Game Design. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Grether, Dominik; Haist, Jörg (Supervisor): Semantische Annotation und Deduktion in Geoinformationssystemen. Ulm, 2007 Ulm, Univ., Diplomarbeit, 2007

Haase, Sebastian; Urban, Bodo (Supervisor): Konzept und Prototyp zur Erzeugung von E-Learning-Inhalten aus technischen Dokumenten am Beispiel von S1000D. Wismar, 2007 Wismar, Hochschule, Diplomarbeit, 2007

Hartung, Daniel; Zhou, Xuebing (Supervisor): Template Protection for PCA-LDA-based 3D Face Recognition Systems. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Hein, Albert; Bieber, Gerald (Supervisor): Echtzeitfähige Merkmalsgewinnung von Beschleunigungswerten und Klassifikation von zyklischen Bewegungen. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Horn, Alexander; Aehnelt, Mario (Supervisor): Multimedia Projekt: Ähnlichkeitsbasierte Ordnung von Lernmodulen. Wismar, 2007 Wismar, Hochschule, Diplomarbeit, 2007

Itzel, Thorsten; Haist, Jörg (Supervisor): Geographische Composite Web Services in dreidimensionalen Geoinformationssystemen. Ulm, 2007 Ulm, Univ., Diplomarbeit, 2007 Ivanfi, Gabor; Ebert, Mirko (Supervisor): Messung der Qualität von E-Learning-Objekten mit Hilfe von Kennzahlen durch Quantifizierung von Eigenschaften des E-Learning-Objekts. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Jenei, Mathias; Diener, Holger (Supervisor); Urban, Bodo (Supervisor): Automatische Generierung von GUIs mittels XML-Beschreibungssprachen. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Kolba, Verena; Zoellner, Michael (Supervisor): Ein Augmented Reality Showcase für den Automobilbau. Koblenz, 2007 Koblenz/Landau, Univ., Diplomarbeit, 2007

Königschulte, Anke; Urban, Bodo (Referent): Konzeption einer Navigationsstruktur für die integrierte Entwicklungsumgebung für E-Learning-Angebote (IEDE). Bremerhaven, 2007 Bremerhaven, Hochschule, Diplomarbeit, 2007

Lehmann, Christoph; Urban, Bodo (Supervisor): JPIP-basierte Bildübertragung für mobile Umgebungen. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Lindhorst, Rene; Urban, Bodo (Supervisor): Sicherheit von drahtlosen Netzwerken. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Linneweber, Bastian; Fuhrmann, Arnulph (Supervisor): Gekoppelte Simulation von Kleidung und Deformationen am virtuellen Menschen. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Lücker, Jennifer; Blechschmied, Heiko (Supervisor):

Konzeption und Implementierung der Bereitstellung multimedialer Inhalte in Locationbased Services. Ulm, 2007 Ulm, Univ., Diplomarbeit, 2007

Lüder, Marian; Bieber, Gerald (Supervisor): Analyse des Luftdruckeinflusses bei der Aktivitätserkennung. Rostock, 2007 Rostock, Univ., Studienarbeit, 2007

Maus, Christian; Bleser, Gabriele (Supervisor): Markerlose Kameraverfolgung und Geometrierekonstruktion in Echtzeit unter Verwendung statistischer Verfahren. Darmstadt, 2007 Darmstadt, TU, Master Thesis, 2007 Mossel, Annette; Holweg, Daniel (Supervisor): Entwicklung einer adaptiven, LODgestützten Geländevisualisierung innerhalb eines Client-Server basierten 3D-Geoinformationssystems. Wiesbaden, 2007 Wiesbaden, FH, Diplomarbeit, 2007

Nickel, Claudia; Zhou, Xuebing (Supervisor); Schmucker, Martin (Supervisor): Authentifizierung von Bildern mit Fingerprinting-Verfahren. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Nieswandt, Erik; Bieber, Gerald (Supervisor): Entwicklung eines Prototyps für Internet-Datensynchronisation auf Basis eines Zonenmodells. Wismar, 2007 Wismar, Hochschule, Diplomarbeit, 2007

Ohl, Stephan; Blech, Michael (Supervisor): Klassifikation und Merkmalsselektion mikroskopischer Objekte. Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

Paschen, Alexander; Urban, Bodo; Ebert, Mirko: Entwicklung eines Konzepts zur Integration von Simulationen ins E-Learning. Rostock, 2007 Rostock, Univ., Studienarbeit, 2007

Pommer, Mira; Dold, Christian (Supervisor): Planung und Kontrolle von Operationen und Interventionen anhand der Computertomographie. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Recker, Ruth-Maria; Jung, Yvonne (Supervisor): Entwicklung eines GPU-basierten Volumenrenderers auf Basis eines Szenengraphsystems. Koblenz Landau, 2007

Ried, Malte; Cavet, René (Supervisor): Generative Programmierung für Datenbanken am Beispiel MediaSeeker. Gießen, 2007 Gießen-Friedberg, FH, Diplomarbeit, 2007

Rombach, Markus; Opel, Alexander (Supervisor): Realisierung und Erweiterung eines Peer-to-Peer Systems unter Verwendung eines Content Management Systems für den legalen Datenaustausch.

Furtwangen, 2007

Furtwangen, Hochschule, Diplomarbeit, 2007

Rosenbaum, Clemens; Schmucker, Martin (Supervisor):

Adaptive Perceptual Audio Hashing. Darmstadt, 2007 Darmstadt, TU, Bachelor Thesis, 2007

Schoger, Carsten; Knuth, Martin (Supervisor): Globale Beleuchtung interaktiver Szenen. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Darmstadt, 10, Dipiomarbeit, 2007

Schütz, André; Urban, Bodo (Supervisor): Betriebsklima in einer Forschungseinrichtung. Eine empirische Untersuchung am Beispiel eines Fraunhofer Instituts. Rostock, 2007 Rostock, Univ., Master Thesis, 2007

Schwarzkopf, Klaus; Santos, Pedro (Supervisor): Entwicklung und Evaluierung von Kalibrierverfahren für Infrarotkameras. Darmstadt, 2007 Darmstadt, Hochschule, Bachelor Thesis, 2007

Seemann, Jörg; Hambach, Sybille (Supervisor): E-Learning – Bildungskonzept zur binnendifferenzierten Förderung von Berufsschülern am Beispiel auszubildender Elektroniker der Fachrichtung Energie – und Gebäudetechnik des dritten Lehrjahres am Berufsschulzentrum Nord in Wismar. Rostock, 2007 Rostock, Univ., Master Thesis, 2007

Sommer, Martin; Ebinger, Peter (Supervisor): Auswertung von Positionsdaten, Funkcharakteristika und des Verbindungsgraphen für die Angriffserkennung in mobilen Ad-hoc-Netzen. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Stadtmüller, Bianca; Oertel, Karina (Supervisor); Peter, Christian (Supervisor): Kulturabhängige Unterschiede bei der Interaktion mit Social Software am Beispiel von Deutschland und Nigeria. Hildesheim, 2007 Hildesheim, Univ., Magisterarbeit, 2007

Stamenov, Simeon; Hellenschmidt, Michael (Supervisor): Simulation of Autonomous Self-organizing Transport Vehicles in the Logistics. Darmstadt, 2007 Darmstadt, TU, Bachelor Thesis, 2007

Stapf, Tobias; Steinbrecher, Tillmann (Supervisor):

Bearbeitung von dreidimensionalen Daten in der Zahnmedizin unter Berücksichtigung statischer Okklusion. Darmstadt, 2007 Darmstadt, Hochschule, Master Thesis, 2007 Terörde, Steffen; Hahn, Volker (Supervisor): Konzeption und Realisierung eines Kameraclusters zur Erzeugung von Videopanoramen.

Darmstadt, 2007 Darmstadt, Hochschule, Master Thesis, 2007

Timm, Marcus; Diener, Holger (Supervisor): Über Game Engines und praktische Schritte zur Umsetzung eines 3D-Computerspiels. Rostock, 2007 Rostock, Univ., Studienarbeit, 2007

Tinz, Jens; Fuhrmann, Arnulph (Supervisor); Knuth, Martin (Supervisor): GPU-basierte Bekleidungssimulation. Darmstadt, 2007 Darmstadt, TU, Diplomarbeit, 2007

Turba, Martin; Ackermann, Jochen (Supervisor): Konzepte zur Verbesserung der Netzwerksicherheit an Hochschulen. Darmstadt, 2007 Darmstadt, Hochschule, Bachelor Thesis, 2007

Ullrich, Martin; Zhou, Xuebing (Supervisor): Histogram-based 3D Face Recognition. Darmstadt, 2007 Darmstadt, Hochschule, Diplomarbeit, 2007

Zühlke, Thomas; Cap, Clemens (Supervisor); Urban, Bodo (Supervisor):

Annotation von Subelementen einer Webseite.

Rostock, 2007 Rostock, Univ., Diplomarbeit, 2007

#### Lectures

At conferences and other events in Germany and abroad, the staff members of the institute were sought-after as lecturers.

#### Mario Becker

An Architecture for Prototyping and Application Development of Visual Tracking Systems

International Conference on 3DTV (3DTV-CON) Kos, Greece, May 8, 2007

Johannes Behr Beyond the Web Browser – X3D and Immersive VR IEEE VR 2007 Charlotte NV, USA, Mar 10, 2007

Johannes Behr InstantReality: Middleware for VR/AR Application Siggraph 2007 / Web3d-tech-talk San Diego CA, USA, Aug 6, 2007

Johannes Behr InstantReality: Middleware for VR/AR Application DevDay Darmstadt, Germany, Aug 29, 2007

Heiko Blechschmied **Trends und Innovationen in der Visual isierung und Interaktion mobiler GIS- Anwendungen** Marcus Evans Berlin, Germany, Jan 30, 2007

Heiko Blechschmied EU-Projekt HUMBOLDT schafft Synergien zwischen GMES und INSPIRE – Datenharmonisierung, Interoperabilität und Sicherheit Intergraph-Forum 2007 Bad Kissingen, Germany, Jun 13, 2007

Gabriele Bleser Development of Visual Tracking Systems Winter Augmented Reality Meeting 2007 Graz, Austria, Feb 26, 2007

Markus Etz MOBILE CHASE – Towards a Framework for Location-Based Gaming GRAPP 2007, Second International Conference

on Computer Graphics Theory and Applications Barcelona, Spain, Mar 9, 2007 Markus Etz Mobile Chase – Das Mobilephone als spielerischer Zugang zu Kulturinformationen

MAI-Tagung – »museums and the internet« Karlsruhe, Germany, May 11, 2007

#### Markus Etz

NETConnect – Connecting Culture through new technology SCCH 2007: Scientific Computing and the Cultural Heritage Heidelberg, Germany, Nov 13, 2007

Dieter W. Fellner Use and Potential of Generative Models Industrial Challenges in Geometric Modelling, CAD and Simulation Darmstadt, Germany, Mar 22, 2007

Dieter W. Fellner Semantik-Nutzung im CG-Modell-Bereich K2-IKT Wien, Austria, Jun 13, 2007

Dieter W. Fellner Second Life Alpbacher Technologiegespräche Alpbach, Austria, Aug 24, 2007

Dieter W. Fellner Visualisierung SFB 627 Stuttgart, Germany, Oct 5, 2007

Dieter W. Fellner **3D Dokumente** Lions Club Darmstadt, Germany, Oct 8, 2007

Dieter W. Fellner Lust auf Informatik Fachschaft der TUD Darmstadt, Germany, Oct 9, 2007

Dieter W. Fellner **Produktionsumgebungen der Zukunft** Symp. Intelligente Produkte und Umgebungen Berlin, Germany, Oct 30, 2007

Dieter W. Fellner Exploiting semantics in/for 3D graphics Bangor Talk Bangor, United Kingdom, Nov 15, 2007

Arnulph Fuhrmann Interaktive Animation textiler Materialien Preisverleihung BMW Scientific Award 2007 Munich, Germany, Dec 6, 2007 Thomas Gierlinger »IMPROVE: Advanced Displays and Interaction Techniques for Collaborative Design Review.«, IMPROVE: Collaborative Design Review in Mobile Mixed Reality.«, »IMPROVE: Designing Effective Interaction for Virtual and Mixed Reality Environments.«, »CINeSPACE: HCI International 2007 Peking, China, 15.-20.7.2007

Daniel Holweg Integration von CAD- und GIS-Daten – Neue Datenbanklösungen 6. Internationales 3D-Forum Lindau, Germany, Mar 13, 2007

Daniel Holweg Mobile 3D-Viewer – Mobile Stadtinformationssysteme der nächsten Generation CeBIT Hannover, Germany, Mar 16, 2007

Yvonne Jung Enhancing X3D for Advanced MR Appliance sWeb3D 2007 Perugia, Italy, Apr 16, 2007

Yvonne Jung Exploration einer virtuellen Stratigraphie mit Hilfe von Verfahren des Interaktiven Designreviews GI Workshop VR/AR Weimar, Germany, Jul 15, 2007

Thomas Kamps Global Grid User Support: Building a Worldwide Distributed User Support Infrastructure German E-Science Conference 2007 Baden-Baden, Germany, May 4, 2007

Thomas Kamps Automatisierte Wissensnetze – Chancen für eine bessere Informationsbeschaffung Handelstag der Fachhochschule Worms Worms, Germany, May 4, 2007

Thomas Kamps Semantische Suche mit automatisierten Wissensnetzen – die Technik passt sich den Daten an? IIR-Knowledge to Process Offenbach, Germany, May 7, 2007

Thomas Kamps Semantische Integration und Suche mit automatisierten Wissensnetzen Enterprise Information, Management – Integration – Architecture Frankfurt/Main, Germany, Jun 27, 2007 Thomas Kamps Wissensmanagement im Entwicklungsbereich: Sicherung und Ausbau des firmeneigenden Know-hows Fränkisches Engineering-Forum Kunststoff Thurnau, Germany, Oct 11, 2007

Jörn Kohlhammer Graphisch-interaktives Arbeiten in mobilen Umgebungen CeBIT 2007 Hannover, Germany, Mar 15, 2007

Jörn Kohlhammer Graphisch-interaktives Arbeiten in mobilen Umgebungen CeBIT 2007 Hannover, Germany, Mar 16, 2007

Jörn Kohlhammer **Mobility at IGD – TRAVO** NOKIA Technologietag Munich, Germany, Jun 13, 2007

Jörn Kohlhammer Visual Analytics DayVis 2007 Heidelberg, Germany, Jun 27, 2007

Jörn Kohlhammer Visual Analytics & GeoVis Visualization Summit Zurich, Switzerland, Jul 2, 2007

Jörn Kohlhammer Visual Analytics für die Finanzindustrie Deutsche Bank Frankfurt/Main, Germany, Jul 11, 2007

Jörn Kohlhammer Semantics-based Approaches to the Visual Analysis of Consumer Data Unilever SPARK Workshop »Visual Analytics for Consumer Understanding«

Jörn Kohlhammer Visuelle Analyse und Entscheidungsunterstützung EpiGrid 2007

Bedford, United Kingdom, Sep 26, 2007

Hagen, Germany, Nov 6, 2007

Thorsten May Visualisierung für das Notfallmanagement INGEO Forum Darmstadt, Germany, Apr 28, 2007

Wolfgang Müller-Wittig Virtual and Augmented Worlds for Culture and Education State of Play Conference on Law and Virtual Worlds to examine »Building the Global Meta-

verse« Singapore, Singapore, Aug 20, 2007 Wolfgang Müller-Wittig Creating & Colonising Virtual Worlds – An Educational Perspective for the 21<sup>st</sup> Century Round-Table Discussion with Virtual World Experts Singapore, Singapore, Aug 20, 2007

Wolfgang Müller-Wittig CAMTech's experience in FP6 Seminar on EU's ICT 7th Framework Programme Singapore, Singapore, Nov 16, 2007

Wolfgang Müller-Wittig **Challenges for modern Scene Graph Systems** 5<sup>th</sup> Eurographics Italian Chapter Conference, Eurographics Association Trento, Italy, Dec 14, 2007

Sebastian Pena Serna Aspect Ratio- and Size-Controlled Patterned Triangulations of Parametric Surfaces 9<sup>th</sup> CGIM 2007 Innsbruck, Austria, Feb 15, 2007

Sebastian Pena Serna JT and IGD 9<sup>th</sup> JT User Group Meeting Manching, Germany, Mar 28, 2007

Sebastian Pena Serna CAD2Vis – Data Conversion Technology for CAD and Visualization INI-GraphicsNet – Technology Presentation Round Darmstadt, Germany, May 8, 2007

Sebastian Pena Serna FunctionalDMU: Requirements and Concept 10th JT User Group Meeting Cologne, Germany, Oct 24, 2007

Sebastian Pena Serna Combining Modeling, Simulation, Optimization and Analysis under a unique Framework ICIAM07 Zurich, Switzerland, Jul 16, 2008

Thorsten Reitz HUMBOLDT – A Framework for Data Harmonisation and Service Integration Earsel 2007 Bolzano, Italy, Jun 20, 2007

Thorsten Reitz Symbology Encoding for 3D GIS – An approach to extend 2D map portrayal standards to 3D urban model visualization UDMS 2007 Stuttgart, Germany, Oct 10, 2007 Thorsten Reitz CityServer3D and beyond: Development of Software Frameworks Supporting the Spatial Data Infrastructure SCORUS 2007 Darmstadt, Germany, Oct 18, 2007

Thorsten Reitz HUMBOLDT: Re-using ORCHESTRA service specifications OGC TC meeting Stresa, Italy, Dec 12, 2007

Georgios Sakas Medizinische Visualisierung »Medizin-Summit« FhG Frankfurt/Main, Germany, Feb 27, 2007

Georgios Sakas **Radio-Onkologie** Update on Radiooncology Heidelberg, Germany, Mar 23, 2007

Georgios Sakas Success factors for SMEs Globalisation forum Berlin, Germany, Apr 23, 2007

Georgios Sakas 2D-3D and 3D-3D Fusion Imaging (US & CT/MR): Interventional US Applied to Prostate Brachytherapy Congress – Gv. Gesellschaft für Ultraschall Athen, Greece, Jun 2, 2007

Georgios Sakas 2D-3D Fusion Imaging (US & CT/MR): Interventional US Applied to Liver RF Ablation Congress – Gv. Gesellschaft für Ultraschall Athen, Greece, Jun 2, 2007

Georgios Sakas Freehand 3D/4D Ultrasound: Extending Existing U/S Devices Congress – Gv. Gesellschaft für Ultraschall Athen, Greece, Jun 3, 2007

Georgios Sakas Summary of the Ultrasound market focusing on 3D/4D Ultrasound Congress – Gv. Gesellschaft für Ultraschall Athen, Greece, Jun 4, 2007

Georgios Sakas MiniPACS Implementation in Telemedicine Congress – Gv. Gesellschaft für Ultraschall Athen, Greece, Jun 4, 2007

Georgios Sakas **3D Alignment Correction for Proton Beam Treatment** BVM Aachen, Germany, Sep 28, 2007 Georgios Sakas Simulations- und Trainingsystem für die Bronchoskopie / Rhinoskopie durch klinische Datensätze BVM Aachen, Germany, Sep 28, 2007

Georgios Sakas Medical Imaging Mevis Bremen, Germany, Nov 21, 2007

Georgios Sakas Telemedicine J&J Präsentation FhG München, Germany, Dec 4, 2007

Pedro Santos Clean Sky JTI – Current State of Play IGLO Open about JTI Brussels, Belgium, Dec 4, 2007

Neyir Sevilmis Semantic based approach for concurrent engineering ProSTEP iViP Science Days Bremen, Germany, Sep 26, 2007

André Stork **Mobile Presence – a Computer Graphics Utopia** 5<sup>th</sup> Eurographics Italian Chapter Conference Trento, Italy, Feb 15, 2007

André Stork **Augmented Mixed Reality Solutions** BAUMA 2007 Munich, Germany, Apr 25, 2007

André Stork Semantics Modeling in Interaction and Visualisation 20 Jahre IGD Darmstadt, Germany, Aug 30, 2007

André Stork Introduction to Fraunhofer ICT Group and IGD Brasilien Workshop Fraunhofer – Senai Porto Alegre, Brazil, Oct 30, 2007

André Stork Introduction to JTI EcoDesign Fraunhofer IGD Kuratorium Darmstadt, Germany, Dec 7, 2007

André Stork Visualisierung von Produktionsprozessen EuroMold 2007 Frankfurt/Main, Germany, Dec 7, 2007

Didier Stricker What we did the last 5 years Media-Event FH Würzburg Würzburg, Germany, Jan 11, 2007 Didier Stricker From marker-based to marker-less tracking Colloquium Universität Tübingen Tübingen, Germany, Jan 12, 2007

Didier Stricker **Trends in Mixed Reality** Colloquium Universität Graz Graz, Austria, Mar 16, 2007

Didier Stricker 3D-Display Fraunhofer HHI: Tagung »3D Screen« Berlin, Germany, Aug 28, 2007

Mohammad-Reza Tazari PERSONA: Technological Goals, Approach, and Achievements Joint PERSONA/SOPRANO Workshop@AmI-07 Darmstadt, Germany, Nov 7, 2007

Sabine Webel Immersive Annotation – Ein Annotationssystem für immersive Umgebungen IFF-Wissenschaftstage Magdeburg, Germany, Jun 28, 2007

Sabine Webel Identifying differences between CAD and physical mock-ups ISMAR 07 Nara, Japan, Nov 14, 2007

Stefan Wesarg VR/AR zur Simulation, Planung und Unterstützung chirurgischer Eingriffe VIII. DGBMT/DVMT-Symposium zusammen mit der Fraunhofer-Gesellschaft als Vorsymposium der DGE-BV – Neue Technologien im Operationssaal der Zukunft München, Germany, Mar 21, 2007

Stefan Wesarg Medizinische Bildverarbeitung am Fraunhofer IGD PEXX e.V. (Physician Executives) – Meeting Berlin, Germany, Jun 22, 2007

Reiner Wichert Ambient Intelligence für Werkstücke und Güter Fraunhofer Symposium Intelligente Produkte und Umgebungen Berlin, Germany, Oct 30, 2007

Reiner Wichert Intellegentes Wohnen – nur eine Vision oder demnächst Wirklichkeit Imobilientag Thüringen: Zukunft des Wohnens Erfurt, Germany, Nov 7, 2007 Harald Wuest Adaptable Model-based Tracking Using Analysis-by-Synthesis Techniques GI Workshop VR/AR Vienna, Austria, Jul 15, 2007

Harald Wuest Feature Management for Efficient Camera Tracking 8th Asian Conference on Computer Vision Tokyo, Japan, Nov 21, 2007

Michael Zöllner **Physical Computing** FRITZING Workshop Potsdam, Germany, Sep 18, 2007

Michael Zöllner Information Design Games GAMEplaces Frankfurt/Main, Germany, Sep 19, 2007

Michael Zöllner **iTACITUS – Novel Interaction and Tracking Paradigms for Mobile AR** VAST 2007 Brighton, United Kingdom, Nov 29, 2007

#### Patents

In order to secure innovative developments, two patents were applied for in 2007.

Nazari Shirehjini, Ali Asghar Steuerung einer steuerbaren Einrichtung

Sakas, Georgios; Wesarg, Stefan; Schwald, Bernd Semitransparente Bildschirm für AR-Anwendungen Contact

# le offer several communication ch

We offer several communication channels if you wish to contact us and request further information about Fraunhofer IGD.

Our route descriptions for every location help facilitate you visiting us. You may look up your contact person in our directory. Or, you may search for additional information on the Internet at http://www.igd.fraunhofer.de.

And a second second

## How to Find us in Darmstadt

In Darmstadt, Fraunhofer IGD is located in the middle of the city. It can easily be reached by car, plane, train, and public transport.

## From the Freeway (A5, A67)

- Freeway intersection Darmstadt (Autobahnkreuz) — freeway exit »Darmstadt/Stadtmitte«
- Follow »Rheinstrasse« t hrough the city tunnel. At the end of the city tunnel, turn left and follow the »Cityring«.
- At the first large crossing, turn left onto »Kirchstrasse«.
- At the next large crossing, turn right into »Landgraf-Georg-Strasse«.
- The first side street on the left is »Fraunhoferstrasse«.
- The entrance to the institute is located on the right side.

## From the Airport (Frankfurt)

 The shuttle bus »Airliner« transfers passengers every half hour from Frankfurt airport (Terminal 1, bus Stop #14, or Terminal 2, Area D/E) to the main station in Darmstadt.

### From the Central Station

- Near the main entrance (east) of the central train station, you will find the central bus station (ZOB) with the following connections:
- Take Bus H (direction »Kesselhutweg«)
- Exit at »Alexanderstrasse/TU«.
- Going back along »Alexanderstrasse« a little.
- Turn left into »Erich-Ollenhauer-Promenade«, which will lead you straight to our main entrance.
- Or take Bus K (direction »TU/ Lichtwiese«) to »Luisenplatz«.

### From Luisenplatz on Foot

- Follow the pedestrian zone (Rheinstrasse).
- passing the castle.
- At the end of the pedestrian zone follow »Landgraf-Georg-Strasse«.
- The first side street on the left is »Fraunhoferstrasse«.
- The entrance to the institute is located on the right side.

Mannheim

### From Luisenplatz by Bus

- Take Bus L (direction »Ostbahnhof«) to »Jugendstilbad«.
- Follow »Landgraf-Georg-Strasse« back a little.
- The second side street on the right is »Fraunhoferstrasse«.
- The entrance to the institute is located on the right side.









### How to Find us in Rostock

In Rostock, Fraunhofer IGD is located in the »Südstadt« area. It can easily be reached by car, train, and public transport.

### From the Freeway (A19)

- Exit the E55 (A19) freeway at »Rostock-Ost« or »Rostock-Süd« and follow the signs to Zentrum/Hauptbahnhof (main station)«.
- At the main station, turn right and follow »Goethe-Strasse«.
- Turn left at the next crossing (Goethe-Platz) and follow the »Südring«.
- Turn right at the first crossing and follow »Erich-Schlesinger-Strasse«.
- At the first crossroads, turn left onto »Rudolf-Diesel-Strasse«.

- The »Rostocker Innovations und Gründerzentrum (RIGZ)« is located at the end of this street.
- Our institute is located at the rear of the RIGZ. Please follow the signs.

### From the Freeway (A20)

- Exit the E22 (A20) at »Rostock-Südstadt« and follow the signs to Niendorf.
- On the country road L132, follow the signs to Rostock.
- Follow the »Nobelstrasse« to the »Südring«.
- Turn right towards the center of Rostock (»Rostock-Zentrum«).
- Turn right at the first crossing and follow »Erich-Schlesinger-Strasse«.
- At the first crossroads, turn left into »Rudolf-Diesel-Strasse«.
- The »Rostocker Innovations- und Gründerzentrum (RIGZ)« is located at the end of this street.

 Our institute is located at the rear of the RIGZ. Please follow the signs.

### From the Main Station

- Take the #23 bus or tram 2, 5, or 6 (direction »Mensa« or »Südring«).
- Exit at »Erich-Schlesinger-Strasse« (2 stops).
- Follow »Erich-Schlesinger-Strasse«, and turn left at the first crossroads (»Rudolf-Diesel-Strasse«).
- The »Rostocker Innovations und Gründerzentrum (RIGZ)« is located at the end of this street.
- Our institute is located at the rear of the RIGZ. Please follow the signs.



# How to Find us in Singapore

The offices of the Centre for Advanced Media Technology (CAMTech) are located on the campus of the Nanyang Technical University (NTU), Jurong West. NTU is situated in the southwestern part, approximately 25 km from Singapore city center.

### By Bus

- Take Bus 179 or 199 at Boon Lay Bus Interchange.
- Exit at the 3rd bus stop from the NTU entrance.
- Walk briskly for 5 minutes through Canteen A and across Car park A (Keep to the right of Car park A).
- Take Lift NS1-1 to the 5th floor. Use the intercom to request entry to CAMTech.

# By Taxi

- The taxi fare from the airport is about 25-30 Singapore Dollars. The ride takes about 30 minutes.
- Ask the taxi driver to stop at the Administration Building. Walk towards Car park A (Keep to the left).
- Take Lift NS1-1 to 5th floor. Use the intercom to request entry to CAMTech.

## By Car

- Car owners, please park at Car park A.
- Take Lift NS1-1 to the 5th floor. Use the intercom to request entry to CAMTech

## How to Find us in Graz

The Fraunhofer IGD Project Office at the Technical University of Graz is located on the campus of the Technical University.

# From the airport Thalerhof Graz (GRZ):

- The fastest and most convenient way to reach us is by taxi.
- Public transportation:
- The bus stop is directly in front of the arrival area of the airport.
- Exit at stop »Jakominiplatz«.
- Change to tram line 6 in the direction of St. Peter.
- Exit at stop »Schulzentrum«.
- For further description, see »From Graz Central Station.«

## From the highway (A2):

- Exit Graz-Ost, Zentrum / Münzgrabenstrasse,
- Turn right at the exit into the Münzgrabenstrasse.
- Follow Münzgrabenstrasse.
- After 1 km turn right into Sandgasse, immediately after a service station.
- After a (first) speed barrier (about 300 m), turn right into the campus.
- Press the button at the barrier to register with the gate keeper and enter the campus.
- Turn left before the gray office building and follow the path to the parking area in front of the second building.

## From the highway (A9):

- Exit the highway A9 at junction Gratkorn-Süd to Graz Andritz onto parkway B67 and continue for about 4 km.
- Continue straight into Grabenstrasse, which becomes Parkring first and then Glacis Strasse.





Centre for Advanced
Media Technology

- Turn right into Wilhelm-Fischer-Allee.
- Go straight into Burgring and continue into Opernring.
- Before the opera house, turn left into Franz-Graf-Allee.
- Continue straight ahead into Mandellstrasse and into Petersgasse.
- After approximately 1.5 km, turn right into Sandgasse.
- After a (first) speed barrier (about 300 m) turn left onto the campus.
- To enter the campus, continue as above.

## From the highway (A9) via (A2):

- At junction Graz West, leave A9 and turn to A2 in the direction of Vienna/Wien.
- Exit A2 at Graz-Ost, Zentrum / Münzgrabenstrasse.
- For further description see »From the highway (A2)«.

## From Graz Central Station:

– Take tram line 6.

- Exit at stop »Schulzentrum«.
- On the opposite side of the bus station, turn into Inffeldgasse and continue on the right side of the street.
- After the »Studienzentrum« on the right side, follow the sign »Zu den Häusern Inffeldgasse 16-16c«.
- Continue for about 100 m to a 2story concrete building (building No. 16b).
- Pass building 16b to reach building 16c.



# Directory

We have listed the addresses of the most important contact persons of Fraunhofer IGD and its partners in the Fraunhofer-Gesellschaft.

Fraunhofer Institute for Computer Graphics Research IGD	Prof. Dr. techn. Dieter W. Fellner Director	+49 6151 155-100	institutsleitung@igd.fraunhofer.de
Fraunhoferstrasse 5 64283 Darmstadt	DrIng. Matthias Unbescheiden Deputy Director	+49 6151 155-155 m	atthias.unbescheiden@igd.fraunhofer.de
Phone: +49 6151 155-0	DrIng. Christoph Hornung 3D Knowledge Worlds and Semant	+49 6151 155-235 ics Visualization	christoph.hornung@igd.fraunhofer.de
www.igd.fraunhofer.de	Dr. rer. nat. Eva Klien Graphic Information Systems	+49 6151 155-412	eva.klien@igd.fraunhofer.de
	DrIng. Jörn Kohlhammer Real-time Solutions for Simulation a	+49 6151 155-646 and Visual Analytics	joern.kohlhammer@igd.fraunhofer.de
	Alexander Nouak Security Technology for Graphics ar	+49 6151 155-147 nd Communication System	alexander.nouak@igd.fraunhofer.de
	Prof. DrIng. Georgios Sakas Cognitive Computing and Medical	+49 6151 155-153 Imaging	georgios.sakas@igd.fraunhofer.de
	DrIng. André Stork Industrial Applications	+49 6151 155-469	andre.stork@igd.fraunhofer.de
	DrIng. Didier Stricker Virtual and Augmented Reality	+49 6151 155-188	didier.stricker@igd.fraunhofer.de
	DrIng. Reiner Wichert Interactive Multimedia Appliances	+49 6151 155-611	reiner.wichert@igd.fraunhofer.de
	Barbara Merten Secretary's Office	+49 6151 155-101	barbara.merten@igd.fraunhofer.de
	Monika Frank Administration	+49 6151 155-681	monika.frank@igd.fraunhofer.de
	Dr. Jutta Schaub Quality Management	+49 6151 155-580	jutta.schaub@igd.fraunhofer.de
	Ingrid Bechtold Library	+49 6151 155-219	ingrid.bechtold@igd.fraunhofer.de
	Wolfgang Puchtler Service Center	+49 6151 155-311	wolfgang.puchtler@igd.fraunhofer.de
Fraunhofer Institute for Computer Graphics Research IGD Branch Office Rostock Joachim-Jungius-Strasse 11 18059 Rostock	Prof. DrIng. Bodo Urban Local Director Interactive Document Engineering	+49 381 4024-110	bodo.urban@igd-r.fraunhofer.de
Phone: +49 381 4024-110 Fax: +49 381 4024-199	DrIng. Jörg Voskamp +49 381 4024-120 Human Centered Interaction & Technologies		joerg.voskamp@igd-r.fraunhofer.de
www.igd-r.fraunhofer.de			
Centre for Advanced Media Technology (CAMTech) Nanyang Technological University (NTU) Nanyang Avenue Singapore 639798	) Prof. DrIng. Wolfgang Müller-Witt Local Director	ig +65 6790 6988	mueller@camtech.ntu.edu.sg
Phone: +65 6790 6988 Fax: +65 6792 8123			
www.camtech.ntu.edu.sg			

Projektbüro@TU Graz Inffeldgasse 16c/II A-8010 Graz, Österreich	Dr. rer. nat. Eva Eggeling	+43 316 873-5417	eva.eggeling@fraunhofer.at
Phone: +43 316 873-5417 Fax +43 316 873-5402			
www.igd-g.fraunhofer.at			
konziel – Agency for Communication Fraunhoferstrasse 5 64283 Darmstadt	Bernad Lukacin +49 6151 155-146 bernad.lukacin@igd.fraunhofer.de Fraunhofer IGD Corporate Communication		
Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. Hansastrasse 72c 80686 München	Prof. DrIng. Hans-Jörg Bullinger President	+49 89 1205-0	info@fraunhofer.de
Phone +49 89 1205-0 Fax: +49 89 1205-7531			
www.fraunhofer.de			
Fraunhofer Information and Communication Technology Group ICT Friedrichstrasse 60 10117 Berlin	DiplInform. Boris Groth Business Manager	+49 30 7261566-0	boris.groth@iuk.fraunhofer.de
Phone: +49 30 7261566-0 Fax: +49 30 7261566-19			
www.iuk.fraunhofer.de			

### Imprint

#### Editor

Fraunhofer Institute for Computer Graphics Research IGD Prof. Dr. techn. Dieter W. Fellner

### **Editorial Office**

Dr. Jutta Schaub

# **Overall Production**

konziel – Agency for Communication Bernard Lukacin www.konziel.com

Achievements and Results, Annual Report All rights reserved. This article shall not be reprinted without the editor's prior consent.

## **Editorial Office**

Fraunhofer Institute for Computer Graphics Research IGD Fraunhoferstrasse 5 64283 Darmstadt Germany Phone: +49 6151 155-146 Fax: +49 6151 155-446 bernad.lukacin@igd.fraunhofer.de www.igd.fraunhofer.de/press\_media

© 2008 Fraunhofer Institute for Computer Graphics Research IGD, Darmstadt

## **Cover Illustration**

Selection from projects of Fraunhofer Institute for Computer Graphics Research IGD