5/2004 Vol. 16

COMPUTER GRAPHIK

topics

Reports on Computer Graphics

Virtual Peranakan Culture

King Sejong for your eyes

CAMTech/IGI ISSUE

COMPUTER GRAPHIK 5/2004, Vol. 16

topics

Reports of the INI-GraphicsNet

Technische Universität Darmstadt, Fachgebiet Graphisch-Interaktive Systeme (TUD-GRIS)
Technische Universität Darmstadt, Interactive Graphics Systems Group

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INI-GraphicsNet

Join the new technology

Computer Graphics is one of the key technologies of a modern information and knowledge society. The INI-GraphicsNet develops market-oriented, state of the art technology to foster and to support the innovation process of enterprises as well as the social development. Numerous businesses use our know-how to implement sustainable products and services. We achieve this with, for example:

- 3D Interaction and Visualization
- Agent Technologies
- Animation
- Augmented Reality
- Computer Supported Cooperative Work (CSCW)
- Database Services
- Geometric Modeling / CAD-Model
- Graphical Information Systems (GIS), Facility Management
- GUI / Interaction Technology
- Image Analysis, Image Quality
- Imaging
- Internet- & Intranet-Solutions
- IT-based Learning and Training
- Medical Data / Image Processing
- Mobile Computing Technology
- Modeling and 3D-Reconstruction
- Multimedia and Hypermedia
- Multimedia User Interfaces
- Perceptual Computing
- Product Data Management
- Rendering
- Scientific Visualization
- Secure Image Communication
- Semantic Modeling
- System Integration
- Telecommunications
- Ubiquitous Computing
- Usability and Utility Engineering Technologies & Methods
- Virtual Prototyping
- Virtual Reality

Our expertise allows us to work on a multitude of industry-related topics which include, amongst others:

- eApplications
- eServices
- eBusiness
- Medical Information Technology
- IT Security and IT for the security in our society
- Visualization and Interaction in traffic technology and traffic telematics
- Ambient Intelligence
- Games and Edutainment
- Usability and Utility Engineering
- Software for the product and production development

Computer Graphics

Computer graphics is the **technology with which pictures, in the broadest sense of the word (synthetic graphics as well as grayscale and color images), are captured or generated, presented, manipulated, digitally processed in the appropriate form for the respective application and merged with other, nongraphical application data.** Computer graphics also includes the computer-supported integration and manipulation of these pictures with other kinds of data, such as audio, speech and video **(to create multimedia systems)** as well as corresponding advanced **dialogue and interactive technologies**. Concepts which characterize the important topics of computer graphics are, to name a few, visualizing information, visual data mining, visual computing, Virtual Reality (VR), Augmented Reality (AR), interactive Internet services and secure image transmission and communication.

Contents

EDITORIAL

Dr-Ing. Wolfgang Müller-Wittig, Dr.-Ing. Luiz Santos

Welcome to the 5th issue of »computer graphic topics« in the year 2004. This issue will focus on activities of the Centre for Advanced Media Technology (CAMTech) in Singapore and Institute for Graphic Interfaces (IGI) in Seoul, South Korea.

Since the last CAMTech issue, CAMTech has experienced yet again another exciting year. Beginning of this year Dr. Wu Zhongke, research fellow, left CAMTech and joined a research lab of the School of Computer Engineering (SCE) at the Nanyang Technological University (NTU).

Furthermore, Dr. Wang Haibin, our long time colleague, joined the Hong Kong Polytechnic University end of this August. Ms Grace Yang, our CGMT assistant manager, moved on to face new challenges in Germany. CAMTech will miss them all very much and would like to thank them for their dedication and contribution.

On another note, we would like to extend a warm welcome to our new CGMT project officer, Ms Sim Feng. Ms Feng, a former NTU student, will strenghten our expertise in the area of 3D modelling. CGMT looks forward to working with her in the coming years.

In this issue, a selection of project achievements that cover some of CAMTech´s competencies are highlighted in the individual technical contributions within this publication.

The first article gives an overview about the status of our Digital Heritage Project »The Virtual Peranakan Culture«. The Peranakans play an integral part in the cultural history of Singapore and its region. The article focuses on the new developments of the interaction device Chinese Calligraphy Brush and the Virtual Tour guide.

Furthermore, CAMTech´s »Virtual Fish Tank« is introduced. The objective of this edutainment project is to simulate autonomous, life-like fish of different species in a realistic underwater environment. The user can freely explore the fish tank, obtain information about any fish and plant, feed the fish, see the world through the eyes of a fish, and play educative games. This real-time application is built with CAMTech's in-house visualization system which utilizes OpenSG.

Hence, a further article describes the currents status of the computer forensics project addressing the specific needs of law enforcement to make the most of new forms of electronic evidence.

CAMTech sees a huge potential in deploying its technologies for the creation of interactive and exciting learning environments. CAMTech meets this edutainment challenge. The next article addresses the various sectors of edutainment CAMTech is focusing on.

A very important issue is CAMTech´s strong link to students. Certainly, this includes the successful student exchange program between the Technische Universität Darmstadt and the Nanyang Technological University (NTU). Besides the supervision of undergraduate and graduate students, CAMTech is now also bringing Secondary School students in touch with latest technologies under the Gifted Education Programme organized by the Ministry of Education. Furthermore, CAMTech hosts the new NTU two-year part-time program leading to a Master of Science degree in Digital Media Technology. This article gives an overview about the current activities.

Finally, CAMTech is very delighted to announce its participation in the new European project ULTRA. Co-ordinated by Fraunhofer IGD, the objective of this project is to develop an »ultra portable« system by applying Augmented Reality techniques to handheld devices. The kick-off meeting recently took place in Darmstadt mid September.

The first article from IGI gives an account of a Joint Research Agreement sponsored by Korean public authorities, which has granted IGI new partnerships and lead to further orientations on new technological and application domains.

The second article describes an ongoing project realized in co-operation with the INI-GraphicsNet Foundation that has been commissioned by administrative agencies from Daejeon City, South Korea, with the goal to evaluate technologies from local small and medium venture companies. The third article describes a nearly concluded cooperation project with several partners from the INI-GraphicsNet in the application area of cultural-content information.

Since the signing of the Research Agreement on May 17 this year, several new Korean staff members, in addition to five new colleagues from the INI-GraphicsNet have joined our research team. This hiring process is still open and we expect to achieve the multinational, highly-qualified working group with competencies to produce first-class applied research results to the global market soon. In the same evolving pace, it is growing our infrastructure; and the new facilities in the Ewha Womans University Campus will soon be fully equipped due to the research activities.

In touch with the Peranakans in VR

Meehae Song, Thomas Elias, Feng Sim, Dr.-Ing. Wolfgang Müller-Wittig, Dr. Tony K. Y. Chan

German Abstract

In den letzten drei Jahren hat es sich CAMTech zur Aufgabe gemacht, die zunehmend verschwindende Kultur der Peranakans in Singapur zu erhalten und der Öffentlichkeit näher zu bringen. Dazu wurden historische Peranakan-Reihenhäuser detailgetreu modelliert, wobei jedes Haus thematische Räume mit prachtvollen Ausstellungsstücken aufweist. Das Eingabegerät selbst ist auch ein Kulturgegenstand. Benutzer können einen Kalligraphiepinsel benutzen, um in der virtuellen Welt zu navigieren und um mehr über die Exponate zu erfahren. Darüber hinaus steht ein Avatar zur Verfügung, der Besucher durch die Räume führt und weitere Informationen über einzigartige Exponate gibt.

Introduction

In the last three years, it has been one of CAMTech's goals to promote Singapore's unique heritage. Many different ethnic groups have been living together in Singapore and so over time, completely new cultures emerged. We have selected the Peranakans as the topic of our Digital Heritage project. The Peranakans evolved as a result of intermarriages between early Chinese settlers and the indigenous Malay women. Much of their culture is being destroyed due to urbanization and neglect. Many people in this region are more interested in technological progress than tradition. Here is a great potential for Virtual Reality (VR) as a new and interesting way of combining tradition with cutting edge technology. We are using VR technologies to preserve the culture and make it accessible to the public in a new and interesting way.

To bring the culture to life in VR, a realistic virtual environment with virtual counterparts of Peranakan heritage objects was created. Great importance was also attached to interaction methods. Users must be given the possibility to actively explore the culture and get in touch with it. We achieve this with a unique two-handed tangible user interface and a virtual tour guide.

Virtual Heritage Objects

The virtual environment is made up of a street with a row of terrace houses that are typical for the Peranakans. An example scene can be seen in figure 1. Each house can be entered and features rooms with furniture, porcelain, silverware and other culturally important items. Attention was paid to the interior decoration of each room.

The virtual counterparts of all Peranakan heritage objects must be as impressive and exciting as the real exhibits in museums and existing shophouses. Using commercial 3D software packages, they were therefore modelled with great attention to details with realistic textures. Information about the material culture was obtained by talking to experts, visiting museums, through specialized books, and through actual heritage site visits. In a second step, the polygon count of the models was optimized to make them suitable for real-time rendering with OpenSG.

Virtual Tour Guide

The virtual tour guide plays an important role in the overall interaction with the Digital Heritage application. He is of Chinese ethnicity and dressed in Peranakan clothing to fit the context. He can be called whenever the user

Figure 1:
Street with Peranakan terrace houses

Figure 2:
Interaction with context sensitive cursors, on-screen menus, and the virtual tour guide

wants to have background information on a previously selected exhibit. He presents information by speaking one or more texts that were pre-recorded for the respective exhibit. Another way of interacting with the tour guide is through following a guided tour. The tour guide will walk from room to room, stopping at interesting exhibits, and explaining them to the user. This is a passive interaction since the user follows the tour guide automatically without actual navigation.

The subdivision surface modelling technique was used to create the body of the tour guide. To add the ability of body movements, the body was mapped to a hierarchical skeleton with a pre-defined set of basic body movements especially for walking in different speeds, turning, sitting, and climbing stairs. These basic body movements will later be combined in real-time while the virtual tour guide follows a path through the Peranakan house.

In contrast to the body, the face was created using the nurbs modelling technique. Besides the basic face, the special facial expressions for each sound of speech were modelled. Morphing is used to combine the different facial expressions during speech generation.

Two-Handed User Interaction

A Digital Heritage application should be both pedagogical and entertaining. Users must be given the possibility to explore the rich content freely and thus being able to learn about the culture and exhibits of interest in an unimpeded way. Many interaction devices fulfil these requirements. However, we wanted an interaction device that fits the context of our application. This prompted us to develop a two-handed tangible interaction device that consists of a Chinese Calligraphy brush and a small writing board. An electromagnetic tracking system is used as the interface to the computer. Users can use the brush to either write simple Chinese characters on the board or point at the screen to move a cursor with which navigation and selection of exhibits and items of on-screen menus is possible.

We defined five simple Chinese characters. Each is simple to write and associated with a command such as going to the upper level of the house. Making users write Chinese characters gets them in touch with an important aspect of the culture. We utilize an online Chinese recognition method that detects the twelve strokes each Chinese character is composed of. The recognition method gets data while the user is writing such as the writing speed and pressure, the relative position on the board, and the timing. The individual strokes can be found during a segmentation process. Comparatively large breaks or variations in writing speed and pressure signalize the beginning of a new stroke. After the individual strokes have been found, their type and sequence is compared to information about known characters. We adjusted this general method to the five characters we use to maximize the success rate of the recognition.

Users can also point at the screen to move a context sensitive cursor. Moving the cursor to the left or right side of the screen rotates the user to the left or right respectively. Positioning the cursor at the top or bottom of the screen moves the user forward or backward. To guide the user in the navigation, the side parts of the screen are coloured differently. The cursor can also be used to make selections in on-screen menus. Since the Digital Heritage application can run in full stereoscopic 3D, the menus have to be part of the 3D scene and are therefore realized as a combination of textured planes. The interaction device also requires special selection methods for menu items. Each menu can have a set of activation areas. These areas can change their appearance whenever the cursor is above them. If the cursor has been there for a specified period of time, they pass a signal to the menu. Figure 2 shows the main on-screen menu on the bottom. The left side shows where the user is in the house. The right side shows the five characters, that users can writer on the board. The five characters are also examples for activation areas. They show the writing sequence whenever the cursor is above them.

Future Work

The virtual environment with terrace houses, thematic rooms and heritage objects have been completed and can be explored. The two-handed tangible interaction device including the Chinese character recognition methods, navigation, and on-screen menus have also been developed. In order to verify the positive feedback we got so far, we are going to carry out extensive user test studies and evaluate the usability and acceptance of the interaction and the entertainment and education value of our Digital Heritage application.

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The Virtual Fish Tank

Thomas Elias, Gerrit Voss, Jochen Quick, Chao Zhu, Meehae Song,
Feng Sim, Dr. Haibin Wang, Dr.-Ing. Wolfgang Müller-Wittig

Introduction

The Virtual Fish Tank is a real-time edutainment application that simulates autonomous, life-like fish of different species in a realistic underwater environment. Each fish perceives the world and reacts based on the objects in its field of view. The behavior of each fish is defined by a set of sub-behaviors like collision avoidance, hunting, and escaping. The reaction is a result of a combination of these sub-behaviors. Models of rocks, plants, and corals are used to create a realistic environment. Optical effects typical for water are also simulated like caustics that occur due to sunlight passing through waves. Interaction methods that let users participate turn the Virtual Fish Tank into a learning environment. Users can explore the fish tank freely, gather information about any fish and plant, feed fish, and play educative games.

Behavior

A simulation loop runs constantly in each fish. In this loop, the fish first perceives its environment, then decides on an appropriate reaction, and at the end moves to the desired direction. The perception is realized by a ray test with the environment. The ray originates in the center of the fish. All objects that make up the environment are organized in cells. Objects within cells are tested only when these cells are in the field of view of the fish. The field of view is defined by a viewing angle and distance.

The behavior of the fish is defined by a set of parameterized sub-behaviors such as avoiding obstacles and other fishes, flocking, escaping, eating, and hunting. Not only does each species have its own sub-behaviors, each individual fish can also have its own list of sub-behaviors. Each sub-behavior gets a list with the perceived objects and decides if it wants to contribute to the final behavior of the fish. If so, it is considered active, and the fish analyzes the perceived objects and calculates a new direction and velocity to swim to as a result. All results have to be combined to one final result. The simplest method is to weight all results with a factor that expresses the importance of the respective sub-behavior and merge them. Another method is to use rules that define the conditions under which certain

German Abstract

Das virtuelle Aquarium ist eine VR-Applikation, die lebensecht wirkende Fische in einer realistischen Unterwasserumgebung simuliert. Jeder Fisch nimmt seine Umwelt wahr und reagiert selbstständig entsprechend der Reize seiner Umgebung. Dazu werden Methoden der künstlichen Intelligenz verwendet, um ein Verhalten auf Basis von vordefinierten Einzelhandlungen zu bestimmen. Benutzer können mit den Fischen auf verschiedene Art und Weise interagieren. Fische lassen sich beispielsweise füttern oder müssen in Spielen gesucht werden.

Figure 1:
Information on the dive slate after a blue tang was selected

Figure 2:
Manta ray and barracudas in deeper water. Their fins are moved with a skin and bones system

sub-behaviors can be active. Yet another method is to use a state machine to find suitable sub-behaviors. Simple methods only work for fishes with a small sub-behavior set. Our current approach is a combination of a state machine and merging. The state machine defines the sub-behaviors that can be merged and weights for each sub-behavior.

After a new direction and velocity is found, the body of the fish is moved accordingly. The fish might decide on a new direction and velocity that vary drastically from the previous ones. For example, this happens in emergency situations when the fish has to escape suddenly. Therefore, the motion has to be smoothened and constrained so that the fish moves according to physical laws and does not turn too quickly.

Bigger fish like the manta ray and barracuda that can be seen in figure 2 are able to move their fins. Their 3D models have a skin and bones system. After the new position of the fish is calculated, the angles in the joints along the spine and in the fins are changed according to a travelling spine wave. The frequency of the wave depends on the velocity of the fish. When the fish turns to the side, the whole spine is also bent by adjusting all angles along it. This allows for a more natural body position.

Interaction

Interactivity plays an important part in any edutainment application. Users can stay in a passive role and observe the fish and their behavior. They can also move freely outside and inside the fish tank and look at any fish and object from any angle. While moving around, users have two options. They can either be invisible to the fish or become a perceivable part of the underwater environment. Being invisible has the advantage that fish won't be disturbed in their behavior and can be observed from close distance. When users can be seen by the fish, they are regarded as danger and the fish swim away as soon as the user comes too close. Users can also select any fish or object and information will appear on a dive slate. In figure 1 the dive slate shows information about blue tangs after one of them has been selected. The information can be presented in form of text and images and later also on video which can be adapted to the user's needs. Children, for example, get information that is less detailed, easier to understand, and more entertaining. The fish tank can be seen through the eyes of any fish whereby the field of view and viewing distance are simulated by changing the camera values. This is particularly interesting for fish that swim in schools since it can be seen how a fish tries to stay close to the others. Fish can also be fed. Fish that are hungry and like the food offered will swim to a virtual hand of the diver, eat some of the food, and swim away to a safe distance. Interactive games are also part of the Virtual Fish Tank. In one that is designed for children, fish of certain species have to be found in the fish tank. Clown fishes have to be found for example and the children have to know that they hide in anemones in order to find them. The children are encouraged to explore the fish tank and find out more by using the dive state. This gives them the information they need to get points in the game.

Future Work

After much work on the behavior of the fish, current work and work to be done in the near future targets the improvement of the underwater environment. This includes the typical light effects that can be observed underwater like caustics and shadows on all surfaces, beams of light, and particles in the water. The models of bigger plants will get a skin and bone system so that leaves can move and thus simulate the effects of underwater currents. Figure 2 shows the results of simple methods that have been used so far to achieve an underwater impression. Transparent textures with caustics patterns were placed on top of each other above the ground and moved periodically and blue transparent planes were placed in front of the camera to simulate the limited viewing distance underwater.

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Computer Forensics

Siddhartha Sanyal, Dr. Tony K. Y. Chan

German Abstract

Die Computer-Forensik ist ein Teilgebiet der Forensik, das sich seit 1989 mit dem Nachweis und der Ermittlung von Straftaten aus dem Bereich der Computerkriminalität beschäftigt. Computer und andere Technologien, wie mobile Telefone und PDAs, werden zunehmend zur Planung und Koordination von Verbrechen eingesetzt. Die Daten auf diesen Medien können wichtige Beweise enthalten, die zur Überführung und Aufklärung von Verbrechen führen können. Jedoch ist die Suche nach verdächtigen Daten ein mühsamer und zeitraubender Prozess und den Ermittlern fehlen oft die notwendigen Computerkenntnisse, um versteckte oder gelöschte Dateien zu finden. Ausgereifte Werkzeuge wie RACES (Rapid Automated Computer Examination System) machen das Durchsuchen erheblich einfacher und effektiver. RACES extrahiert automatisch alle Daten, die auf Partitionen und logischen Laufwerken liegen, auf einer hardwarenahen Ebene. Dadurch werden auch versteckte und teilweise gelöschte Daten gefunden. Sobald alle Daten vorliegen, bietet RACES ausgereifte Suchfunktionen, mit denen die Daten schnell nach Textmustern oder Bildern durchsucht werden können. Darüber hinaus zeigt RACES Informationen über den Datenträger, wie beispielsweise die Seriennummer, die zur Archivierung von Beweisen notwendig sind.

Computer Forensics started roughly in 1989. From the very start one of the principle challenges facing the science of computer forensics was the fact that the end users were not the best people in the knowledge of computer science. Usually the investigations are done by people who treat it as a mere software rather than try to understand the intricacies that are a part of almost every computer evidence unearthing process.

The crime scene is much more real-time than the investigation process. Usually the discovery of incriminating evidence and the subsequent conviction of an individual or an organization can take months, whereas the crime scene is literally evolving every second. One of the major concerns regarding this is the possible loss of critical information. Probably the biggest challenge in computer forensics is the wastage of time in sieving through redundant information. Days and weeks are spent to determine the deleted content of a hard drive. A simpler method would be probably to obtain the information by simply interrogating the suspect. Often suspects when confronted with a person, whom they perceive to be having superior knowledge, feel they have no way out and end up confessing their crimes.

A principle component of any computer forensics is the human expertise involved. Software can only extract information. To make sense of that information, decipher them and finally present them in a manner acceptable to a court of law, requires trained personnel who not only are experts in handling of the toolset, but also understand the way criminals think and work. Some time back computer forensics used to only refer to personal computers or notebooks. It now includes a wide range of gadgets such as PDAs, cell phones, USB flash cards and even fax machines. It's like a continuous cat-and-mouse game where the law enforcement officials are constantly trying to catch up with the rapid proliferation of technology.

RACES (Rapid Automated Computer Examination System) was undertaken with some principle goals in mind: development of a comprehensive software and hardware solution for the investigation of all computer-related crimes, provide support to the regional issues pertaining to Singapore and the South East Asian region, and most importantly to be able to have full control over the source code and other information that are regarded as proprietary for commercial solutions.

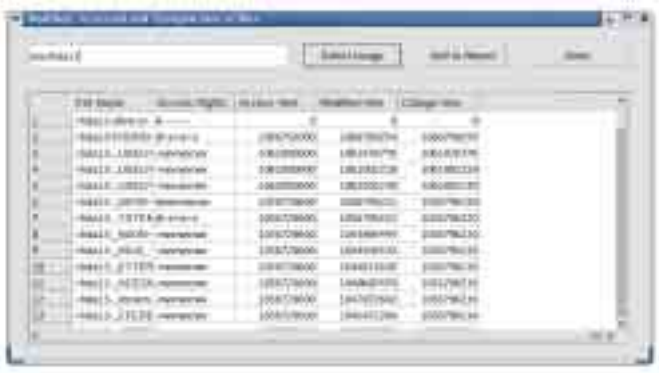

Figure 1:
Timelines for files

The aim was to provide system information and analyze ambient media, in an attempt to come up with a blue print of the activities on the computer system and their respective timelines. RACES provides for three options for acquisition of information: cloning a logical partition in a multi disk environment, cloning a logical partition in a single disk but multiple partitions environment and cloning an entire physical partition in a multiple logical partition environment.

In order to achieve the third objective the patching of the kernel with a loop back device was required. MD5 hash for integrity check is also provided and some other options, such as copying by the block number or the number of bytes are allowed. Though the software targets hard disk media, other forms of media can be also accommodated.

In legal cases there is always the need to archive a case for future references. The software system gives comprehensive image information for such purposes. The information provided includes the File System Type, the serial number of the media, cluster and sector size and various other attribute definitions. For good measure it also distributes the information under the broad categories of File System Information, Meta Data Information and Content Data Information. RACES will output the filenames and the line numbers or the actual lines that matched the regular expression. Multiple word searches and the use of words from past cases extracted from an expanding database are also incorporated.

RACES has nine different analysis functions:

- Image Meta Information: It gives general information about the system.
- String Search: It searches for a string pattern through the image and lists down the byte offset where the particular pattern occurs.
- Hex and ASCII display: This option displays the hex and ASCII contents of any particular block.
- MAC Times: It displays the time line activities of the different files.
- Display disk unit entries: It displays what is the content of a particular media unit.
- Picture files: This option sorts out the picture files and displays them.
- Sort Files: It sorts files according to categories.
- Slack Space Contents: This function shows information present, if any, within the slack space.

The trials conducted with RACES show an average cloning time of less than ten minutes for a 10GB media with a Pentium 4 system and 1 GB of RAM. However it has been also noted that the cloning speed is not strictly linear.

The insurance industry loses millions each year through fraudulent claims. Employee fraud and computer misuse is increasingly becoming a major problem for the industry. Hence computer forensics can be used to conduct internal investigations within the company. Terrorist activities involve the usage of computers for planning, co-ordination and transaction of money. The next decade stands to see an explosion of such situations which require the investigation of electronic systems.

In the court the judge is not a computer expert, but rather a legal expert. He will ascertain guilt depending on the merit of the case, and whether any laws were violated. So however sophisticated a forensics toolkit is, it calls for effective training of the personal extracting and analyzing the information and preparing the case. Hence the information has to be admissive, authentic, accurate and complete. Computer forensics as a science will have to always live up to these challenges.

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Edutainment in Singapore

Dr.-Ing. Wolfgang Müller-Wittig, Richard Leow, Yong Chee Loong

New technologies in computer graphics make the creation of realistic interactive virtual learning environments possible, enabling us to enjoy a whole ambience of new experiences. The effectiveness of education through such virtual means is well captured in this Chinese proverb:

I hear → I forget
I see → I remember
I experience → I understand

With highly interactive real-time systems, users are submerged in simulated real worlds, where they can visualize complex data and processes in a realistic sensory environment.

CAMTech meets this edutainment challenge. It supports and enhances the learning process by immersing users in fascinating worlds, that are entertaining enjoyably, and most importantly, educationally.

There are many other instances where new learning environments are able to provide a memorable learning experience. The creative possibilities for virtual worlds are as unlimited as one's imagination. The key advantages of edutainment in virtual worlds are that complex scientific information can be easily communicated through different visualization processes and the ability to experiment with intuitive interaction. These exciting new possibilities allow the user to »experience« the information. There are many examples that show how contents about culture, history, space, biology or any other topic can be successfully transferred through attractive exhibits using highly interactive virtual worlds.

CAMTech regularly carries out research and development activities in this field of edutainment, for example the virtual planetarium, geographical information system and molecular cell structure. For the pre-

German Abstract

CAMTech entwickelt derzeit verschiedene Szenarien, um interessante Phänomene aus den Bereichen Wissenschaft und Kultur anschaulich zu vermitteln. Eine immersive Darstellung und intuitive Interaktion mit den Lehrinhalten generiert eine vollkommen neue Lernumgebung. Für die Echtzeitvisualisierung dieser komplexen Szenen setzt CAMTech das auf Szenengraphik basierende Rendering System OpenSG ein.

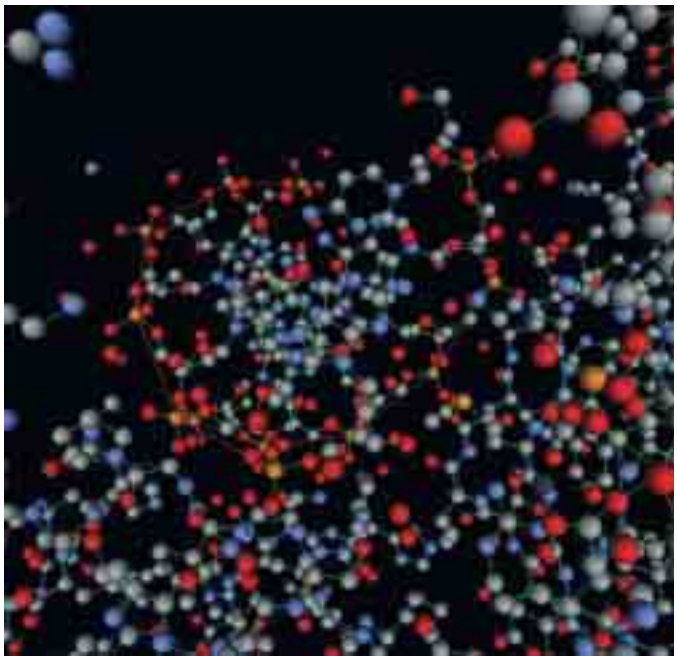

Figure 1: Explore and interact with complex 3D molecular structures

Figure 2:
Be a hitchhiker to the virtual galaxy

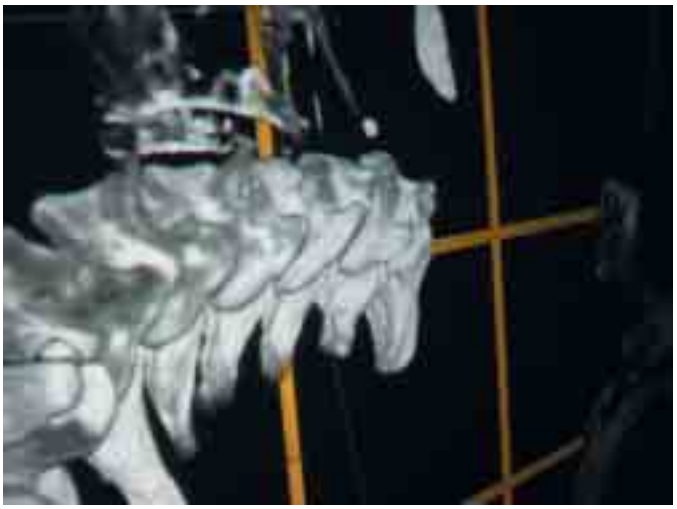

Figure 3:
New learning environments for medicine

sentation of these virtual scenarios CAMTech is using the scene-graph based rendering system OpenSG (www.opensg.org).

The edutainment market is not new for Singapore; it has been here for sometime and it will continue to grow in an exponential manner. In Singapore, though the opportunities are great and the potential is vast, it is not yet very much developed compared to the foreign counterparts such as Japan and America. Even regionally, countries such as Thailand and Malaysia are catching up fast with the edutainment industry. Currently, CAMTech focuses on various sectors of edutainment that possess great potential in the future.

Children Education

The newest form of children's leisure center that has evolved has a primary emphasis on hands-on discovery learning through free spontaneous play, but one that can also incorporate some elements of pure entertainment. Most adults don't fully understand and appreciate the value of spontaneous play to the social, physical, mental and emotional development of their children. There is little doubt that children's edutainment centers are at the beginning of a significant growth curve in Singapore.

Arts and Culture

The trends of globalization, technology and demographic changes are expected to have profound effect on urban development. The challenge for Singapore is to modernize yet retain elements of its original cultural identity so that its future generation will have a sense of place, history and belonging. It is a continuing challenge to maintain this delicate balance.

Thus to be able to enable such appreciation of the rich cultural heritage that makes Singapore Singapore, edutainment is a possibility to arouse interest.

Tourism

The Singapore Tourism Board has always harvested the power of technology to improve the attractiveness and entertainment level of the different places of attraction. Such places include Sentosa, Singapore Discovery Centre, Downtown East etc. Both the government and private companies are involved in building an infrastructure to strengthen Singapore's position as a regional tourism hub and the gateway to Asia. Further effort will be put into theme parks, indoor family entertainment centers and »edutainment« centers.

Given that, CAMTech is currently in contact with Singapore Science Centre, National Heritage Board, and Singapore Tourism Board to further discuss the implementation of such virtual scenarios for their exhibitions.

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Students at CAMTech

Dr.-Ing. Wolfgang Müller-Wittig

Prof. Dr. Tony Chan and Prof. Dr.-Ing. Wolfgang Müller-Wittig are involved in regular teaching activities at the School of Computer Engineering of the Nanyang Technological University which includes supervising undergraduate and graduate research work projects. Currently, CAMTech is hosting about 25 students.

Furthermore, the Centre for Advanced Media Technology facilitates the exchange of students between Germany and Singapore. Each year CAMTech hosts about five students from Germany to carry out their Diploma thesis (equivalent to a Masters thesis), study thesis or internship during their six-month stay in Singapore. The students worked on the following projects:

Virtual and Augmented Environments for Edutainment

André Schröder worked on CAMTech´s project Virtual Fish Tank. The Virtual Fish Tank allows the user to get first hand diving experience without getting wet. The virtual divers can truly immerse themselves in their underwater experience and explore the natural habitat of the creatures at their finger tips. In particular, André Schröder was involved in the development and enhancement of the behavior engine of the system by specifying and implementing some new behaviors of the fishes.

Furthermore, André Schröder developed a game using Augmented Reality technology. The game requires a player to navigate through a 3D environment to discover items along the way. Similar to a memory game, items of the same colour need to be discovered in a series. Obstacles such as small devil heads poses more challenge to the player and make it more exciting since the player needs to avoid them during game play. The interface works by capturing the player's hand that holds a special marker. On the video display, the player will see him/herself holding the 3D game in his/her hands. The ball moves as the player moves the marker.

German Abstract

INI-GraphicsNet unterstützt den Austausch von Studenten. Der Studentenaustausch zwischen CAMTech in Singapur und dem Fraunhofer IGD in Darmstadt wurde bereits 1998 initiiert. Jedes Jahr ermöglicht CAMTech fünf deutschen Studenten, ihre Diplomarbeit während eines sechsmonatigen Aufenthalts in Singapore anzufertigen. Darüber hinaus entsendet CAMTech inzwischen PhD-Studenten der Nanyang Technological University (NTU) nach Darmstadt, damit sie ihre wissenschaftliche Arbeit während eines mehrmonatigen Aufenthalts im Fraunhofer IGD vorantreiben.

Figure 1:
Exchange Students (from left to right): Michael Knopke, Daniel Kondermann, Claudia Nieuwenhuis, André Schröder

Figure 2: Augmented Reality ball game

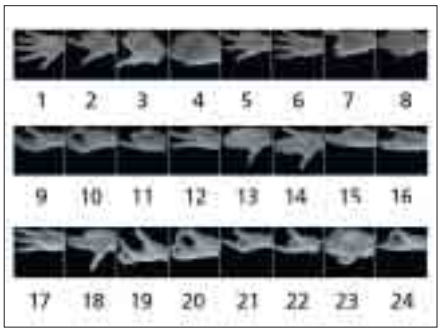

Figure 3: Set of hand postures and recognition

Real-Time Hand Posture Recognition

Today, the computer has become an integral part of our daily lives and human-computer interaction has gained great importance during recent years. Still, interaction with a computer is far from being as natural as interaction with another human being.

This research project conducted by Claudia Nieuwenhuis aims at developing an application which makes communication between humans and computers as natural as possible. Instead of common input devices like the mouse or the keyboard, hand posture recognition is used to deliver commands. To avoid data gloves and large signs and to make the interface as small and natural as possible, only a small marker that can be worn around the wrist, like a bracelet, is used. The application is able to recognize any given set of up to 24 hand postures with 98 percent reliability with real-time processing.

Real-Time 3D Marker Tracking Using Particle Filtering and Color Segmentation

The most common approach in tracking the location of an object is to use artificial markers that can be easily recognized by the software using only a single video camera. The aim of Daniel Kondermann´s project was to create a sophisticated marker tracker with scalable accuracy that performs well even in challenging light setups, highly cluttered scenes and with partial occlusions of the marker to be tracked. Therefore color image segmentation and Particle Filtering (also known as Bayesian Estimation) with a new kind of dynamic model was used and several methods of image segmentation and different Particle Filtering methods were implemented.

Virtual Zoo

The objective of Michael Knopke´s work was to develop and realize a concept to easily create a library of different motions for the project »Virtual Zoo«. Therefore, a big variety of animals have to be created and animated. Basic motion sequences like walking, eating, jumping or hunting that can be blended are needed. Furthermore, character animation is divided in mainly four parts: Modelling, creating a rig (skeleton), animating the rig, and combining the

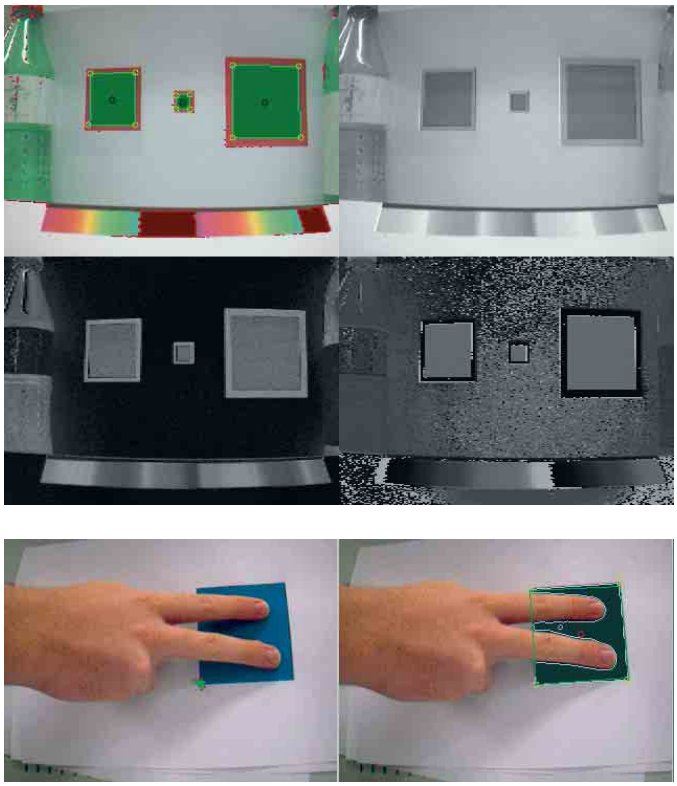

Figure 4:
Image segmentation and tracking of partially occluded marker

model and the rig (skinning). To create a natural walkcycle of quadruped animals, one must have a sophisticated IK-system (IK = Inverse Kinematics) and settings for changing the phase of each leg. Every animal has a different way of bending its legs, depending on the anatomy. During this project, realistic looking walkcycles were generated. Hence, editing motion graphs was the primary way to the define the behavior for each bone. By linking the walk cycle to a path the model is able to walk or run uphill and downhill without losing ground contact or sliding its feet. Finally, the model including its animation was transferred to the real-time visualization system.

Meanwhile, CAMTech launched a specific exchange model for PhD students of the Nanyang Technological University. NTU student Gong Ruibin conducted his research work under the supervision of Professor José L. Encarnação and his research team from May to July of this year. Ms. Zheng Zhi was just sent to Darmstadt in August to further work on her PhD topic in the field of multi-user shared virtual environments.

Furthermore, CAMTech has been selected by the ministry of education to mentor two projects for the Gifted Education Programme (GEP). The aim of the GEP Kool Kids Programme is to provide more computer literate S2 and S3 pupils with a conducive, open and stimulating environment in which to explore computer technologies. Participants will have access to state-of-the-art hardware and software, instructors and specialists in the various areas of computer science. The two schools CAMTech is mentoring are Anglo-Chinese School and Victoria School. Meehae Song and Prof. Dr.-Ing. Wolfgang Müller-Wittig are supervising five students who are working on the project »Singapore Holo Deck«

Finally, CAMTech hosts the new two-year part-time program, leading to a Master of Science degree in Digital Media Technology. This program was launched for the first time this academic year 2004/2005. Core modules focus on the basic areas of computer graphics, multimedia, Virtual Reality and animation. Furthermore, this program is linked to the ICPNM (International Certificate Programme for New Media). Part of the course requirements for the M.Sc. (Digital Media Technology) may be fulfilled by completing the ICPNM.

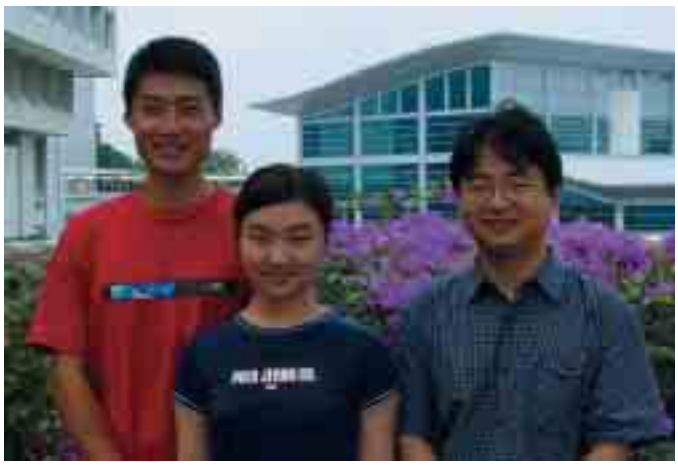

Figure 5:
PhD Students at CAMTech (from left to right): Gong Ruibin, Zheng Zhi, and Zhu Huabing

Figure 6:
Secondary School Students from GEP Kool Kids Programme

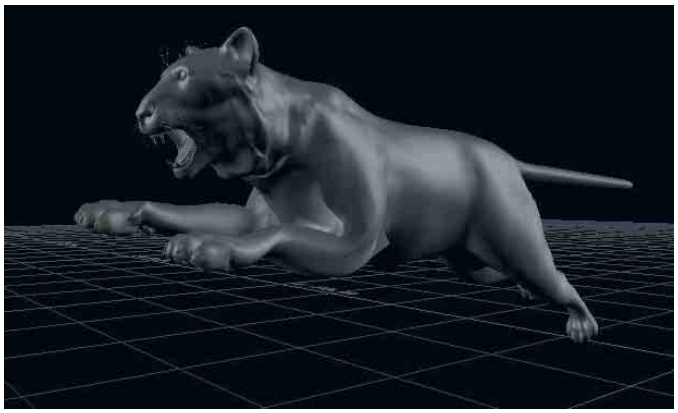

Figure 7:
Animated tiger

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Ultra-portable Augmented Reality for industrial maintenance applications

Dr.-Ing. Didier Stricker, Dr.-Ing. Wolfgang Müller-Wittig

German Abstract

Erweiterte Realität (Augmented Reality) ist eine ideale Technologie für industrielle Service- und Wartungsanwendungen. Computererzeugte Informationen werden mit der Ansicht des Technikers gemischt, so dass der Anschein entsteht, sie würden die realen Szenen überlappen. So demonstrieren sie dem Techniker schrittweise komplizierte Reparationsaufgaben. Dennoch erfordern vorhandene Lösungen umfangreiche Hardware, die in ihrer Brauchbarkeit eng begrenzt sind. Die Zielsetzung dieses Projektes ist es, ein »ultra-portables« System zu entwickeln, das Augmented Reality-Techniken auf tragbaren PCs anwendet. Dieses bietet eine bequeme und unauffällige Lösung und integriert Augmented-Reality-Funktionen mit einem »Near-the-Eye-Display«, drahtlosen Anschlüssen und Remote-Unterstützung über Mobiltelefone. Das Projekt beruht auf am Markt erhältlichen mobilen Endgeräten, so dass keine kostspielige Vorrichtung extra entwickelt werden musste. Die Herausforderung besteht im Entwickeln eines leistungsstarken Systems, das in Echtzeit alle Augmented-Reality-Funktionen auf einer kleinen Vorrichtung mit stark begrenzter Kapazität bereit stellt. Gleichzeitig muss der Techniker über alle notwendigen Werkzeuge für Generierung und Management des Inhalts verfügen. Das Resultat des Projektes ist ein ultra-leichtes und kompaktes System mit passender Software für das Schreiben und Editieren von Workflows, für Kontextmanagement, Tele-Beratung und Augmented Reality. Es ermöglicht eine leistungsfähige Produktion von elektronischen Handbüchern und die Vor-Ort-Unterstützung der Außendienst-Mitarbeiter.

ULTRA

Augmented Reality is an ideal technology for industrial service and maintenance applications. Computer-generated information is blended into the field of view of the technician so that they appear overlaid on the real scene and demonstrate step-by-step the complex reparation tasks.

Nevertheless, existing solutions require bulky hardware thus severely limiting their usability.

The objective of the new European project ULTRA is to develop an »ultra portable« system by applying Augmented Reality techniques to Pocket-PCs. This will offer a comfortable and unobtrusive solution, integrating Augmented Reality functionalities with near-the-eye display, wireless connection, and remote support over an integrated mobile phone. The development does not suffer from the development of a specific hardware, but relies on the solid market of mobile handheld devices. The challenge consists in developing a high-performance run-time system, including all the excepted Augmented Reality functionalities on a small device with very limited capacity, and at the same time, in providing all the necessary tools for content creation and management.

The result of the project will be an ultra-light and compact system with appropriate software for authoring, workflow editor/engine, context management, remote communication, and Augmented Reality. It will enable an efficient production of electronic Augmented Reality manuals, thanks to the authoring system and the workflow editor, and on-site support for mobile workers. The required information will be presented in a small monocular eye display as text, animation, and 3D graphics correctly registered onto the images of the real scene, which will be taken by the user when required. The interactions will be achieved via pen on the display of the handheld device, for example for the compilation of

Figure 1:
Augmented Reality manual for service task with a wearable computer

Figure 2:
ULTRA equipments, handheld PC and near the eye display

notes, or will be hands-free and occur via speech recognition during the execution of the maintenance tasks themselves.

As the system will not require expensive hardware and will be very easy to wear, it will be suitable for many applications including:

– maintenance and support of complex machinery
– construction and production
– edutainment and cultural heritage

ULTRA will play a significant role in pushing the current limit of the existing mobile Augmented Reality technologies and will allow for the real implementation of advanced and novel applications in the area of maintenance and service. It will build upon the current state-of-the-art of mobile systems for workers, to develop a usable method that offers all the functionalities of an AR system on a small hardware. It bases on the new principle of »on-demand« Augmented Reality, which consists in taking a single image of the real scene when needed and superposing the real-time virtual animations correctly onto this overlaid single image.

The most widely used maintenance information medium today is still the traditional manual, available as printed book or sometimes as hyperlinked electronic documents visualized on PCs. Both solutions require a lot of user interaction and good a-priori knowledge of the document, in order to rapidly find the right information. Moreover, book-like solutions are not context related and do not offer the possibility to see the real scene and the manual instructions at the same time. It results in a significant waste of time and lack of efficiency, which will have dramatic consequences in a near future, since machines become continuously more complex, exist in a lot of variations, and finally have a shorter life cycle.

In order to ensure the development of the new ULTRA system on the one hand, and on the other hand to ensure its introduction into industrial environments, end users have been involved and will influence in a very early stage the system design. After the definition of trials and the collection of all the available data, appropriate solutions will be defined and the system will be designed. The project is therefore divided into the following four major areas:

Authoring tool: The authoring tool will combine a process flow editor with a 3D Virtual Reality editor for the design of the animated maintenance instructions. The focus will be put on the optimization of the user interactions in order to be able to create complex 3D dynamic scenes in a very short time. We rely here on international standard so that existing information can be easily imported and exported.

Run-time system: The run-time system consists in a 3D graphic engine for PocketPCs. It will be based on the new standard OpenGL for Embedded System and will rely on the rendering API OpenSG (see www.opensg.org). It will enable real-time 3D graphics rendering on handheld devices. The system will be cross platform and support the three major operating systems – Windows Mobile, Linux and Symbian.

Near-the-Eye Display Unit: The display unit will be a monocular display placed near the eye. The unit will also include an earphone, a microphone as well as a camera. An important issue is the ergonomic and the comfort of the system. Further issues concern the battery management and its suitability to industrial environment.

User evaluation and trials: The system will be evaluated on base of extensive trials. Real scenarios have been defined and will be implemented during the project. They will consist in maintenance work of machineries as well as command board. These products have become very complex in the last years, so that new forms of support fulfill a real need.

ULTRA is a Specific Targeted Research Project selected under Call 2 of the European FP6 (6th EU Framework Programme for Research, Technological Development and Demonstration) of the Information Society Technologies R&D Programme (IST). The project has been launched on September 16 to 17, 2004 in Darmstadt, Germany. The first evaluation prototype will be already available in March, 2005.

The ULTRA consortium consists of Fraunhofer IGD and the partners Trivisio GmbH, Germany, INTRACOM, Greece, METICUBE, Portugal, and CAMTech, Singapore.

Further information on the project can be found at the following URL: www.ist-ultra.org

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New R&D in Korea

Dr.-Ing. Luiz Santos

German Abstract

Nachdem das Fraunhofer IGD, das koreanische Ministerium für Information und Kommunikation, das koreanische Institute of Information Technology Assesment (IITA) als Projektträger sowie die beiden Gründungsmitglieder EWHA Womans University und die INI-GraphicsNet Stiftung die neuen Verträge unterzeichnet hatten, führte NEMETech eine inhaltliche Neuausrichtung und Umstrukturierung zum Institute for Graphic Interfaces (IGI) durch. Von den verschiedenen Institutionen des INI-GraphicsNet werden Mitarbeiter an das IGI entsandt, um zusammen mit koreanischen Mitarbeitern Projekte durchzuführen. So entsteht mit dem IGI eine internationale Einrichtung mit einer regen interkulturellen Zusammenarbeit. Die FuE-Aktivitäten konzentrieren sich dabei auf den Bereich Intelligent Manufacturing Systems. Dabei beschränkt sich IGI aber nicht nur auf die eigentlichen Kernbereiche wie Virtuelle und Erweiterte Realitäten, sondern bezieht auch die Bereiche E-Learning und Sicherheit konzeptionell mit ein.

New R&D in Korea

The Institute for Graphic Interface IGI former NEMETech – has recently been assigned by its founding partners and by the Fraunhofer IGD as the R&D Center responsible for the realization of strategic Research and Development (R&D) as established by a major agreement between these institutions and the Korean ministry of information and communication (MIC) and Korea Institute of Information Technology Assessment (IITA).

This agreement has its basis in the Korean government program to foster international co-operations for the development of cutting-edge Information and Communication Technology (ICT) in Korea, and thus to achieve leading positions on the innovation front and global market.

On May 17, 2004, a major public event was held on the campus of the EWHA Womans University for the signing of this agreement and the inauguration of the new IGI building. IGI will focus its technological competencies on the topics of Intelligent Manufacturing Systems and Information Assurance.

These two topics have been selected due to their market relevance in a long-term perspective following technological evolutions as well as and business and societal tendencies. The choice of the first topic is based on the high-demand for ICT in modern manufacturing industries, which are increasingly forming cross-national production communities and which face fierce competition in the global market. The second topic was selected due to the growing employment of electronic services and data records and requires protection of digital contents and data flow. A similarly important aspect regarding these choices refers to the »world-dimension« of the potential market, and the opportunity to serve several application areas and users with the same core technology.

The renowned technological excellence of the project partners, including EWHA Womans University and Electronics and Telecommunications Research Institute (ETRI), complemented with experiences in international projects will foster the joint development of world-class applied research and technology for both the domestic and the international market. Furthermore, proven competencies on services related to technology transfer will support the market-oriented character of the business model, and the dissemination and the exploitation of the research findings.

The research team is being progressively composed of highly-qualified German and Korean researchers, engineers and designers. In addition, graduate students and visiting researchers will gain valuable experience in working in industry-oriented projects. The technical competencies of all of those collaborators will be advanced with project management skills and the work in multinational, multidisciplinary teams.

Besides providing challenging opportunities for qualified Korean scientists and engineers, IGI will also raise positive prospects for local small and medium technology providers by means of co-operation agreements. IGI's customers will benefit from a reliable partner and high-end source for innovative solutions.

Through the new R&D Center, Korea can reinforce existing and reach leading positions in the international ICT community and worldwide market.

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Evaluation of new technologies from companies in the region of Daejeon Metropolitan City

Dr.-Ing. Luiz Santos

German Abstract

Zusammen mit dem »Small & Medium Business Support Center« der Stadt Daejeong und der INI-GraphicsNet Stiftung führt das IGI gegenwärtig eine Evaluierung des Einsatzes von neuen Technologien in kleinen und mittelständischen Firmen aus der Region Daejeong durch. Ziel dieser Evaluierung ist es einerseits der Stadt Daejeong Entscheidungsgrundlagen für zukünftige Aktivitäten zu geben. Vor allem bietet IGI dadurch aber den einzelnen Firmen die Möglichkeit, den für sie relevanten technischen Sektor und somit auch ihre internationale Marktfähigkeit besser einzuschätzen.

Evaluation project

The commercial exploitation of a newly developed technology is a very rewarding result of an applied Research and Development activity. For a successful exploitation, the first and decisive step is the evaluation of the technology with regard to its scientific value and innovation asset, but also concerning its market prospect. Such an evaluation ought to be conducted by independent and internationally experienced experts in order to provide valuable feedback on the respective technological sector and current market situation.

The Small & Medium Business Support Center on behalf of the Business Assistance Division, both from Daejeon City, and IGI have set up a project to evaluate newly backed technologies from SMEs located in the region of Daejeon City. IGI has appointed the INI-GraphicsNet Foundation to define and realize the evaluation process.

Project implementation

The project started with a workshop in Daejeon City, promoting the project and presenting INI-GraphicsNet Foundation to the invited companies. They were encouraged to participate in the action with the evidences of the background experience from the Foundation, the prospects of benefits, and assurance of non-disclosure.

The four steps of evaluation were:

1. *Presentation of the technology and product*: A questionnaire prepared by INI-GraphicsNet Foundation was distributed to the interested companies.
2. *Initial review*: 40 companies filled out and returned the questionnaires, in some cases accompanied by further relevant material. All this information was evaluated by experts from the INI-GraphicsNet and other institutions.
3. *On-site evaluation*: Based on predefined criteria, the fifteen best-rated technologies were selected for the second evaluation round. For this purpose, IGI organized several individual meetings between company staff members and expert evaluators for further clarifications and personal discussions. By the time this article went to the print, all the on-site evaluations had been completed with very positive and promising results.
4. *Final report*: The detailed results of these evaluations will be individually handed out to the respective companies, and a complete report to the Business Support Center. These documents shall report on the overall quality of the technology and include recommendations for further steps towards a successful commercialization. For the companies not selected for the on-site evaluation, the document will clarify the judgment and provide the due recommendations.

Figure 1: Evaluation session at CyRun co

Thanks to the successful results so far, a follow-up project is being discussed, with the help of which the companies may exploit further services of INI-GraphicsNet Foundation to bring their technologies to the European market.

Points of contact

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EduTeCH – Edutainment Technologies for Cultural Heritage in Asia

Arne Schilling, Dr.-Ing. Luiz Santos

The Gyeongbokgung palace in Seoul – the main palace of the royal family during the Joseon Dynasty (1392-1910) – is one of the most visited historical places in South Korea. Unfortunately, great parts of the palace buildings were on multiple occasions either destroyed by fires, or dismantled by hostile invaders and carried away from Korea. Currently, visitors can see only some renovated buildings, which are sometimes not even situated at their original location. Gyeongbokgung is also the location of Jiphyeonjeon, the academy building, where the Korean alphabet, Hangeul, was created and proclaimed in 1446 under the regency of King Sejong. Such cultural treasure and dynamic historical background are deemed worthy of being documented for all future generations and made more widely known.

Latest IT technologies in the fields of mobile computing, Virtual Reality, visual tracking, and digital storytelling, allow us to create highly realistic virtual simulations that can bring this history back to life. Within EduTeCH, the competencies from several INI-GraphicsNet member institutions have been put together in order to create an »Edutainment« system (Education and Entertainment interactive application) for pupils and children, which teaches the basics of the Hangeul alphabet in a very playful way.

With special equipment, the user of the system is able to immerse into a virtual scene and experience a reconstruction of the Gyeongbokgung palace (cf. figure 1). After a personal encounter with virtual characters (avatars), the visitor gets involved in an educational game. The avatars are connected to the story engine and show realistic behaviors depending on the structure of the narration. The scene is composed of reconstructions of dismantled buildings of the palace site. In several areas of interest, the story gets activated and the user is

German Abstract

EduTeCH verbindet verschiedene innovative Informationstechnologien wie z. B. interaktives Storytelling und Virtuelle Realitäten (VR) und zu einem unterhaltsamen Erlebnis für historische Stätten. Die spielerische Anwendung findet auf dem Gelände des Gyeongbokgung-Palastes in Seoul (Süd-Korea) statt, wo der Benutzer die geschichtlichen Hintergründe bei der Entstehung des koreanischen Alphabets erfährt. Mithilfe von virtuellen Rekonstruktionen der Gebäude und deren Darstellung mit VR-Technologien gewinnt der Benutzer einen Eindruck, wie der geschichtsträchtige Ort in früheren Zeiten ausgesehen hat. Der Virtuelle Charakter übernimmt die Rolle eines Erzählers, der den Besucher spielerisch in eine informative Geschichte verwickelt. Der Verlauf der Geschichte wird dabei abhängig vom Standort des Benutzers mithilfe der Storytelling-Technologie individuell angepasst.

Figure 1: Digital reconstruction of Gyeongbokgung Palace

confronted with tasks, which he/she has to solve in order to reach the next chapter. The story engine ensures that the story develops individually and in accordance to the user's path around the site. The system is based on a Blender 3D engine; the developed interfaces enable the connection of the virtual environment and the narrative processor.

Sung Sam Mun (cf. figure 2) – the avatar embodying one of the scholars of King Sejong – guides the visitor on his/her exploration of the virtual palace. As for the game, Sung Sam Mun asks for the visitor's help, because somebody has stolen the alphabet table and scattered the letters all over the palace! The hiding places have to be found and questions to be answered to retrieve the letters. To answer the questions, the visitor has to explore the palace and to study some historical background information (cf. figure 3). Thus, EduTeCH brings together education and entertainment elements in order to create an informative experience. Similar application could be generated in relation to any cultural asset in any country. It is worth remarking that Republic of Korea has seven sites that are registered on the »World Heritage« List by the UNESCO.

Currently, a business plan is beingCurrently, a business plan is being elaborated and a market analysis carried out by the partners in order to evaluate the impact and commercial opportunities of such an application in the Asian and European markets.

EduTeCH is carried out by IGI in Korea, CAMTech in Singapore, and ZGDV, Fraunhofer IGD and GIStec in Germany.

Figure 2:
Sung Sam Mun, one of the virtual characters that guide the user through the interactive narration

Figure 3:
Accompanied exploration of the palace while being challenged by the instructive game

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A home for INI-GraphicsNet

Worldwide research network strengthens Darmstadt location / INI-GraphicsNet Foundation laid foundation stone for new office building / Hessian minister of science with hammer and trowel

Screens showing desired details of an artwork simply by pointing; a half transparent display, supporting an operating surgeon's work by blending virtual info in his visual field; mobile systems enabling displays of complex graphics on mobile phones or PDAs; AR binoculars, fading in virtual info on a realistic field for the viewer; biometric procedures, making access controls or documents more secure! German research is hot – contrary to some critical voices there are numerous local examples here of how research can step up the economy and society. This applies especially to the development of Computer Graphics.

It was Professor José L. Encarnação who, with much vision and pioneering spirit, set up this discipline at the Technische Universität Darmstadt almost 30 years ago. The foundation of the Computer Graphics Center (ZGDV) and the Fraunhofer Institute for Computer Graphics IGD created the basis for today's leading research network on the visualization and processing of computer data. INI-GraphicsNet now gets its own home, possible through the gift of a property of nearly 2,300 square meters which the *Land* Hesse passed on to the INI-GraphicsNet Foundation late 2002. After detailed planning, construction has started in September 2004.

With its new office building situated directly next to the Fraunhofer Institute for Computer Graphics IGD building in Darmstadt's city center, the INI-GraphicsNet Foundation can perceive its covering role in the network even more intensive from 2006 on. Aim is to further bundle the network's activities, sponsor promising technologies and support the transfer of development ready for market-introduction. Meanwhile the foundation's fame as incubator of innovative ideas has grown beyond the network.

With the new building the foundation secures itself a solid base to reach these goals and at the same time strengthens the Darmstadt location as an internationally noted science-city. Starting shot for the construction of the foundation's building was the laying of the foundation stone, in October 13, 2004. This milestone in the strengthening of research was acknowledged by the Hessian minister of science Udo Corts, the mayor of Darmstadt Wolfgang Glenz and Professor Hanns H. Seidler, chancellor of Technische Universität Darmstadt. Founder and Chairman Professor José L. Encarnação and his guests of honor then placed the traditional scrolls. Containing the building's blueprints, the day's newspaper, some coins and other information, it should bring long-term luck to the building and the people who work in it.

Those interested could obtain a visual impression of the building through the brand-new »AR binoculars«. This highly innovative system superimposed virtual information over the terrain. This way, the viewer obtained an exiting look into building phases and could actually see the completed building.

Experienced incubator

The INI-GraphicsNet Foundation has several years of experience in the identification and utilization of research outcomes in Information and Communication Technologies. Over the last two years the foundation has already mediated a number of businesses to equity financiers through investor and expert meetings. Moreover, it is successfully supporting the hiving off of numerous spin-offs from the INI-GraphicsNet research network, the world's largest international network in the research and development of Computer Graphics.

More information on INI-GraphicsNet and the INI-GraphicsNet Foundation can be found on the internet at: *www.inigraphicsnet-stiftung.de*, *www.inigraphics.net*

The new building of the INI-GraphicsNet Foundation

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Sweating at music

High-carat ideas presented by nine young future entrepreneurs at the 1st public BusinessplanAward of the INI-GraphicsNet Foundation at the Darmstadt TIZ / Jury acknowledged the contributions' high quality / Prizes presented in a festive setting

BusinessPlan Award 2004: Presentation of the winner's technology

BusinessPlan Award 2004: Honouring of the prize winners, here: Dr. Didier Stricker, Fraunhofer IGD

The jurors found the selection not easy. Though at the end, no doubts remained on having found the most marketable and innovative idea. The already multiply awarded »StepMan« also starred in Darmstadt and clearly took first rank. »We're delighted to win first prize,« says Holger Diener of the Fraunhofer Institute for Computer Graphics in Rostock, Germany. »On the basis of its versatile functional possibilities StepMan is usable in both leisure and competitive sports, in fitness studios as well as in rehabilitation and healthcare.« Besides the adaptation of the music to one's step frequency the system also measures biometric data as heartbeat, respiration and oxygen concentrate and evaluates these graphically and acoustically. This allows the preparation of targeted individual training-, rehabilitation- and relaxation programs. As numerous researches prove, music promotes more regular and relaxed movement at sporting activities. Respiration intensifies and muscles receive a better oxygen supply. The complex StepMan-software adapts music played on walkman, mp3-player or smartphones through integrated movement sensors. The athlete moves to the music's beat and thereby adjusts his rhythm to the desired pulse rate.

Rank 2 for measurement and testing technology

Extensive load tests and analyses are essential in new product development. Engineers and constructors must often destroy material to gain knowledge about its properties and other important information. At this stage the procedure of Ralf Bernhard from the Wismar University joins in. He founded his business for the production and distribution of automatic measurement- and test equipment, mainly by optic testing and sensory. The company would like to establish itself as a specialist in nondestructive testing. To achieve this, a product for the fast automatic testing of saw blades has already been designed.

Rank three for development at maintenance operations

A service manual for complex technical plants often takes up several thousand pages. For maintenance personnel it is often a big challenge to get the hang of these. Aim of the AR-Maintenance GmbH is to help out here intelligently. To achieve this Dr. Didier Stricker uses the Augmented Reality System »AR-Browser«, developed at the BMBF master research project ARVIKA from Fraunhofer IGD in Darmstadt, Germany. The system uses a portable computer and a semitransparent eye phone to lead a technician directly through complex servicing processes. In this process the operating steps are shown as 3D-animations superimposed with the equipment needing maintenance. The service technician can thus also effectively solve complex problems and avoid production stagnation.

High quality of the contributions

In all the organizers showed great satisfaction with the first Darmstadt Businessplan presentation. »We had a distinct high quality of technologies and ideas,« explains Wolfgang Kniejski, managing director of the INI-GraphicsNet Foundation. »We and the innovators enjoyed the fact that many financiers started constructive talks for further cooperation on site and during the meeting.« The prize-presentation took place three days after the Businessplan presentation on October 10, 2004 in the course of the panel discussion »Research and technology in Germany – conditions for an innovative business location« at the central station in Darmstadt. There the prize winners were honoured by Professor. José L. Encarnação and prominent science, politics and business representatives.

The INI-GraphicsNet Foundation

Initiator of the Darmstadt BusinessplanAwards is the local INI-GraphicsNet Foundation together with the Working Group on Start-up Consultation Starkenburg. The realization of innovations in line with market requirements is sponsored since several years by the board of the leading network for computer graphics, which includes the Fraunhofer Institute for Computer Graphics Research IGD and the Computer Graphics Center (ZGDV). Further information about the award can be found on the internet on page: *http//www.inigraphicsnet-stiftung.de/bp_award* or at the

INI-GraphicsNet Foundation
Code word »Ideenwettbewerb«
Thorsten Stürmer / Elke Jäger
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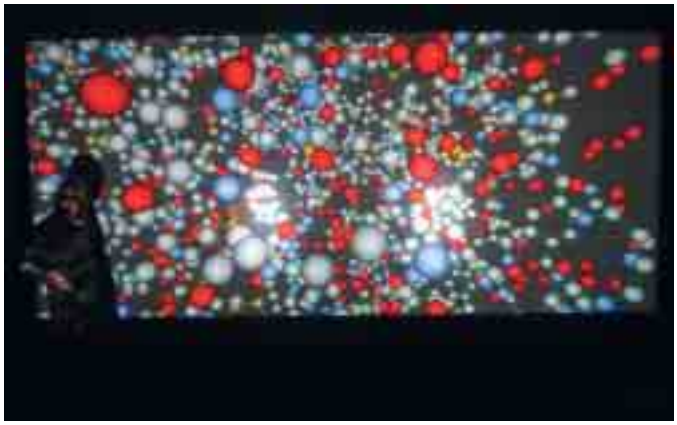
SCE delegation with key members of IOIT VR Lab
(Second row from left: Mr Gerrit Voss, Prof. Le Hai Khoi, Prof. Seah Hock Soon, Prof. Cai Wentong, and Prof. Wolfgang Müller-Wittig)



Active stereo projection on 4,7m x 2,1m screen

Virtual Reality Workshop in Hanoi, Vietnam

As part of the effort to project Nanyang Technological University (NTU) as the Information Technology hub in the region, a group of academics from the School of Computer Engineering (SCE) visited the Institute of Information Technology (IOIT) in Vietnam from March 23 to 26, 2004. The delegation, led by the Dean, Prof. Seah Hock Soon, consisted of Prof. Cai Wentong, Head of Computer Science at SCE, Prof. Wolfgang Müller-Wittig, Director of CAMTech/SCE and Mr Gerrit Voss, Project Leader at CAMTech/SCE.

The main objective of the visit was to harness SCE's IT expertise to set up the first Virtual Reality (VR) Laboratory in Vietnam and run a technical workshop on VR including an introductory tutorial on OpenSG. The workshop also provides a platform to showcase their school's current research projects so as to solicit immediate and long-term collaborations in teaching and research.

Imagine, Visualize, Realize

The Centre for Graphics & Media Technology (CGMT) organized with its strategic international partners IM Innovations, AMD, nVidia, and Christie Digital a 3D visualization event. This 3D immersive visualization roadshow took place from June 24 to 29, 2004 at the facilities of Christie Digital in Singapore. High quality content was presented on a three node cluster of AMD workstations with nVidia graphics, two Christie Digital Mirage projectors driven by our OpenSG based Virtual Reality system. During the various sessions the use of immersive 3D visualization technology and solutions was promoted to various targeted customers from industry, government, and education.

CAMTech provides Technical Support for Nicoll Highway Inquiry

CAMTech was requested for the provision of a 3D computer visualization by the ministry of manpower of Singapore. Subsequently, CAMTech developed a 3D model of the accident scene at the MRT Circle Line worksite. This virtual model of the overall wall systems is meant for the general purpose of illustration and ground orientation in order to facilitate the Committee of Inquiry (COI) hearing. Using a highly interactive in-house visualization system, this 3D scene was presented to the public during the opening of the hearing in August 2, 2004 for the first time. The 3D scene will be used throughout the eight weeks inquiry.

Given the sensitivity of the case, CAMTech appreciates your understanding that no images of the 3D model will be presented here at this point in time.

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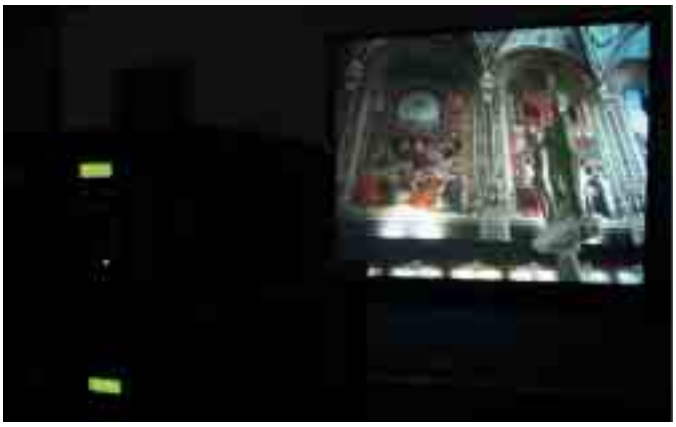
Partners of the IGI

CAMTech provides Technical Support for Partner Institute IGI

CAMTech provided with its partners Christie Digital and HP the technical support for the Virtual Reality presentations during the public ceremony of the Institute for Graphic Interfaces (IGI) at the Ewha Womans University held on May 17, 2004. Using the OpenSG based in-house visualization system, INI-GraphicsNet VR project contents in the field of cultural heritage, engineering, and life sciences were showcased to various representatives of government, industry, and research. In particular, CAMTech and IGI are grateful to Christie Digital Singapore and its local partner KMT for the prompt installation of the passive projection system, HP Singapore and HP Korea for sponsoring the graphics workstation, and department »Virtual & Augmented Reality« of Fraunhofer IGD for the delivery of VR content.



Passive stereo projection on 4m x 3m screen

VRCAI & Graphite 2004 at Nanyang Technological University Singapore

This year the Graphite 2004 conference, chaired by Professor Yong Tsui Lee, and the VRCAI 2004 conference (Virtual Reality Continuum and its Applications in Industry), co-chaired by Professors Judy Brown and Cai Yiyu, were held jointly at Nanyang Technological University, Singapore from June 15 to 18, 2004. Three key

VRCAI Program Chair Prof. Jiaoying Shi from Zhejiang University, China introduces keynote speaker Prof. Encarnação

note speakers were invited: Professor James Foley gave a talk about the »Grand Challenges in Computer Graphics«, Professor José Encarnação shared his »Visions of Ambient Intelligence and How to Make it Happen«, and Professor Jackie Morie gave insights in »Augmented Cognition and Augmented Art: The Evolution of Traditional VR«.

About 250 participants from 27 countries joined the conferences. The technical program was complemented by tutorial programs, Electronic Theatre, Digital Art gallery, and Emerging Technology exhibition. CAMTech provided some technical support for the Digital Art installations and Emerging Technology Exhibition. In particular, CAMTech's various Virtual Reality Applications were showcased at the booth of Christie Digital.

StepMan wins another award at the Idea Contest MV 2004 »Venture Sail«

The Fraunhofer Institute for Computer Graphics Research IGD in Rostock, Germany has been awarded for the innovative StepMan for the second time in a row, at the annual Idea Contest in Mecklenburg-Western Pomerania (MV). Last year, the jury awarded the research idea for the development of StepMan and this time for its ongoing development into a realizable business idea. The development of special software for audio devices, where the speed of music is adapted to the athlete's pulse rate, received 3rd prize in the category »Start-up Team«. The prize was presented together with a 40,000 Euros reward during the festivities at the international »Hanse Sail« in Rostock in August 2004.

»We're delighted to receive an award for concept realization this year,« says Holger Diener of the Fraunhofer Institute for Computer Graphics IGD in Rostock. »On the basis of its versatile and useful functional possibilities, StepMan is usable in both leisure and competitive sports as well as in fitness centers and the rehabilitation and relaxation area.« Besides the adaptation of music to one's step frequency, the system will in future also measure biosensoric data as heartbeat, respiration and oxygen concentrate and evaluate these both graphically and accoustically. Through the gained information, targeted individual training-, rehabilitation- and relaxation programmes can be prepared.

For excercising people music plays an important part in motivation and support, no matter indoor or outdoor sports. As numerous research proves, music promotes more regular and relaxed movement at sporting activities, intensifying respiration and improving oxygen supply to muscles. The complex StepMan-software adapts the speed of music to the data measured by sensors integrated in walkman, MP3-player or smartphones. The athlete then »automatically« adjusts his rhythm and so his pulse rate. The software does not interfere with playback quality, i.e. a melodious Joe Cocker does not turn into a croaking frog.

The Idea Contest MV was first written out by the Gründerflair MV Initiative and the Patent- and Commercialisation Agency MV (PVA-MV) three years ago. The new designation »Venture Sail« amplifies the idea contest's future partnership to the »Hanse Sail« fair; a stronger resonance in the Baltic Sea area is expected. Aim of the contest, supported by the German federal ministry of education and research (BMBF), is to encourage and develop special ideas and concepts of public research.

The PVA-MV press release on the Idea Contest MV 2004 as well as pictures of the award ceremony can be found on the internet under: *http://www.pva-mv.de/de/ideenwettbewerb/IW2004.php*

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New media offer career prospects

Career component for multimedia students and professionals / imedia – The ICPNM Academy offers interdisciplinary and intercultural new media training / INI-GraphicsNet Foundation scholarships

No one can ignore new media today: 3D animations, Virtual and Augmented Realities, interactive webdesign, multimodal human-computer interaction and other digital technologies are present in science and education, business and administration. On a company level this causes a growing need for highly-educated professionals, who can combine know-how and design.

For example, a new research by TechConsult, IBM and impulse about »Internet and eBusiness in small and medium-sized enterprises (SME)« reveals that already 40 percent of all SME operate eBusiness, with an upward tendency. However, 44 percent complain about the lack of staff know-how, impeding the introduction of eBusiness. Only highly-educated professionals could fill this loophole.

imedia – The ICPNM Academy in Providence, Rhode Island, USA therefore offers a qualification and training program for new media, tailored to business demands. Because not only in eBusiness innovative technologies are essential. Companies, for example, must anticipate today's dynamic market trends through a shortening of product development times. But new media are also applied in trend areas like edutainment and knowledge management. Besides, in tomorrow's world of employment, team-oriented cooperation will grow in importance. Interdisciplinary teams will then be able to work on images, graphics and texts or enter three-dimensional spaces at equal times. New media have an enormous potential. In its interdisciplinary study program, imedia connects computer graphics and vizualization technologies with design and business management. »What's the use of prime education, when it doesn't meet business demands?« knows Dr. Joachim Rix, managing director of the INI-GraphicsNet Foundation in Darmstadt, Germany. The International Certificate Program for New Media ICPNM consequently appeals to students from all over the world, who dare to look beyond the borders of their study subjects to lay the foundation for their careers. The same applies to industry and business employees who would like to keep training for the purpose of lifelong-learning. Experiences of former participants confirm the competitive advantage on the job market through the internationally reputed certificate: Those who show initiative today have tomorrow's best options. »It's a win-win situation for both participants and future employers« raves Professor Dr. Miguel Encarnação, President of the ICPNM-Academy. »Through lecturers and practical training posts, the industry contributes actively to the program, influencing relevant contents. Students on the other hand, can draw the attention of industry representatives while in training and prove themselves during the practical term.« Also important for students is the recognition of the program by their own respective studies. Arrangements for this have been made with numerous universities all over the world.

ICPNM

The ICPNM offers an exclusive number of placements per semester. Aim is to solve assignments with digital media in an innovative and interdisciplinary way. For this, participants first train their technological knowledge, ability of visual expression, conceptional abilities and teamoriented communication for five months. The curriculum consists of both theoretical instruction and applied excercises. Internationally acknowledged technology experts, designers and specialists attend to the students. Next, during a four-month practical term, they apply this knowledge at an institute of the worldwide-operating INI-GraphicsNet or an interested company. Waving at the end of the program is the International Certificate for New Media. On top of that graduates qualify for the next two levels of training at the ICPNM-Academy and for participation in projects within the INI-GraphicsNet.

Apply now

The course starts twice a year; application deadline for the next round in January 2005 is December 6, 2004. Early applications are recommended, as they are treated on a »first-come, first-served« base. The INI-GraphicsNet Foundation also supports promising applicants with scholarships that are granted under specific criteria. Those interested could apply until October 1, 2004 to enter the first allocation round. Later applications will be considered if funds are still available. The program starts at January 10, 2005 with an introductory week and ends at October 21, 2005. Conditions for participation to the program are: excellent English skills (TOEFL-Test), a minimum of two years study or professional experience in computer science, engineering, architecture, art, design, education, the arts or digital media as well as basic electronic data processing and maths skills.

Information and application forms can be found at *www.imedia-academy.org* and *www.icpnm.org* or at

Julia Wolin
imedia – The ICPNM Academy
Providence, Rhode Island, USA
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Email: info@icpnm.org.

Questions about INI-GraphicsNet Foundation scholarships as well as the allocation procedure are answered by

Dr. Joachim Rix
INI-GraphicsNet Foundation,
Darmstadt, Germany
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Email: joachim.rix@inigraphics.net

imedia – The ICPNM Academy

The ICPNM-Program was brought into life by the Rhode Island School of Design (RISD) in Providence, USA, the INI-GraphicsNet Foundation in Darmstadt, Germany, and the Technische Universität Darmstadt (TUD). Aim was the foundation of an internationally highly reputed and unique training program for interactive digital media. As the institute cooperates closely with universities, research institutes and partner enterprises in Europe, Asia and the USA, it succeeds to connect academic research with the principle of lifelong-learning and entrepreneurial flair. Close connections with several companies show the growing industrial importance of new media. For example, through an industrial forum imedia cooperates with Bertelsmann Media-Academy, Burda Medien, DaimlerChrysler, SAP, Siemens as well as Siemens Business Services and last but not least the Telekom Business Academy. Meanwhile three staged courses in new media are offered. In 2002, imedia took over the academy's management, completing the qualification sector of INI-GraphicsNet.

Trade fair tour with electronic companion

Visitors to the IT trade fair Systems which took place in Munich, Germany from October 18 till 22, 2004, could use their mobile phone as electronic assistant. Difficult orientation by confusing fair-maps or waiting at over-run info stands now belonged to the past. With the digital fair-system xGuide, developed by the Fraunhofer Institute in Rostock, Germany, the guest could download specific info on exhibitors or fixtures directly on his or her mobile phone. When the desired exhibitors were entered, the digital fair-guide also functioned as a personal navigation system, storing an individual route and time schedule and leading the guest to the desired exhibition stand.

This new service made special handheld computers or PDAs superfluous. »Almost every visitor to a trade fair now owns a mobile phone, making mobile information services available to more interested guests.«, said Gerald Bieber, head of the Mobile Multimedia Technologies department at Fraunhofer IGD Rostock. Information could be downloaded on standard mobile phones equipped with Java or Wap in the run-up to the fair or on location. For this, the mobile user simply sent a premium SMS with the word »xGuide« to telephone number 44466. Costs for the use of this service amounted to 1.99 euro plus connecting costs. In future, this innovative system will also be available to visitors of other trade fairs who would like to inform themselves in a comfortable and comprehensive way about hall-maps or fixtures by mobile phone.

The mobile visitor information system xGuide is already being used and developed successfully at museums, congresses or trade fairs for six years. The electronic information service is also usable as a tourism or airport guide with the for this purpose standard-developed XyberScout platform.

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Mobile services open new market perspectives

The MAP-Forum network for technology exploitation in Darmstadt, Germany is noticing a growing interest of businesses and administrative authorities in new models for organization as well as for technical solutions for the supply of mobile services. On the occasion of its one-year existence the managing directors of the MAP-Forum Dr. Dirk Balfanz, Computer Graphics Center (ZGDV), and Welf Schröter, Forum Soziale Technikgestaltung (Forum for Social Technology Design), emphasize the potentials and chances for new added value in »Electronic Mobility« technology.

Knowledge-based services that are made available to virtual business and working spaces in a mobile way, can offer considerable benefits in purchasing, long-distance servicing, energy saving, building management and training, especially to small and medium-sized enterprises (SME) and trade. This would require some rethinking in respect to the addressed users, commented Dr. Balfanz on the MAP-Forum's annual meeting. The technology should not be oriented too much to expectations of juvenile enthusiasm for technology, but should be tailored more strongly to user demands; users that are over 40 if not 50, confirmed the managing director of the technology forum. In this way technology development is taking the increasing age of society and demographic change into consideration. This was also indicated by the results of the »Zukunftsradar 2030« (»Future radar 2030«) project of the Future-Initiative Rheineland-Palatinate (ZIRP), which were presented by ZIRP's managing director Heinz Kolz at the annual convention on Monday, September 27, 2004.

The MAP-Forum at ZGDV emerged in August 2003 as exploitation network out of the »MAP – Multimedia-Arbeitsplatz der Zukunft« (»Future's multimedia-working place«) project, that was promoted by the federal ministry for science and employment (BMWA) as technology-plan in the space of summer 2000 to 2003. At the MAP-Forum's meeting, Balfanz and Schröter could look back on a successful and active starting year. The MAP-project's partners e.g. introduced their technologies and strategies for future's working place to a skilled public on a number of regional and interregional meetings and fairs, including CeBIT 2004. On top of that the MAP-Forum engaged itself in dialogues with unions, communities and educational bodies that are dealing with the social design of new, mobile working environments, as well as in the »MobileMedia-Taskforces« network of the BMWA federal initiative »MobileMedia«.

Further information can be found under URL: *www.map-forum.de*

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CGEMS – Computer Graphics Educational Material Source

Sharing knowledge

The Computer Graphics Educational Materials Source CGEMS is an online system that provides curricular material for computer graphics educators. In 2002, this educational project started with a draft version, in part funded by the European Commission Alfa INETGAM project and by special Eurographics education board and ACM/Siggraph education committee grants. The system includes a method for contributors to submit and editors to jury and control the quality of content to ensure sound and robust materials. The fast pace of change in the computer graphics field makes it difficult for educators to continually design up-to-date, meaningful and robust curricula that address the full potential of new technology. Although small systems and groups of people exist who are trying to address this issue, there is currently no centralized worldwide-refereed repository for computer graphics educational materials. CGEMS supports a way for educators in easily accessing quality course

materials and for contributors to share and get recognition for their curricular innovations.

Aims and objectives
The CGEMS project aims to serve the computer graphics educational community on a number of levels. First, by making timely and quality materials available to educators, those teaching in the rapidly changing computer graphics field will be able to tap into resources that will aid in their efforts to keep pace. Often it is not enough to know how the technology works, rather it is most important to understand its implications and how best to apply it. Only at this point can an educator design materials for students that fully reveal the potential of the technology. Finally, the collective contributions of the computer graphics community will add to a network of knowledge and understanding that educators may use to provide content-rich courses.

Contributions welcome
CGEMS welcomes original and creative contributions at any time. It publishes high-quality educational materials. Volunteers can use CGEMS in a straightforward manner and with minimal maintenance effort only by registering through the online server in order to submit their course innovations. Authors are encouraged to provide in-depth conclusions of their insights on the weaknesses, strengths and lessons learnt of the issues discussed. In order to facilitate content availability and peer recognition, CGEMS implements policies for submission and the subsequent editorial review of materials.

Curricular development in a technically complex and rapidly changing landscape is not trivial. Rather, a successful curriculum is creative and innovative and deserves research recognition. CGEMS seeks to support these efforts by providing an opportunity to have curricular materials peer-reviewed, thus making them worthy of recognition.

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For further information please visit the homepage of CGEMS:
http://cgems.inesc.pt

Events
Workshops

Traffic Day – Mobility for the Future

The EU-east expansion, boom in mail-order business, no-storage just-in-time-production and the trend towards a larger mobility also in leisure time, are stressing Germany's traffic systems up to their limits. Roads, rails, waterways and air space cannot be multiplied at wish. The expected rise in transport output by 63 percent until 2015 by experts for the federal republic alone can only be managed with intelligent, networked traffic systems and efficient logistical chains that are based on advanced information technology (IT). This would optimize passenger and freight transport by road, rail, waterway or air space. Particularly industry, commerce, trade and the entire traffic system, but also every individual, can benefit from integrated traffic offers, modern telematics and navigation technology or information systems for tourism und administration. Whether interactive three-dimensional city maps equipped with a navigation function, simulation of traffic flows, disaster management or mobile ticket systems, these and many more ready for market-introduction appliances for the traffic sector are developed by the Fraunhofer Institute for Computer Graphics IGD and the Computer Graphics Center ZGDV in Darmstadt, Germany by order of businesses and government institutions. Advanced solutions for a safe, networked and environmentally friendly mobility are shown by Fraunhofer IGD and ZGDV in the course of the first

Traffic Day

Time: Wednesday, November 17, 2004
Place: Fraunhofer IGD
Fraunhoferstrasse 5
64739 Darmstadt, Germany

In short lectures, well-known experts of renowned companies and institutions report what chances the use of modern integrated systems offer for various traffic sectors. That the combination of new interactive information- and communication technologies is enabling a multitude of appliances is shown by researchers of Fraunhofer IGD and ZGDV through live-demonstrations. Those interested can try out the systems by themselves.

Detailed information on the meeting's agenda, live-demos and a how to reach us can be found at:
www.traffic-day.de

Participation to Traffic Day is free, though a registration is desired. Please register online at the website above or by email (bernad.lukacin@inigraphics.net) until November 5.

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TESI 2005 – Training, Education & Simulation International

Unique event, unique ideas, unique opportunities

TESI 2005 is a new conference and exhibition, offering a fresh focus on international developments in training, education and simulation technology. It presents a perfect platform to spotlight, analyze and discuss cutting-edge developments and applications of technology – regardless of industry or service background. In March 22 to 24, 2005, the conference will take place in the historic town of Maastricht, nestled in the Netherlands near the borders of Germany and Belgium. In addition to this experience, the MECC center, in which the conference will be held, offers one of the finest modern conference facilites in Europe.

Discussing innovations
Set to become the major annual international forum in Europe, TESI 2005 will address study and advancements in the design, evaluation, and application of education or modelling products, systems, and services. Focusing on technology rather than sector, the event offers a unique opportunity to meet and discuss ideas and innovations with like-minded end users and developers from such diverse sectors as Automotive, Aerospace, Defense, Education, Entertainment and Leisure, Finance, Gaming, Intelligence, Medical, Research, and Space. Hence, exhibitors, delegates, and visitors will represent a varied mix of senior and middle management buyers, technical specifiers, technologists, and influencers as well as leading manufacturers and service suppliers that makes the forum a place to meet new customers and competitors as well as many colleagues.

Maximized interchange
The Conference Chairman Dr. John E. Sirmalis also confirms that TESI 2005 represents a novel approach as the forum will bring together experts from the broadest spectrum of training, education, and simulation to share ideas across areas of interest. »Our theme for TESI 2005 is »The Essence Of Experience«,« tells the Conference Chairman. In his opinion, the decisive task of the Technical Program Committee is to explore innovative thinking especially in simulation technologies, synthetic and collaborative environments, learning and training practices, and human interfaces. »Maximizing the opportunity for cross-community technological interchange is our important goal,« Dr. Sirmalis describes the importance of the new conference in Maastricht.

For further information please contact the TESI Secretariat:
Phone: +44 / (0) 1322 / 660070
Fax: +44 / (0) 1322 / 616350
Email: support@tesi2005.com

or visit the homepage:
http://www.tesi2005.com

An eyewink from the canvas

Fraunhofer IGD presents the exhibition »Freundeskreis« by Georgia Wilhelm

Those who look at Georgia Wilhelm's portraits can practically feel the stare of portrayed rest on them. It's a game of seeing and being-seen between the exhibition's paintings and visitors. The artist's forceful works under the title »Freundeskreis« (»Circle of friends«) can be seen in the lobby of the Fraunhofer Institute for Computer Graphics from October 15 until November 4, 2004.

Georgia Wilhelm brings people out of her environment on canvas in exiting, larger than life sized formats. This way, faces and arms turn into regular body-landscapes that seem to suck the viewer into the image. Ears, laughter lines and hair strains seem authentic to the visitors' eyes. It causes a feeling of an intense, almost creepy closeness to the unknown

faces. To make the persons' history and individuality visible on canvas the 39-year old artist's own photos serve as portrait-model. »I let people talk about their lives to take away their shyness for the camera,« says Georgia Wilhelm to explain the openness and naturalness of the portrayed. The persons almost seem to flirt with the camera, giving the viewer the impression to be able to make contact with the portrayed.

Michael Bach, renowned artist from Düsseldorf and former professor of the Offenbach artist, describes the forceful images: »Of course it's just oil on canvas, but that painting there on the wall is also the painting in my head, in my life. It connects itself with one's own biography, one's own memory.«

Already during her study at the Academy for Design in Offenbach Georgia Wilhelm was fascinated by the theme human figure. In this period representations emerged in a rather expressive way of painting, intuitively made without models. Important for the Weiden-born art creator was the theoretical dealing with contemporary art trends: »I was especially interested in the figurative painting from after 1945.« After graduating in painting and art history in 1995, she moved into her studio in a former Offenbach factory. Since then the portraitist regularly shows her works on exhibitions as »Kunstansichten« (»Art views«) in Offenbach or in Frankfurt's »Haus 33«. Moreover, since 1999 the artist is also working as graphic and screen designer, thereby moving her emphasis to photos as portrait-models. This way, Georgia Wilhelm remains true to her theme »human images« since studying; she does however, besides oil and brush, use modern aids as a digital camera now.

Exhibition »Freundeskreis«

Duration:
October 15 - November 4, 2004
Opening times:
Monday to Friday, 8 AM - 6 PM
Place:
Lobby of the Fraunhofer IGD
64283 Darmstadt, Germany

Further information can be found on the website:
www.igd.fraunhofer.de/house-art

Mobile dreams in the third dimension

To access the newest high-tech fast and uncomplicated via mobile phones is many a mobile-owner's dream. This is shown by the great public interest in pocket devices on trade fairs like CeBIT or Photokina. In the near future, with the combination of internet and digital mobile phone systems, many users can have access to completely new functions as multimedia info, commercial and entertainment services. Though even with increasing efficiency of transmission networks, tomorrow's mobile phone services will only be successful if they correspond to the many users' individual interests and demands. That's where network-based Geographic Information Systems (GIS) already offer complex IT solutions to optimally master mobile processes of business and leisure; e.g. in telecommunications, traffic, tourism and the environment. The biggest challenge is to develop such systems for all the usual commercial terminal equipment and reach a global mass-market. Which mature technologies that can be used profitably for mobile terminal devices, were shown at the 2D/3D Mobile Computing Congress 2004, interactive and mobile – the new dimension of communication that took place on Friday, October 22, 2004 at the Fraunhofer-Institute for Computer Graphics IGD in Darmstadt.

At the meeting, well-known specialists from industry and science reported to the new mobile phone generation about actual and future challenges. Dr. Andreas Binder of Vodafone Pilot Development GmbH, Munich e.g. showed what real chances tomorrow's mobile internet offers. What new interfaces for users can look like through the innovative Augmented Reality technology was reported on by Professor Dr. Schmalstieg of the University of Vienna. Dr. Uwe Jasnoch of GIStec GmbH, Darmstadt throwed a light on the use of multimodal 3D data that can be called upon individually, place-related and goal-directed. Further speakers reported on new visualization- or interaction technologies for Mobile Computing. Through live demonstrations convention participants further obtained an extensive insight on actual applications in the field of interactive Multimedia Systems and Computer Graphics.

The themes of other lectures as well as detailed information on the 2D/3D Mobile Computing Congress 2004 can be found on the internet under URL: *www.mc-kongress2004.de*

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Dial C for Customer

Informational meeting »Finding new customers – methods and tools for cold calling« at the Multimedia Support Center Hessen

32.4 percent of all small and medium-sized enterprises (SME) will increase their investments in marketing and advertising in the next five years. Marketing therefore tops the list ahead of distribution (27.9%) and rationalization measures (25.8%). This was revealed by a survey entitled »Mind – Mittelstand in Deutschland« (»SME in Germany«) carried out by the Institute for SME Research in 2003. Changing economic conditions are the reason behind this. Close, long-term relationships with customers are breaking apart, and regional and national spheres of influence are shrinking.

Marketing departments in companies are being forced to establish new contacts. This involves selecting the addresses of potential customers and then calling these customers or speaking with them personally. It is just as important to identify the right

target groups here as it is to use the appropriate direct marketing instruments. High success rates cannot be achieved through widely scattered, non-specific advertising. Instead, targeted methods and tools are required for so-called »cold calling«. In September 23, 2004, the informational meeting entitled »Finding new customers – methods and tools for cold calling« demonstrated how precision tools can open up great potential for small and medium-sized enterprises in particular.

The Multimedia Support Center Hessen (MMSC) organized this event in close cooperation with the Darmstadt Chamber of Commerce and Industry. Professionals from the areas of business and law spoke to participants in-depth about the fundamentals and methods of cold calling. In an introductory lecture, Dennis Wolpert from EMB AG discussed systematic cold calling as a component of modern customer acquisition strategies. Thomas Jung from Deutsche Post AG took a very practical approach to the question of appropriate distribution channels when contacting potential customers. A speaker from Hoppenstedt GmbH revealed possibilities for researching addresses and information in business databases. Participants also found out the extent to which customer canvassing using »cold« addresses is a legal grey area and which measures are legally unobjectionable. In the final presentation, a research professional from the Darmstadt-based Information Experts agency explained how to find out about customers and competitors quickly, accurately and economically.As an independent eCommerce competence center, the MMSC has worked since 1998 to support small and medium-sized enterprises which want to introduce and use modern multimedia technologies in a profitable way. The MMSC, a forum of the Computer Graphics Center (ZGDV) in Darmstadt, is an important component in the »hessen-media« initiative in the German Land of Hessen.

Detailed information on the event can be found at: *www.mmsc-hessen.de*

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Researchers and Students at INI-GraphicsNet

Due to its international nature, the INI-GraphicsNet is obliged to a long tradition of exchanging researchers and students. Visitors in research and academia from all over the world have been hosted in INI-GraphicsNet institutes, which are adjoined to local universities and participate in university research, teaching and life. The Portuguese Centro de Computação Gráfica (CCG) is related to the University of Minho, CAMTech in Singapore to the Nanyang Technological University (NTU) and imedia, The ICPNM Academy in the US to RISD, the Rhode Island School of Design. The German institutes are adjoined to the Universität Rostock and the Technische Universität Darmstadt. Recently several new institutes joined the INI-GraphicsNet. VICOMTech in San Sebastian/Spain, NEMETech in Seoul/Korea and GraphiTech in Trento/Italy. And of course not to forget the new partnerships with the affiliated universities. These are the Universidad del País Vasco Euskal Herriko Unibertsitatea (University of the Basque Country), the Ewha Womans University in Korea and Università degli Studi di Trento in Italy. Student exchange programs between IGD and imedia in Providence or CAMTech in Singapore directly support the exchange of students between these institutes. This way it's very easy and much less bureaucratic for students to get financial support. But of course there are other possibilities to get funding for exchanges where non of these internal exchange programs apply. Several hints on how to find these scholarships can be found on the studINI Web Site *(http://www.inigraphics.net/students/studini/index.html).*

Of course the student exchange appointee will assist you too, if you have further questions. Another good starting point for a search for scholarships is *http://www.daad.de/.*

Marie Curie Fellowships for example provide European placements for pre and post-doctoral researchers, usually up to the age of 35, and for experienced researchers. Last December the first calls for proposals under the 6th framework have been published. Individuals may have a look at *http://europa.eu.int/comm/research/fp6/mariecurie-actions/action/fellow_en.html* to find the actual proposals and the deadlines for applications. A good place to start searching for Marie Curie Actions is the new website *http://mc-opportunities.cordis.lu*.

While Marie Curie Fellowships are targeting experienced researchers, there are other funding opportunities for internships. The Leonardo Da Vinci program for example supports exchanges for internships within Europe. Due to the increased number of INI-GraphicsNet institutions within the European community, this program seams to be very promising.

Don't hesitate to contact studini@igd.fraunhofer.de for information and for assistance with the application.

Additionally there are some new calls for application for PPP projects, programs for the exchange of persons in predefined projects. These programs are offered by the DAAD and are available for a special exchange country and typically a German project partner. More information on that subject you can find at *(http://www-zv.upb.de/~eb/neu%20eu%20web/ppp.htm)* (in German).

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ALUMNI

Addressing former staff members of INI-GraphicsNet:

The INI-Graphics-Alumni Forum

is a meeting-place and pool for former staff members of the INI-GraphicsNet. If you wish to become a fellow member please contact:

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Dr.-Ing. Hagen Schumann
July 16, 2004
»Precise calibration of static and dynamic Vision systems«
Supervisors:
Prof. Dr. José L. Encarnação,
Prof.Dr.-Ing. G. Sakas

Dr.-Ing. Hagen Schumann celebrates his graduation

Over the last years the performance of modern computers in general and those of graphics boards has increased tremendously. Due to this development 3D Computer Graphics and Computer Vision applications gain increasing interest. In the field of 3D Computer Graphics it has become possible to render complex and textured models at at least interaction frame rate even on low-cost, off-the-shelf consumer PCs. This is especially observable in the fast increasing number and quality of 3D Computer games. The fast growing number of internet users and the increasing opportunities of eCommerce and virtual product presentation also lead to an increasing interest in 3D Computer Graphics. These developments and new business opportunities lead to the demand for technologies that are, on the one hand, able to generate precise, photo realistic 3D models of already existing objects time- and cost-effectively and, on the other hand, allow to present them in a realistic, impressive, and costumer-convincing way.

Methods of *Reverse Engineering*, which means the digitization of the geometry as well as the texture of real 3D objects, allow an increasingly fast and effective generation of realistic 3D models from data of precisely calibrated and measuring 3D sensors.

The employment of *Augmented Reality* techniques offers convincing opportunities for the integration of virtual computer-generated information and models in a real environment which is, for example, given as an online or offline video stream or images.

Potential applications based on these technologies range from computer-supported learning via entertainment (TV, computer games) to realistic product presentation in the field of eCommerce.

A requirement for all of this is the precise knowledge of the camera parameter (position, orientation, focal length) of each frame or even field of the video stream or image.

Within the frame of this work, a new flexible, user-friendly and practicable method has been developed and its precision evaluated, that allows easy, robust, and precise calibration of a 3D sensor based on the »structured light« approach. The developed method facilitates several views of a freely moveable planar pattern of uniform calibration markers. Correspondences between the different views are calculated from the projector pattern.

Furthermore a new method for the video-based tracking of a »Pan-Tilt-Roll-Zoom« camera in dynamic scenes has been developed and its precision evaluated. The focus of the development was besides practicability mainly on the ability of real-time operation (>25Hz) on consumer PCs running standard operating systems. The developed tracking approach is based on a dynamic set of natural features extracted fully automatically from the images. The suitability of point-like and line features has been evaluated. The quality of the tracked features are permanently evaluated during the tracking. Features with an insufficient tracking quality are removed from the data set and replaced in real-time by newly selected features. The camera parameters are calculated from the set of tracked features using an optimization approach based on the minimization of the projection error on the image plane.

Operation in dynamic scenes has been achieved by detecting outliers and removing them from the set of tracked features. Real-time operation has been achieved by using a parallel, multi-threaded system architecture. The performance of the developed system in terms of frame rate and precision of the tracked camera parameters has been evaluated in static and dynamic scenes.

Dr.-Ing. Bernd Lutz
»Concepts for the Use of Virtual and Augmented Reality for Interactive Knowledge Transfer«
September 10, 2004
Supervisors:
Prof. Dr. José L. Encarnação, Prof. Michael Schenk

In today's information society, it is becoming increasingly necessary to acquire knowledge and to illustrate complex information. Already at school, an increasing amount of more and more complex facts has to be taught. This procedure continues at the universities as well as in working life. Modern didactic principles try to a greater extent to teach the learner knowledge by acting independently and by gaining own experiences. Such principles can easily be illustrated with the help of the Virtual and Augmented Reality (VR and AR) technology.

The aim of this thesis is to develop concepts for the use of Virtual and Augmented Reality for interactive knowledge transfer. For this purpose, the demands that are made on a virtual learning environment are initially analyzed. Technological as well as didactic demands are considered during this process.

On the basis of these demands, a framework for Virtual Learning Environments is designed. This framework contains the creation process for Virtual Learning Environments as well as the necessary presentation components. The design process is structured into the parts Modeling, Authoring, and Adaptation, whereby also persons without expert knowledge on Virtual Environments have to be able to carry out the Adaptation step. The components developed for the presentation are Learner and Learning Object Data, a Learning Environment Manager, and Interaction.

Interaction with this environment is an important opportunity to transfer knowledge in Virtual Environments. Within the scope of this thesis, the possible interaction scenarios – from single user to group scenarios – are examined und projected onto the four different social teaching methods. Since learning always contains a social aspect, scenarios for group interaction in Virtual Learning Environments have great significance. Therefore this form of interaction is especially considered. A suitable choice of interaction devices is important for the interaction in Virtual Learning Environments. Special VR devices are often too complicated, too prone to errors, and too expensive to be used for knowledge transfer. In this thesis, a universal interaction device for Virtual Learning Environments is developed to solve these problems. This interaction device uses virtual devices for the interaction with the Virtual Environment. Because of the use of virtual devices for the interaction with the Learning Environment, the amount of necessary devices is reduced to one device, and, at the same time, an interaction device is created which can be flexibly used. The output device, which is used for the display of the virtual devices, can also be used for the representation of further learning contents.

The concepts outlined in this thesis have been used to create several Virtual Learning Environments. These Learning Environments were presented to the public, for example, on the EXPO 2000 in Hannover, and the Cybernarium Days in Darmstadt and Munich.

Dr.-Ing. Bernd Lutz celebrates his graduation

STUDY & DIPLOMA THESES

»Development of a GIS-based Workforce Management System to Coordinate Mobile Resources at Big Events«
Diploma thesis by: Henrik Allendorf
Supervisor: Heiko Blechschmied

The untroubled run of a big event requires optimal cooperation of action forces from different vocational fields. According to their task, they must be coordinated in a way that they can react and act in an appropriate manner in any situation. For this purpose, it is absolutely necessary that there is unlimited information flow between the action forces on site and a central control station where all information is gathered and handled.

Objective of this diploma thesis was to prepare an overall system visualizing – on the basis of a geoinformation system (GIS) – the particular position of mobile action forces, including regulations for the spatial areas of application, and realizing the coordination of orders. The system should base on the GIS components developed at Fraunhofer IGD and be extended in a way that it could meet the requirements of a defined application scenario for a big event in the city of Darmstadt.

The coordination and supervision system implemented within the scope of this diploma thesis satisfies the demands on such a system arising both from the infrastructure of the components used and from the requirements of such a scenario. Besides components for the coordination and supervision of mobile resources, the system shows an effective alarm management component and an interface to the management of work orders. The operability of the different components of the infrastructure, especially the handling of interfaces which serve to change positions and to manage work orders, is demonstrated on the basis of a street party defined as application scenario.

»Concept and implementation of a procedure for efficient, non-precise database queries within the context of a sketch-based GIS«
Diploma thesis by: Frank Dangelmayer
Supervisor: Thorsten Schulz

Textual notation (like SQL) is often required for geographical queries. It is difficult to describe spatial data in that way. Spatial data can be described more easily with

the help of visual specifications like sketches. In the past, queries which were created out of sketches did not receive much attention.

In this thesis, the concept and implementation of a system is presented for the generation of queries on a geographical database based on analyzed sketches. Here, a sketch contains several geographical objects (e.g. buildings, bus stops, streets, etc.), which can have different relations to each other (e.g. the distance between the building and the street is 50 meter). This configuration will be identified in a geographical database.

To answer a query efficiently, special index structures and algorithms for spatial data are necessary. Oracle Spatial is a database schema for managing and querying spatial data with the use of R-trees. This has been analyzed in this thesis. The new system and the developed methods are based on an oracle spatial database.

The system, which has been developed in this thesis, receives the analyzed sketches from a program called SketchQuery. Based on this data, a query to an oracle spatial database is generated. After that, the similarity of the query results and the original sketch is determined. The geometrical similarity (e.g. of the street contour) is also considered. Finally, the query results are converted and returned to SketchQuery for presentation.

In this thesis, four modules have been designed and realized. Two of them communicate with SketchQuery to get the data from the sketch and to return the result for presentation. One module creates and executes the database query. Another module calculates the difference between the query results and the sketch.

»Integrating Blender into the Projects of the ZGDV«
Master thesis by: Birgit Dohr
Supervisor: Oliver Schneider

The aim of this master thesis was to create a test environment for the Storytelling Platform of the ZGDV. For this purpose it was necessary to employ the 3D modeling tool Blender as a renderer, as it has a game engine at its disposal that is capable of rendering interactive non-linear stories in real-time. Moreover, the creation suite provides an integrated Python interpreter and a corresponding application programming interface with the help of which scripts can create and manipulate 3D content. The individual scenes of a story are defined in scene scripts which have been implemented in PlayerML, an XML-based mark-up language.

Therefore, an interface had to be created that was capable of providing a means of communication between Blender and the Storytelling Platform as well as translating the PlayerML commands into Blender-specific Python commands. The establishment of communication has been accomplished by providing sockets for both components so that Blender knows which scene to render next. The PlayerML scene scripts are then transformed into document object models. The latter are cross-platform formats that can be accessed and manipulated so that the interfaces are able to parse the scripts and extract the relevant attribute values. The top-level objects of the scripts as well as their values are then translated into Blender-specific Python commands.

These techniques facilitated the creation of a test environment that was capable of rendering stories in real-time. Simple animations are also supported in case an IPO curve is attached to an object. Still, enhancements have to be made in order to include sound and interaction.

»Segmentation and simplification of triangle meshes through detection of theoretical edges«
Master thesis by: Henning Hirschbach
Supervisor: Konrad Klein

The goal in 3D reconstruction is to generate accurate and, at the same time, simple representations of real objects. Scanned models are commonly represented by triangle meshes. During the scanning process, sharp model edges are slightly rounded due to the sampling theorem. This rounded representation of the sharp model edges is inaccurate and, in addition, it increases the storage requirement of the meshes because of the higher number of vertices and facets.

This master thesis addresses the location and correction of the rounded model edges. To locate rounded model edges in meshes, the meshes are segmented and suitable surface primitives are fitted to the segments. The model edges result in the cut curves of adjoining surface primitives. For the initial segmentation, the mesh surface curvature is analyzed. Subsequently, an iterative process optimizes the mesh segmentation, the approximation error of the fitted surface primitives, and merges adjoining surface primitives if possible. Finally, the user may reconstruct (correct) the model edges found in the meshes.

To estimate the surface curvature and to segment a mesh, different methods are introduced and evaluated. The results of the selected method are represented and discussed in detail. Furthermore, suitable methods are introduced and discussed for fitting surface primitives to mesh segments as well as for computing and representing the edge information found. Finally, two approaches of reconstructing the model edges are introduced and compared with respect to the results achieved.

»Design and implementation of an Augmented Reality-based authoring tool for industrial maintenance and service manuals«
Diploma thesis by: Timo Jürs
Supervisors: Dr. Christian Knöpfle, Prof. Dr. Christian Bohn (Fachhochschule Wedel)

Previous researches on Augmented Reality (AR) in the industrial context primarily focused on the evaluation of basic technologies such as tracking systems or mobile computers. The need for an intuitive creation of AR scenes as a requirement for general acceptance and use has been ignored for the most part. Therefore, this thesis plans and implements an AR authoring environment. The resulting prototype allows further investigations and can be considered as groundwork for the collection of first experiences with AR authoring.

»Methods for Virtual Try On: Prepositioning of virtual cloth patterns through physically-based simulation«
Diploma thesis by: Jason Kafka
Supervisors: Clemens Groß, Volker Luckas

The diploma thesis presented describes a new technique which robustly automates the process of dressing virtual humans with virtual cloth. The designed algorithm applies methods taken from the area of physically-based simulation to achieve an arrangement for cloth patterns on a virtual human.

This is achieved by modeling the cloth patterns as rigid bodies, which are connected at their seams through virtual springs. The springs exert forces on the rigid bodies in such a way that an end configuration is achieved in which they can be used as input for a succeeding sewing simulation.

A new method that uses spring forces accordingly to push colliding cloth patterns apart deals with collisions appearing during simulation.

»Development of software tools for reading, writing and interchanging electrocardiograms and medical files according to SCP-ECG«
Diploma thesis by: Elena Villalba Mora
Supervisor: Ilias Sachpazidis

This project focuses on the development of tools that manage the interchanging of electrocardiograms and medical files according to the Standard Communication Protocol for Computer-assisted Electrocardiography (SCP-ECG).

The standard SCP-ECG is described in the document prEN 1064:2002 prepared by the European Committee for Standardization of Health Informatics (CEN/TC 251).

The project contains applications for reading and creating SCP files as well as for interchanging them.

The reading part is well developed, but the writing and interchanging parts must be enlarged in future improvements.

In the course of this thesis, the state of art is described. Then, the implementation of the project is explicated.
To conclude, future possible extensions are explained.

»Synthesis of face images«
Diploma thesis by: Stefanie Krusche
Supervisor: Henning Daum

Tests of face recognition methods require large amounts of face images. This thesis investigates whether elements of face recognition methods can be used for the synthesis of new face images and thus whether they are suitable for the simple generation of face image databases. Two of the best-known face recognition methods have been examined, namely Elastic Bunch Graph Matching and the Eigenface-method. The Eigenface-method for the synthesis of face images proved much more promising and was thus investigated in depth in this thesis. Since basic images of the Eigenface-method require the subject always to be in the same position and to have a uniform size, the localization of faces in images and their normalization was performed by affine and radial transformation. The variable selection of the determining parameters was examined and assessed in the synthesis. Firstly, it could be shown that the synthesis of new face images is possible by using Eigenface, and secondly, how the best results could be obtained by selecting suitable parameters.

»Realization of a graphical navigation system running on cell phones using GPS and a web-based GIS«
Diploma thesis by: Christoph Schaefer
Supervisor: Heiko Blechschmied

Applications on mobile terminals gain ever more significance. In this thesis, a navigation solution for mobile telephones was realized.

The data stream which is generated by the GPS receiver is received in NMEA format over a Bluetooth connection. Servlets interpret this data and produce with its help an XML structure according to the pattern, which is provided by the Intelliwhere Location Server for map generation. The Servlet interprets the NMEA data stream according to the data records: GPRMC, GPRMB and GPGSA. Invalid data are not used. The location server generates a map, which is indicated on the mobile phone. For the orientation of the user, the current position is marked with a hair cross. The connection over Bluetooth has been developed as an independent package and can therefore easily be integrated into further applications.

»Visualization and programming of a semantic network«
Bachelor thesis by: Alexander Schlederer
Supervisor: Rainer Malkewitz

This thesis is about programming and visualizing a semantic network. With regard to the semantic network, XML Topic Maps have been chosen as target technology. The thesis starts with general introductions of semantic networks and Topic Maps. Existing visualization approaches are discussed along with possible improvements. Finally, the design and implementation of an application based on Topic Maps is explained. The advantages of XTM, as a standard for encoding knowledge, are used to find persons (names), their competencies, and related scientific publications within an academic institution. The results of this work have been used as a part of the INI-GraphicsNet knowledge portal project.

»Realization of a Context-specific Semantical Filter for a Feature-based Virtual Modeling Environment«
Diploma thesis by: Christopher Schmidt
Supervisor: Gino Brunetti

SmartSketches, a virtual conceptual design environment providing functionality for virtual styling and solid modeling, has recently been extended by a feature-based, parametric approach for assembly and part modeling. Objective of this extension has been to realize an intuitive interface for the conception and embodiment of mechanisms in virtual environments taking into account the critical interfaces between involved parts as well as joints and kinematics. With the feature-based approach, users are supported to define the parametric interdependencies between the parts of an assembly and to interactively simulate and experience the obtained mechanism at any time of a modeling session. For this purpose, features and parametrics are mapped into a net of geometric constraints that are solved whenever the user interacts with the model by either inserting or modifying parts or constraints. The problem of this approach is the computationally expensive solving of the constraints especially for the interactive kinematics simulation, where only simple mechanisms with about four parts corresponding to 30-40 constraints could so far be solved in real-time.

Objective of the diploma thesis was therefore to improve the system performance taking advantage of the observation that, dependent on the current system modus and the type of task, only a small subset of the constraints might be necessary but sufficient to guaranty the right behavior of a virtual mechanism. For example, when positioning parts in an assembly or adding joints between parts, only those constraints need to be considered that control the relative position and the degree of freedom between the parts. Similarly, when modifying a part by adding or modifying its features, only those constraints defining the part are of interest, all other parts as well as the relationships between the parts are out of scope.

Result of this diploma thesis is the realization of functionality in SmartSketches, which allows, via a semantic filter, to restrict the view on the product information according to the actual modeling context, which is defined by the current user operation. The realized model contexts are a part view during the modeling of parts and an assembly view for assembling operations and kinematics validating of obtained mechanisms. With this, it is now possible to reduce the number of active constraints for the kinematics simulation to an average number of two constraints per joint allowing the assembly and real-time simulation of a mechanism with up to 20-30 involved parts.